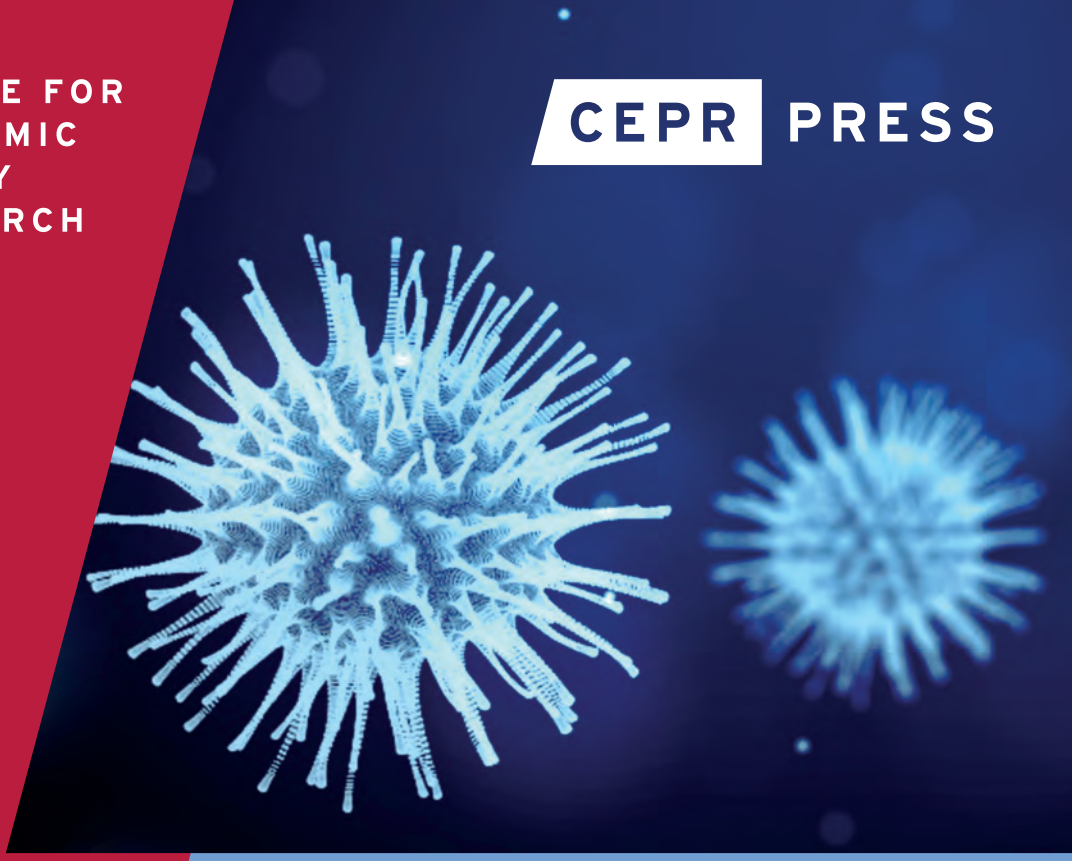
CENTRE FOR ECONOMIC POLICY RESEARCH

CEPR PRESS



COVID ECONOMICS

VETTED AND REAL-TIME PAPERS

ISSUE 35
7 JULY 2020

A simple method to estimate firms' liquidity needs during the Covid-19 crisis with an application to Italy[1]

Fabiano Schivardi[2] and Guido Romano[3]

Date submitted: 1 July 2020; Date accepted: 2 July 2020

We propose a simple method based on firms' balance sheets and sectoral predictions of sales growth to determine the firms that will become illiquid month by month as the Covid-19 crisis unfolds. We apply the method to the population of Italian incorporated businesses to the end of 2020. We find that at the peak, around 200,000 companies employing 3.3 million workers would become illiquid. The progression is fast, with 180,000 firms turning illiquid already by April. The liquidity shortage, defined as the "negative" liquidity stock of illiquid firms, amounts to 72 billion. We evaluate the Italian government liquidity decree, which provides guarantees for bank loans under four different facilities of increasing complexity. Assuming that firms have access to all the facilities, almost all firms are able to cover their liquidity shortfalls. The issue is the speed of implementation: the facilities supplying more liquidity are more complex to administrate, and many firms require these facilities to cover their liquidity shortfalls. Overall, we conclude that even in the case of a second wave after the summer, which would increase the liquidity shortfall substantially, firms' liquidity needs are manageable under the current schemes of liquidity provision.

1 We are grateful to webinar participants at the OECD and the ECB for useful comments. We are also grateful to Letizia Sampoli and her team of Cerved sector analysts for providing us sales forecasts for more than 500 sectors. David Kwon provided superb research assistance. The views expressed in the paper are those of the authors and do not necessarily reect those of Cerved Group.

