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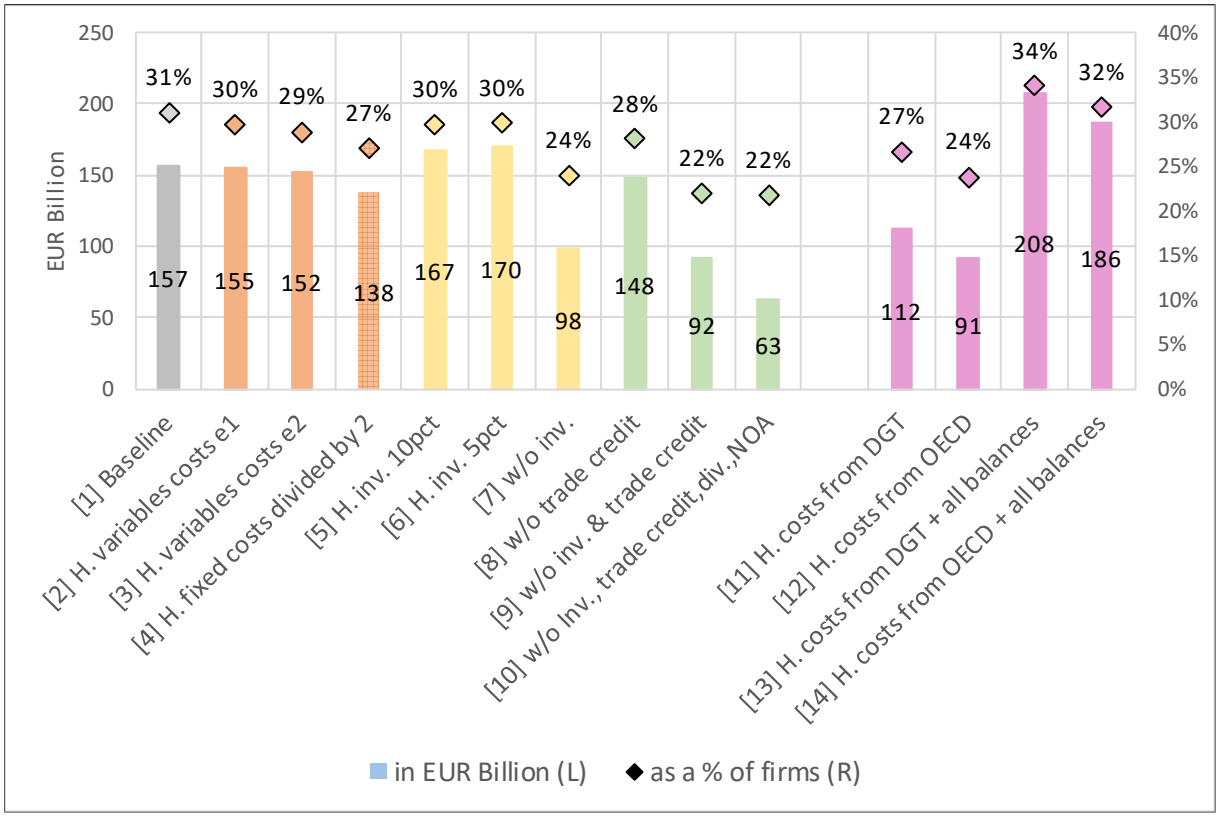
C1 – Sensitivity of results to simulation assumptions

The analysis of the sensitivity of the results to the simulation assumptions is carried out here for the operational need for financing indicator alone. However, the conclusions would be the same if we focused on cash flow shocks. Generally speaking, we observe that, depending on the assumptions used, the results of the simulations can vary significantly around our reference scenario - which is the one that seems to us to be the most coherent from an economic and financial point of view.
Sensitivity tests are used to illustrate how our results change under different sets of assumptions. For this purpose, we consider several alternative scenarios around our baseline scenario. The sensitivity of the estimated operational need to different sets of assumptions is analysed both in terms of amount and percentage of companies.

These scenarios show a variation in the share of companies facing an operational need ranging from 22% to 34% (30% in the baseline scenario). In terms of amount, the estimated aggregate operational need ranges from EUR 63 billion (scenario ignoring post-EBITDA cash flows) to EUR 208 billion (full cash flow modelling with the assumption of greater rigidities in the adjustment of operating costs, in particular purchases), with EUR 157 billion in the baseline scenario. The details are shown in Figure C1.

