MODELLING ECONOMIC CRISES IN HUA HE FRAMEWORK

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KEYWORDS

Hua-He methodology, corporate liquidity, agent based model, state intervention

ABSTRACT

In our paper we model firms' liquidity using the Hua He methodology. We investigate how cooperation of firms improve the possibilities of liquidity management. During a crisis, various effects identified in the literature hurt firms' liquidity position and lead to increased bankruptcy risk. We may counterbalance these adverse effects by providing immediate cash transfers and granting periodic cash flow transfers or additional credit lines. Cooperating with peers pays off. The importance of liquidity transfer between agents is higher during a crisis than in normal economic environment. It contributes to a lower default rate the losses are more moderate as well. The promotion of holdings of conglomerate-type or cross-ownership across local firms but with a wide variety of sectors may relieve some of the state burdens during a crisis. Several consequences can be drawn for policy makers how ameliorate resilience of agents.

INTRODUCTION

In our paper, we model how partnership and cooperation along the supply chain can contribute to better corporate liquidity and decrease the default frequency of participant firms. In ISCRM (Integrated supply chain risk management) literature, operational performance is the most frequently covered (Bredell, R. and Walters, J. 2017). Supply chain disruptions – a special topic within ISCRM - are partially as an unforeseen triggering event, like supplier bankrutcy (Bugert and Lasch, 2018). In our paper we model a less sever event than bankruptcy, we focus on liquidity shocks of interrelated agents. Specially, our scope of research within the large topic of financial flow of supply chain is solely whether common liquidity management like a cash pool agreement can improve the surviving ability of agents during a crisis. Since we are interested in the changes of default frequency depending on the different liquidity management practices, we treat liquidity as an exogen variable, and we disregard the specific reasons that change a liquidity position because they may be varied and complex. We describe liquidity developments as a random process for certain types of analysis, and we focus on the possible strategies of agents. The correlation of liquidity changes is the only representant of connection between the agents: A positive correlation can describe the case of agents in the same supply chain, a negative correlation can characterise competing agents. The scope of our paper is how the liquidity of correlated agents emerges with and without their cooperative liquidity management.

At that point, it is important to precise the terminology of agents' liquidity. In this paper, we assume that agents target a level of liquidity reserves or a level of cash reserves that has to be reached to maintain business continuity. We are not modelling the entire cash flow of the agents: we focus on that part of it, which is kept within the agent as operative cash to assure liquidity. Excess liquidity, the remaining part of created cash flow can be used for investments or paid out to creditors or shareholders. Therefore we assume that liquidity shocks have an expected value equaling zero. The growth of the cash flow of a prospering agent is not modelled here; it is part of the excess liquidity withdrawn from the scope of liquidity management. Rather than a sole figure, the targeted liquidity is an interval acceptable for the agent.

THE FRAMEWORK OF OUR MODEL

Literature suggests that a crisis may affect firms in at least four different ways. We may see (1) our sales and profit rate falling, and thus, expected cash flow might descend. During the Covid-19 crisis, restaurants, cinemas, and pubs had to stay closed, radically cutting expected returns. Simultaneously, (2) the uncertainty increases in the economy, so the cash flows' standard deviation may climb. The pandemic caused customers to stock up some food and detergents at the beginning that they consumed, later on, creating waves in otherwise steady demand.

Moreover, (3) activities following separate trends earlier may show the same development pattern. In other words,

Communications of the ECMS, Volume 35, Issue 1,
Proceedings, ©ECMS Khalid Al-Begain, Mauro Iacono,
Lelio Campanile, Andrzej Bargiela (Editors)
ISBN: 978-3-937436-72-2 / 78-3-937436-73-9(CD) ISSN 2522-2414

the correlation between business units and firms may increase. Companies like travel agencies, shopping malls, and car-sharing services had seen little connections in their performance earlier, but because of the lockdown, their performance became more correlated, removing most of the diversification opportunities offered earlier. Finally, (4) banks may cut back on credit lines available and reduce outstanding loan amounts to limit their exposure to increased bankruptcy risk in the economy. Besides these effects, even the cost of financing (interest rates) may arise, but we will keep those stable in our runs.

