ECONOMICS – WORKING PAPERS 2020/09

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EIB Working Paper 2020/09
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This is a publication of the EIB Economics Department

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Published by the European Investment Bank.
Printed on FSC Paper.

pdf: QH-BK-20-009-EN-N ISBN 978-92-861-4850-7 ISSN 2599-736X DOI 10.2867/417469

Investment vs debt trade-offs in the post-COVID-19 European economy

Laurent Maurin and Rozália Pál*,**

Summary

We use firm-level financial data to illustrate the impact of the COVID-19 crisis under several scenarios. We estimate COVID-19 induced cumulative net revenue losses for EU companies in the range of 5.4 to 10.0% of total assets, depending on the strength of the policy support and length of the normalisation period. The results appear robust to the consideration of sector specific decline in sales and cost-elasticities.

The decline in internal financing capacity is likely to reduce investment by 24.3 to 48.5% during the COVID-19 crisis, compared to 19% during the Great Financial Crisis (GFC). Using historical regularities, we then assess the likelihood of such decline by estimating a macro based Bayesian VAR model for which we identify a standard demand shock. We then calibrate the demand shock to generate the computed decline in net revenues associated to the most benign scenario. The comparison between conditional and unconditional projections supports the existence of a trade-off faced by corporates between investment and leverage. It also suggests that, should the estimated gap in net revenues materialise as the result of the crisis, the decline in corporate investment would likely be within the computed ranges.

Key Words:

Corporate investment – leverage – financing structure – firm-level data – Scenarios – calibration - BVAR models – shocks identification – conditional projections

J.E.L classification: E22, D92, F34, G31, G32

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** The paper does not necessarily reflects the view of the EIB. The authors would like to thank for comments received from D. Revoltella, C. Ebeke, P. de Lima, B. Marchitto, A. O. Santos, K. Koerner, K. Gattin Turkalj, the participants to the second episode of CompNet ProdTalks, as well as ESM and IMF participants to an IMF meeting on corporate vulnerabilities.

1 – From liquidity shortfalls to reduced net revenues

The COVID-19 crisis and related lockdown have taken their toll on the EU corporate sector. The immediate consequence is a liquidity drain. Revenues are being curtailed, while some of the cost structure of firms cannot be adjusted. Policymakers have been reacting fast, offering support in the form of deferrals, temporary transfers or moratoria on debt. Several EU countries have also offered guarantee schemes, to ease the banks' lending to corporates. The policy support alleviates part of the problem but leverage is likely to increase and corporate investment to decline.

In a previous study based on a similar methodology (EIB, 2020a), we estimated liquidity shortfalls conditioned on the length of the lockdown and the stringency of the policy support. With expectation of a U shaped recovery, we extend the exercise to assess the possible medium-term strategic choices for firms. Indeed, for corporates, the crisis materializes in several steps: first, depleting liquidity buffers when the closure of the economy does not enable them to operate their business activity. This is followed by a long normalization period during which internal resources are below normal. Overall, at the end, the cumulated decline in internal financing capacity leads to cuts in investment plans.

Using an accounting approach and ORBIS firm level data, we assess medium term strategic choices for firms, following the months of lockdown and different normalisation scenarios. We show that the hit to corporate investment is likely to be very large. We estimate COVID-19 induced cumulative net revenue losses for EU companies in the range of 5.4% to 10.0% of assets, depending on the stringency of the scenario considered. The range of estimates appears to be robust to the consideration of sector specificities. A longer normalisation process would be more adverse, adding a further decline of net revenue of around 1.5% of total assets when a period of six instead of three months is considered. Compared to the normal policy support, heightened policy support would further limit the reduction in net revenues by 3.0 percentage points and 1.7 percentage points of assets in the cases of a long and short normalisation period respectively.

To compensate for these losses, EU corporates will face a difficult trade-off between investment and leverage. Even in the most favorable scenario, we estimate a potential gap in corporate investment by 24.3 to 48.5%, well above the drop recorded during the financial crisis. Corporate leverage increases by 3.2 to 6.4 percentage points of total assets, depending on how much firms try to protect investment. Using historical regularities, we then assess the likelihood of such decline by estimating a macro based Bayesian VAR model for which we identify a standard demand shock. We then calibrate the demand shock to generate the computed decline in net revenues. The comparison between conditional and unconditional projections supports the existence of a trade-off faced by corporates between investment and leverage. It also suggests that, should the estimated gap in net revenues materialise, the decline in corporate investment would likely be within the computed ranges.

The rest of the paper consists of four sections and concluding remarks. Section 2 presents the methodology and the calibration of the scenarios. Section 3 details the computations of the losses in net revenues and impact on corporate investment. Section 4 extends the methodology to consider sector specific cost-elasticities and decline in sales. Section 5 develops a BVAR model to assess the robustness of the computations under the light of historical regularities. Section 6 concludes.

2 – Methodology based on firm-level data

We analyse the impact of the crisis on corporate investment in two steps. In the first step, we estimate the loss in net revenues resulting from the lockdown and the normalization period using a simplified accounting identity of net revenues. Using a granular dataset, we estimate the cost elasticity to sales and calibrate the policy support. We then develop various scenarios regarding the length of the normalization period and the strength of the policy support. In the second step, we envisage how the decline in net revenues will reduce the internal financing capacities of corporates and therefore investment.

A simplified accounting decomposition of corporate net revenues

As shown in Equation 1, the change in net revenues is equal to the change in sales minus the change in costs.

$$\Delta \text{Net revenues} = \Delta \text{Sales} - \Delta \text{Costs} \qquad \text{EQ. 1}$$

While the revenues of sales are relatively easy to record, as they are reported separately in the database, costs are more difficult to compile. In the following, we consider the four main items of costs: employees costs (compensation and social contribution), material costs (intermediary consumption of material assembled or used in the production process), financial costs and other costs (such as rent, administrative costs, insurance, energy consumption. Those do not include depreciation). The decomposition is shown in Equation 2.

$$\Delta \text{Costs} = -\Delta \text{Employees Costs} + \Delta \text{Fin. Costs} + \Delta \text{Adm. Costs} + \Delta \text{Material Costs} \qquad \text{EQ. 2}$$

Sales and costs are not independent however. When corporates face a change in activity, they adjust their production structure. When activity goes down, corporates reduce their expenditure mostly by reducing the consumption of intermediary products. They also layoff some of their employees. Finally, they can reduce other charges such as rent (by reducing the physical space they occupy, energy consumption or insurance contracts).

$$\Delta \text{Costs} = \alpha \,.\, \Delta \text{Sales} \quad \text{with } 0 < \alpha < 1 \qquad \text{EQ. 3}$$

For many reasons, corporates do not adjust fully to a change in sales, especially at short horizons. The cost elasticity to sales is well below one in the short to medium run and increases over time to reach one in the long-term. First, given contract costs, it can be optimal not to react fully to avoid re-bargaining in case the decline is perceived temporary. Given that many of the contracts are staggered and have a notification period, companies cannot untie the commitment instantaneously. Even when possible, this often comes at a cost. For example, the delivery of intermediary goods is agreed before the delivery and cancelling or postponing following a fall in activity implies penalties. Overall, the cost elasticity is well below one over the business cycle. At the macroeconomic level, this explains why the profit share is pro-cyclical: it diminishes in bad times and increases in good times.

It is also well know that the elasticity varies across type of expenditure. Hence in the following, we estimate the cost elasticity to sales for each of the four cost component.

Estimating cost elasticity

We use a comprehensive dataset of around 13 million non-financial corporates located in the EU (ECON computations based on ORBIS- Bureau Van Dijk), covering 17 European countries: Austria, Belgium, Bulgaria, Croatia, Czech Republic, Finland, France, Germany, Hungary, Italy, Latvia, Poland, Portugal, Romania, Slovenia, Spain, Sweden.[1] The selected dataset covers all manufacturing, construction, utilities

1 It is well known that the country coverage of ORBIS is uneven (see Kalemli-Ozcan et al., 2015).

and non-financial services sectors. We use both balance sheet and P&L information. The sum of assets covered in the database amounts to around EUR 8 tn while the final selected sample with available financial data amounts to around EUR 3 tn (see **Table 6** in Appendix for more information on the dataset). We estimate the short-term elasticity of costs components to sales using this dataset over the years 2014-2018.

We start a simple benchmark static estimation with common effect and least square. Dynamic adjustment is not considered nor control variables. Using the entire dataset, the relative change of each of the four cost components is projected on the relative change of sales and a constant. The results, reported in **Table 1**, show that the elasticities are significantly below one and differ across components: a 10% decline in sales is associated to reductions of 4.2, 7, 3.4 and 2.0 % reduction in respectively employment cost, material consumption, financial costs and other operating expenses.