Figure C1 – **Operational need according to different assumptions (in EUR billion and as a % of companies)**



Note: The bar [1] or "baseline" shows the results of the baseline scenario. The scenarios shown on the left of the Figure (in orange, yellow and green) are adaptations of this baseline scenario. The scenarios whose results are shown in purple, on the right of the Figure, are based, following whenever possible the indications available in the published working documents, on the assumptions of the study of the DG Treasury (Hadjibeyli *et al.*, 2021) on the one hand and that of the OECD (Demmou *et al.*, 2021a) on the other. To simplify the presentation, the figures here are not weighted by number of employees (contrary to what is done in the body of the article).
Sources: DGFiP-Insee data, Dares, Acoss. Authors' calculations.

- Our assumptions regarding the adjustment of operating expenses affect results marginally

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In scenarios 2 and 3, we adjust the elasticity of variable costs to turnover (which do not include purchases of goods and raw materials) and replace our sectoral elasticities by, respectively, elasticities common to all sectors but varying over time as defined by Hadjibeyli *et al.* (2021) (scenario 2) or by a single and constant elasticity over time of 0.8 (assumption in line with Demmou *et al.*, 2021a) (scenario 3). Scenario 3, in which expenses adjust to changes in turnover slightly more strongly than in our baseline scenario, leads to a slight decrease in the operational need in terms of both the amount (EUR 152 billion) and the percentage of companies (29%).

- Our assumptions regarding fixed costs may lead to a slight overestimation of the operational need

Our fixed costs item thus includes property rental expenses as well as expenses related to lease payments. Although they are independent of the volume of activity, these expenses may have been the subject of ad hoc agreements and may have been shifted in time or renegotiated. We therefore present an alternative scenario (scenario 4) in which these expenses are reduced by half. In this case, the operational need falls by EUR 20 billion to stand at EUR 138 billion, a need borne by 27% of companies.

- Our assumptions regarding companies' investment behaviour are a determining factor in the results: a smaller reduction in investment spending mechanically raises needs for financing.

In scenarios 5 to 7, the assumptions regarding companies' investment behaviour are altered by limiting the share of reduced spending compared to the baseline scenario. In scenario 5, it is assumed that companies having experienced a negative activity shock in March-April cut back their annual investment spending by a flat 10%. In scenario 6, by 5%. This limited adjustment results in a higher operational need of EUR 167 billion and EUR 170 billion respectively for scenarios 5 and 6. Finally, scenario 6 ignores investment spending altogether: the operational need then drops by more than a third and the share of firms facing a need falls by 6 percentage points. Not taking investment flows into account therefore leads to a substantial underestimation of companies' financing needs.

- Ignoring companies' post-EBITDA cash flows results in underestimating the operational need by half

Similarly, in scenarios 8, 9 and 10, we illustrate the impact on the operational need of ignoring several cash flow balances. For example, ignoring the change in WCR related to intercompany loan flows reduces the share of companies facing an operational need by 2 percentage points. If investment flows are also ignored, then the flows related to non-operating transactions (in particular financial results, as exceptional items are neutralised in the simulation), the number of companies facing an operational need drops by 8 percentage points, i.e. slightly more than one company in five concerned by an operational need (22%). The aggregate need drops by 60%, from EUR 157 billion in the baseline scenario to EUR 63 billion in scenario 9.
More than the sensitivity to the simulation assumptions, scenarios 8, 9 and 10 enable us us to compare our results with the analyses conducted in several studies close to ours but whose simulation stops at the level of the EBITDA. From this point of view, these studies potentially underestimate the liquidity risk significantly.

- Our assumptions regarding the adjustment of purchases of goods and raw materials strongly influence the estimates

Scenario 11 is based on the assumptions of Hadjibeyli *et al.* (2021). It therefore ignores capital expenditure, dividend payments, flows related to customer-supplier settlement differences (intercompany loans) and non-operating transactions. However, it is more conservative with regard to the adjustment of purchases of goods and raw materials (elasticity of less than 1 and varying over time between 0.25 and 1). As a result, the result obtained is almost twice as high as the EUR 63 billion of scenario 9: 27% of companies face an operational need for a total amount of EUR 112 billion. Scenario 12 is based on the assumptions of Demmou *et al.* (2021a); by subjecting our simulation to these assumptions, the aggregate operational need drops to EUR 91 billion and only concerns 24% of companies.

- Our comprehensive modelling of companies' cash flows has a strong impact on the results, compared to simplified approaches

Finally, when all of the flows not taken into account are reintegrated into scenario 11, we end up with an aggregate need of EUR 208 billion spread over 34% of the companies in our sample (scenario 12). Scenario 14 carries out

the same exercise as in the OECD study (Demmou et al., 2021a): with equivalent assumptions and taking into account all cash flows, the operational need stands at EUR 186 billion and concerns 32% of companies.

