A Granular Examination of the Impact of the Health Crisis and the Public Support Measures on French Companies' Financial Situation

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Abstract – We develop a microsimulation model fed by a particularly rich set of individual data in order to assess the impact of the health crisis on the financial situation of more than 645,000 French companies in 2020. We show that the relative stability in net debt at the macroeconomic level is concealing major disparities on an individual level. Heterogeneity is particularly significant between sectors (before and after public support measures) but is also present within each sector. Our simulations confirm the need for public intervention during the crisis: a mere adjustment in company behaviour is insufficient to absorb the shock. These support measures brought the share of firms with a negative cash flow shock in line with normal years, although "extreme" cash flow shocks occur more frequently than usual. One important lesson learned from this exercise is that sector and size cannot be the only criteria taken into account when drawing up crisis recovery policies.

JEL Classification: D22, G32, G38
Keywords: COVID-19, microsimulation, non-financial corporations, cash flow, debt

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The French economy suffered an unprecedented shock in 2020, with GDP shrinking by 7.9%.[1] To absorb the resulting loss of revenue, French companies resorted to huge amounts of debt, with the debt of non-financial corporations (NFCs) increasing by nearly 217 billion euros (+12%) in 2020. At the same time, their cash holdings also increased by more than 200 billion euros (+29%). At the end of 2020, the impact of the crisis on the net debt of French companies was therefore relatively limited, increasing by only 17 billion euros (+0.8%). However, liquidity and solvency risks analysis must go beyond this aggregate picture and assess risks at the individual level: it is crucial to identify which companies have additional debt, which have additional liquidity, and if the same companies have both.

In this article, we develop a microsimulation model in order to assess the impact of the health crisis on the financial situation of companies at the individual level, and to accurately identify the disparity in cash flow situations in 2020. Estimates of the cash flow shocks experienced by each company and their ensuing financing needs (before and after taking into account the effect of public support measures) also serve as a starting point for evaluating France's *quoi qu'il en coûte* ("whatever it takes") policy.

Our study joins a number of recent research studies that seek to evaluate the impact of the COVID-19 pandemic and of the resulting restrictions taken to contain it on companies' financial health. The lack of data enabling changes in companies' individual financial situations to be monitored and measured in real time as the pandemic progressed make this a particularly difficult task. In this context, it becomes necessary to use alternative, high-frequency data (monthly VAT data in our case) to capture changes in business activity during 2020, and to simulate the impact of this altered activity on the financial situation of each company, based on the most recent balance sheets available. Finally, as some public support measures to aid companies were actually implemented (secured loans, short-time work scheme, etc.) the simulation tools used is geared more towards analysing the extent to which they were used, their intensity and even their effectiveness.

We simulate, month by month, all of the cash inflows and outflows of nearly 650,000 companies, representing 85% of the value added for NFCs (excluding sole proprietorships). To do so, we use the data provided by Bureau *et al.* (2022, this issue), who recount the turnover developments of each company in 2020, based on their monthly VAT declarations. We reason on financing remaining the same (i.e. before any debt adjustments or increases), and we estimate the cash flow shock suffered by the company each month, which corresponds, assuming capital is constant,[2] to a variation in net financial debt.

We then use these results to evaluate the NFCs' financing needs, by quantifying a so-called "operational" need. In contrast with the cash flow exhaustion or illiquidity situation often discussed in the literature (Guerini *et al.*, 2020; Hadjibeyli *et al.*, 2021), this approach is based on the idea that companies need to maintain an operational cash flow cushion that can be used immediately to fund the operating cycle when activity does pick up. This operational need therefore corresponds to the external funding request submitted by NFCs to the financial sector.

From a methodological point of view, our work sits along the same lines as that of Guerini *et al.* (2020), Demmou *et al.* (2021a; 2021b), Schivardi & Romano (2021), Carletti *et al.* (2021) and Hadjibeyli *et al.* (2021). Most central banks (Anayi *et al.*, 2020; Blanco *et al.*, 2020; Tielens *et al.*, 2021) and major institutions (Maurin & Rozália, 2020; Connell Garcia & Ho, 2021; Soledad Martinez-Peria *et al.*, 2021) have also conducted similar exercises to ours. These simulations, carried out using individual accounting data, differ from more structural studies (Gourinchas *et al.*, 2021) and work based on survey data (Bloom *et al.*, 2021).

To our knowledge, our study is one of only three to conduct a comprehensive simulation of cash flows, alongside those of the Bank of England (Anayi *et al.*, 2020)[3] and the Bank of Spain (Blanco *et al.*, 2020). Investments, dividend payments and financial flows relating to client/supplier payments are effectively ignored in the other studies listed above, especially those that are based on France and that use relatively similar data to ours (Guerini *et al.*, 2020; Hadjibeyli *et al.*, 2021).[4]

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1. According to the estimation available at the time of writing and subject to revision, as are the other figures in this paragraph.
2. And excluding the disposal of assets.
3. Unlike ours, the Bank of England study is mainly based on large enterprises; it looks at 95,000 companies, the majority of which have a turnover of more than 10 million pounds (11.66 million euros). In the absence of any relevant data, the accounts and turnover of small enterprises are simulated in their entirety.
4. With the exception of Banque de France company rating data, which is original to our study.

One major advantage of our study is that it looks at the real activity of companies month after month using VAT data, while the most comprehensive studies in terms of modelling, such as that of the Bank of England, rely partly on modelling activity trajectories at the sectoral level. Unlike the Directorate-General of the French Treasury study (Hadjibeyli *et al.*, 2021), which imputes a sectoral activity shock, defined at the NACE 17 level, to firms for which monthly VAT data is not available, we choose to use only monthly activity shocks observed at the individual level, and thus have a smaller sample. We also have information on the effective use of short-time work and deferrals in social security contributions at the individual level, which allows us to analyse, in detail, the heterogeneity of individual situations. Finally, for the largest companies, we use the profiled accounts drawn up by INSEE (companies in the sense of the Law on the Modernisation of the Economy, see below), which enable us to implicitly take into account intra-group cash flows. This is especially important during times of crisis, when liquidity flows between subsidiaries, and is an original aspect of our study.

Firstly, we observe very strong heterogeneity in the cash flow shocks suffered by NFCs in 2020, between sectors, within the same sector, and between companies in the same size category or with the same risk classification. The occurrence and intensity of negative cash flow shocks as at the end of 2020 were correlated to companies' pre-crisis credit quality: the riskiest companies suffered the most acute shocks, while lower risk companies generally had more liquidity, and therefore fewer operational needs. In terms of amounts, intermediate-sized enterprises (ISEs) and large enterprises (LEs), which represent 1.5% of the companies in our sample, accounted for (after support) most of the total increase in the net debt of NFCs as at the end of 2020. Finally, we show that the support measures recenter the distribution of cash flow shocks so that they more closely resembled those seen in a "normal" year (2018), but the dispersion of these shocks remained high, with a higher proportion of very negative or very positive shocks: 21% of companies post a "significant" increase in net debt (more than one month's turnover) in 2020, compared to 13% in 2018, and almost 25% see a relatively "significant" fall in their net debt in 2020, compared to just 10% in 2018. This change at both tails of the distribution is even more noteworthy if we look only at the companies that were most vulnerable before the crisis.

The remainder of this article presents the data used and the scope of the study (section 1), followed by the microsimulation method (section 2) and the results (section 3). The conclusion draws lessons in terms of public policy for exiting the crisis and suggests avenues of development of the analysis.

1. Presentation of Data and the Sample

1.1. Data

We use five individual data sources which give us a good insight into companies' financial situations as well as the public support packages they benefit from:

- VAT data (DGFiP, *Direction générale des finances publiques* – Directorate-General for Public Finance): the monthly declarations submitted by companies to the DGFiP with regard to VAT payments; this data gives us the turnover of each company as the sum of all taxable and non-taxable activity conducted both in France and abroad. This data and the method used to apply it are detailed in our companion paper on the impact on activity (Bureau *et al.*, 2022, this issue).

- Company accounting data (INSEE, FARE, *Fichier approché des résultats d'ÉSANE* – ESANE approximate results database): FARE data provides information on the profit and loss accounts and balance sheets of legal units (LUs) incorporated in France. It is used to model changes in the accounting inputs into the simulation. Here, we use INSEE FARE data from 2018.[5] For analysis at the "company" level (with "company" defined by the Law on the Modernisation of the Economy), in its FARE data, INSEE also provides so-called "profiled" accounts which consolidate the activity of companies made up of several legal units (see Haag, 2019). For companies made up of several legal units, information on their profiled accounts is used, except in cases where the aggregate turnover obtained from VAT declarations (for the legal units that comprise the consolidated company) differs from that detailed in the 2018 profiled accounts. As this analysis is conducted on a sample of companies present in the 2018 FARE, it does not take into account any companies formed in 2019 or 2020. Please note that the characteristics of the companies evaluated may have changed between 2018 and 2020, in particular for the most fragile among them. This limitation is shared by all similar studies,

5. *When the study was conducted, data for 2019 was not yet available.*

as no financial statements were available for 2020 when they were conducted.[6]

- Data on short-time work scheme (DARES, *Direction de l'animation de la recherche, des études et des statistiques* – the Directorate for research and statistics of the ministry of labour): this data shows all of the short-time work permits granted to each establishment, as well as all requests for reimbursement of the compensation paid to employees under the short-time work scheme from January 2017 to November 2020.[7] We match the data declared for each establishment with the companies they belong to. In our sample, 60% of companies have at least one establishment appearing in this database.

- Data relating to social security contribution deferral and exemption schemes: the data on employer contribution exemptions/deferrals was provided by ACOSS. It covers the period from March to November 2020.[8] The database contains an entry for each month which indicates, per establishment, the amount of the social security contributions due and the amount of the social security contributions deferred. The data does not distinguish between deferred contributions (which represent social debt for the company) and contributions that are the subject of an exemption. Of all the companies in our sample, 64% have at least one establishment that appears in this database.

- Data relating to the Banque de France rating: the Banque de France rating assesses companies' ability to honour their financial commitments over a three-year period. Ratings range from 3++ (the company's ability to honour their financial commitments is deemed to be excellent) to P (the company files for bankruptcy). The rating 0 is given to companies for which the Banque de France has not gathered any payment defaults on trade bills, or any unfavourable judicial information or decisions, and does not have any recent accounting information.[9] Companies are only rated when they have a turnover of 750,000 euros or above. As a result, we document therafter a correlation between very small enterprises (VSEs) and ratings of 0. We use the rating in force at 31 December 2019.[10] Almost all companies in the sample have a Banque de France rating, although 70% of these ratings are 0. Table 1 summarises the individual data used in the study.

