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Pandemic and bank lending: Evidence from the 2009 H1N1 pandemic

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ABSTRACT

This paper empirically analyzes the impact of pandemic on the contracting of bank loans. Using data on syndicated loans during the season of H1N1 Swine Flu, we find that more flu is associated with higher loan spreads and smaller loan size. The adverse impact of pandemic was alleviated by the approval of vaccines.

1. Introduction

In early 2020, the novel coronavirus (COVID-19) spreads worldwide, which has been listed as a global pandemic by the WHO. However, little is known about its impact on the financial market. Similarly, the H1N1 pandemic first detected in the United States in April 2009 may cast light on the impact of the ongoing COVID-19 pandemic (Goodell, 2020). There is a growing literature that studies the impact of exogenous extreme events on the financial market, e.g. natural disasters such as earthquakes and hurricanes (Hosono et al., 2016; Gallagher and Hartley, 2017). Limited attention, however, has been paid to the shock of infectious disease such as pandemic.

In this paper, we examine the impact of H1N1 pandemic on bank lending in a cross-country setting. We find strong evidence that the number of H1N1 cases is positively associated with loan spread, while negatively associated with loan amount. Our results are robust after controlling for a set of loan terms, borrower characteristics, macroeconomic indicators, and year-month fixed effects. Our findings are also substantiated with an alternative source of pandemic data from the WHO. Besides, we find that the introduction of H1N1 vaccine in September 2009 significantly alleviates the adverse impact of pandemic.

Our research sheds light on the impact of public health events on the financial market, which can further transmit to the real economy. Recent studies mainly focus on the impact of public health events on the default rates of credit card and mortgage (Houle et al., 2015), stock markets (McTier et al., 2013; Donadelli et al., 2017; Baker et al., 2020), and economic growth (Goenka and Liu, 2019; Barro et al., 2020; Jordà et al., 2020). In this paper, we investigate the impact of H1N1 pandemic on bank lending from the perspective of borrowing firms.

The paper proceeds as follows. Section 2 introduces the data. Section 3 presents the empirical results. Section 4 concludes the paper.

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Table 1
Descriptive statistics.

	N	Mean	Std dev	Min	Median	Max
CumCases (raw number)	2036	53,103.37	49,569.02	0	44,689.00	109,763
CumCases	2036	7.75	4.86	0	10.71	11.61
NewCases (raw number)	2036	3045.80	6658.34	0	43.00	38,302
NewCases	2036	4.45	3.60	0	3.78	10.55
CumCases_WHO (raw number)	746	4641.66	10,699.58	0	0.00	33,902
CumCases_WHO	746	2.43	3.95	0	0.00	10.43
Deaths_WHO (raw number)	746	21.44	52.31	0	0.00	170
Deaths_WHO	746	0.95	1.76	0	0.00	5.14
All-in-Drawn spread	1933	335.98	153.51	25.00	312.50	1000.00
Facility size	2036	5.10	1.63	−4.67	5.22	10.02
Maturity	2036	4.05	2.81	0.17	4.00	41.75
Credit line	2036	0.62	0.48	0.00	1.00	1.00
Term loan	2036	0.34	0.47	0.00	0.00	1.00
Senior	2036	1.00	0.05	0.00	1.00	1.00
Secured	2036	0.77	0.42	0.00	1.00	1.00
No. of lenders	2036	8.27	8.17	1.00	5.00	58.00
No. of facilities	2036	1.95	1.40	1.00	1.50	9.00
Firm size	2036	7.68	2.04	3.62	7.52	16.66
Leverage	2036	36.60	25.70	0.00	33.51	119.33
Profit margin	2036	−0.83	21.25	−108.26	2.68	63.61
ROA	2036	11.63	8.38	−21.23	11.20	41.25
NWC	2036	11.32	19.12	−50.47	8.96	66.73
Tangibility	2036	71.49	41.74	0.01	68.21	183.66
GDP growth	2036	0.63	3.03	−14.76	2.56	19.59
GDP per capita	2036	10.68	0.44	7.00	10.79	11.56
Inflation	2036	1.09	1.52	−4.48	1.64	15.88
Banking crisis	2036	0.96	0.20	0.00	1.00	1.00
WGI	2036	1.21	0.28	−0.75	1.25	1.80
Political Rights	2036	1.09	0.63	1.00	1.00	7.00

2. Data

We measure the severity and prevalence of H1N1 pandemic using the number of confirmed infected cases released by the FluNet.[1] It compiles weekly data on H1N1 cases from the National Influenza Centers (NICs) of the Global Influenza Surveillance and Response System (GISRS) and WHO regional databases.