Table 1 Simple benchmark estimation

	Δ Employment cost	**Δ Material consumption**	**Δ Financial costs**	**Δ Other operating expenses**
Sales growth	**0.422***** (0.000)	**0.697***** (0.000)	**0.344***** (0.000)	**0.205***** (0.000)
Constant	0.054*** (0.000)	-0.007*** (0.000)	-0.036*** (0.000)	0.086*** (0.000)
Observations	7,779,045	6,722,042	7,219,302	8,152,912
Number of id	2,522,717	2,259,871	2,352,748	2,694,460

*Source: Authors' estimations based on annual data. Notes: Random effect GLS regressions. See Equation 3. Standard errors in brackets, *** $p<0.01$, ** $p<0.05$, * $p<0.1$. Panel dataset constructed from annual data over the years 2014-2018. R2 ranges from 2.8% (for Δ Financial costs) to 19.8% (for Δ Material costs).*

We then estimate more sophisticated equations to account for dynamic adjustment and controls. For each of the four cost components considered, the relative change is now projected on the relative change of lagged, contemporaneous and future sales and year dummies. The estimations are performed with random effects and dummies for firm size, industry group and country.

Table 2 reports the results of the more sophisticated equation estimated on the whole dataset (**Table 4** presents the elasticities estimated at the sector level).[2] It confirms that the short-term response is below 1 and differs across cost component. Hence a sales reduction (expansion) dampens (widens) margins. Across components, the reaction varies from 37 to 83% when the reaction is considered over three periods and 29 to 77% when considered over two periods. The estimation suggests that intermediary consumption is more responsive as corporations can more easily adjust their orders. Conversely, other operating expenses that consist of rent, insurance, and are more rigid by nature, have a lower elasticity. A decline in sale activity reduces employment costs by 40 to 52%.

[2] The estimated equation is $\Delta Costs_t = \beta + \alpha_0 . \Delta Sales_t + \alpha_1 . \Delta Sales_{t-1} + \alpha_2 . \Delta Sales_{t+1} + dummies + \varepsilon_t$

Table 2 Estimated elasticities

	Δ Employment cost	Δ Material consumption	Δ Financial costs	Δ Other operating expenses
$Sales_t$	0.331***	0.691***	0.283***	0.219***
	(0.000)	(0.000)	(0.001)	(0.000)
$Sales_{t-1}$	0.121***	0.0615***	0.155***	0.0731***
	(0.00)	(0.00)	(0.00)	(0.00)
$Sales_{t+1}$	0.0726***	0.0780***	0.0685***	0.0759***
	(0.000)	(0.000)	(0.001)	(0.000)
2015.year	0.019***	-0.104***	0.018***	-0.004***
	(0.000)	(0.001)	(0.001)	(0.000)
2016.year	0.040***	-0.018***	-0.032***	0.081***
	[illegible]	[illegible]	[illegible]	[illegible]
2017.year	0.018***	-0.019***	0.002	0.098***
	(0.001)	(0.002)	(0.003)	(0.000)
2018.year	0.124*	0.007	-0.162	
	(0.070)	(0.127)	(0.166)	
Constant	-0.0259***	-0.00208	-0.0372*	0.0766***
	(0.009)	(0.015)	(0.019)	(0.005)
Observations	3,030,778	2,641,869	2,826,541	3,224,224
Number of id	1,254,172	1,121,562	1,180,108	1,326,125
Medium-term elasticities(%)				
Past, present and future	*52.5*	*83.1*	*50.7*	*36.8*
Present and future	*40.4*	*76.9*	*35.2*	*29.5*

*Source: Authors' estimations based on annual data. Notes: Random effect GLS regressions with firm size (4 dummies), industry sector (10 dummies) and country dummies. See footnote 2. Standard errors in brackets, *** p<0.01, ** p<0.05, * p<0.1. Panel dataset constructed from annual data over the years 2014-2018. R2 ranges from 1.6% (for Δ Financial costs) to 17.0% (for Δ Material costs).*

These elasticities are comparable to those reported in the literature. Banerjee et al. (2020) estimate that total operating costs react by 60% to revenues and they build the scenario on a 25% drop of sales.

OECD (2020) estimates that on an annual basis employment costs react by 40% while material costs fully adjust, reacting by 100%. However, they also consider that, in the very short-term, flexibility is much reduced and those components adjust by only 20 and 80% respectively. This study assumes a decline in output and sales of 50-100% for sectors most affected and 15% for the rest, while the elasticities of intermediate inputs to sales is considered to be 80%.

EC (2020) considers an elasticity of employment compensation of 15% under the scenarios without support policy and which increases to 80% under the scenario with implemented policy measures. The average cost to sales elasticity across sectors is assumed to be 60%, the elasticity of material cost to sales is set at 50%, while the elasticity of fixed costs is at 10%. Some studies (see Room et al., 2011) also provide evidence of non-linearity and heterogeneity regarding the reaction to the revenue decline. For example, businesses relying on labour-intensive production technology are more likely to react faster to negative shocks. Moreover, larger falls in revenues might reduce cash flows or increase debt disproportionately.

Designing the scenarios

We design four scenarios to account for the possible impact of the crisis. The scenarios are based on views on (1) the strength of the policy support for which we consider two cases (2) the length of the normalisation period.

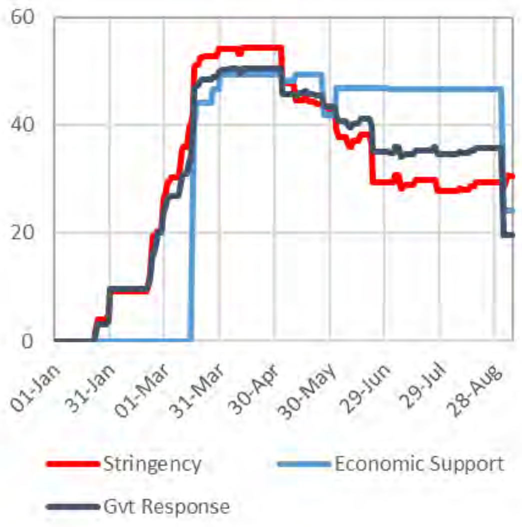
We use two public sources to compute an indicator of overall EU lockdown intensity. For each source, we build an EU aggregate as the weighted average based on GDP in 2019 of the EU economies reported.

First, we use data from Oxford's COVID-19 Government Response Tracker4 (OxCGRT) for containment measures (see Hale et al., 2020). OxCGRT collects information on government policy responses across eight dimensions, namely: (i) school closures; (ii) workplace closures; (iii) public event cancellations; (iv) gathering restrictions; (v) public transportation closures; (vi) stay-at-home orders; (vii) restrictions on internal movement; and (viii) international travel bans. The measure is a recommendation or a requirement and whether it is targeted or nation-wide. We normalize each measure to range between 0 and 1 and make them comparable. In addition, a Stringency Index is computed as the average of the sub-indices, again normalized to range between 0 and 1.[3] The results are shown **Figure 1**. The three indicators share a similar pattern: the lockdown indices reach a peak of around 50% in the second half of March and first half of April when most EU countries were implementing very strict social distancing measures. From then, the economic support remained constant while the stringency declined, reaching 30% in late August, far above a normal situation.

Second, we use the Google mobility index database on retail and transit-station mobility published in Google Mobility Reports. These datasets show how visits and length of stay at different locations places change compared to a baseline. Daily data are available for 73 countries in our dataset, with coverage beginning from February 15, 2020. Changes for each day are compared to a baseline value for that day of the week. The baseline is the median value, for the corresponding day of the week, during the 5-week period during the 3rd of Jan to the 6th of Feb 2020. The locations are grouped in six categories: Grocery & pharmacy (grocery markets, food warehouses, farmers markets, specialty food shops, drug stores, and pharmacies), Parks (local parks, national parks, public beaches, marinas, dog parks, plazas, and public gardens), Transit stations (public transport hubs such as subway, bus, and train stations), Retail & recreation (restaurants, cafes, shopping centres, theme parks, museums, libraries, and movie theatres), Residential and Workplaces. In **Figure 2**, we plot the index for the whole EU, for each category of the three relevant categories retained. The three indicators share the same patterns over most of the sample, from the middle of February until the middle of June. They reach a trough, 60 to 70% below normal frequentation in the second half of March and first half of April. From then, they recover until mid-June when they remain 20 to 30% below normal frequentation. After, the frequentation of retail and recreation continues normalising and gets very close to normal in August, that of transit station flattens 20% below normal and that of workstation resumes declining, standing 30% below normal in the middle of August. It should be noted that the holiday period in Europe may reduce the normal frequentation pattern of work stations and transit stations. This seasonal effect is not taken into consideration in the deviation based on a baseline in the beginning of the year. Hence, the indicator may be more difficult to read since the middle of June, when the holiday season starts in parts of the EU. **Figure 2** clearly shows that the trough is 60 to 70% below normal and that the normalisation takes time and is probably not reached in the summer of 2020.