1.2. A Sample of More Than 645,000 Non-Financial Corporations

The study focuses on NFCs, excluding sole proprietorships, that declared their VAT on a monthly basis between 2018 and 2020. We exclude companies for which the data is imputed, those whose financial year is not 12 months long, those that have undergone a restructuring and those in the education (PZ) and public administration (OZ) sectors. Companies whose VAT data is not consistent with FARE balance sheet data are also excluded.[11] 745,806 legal units are analysed, reduced into 645,300 companies (66,986 companies profiled by INSEE and 578,314 companies made up of just one legal unit). The study sample covers 71% of the value added (VA) of NFCs (81% of the value added of ISEs and LEs, 72% of the value added of small

6. However, in 2019 and 2020, almost three quarters of new companies were set up under the micro-entrepreneur legal status (INSEE, "Enterprise births – December 2020", Informations Rapides N° 008, 15 January 2021) and therefore do not fall within the scope of our study, which only looks at companies. Please also note that using the 2019 FARE would have given rise to other issues, such as taking into account the CICE (crédit d'impôt pour la compétitivité et l'emploi – tax credit for employment and competitiveness) transforming into a reduction in long-term social security contributions and double counting in 2019.

7. For December, we do not have the amounts but we do have information on the use of the short-time work scheme. We therefore impute the compensation amounts paid in December while also extending the November compensation for companies whose short-time work period was still ongoing. For companies whose short-time work period ended in December, the compensation amount is set to zero.

8. For December, given the lack of observed data at the time this study was conducted, we imputed the amounts of deferrals declared in November.

9. For more details, please visit: https://entreprises.banque-france.fr/page-sommaire/comprendre-la-cotation-banque-de-france

10. For profiled companies, we use the rating for the head of the group. In the absence of a SIREN number for the head of the group, we use the rating for the legal unit within the profiled company with the largest value added.

11. In particular, we only analyse companies (legal units or profiled companies) for which we have identified a discrepancy of less than 35% between the annual turnover declared in FARE for the 2018 financial year and the annual turnover calculated based on monthly VAT data for the same period. Companies that are in the 2018 FARE but for which we had no VAT data in 2020 are also excluded.

Table 1 – **Individual data used in the study**

Data	Source	Years	Frequency
Turnover (VAT)	INSEE-DGFiP	2014-2020	Monthly
Balance sheets (FARE)	INSEE-DGFiP	2018	Annually
Employer contribution deferrals	ACOSS	2020	Monthly
Short-time work	DARES	2020	Monthly
Credit ratings	Banque de France (FIBEN)	2019	Rated on 31/12/2019

Notes: In addition to observed data, the microsimulation model also uses individual simulated data for solidarity funds and corporate income tax deferrals.

and medium-sized enterprises (SMEs) and 38% of the value added of VSEs).[12] Table 2 gives a breakdown by size and sector of the companies in our sample, and shows that VSEs are under-represented compared to the FARE database as a whole (96% of FARE companies and 52% of jobs). This is largely due to the fact that many VSEs are sole proprietorships and/or have data imputed in FARE and are thus excluded from our sample, or that they declare their VAT on a quarterly or annual basis and therefore cannot be included in this analysis. On the contrary, SMEs, ISEs and LEs are over-represented in terms of both workforce and jobs, compared to their weighting in the FARE database.

Some sectors appear to be under-represented ('*Trade*') or over-represented ('*Health*') compared to FARE in terms of number of companies (see Table 2). However, the sectoral breakdown of jobs in the sample is relatively similar to that for all economic activity, including in these two industries.

Table 3 describes the Banque de France credit rating distribution of our sample. The large amount of VSEs is reflected in the majority of ratings being 0 (around 70%). The best ratings (3++ to 4+, comparable to Investment Grade), represent 10% of companies in the sample (or one third of companies with a rating other than 0), while the less good ratings (4 to P, similar to the High Yield category) represent around 20% (or two thirds of companies with a rating other than 0). While the best ratings (3++ to 4+) only represent 10% of companies in the sample, they cover almost half of total employment (49%). On the contrary, ratings of 0, which represent 70% of companies in the sample, account for just 18% of total employment.

1.3. Overview of Companies' Financial and Economic Situations before the Crisis

Table 4 shows the main economic and financial characteristics of the companies in the sample in 2018. Firstly, it confirms that small enterprises dominate the sample: the median company has two employees and a turnover of 400,000 euros.

Net financial debt – financial debt net of cash holdings – was relatively low before the crisis. The median net debt was therefore negative (i.e. the liquidity held exceeded debt) and the financial leverage ratio (net debt to equity) was

12. If you exclude sole proprietorships, the coverage rate increases to 85% of the value added of NFCs.

Table 2 – **Distribution of study sample companies by sector and size**

	Companies			Jobs		
	Study sample		FARE 2018 total[(a)]	Study sample		FARE 2018 total[(a)]
	Number	% of the total	as a %	Number	% of the total	as a %
Agriculture[(b)]	729	0	0	3,768	0	0
Manufacturing Industry	58,524	9	6	2,338,316	24	21
Energy, Water & Waste	4,050	1	1	185,446	2	3
Construction	108,552	17	13	1,009,816	10	11
Trade	176,340	27	18	2,224,502	23	21
Transport	21,115	3	4	878,589	9	9
Hospitality	63,464	10	7	585,607	6	7
Information & Com.	23,607	4	4	517,119	5	6
Property	36,862	6	6	124,171	1	2
Other Services[(c)]	146,813	23	29	1,551,986	16	17
Health	5,244	1	13	284,899	3	4
Total	645,300	100	100	9,704,218	100	100
VSEs[(d)]	520,866	81	96	1,208,153	12	52
SMEs (exc. VSEs)	114,788	18	4	2,993,528	31	18
ISEs and LEs	9,646	1.5	0.2	5,502,537	57	29
Total	645,300	100	100	9,704,218	100	100

[(a)] Entirety of the FARE 2018 database, excluding sectors not included in the study ('*Financial and Insurance Activities*', '*Public Administration and Education*').
[(b)] FARE only gathers information about some companies in the '*Agriculture*' sector. Although these companies have been included in the sample as a whole, the *'Agriculture'* sector does not explicitly appear in the graphs when looking at inter-sector differences (see below).
[(c)] '*Other Services*' includes the MN ('*Scientific and Technical Activities'* and *'Administrative and Support Service Activities'*) and RU ('*Other Service Activities'*) sectors.
[(d)] Company sizes are as defined in the 2008 Law on the Modernisation of the Economy. The term "VSE" used in this study strictly corresponds to the term "microentreprise" (micro-enterprise) as used in said law.
Sources: data from INSEE-DGFiP.

Table 3 – **Distribution of companies in the sample by Banque de France credit rating**

	Companies		Jobs	
Credit rating	Number	% of the total	Number	% of the total
3++	6,682	1	961,415	10
3+	12,006	2	861,293	9
3	19,337	3	1,691,211	17
4+	26,615	4	1,232,873	13
4	37,785	6	1,198,785	12
5+	32,664	5	1,160,672	12
5	26,090	4	491,604	5
6	19,271	3	294,248	3
7	4,438	0.7	22,317	0.2
8	2,942	0.5	13,700	0.1
9	302	0.0	1,592	0.0
P	3,217	0.5	33,754	0.3
0	453,636	70	1,738,407	18
No rating	315	0	2,347	0
Total	645,300	100	9,704,218	100
Invest. Grade: 3++ to 4+	64,640	10	4,746,791	49
High Yield: 4 to P	126,709	20	3,216,673	33
0	453,636	70	1,738,407	18
No rating	315	0	2,347	0
Total	645,300	100	9,704,218	100

Sources: Data from INSEE-DGFiP and Banque de France FIBEN database.

Table 4 – **Descriptive statistics on the study sample in 2018**

	5th percentile	25th percentile	Median	75th percentile	95th percentile
Workforce	0	1	2	6	31
Turnover (€ thousand)	56	168	396	1 075	6 991
Value added (€ thousand)	13	69	162	405	2 126
EBITDA (€ thousand)	−39	4	25	76	459
Cash (days of turnover)	0	12	38	95	322
Total assets (€ thousand)	33	115	286	827	6 218
Profit share (%)	−28	5	18	35	93
Net debt/EBITDA	−13.6	−2.2	−0.3	1.7	12.3
Net debt/Equity	−2.2	−0.7	−0.2	0.4	3.7

Sources: Data from INSEE-DGFiP.

less than or equal to 0.4 for 75% of companies. However, some companies in their distribution tail had significant debt: 5% had a financial leverage ratio above 3.7 and a net debt/EBITDA exceeding 12.3.

With regard to cash holdings (available cash and marketable securities), the situation was very mixed: before the crisis, 25% of NFCs had cash holdings equal to or less than 12 days of turnover, while 25% had a cushion of cash totalling more than 3 months of turnover.

2. The Microsimulation Method

The accounting simulation is conducted in two stages: firstly, the impact of the health crisis on the cash flow of each company is estimated; then, this result is used to identify their need for financing.

2.1. Cash Flow Statement Simulation

The first stage of the simulation consists of tracking, for each company, all cash expenses and revenues that took place in 2020. More formally, it consists of simulating the impact of the COVID-19 crisis on the cash flow statement of each company.

In practice, cash flow statements are computed following the method used by the Banque de France's Enterprise Division for its annual study on the financial situations of companies (Bureau & Py, 2021). This approach follows a standard financial analysis framework. The concepts are therefore those employed in

corporate finance and not those used in national accounting. The final cash variation (or cash flow shock) therefore comes from: *(i)* cash flows from activity, including operating cash flows, non-operating cash flows from corporate tax and dividend payments, as well as cash flows linked to the main government support measures (excluding State-guaranteed loans) and *(ii)* cash flows from investing activities. Cash flows from financing activities (change in equity capital or in financial debt) are assumed to remain constant at this stage.[13] In the second stage of the analysis, debt becomes the adjustment variable to absorb cash losses and restore available cash to the target level (see below).

We began by simulating the $EBITDA_{ft}$. This is written as turnover T_{ft} minus intermediate consumption IC_{ft}, gross wages W_{ft} and production taxes PT_{ft}:

$$EBITDA_{ft} = T_{ft} - IC_{ft} - W_{ft} - PT_{ft} \quad (1)$$

From this simulated EBITDA, cash flow variation is written for each company *f* for the month *t* (compared to the same month *t* of the year *n*-1):

$$\begin{cases} \Delta Cash_{ft}^{w/o\ support} = EBITDA_{ft} - \Delta WC_{ft} - CIT_{ft} - \\ \qquad\qquad Int_{ft} + NOA_{ft} - Div_{ft} - Inv_{ft} \\ \Delta Cash_{ft}^{w/\ support} = \Delta Cash_{ft}^{w/o\ support} + \\ \qquad \underbrace{STW_{ft} + Def_{ft} + CIT_{ft}^{Def.} + SF_{ft}}_{Support\ measures} \end{cases} \quad (2)$$

Turnover is calculated using monthly VAT declarations. We simulate monthly changes in the other accounting inputs in 2020, combining information relating to the trend in turnover observed on an individual basis with snapshots of income statements at the end of 2018, and creating assumptions on how companies adjust their behaviour. These assumptions are summarised in the following Box and detailed further in Bureau *et al.* (2021, Appendices 2 to 4); a table in the appendix also contains all the data and values used in 2020 to construct the cash flow statement.