Our simulation focuses on identifying the effects of these changes on a simple system consisting of three agents. These agents may be viewed as three business units of the same firm, three companies owned by the same investor, and three sectors of the same economy.

To model cooperation among the agents, we may allow them to offer their additional liquidity to each other during hard times. This option could represent a co-owned bank account, a cash pool system, or even rearranging state spending and tax incomes. Since there is an empirical evidence that trade credit positions tend to increase in a crisis situation throughout the supply chain. (e.g. as per central bank of Hungary's data trade credit volume increase by 4% between end of 2019 and end of Q3 2020 (MNB, 2020) We can interpret the increased level of trade credit among firms as a form of cooperation in managing liquidity even for not commonly owned firms as well.

Our research aims at identifying crisis consequences and the effectiveness of possible countermeasures targeting to lower the chance of bankruptcy. Our model offers three ways to improve the situation of the agents. We may (A) increase the expected cash flow by reducing fees, dues, and taxes to be paid or offering state subsidies over a while. Also, (B) an additional on-time monetary aid could be provided to raise the available amount of cash initially. Besides, (C) we may also offer additional outside financing sources like low-cost bank loans or credit lines.

MODELLING OF LIQUIDITY SHOCKS

Liquidity shocks are described by the Hua He methodology. (Hua He 1990).

It can be easily seen, that the X_1, X_2, X_3 variables have

a) zero expected value,
b) unit standard deviation, and
c) they are independent,

if their possible values are the ones in the table below, provided that each row is selected randomly with a q = 1/4 probability. Once a row is selected, all the 3 variables take their value from the selected row simultaneously.

a) *zero expected value*: the sum in each column is zero,
b) *unit standard deviation*: the sumproduct of each column with itself is 4 (this should be multiplied by q = ¼ to get the unit variance)
c) *Independence:* the sumproducts of any two different columns are zero.

Table 1. : X_1, X_2, X_3 variables

X_1	X_2	X_3
0	0	$\sqrt{3}$
0	$\sqrt{\frac{8}{3}}$	$-\sqrt{\frac{1}{3}}$
$\sqrt{2}$	$-\sqrt{\frac{2}{3}}$	$-\sqrt{\frac{1}{3}}$
$-\sqrt{2}$	$-\sqrt{\frac{2}{3}}$	$-\sqrt{\frac{1}{3}}$

Having 3 independent standardised random variables is its basic statistical procedure to create 3 variables with given covariance and expected value.

This way we have a non recombining tree with 4 branches in each step, and the 3 liquity values of the firms in each node. L(*i, j, k*) is the current size of the liquidity of company k in step *i*, on node *j*. We depart from the original Hua He type of tree, cutting it on both side at 0 and 200, not allowing a negative or unnecessary high level of liquidity.

<u>*Illustration:*</u> *Two agents, with given correlation of the change of their liquidity*

In this scenario, we need only 2 variables and 3 possible outcomes:

X_1	X_2
0	$\sqrt{2}$
$\sqrt{\frac{3}{2}}$	$-\sqrt{\frac{1}{2}}$
$-\sqrt{\frac{3}{2}}$	$-\sqrt{\frac{1}{2}}$

Since X_1 and X_2 are independent, the Y_1 and Y_2 variables will have a correlation ρ, if

$$Y_1 = X_1 \text{ és}$$
$$Y_2 = \rho X_1 + \sqrt{1-\rho^2}\, X_2$$

The next step is to adjust to the given variances of the changes in liquidity. We assume that the drifts of the liquidity changes are zero.

MODELLING OF AGENTS' LIQUIDITY MANAGEMENT

After having modelled the liquidity shocks, the liquidity policy has to be defined according to which the three agents are acting. The starting L0 level of liquidity reserves will be equally 100 for each of the agents. As liquidity shocks occur, agents have to respect some simple rules of liquidity management.

Assuming individually managed liquidity, the following rules are applied to each of the three agents:

1. The desired level of liquidity is 100.
2. If an agent's liquidity is less than 100, the agent has to apply for a bank loan.
3. Once the liquidity of the agents has reached 0, default occurs.