C2 – Validation of the microsimulation model

As indicated in the article, 2019 and 2020 FARE data were not available at the time of this study, so our simulations are based on 2018 company accounts. We now have a sample of balance sheets closed in 2019 and 2020 via the FIBEN database of the Banque de France. These additional data are used in this appendix to validate our microsimulation model. Among the various microsimulation studies of the impact of the health crisis, we are the only ones, to our knowledge, to carry out this type of ex post comparison between modelled results and observed data.

It should be noted that our messages are perfectly in line with the results of Bureau & Py (2021), which analyse the financial situation of companies in France on the basis of more than 300,000 annual accounts closed in 2020 (FIBEN data). At the aggregate level, they conclude, as we do, that the net debt of non-financial corporations was virtually stable in 2020. At the disaggregate level, Bureau & Py (2021, Figure 3, p. 6) observe in particular: *(i)* strong heterogeneity in changes in the net leverage ratio (debt net of cash to equity) between 2019 and 2020 and *(ii)* an almost identical distribution of deteriorations and improvements in leverage in 2019 and 2020. These results are consistent with one of our main findings that shows that the support measures lower the proportion of negative cash flow shocks to that of a normal year (see Section 4.1.2).

As detailed in section 3, the core of our analysis consists of simulating a flow table, company by company, in order to deduce a cash flow shock at the individual level. In order to challenge our microsimulation model, we calculate cash flow shocks based on observed FIBEN data for a sample of nearly 55,000 legal units that closed their accounts by end-December 2020. The size of this sample is explained by the fact that: *(i)* we only consider accounts closed at end-December; *(ii)* the FIBEN database only collects the accounts of companies with a turnover of over EUR 750,000; *(iii)* the construction of a cash flow table requires that the sample be disaggregated over two years (e.g. over 2019 and 2020 for the 2020 cash flow table); and (iv) we only consider companies that were already in operation in 2018, in order to be able to compare these results with those of our simulations.

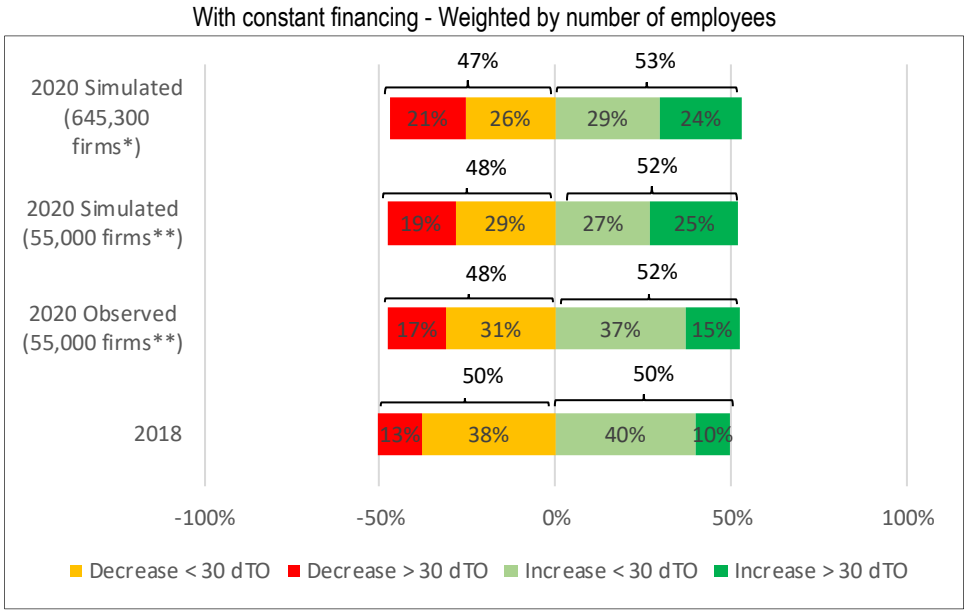
Figure C2-I represents a stylised distribution of cash flow shocks and compares the simulated and observed shocks for this sample. It highlights the share of companies facing negative and positive cash flow shocks, both large and moderate. Companies are weighted by their number of employees.
First, we find that the distribution of cash flow shocks is almost identical whether the simulation is conducted on 645,300 companies (as in the body of the article) or on the reduced sample of 55,000 companies (as here). Second, when we compare, for this reduced sample, the simulated distribution (second bar from the top) with the observed distribution (third bar), we see that the distribution between negative and positive shocks is strictly identical (48% compared to 52%) but that the share of particularly strong shocks is higher in the simulations (19% compared to 17% for negative shocks; 25% compared to 15% for positive shocks).