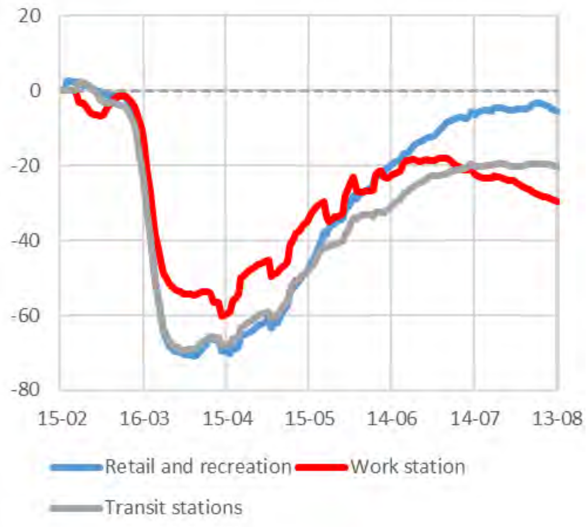
3 The data start on January 1, 2020 and cover 151 countries/regions.

Figure 1 Lockdown index *(EU average)*



Source: Authors' calculations based on Oxford indicator. Last record: 6 September 2020.

Figure 2 Mobility index *(EU average)*



Source: Authors' calculations based on COVID-19 Google mobility Report.

The two indicators show that the peak of the crisis was reached in the second half of March to first half of April, with indicators of lockdown close to 50% and mobility more than 60% below normal. On average, in the three months between 15 February and 15 May, the lockdown indicator reaches 30% while mobility is reduced by 40%. Assuming a full path-through into corporate activity, sales would have been reduced by 30 to 40% over this period. We assume an average reduction in corporate activity by 35% during this three months period. This is much in line with the decline recorded in IP or EC surveys over the period.

The indicators also suggest that normalisation is ongoing but remains uncompleted in the middle of August. We therefore assume two paths towards normalisation. In the first, the return to normal takes three months and is reached in the middle of September. In the second case, it takes six months and is completed in the middle of December. These assumptions are relatively benign for several reasons. First, they don't entail a second wave of lockdown. Second, they don't consider permanent effects even though to date, no vaccination has been widely recognised as performing. Third, they are much more positive that those associated to a U-shaped recovery. As shown in **Table 3**, the two cases related to the length of the normalisation period are one dimension of the four scenarios considered thereafter. Still, scenarios are realistic as follow the observed normalisation path presented in Mobility and Lockdown index while the six versus three months of normalisation might give an indication how much it might worsen the losses accumulation in case of three months longer normalisation.

The other dimension of the scenarios relates to the strength of the policy support. Indeed, in Europe, during the crisis, governments have implemented many support measures to alleviate part of the crisis burden on corporates. Since, as shown before (see **Table 1**, **Table 2** and **Table 4**), costs cannot be perfectly adjusted to sales in the short-term, firms' net revenues are pro-cyclical. They decline when sales decline. To limit the impact of the unprecedented decline in sales recorded during the lockdown, in parallel to social distancing measures, most member states governments have implemented support measures, most importantly wage subsidies or short-term unemployment schemes, as well as tax and loan payment deferrals. All member states have implemented some form of tax holiday as part of their policy response measures. As shown in EIB (2020a), these measures first alleviate the cash flow problems, but their impact is limited albeit very uncertain. In the absence of more quantitative studies regarding the impact of the country based measures, we assume two calibrations of the impact of the policy support, a baseline case and a heightened policy support case.

In our approach, since the subsidy alleviates part of the cost, it increases the short-term elasticity of the cost component to the change in sale. Wage supports enable to lower the cost of employees more than in normal times. The same is true for rent or tax reduction. The effect on interest costs is more marginal as moratorium postpone loan repayments that will have to be paid anyway. The policy does not alter the adjustment of material costs so that the elasticity of this cost component, the most reactive to activity, is unchanged. The bulk of the policy support on net income provides from wage support and temporary unemployment schemes.[4] The two cases and the four resulting scenarios are shown in **Table 3**.

In the baseline policy support case, compared to normal cases, the policy measures implemented enable firms to increase the reactivity of their employment cost by 60%, that of other expenses and financial costs by 40%. The estimated elasticities used for scenario calibration are those including the reaction on change in sales in the current and future period (period t and t+1) as we aim at capturing the immediate reaction (the reaction on changes in the previous period is a longer-term reaction). The support is assumed to be twice stronger in the heightened policy support case. Combining the estimated elasticities, the scenarios for the policy support, the assumed decline in sales and the shape of the normalisation period, we obtain the calibrations of the four scenarios presented in **Table 3**.

Table 3 Calibration assumptions

		% reduction during the lockdown period				Evolution during the normalisation period	
		Policy support		Heightened policy support		Fast, 3 months	Slow, 6 months
	Estimated elasticities	Policy support	Adjustment after policy and decline in sales	Policy support	Adjustment after policy and decline in sales		
Sales			35%		35%		
Employment cost	**40%**	**60%**	23%	120%	31%	Each component follows a linear path to return to normal over three months	Each component follows a linear path to return to normal over six months
Other operating expenses	**29%**	**40%**	14%	80%	19%		
Financial costs	**35%**	**40%**	17%	80%	22%		
Material consumption	**77%**	**0%**	27%	0%	27%		

Table 3 shows that, during the lockdown period, following the 35% drop in sales, under the normal policy support, employment costs, other operating expenses and financial costs are reduced by 23%, 14% and 17%, respectively. Under the heightened policy support, the reduction is larger, of 31%, 19%, and 22%. In both cases, material consumption, unaffected by the policy support, is reduced as in normal times, by 27%. Given that in both cases, the reduction in the cost components is below that in sales, the net revenues of the corporates decline. We compute the decline in the next section.

3 – Losses in net revenues derived from symmetric calibrations

The impact of the crisis is illustrated by adjusting each component of net revenues symmetrically to all firms. Under each scenario, we account for the change in corporate activity using the calibrations presented in **Table 3**. For each corporation, we compute the cumulated losses in net revenues until the end of the normalisation process in 2020 under the four scenarios, each considered separately for each corporation, using EQ. 1 and 2 and the elasticities estimated for EQ. 3. The loss in net revenues is computed as percentage of assets.[5] In the computations, firms that have costs above sales in normal

4 As shown in EIB (2020a), this is true for net revenues but not for cash hoardings. Maintaining positive cash buffers is a necessary condition for corporations to survive and be able to continue operating. In this regard, tax and interest postponement help to the extent that they enable firms to keep alive.

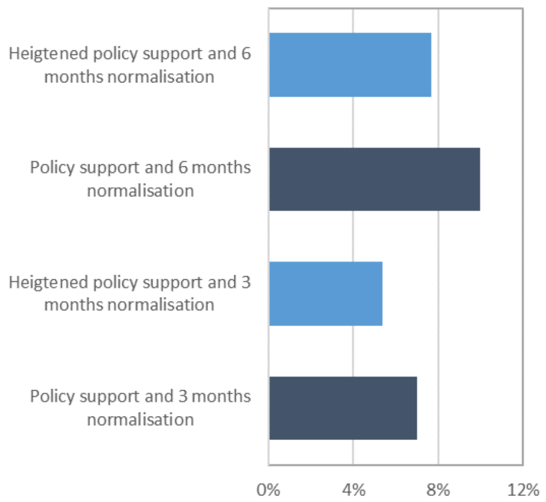
5 Previously in EIB (2020b), we constructed a scenario with stronger sales drop but counter-balanced by higher sensitivity of total costs to sales and faster recovery.

time are excluded. Doing so, we exclude unprofitable firms that would benefit from the crisis under our methodology by recording lower losses or even positive net revenues.