The commercial bank offers the following construction to the agents:

1. Agents under the liquidity of 100 can be financed by a loan.
2. The bank limits its exposure toward the individual agents: the maximum level of total outstandings for the same agent is limited to 50.
3. The bank collects an interest rate of ib=0.50% on the outstanding amount of the loan.
4. Repayment takes place in each of the periods where the agent’s liquidity is above 100.

Allowing cooperation in liquidity management like a cash pool, the following rules are applied to each of the three agents:

1. The desired level of liquidity is 100.
2. If an agent’s liquidity is less than 100, the agent has to apply for the cash reserves of related partner agents.
3. Above the desired level of liquidity, agents can provide their cash reserves to distressed partners.

The commercial bank offers the same construction to the agents as in the case of individually managed liquidity.
The characteristics of partner loans:

1. Partner loans are provided for one period (month),
2. at a rate of ip=0.25%.
3. Partner loans can be renewed if the issuer still has liquidity reserves above the level of 100.

As Diamond and Rajan suggest (Diamond - Rajan, 2001) the lender can face a liquidity shock as well. In our model we desregard from the illiquidity of commercial banks, we focus solely on the liquidity of the three firms/agents.
Order of financing and repayment:

1. If there are two distressed agents in the given period, the third will offer its liquidity surplus to the one facing a higher liquidity shortage.
2. In the case of two potential financing partners, the agent with the higher liquidity surplus will first provide partner loan to the distressed agent.
3. Agents first repay the partner loan of a higher volume.
4. Banks can lend to all the three agents at the same time.
5. Agents have to redeem first their bank loan.

After the occurrence of liquidity shock, agents assess their modified liquidity position and apply the above-listed elements of the model.

SIMULATION OF NORMAL AND STRESSED ECONOMIC ENVIRONMENT

Base case

First, we define the state of the world without any crises. Let us suppose all three agents have the same parameters. We keep the initial cash balance for all our runs for all agents at 100, which is equal to the cash need of the operation that the agents aim to maintain. (If falling below that level, companies try to attract additional cash.) The cost of borrowing from the peers (cash pool) remains at 0.25% per period (month) while that of the bank loan stagnates at 0.50%, implying a 12-period (yearly) rate of 3.04% and 6.16%, respectively.
All simulations last for 120 periods (10 years), and each Monte Carlo simulation covers 10 thousand individual runs. Those runs could represent alternative paths for a chosen group of firms and the development of a different set of agents in the same economy. Thus, the sum of the outcomes may be interpreted as a country-wide performance.
For the base case, the agents face an expected cash flow of 1 with a standard deviation of 10 for each period. The correlation among the cash flows of the agents is 0. The maximum credit line available with our bank is 100, as there is no cooperation among the agents (cash pool not available). (Table 2)

Table 2: No-crisis outcome matrix

Outcomes	A	B	C
1	1.0000	1.0000	18.3205
2	1.0000	17.3299	-4.7735
3	15.1421	-7.1650	-4.7735
4	-13.1421	-7.1650	-4.7735

Our results show that in 2.49% of the cases, at least one period existed at the end of which at least one firm had a negative cash balance. When considering the total of firm periods, only 0.22% ended with a bankruptcy even in the worst case. (In each period, we may count 0 to 3 firm bankruptcy periods.) Closing cash balance ranged from -205 to 636, with an average of 224 for the three agents. (Table 3)

Table 3: No-crisis case results

	Average	Min	Max
Bankruptcy firm-periods	0.00%	0.00%	0.22%
Closing Cash	224.02	-204.74	635.67
Closing Pool Debt	0.00	0.00	0.00
Closing Bank Loan	9.07	0.00	100.00

As the firms operate independently, any change in the correlation of cash flows remains without effect. When we allowed for cooperation (Table 4), the bankruptcy rate fell to 0.01%, while the maximum ratio of bankruptcy firm periods was 0.01%. The cash pool’s existence raised the minimum closing cash level but let the agents accumulate a considerable debt and deposit towards their peers.