2 Luiss University, EIEF and CEPR.

3 Chief Economist, Cerved Group Research Department.

Covid Economics 35, 7 July 2020: 51-69

1 Introduction

A fundamental question to predict the economic effects of the Covid-19 pandemic is to understand their persistence, that is, if the economy will return quickly to its pre-crisis level or if it will take a long time to reabsorb the fall in output. This depends on how many companies will go bankrupt from the liquidity crisis due to the fall in sales. Bankruptcies have long lasting effects, prolonging the negative consequences of the shock. They amplify the real (through input/output relationships) and financial (through trade payables and receivables) contagion to other companies, which can have a chain effect on the entire economy. When this happens, bad loans grow, and the infection is extended to the financial sector. Therefore, it is important to provide firms with liquidity to avoid bankruptcies at this scale. This is a shared goal, and the response by policymakers has generally been to provide *whatever it takes*. In fact, most governments have set up some form of credit guarantee, particularly for small and medium enterpreises (SME) OECD (2020). However, these policies need to be credible; therefore, it is important to determine *how much it takes*: are the schemes that governments provide sufficient to avoid massive liquidity-induced bankruptcies?

In this paper, we develop a simple accounting framework to determine which firms will have liquidity constraints and to what extent. The general logic is very straightforward and is based on three ingredients: the initial stock of liquidity, an estimate of the evolution of cash flow month by month and the budget equation determining the evolution of liquidity. The framework uses firms balance sheets to obtain pre-pandemic output and costs as well as the initial stock of liquidity. It requires as an input the month by month estimate of sales growth at the sectoral level which, given each firm's previous year sales, make it possible to forecast sales evolution at the level of the firm. Costs are predicted using inputs' elasticities, which allow us to use sales growth forecasts–mediated by the elasticity of each input–to determine monthly outflows. Given an initial stock of liquidity, the budget equation determines the stock of liquidity month by month. When this value turns negative, we classify a firm as illiquid. The absolute value of the negative liquidity is the amount of the liquidity shortfall. Summing across all illiquid firms produces the aggregate liquidity needs to avoid firms going bankrupt. The method is transparent and straightforward to implement.[1] It has been used by various institutions (Bank of Italy 2020, European Commision 2020, OECD 2020).

We apply the method to the population of Italian incorporated businesses, around 650,000 companies producing three quarters of the Italian private sector output. We consider the period from March 2020 until the end of the year. Sales growth from more than 500 sectors is forecasted by Cerved, a data provider and credit rating agency that also supplies firm balance sheets. The forecasts are carried out by Cerved sectoral experts, who take into account both the legislation (the lockdown) and other economic factors (drop in demand, effects of social distancing, disruption of supply chains etc.). We set all financial outflows and tax payments to zero, based on legislative decrees that allow firms to postpone them. Using time series data and taking into account a job retention scheme enacted by the government, we assume that the elasticity of intermediate goods and services expenditure to sales is 0.5 and that of labor is 0.75. In the baseline scenario, the lockdown is active from mid-March to the beginning of May for non essential sectors. Then, activity gradually reverts back to normal at different speeds according to sectoral characteristics. We experiment with both input costs elasticities and the evolution of the pandemic, allowing for a second wave in the Fall.

We find that the effects of the pandemic are very quick, with more than 180,000 firms, employing 3.1 million workers, already becoming illiquid in April. The number of illiquid

[1] A brief note illustrating it was posted on the economists blog lavoce.info at the end of March and a code with a mock dataset is available http://docenti.luiss.it/schivardi/policy-wor/policy-work/.

Covid Economics 35, 7 July 2020: 51-69

firms peaks at 200,000 (employing 3.3 million workers) in September, and then it decreases very slightly for the rest of the year. The amount of liquidity shortage, that is, the value of "negative" liquidity of illiquid firms, is 40 billion in April. Then, it keeps increasing until the end of the year, when it reaches 72 billion. Of these, more than 50 million are in firms with less than 500 employees.

Next, we use the scheme to evaluate the coverage provided by the Italian Liquidity Decree, which supplies public guarantees to bank loans issued as a response to the pandemic. The decree designs different facilities to provide loan guarantees, with the amount of guarantee decreasing with the size of the loan and with different conditions for small (less than 500 employees) and large firms. We find that theoretical coverage is complete: assuming that firms have access to all the facilities, basically all firms are able to cover their liquidity shortfalls. The issue then becomes implementation: in fact, the semi-automatic facilities supply limited coverage, and only the more complex ones bring coverage close to full. However, the complex facilities require both bank screening (as the guarantee is not full) and an approval from a government agency. Given that we forecast that many firms will become illiquid quickly, there could be a congestion effect that prevents the full theoretical coverage from becoming actualized. The key issue is therefore the speed of implementation. We propose a simple scheme, according to which firms with good pre-crisis rating are granted credit semi-automatically so that banks can deploy their screening capabilities for firms with less solid rating, distinguishing illiquid but solvent firms from insolvent firms.