This ex-post analysis therefore validates the main conclusion of the article: using observed data, we check that the distribution of cash flow shocks (positive vs. negative) is almost identical to that of a normal year (2018), even though very large shocks are more frequent. Taking into account observed data, on a limited sample, slightly mitigates the result regarding the increase in large shocks, without however invalidating it: there are still more large negative shocks in 2020 than before the crisis (17% compared to 13%); the same holds true for very large positive shocks (15% compared to 10%).
Given the magnitude of the shock and the highly atypical nature of the health crisis, it seems to us that the capacity of our model to capture the distribution of the impacts of the crisis is reasonable, even if we cannot rule out the assumption that, within the positive shocks, very large shocks are potentially overestimated.

Even though our model is comprehensive and detailed (especially in comparison with several similar studies, see above), its main aim is to capture the breakdown of the impacts of the crisis between companies. Given the simplifying assumptions made and the atypical nature of the health crisis, we find it difficult to believe that this

type of model can accurately predict, for each company, choices as complex as investment or dividend payments. At the individual level, we therefore expect, by nature, to have a lot of noise in this type of estimate.

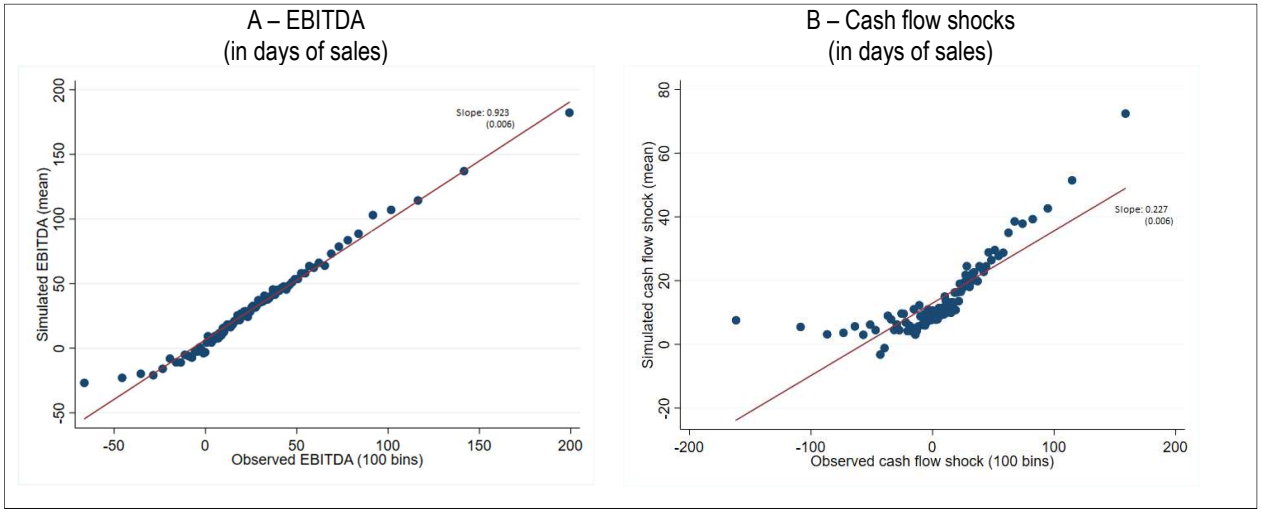
Figure C2-I – **Share of companies with positive or negative cash flow shock in 2020**



Notes: The orange and red bars show the % of companies, weighted by number of employees, facing a decline in cash flow in 2020: strong (> 30 days of sales) or moderate (< 30 days of sales). The green bars show the % of companies facing an increase in cash flow: strong (> 30 days of sales) or moderate (< 30 days of sales). These shocks are calculated with constant financing compared to the previous year. The first and last bars are taken from Figure 3 in the body of the text (i.e. the situation at end-2020 simulated on the study sample of 645,300 companies, and the situation at end-2018 on these same 645,300 companies). The two intermediate bars concern: *(i)* the cash flow shocks calculated on a sample of 55,000 legal units whose accounts are present in the FIBEN company database in 2020, and *(ii)* the simulated shocks (based on FARE 2018 data) for this same sample.
Sources: DGFiP-Insee, Dares, Acoss, Banque de France. Authors' calculations.