Decline in net revenues under the various scenarios

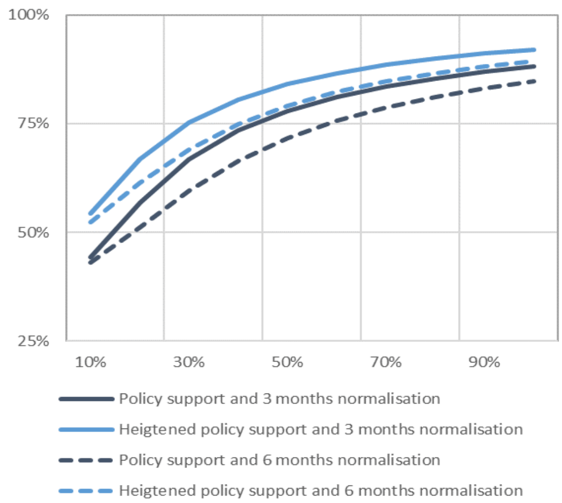
We rely on the last available data with the highest coverage of firms (end of 2017) taken as firms' financial situation in period of normal economic activity. We compute the cumulative net revenue loss for each individual firm. The unweighted mean reduction in net revenues could range between 5.4% and 10.0% of total assets across the four scenarios (**Figure 3**). A longer normalisation process would be more adverse, adding a further decline of around 1.5% of total assets when extended by three months (**Figure 3**). Compared to the normal policy support, heightened policy support would further limit the reduction in net revenues by 3.0 percentage points and 1.7 percentage points of assets in the cases of a long and short normalisation period respectively.

Figure 3 Net revenues reduction associated to various scenarios *(mean, % of total assets)*



Source: Authors' computations based on ORBIS

Figure 4 Cumulative distribution of the decline as a share of the capital base



Source: Authors' estimations based on ORBIS
*Note: **x-axis**: net revenues reduction as % of existing equity, **y-axis**: proportion of firms with less than the given capital reduction)*

The estimates depicted in **Figure 3** require the computation of the decline in net revenue for each firm in the dataset, using symmetric elasticities across all firms. The figure then depicts the mean estimates as a percentage of total assets. A simpler estimation based on the mean value is also possible, by multiplying the share of each costs component by its estimated elasticities to sales augmented by the policy support (as in Equation 3). The mean decline in net revenues is then obtained by implementing Equation 2. **Table 4** compares the results obtained using these two different methodologies to cross-check the robustness of the firm-by-firm computations.

As show **Table 4**, the results are relatively similar for the four scenarios. In the most benign case, obtained with the short normalization period and the heightened support, the decline in net revenues to assets amounts to 5.4% in the firm-by-firm estimates and 6.4% in the estimates based on the median share. In the most adverse scenario, the decline ranges from 10.0 to 11.2%. The computations based on the median tend to be more adverse however, at 0.9 to 1.4% of assets. This reflects the fact that across firms, the shares of cost components are negatively correlated. This justifies the need to conduct firm-level estimations.

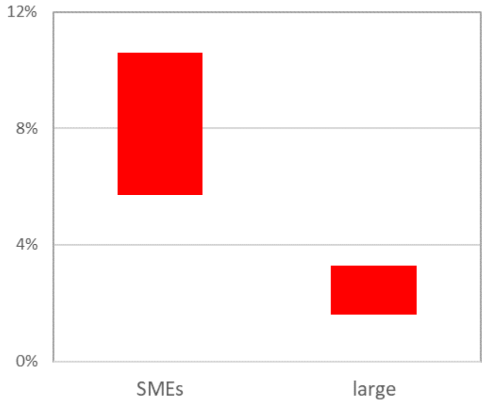
Table 4 Decline in net revenues to assets: Comparison between direct estimates and estimates based on the medians *(% total assets)*

	Baseline policy support		Heightened policy support	
	Direct estimates (1)	*Based on median share (2)*	*Direct estimates (1)*	*Based on median share (2)*
Short normalisation	*7.0%*	8.4%	*5.4%*	6.4%
Long normalisation	*10.0%*	11.2%	*7.7%*	8.6%

*Notes: (1) As in **Figure 3**. (2) Based on the median shares and elasticities estimated in the entire sample.*

The reduction in net revenues would correspond to more than half the capital base for 16 to 28% of EU corporations (**Figure 4**). Expressing the estimated reduction in net revenues as a share of the capital base, at the level of each corporation, one can compute the cumulative distribution of equivalent capital losses across the entire set of EU corporates. With a three months normalisation period, one-third of the corporations would record declines in net revenues corresponding to more than one-third of their capital base in the policy support scenario. In the heightened policy support scenario, with a stronger policy support, the distribution of losses shifts to the left in **Figure 4** and one-fourth of the corporations would suffer losses accounting for at least one-third of their capital base. Interestingly, a non-negligible portion of corporates would suffer losses whipping out their entire capital. In the most adverse scenario, 17% of corporations would lose more than 90% of their capital base.

Figure 5 Interval of net revenues reduction by size of corporation *(mean, % of total assets)*



Source: Authors' estimations based on ORBIS

The computations based on the unweighted mean of the whole sample mask important differences however. Indeed, looking across size, the unweighted mean estimate for the overall corporate sector masks large difference across firms size (**Figure 5**). By grouping the four scenarios, the small and medium-sized enterprises (SMEs) of less than 250 employees would suffer a reduction in net revenues comprised between 5.7 and 10.6% of assets.[6] Larger corporates of more than 250 employees would be affected by around two-third less, from 1.6 to 3.3%. The large differences across firms are another justification for conducting firm-by-firm estimations.

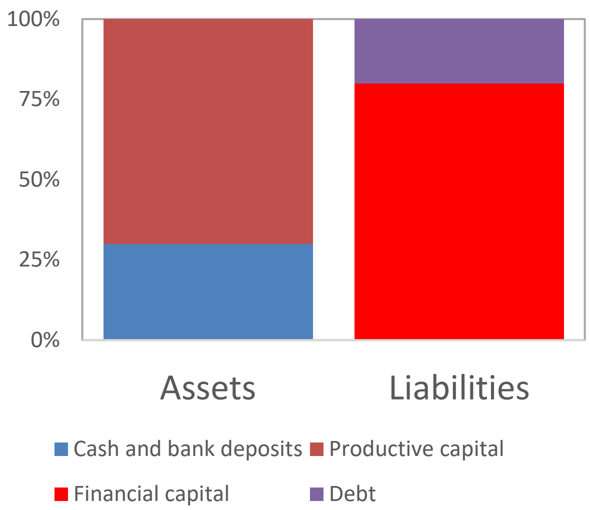
In our sample, larger corporations own 40% of the total assets of the corporations, a ratio much above that of their share in the overall population of corporations. Hence, weighting the estimates by size reduces the overall loss in net revenues based on the unweighted mean of the whole sample, from 5.4 - 10.0% to 4.1-7.7% of total assets. Since the non-consolidated total assets of EU corporates amounted to 42.7 EUR tn in 2018, the latest record available, the loss would range from 1.7 to 3.4 tn EUR, i.e. 12.6% to 23.6% of EU annual GDP.[7]

[6] Within the SMEs group, the differences between micro (less than ten employees), small (between 10 and 49 employees) and medium enterprises (between 50 and 250 employees) are much more contained, with impacts ranging from a low of 5.4 to 6.3% and a high of 10.2 to 11.7%.

7 According to Eurostat, EU GDP amounted to 13.9 EUR tn in 2019.

A trade-off between investment and leverage

Figure 6   Stylised balance sheet representation
(% of total balance sheet)



Source: Authors
Note: the shares plotted are entirely discretionary.

We consider a simplified accounting identity to illustrate the impact of loss in revenues on the main balance sheet components (**Figure 6**). The simplified identity assumes that all the net revenues are retained and converted to capital. Net revenues finance the accumulation of cash and liquid assets, of real investment, and debt reduction. Hence, loss in net revenues will result in reduced cash balance, and/or increased indebtedness and/or lower investment.

We focus on the most benign scenario (heightened policy support and 3 months normalisation) and consider a simplified accounting identity to illustrate the impact of lower revenues on the main balance sheet components. As shown in Equation 4, under the simplified balance sheet approach, compared to baseline, lower net revenues result in reduced cash accumulation and/or increased indebtedness, ΔDebt, and/or lower investment, ΔInv.[8]

$$\Delta \text{Net revenues} = \Delta \text{Cash} - \Delta \text{Debt} + \Delta \text{Inv} \qquad \text{EQ. 4}$$

Historical regularities suggest that following downturns, cash buffers absorb a part of the reduction in net revenues. This is likely to happen in the EU, especially as EU corporates entered the crisis with sizeable cash positions (**Figure 7**). During the lockdown period, these positions have decreased, but post crisis, most likely, firms will not fully restore their cash positions. We estimate that during the Lehman and sovereign debt crises, cash positions were reduced by 2% of GDP (**Figure 7**). According to current forecasts, during the Corona crisis, output will be reduced by more than during the financial crises, up to twice as much. Moreover, given the current very low interest rate environment, return on cash and liquid assets is almost nil. Hence, we assume that following the corona crisis, cash positions will absorb more than during the Lehman crisis, 3% of GDP of the loss in net revenues.