As stated above, our methodology has been employed by several economic institutions (Bank of Italy 2020, European Commision 2020, OECD 2020) with comparable results. We are only aware of three papers independently developed and related to our work. Carletti, Oliviero, Pagano, Pelizzon & Subrahmanyam (2020) estimate the drop in profits and the equity shortfall following the Covid-19 crisis for a sample of Italian firms, finding that they are substantial. Compared to us, they focus on profits rather than liquidity, use a smaller sample of 81,000 firms (our sample of 650,000 firms is the universe of incorporated firms) and use a different methodology to estimate demand and costs. In particular, they assume zero elasticity for intermediate goods and services (intermediates in what follows) which, as we show in our exercise, has a strong influence on the estimates. De Vito & Gomez (2020) focus on listed firms in 26 countries. Compared to our sample with a large majority of private firms, listed firms on average hold more liquidity, so the share of firms becoming illiquid early on is much smaller: only 10% within six months under the most adverse scenario, against 31% in our case. This is in line with the idea that listed firms are financially more solid and lends support to the view that government schemes should target SMEs first. McGeever, McQuinn & Myers (2020) carry out a similar exercise for Ireland. Compared to us, they have no information on the firm's stock of liquidity before the crisis and only focus on a subset of highly affected sectors, for which they assume that sales go completely to zero for three months. Also their treatment of costs differ. They estimate liquidity needs of between 2.5 and 5.7 billion. In related work, Schivardi, Sette & Tabellini (2020) use our framework to analyze the possibility that government loan guarantees might induce "zombie" lending, that is, the provision of credit to firms that were already insolvent before the crisis. They conclude that due to the nature of the shock, which hits firms independently from their economic and financial conditions, the amount of "zombie" lending is likely to be limited.

The rest of the paper is organized as follows. Section 2 illustrates the method and describes the preferred parameterization. Section 3 applies it to the Italian population of incorporated businesses and Section 4 evaluates the Italian Liquidity Decree. Section 5 explores alternative parameterizations in terms of the evolution of the pandemic and the elasticities of inputs and Section 6 concludes.

2 The method

In this section, we illustrate the accounting scheme and the choice of the parameters and forecasts to implement it.

2.1 The accounting scheme

We construct an accounting framework that allows us to estimate the liquidity needs of firms during the Covid-19 crisis. The framework identifies the month in which a firm becomes illiquid (if any) and the amount of the liquidity shortage afterwards. The general logic is simple and is based on three ingredients:

1. the initial stock of liquidity in the firm's balance sheets
2. an estimate of the evolution of cash flow month by month
3. the budget equation governing the evolution of liquidity.

Specifically, for firm i in month m of 2020, given an initial stock of liquidity L_{i0} in February, sales S_{im} and outlays C_{im}, the evolution of liquidity L_{im} is:

$$L_{im} = L_{im-1} + S_{im} - C_{im} \tag{1}$$

for m =March, April,..., December 2020. To implement Equation 1, we therefore need L_{i0} as well as the monthly evolution of cash flow (sales minus costs). Based on this, we can determine the month in which L_{im} turns negative. In this case, a firm is defined as illiquid. For each month m, the total (that is, for the whole economy) liquidity shortage TLS is the sum of all the liquidity shortages of illiquid firms:

$$\text{TLS}_m = \sum_{L_{im}<0} |L_{im}|. \tag{2}$$

The method requires information on firms' balance sheets. Balance sheets are typically available for all listed firms. In many countries, they are also available for unlisted incorporated firms. The Orbis database of Beurau Van Dick contains data for many countries and is widely used in research (Kalemli-Ozcan, Sorensen, Villegas-Sanchez, Volosovych & Yesiltas 2015). In our application to Italy, we use the Cerved database, which covers all incorporated Italian businesses. By law, they are obliged to file their balance sheets every year to the Firm Registry. We focus on the 650,000 non-financial firms which account for approximately three quarters of private sector GDP. We use the most recently available balance sheets, which are from 2018. Ideally, one would use those of 2019; however, note that this is not a major limitation. In fact, while the exercise predicts liquidity needs firm by firm, we are interested in the aggregate values. As long as the distribution of firms' conditions is invariant between 2018 and 2019, the aggregate results will be unaffected by idiosyncratic firm movements that leave the distribution unchanged.

From the balance sheets, we obtain the initial value of liquidity, defined as the value of liquid assets reported in the balance sheets. For sales, we consider the sales of 2018 and assume that absent the Covid-19 crisis, monthly sales would have been equal to 1/12 of the total sales of 2018. We then apply forecasts of sales growth described in more detail in the next subsection. In terms of firm costs, we assume that following the Italian government decrees enacted during the crisis, all financial payments and taxes are suspended. Moreover, we also assume that firms freeze their investment expenditures.[2] The only outlays left are

[2]Accounting for financial payments is straightforward, and in an initial version of the procedure implemented, before the government had frozen financial payments, we had taken them into account. We assumed that each month, a firm had to pay 1/12 of the interest expenses reported in the balance sheets of 2018 and 1/12 of the mortgage payments, which were estimated as a fraction of long term debt.