The comparison, at the individual level, of simulated and observed shocks is shown below in Figure C2-II for the EBITDA (A) and for cash flow shocks (B). Let us first consider the EBITDA. The 55,000 companies in the sample are classified into 100 quantiles of observed EBITDA (from the lowest to the highest EBITDA) and the corresponding average of simulated EBITDA is calculated for each quantile. The slope of the linear regression line of the scatter plot by OLS is also shown (with the standard deviation in brackets). In terms of EBITDA, the scatter plot is perfectly aligned and the slope of the regression line is very satisfactory (0.92). If we consider the cash flow shocks (Figure C2-II-B), the shape of the scatter plot remains as expected, indicating a positive correlation between simulated and observed shocks, but the slope of the linear regression line is mechanically weaker (0.23).

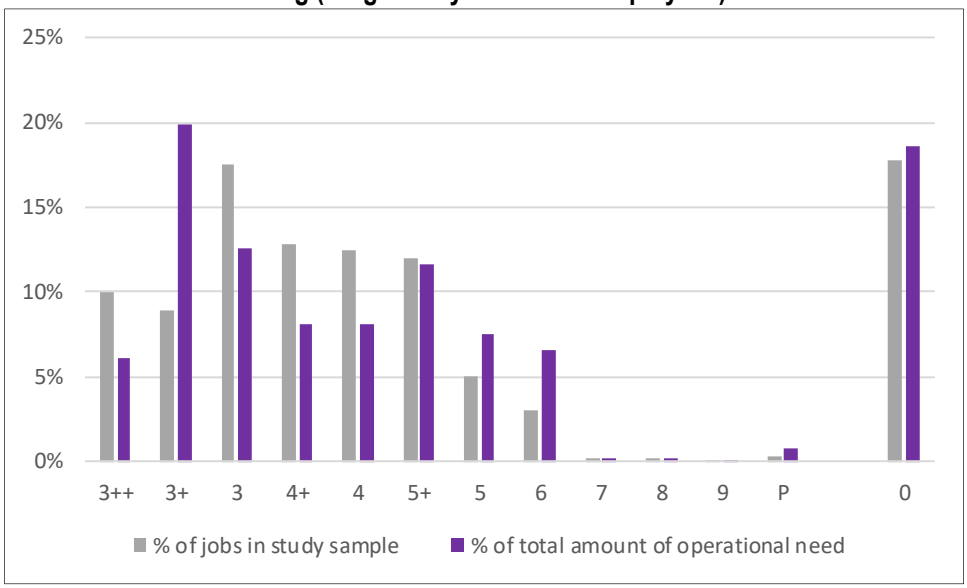
Figure C2-II – **Relationship between simulated variables and observed variables**



Notes: the "observed" variables (EBITDA and/or cash flow shocks) are calculated from FIBEN data from a sample of close to 55,000 legal units that closed their accounts at end-December 2020, using the method described in the body of the text. The "simulated" variables are calculated for this same sub-sample but using only the data used in the body of the article (notably the 2018 balance sheet data). The simulated EBITDA and cash flow shocks are expressed in days of 2018 sales. The observed EBITDA and cash flow shocks are expressed in days of 2019 sales. The observed and simulated ratios are trimmed at 1%. The Figure is of the "binned scatter plot" type. For the EBITDA, for example, the companies in the sample are broken down into 100 classes of observed EBITDA (from the lowest to the highest EBITDA) and the corresponding average of simulated EBITDA is calculated for each class. The line is the result of an OLS linear regression (with the standard deviation in brackets).
Sources: DGFiP-Insee, Dares, Acoss, Banque de France. Authors' calculations.

C3 – Operational financing need by credit rating

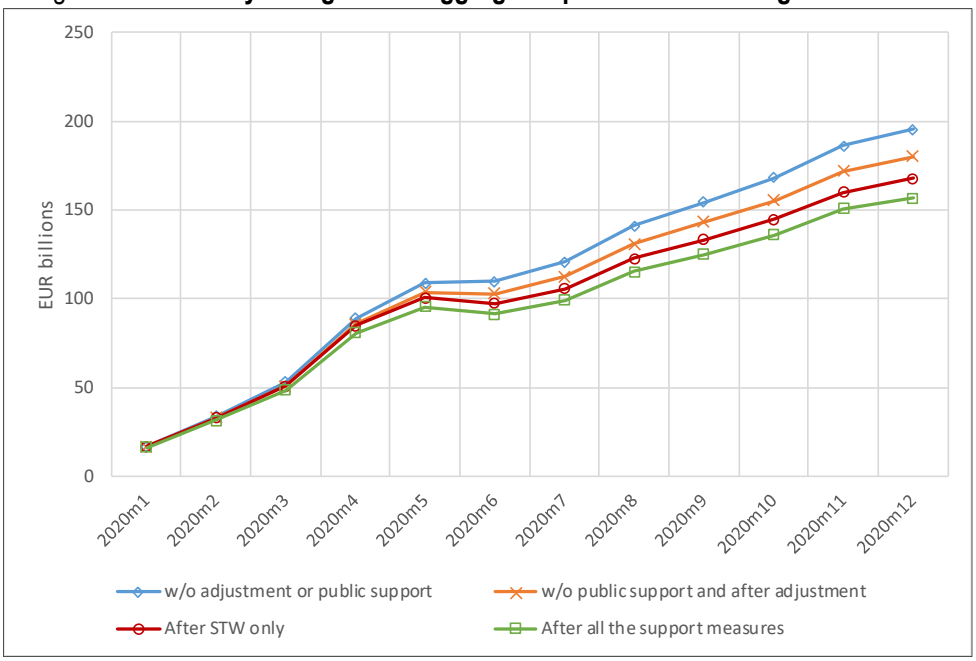
Figure C3 – **Breakdown of the total operational financing need at end-2020, by Banque de France credit rating (weighted by number of employees)**