According to the European Investment Bank Investment Survey (EIBIS), internal resources contribute to the financing of investment by 60%. This ratio is an average across firms. However, half of corporates don’t tap external finance and half of corporates access external resources to finance their investment. When they do so, their funding mix consists of 60% of external finance and 40% internal finance (median values). We consider these cases as the two extreme cases.

In the “as usual” case, corporations do not alter their financing pattern and continue financing their investment with internal finance for two-thirds. In this case, in the less adverse scenario, after drawing on cash positions, two-thirds of the remaining decline in net revenue would be absorbed by lower

8 The estimations do not incorporate additional external financing to re-start business activity at the end of lockdown (see Didier et al. 2020 and Gopinath 2020).

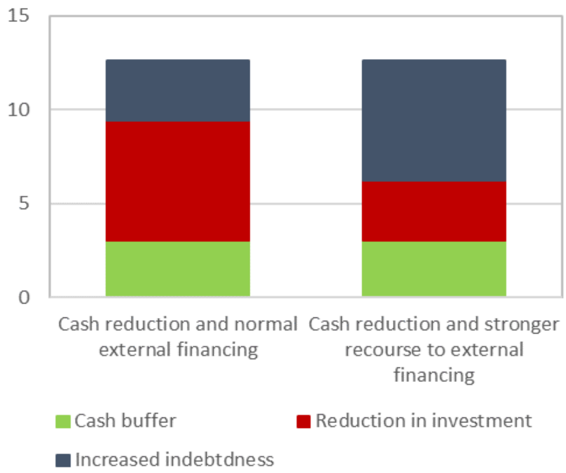
investment, a reduction of 6.4% of GDP. EU corporate investment would shrink by 48.5%. Debt would also contribute to fill the gap, and rise by 3.2% of GDP **(Figure 8**, left hand bar**)**.

Alternatively, if corporations were to increase their access to external finance, the decline in investment would be more contained. We use the EIBIS to calibrate this change and assume that the whole sample of firms taps external finance, even those that do not do so in normal times. Corporations which normally finance investment only through internal resources, around 50% of corporates according to the EIBIS, tap external finance as the others do. The share of external financing to investment would then raise from one-third to two-thirds. Following the decline in net revenues, investment would be reduced, but half less, by 3.2% of GDP (a fall of 24.3% compared to its level in 2019) at the cost of a higher increase in indebtedness, by 6.4% of GDP (**Figure 8**, right hand bar**)**.

Figure 7 Evolution of liquid assets over GDP *(%, EU economy)*

Source: Authors' computations based on EUROSTAT.

Figure 8 Filling the gap: impact on investment and indebtedness *(%, EU economy)*



Source: Authors' computations based on EUROSTAT and ORBIS. Results under the benign scenario: heightened policy support and 3 months normalisation period.

The scenario analysis portrays a fall in corporate investment that would be more pronounced than that recorded during the financial crisis, when corporate investment fell by 19%. This is in line with the forecasts that also project a much higher impact on GDP and with the EC findings of a cumulative drop in private investment of EUR 831 bn in 2020 and 2021 taken together (see EC 2020). In the first two sections, we illustrate the robustness of this result. In Section 4, we cross check the aggregated results obtained for the decline in net revenues with bottom-up sectoral estimates taking into consideration sector asymmetries and direct estimates based on unweighted mean statistics. In Section 5, we use macroeconomic time series to estimate a BVAR models and gauge the response to the COVID-19 crisis based on historical regularities.

4 – Accounting for sector asymmetries

The COVID-19 crisis has affected the economic sectors in the EU unevenly as shown in the large range of declines in stock prices across sector. In what follows, we breakdown our dataset in 30 sectors and estimate sector specific adjustment elasticities. The 30 sectors and the associated distribution of corporates across sectors, in terms of numbers and share of assets is reported in **Table 6.**

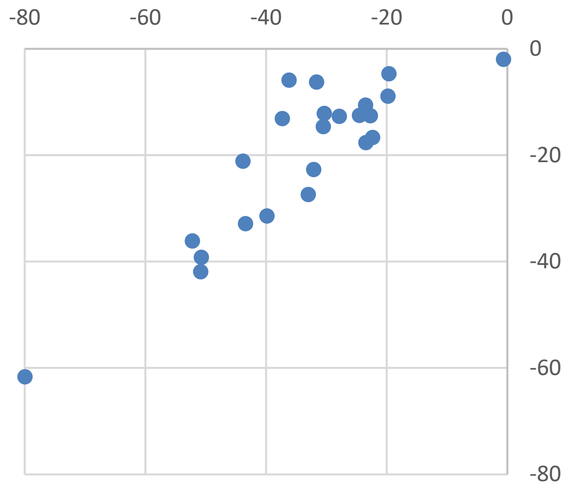
The sector breakdown available from our database is matched with that available from EC confidence indicator survey data for 24 out of the 30 sectors. We also match the databases with REFINITIV data on sectoral stock prices data. This match is achieved for all the sectors. The breakdown confirms the large variability of the decline of confidence across sector, at the peak of the crisis, but also over a longer period (**Figure 9**).

Given that to a large extent, production processes are specific to each sector, it is also likely that the cost elasticity to sales varies from one sector to another. Hence, we re-estimate the elasticities at the level of each sector. The results, shown in **Table 4**, indeed suggest high variability in the adjustment of costs across sectors.

As before, we use the sum of the elasticities augmented by the policy support to compute the decline in net revenues at the firm level. However, differently from before, we now use the sector specific decline in sales derived from the EC surveys. When those are not available, changes in stock prices are used. Hence, we take into account the differences in sales decline across sector. Overall, the declines in sales across sector are then recalibrated to ensure that their median corresponds to the 35% decline considered earlier. The unweighted mean across firms is then compared to the direct symmetric estimates computed above.

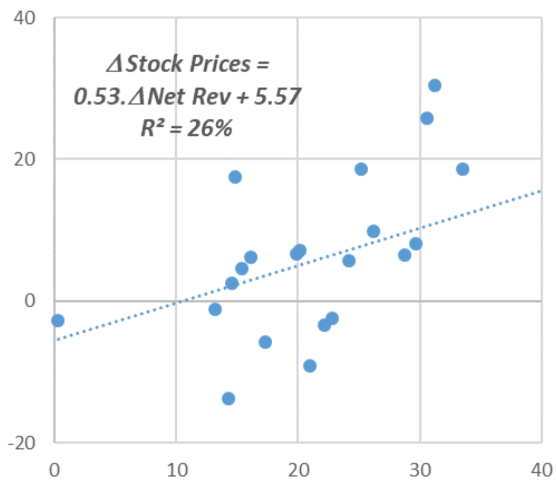
Figure 10 reports the correlation between the estimated decline in net revenues as a share of sales in the benign scenario and the decline in stock prices between early February and end-July. The correlation is positive and significant: a larger decline in the mean net revenues of the sector is associated with a larger decline in stock prices. Together with the sector specific elasticities, the simple accounting decomposition accounts for one-fourth of the variability recorded in sectoral stock prices.