We created a cash flow statement for each company and for each month of the year 2020 (comparing the month in question in 2020 with the same month in the previous year).[14] As such, we have the variation in cash (or "cash flow shock") for each company ("before financing") for a given month and for the entirety of 2020. Table 5 shows the main components of the cash flow statement.

The variation in cash enables us to make an initial distinction between companies that experienced

13. We reason on financing being the same as in 2018, assuming that loans maturing in 2020 are rolled over with the same conditions as the initial loan.
14. As tax returns are completed annually, a monthly approach such as this is only possible with a simulation method like ours. As such, even if we had the tax returns for fiscal year 2020 now, they would still have to be put through the simulation to obtain monthly figures.

Box – **Assumptions on How Companies Adjusted their Behaviour**

Intermediate consumption (IC_{ft}):

- Fixed costs: this amount denotes the corresponding monthly sum of the annual fixed costs declared in each company's 2018 income statement;
- Variable costs: we assume that the 2020 ratio of variable costs to turnover is identical to that shown on the 2018 balance sheets; variable costs then fluctuate according to monthly observed changes in turnover and depending on the elasticity of such costs to turnover that we estimate at the sectoral level based on historic data.

Gross Wages (W_{ft}):

- Before taking into account short-time work, the annual wage costs for 2020 are assumed to be identical to wages declared in FARE for the 2018 financial year, and then made monthly;
- The analysis is therefore conducted with the same payroll structure as the one observed the 2018 FARE. The impact of this assumption should not be overestimated, as employment withstood much of the crisis in France in 2020. INSEE[(a)] reported that employment fell by 1.9% in the first quarter[(b)] and by 0.8% in the second quarter, before experiencing an upturn in the third quarter (+1.7%) and remaining stable in the fourth (−0.1%). However, employment dynamics varied considerably between sectors, with relatively restrained drops in construction (−0.2%) and manufacturing industry (−0.3%) and larger ones in traded services (−3.6%), which felt the effects of the decline in hospitality (−4.1%).

Production taxes (PT_{ft}): we assume that the production taxes (*contribution économique territoriale* – a regional tax –, *contribution foncière des entreprises* – corporate real estate tax –, etc.) are identical to those *recorded in 2018.*

Variation in working capital (ΔWC_{ft}): we abstract from the dynamics of inventories and assume that WC is equivalent to trade credit, which is modelled using the method described in Bureau *et al.* (2021, Appendix 2). Developments in trade credit follow those of turnover, based on the ratio of trade receivables and trade payables to turnover, measured individually in the 2018 balance sheets and assumed to be unchanged in 2020[(c)]. Not modelling changes on a monthly basis should have limited impact on the need for financing estimated at the end of 2020, assuming that activity has returned to pre-crisis level at the end of 2020; taking these changes into account on a monthly basis would however have plausibly led to liquidity needs being transferred from one period to another alongside increases and liquidation of inventories. Our assumption seems reasonable at the aggregated level and is supported by the *ex post* analysis of the →

Box – *(contd.)*

2020 balance sheets available for a sample of companies in the FIBEN (*Fichier Bancaire des Entreprises* – banking database of companies)[d].

Corporate income tax (CIT_{ft}) and interest expenses (Int_{ft}): these variables correspond to taxes on profits and to interest and similar expenses, respectively, which are assumed to be identical to the figures for 2018 and spread evenly over 12 months.

Non-operating activities (NOA_{ft}): this heading regularly gathers the net profit on joint operations, income less financial charges (excluding interest expenses), income less extraordinary charges on management activities, and transfers between expense accounts, excluding deferred charges. We neutralise the extraordinary elements and exclude transfers of expenses for which there is no information in FARE. The profit on joint operations is adjusted in line with the impact on activity, while the other items are assumed constant.

Dividends (Div_{ft}):
- For CAC 40 companies: we use the dividends recorded for the company in question in the 2018 FARE, to which we apply the observed rate of growth in the group's dividends between 2018 and 2020;
- For other companies: we assume that the companies that experienced a drop in activity in April 2020 did not pay dividends to external shareholders and reduced intra-group dividends by 50%. The sensitivity of our results to these different adjustment assumptions is further detailed in the Online Appendix C1[e]. This modelling method does however mean that we may have overestimated the reduction in dividends for small business owners, for whom dividends are often a key part of their remuneration and are therefore harder to reduce.

Investment (Inv_{ft}): we assume that companies reduced their investment expenditures in proportion to their individual drop in activity, based on a sector × size elasticity estimated using historic data (see Bureau *et al.*, 2021, Appendix 3). Such an assumption based on a constant elasticity of investment expenditure to turnover is of course simplistic, but given the lack of any infra-annual data on investment trends, we believed that this approach was the most reasonable. In Bureau *et al.* (2021, Appendix 3), we accompany this by two *ad hoc* investment reduction scenarios, which aim to illustrate the sensitivity of the estimated need to investment expenditure, and analyse the consistency of our results with macroeconomic changes in investment in 2020.

With regard to cash flows from public support scheme, we observe the amounts received from short-time work (STW_{ft})[f] and the amounts received from social security contribution deferrals and exemptions (Def_{ft})[g]. We simulate the amounts linked to exemptions and deferrals of corporate income tax (CIT_{ft}^{Def}), as well as those from solidarity funds (SF_{ft}). Our method for simulating the individual shock of these support measures is presented in the appendix (see Online Appendix C1 and Bureau *et al.*, 2021, Appendix 4). This simulation takes into account monthly changes in the rules for the schemes (eligibility thresholds and support calculation methods), individual monthly turnover data for 2019 and 2020, workforce, sector and geographical location in order to account for specific characteristics linked to the curfew imposed in some areas in the final quarter of 2020.

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[e] INSEE, Emploi salarié – quatrième trimestre 2020 (Salaried employment – fourth quarter 2020), Informations Rapides N° 061, 9 March 2021.
[b] Compared to the previous quarter, adjusted for seasonal variations.
[c] For illustrative purposes, Online Appendix C4 presents the infra-annual changes in cash flows linked to developments in trade credit in the 'Hospitality' *sector.*
[d] Using a sample of 102,722 legal units in the FIBEN database as at 31 December, and for which 2019 and 2020 company accounts are available, we observe that the total stock of the median inventory (raw materials, goods, finished products and products in production) did not change between 2019 and 2020. There are however significant individual differences, with the first quartile recording a 16% reduction in inventories and the third quartile recording a 16% increase.
[e] Link of the Online Appendix at the end of the article.
[f] With regard to short-time work, equation (2) is a simplified representation of the simulation for presentation purposes. In practice, short-time work is taken into account for net wages W_{ft} and therefore applied starting from the EBITDA. Specifically, net wage expenses are defined as:

$$\begin{cases} W_{ft} = \dfrac{W_{f,2018}}{12} & \text{without short-time work} \\ W_{ft} = \dfrac{W_{f,2018}}{12} - STW_{ft} \cdot \dfrac{1}{0.7 \cdot \left(1 + \dfrac{Social\ contributions}{Wages_{f,2018}}\right)} & \text{with short-time work} \end{cases}$$

[g] However, we cannot distinguish between exemptions and deferrals in our data.

a net increase in liquidity during the crisis and companies with a net decrease. Companies that posted negative variations in cash at the end of 2020 are able to mobilise different levers to bridge the gap: drawing from the cash they had available at the start of the year, making use of external sources of funding (bank credit, bond debt or the release of new capital), or even disposing of certain assets. With the exclusion of the issuance of equity and the disposal of assets, the variation in cash (before financing) measures the change in companies' net debt at the end of 2020. Whether this shock on cash flow is absorbed through the use of cash available as assets or by resorting to borrowing (or, more likely, a combination of the two), the effect on the change in each company's net financial debt is the same.

Table 5 – **Cash flow statement summary**

	Content	Calculation Assumptions
Flow of cash from activity	Surplus (or deficit) of cash generated by the company's operating cycle (= EBIDTA − Δ WCR), net of taxes and shareholder remuneration, and including income from support measures (STW, SSC deferrals, CT deferrals and SF)	- Flows simulated using observed monthly turnover (VAT data) - With adjustment assumptions for variable costs, fixed costs, inter-company credit and dividends - Observed STW and SSC deferrals - Simulated CT deferrals and SF
+ Net flows from investment	Disbursements net of cash receipts from acquisitions/disposals of fixed assets	Flows simulated using FARE 2018 data and a "*sector* × *size*" elasticity to turnover
+ Net flows from financing	Cash receipts and disbursements relating to choice of financing (injection of capital, loans issued and repaid)	Assumption based on financing structure remaining unchanged
= Variation in cash		

Notes: STW: Short-Time Work; SSC deferrals: deferrals of social security contributions; CT deferrals: corporate tax deferrals; SF: solidarity funds.

2.2. From the Variation in Cash to the Operational Need for Financing

Here, we are using need for financing to denote the portion of net expenses (negative variation in cash) that companies are unable to meet after consuming some or all of their liquidity. As such, they rely on external sources of financing.[15] In this sense, the aggregated need for financing can be assimilated to the request for financing submitted by NFCs to the financial sector following the impact of COVID-19.

We consider two scenarios for the consumption of available cash holdings ($Available\,CH_f$):

(*i*) liquidity shortage: this approach is based on a situation in which the company declares a need for financing, when consuming all available cash holdings at the start of the year does not allow it to fulfil its immediate payment obligations:

$$Liquidity\ shortage_{ft} = \begin{cases} Available\,CH_f - \Delta Cash_{ft} \\ if\ Available\,CH_f - \Delta Cash_{ft} \leq 0 \\ 0\ otherwise \end{cases} \quad (3)$$

In other words, the company has a need for financing only when it is conceptually in a "negative cash" situation at the end of 2020 (a situation referred to as "illiquidity" in Guerini *et al.*, 2020; Demmou *et al.*, 2021a, 2021b; Schivardi & Romano, 2021; Hadjibeyli *et al.*, 2021).

(*ii*) operational need for financing: this refers to resources required by the company to absorb the drop in cash as a result of the fall in activity, while maintaining a minimum cash buffer to support recovery. Further details on its composition can be found below.