Table 4: No-crisis with cooperation case results

	Average	Min	Max
Bankruptcy firm-periods	0.00%	0.00%	0.01%
Closing Cash	227.74	26.90	635.71
Closing Pool Debt	0.00	-311.62	241.44
Closing Bank Loan	0.79	0.00	100.00

As the pool added liquidity to the system, it is no wonder that bankruptcy became less frequent. At the same time, we may very well imagine that there is not too much pressure for the agents to cooperate once there are also transaction costs associated with teaming up as the expected advantages are moderate when just focusing on averages instead of considering the extreme values.

Crisis cases

As a next step, four crisis effects were simulated separately and in one joint case. The modified parameters were (1) expected cash flow cut back to 0, (2) standard deviation increased to 20, (3) correlation climbed to 0.4, and (4) maximum bank loan available decreased to 50.
When cutting back expected cash flow to 0, the bankruptcy rate jumped to 29.7% (Table 5). It is worth noting that while the average and the maximum cash balance has declined by almost the total of 120 (1 unit for each period) compared to the base case, the minimum closing cash had a slighter decline.

Table 5: Lower expected cash flow crisis

	Average	Min	Max
Bankruptcy firm-periods	0.02%	0.00%	0.48%
Closing Cash	127.82	-293.90	561.79
Closing Pool Debt	0.00	0.00	0.00
Closing Bank Loan	38.98	0.00	100.00
With cooperation			
Bankruptcy firm-periods	0.00%	0.00%	0.41%
Closing Cash	121.84	-130.76	566.06
Closing Pool Debt	0.00	-457.14	390.76
Closing Bank Loan	31.03	0.00	100.00

With cooperation allowed, the results were less extreme, and the bankruptcy ratio fell to 4.34%. We may see how cross-agent transfers enhance the surviving ability of the system. Thanks to the cheaper help received from peers, minimum closing cash also climbed radically. Here we see the advantages that we might seriously underestimate if considering non-crisis average performance only.
When the crisis increases the standard deviation of the cash flows, the extreme values may change radically. (Table 6) While the bankruptcy ratio boomed to 53.88, minimum decreased and maximum increase radically boosted inequality across firms without any fundamental differences.

Table 6: Higher standard deviation crisis

	Average	Min	Max
Bankruptcy firm-periods	0,07%	0,00%	0,76%
Closing Cash	240,53	-562,40	1 097,40
Closing Pool Debt	0,00	0,00	0,00
Closing Bank Loan	26,51	0,00	100,00
With cooperation			
Bankruptcy firm-periods	0,01%	0,00%	0,75%
Closing Cash	234,30	-323,69	1 098,75
Closing Pool Debt	0,00	-642,54	836,55
Closing Bank Loan	12,89	0,00	100,00

The cash pool cut back the bankruptcy rate to 7.89%, increased the minimum closing cash, but could not reduce the maximum of bankruptcy firm-periods and bank loan usage.
As explained earlier, without allowing for cooperation, the change in correlation has no mathematical effect in the model, as, e.g., the bank loan available for the agents does not depend on the amount taken by their peers, like it would in real life. So, an increased correlation level only limits the positive effects of cooperation.

Table 7: Higher correlation crisis

	Average	Min	Max
Bankruptcy firm-periods	0.00%	0.00%	0.48%
Closing Cash	206.89	-179.35	671.27
Closing Pool Debt	0.00	0.00	0.00
Closing Bank Loan	13.58	0.00	100.00
With cooperation			
Bankruptcy firm-periods	0.00%	0.00%	0.44%
Closing Cash	216.36	-120.78	607.16
Closing Pool Debt	0.00	-220.66	199.22
Closing Bank Loan	5.23	0.00	100.00

Table 8: Lower bank loan limit crisis

	Average	Min	Max
Bankruptcy firm-periods	0,01%	0,00%	0,33%
Closing Cash	218,88	-168,97	660,87
Closing Pool Debt	0,00	0,00	0,00
Closing Bank Loan	5,76	0,00	50,00
With cooperation			
Bankruptcy firm-periods	0,00%	0,00%	0,20%
Closing Cash	221,71	-69,50	681,97
Closing Pool Debt	0,00	-286,24	366,43
Closing Bank Loan	1,13	0,00	50,00