Covid Economics 35, 7 July 2020: 51-69

cost of labor and intermediates. To estimate them, we use the elasticity of each input to sales, which allows us to determine the evolution of costs from that of sales. Given an elasticity of each input to sales, $\varepsilon_{WS}, \varepsilon_{MS}$, and sectoral estimates of the drop in sales for each month compared to the pre Covid-19 value d_{im}, Equation 1 becomes:

$$L_{im} = L_{im-1} + (1 - d_{im})S_i - (1 - \varepsilon_{WS} d_{im}) * W_i - (1 - \varepsilon_{MS} d_{im}) * M_i \tag{3}$$

where $L_i = L_{i2018}/12$ is monthly sales according to 2018 sales and similarly for labor costs W_i and intermediates M_i. To implement Equation 3, we need to determine the values of d_{im}, ε_{WS} and ε_{MS}.

2.2 Sales forecasts and inputs elasticities

Sales forecasts for approximately 500 sectors were produced by Cerved sector experts. Cerved is a data provider and credit rating agency that computes firms default probability (the score) used by banks to process credit applications. Sectoral forecasts are used by Cerved in their predictive exercises. In the basic scenario, the lockdown lasts until the beginning of May, as it actually did, and applies at the sectoral level according to the various Government decrees that were issued during the acute phase of the pandemic. The key distinction is between essential sectors (food, health, delivery), which were allowed to continue production, and non essential sectors, which had to shut down. The scenario then assumes a period of partial opening that also varies by sector, and after that, activity gradually recovers. In addition to the legal constraints, the sectoral estimates also take into account sectoral exposure to Covid-19 specific effects, such as the possibility to work remotely, the effects of social distancing, the reduction in mobility, etc. The appendix reports a detailed description of the procedure, as well as a 2-digit aggregation of sales growth for 2020 with respect to 2019. The most affected sector is air transportation, which records a drop of 46%. At the opposite end, online retail trade increases by 30% (see Appendix Table 3). In the base scenario, it is assumed that the pandemic gradually disappears. Cerved also computed a pessimistic scenario in which the virus returns in the Fall. We evaluate the effects of the pessimistic scenario on firms' liquidity in Section 5.1.

Table 1 reports descriptive statistics of firms, dividing them according to the predicted sectoral drop in sales for 2020 with respect to 2019. We separate sectors in groups with a drop of 20% or larger, between 20 and 10%, between 10 and 0%, and with non negative sales growth. The group with the largest drop is by far the most populated, with more than 300,000 firms. The two intermediate groups have approximately 130,000 firms, and less than 60,000 firms record sales increases. Firm characteristics are very similar across groups: while the mean values of employment, sales and liquidity differ somewhat due to the skewed distribution with some large outliers, the 25^{th}, 50^{th} and 75^{th} percentiles are remarkably similar, with a large prevalence of small firms in all clusters: the 75^{th} percentile of employment varies between 7 and 9. Average liquidity is around 400,000 euros, but the median is much slower, at around 30,000 euros in all groups, while the 25^{th} percentile is always below 10,000 euros. This indicates that many firms have small liquidity buffers.

Next, we consider two indicators of financial fragility: leverage, which is defined as debt over equity, and Cerved Group Credit Score, a riskiness indicator computed by Cerved that takes values from 1 (very safe) to 10 (very risky).[3] As it turns out, firms are also very similar across groups in terms of financial conditions. The statistics in Table 1 therefore indicate that, not surprisingly, the crisis hit sectors with an intensity uncorrelated to sectoral characteristics, at least related to size and financial health.

[3]Given that leverage is very skewed due to the large number of small firms with either no debt or very low equity, we trim leverage at the 1^{st} and 99^{th} percentiles.

Covid Economics 35, 7 July 2020: 51-69

Table 1: Firm Statistics by Change in Sales

	Mean	p25	Median	p75	S.D.	N. Obs.
> 20% Decrease						
Employees	13.5	0	2	8	294	316,529
Sales	3,797	146	452	1,404	104,170	316,855
Liquidity	419	7	28	112	30,846	316,529
Leverage	1.09	0	0	0.757	2.9	291,176
Risk Class	5.43	4	5	6	1.64	311,238
10 − 20% Decrease						
Employees	14.1	0	2	7	161	135,470
Sales	4,278	107	348	1,143	109,171	135,777
Liquidity	448	7	29	118	16,568	135,470
Leverage	0.907	0	0	0.494	2.64	127,563
Risk Class	5.21	4	5	6	1.54	133,717
0 − 10% Decrease						
Employees	21.6	0	3	9	349	127,882
Sales	3,131	105	318	1,042	57,506	127,992
Liquidity	320	7	27	105	6,725	127,882
Leverage	0.854	0	0	0.444	2.52	118,746
Risk Class	5.05	4	5	6	1.58	126,359
10% Increase						
Employees	17.4	0	2	7	233	57,917
Sales	6,489	154	585	2,209	70,270	57,953
Liquidity	583	8	34	135	16,072	57,917
Leverage	1.19	0	0	0.891	3.05	53,110
Risk Class	5.42	4	5	6	1.66	56,961

Note: The table reports descriptive statistics for firms characteristics, split according the drop in sales. Leverage is debt over equity and is trimmed at the 1st and 99th percentile. Risk class is from the Cerved Credit Score, which takes discrete values between 1 (very safe) to 10 (very risky), with unit intervals.