Syndicated loans data is retrieved from the Dealscan of Thomson Reuters, which provides information on borrowers and loan contracts, such as pricing and non-pricing terms. Syndicated loans are usually structured in a number of facilities. We treat multiple facilities of a deal as different loans because loan spreads, identity of lenders and other contractual features often vary across different facilities. Thus, an observation in our analysis is a loan facility extended by a syndicate to a borrower. We exclude loans extended to financial borrowers (with 2-digit SIC 60 through 64). We measure loan spread by the All-in-Drawn spread over LIBOR in basis points, which accounts for both one time and recurring fees. Loan size is defined as the logarithm of loan amount. We follow the empirical literature on the determinants of loan contracts in order to choose a set of loan-specific variables. Specifically, we include loan maturity, term loan, senior loan, credit line, number of lenders and facilities, and secured by collaterals. Besides, we include dummies to control for loan purposes, i.e. corporate purposes, debt repayment, takeover, working capital, and other.

We merge syndicated loan data with Compustat Global database to obtain annual accounting variables of the borrowers.[2] We ultimately compile a sample of 2036 unique loans in 37 countries over 2009–2010.[3]

We control for a set of firm covariates that may affect loan contracts, including firm size (i.e. the logarithm of total assets), leverage, profit margin, return on assets (ROA), net working capital over total assets (NWC), and tangibility. In addition, we include a set of macroeconomic indicators, i.e. GDP growth rate, the logarithm of GDP per capita, and inflation rate retrieved from the World Development Indicators. In order to isolate the effect of pandemic from the financial crisis, we control for a banking crisis dummy from Laeven and Valencia (2013). To account for institutional quality, we include the average of six dimensions of World Governance Indicators. In addition, we control for political rights from Freedom House (Qi et al., 2010). We also include industry dummies that classify borrowers into 65 sectors based on two-digit SIC codes. Besides, we include year-month fixed effects to capture the time trend, and cluster the standard errors at the borrower-country level. Finally, all firm accounting variables and All-in-Drawn spread are winsorized at the 1st and 99th percentiles. Table 1 shows some descriptive statistics. Note that the number of cases is zero prior to the outbreak in April 2009, and is set to zero after the WHO declared the end of the H1N1 pandemic in August 2010.

[1] www.who.int/influenza/gisrs_laboratory/flunet/en/
[2] We are grateful to Sudheer Chava and Michael Roberts for providing the link between Dealscan and Compustat (see Chava and Roberts, 2008).
[3] The sample for pricing regression is smaller due to missing values in All-in-Drawn spread.

Table 2
H1N1 cases and bank lending. The dependent variables are All-in-Drawn spread in columns (1)-(2), and Facility size in columns (3)-(4), respectively. All-in-Drawn spread and borrower accounting variables are winsorized at the 1st and 99th percentiles. Loan purpose dummies, borrower industry dummies, and year-month fixed effects are included but their estimates are suppressed for brevity. Robust standard errors clustered at the borrower-country level are reported in parentheses below the coefficients. ***, **, * denote significance at the 1%, 5% and 10% levels, respectively.