Notes: Figures after taking into account public support measures (i.e. short-time work, solidarity fund, deferrals of taxes and social security contributions).
Sources: DGFiP-Insee data, Dares, Acoss, Banque de France-Fiben. Authors' calculations.

C4 – Changes in the operational financing need before and after taking public support schemes into account

Figure C4 – **Monthly change in the aggregate operational financing need in 2020**

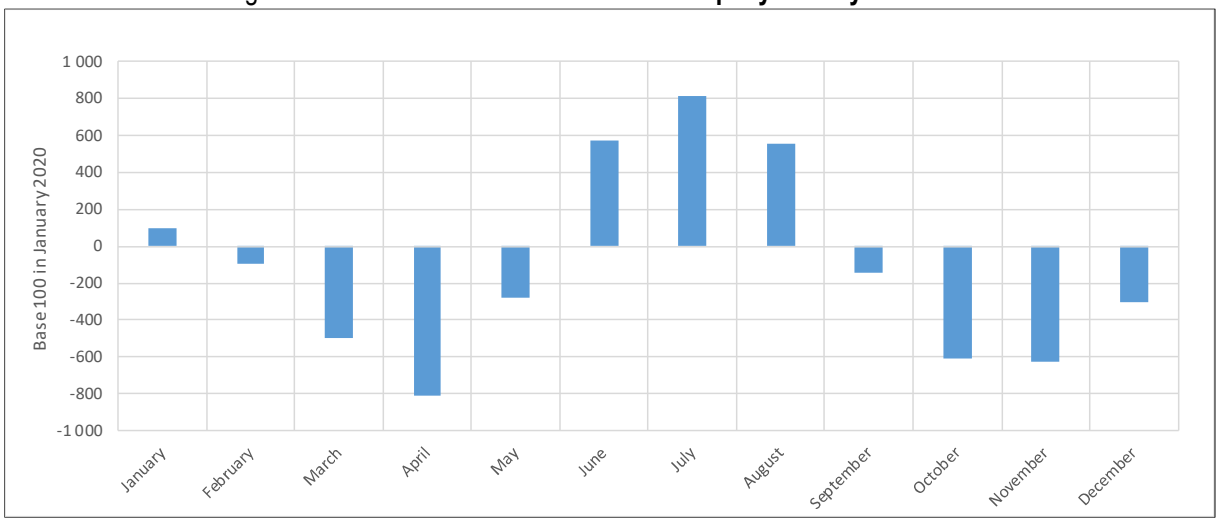


Sources: DGFiP-Insee data, Dares, Acoss, Banque de France-Fiben. "Without adjustment" means that our assumption regarding the adjustment of the investment and dividend payment behavior of NFCs is not taken into account. In terms of public support, the following measures are considered: short-time work (STW), solidarity fund (SF), deferral of taxes and social security contributions. Authors' calculations.

This Figure shows the monthly change in the financing need with and without support measures. The operational financing need increases in a relatively linear manner throughout 2020. However, the aggregate operational need levels off between May and July due to the first lockdown exit. A comparison of the different curves shows a ramping up of the support measures, which brought the aggregate operational need down by 6% in March-April, by 8% in May and by 12% from July onwards.

C5 – Monthly change in intercompany loans

Figure C5 – **Cash flows related to inter-company loan dynamics in 2020**



Sources: DGFiP-Insee data, Dares, Acoss, Banque de France-Fiben. Authors' calculations.