The last input we need is a value for the two elasticities of labor and intermediates to sales. To obtain a rough estimate of the two values, we use the balance sheets of Italian non financial incorporated companies between 2005 and 2015, which contains a total of 3.9 million firm-year observations. We regress the percentage annual change (the log difference) in intermediate expenditure and the wage bill on the percentage change in sales, controlling for year and firm fixed effects. For intermediates, we obtain $\varepsilon_{MS} = 0.70$. While purchases of goods are highly elastic, due to the strong pro-cyclical behavior of inventories (Khan & Thomas 2007), services expenditure, which includes rents and fixed contracts for the provision of telecom services, royalties etc., is more difficult to cut in the short run. Moreover, these estimates are based on all changes in sales, including both small and positive ones, but during the Covid-19 crisis the most important changes are large and negative. In the presence of non-linearities and asymmetries, estimates based on the whole sample might not adequately capture the response to a large negative shock. To check how firms respond to such a shock, we repeated the regressions using only observations for which the change in sales was below -0.1. The number of observations drops to 1.05 million and the elasticity to 0.62, indicating that large negative shocks are more difficult to accommodate. We therefore assume a conservative value for the elasticity of intermediates of 0.5.[4]

[4]We are aware of the fact that our estimates do not account for endogeneity. However, we only use them

Covid Economics 35, 7 July 2020: 51-69

Covid Economics 35, 7 July 2020: 51-69

For labor, the same exercises as above delivers $\varepsilon_{WS} = 0.46$ for the whole sample and $\varepsilon_{WS} = 0.40$ when focusing on sales drops of at least 10%. However, the labor elasticity during the Covid-19 crisis critically depends on public supplement schemes. The Italian government provides a job retention scheme that allows all firms to reduce paid work by any amount and have the government pay workers for the income loss (the *Cassa integrazione guadagni* or the Fund to integrate income). This greatly increases the elasticity of the wage bill to production. The scheme has been extensively used by Italian firms: in April, the number of hours paid was almost 900 million, equal to the *total* amount paid in 2009, the worst year of the financial crisis, when GDP contracted by more than 5%. To account for this, we set ε_{WS} to 0.75. This measure is renewed on a monthly basis, so it might be discontinued before the end of the year. For simplicity, we assume that both elasticities are constant throughout the exercise. Changing the values of the elasticities obviously affects the absolute vales but not the general conclusions, as we show in some robustness exercises below.

One final point is that input elasticities are likely to be asymmetric. We do not allow for full adjustment – elasticities are smaller than 1 – for sales drop, allowing for frictions in reducing inputs in the short run. However, for the few sectors that expand sales, assuming low elasticities will boost cash flow, as the firm is allowed to expand sales with proportionally smaller increases in costs. This might be sensible to the extent that some of the costs have a fixed component. At the same time, elasticities for increases in output might be higher than those for decreases.[5] To take this into account, we have experimented by assuming that ε_{WS} and ε_{MS} are smaller than one only when sales contract and equal to 1 when sales expand. Unit elasticity is consistent with a constant return to scale production function and no fixed costs.[6] We have experimented with this asymmetric parameterization, finding that it makes very little difference because, as shown in Appendix Table 3, very few sectors increase their sales during 2020.

3 Results

We now apply our scheme to the universe of Italian incorporated companies. For each month, we compute the number of firms that are illiquid (firms for which $L_{im} < 0$) and the workers employed by these firms and plot their evolution from March to December of 2020 in Figure 1. The crisis is clear very quick: already in April, 180,000 firms, employing 3.1 million workers, become illiquid. The peak is reached in September, with 201,946 firms, and then the number decreases very slowly for the rest of year. In terms of workers, in September, 3.5 millions are employed by illiquid firms, which amounts to 12% of total Italian employment.

Figure 2, Panel a) plots the total liquidity shortage (TLS) defined in Equation 2 as a total and separately for firms above and below the 500 employee threshold.[7] The TLS is 12 billion in March, jumps to 40 billion in April and increases steadily until September by

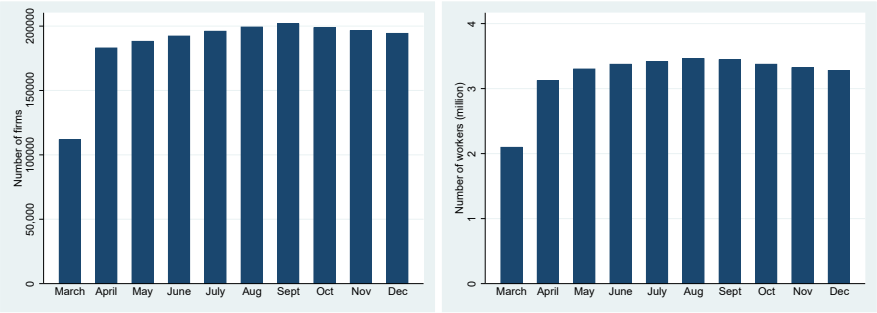
to get a rough idea of the magnitude and interpret them conservatively to account for the exceptional nature of the situation. In Section 5.2, we experiment with alternative values.