While the bankruptcy rate was 5.65% in our MC, no major differences could be identified then the initial results in Table 3. (Table 7) When cooperation was allowed, the bankruptcy rate declined to 0.85%, far higher than the 0.22% we received in the no-crises scenario. The lowest closing cash is well below the level estimated (Table 4) with the initial parameters. These results call for the policymakers to aim at a well-diversified economy and promote holdings interested in less interlinked business fields. Cooperation of suppliers- and buyers or competitors could be less fruitful. Thus, creating interconnected supply chains in the same country may not be optimal from the liquidity risk point. Finally, limiting bank loans particularly hit the firms when no cash pool system was available. The bankruptcy rate climbed to 9.25% (base case: 2.49%) while closing cash and bank loan data were not affected.
With the cash pool system, the bankruptcy ratio was reduced to 0.29% that was still considerably higher than the 0.01% in the base case. Also, bankruptcy firm-periods increased in proportion.

Table 9: Complex crisis

	Average	Min	Max
Bankruptcy firm-periods	0,20%	0,00%	1,12%
Closing Cash	110,96	-727,10	976,81
Closing Pool Debt	0,00	0,00	0,00
Closing Bank Loan	24,06	0,00	50,00
With cooperation			
Bankruptcy firm-periods	0,12%	0,00%	1,12%
Closing Cash	129,74	-594,35	997,99
Closing Pool Debt	0,00	-542,18	565,05
Closing Bank Loan	21,77	0,00	50,00

When all crisis effects appeared at once in our model, consequences became radical. The bankruptcy rate reached 76.87%, average closing cash fall, while the distribution range doubled.
Adding the possibility of cooperation to the model reduced the proportion of the bankruptcy cases to “only” 44.75%. The difference between the extreme values got smaller but was still dramatically boosted. (Table 9)

CRISIS MANAGEMENT OPPORTUNITIES

Seeing the majority of the agents failing is usually unacceptable for policymakers. Our model allows for three types of anti-crisis actions. Offering a one-time monetary help would boost initial cash reserve, reducing taxes, and providing transfers would push up expected cash flow, while offering additional loans will extend our bank credit lines.
Next, we review what measures would be necessary to counterbalance the complex crisis. The aim is to reduce the bankruptcy ratio to a similar level we experienced in the base scenario.

Table 10: Crisis management with initial cash aid

Startup cash	Bankruptcy rate	
	Without cash pool	With cash pool
100	76.87%	44.75%
200	49.24%	18.99%
300	21.16%	7.75%
400	9.54%	1.94%
500	4.26%	0.34%
600	2.67%	0.05%
700	0.01%	0.00%
w/o crisis	2.49%	0.01%

Results show that offering a startup remedy of 100 cash units (doubling the liquidity) would push down the non-cooperative case’s bankruptcy rate to the cooperative scenario level. An additional 100 units would be still only enough to reach a 21.16% level. Altogether, we need to add almost 500 extra cash units (total available: 600) to keep the agents as safe as before the crisis. (Table 10)
When focusing on periodic transfers, cooperation lowers the needed support. As increased correlation has hit only the cooperative case, lowering the bankruptcy rate to the standard (before-crisis) level requires far more state support when allowing for the cash pool. (Table 11)

Table 11: Crisis management with periodic cash aid

Expected period cash flow	Bankruptcy rate	
	Without cash pool	With cash pool
0	76.87%	44.75%
1	57.64%	30.16%
2	35.15%	11.48%
3	19.02%	7.87%
4	11.09%	1.86%
5	4.03%	1.58%
6	1.56%	0.20%
7	0.45%	0.16%
8	0.17%	0.15%
9	0.12%	0.01%
w/o crisis	2.49%	0.01%

Last, we also estimated the needed increase in bank loans available. Here again, the state has to offer more aid in the cooperative case to return to the before-crisis level to counterbalance the effect of higher correlation that does not affect the non-cooperative case. (Table 12)
Our results show that completely rebalancing the crisis effect would cost us (600-100)=500 units of cash, or (6-0)=6 units of periodic transfers, or (600-50)=550 units of credit line for each of the agents in the non-cooperative case. For the cooperative alternative, shadow costs equal (700-100)=600 cash, (9-0)=9 periodic transfer, or (800-50)=750 units of surplus in the credit line. In other words, in a cooperative system, the relative cost of using initial cash transfer is lower than in a non-cooperative economy.