Figure 9 Change in economic confidence indicators across sectors of the EU economy *(x-axis: April to February, y-axis: July to February)*



Source: Authors' computations based on EC Surveys.
Note: Each point relates to a sector. See **Table 6** *for the list of sectors. 24 out of 30 sectors are matched.*

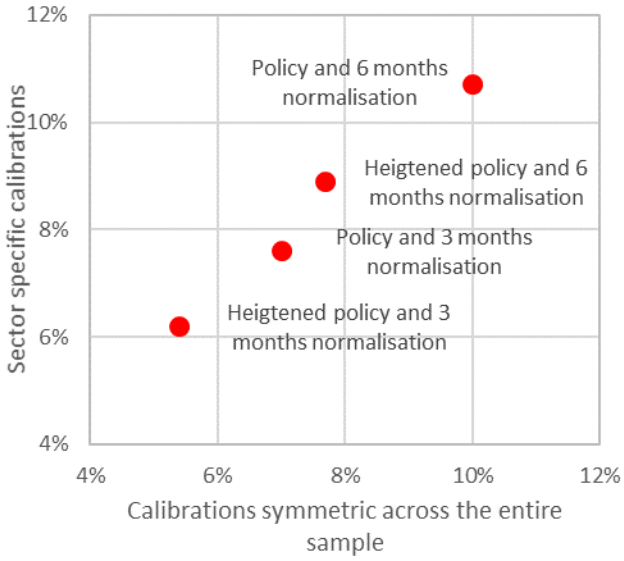
Figure 10 Estimated relative decline in net revenues and stock price decline across sectors of the EU economy *(benign scenario)*



Source: Authors' computations based on EC Surveys.
Note: Each point relates to a sector. The decline in stock prices relate to end of July relative to beginning of February. See **Table 6** *for the list of sectors.*

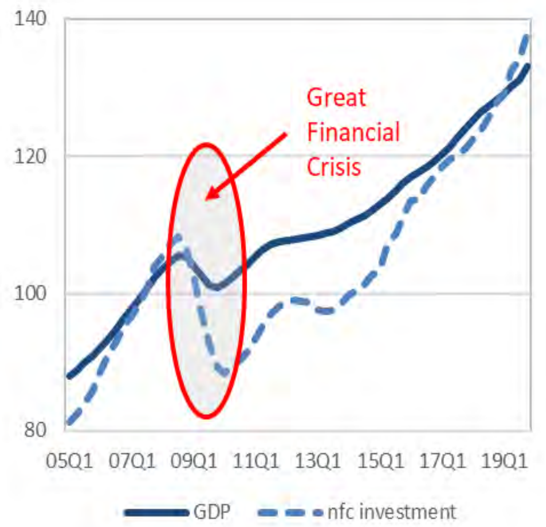
Using the sector specific elasticities and decline in sales, we compute the mean decline in corporate net revenues as a share of assets for the whole economy, as the unweighted mean of firms by firm computations. T **Figure 11** suggests that the results obtained using symmetric calibration across the whole economy are robust to the consideration of sector asymmetries. Indeed, for each scenario, the estimates are relatively similar.

Figure 11 Comparison of estimates across scenarios *(Decline in net revenues over assets)*



Source: Authors' computations based on EC Surveys.
Note: Each point relates to a scenario.

Figure 12 Historical perspective on GDP and non-financial corporate investment
(index, 100=2007)



Source: ECON computations based on EUROSTAT.
Note: Nominal values, fourth-quarter moving average to seasonally adjust the data

5 – Accounting for historical regularities

The scenario analysis portrays an impact on investment at least two times above that recorded during the financial crisis, when corporate investment fell by 19% (**Figure 12**). This is in line with the forecasts that depict a much higher impact on GDP. To assess the robustness of the link between net revenues and corporate investment, we use a dataset that differs from the granular dataset used in the previous sections. The new dataset contains aggregate time series related to the EU economy.

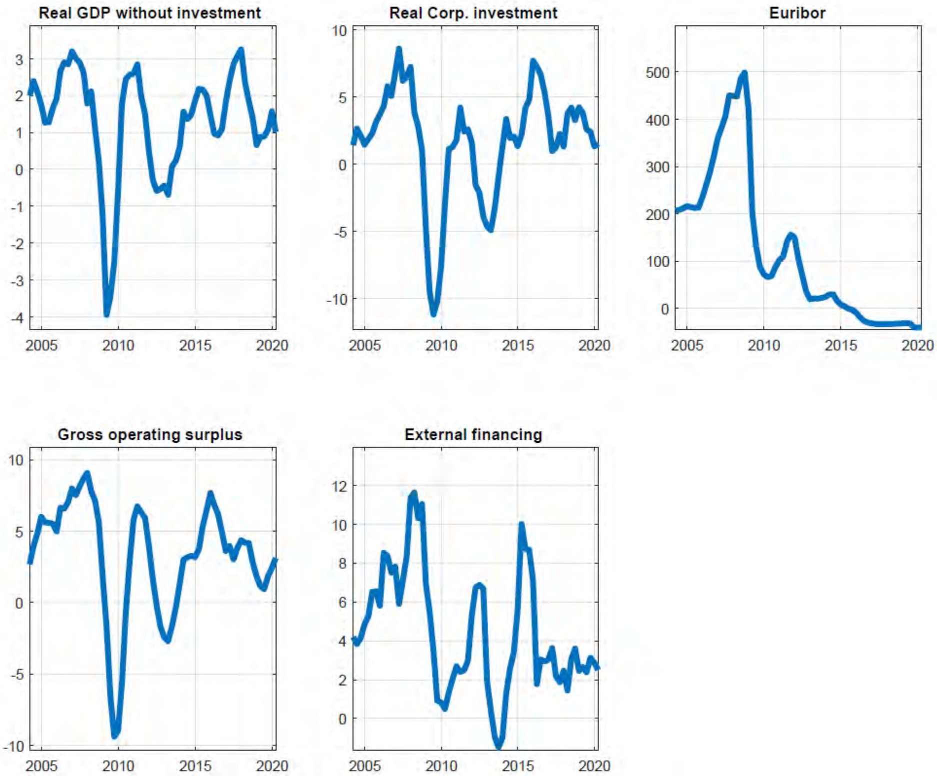
The dataset is quarterly and covers the period 1999Q1-2019Q4. It augments the standard set of variables considered in monetary policy models with variables related to corporate financial liabilities. We use real non-financial corporate investment, taken from Eurostat integrated accounts, and real GDP net of investment, henceforth activity. Besides, we incorporate the 3-month Euribor as a measure of the monetary policy rate, from the ECB. Since we do not aim at identifying monetary policy shocks, price indicators are not incorporated in the model. Corporates' gross operating surplus is used as a measure of net revenues. Finally, we build an indicator of external finance by adding corporate debt issuance, bank loans and other financial intermediaries (the series are taken from Eurostat sectoral accounts). In all cases, to compute the real series, we deflate the nominal series with the GDP deflator. The series incorporated are plotted in **Figure 13** over the period 2004Q1 to 2019Q4.

We estimate a VAR model based on these series and identify a demand shock to draw inference about the COVID-19 crisis from historical regularities by comparing unconditional and conditional projections resulting from the COVID-19 shock. In order to model dynamic interlinkages in the aggregate economy we opt to rely on a VAR(p), defined as follows

$$y_t = c + \sum_{i=1}^{p} \Phi_i y_{t-i} + \varepsilon_t \qquad \text{EQ.5}$$

where $y_{c,t}$ is a vector of endogenous variables, c is a vector of constant, Φ is the matrix of autoregressive coefficients and ε_t is a generalisation of a white noise process. Our VAR includes the five variables discussed above. Given the high parametrization of the model, we use Bayesian techniques to estimate it. We use a standard natural conjugate prior that assumes a normal distribution for the coefficients in the VAR and an inverse-Wishart distribution for the covariance matrix. The BVAR estimation is implemented via dummy-priors following the methodology of Banbura et al. (2010).[9] The Gibb-sampler algorithm is used: 20000 replications are estimated and the first 10000 draws are burned. The model retained is estimated with four lags, *p*=4 in equation 4.

Figure 13 Series used in the BVAR *(annual growth rate, %, except Euribor, b.p.)*



Source: Authors' computations based on ECB and Eurostat.
Note: last record is 2019Q4.

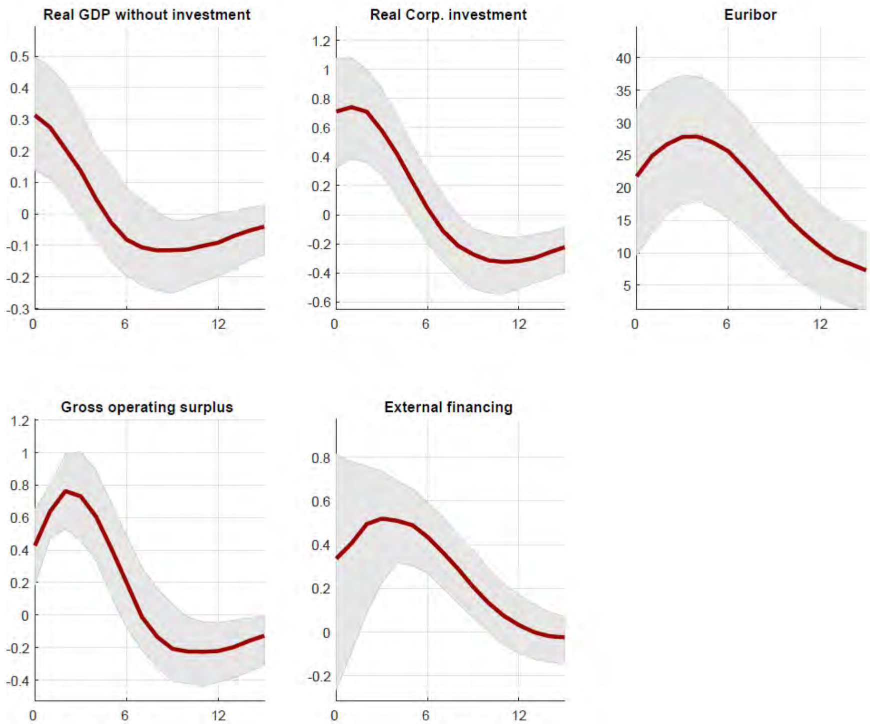
As with traditional VARs, shock identification is very important. We use sign restrictions to identify demand shocks that are recognised to be the main drivers of business cycles. In line with most of the literature, a positive demand shock is defined as a shock which has a positive impact on corporate investment and activity, and triggers a monetary policy reaction, an increase in the policy rate. Since profits behave pro-cyclically, we also impose that a positive demand shock has a positive impact on net