[5] Regression estimates only using positive sales changes deliver a slightly larger elasticity for intermediates and a lower elasticity for labor.

[6] Note that we are not accounting for the cost of capital. That is, we do not impute any capital costs in case of sales growth. Using survey data for Italian manufacturing firms with information on capacity utilization, Pozzi & Schivardi (2016) show that the average degree of capacity utilization is 81%, with a standard deviation of 13%; the 5^{th} and the 95^{th} percentile are 60 and 98%. This suggests that most firms will be able to deliver the small increases in sales we predict for a few sectors without resorting to increases in the capital stock and therefore without cash outflows.

[7] We use the 500 employee threshold to define SMEs because this is the definition used by the Italian government in the liquidity decree that we analyze below.

Figure 1: Illiquid firms and workers



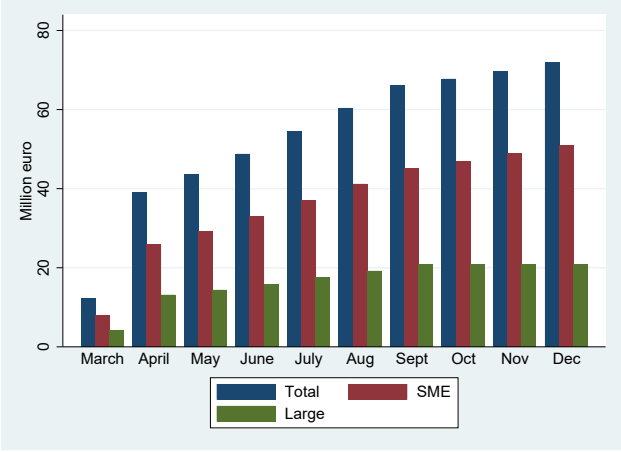
(a) Number of illiquid firms (b) Workers in illiquid firms

Note: The figure reports the total number of illiquid firms (Panel a) and the total number of workers in such firms (Panel b) using Equation 3 to detect the firms for which liquidity has hit the zero constraint.

Covid Economics 35, 7 July 2020: 51-69

approximately 5 billion per month. After that, the growth slows to 2 billion per month, reaching a peak of 72 billion in December. SMEs account for 2/3 of the total at the beginning of the crisis and for 3/4 of the total in December.

Figure 2: Total liquidity shortage for all firms and by firm size



Note: The figure reports the value of the total liquidity shortage (TLS) defined in Equation 4 for all firms and distinguishes between firms above and below the 500 employees threshold.

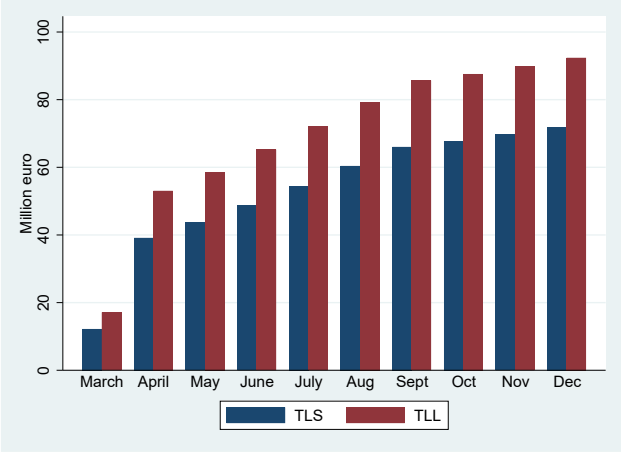
TLS measures the value of the "negative" liquidity accumulated by firms that hit the zero liquidity constraint. As such, it does not include the value of liquidity that firms had before the crisis that is lost before hitting the zero liquidity constraint. To account for this, we also compute the total liquidity loss (TLL), defined as the total liquidity lost by illiquid firms:

$$\text{TLL}_m = TLS + \sum_{L_{im}<0} L_{i0}. \tag{4}$$

where L_{i0} is the initial liquidity stock. Figure 3 reports the evolution of TLL and TLS to

facilitate comparisons. In March, TLS is 12 billion and TLL is 17 billion. The difference grows over time and reaches a maximum of 22 billion in December. Therefore, accounting for the liquidity lost makes a difference, as illiquid firms do deplete a substantial liquidity stock. However, TLS represents the largest component of TLL.

Figure 3: Total liquidity loss



Note: The figure reports the values of the total liquidity shortage (TLS) and of total liquidity loss (TLL).