	All-in-Drawn spread		Facility size	
	(1)	(2)	(3)	(4)
CumCases	11.386***		−0.083**	
	(4.022)		(0.036)	
NewCases		9.424**		−0.068**
		(4.066)		(0.030)
Facility size	−9.169***	−9.455***		
	(2.672)	(2.840)		
Maturity	−4.597***	−4.900***	0.033	0.035
	(1.046)	(1.099)	(0.032)	(0.032)
Credit line	−12.663	−10.569	−0.246*	−0.262*
	(21.001)	(20.385)	(0.134)	(0.133)
Term loan	42.360**	44.648**	−0.033	−0.050
	(18.447)	(17.830)	(0.163)	(0.162)
Senior	−58.285	−55.840	1.082***	1.066***
	(113.626)	(113.561)	(0.291)	(0.294)
Secured	63.149***	63.846***	−0.326**	−0.331**
	(8.129)	(8.007)	(0.137)	(0.143)
No. of lenders	−1.622***	−1.671***	0.065***	0.066***
	(0.419)	(0.407)	(0.008)	(0.008)
No. of facilities	2.327	1.469	−0.225***	−0.219***
	(3.290)	(3.313)	(0.039)	(0.040)
Firm size	−0.401	−0.568	0.287***	0.289***
	(4.628)	(4.680)	(0.095)	(0.094)
Leverage	0.632***	0.630***	0.007***	0.007***
	(0.093)	(0.092)	(0.001)	(0.001)
Profit margin	−0.698***	−0.693***	−0.001	−0.001
	(0.078)	(0.081)	(0.001)	(0.001)
ROA	−0.777***	−0.761***	0.013***	0.013***
	(0.256)	(0.263)	(0.002)	(0.002)
NWC	−0.933***	−0.936***	0.001	0.001
	(0.190)	(0.187)	(0.001)	(0.001)
Tangibility	−0.081	−0.089*	−0.000	0.000
	(0.053)	(0.051)	(0.001)	(0.001)
GDP growth	1.557	0.434	−0.142***	−0.134**
	(5.402)	(5.210)	(0.052)	(0.054)
GDP per capita	104.276***	113.135***	0.474	0.410
	(37.767)	(36.833)	(0.389)	(0.411)
Inflation	22.020***	21.420***	0.122*	0.128**
	(6.999)	(7.031)	(0.063)	(0.061)
Banking crisis	17.314	15.950	1.356*	1.372*
	(45.132)	(47.705)	(0.709)	(0.703)
WGI	−74.224	−82.708	0.434	0.502
	(54.835)	(55.888)	(0.481)	(0.519)
Political Rights	−10.347	−12.303	0.284	0.298
	(20.618)	(19.620)	(0.214)	(0.226)
Constant	−725.692**	−756.987**	−5.008	−4.799
	(339.608)	(338.876)	(3.910)	(3.932)
Loan purpose dummies	Yes	Yes	Yes	Yes
Industry dummies	Yes	Yes	Yes	Yes
Year-month FE	Yes	Yes	Yes	Yes
N	1,933	1,933	2,036	2,036
R-square	0.432	0.429	0.540	0.539

3. Empirical results

Table 2 shows our main results. Our key proxy for H1N1 pandemic is CumCases, which is the logarithm of the number of *cumulative* cases on a monthly basis plus one. In column (1), we find that H1N1 Flu is positively associated with loan spread, which is significant at the 1% level. The effect is also economically significant. A one standard deviation increase in H1N1 Flu will lead to a rise of 55.34 basis points of loan spread (=11.386×4.86), which is about 16.47% of the sample mean (=55.34/335.98). However, our cumulative measure of H1N1 cases may pick up confounding factors in the time trend (e.g. economy policy). We thus construct NewCases, i.e. the logarithm of the number of *new*, incremental cases on a monthly basis plus one, which can capture the evolution of pandemic in different phases. We still find a positive impact of new cases on the loan spreads in column (2). Next, we turn to the impact of pandemic on the lending volume in columns (3) and (4). Both proxies of H1N1 Flu are negatively associated with loan size. Likewise, we observe

Table 3
Alternative sample from the WHO. The dependent variables are All-in-Drawn spread in columns (1)-(2), and Facility size in columns (3)-(4), respectively. All-in-Drawn spread and borrower accounting variables are winsorized at the 1st and 99th percentiles. Loan controls, loan purpose dummies, borrower controls, borrower industry dummies, and year-month fixed effects are included but their estimates are suppressed for brevity. Robust standard errors clustered at the borrower-country level are reported in parentheses below the coefficients. ***, **, * denote significance at the 1%, 5% and 10% levels, respectively.