From an economic point of view, approach (*i*) is not perfect in the sense that in order for companies to function, they need to have a build-up of operational cash to allow for time lags between revenue and expenditure in periods of activity. We therefore sought to identify a level of operational cash that would allow companies to resume operations in a period of recovery and below which companies would not want to drop. As such, we make the assumption that companies would want to maintain the same level of cash flow in terms of days of turnover as they had at the end of 2018. This operational cash buffer is itself calculated using a "target" turnover that took into account both the impact of the crisis on activity (which reduced the immediate need for cash) and forecasts for a return to normal. This "target" turnover is defined as the average between the mean turnover over the last six months $T_m^{Observed}$ and the mean counterfactual turnover $T_m^{Contrefactual}$ (i.e. the turnover that would have been achieved if no crisis had occurred)[16] over the following six months:[17]

$$T_t^{Target} = \sum_{m=t-5}^{t} T_m^{Observed} + \sum_{m=t+1}^{t+6} T_m^{Contrefactual} \quad (4)$$

The operational need is therefore defined as the need for financing required to restore the operational cash buffer ($Cash\,buffer_f$), which is itself dependent on "target" turnover:[18]

$$Ope.\,fin.\,need_{ft} = \begin{cases} \left(Available\,CH_f - Cash\,buffer_f\right) - \Delta Cash_{ft} \\ if\ Available\,CH_f - \Delta Cash_{ft} \leq Cash\,buffer_f \\ 0\ otherwise \end{cases} \quad (5)$$

15. *Excluding, for simplicity, asset disposals.*
16. *See Bureau* et al. *(2022, this issue) for more details on how this counterfactual turnover was calculated.*
17. *To be conservative, the target level of cash is also capped within each A17 sector to the median value of the distribution of cash in days of turnover.*
18. *No need for financing is deemed to exist if, at the end of 2020, the company have cash equal to or exceeding the target operational cash amount, or if the company posts an increase in cash during the crisis.*

As previously noted, FARE data for 2019 and 2020 was not available when this study was conducted, so our simulations rely on company accounts from 2018 for balance sheet data. However, we now have a selection of balance sheets ended in 2019 and 2020 thanks to the Banque de France's FIBEN database. This data are used in the Online Appendix C2 (Link at the end of the article) to validate our microsimulation model.

3. Findings

3.1. Dispersion of Cash Flow shocks and Effect of Support Measures

3.1.1. Estimate of Aggregated Shock

Firstly, the impact of the health crisis is estimated at the aggregate level. Specifically, we add up individual variations in cash at the end of December 2020, taken from cash flow statements, for every company in our sample. As such, reductions and increases in cash offset each other, as is the case in national accounting or on a macroeconomic level.

$$\Delta Cash^{2020} = \sum_{f=1}^{645\,300} \Delta Cash_f^{2020} \qquad (6)$$

Figure I below shows the succession of revenues and expenses, from the EBITDA simulated at the end of 2020 to the final shocks on cash flow. Ultimately, the aggregated cash flow shock for the companies in our sample, after taking into account the public support measures (short-time work, solidarity funds, social security contribution deferrals, and three-month corporate tax deferrals) totalled 5.2 billion euros in 2020, representing a slight increase in liquidity (i.e. a drop in net debt). Without public support, net debt would have increased by 51 billion euros. The aggregated effect of these public support measures on the companies in our sample was around 56 billion euros, which appears to be relatively consistent with the figures available for all NFCs.[19] The use of the short-time work scheme contributes to more than half of the decrease in the cash drop.

This overall picture of relative stability in net debt is consistent with the macroeconomic data now available on the evolution of debt among NFCs (see above). It is, however, difficult to interpret, in the sense that it hides the existence of very different individual situations, as cash excesses offset deficits: 41% of companies effectively record a reduction in cash at the end of 2020,[20] after public support measures, for an estimated total amount of 198 billion euros (Figure II).

3.1.2. Distribution of Cash Flow shocks

Figure III presents a simplified distribution of cash flow shocks. It also highlights the share of companies facing moderate or considerable negative or positive shocks.[21] In 2018, the proportion of negative and positive shocks was exactly equal (50% vs 50%). This once again illustrates the heterogeneity of the situations companies are in, even before the crisis. In particular, it underlines a key point in our analysis: what we measure as a cash flow shock reflects not only the impact of the health crisis but also the normal life of companies, whose net financial debt increases and decreases without that necessarily suggesting anything about their financial situation.

The distribution of cash flow shocks, excluding public support measures and without adjustments in company behaviour (i.e. under the assumption that investment expenditure is maintained unchanged and that all dividends are paid) shows that 6 in 10 companies would experience a reduction in cash (Figure III). Comparing this with a "normal" situation (that of 2018) clearly illustrates the deformation towards the left (i.e. towards a drop in cash) of the distribution of shocks due to the effect of the crisis.

The need for public intervention is made clear by the distribution after adjustments in company behaviour (according to the assumptions detailed in the box) and before public support: the distribution of negative and positive shocks is shown as 56% and 44% respectively, illustrating that solely adjusting investment expenditure and dividends is not enough to absorb the impact.

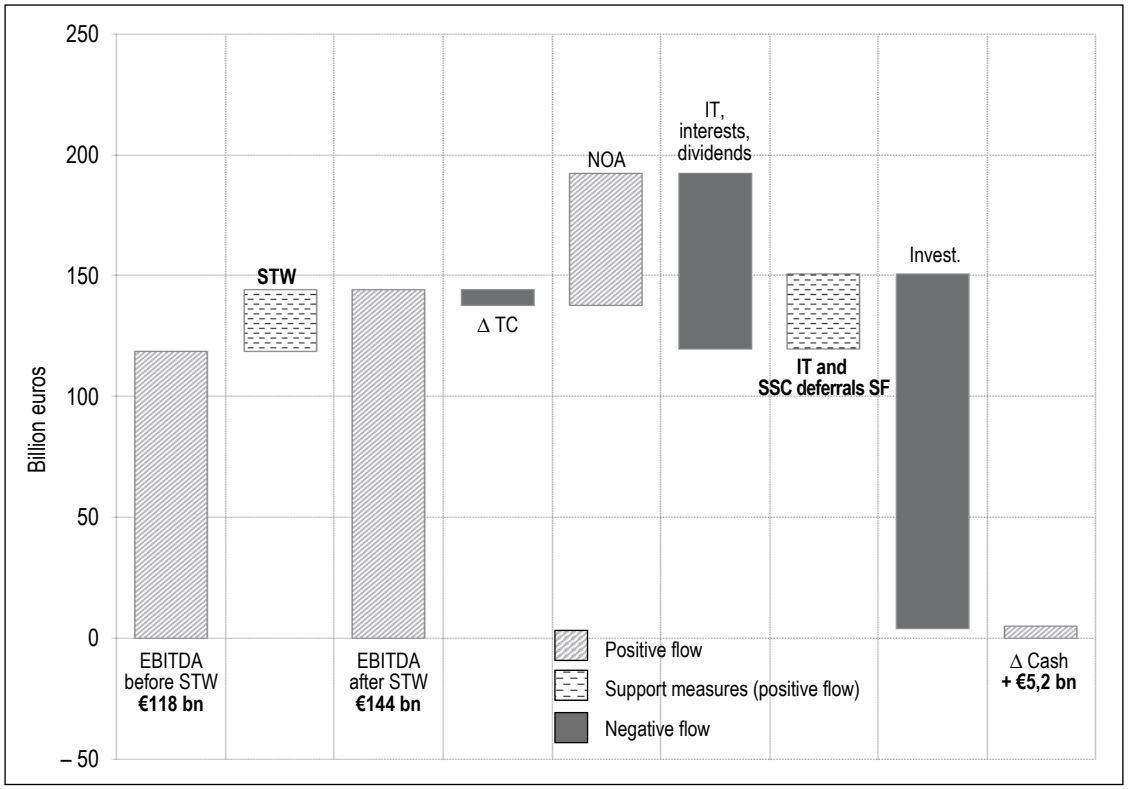
Finally, the distribution of cash flow shocks after support measures is recentred, at 47% and 53%, a slight improvement on 2018. Nevertheless, looking at "extreme" shocks paints a different picture: in a "normal" year, 13% of companies record a strong increase in their net debt (see 2018 in Figure III), but in 2020, this figure is 21% after adjustment and public support. The opposite is also true for companies estimated to have reduced their net debt following public

19. This sum of 56 billion euros can also be compared to around 77 billion euros at the end of 2020 for the four major measures taken into account in our simulations, representing a coverage rate of around 73%, which is consistent in terms of the value added of the NFCs in our sample.

20. Including some companies facing a very notable shock (and therefore a considerable increase in net debt) and others with a more moderate shock.

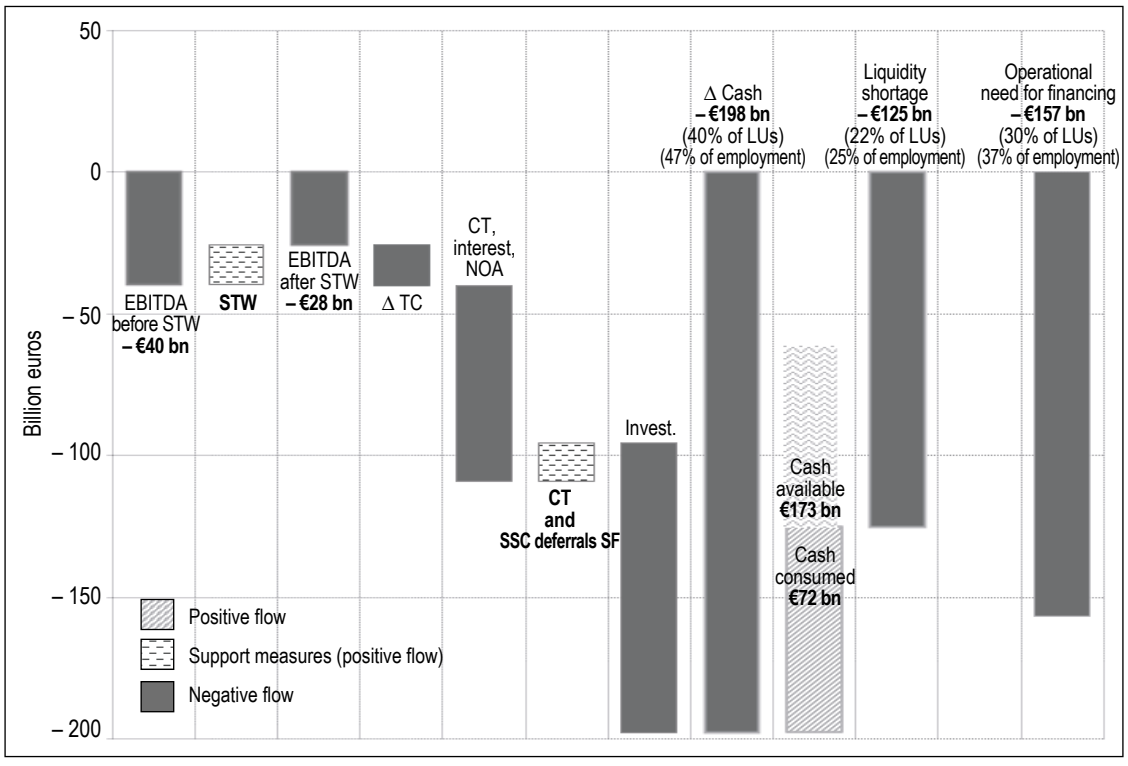
21. The threshold of 30 days of turnover distinguishing relatively more "strong" and more "moderate" shocks is determined on an ad hoc basis. Our conclusions are qualitatively robust to other threshold values. As an indication, before the crisis, the median cash level for companies in our study sample is 38 days of turnover (cf. Table 4).