Table 2 reports firms' characteristics separately for liquid and illiquid firms as of December 2020. The two groups are very similar in terms of size, with illiquid firms slightly larger both in terms of sales and employment. Illiquid firms also have more trade credit and less debt at the mean. However, their equity is lower: the mean is 1.2 million (median 47,000) against 1.7 million (median 86,000) for liquid ones. Not surprisingly, the biggest difference emerges in terms of the stock of liquidity, which is less than one fourth of that of liquid firms both at the mean and at the median. Lower equity and liquidity implies that illiquid firms were ex ante slightly more risky, with an average leverage of 1.56 against 0.8 (but the median firm has zero leverage in both groups) and an average risk class of 5.9 against 5.0. All in all, these values indicate that firms that turn illiquid were more financially fragile before the crisis. However, the difference is mostly in the liquidity holdings, while other characteristics are relatively similar.

4 Evaluating the Italian government liquidity guarantee decree

The response of many governments to firms' liquidity needs following the Covid-19 crisis has been to set up schemes of credit guarantees for bank loans, particularly to SMEs. According to an OECD survey of policies enacted by governments in 54 countries to contrast the crisis, as of April 20th, 2020, 52 of them had set up some form of government-provided financial support for SMEs (see OECD 2020, Table 3). The analytical framework described in the previous Section allows us to evaluate the extent of coverage provided by such schemes. We therefore use it to analyze the coverage provided by the Italian scheme, set up in Decree n. 23 of April 8, 2020 (*Decreto liquidità*). The decree offers public guarantees that decrease with the amount of the loan. In particular, for firms with less than 500 employees (SMEs

Covid Economics 35, 7 July 2020: 51-69

Table 2: Liquid and Illiquid Firm Characteristics

	Mean	p25	Median	p75	S.D.	N.Obs.
Liquid						
Employees	15	0	2	7	297	443,258
Sales	3,598	119	370	1218	96,927	444,037
Commercial Credit	835	0	5	231	17,911	443,258
Equity	1,725	24	86	350	73,183	444,029
Debt	1,386	0	0	71	126,481	443,911
Liquidity	559	12	44	164	28,448	443,258
Leverage	0.798	0	0	0.392	2.45	423,587
Risk Class	5.04	4	5	6	1.54	437,481
Illiquid						
Employees	16.9	1	3	9	233	194,540
Sales	4,951	155	503	1,598	90,533	194,540
Commercial Credit	1,048	0	10	314	13,064	194540
Equity	1,216	11	47	214	80,356	194,540
Debt	937	0	0	195	14,636	194,540
Liquidity	105	3	11	39	1,336	194,540
Leverage	1.56	0	0	1.5	3.45	167,008
Risk Class	5.9	5	6	7	1.61	190,794

Note: The table reports descriptive statistics for firms' characteristics before the crisis separately for liquid and illiquid firms. Leverage is debt over equity and is trimmed at the 1st and 99th percentile. Risk class are from the Cerved Credit Score, which takes discrete values between 1 (very safe) to 10 (very risky), with unit intervals.

in what follows), it offers:

- **Measure 1**: Full guarantee up to the minimum between 30.000 and 25% of 2019 sales.
- **Measure 2**: For firms with less than 3,2 million turnover, 25% of 2019 sales, with 90% government guarantee and 10% Confidi (an association for mutual guarantees) guarantee.
- **Measure 3**: Up to 5 million with 90% government guarantee.
- **Measure 4**: Up to the maximum between 25% of sales and twice the labor costs of 2019, with a guarantee from 90% to 70% according to firm and loan size.

Measures 3 and 4 require the approval of a Government agency. Firms with more than 500 employees have access to Measure 4 only.

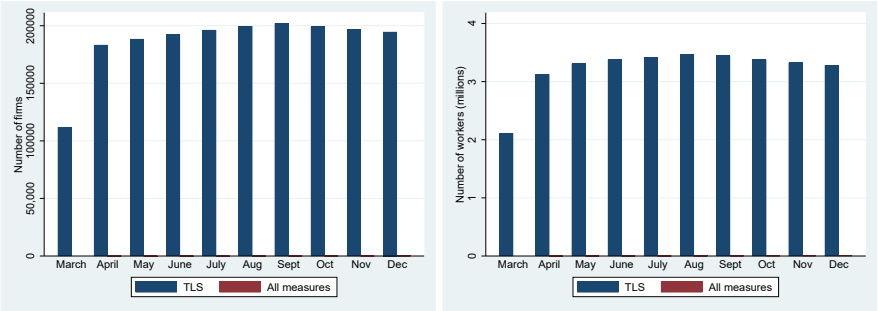
The government claims that this scheme mobilizes 400 billion euros which, according to the numbers seen in the previous section, should be more than enough to cover liquidity shortages. To check for this, we let firms borrow the maximum amount according to the measures above and check which firms cannot cover their liquidity shortage with such borrowing. Figure 4 shows that coverage is indeed complete: at peak, just 153 firms, employing less than 13,000 workers, cannot cover their liquidity shortages.