[9] There are four hyperparameters {τ, c, δj, σj} that together generate sequences of dummy data, which in turn imply a Normal-Inverse-Wishart prior. The first two hyperparameters control the degrees of prior tightness: σj governs the overall tightness of the prior while c determines the tightness of the prior on the constant. In line with values often used in the literature, we set these two hyperparameters to σj = 0.1 and c = 1.

revenues. Finally, the response of external financing is left undetermined. On the one hand, an improved outlook increases internal resources and enables corporations to finance investment using relatively less external finance. On the other hand, expectations of stronger activity may incentivise corporations to raise investment even more than net revenues do and to increase their access to external finance.

Impulse responses are constructed by taking a joint draw from the unrestricted Normal-Wishart posterior for the VAR parameters as well as a possible random decomposition of the variance-covariance matrix. For each set of estimated parameter, up to 500 draws of a rotation matrix are taken until the response matrix obtained by the product of the two fulfils the sign restrictions explained above.[10] When this happens, the draw is retained, the impulse response functions are generated and the corresponding shocks stored. As shown in **Figure 14**, a positive demand shock leads in the short-term to an increase in activity, corporate investment and gross operating surplus. The effect on these three variables remains significant for more than a year and up to six quarters. Monetary policy reacts with an instantaneous increase in the Euribor. Investment reacts more strongly than activity: at the peak, the increase in corporate investment is more than twice stronger that in activity. A demand shock accelerating activity by 0.3 pp triggers an increase on corporate investment by close to 0.8 pp. While median estimates suggest that external financing is pro-cyclical, increasing with positive demand shocks, part of the distribution is in negative territory. Hence, in some cases, access to external finance is contra-cyclical.

Figure 14 Response to demand shock



Source: Authors' computations based on ECB and EUROSTAT.
Note: The impulse-response-functions (IRFs) are estimated based on the BVAR estimated and the shock identified with sign restrictions. The red line reports the median of the estimated impact while the grey area reports the range of its distribution within the 15% to 85% interval. All the responses relate to the annual growth rate, in %, except for the Euribor, in basis points.

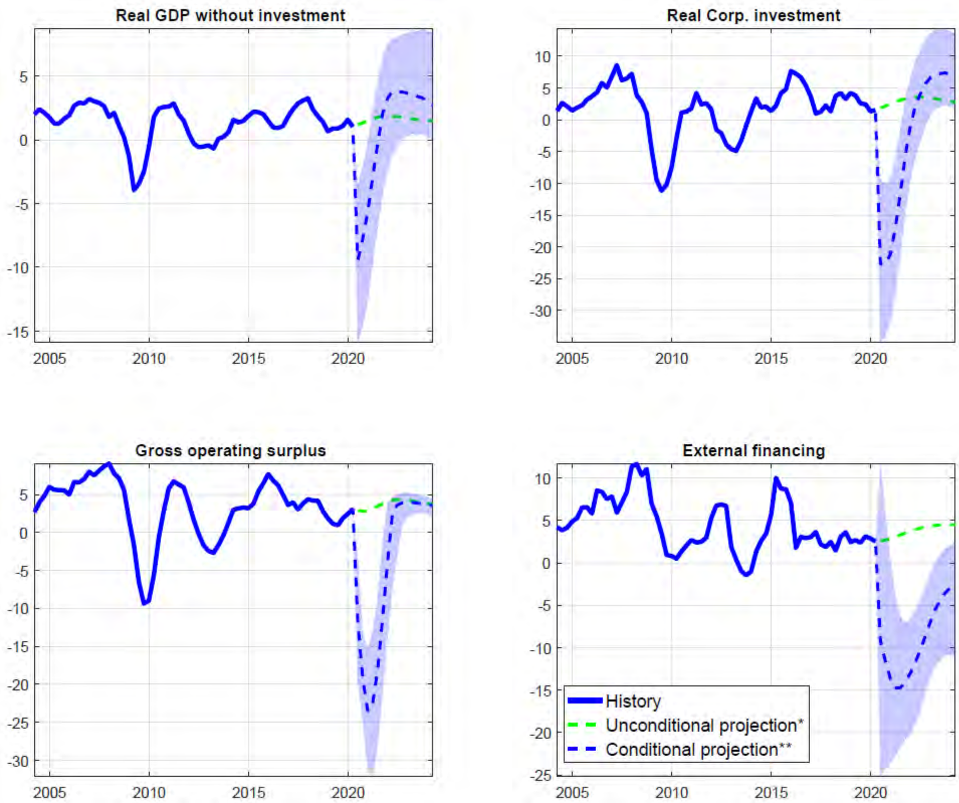
We use the model to illustrate the impact of a large decline in gross operating surplus on investment. We calibrate a demand shock that triggers a 27% deviation in gross operating surplus compared to the unconditional projection obtained from the model. This deviation in gross operating surplus corresponds to the gap of 5.4% in net revenues over assets estimated in the firms-by-firm analysis to illustrate the

[10] See Kanngieser et al. (2019) for more details.

COVID-19 impact in the most benign scenario. The maximum deviation is reached within two quarters and thereafter, the response of gross operating surplus follow the response to a demand shock.

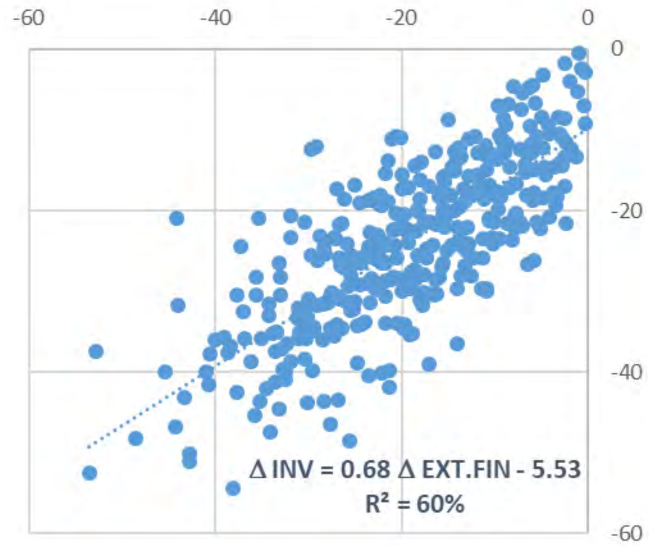
The comparison between the conditional and unconditional projections is plotted in **Figure 15**, together with the recent history of the variables, since 2005. From the figure, several observations can be made. First, the shock is largely unprecedented over the period, for all the variables in the model and even compared to the period of the Great Financial Crisis in 2008-2009. Second, the shock triggering a 27% deviation in net revenues from its pre-crisis level results in a decline in EU economic activity, slightly below 10% at the trough, a value similar to that entailed in the projections of the major institutions, such as the CB, EC, IMF or OCED in the summer of 2020. Third, in 2020, the median corporate investment gap, obtained as the difference between the conditional and unconditional projections is around 25%, a value also very close to that computed using firm-by-firm data and accounting rules. Finally, after the crisis, a strong rebound is projected for corporate investment and activity, well above pre-crisis projections. For both variable, from the middle of 2021 onwards, the path for the annual growth rate is, in the conditional projections, well above that in the unconditional scenario.