Also, additional credit lines are relatively better than periodic transfers.

Our results allow us to express the value of cooperation among agents in startup cash (100), periodic subvention (1.5), and additional credit line (150) by contrasting the cooperative and non-cooperative cases for bankruptcy rates. As the agents' cross-financing always adds value, it is advisable for policymakers to introduce or enhance cross-sector and cross-company transfers, e.g., using additional income due to increased corporate tax rates to support companies in serious need.

Table 12: Crisis management with an extended credit line

Credit line available	Bankruptcy rate	
	Without cash pool	With cash pool
50	76.87%	44.75%
100	61.63%	31.96%
200	43.63%	20.16%
300	27.00%	8.43%
400	17.31%	3.59%
500	7.02%	1.14%
600	2.93%	0.28%
700	1.06%	0.20%
800	0.13%	0.05%
w/o crisis	2.49%	0.01%

Nevertheless, would a combination of the possible intervention measures offer a better solution than single-measure solutions? We identified some complex crisis management packages leading to a bankruptcy rate similar to the before-crisis status. First, we set back two of the three parameters to their initial level and checked how the remaining effect of increased standard deviation and correlation could be compensated with the single leftover parameter. (Table 13)

Table 13 Crisis management with an increase in the credit lines available

	Initial cash	Expected periodic cash flow	Credit line available	Bankruptcy rate
w/o crisis	100.00	1.00	100.00	2.49%
A	100.00	1.00	**500.00**	1.95%
B	**400.00**	1.00	100.00	2.51%
C	100.00	**5.00**	100.00	1.51%
With cash pool				
w/o crisis	100.00	1.00	100.00	0.01%
A	100.00	1.00	**700.00**	0.01%
B	**600.00**	1.00	100.00	0.00%
C	100.00	**7.00**	100.00	0.02%

When contrasting results in Table 13 with the no-crisis case, we may estimate the cost of added standard deviation and correlation. Accepting that bankruptcy rates are almost the same, the increased standard deviation has a shadow price of (400-100)=300 initial cash, (5-1)=4 additional cash flow over all the simulated periods, or (500-100)=400 units of additional credit line. Based on this, assuming additivity, the increased correlation that hits only the cooperative case would cost (600-400)=200 initial cash units, (7-5)=2 units of additional periodic cash flow, or (700-500)=200 units of surplus credit line.

When contrasting the total price of the crisis calculated earlier, we may see that 60-70% of the crisis-management costs is linked in our example to the higher standard deviation. This result may be interpreted as stabilising the markets is more important than regaining profitability or improving liquidity immediately.

As we may have various alternatives to reset economic stability, we should also compare costs and other consequences of using those alternatives. Our simulation covered 120 periods, so when assuming a positive cost of capital for the financing, 1 unit of periodic transfers has a maximum present value of 120. Our results showed that 500 units of initial cash subvention have similar effects as 6 units of additional periodic transfers in the non-cooperative case. When rates are low, immediate cash aid might be preferred, while higher rates may make periodic transfers cheaper. During a crisis, we usually see inflation and risk premium climbing. Thus, periodic transfers could offer a cheaper solution. Another argument for choosing periodic transfers would be that we can quickly stop those if the crisis ends earlier than initially assumed. When focusing on providing additional credit lines, those seem to be even more attractive. The main reasons for that include (1) we do not have to provide the total of the credit line in the form of loans to all firms immediately and for all the periods, and (2) loans are repaid sooner or later and earn us interest during their lifetime. As credit lines needed to manage the crisis are only slightly larger than initial cash transfers, we may consider them the cheapest alternative. Simultaneously, this method may call for very different conditions than applied outside of crisis periods as we should provide the estimated amount of loans even without adequate collaterals, probably for the total length of the crisis without any forced repayment.