Figure I – **Main cash flows aggregated for all companies in the sample at end December 2020**



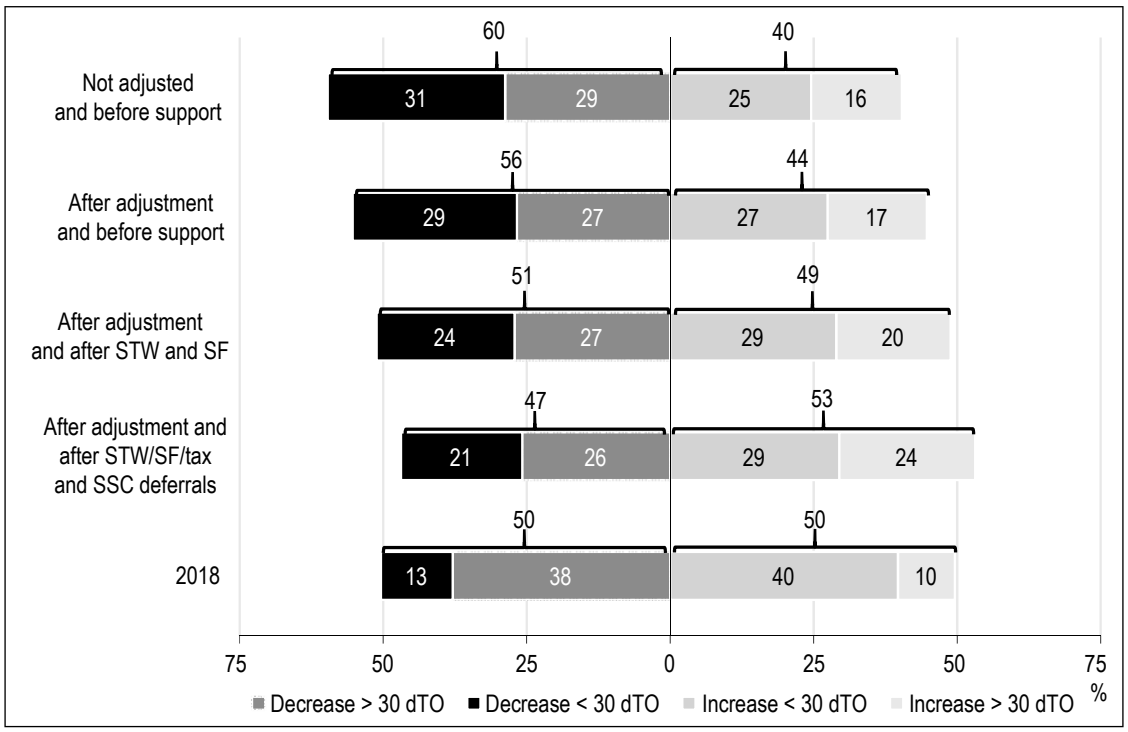
Notes: STW: short-time work. ΔTC: change in trade credit from previous year. NOA: non-operating activities. SF: solidarity funds. Invest.: net flows from investment.
Sources: Data from INSEE-DGFiP, DARES, ACOSS. Authors' calculations.

Figure II – **Main cash flows aggregated for all companies in the sample with a drop in cash holdings at end December 2020**



Notes: See Figure I.
Sources: Data from INSEE-DGFiP, DARES, ACOSS. Authors' calculations.

Figure III – **Share of companies (weighted by employment) with positive or negative shock on cash flow in 2020 with financing unchanged (%)**



Notes: Companies are weighted by workforce. Shocks are calculated with financing unchanged from the previous year, so before State-guaranteed loans. Black and very light grey bars indicate significant (negative or positive) shocks, while dark and light grey bars indicate moderate shocks. "Not adjusted" indicates where our assumption of reducing investment and dividends are not applied. In terms of public support, we firstly consider subsidy schemes: short-time work (STW) and solidarity funds (SF). We then integrate deferrals of tax and social security contributions that are to be paid at a later date.
Sources: Data from INSEE-DGFiP, DARES, ACOSS. Authors' calculations.

support: 1 in 4 companies posts a significant positive cash flow impact after adjustment and support measures at the end of 2020, compared to just 1 in 10 in 2018. Public support measures therefore help some companies to considerably improve their cash flow situation.

3.1.3. Sector Analysis

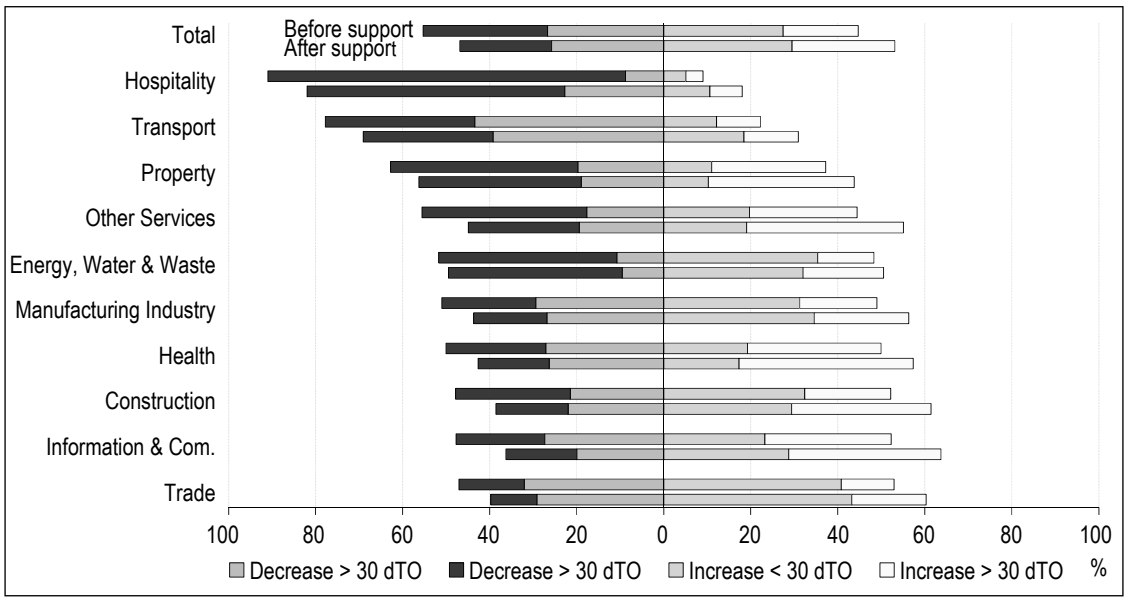
The cash flow shocks experienced also vary wildly between sectors, in line with the drops in activity (Bureau *et al.*, 2022, this issue): the sectors most affected were also those that suffered the largest estimated increases in net debt. In the '*Hospitality'* sector, 9 in 10 companies see their net debt increase before support measures (Figure IV). Although 80% of companies in the sector remained in a negative cash flow situation after receiving support, these measures help to ease the intensity of the shock – measured by the median shock – with the effect being more pronounced in those sectors most affected by a drop in activity (Figure V). As such, the median shock in the '*Hospitality'* sector is halved, and it falls by less than one third in the least affected sectors, such as '*Information and Communication'*, '*Property'* and '*Energy'*. The dispersion of cash flow shocks after support is also notable within each sector, including in sectors that withstood the crisis somewhat better. In '*Information and Communication Technologies*', for example, 15% of companies still experienced a significant increase in net debt. On the other hand, in the most affected sectors, such as '*Hospitality*', almost 20% of companies post a reduction in their net debt after support – twice as many as before receiving support. In addition to the impact of public support, the not insignificant share of companies that experience an increase in cash flow in each sector reflects the capacity of some companies to adapt, for example by switching to distance selling or by developing their online presence (Bureau *et al.*, 2022, this issue).

3.1.4. Analysis by Credit Risk

Finally, we conduct a cash flow impact analysis by Banque de France rating. The rating reflects the credit risk of each company in our sample at the end of 2019, before the COVID-19 crisis.[22] The rating scale reflects the likelihood that the

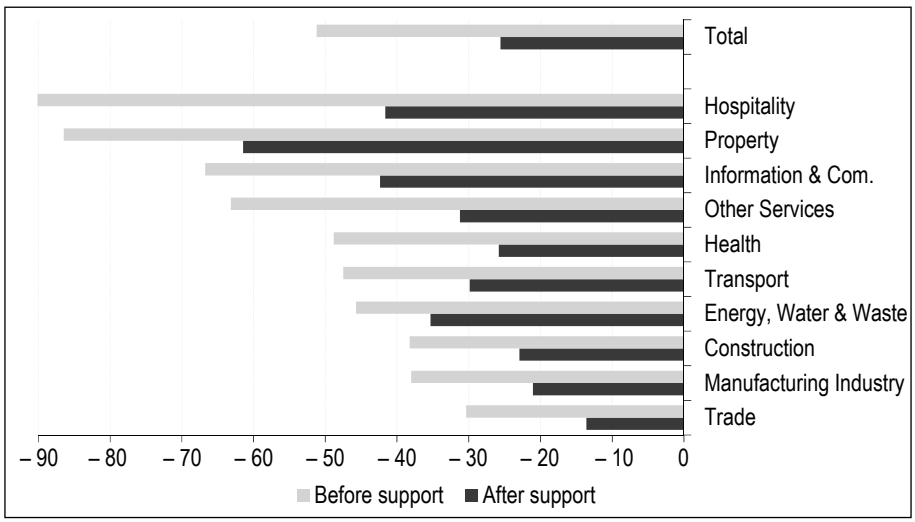
22. See Section 2, and Table 3 in particular, for more information on Banque de France ratings.