	All-in-Drawn spread		Facility size	
	(1)	(2)	(3)	(4)
CumCases_WHO	23.769***		−0.256***	
	(5.196)		(0.066)	
Deaths_WHO		29.220***		−0.254**
		(6.536)		(0.096)
Constant	−550.134	−560.820	−1.246	−1.793
	(543.257)	(439.263)	(4.988)	(5.414)
Loan controls	Yes	Yes	Yes	Yes
Loan purpose dummies	Yes	Yes	Yes	Yes
Borrower controls	Yes	Yes	Yes	Yes
Industry dummies	Yes	Yes	Yes	Yes
Year-month FE	Yes	Yes	Yes	Yes
N	702	702	746	746
R-square	0.507	0.508	0.632	0.628

Table 4
Impact of the introduction of vaccine. The dependent variables are All-in-Drawn spread in columns (1)-(2), and Facility size in columns (3)-(4), respectively. All-in-Drawn spread and borrower accounting variables are winsorized at the 1st and 99th percentiles. Loan controls, loan purpose dummies, borrower controls, borrower industry dummies, and year-month fixed effects are included but their estimates are suppressed for brevity. Robust standard errors clustered at the borrower-country level are reported in parentheses below the coefficients. ***, **, * denote significance at the 1%, 5% and 10% levels, respectively.

	All-in-Drawn spread		Facility size	
	(1)	(2)	(3)	(4)
CumCases	18.355***		−0.131***	
	(4.342)		(0.032)	
CumCases*Vaccine	−12.086**		0.082*	
	(5.912)		(0.046)	
NewCases		18.803***		−0.119***
		(4.417)		(0.033)
NewCases*Vaccine		−17.423**		0.094*
		(6.927)		(0.052)
Constant	−812.231**	−872.448**	−4.438	−4.195
	(339.039)	(342.956)	(3.849)	(3.957)
Loan controls	Yes	Yes	Yes	Yes
Loan purpose dummies	Yes	Yes	Yes	Yes
Borrower controls	Yes	Yes	Yes	Yes
Industry dummies	Yes	Yes	Yes	Yes
Year-month FE	Yes	Yes	Yes	Yes
N	1,933	1,933	2,036	2,036
R-square	0.434	0.434	0.541	0.540

a sizeable economic effect, i.e. a one standard deviation increase in H1N1 Flu reduces the loan size by 0.40 (0.083×4.86), which is about 7.84% of the average loan size (0.40/5.10). In sum, Table 2 provides evidence on higher loan spread and lower loan amount brought by the H1N1 pandemic.

As a robustness check, we also collect the data on H1N1 infected cases and deaths from the WHO, which is available only for a short period from April to June 2009.[4] We set the number of cases and death prior to the outbreak in April 2009 as zeros, and terminate the sample by June 2009 as the WHO no longer updates such information afterwards. We construct two proxies for the prevalence of H1N1, i.e., CumCases_WHO and Deaths_WHO, which are the logarithm of the number of *cumulative* cases plus one, and the logarithm of the number of deaths plus one. Table 3 shows the impact of pandemic on bank lending with the new sample, which substantiates our earlier findings.

In September 15, 2009, the FDA announced the approval of four 2009 H1N1 influenza vaccines. Two weeks later, the US states placed first orders of 2009 H1N1 vaccine. In addition, the WHO also recommended H1N1 virus vaccine in the October 2009 meeting of the immunization Strategic Advisory Group of Experts. As a milestone in combating with the H1N1 Flu, the introduction of vaccines may alleviate the concerns of pandemic and its impact on the financial market. As a result, we expect weaker results since the

[4] See the "Situation updates - Pandemic (H1N1) 2009" of WHO: www.who.int/csr/disease/swineflu/updates/en/

introduction of vaccines. We construct a vaccine dummy, which equals one after the introduction of H1N1 vaccine, and zero otherwise. Table 4 shows negative and significant coefficients for the interaction terms in the pricing regression, and positive ones for the interaction terms in the quantity regression. It suggests weaker pricing effect and quantity effect since the introduction of H1N1 vaccine. This is in line with the conjecture that the uncertainty and pessimism faded in the financial market since the introduction of the vaccines.

4. Conclusion

Using a large sample of syndicated loans in 37 countries during the H1N1 pandemic over 2009–2010, we find that the pandemic increases the cost of bank loans and restrains the volume of bank lending. In addition, the adverse effect was undermined by the introduction of vaccines.

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CRediT authorship contribution statement

Di Gong: Methodology, Formal analysis, Writing - original draft, Funding acquisition. **Tao Jiang:** Data curation, Investigation. **Liping Lu:** Writing - review & editing, Validation, Funding acquisition.

Supplementary materials

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