The cash flows linked to intercompany loan dynamics in the '*Hospitality*' sector reflect fairly closely the dynamics of the crisis itself. First, between March and June, companies significantly disbursed to cope with the first lockdown. Then, thanks to the exit from lockdown and the summer season, companies recorded highly positive cash flows linked to intercompany loans between June and August. Finally, as the second wave of COVID-19 built up, leading to the second lockdown in autumn 2020, companies once again significantly disbursed.

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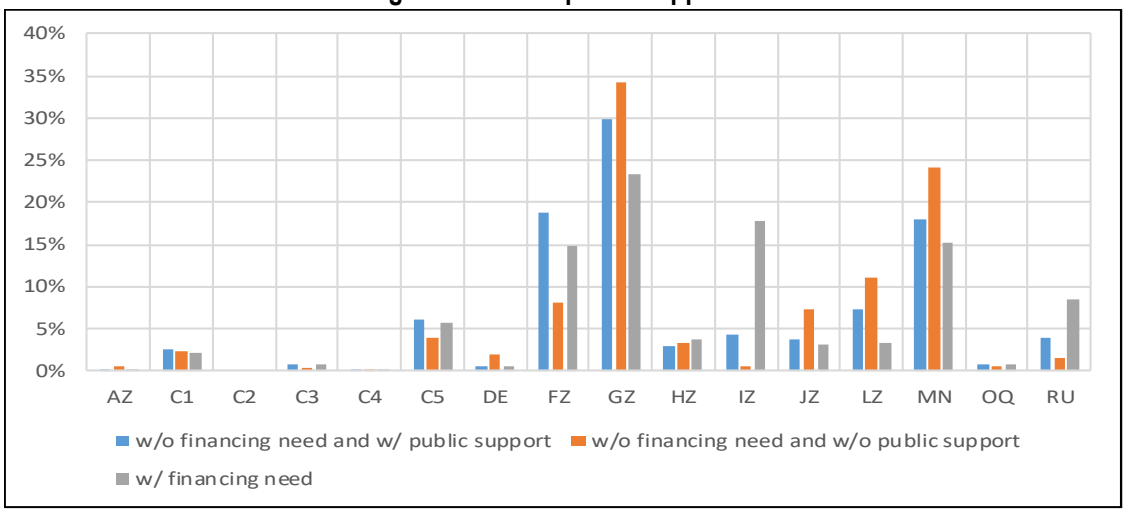
C6 – Comparative analysis of companies according to their financing need and the public support received

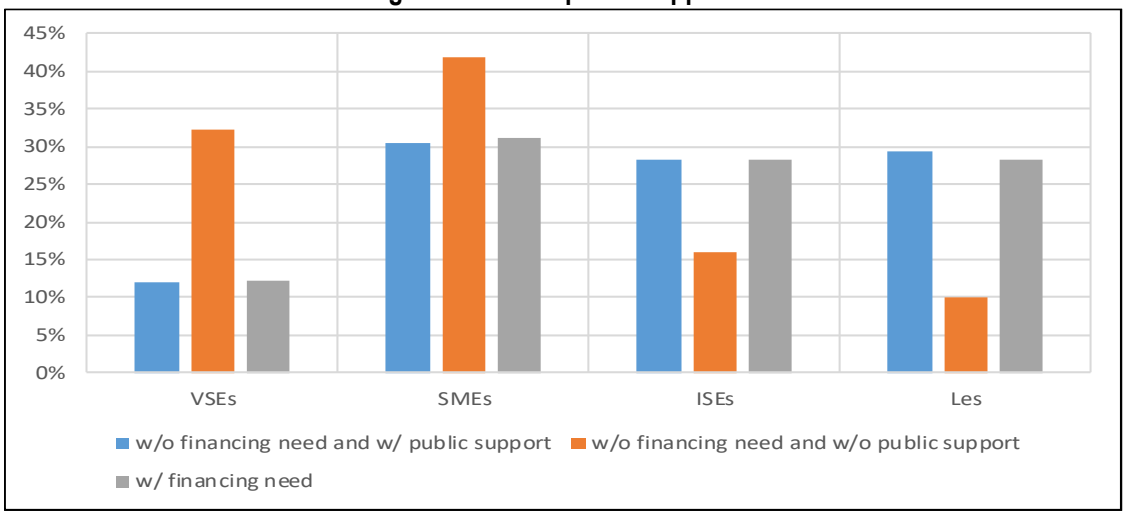
In this appendix, we examine the distribution of companies according to whether or not they have an operational financing need before receiving support and according to whether or not they benefit from support schemes. We thus subdivide the population of companies into three categories: *(i)* those with a financing need, *(ii)* those without a financing need in our simulations and which, in practice, do not receive any public support and finally *(iii)* those without a financing need but which nevertheless receive support. One could consider subdividing the companies with a financing need into those receiving support and those not receiving support. However, only 1% of companies with a financing need do not receive support. The marginal nature of this last group of companies is also reassuring information about the quality of our simulation. We first examine the distribution by sector (Figure C6-I) and by company size (Figure C6-II) of these three populations of companies.