Figure IV – **Share of companies (weighted by employment) in each sector with positive or negative shocks on cash flow at end of 2020 (%)**



Notes: Support includes short-time work, solidarity funds and deferrals of tax and social security contributions.
Sources: Data from INSEE-DGFiP, DARES, ACOSS. Authors' calculations.

Figure V – **Median negative shock on cash flow at end of 2020 before and after support measures, in days of turnover**



Sources and coverage: data from INSEE-DGFiP, DARES, ACOSS; companies posting a negative impact on cash flow before support measures. Authors' calculations.

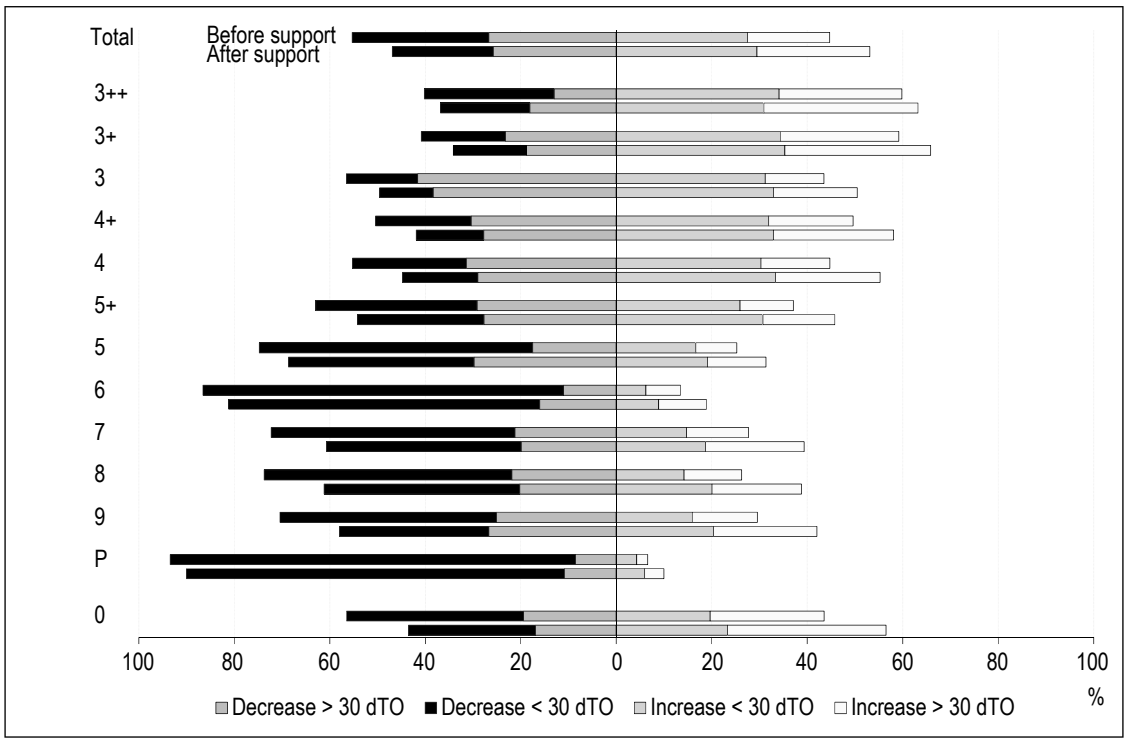
company may default within three years and ranges from 3++ for the best rated companies to P for those that filed for bankruptcy.

Figure VI illustrates the strong correlation observed between the occurrence and intensity of cash flow shocks on the one hand, and credit quality on the other. As such, from credit rating 5+ (equivalent to BB), at least half of companies in the category experienced a drop in cash. It should be noted that companies rated 5+ to P represent a significant share of employment (21% in our sample).

Several factors can help to explain this correlation between credit quality and cash flow impact: firstly, the effects of the composition of each sector, due to the under-representation of highly rated companies in the sectors most affected, such as '*Hospitality*'. In addition, the reduction in activity was generally less significant for companies with a higher rating, which may also suggest that they were better able to adapt during the crisis (going online, etc.).[23]

23. This point is yet to be thoroughly researched.

Figure VI – **Share of companies (weighted by employment) in each credit rating category with a positive or negative shock on cash flow at end of 2020 (%)**



Notes: See Figure IV.
Sources: Data from INSEE-DGFiP, DARES, ACOSS, Banque de France FIBEN database. Authors' calculations.

However, it is important to note that here, the correlation is not linked to the fact that more highly rated companies had larger reserves of liquidity *ex ante*, as this stage in the analysis was before any initial cash holdings had been used.

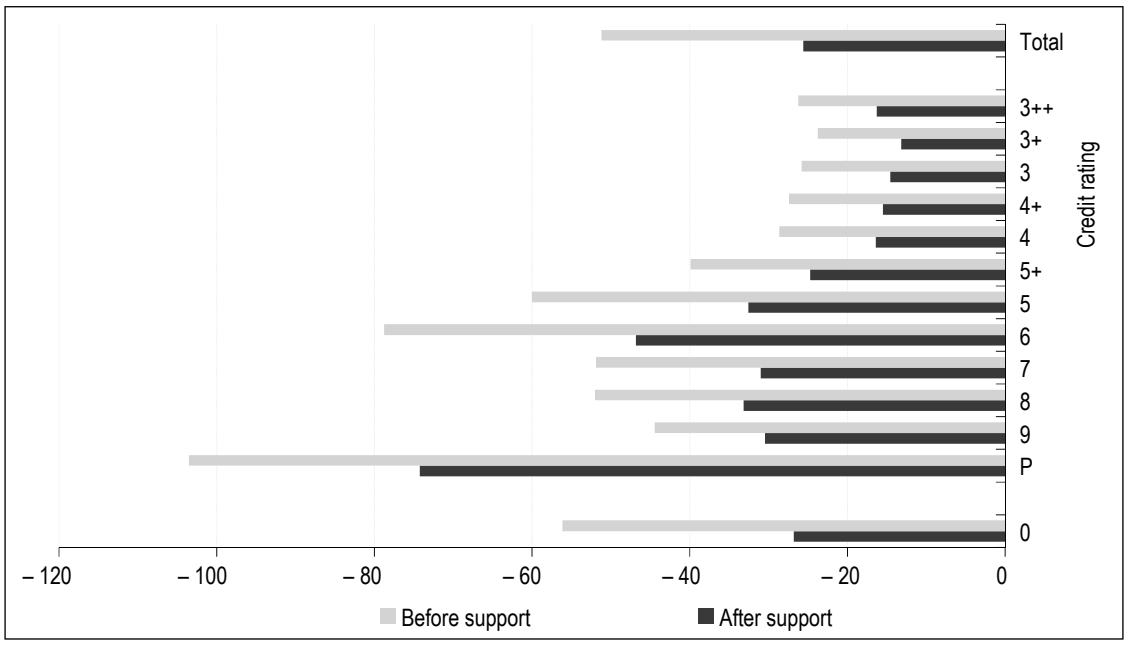
The decision of many European countries, including France, not to base public support on companies' pre-crisis financial situation means that non-viable companies were protected during 2020. Our simulations show that vulnerable companies did indeed benefit from the support measures implemented, but not more than the others. A quick look at Figure VI may suggest as such. In fact, thanks to the support measures put in place, the percentage of very vulnerable companies (those rated 7, 8 and 9) that experience a drop in cash flow fall more than those companies with other credit ratings (reductions of 12 to 13 percentage points [pp] compared to 3 to 10 pp for other ratings). This should not be over-interpreted, however: firstly, the effect is not verified for the category of most vulnerable companies, i.e. those in insolvency proceedings (rated P). Secondly, the impact of the support measures is similar for companies rated 7, 8 and 9 (reduction of 12 to 13 pp) and for companies rated 0 (reduction of 13 pp). Companies rated 0 are simply those for which the Banque de France has not recorded any unfavourable information regarding incidents relating to trade bill payments or judicial decisions. Zero-rated companies cannot be systematically treated as vulnerable companies but they have benefitted a lot from the support measures put in place.

If we now consider the intensity of the impact – measured by the median impact (Figure VII) – we can in fact see that the companies with the worst ratings (7 to P) benefit from the support measures less than other companies (28-40% reduction in median impact, compared to 38-52% for other ratings). It should also be noted that in terms of amounts, the increase in net debt is primarily concentrated in companies with the best ratings (Figure VIII): 50% of the total amount was covered by Investment Grade companies (rating equal to or above 4+).[24] The companies that were most vulnerable before the crisis (ratings 7 to P) represent just 0.6% of the aggregated increase in net debt.

To sum up, while it may appear that the companies that were most vulnerable before the crisis benefit from public support, the aid they received is not disproportionate.

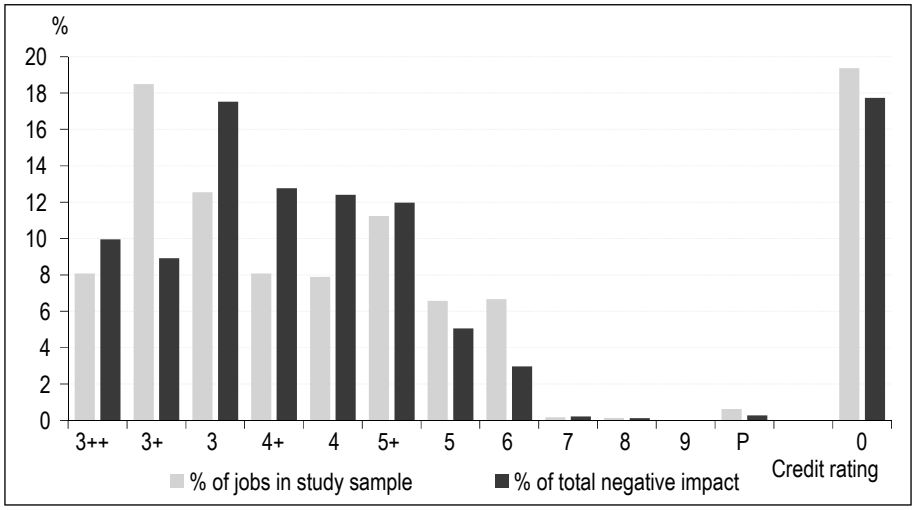
24. This is partly linked to the impact of size, with more highly rated companies also being larger in terms of structure.

Figure VII – **Median negative shock on cash flow before and after support measures at end of 2020 in days of turnover, by credit rating**



Sources and coverage: Data from INSEE-DGFiP, DARES, ACOSS, Banque de France FIBEN database; companies posting a negative shock on cash flow before support measures. Authors' calculations.