SUMMARY AND CONCLUSIONS

Our paper analysed the crises effects on our three agents' model. As the literature suggests, during a crisis, not only expected cashflow might decrease, and the standard deviation of those may climb, but the correlation among various actors' performance could increase if used the Hua He model to simulate the random payoffs of the agents. Our results build on Monte Carlo simulations with 120 periods and 10 thousand runs. Our most important results are as follows.

1. Various effects of crisis identified in the literature hurt firms' liquidity position and lead to increased bankruptcy risk.

2. We may counterbalance these adverse effects by providing immediate cash transfers and granting periodic cash flow transfers or additional credit lines.
3. Cooperating with peers pays off. Our results illustrate why it is dangerous to consider the advantages of cooperation based only on records from non-crisis periods. It is during crisis periods that we may see how vital help from fellow firms may be. Thus, to mitigate risks, the state should promote such cooperation, and it might be justified to use cross-sector transfers to stabilise the economy.
4. Voluntary cooperation or forced reallocation across firms helps the economy to perform better during crises. That is why policymakers should promote the establishment of holdings or cross-ownership across local firms. Crises more jeopardise standalone firms and put more jobs at risk there.
5. Cooperation among firms with less correlated business performance is more advantageous than for other companies. However, it is an already widespread consequence that cooperation or integration within the supply chain (among collated firms) can reduce transaction costs through the reduction of uncertainties in normal market circumstances as well (see for example: Zhao, Huo, Sun, and Zhao, 2013), we find that cooperation like holdings created by conglomerate-type mergers and economies with a wide variety of sectors can survive crises with less loss. An economic policy giving a unique preference to investments or FDI in a few interlinked sectors (car manufacturing, tourism) aiming to boost the GDP may cut back on its crisis-resistance.
6. Should the before-crisis status involve cooperation, the state must provide more aid to make the economy return to the initial level during the crisis as the increased correlation needs counterbalancing. In non-cooperative economies, creating holdings and introducing cross-sector or cross-firm transfers during a crisis may relieve some of the state burdens.
7. A crisis enhancing standard deviation would increase inequality across firms with no fundamental differences. These random effects may annul any competitive advantages leading to a higher-than-normal survival rate for the less efficient and lower-than-normal survival rate for the more efficient companies. Thus, we may see an efficiency loss across the whole economy. To evade those losses, the resilience of lending and transfer rules has to be boosted when facing hard times. Often, we see the contrary in commercial banks so that regulatory interventions could be justified.
8. During the crisis-management, a particular focus should be given to reduce fluctuations in the economy by upkeeping laws and evading panic. A less hectic environment may dramatically cut back on the loss that the crisis may cause.
9. Providing an increased credit line with very lax conditions (no collaterals, extreme duration) may offer the cheapest risk-management alternative.

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JÁNOS SZÁZ, CSc is a full professor at the Department of Public Finance and Banking at Corvinus University of Budapest. He was the first academic director and then president of the International Training Center for Bankers in Budapest. Formerly he was the dean of the Faculty of Economics at Corvinus University of Budapest and President of the Budapest Stock Exchange. Currently, his main field of research is financing corporate growth when interest rates are stochastic.

GÁBOR KÜRTHY, PhD, is an associate professor and head of the Department of Public Finance and Banking at Corvinus University of Budapest. Once he applied for the job of village idiot of South-Buda. He got down to the last two, but he failed the final interview, because he turned up. The other bloke was such an idiot he forgot to. And if you've read this, you may have a clue what a (liquidity) shock is.

NÓRA FELFÖLDI-SZŰCS, she has served as a lecturer at Corvinus University since 2006. She obtained her PhD at CUB in 2013. From 2015 to 2020, she has been a researcher at John von Neumann University. Her primary field of interest covers microfinance, credit risk, and contract theory.