Figure 15 Comparison of projections: unconditional and post-decline in net revenues



Source: Authors' computations based on ECB and EUROSTAT.
*Note: The projection start in 2020Q1. *: The unconditional projection represents the BVAR forecast pre-COVID-19 shock. *: The conditional projection is conditioned on a demand shock resulting in a median gap of 25% in gross operating surplus compared to the unconditional projection in 2020.*

Figure 16 The trade-off: stronger investment decline or higher leverage?



Source: Authors' estimations based on ECB and EUROSTAT.
Note: Decline in external financing (x-axis) and in corporate investment (y-axis) associated with scenarios generating a median gross operating surplus 25% below its unconditional projection in 2020. The dots represent the minimum values reached within the period of 1 year after the shock.

The reported results are based on a very high number of draws. We randomly select 400 conditional projections for which we plot the projected decline within the year after the shock for corporate investment and external financing. The results, presented in **Figure 16**, clearly show the existence of a strong relationship between the two: the stronger the decline in external financing, the stronger is the decline in corporate investment. The correlation between the two amounts to 60%. Hence the estimated model shows the existence of a trade-off between leverage and corporate investment in reaction to the adverse demand shock.

6 – Concluding remarks

The first peak of the Corona crisis has been reached but economic conditions only gradually normalise and the possibility of another peak cannot be excluded. The crisis will have a major and long-lasting impact on corporates balance sheets.

Using an accounting approach and ORBIS firm level data, we assess medium term strategic choices for firms, following the months of lockdown and different normalisation scenarios. We show that the hit to corporate investment is likely to be very large. We estimate COVID-19 induced cumulative net revenue losses for EU companies in the range of 5.4% to 10.0% of assets, depending on the stringency of the scenario considered. The range of estimates appears to be robust to the consideration of sector specificities.

To compensate for these losses, EU corporates will face a difficult trade-off between investment and leverage. Even in the most favorable scenario, we estimate a potential decline in corporate investment by 24.3% to 48.5%, well above the drop recorded during the financial crisis. Corporate leverage increases by 3.2 to 6.4 percentage points of assets, depending on how much firms try to protect investment. Using historical regularities, we then assess the likelihood of such decline by estimating a macro based Bayesian VAR model for which we identify a standard demand shock. We then calibrate the demand shock to generate the computed decline in net revenues. The comparison between conditional and unconditional projections supports the existence of a trade-off faced by corporates between investment and leverage. It also suggests that, should the estimated gap in net revenues materialise, the decline in corporate investment would likely be within the computed ranges. While the estimates appear very large, they don't incorporate several other adverse effects, such as, rise in corporate bankruptcies, adverse confidence effects and increase in households saving ratios, spikes in uncertainty or escalated financial tensions, debt overhang and persistent drag on external trade.

Besides, the model clearly supports the existence of a trade-off regarding the reaction of investment to an adverse demand shock: a lower decline is obtained at the cost of higher indebtedness. The bleak outlook for EU corporates suggests the need for new policy tool to support corporate solvency, thereby avoiding a protracted period of weak economic performance and restoring the conditions for higher long-term growth.

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Appendix

Table 5 Sectoral composition of the dataset

	Sectoral composition			
	nbr of firms	Share (%)	Total Assets (bn)	Share (%)
Agriculture	437,334	3.4	255	3.2
Mining	34,693	0.3	42	0.5
Food Manufacturing	315,184	2.4	208	2.6
Textiles	218,532	1.7	93	1.1
Wood	267,534	2.1	122	1.5
Coke and petroleum	2,052	0.0	4	0.0
Chemicals	57,904	0.5	70	0.9
Pharmaceuticals	8,968	0.1	21	0.3
Rubber and plastic	221,273	1.7	169	2.1
Basic Metal	465,079	3.6	270	3.3
Manuf of computer electronics	56,170	0.4	58	0.7
Manuf of electrical equip	64,012	0.5	59	0.7
Machinery	168,074	1.3	167	2.1
Transport equipment	53,156	0.4	60	0.7
Other Manuf	341,901	2.6	148	1.8
Electricity gas	50,142	0.4	202	2.5
Water	91,010	0.7	92	1.1
Construction	2,032,805	15.7	995	12.3
Trade	3,618,427	27.9	1650	20.4
Transportation	702,986	5.4	347	4.3
Accomodation and food service	1,073,437	8.3	293	3.6
Publishing	134,021	1.0	93	1.2
Telecommunication	34,964	0.3	30	0.4
IT	350,043	2.7	210	2.6
Real estate	435,868	3.4	1510	18.7
Legal and accountung	805,949	6.2	748	9.2
R&D	30,942	0.2	38	0.5
Other professional services	351,956	2.7	148	1.8
Health	328,736	2.5	132	1.6
Art and recreation	206,363	1.6	113	1.4
Total	12,959,515	100	8091	100

Source: Authors' computations based on ORBIS.
Note: the correlation between the share by number of corporations and by total asset mounts to 79.8%.

Table 6 Sectoral asymmetries: cost-elasticities and sales drop

	Estimations sector specific elasticities of cost components								***Estimated change in sales activity during the lockdown (%)****
	Past, present and future				***Present and future***				
	Employment costs	material costs	Financial expenses	Other operating expenses	Employment costs	material costs	Financial expenses	Other operating expenses	
Agriculture	39.1	75.3	44.5	27.4	29.8	66.8	32.8	21.3	-15.5
Mining	47.8	92.2	45.6	25.6	35.3	82.4	34.6	21.6	-34.2
Food Manufacturing	52.1	93.6	50.8	29.1	43.7	86.1	37	24.4	-32.6
Textiles	59.6	99	52.6	40.8	46.6	94.3	34.9	33	-34.3
Wood	54.2	94.3	56.6	35.2	41.5	91.1	41.4	28.6	-25.8
Coke and petroleum	42.8	163.7	100	31.5	32.4	146.1	62	27.3	-32.8
Chemicals	49	91	55.6	33.2	37	88.9	42.3	27.7	-22.1
Pharmaceuticals	36.1	83.3	86.1	24.9	26.6	77.6	56	18.1	0.0
Rubber and plastic	56.6	100.1	59.7	35.4	43.1	96.6	41.3	29.1	-33.9
Basic Metal	61.2	101.1	58.9	44	46.8	98.7	40.7	36.5	-30.1
Manuf of computer electronics	53.6	91.6	48.7	40.4	38.1	88.1	34.9	34	-25.0
Manuf of electrical equip	53.3	108.8	56.2	46.1	39.8	108.8	40.9	39.2	-21.9
Machinery	56.9	102.9	52.6	44.1	42	99.2	38.6	37	-26.8
Transport equipment	54.4	95.6	48.3	34.6	42	85.1	35.1	28.3	-38.4
Other Manuf	62.5	97.7	55.2	42.5	47.8	95.7	37.2	34.6	-39.6
Electricity gas	34.8	77.4	38.6	23.3	27.6	72.5	29.7	20.8	-45.0
Water	49.7	94.1	59.2	36.5	38.1	85.5	42.2	30.3	-36.6
Construction	54.2	86.9	42.9	33.5	42.3	80.4	29.7	26.9	-25.7
Trade	51.6	80.8	56.5	37.3	38.6	76.7	38	30.4	-46.1
Transportation	59.6	93.3	76.6	47.7	47.9	84.8	54.9	39.4	-54.5
Accomodation and food service	64.6	82.5	49.7	27.3	56.9	78.6	36.5	23	-82.2
Publishing	48	71.9	48	37.3	35.7	63.6	33.8	30.1	-53.0
Telecommunication	51.4	74.8	61.2	41.3	35.3	69.8	37.7	32.1	-24.6
IT	58.7	74.2	55.9	49	43.6	70	37.6	41.1	-45.7
Real estate	38.8	70.1	28.1	16.8	29.3	63.7	21.3	13.8	-35.3
Legal and accountung	47.9	72.4	43.3	42.7	35.2	64.5	30.7	34.5	-42.1
R&D	39.4	71.2	34.3	30.2	30.9	64	24.2	25.3	-43.3
Other professional services	52.7	77.9	46.2	44.6	38.2	70.1	31.5	36.2	-53.1
Health	60.5	81.6	51	44.6	51.2	77.9	42.4	37.7	-14.8
Art and recreation	48.5	67.4	38.9	30.5	39.3	63.8	27.3	25.1	-35.4

Source: Authors' estimations.

*Note: Elasticity reported in %. * Estimated change in sales during the lockdown based on the change in EC confidence indicator o in stock prices (when the indicator is not available), between February and April 2020. The changes are rescaled to reach a median value of -35% as in the scenarios implemented on the whole economy.*

ECONOMICS – WORKING PAPERS 2020/09

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PDF: ISBN 978-92-861-4850-7