Figure VIII – **Distribution of total shock on cash flow at end of 2020 (€198 bn) after support measures, by credit rating**



Sources: Data from INSEE-DGFiP, DARES, ACOSS, Banque de France FIBEN database. Authors' calculations.

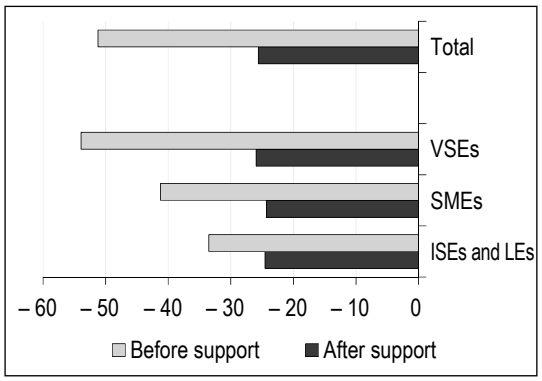
3.1.5. Analysis by Size of Company

Company size appears to be a secondary factor determining the occurrence of cash flow impacts: before support, net debt was estimated to have increased in around 50% of companies, regardless of their size. After support, this figure fell to 41% for ISEs and LEs, 44% for SMEs and 46% for VSEs. However, the public support mechanisms were better at alleviating the intensity of the impact for VSEs: the percentage of VSEs in great difficulty (cash drop exceeding 1 month of turnover) fell from 37% before support to 24% after, while the median cash flow impact among VSEs fell by half (Figure IX). Based on the amounts held by companies, ISEs and LEs represented nearly 60% of the total cash flow impact (Figure X).

3.2. From Cash Flow Impact to the Operational Need for Financing

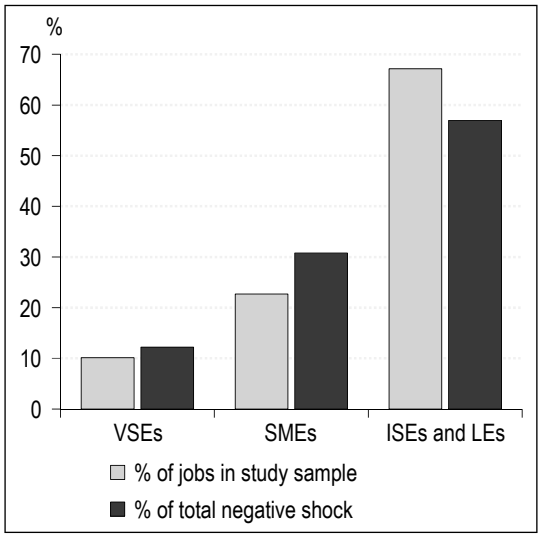
To finish, we will take a look at the analysis of the operational need for financing (see Section 2.2). In order to calibrate the operational cash buffer, this indicator takes into account a number of

Figure IX – **Median negative shock on cash flow at end of 2020 before and after support measures, in days of turnover, by company size**



Sources and coverage: Data from INSEE-DGFiP, DARES, ACOSS; companies posting a negative shock on cash flow before support measures. Authors' calculations.

Figure X – **Distribution of total shock on cash flow after support at end of 2020 (€198 bn)**



Sources: Data from INSEE-DGFiP, DARES, ACOSS. Authors' calculations.

additional factors compared to the cash flow shock indicator we saw in the previous section: the distribution of cash holdings at the start of the crisis among the companies, the intensity of the downturn in activity suffered by each company and each sector's growth outlook. To simplify matters, we concentrate on the points where the operational need provided additional insights to those offered by cash flow shocks.[25]

Of the 47% of companies that experienced a drop in cash, 1 in 5 are able to absorb this impact using cash holdings they have at the start of the year, without resorting to other external sources of financing, while maintaining enough of a liquidity cushion to be able to resume operations following the crisis (Figure XI). Before support, the share of companies with no operational need is thus 56% for all company sizes. After support, this figure is 68% for VSEs, 65% for other SMEs and 61% for ISEs and LEs.[26] The largest companies also have cash equivalents in the form of "available" lines of credit on which they can draw in difficult periods, and which are not taken into account here.[27]

At the sectoral level, liquidity differences change the hierarchy of the most affected sectors when a drop in cash becomes an operational need. '*Property*' in particular has liquidity that allowed it to absorb the impact: while nearly 1 in 2 companies experiences a cash flow shock (after support), only 1 in 4 recorded an operational need. In '*Trade*' on the other hand, the number of companies that experienced a reduction in cash falls by only 10 pp following use of some of their cash assets (Figure XII), such that companies in this sector represent more than 20% of the total operational need in the sample. However, '*Hospitality*' remains the sector most affected by the crisis, with 50% of companies recording an operational need exceeding one month of turnover – five times higher than for the '*Health*' sector, for example – and representing 10% of the aggregated operational need.

Finally, an analysis by risk reveals strong negative correlation between companies' operational needs and their credit quality before the COVID-19 crisis. As companies with better ratings have more liquidity, they are able to absorb the drop in cash more readily. As such, the majority do not have any operational need for financing (Figure XIII). More specifically, 65% to 75% of the NFCs with the best ratings (3++ to 4+, or Investment Grade) do not have an operational need, compared to 10% to 60% for NFCs with lower ratings (4 to P).

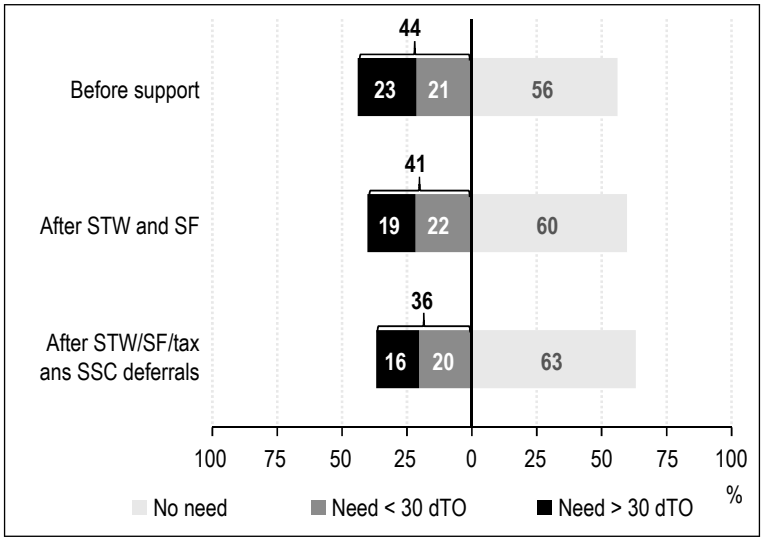
The intensity of the operational financing need is also higher and varies much more for companies with lower ratings. As such, the median

25. Online Appendix C4 presents the monthly changes in the aggregated operational need for financing before and after taking into account the support measures implemented. Changes in the operational need for financing reflect developments in the crisis as well as the increase in the power of support measures, which reduce the operational need for financing by 6% in March and April, 8% in May and 12% from July (compared to the operational need for financing that would exist without these support measures).

26. In Online Appendix C5, we briefly analyse some characteristics of companies with and without an operational need for financing and whether or not they benefit from support measures. This analysis identifies two aspects that may help to explain why, among the companies with no operational need for financing, some received assistance and some did not, as it relates to the cash holdings they have available before the emergence of the pandemic and the sector to which they belong.

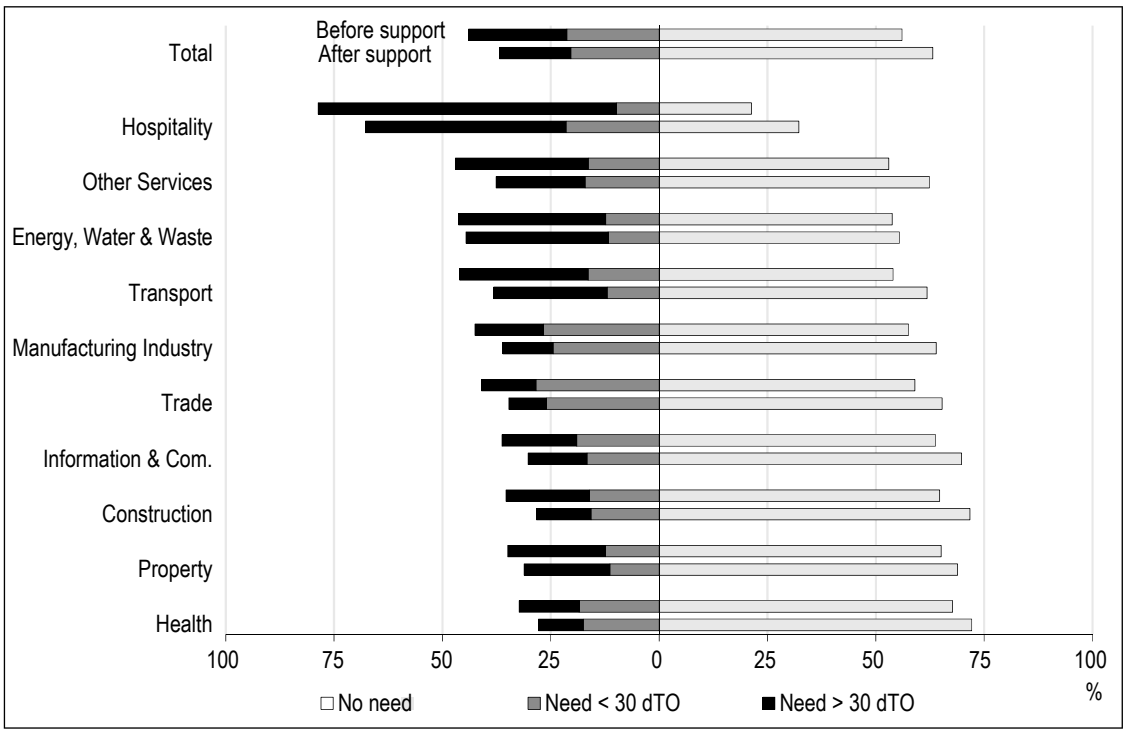
27. The ability to obtain these available lines of credit and the flexibility they provide in terms of liquidity risk management vary considerably depending on the size of the company. In December 2020, at the aggregated level, LEs have as much available credit as they have mobilised credit. On the other hand, for VSEs and SMEs, available credit represented just 12-13% of credit beyond what have already been used. This figure was 28% for ISEs (sources: Banque de France, FIBEN/Risk Division).

Figure XI – **Share of companies (weighted by employment) with operational need for financing at end of 2020**



Notes: Companies are weighted by workforce. The black and dark grey bars represent significant and slight needs for financing respectively, while the light grey bars represent no need for financing. In terms of public support, we firstly consider subsidy schemes: short-time work (STW) and solidarity funds (SF). We then integrate deferrals of tax and social security contributions that are to be paid at a later date.
Sources: data from INSEE-DGFiP, DARES, ACOSS. Authors' calculations.