Figure C6-I – **Sectoral distribution of companies according to their financing need and the public support received**



Sources: DGFiP-Insee data, Dares, Acoss, Banque de France-Fiben. Authors' calculations.

Figure C6-II – **Distribution of company sizes according to their financing need and the public support received**



Sources: DGFiP-Insee data, Dares, Acoss, Banque de France-Fiben. Authors' calculations.

Companies "without a financing need and with support" are distinguished from those "without a financing need and without support". Conversely, they share characteristics with companies with a financing need. Companies

"without a financing need and with support" are over-represented (compared to companies "without a financing need and without support") in the '*Construction'* (FZ), '*Transport*' (HZ) and '*Hospitality'* (IZ) sectors, three sectors particularly affected by the crisis. Conversely, they are under-represented in two of the sectors least affected by the crisis: '*Trade'* (GZ) and '*Scientific and technical activities'* (MN). In terms of size (as defined by the LME), the population of companies "without a financing need and with support" counts a large number of intermediate-sized companies (ISEs) and large enterprises (LEs) than that of companies "with a financing need and without support".

More generally, the population of companies without a financing need according to our simulation but which have benefited from support schemes does not differ particularly from the population of companies with a financing need in terms of their size or sector of activity. They do, however, differ in some of their "pre-crisis" characteristics (Table C6).

Table C6 – **Descriptive statistics of the different populations of companies**

Without operational financing need and with support								
	N	**Mean**	**Standard deviation**	**p10**	**p25**	**p50**	**p75**	**p90**
Amount of support (k€)	346,090	79	1,.370	2	5	15	40	100
Employment 2018	346,090	15	452	0	1	2	6	16
EBITDA 2018 (k€)	346,090	386	13,609	1	12	38	103	288
VA 2018 (k€)	346,090	1 388	35,942	36	78	179	446	1,149
Cash flow 2018 (days sales)	345,795	161	2,297	5	23	65	142	279

Without operational financing need and without public support								
	N	**Mean**	**Standard deviation**	**p10**	**p25**	**p50**	**p75**	**p90**
Amount of support (k€)	23,468	0	0	0	0	0	0	0
Employment 2018	23,468	4	37	0	0	1	3	7
EBITDA 2018 (k€)	23,468	215	3,520	0	9	33	97	244
VA 2018 (k€)	23,468	522	7,277	21	54	122	317	681
Cash flow 2018 (days sales)	23,468	269	4,300	5	19	57	150	327

With operational financing need								
	N	**Mean**	**Standard deviation**	**p10**	**p25**	**p50**	**p75**	**p90**
Amount of support (k€)	256,761	111	2,602	4	9	25	56	135
Employment 2018	256,761	16	336	0	1	3	7	17
EBITDA 2018 (k€)	256,761	207	13,055	-33	-3	12	44	135
VA 2018 (k€)	256,761	1,347	40,554	25	64	153	379	1,009
Cash flow 2018 (days sales)	256,638	37	153	1	7	21	45	81

Note: Cash flow is expressed in days of sales (DSO).
Sources: DGFiP-Insee data, Dares, Acoss, Banque de France-Fiben. Authors' calculations.

As expected, the amount of public support received is significantly greater for companies with a financing need than for those without. This observation is valid for all quantiles of the distribution presented. As regards the pre-crisis EBITDA, companies with no financing need but which nevertheless receive support show a slightly higher EBITDA than companies with no financing need and which receive no support (as expected, the EBITDA of companies with a financing need is much lower, negative for almost 25% of these companies). However, this gap (approximately 45% on average) is much smaller than the gap in VA (approximately 62% on average).
Finally, the main difference between companies receiving support and those not receiving support (among the companies with a financing need) seems to stem directly from cash holdings. Expressed in terms of days of sales, the cash flow of companies without a financing need and receiving support is significantly lower than that of companies without a financing need and without support (161 days of sales compared to 269 days of sales on average).

Thus, overall, the analysis identifies two dimensions that may explain why some companies with no financing need benefit from support measures and others do not: *(i)* the cash available in assets, which is rarer among companies that receive support (even if, by construction, these companies have sufficient cash to cope with the resumption of activity) and *(ii)* sectoral affiliation (due to the importance of this dimension in the eligibility for certain support measures).