Figure XII – **Share of companies (weighted by employment) with operational need for financing at end of 2020 by business sector**

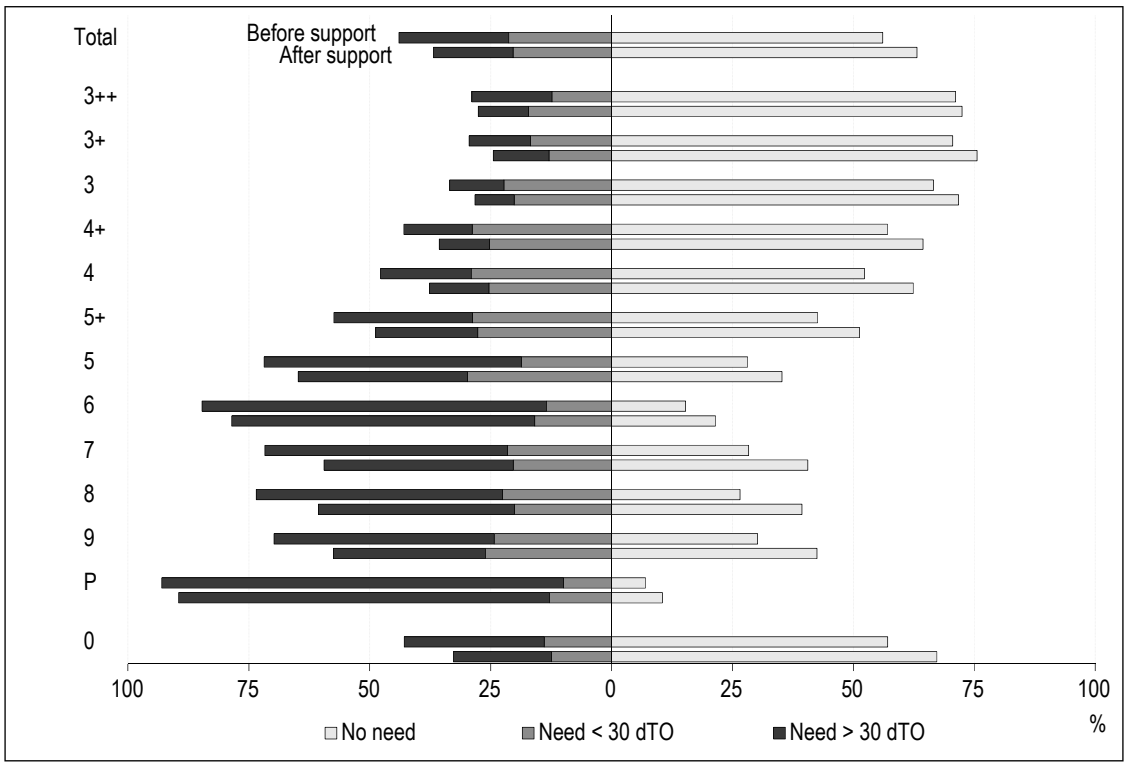


Notes: Support includes short-time work, solidarity funds and deferrals of tax and social security contributions.
Sources: Data from INSEE-DGFiP, DARES, ACOSS. Authors' calculations.

operational need is between 14 and 73 days of turnover for the lowest-rated companies, compared to just 10 to 16 days for the highest-rated. In terms of exposure, the companies with the highest ratings (3++ to 4+) represent almost 50% of the total operational need for financing. The risk in this category is, by definition, limited (Banque de France default rate over three years of 0.04% to 0.55% for companies rated at the end of 2016).[28] Those

28. A company is considered to have defaulted if it filed for bankruptcy or if it receives a rating of 9 as a result of major incidents relating to trade bill payments.

Figure XIII – **Share of companies (weighted by employment) with operational need for financing at end of 2020, by credit rating***



* As a reminder, the rating 0 is given to companies for which the Banque de France has not gathered any unfavourable data regarding incidents relating to trade bill payments, or judicial information or decisions, and does not have any recent accounting information.
Notes: See Figure XII.
Sources: Data from INSEE-DGFiP, DARES, ACOSS. Authors' calculations.

with lower ratings (4 to P) represent 35% of the total. While this exposure is substantial, it remains very limited for the worst-rated companies (7 to P), which represent just 1.1% of the total operational need. Attention should however be paid to those companies rated 5 and 6, which represent 14% of the total operational need, but only 7% of companies and 8% of the workforce in our sample.[29]

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This study uses a microsimulation model to assess the impact of the health crisis on more than 645,000 French companies. It highlights the high level of heterogeneity in the cash flow shocks experienced by companies in 2020, including within each business sector. This underscores the undeniable benefit of the microeconomic approach, which is essential for refining the macroeconomic diagnosis on the impact of the health crisis. It also underlines the need for caution when it comes to public policy: sector cannot be the only criteria used to define policies for emerging from crises.

In addition, this work shows that the support measures implemented by the French government have changed the dispersion of cash flow shocks to more closely resemble a "normal" year. However, in distribution tails, we also see an improvement in the situation of some companies and further weakening of other companies that were already vulnerable before the crisis. Some of these companies may therefore face difficulties when support measures are lifted. The main challenge in terms of public policy is, in this context, finding the right balance between maintaining the productive fabric and skills, minimising the social impact of the crisis and preserving the virtues of the process of creative destruction. One avenue on the matter is the improvement of restructuring processes, which can be made more efficient so that cases of companies in difficulty can be handled as well as possible. In addition to the arrangements put in place during the crisis to speed up these processes, promoting preventive safeguarding procedures and amicable settlements (*ad hoc* mandates and conciliation) could support the

29. More details on the distribution of the operational need by credit rating can be found in Online Appendix C3.

recovery of companies in difficulty (see Zapha & Fouet, 2021).[30]

It should be noted that while our microsimulation model is one of the most comprehensive and detailed to look at corporate liquidity shocks during the COVID crisis, there are still limitations inherent to this type of exercise to consider: firstly, certain expenses likely to affect companies' cash flows were not modelled (such as inventory variation). Secondly, the simulations is conducted on a sample of companies present in the 2018 FARE. As a result, they are not a perfect measure of the situation of companies at the start of 2020, they do not take into account young companies created in 2019 and 2020 and the analysis is conducted with staff numbers unchanged. Finally, taking into account two of the main support measures (solidarity funds and corporate tax deferrals) requires simulated data. This is not the case for short-time work and social security contribution exemptions and deferrals, for which we used observed data.

One avenue for extending this work would be to compare the operational need for financing estimated in the study with the actual increase in debt observed in 2020 (State-guaranteed loans, bond issuances, etc.). The difference between the two would effectively be an estimate of companies' "precautionary debt" during the crisis. □

30. Safeguarding procedures and amicable settlements are more successful, representing 60% and 70% of debt restructuring agreements respectively, compared to 25% for receivership. Epaulard & Zapha (2022) show that safeguarding performs better in part due to the negative reputation of receivership.

Link to the Online Appendix:
https://www.insee.fr/en/statistiques/fichier/6472311/ES532-33_Le-et-al_Online-Appendix.pdf

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APPENDIX

Table – Data, Assumptions and Values Used to Construct the Cash Flow Statement

	Underlying data used	Assumptions	Values used in 2020
Flow of cash from activity			
Turnover	Monthly turnover gathered from VAT data		TO_m: Monthly turnover observed up to the end of 2020
(–) Intermediate consumption	Fixed and variable costs declared in FARE 2018	Purchases adapt to and follow changes in activity. Other variable costs are partially adjusted. - Variable costs (VC): 2018 ratios in % of turnover - Fixed costs (FC): rental and leasing costs	$Purchases_m$ = ratio of purchasing x TO_m Other VC_m = ratio of purchasing x e x TO_m, where e is the estimated elasticity of the sector (0.6<e<0.9 depending on sector) FC_m = FC /12
(–) Personnel costs, adjusted for short-time work (STW) if applicable	Personnel costs (PC) declared in FARE 2018 + observed monthly compensation for short-time work (ACOSS)	Constant workforce. If short-time work, we assume in all cases: (*i*) compensation paid to the employee equal to 70% of gross remuneration; (*ii*) compensation 100% borne by public authorities; (*iii*) no additional pay; (*iv*) constant ratio of social security contributions (SSC) / salary (2018 figure)	If no STW: PC_m = PC / 12 If STW: PC_m = PC / 12 − STW_m/ [0.7 · (1 + 2018ratio $_{SSC / salary}$)]
(–) Variation in ICC	Trade receivables (TR) and trade payables (TP) declared in FARE 2018	Payable upon 60 days See simulation details in Appendix 2 of Bureau *et al.* (2021)	ratio of TR = TR / ($TO2018_{m\_close}$ + $TO2018_{m\_close-1}$) ratio of TP = TP / ($TO2018_{m\_close}$ + $TO2018_{m\_close-1}$) TR_q = ratio of TR x ($TO_{m,q}$ + $TO_{m,q-1}$) TP_q = ratio of TP x ($TO_{m,q}$ + $TO_{m,q-1}$) ICC_q = TR_q – TP_q Δ ICC = ICC_q – ICC_{q-1}
(–) Miscellaneous, including corporate tax (CT), dividends	Non-CAC 40: dividends from FARE 2018 CAC 40: dividends from FARE 2018 and observed dividend growth rate	Non-CAC 40: Companies reduced their dividends via intra-group and external shareholders (if downturn in activity in April)	% of dividends paid by head of the group = 0% % of intra-group dividends paid = 50%. CAC 40: FARE 2018 dividends x group's observed dividend growth rate
(+) Social security contribution deferrals	Deferrals observed in 2020 for employer AND employee contributions (ACOSS)	Employer contributions = 60% of total SSCs. No distinction between exemption and deferral	SSC deferral = 0.60 x deferral observed
(+) CT deferrals	Observed CT in FARE 2018	Three-month CT deferral for companies in the most affected sectors	Deferral of CT to Q2 = CT / 4 for the most affected sectors
(+) Solidarity funds	Eligibility for and amount of support estimated taking into account monthly developments in the rules for the scheme and based on: workforce, TO losses, sector, location	- Simulated data - See simulation details in Appendix 4 of Bureau *et al.* (2021)	Simulated data
Net flow of cash from investment	Investment in FARE 2018	Estimate of "*sector* × *size*" elasticity of investment expenditure to turnover. See simulation details in Online Appendix 2	Invm = Investment / 12 x e x drop in activity (0.1 < e < 0.6)
Net flow of cash from financing		No variation in structure of financing in the first instance. Implicit assumption of loans maturing in 2020 being rolled over	