Of course, this is the maximum theoretical coverage assuming that firms have access to the maximum loan supply the decree allows for. However, as discussed above, the procedural complexity of the measure increases with the amount it supplies. For example, Measure 1 offers SMEs up to 30,000 euro fully guaranteed. This measure is being implemented

Covid Economics 35, 7 July 2020: 51-69

Covid Economics 35, 7 July 2020: 51-69

Figure 4: Illiquid firms and workers without and with the Decree

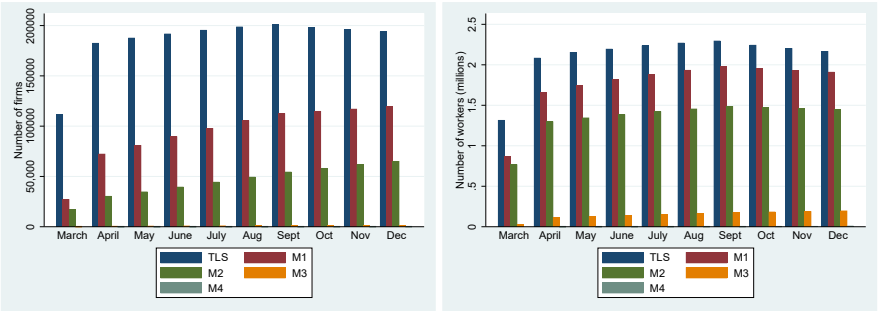


(a) Number of illiquid firms (b) Number illiquid workers

Note: The figure reports the total number of illiquid firms (Panel a) and of workers in such firms (Panel b) without and with the liquidity decree.

rather quickly, as it entails no risk for banks. As the loan amount increases, the government guarantee stops being complete. This means that banks might need some time to process applications, as well as to obtain the approval from the government agency. However, many firms become illiquid very quickly, so it is essential that credit flows to firms quickly. To check the amount of coverage from the different measures, Figure 5 reports the liquidity shortages after borrowing the maximum amount on measure 1 and after adding measures 2, 3 and 4 sequentially. We perform this exercise only for SMEs, as large firms only have access to measure 4.

Figure 5: Firms with liquidity shortfalls according to the liquidity measure



(a) Number of illiquid firms (b) Number of illiquid workers

Note: The figure reports the liquidity shortfalls with no borrowing, with borrowing from measure 1, then when adding measures 2, 3 and 4. We only consider SMEs.

At peak, more than 100,000 firms are not fully covered by measure 1, and around 65,000 by measure 2. It is only with measure 3 that we obtain almost full coverage (Panel a). Things are even more dramatic in terms of workers, as measures 1 and 2 are sufficient only for small firms. In fact, almost 1.5 million workers are in firms that cannot cover their liquidity needs with measure 2. With measure 3, which supplies up to 5 million euros, the number of uncovered firms and workers drastically drops to 1,430 firms and 197,473 workers. However, the measure only entails a 90% guarantee, so banks will have to screen borrowers. Additionally, the measure requires approval from the government. According to

our calculations, over 60,000 firms will need it, implying that the banking system and the government agency will have to process a large number of applications in a short period of time.

One way to speed up the process is to provide a two-stage procedure, using algorithms that measure credit risk in a timely manner based on scoring models in the first stage. If a company has a positive score, the credit should be given with a lean and fast investigation. Banks' specific skills in credit assessment should be committed to companies with weak scores to distinguish between companies that still have development prospects, despite their negative quantitative indicators, from those that do not. By their nature, the scores do not incorporate soft information, that is, the information that banks develop through direct relationships with their customers or that can be collected through direct investigation of the applicants. Soft information is important in cases in which hard information raises a red flag.

To assess how much this approach would reduce the preliminary investigation, we used the Cerved Credit Score. Of the 110,000 companies that will need liquidity in April, around 90,000 fall into the first seven classes, considered solvent. These firms should get credit quickly with simplified procedures. The reduction in the number of detailed investigations would allow banks to devote more time and resources to carefully but quickly screen the 20,000 companies in the risk area.

Covid Economics 35, 7 July 2020: 51-69

5 Alternative parameterizations

We now experiment with two changes in the parameterization. First, we re-run the exercise under a more pessimistic scenario on the evolution of the pandemic and the size and persistence of the drop in sales. Second, we vary the elasticities of inputs. To facilitate comparisons, we report graphs in which the alternative parametrization are compared with the basic one.

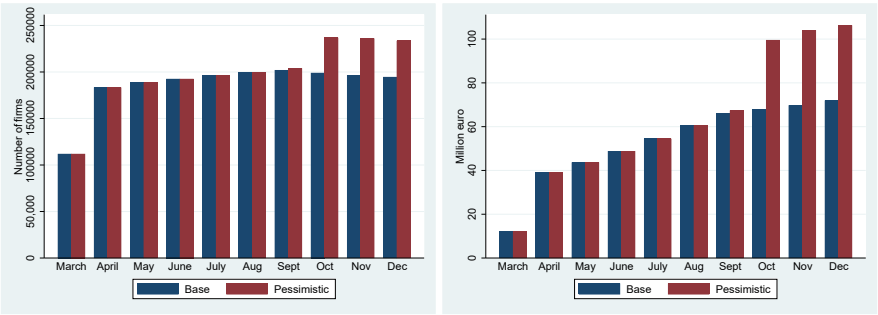
5.1 Pessimistic scenario

As we write, the Covid-19 pandemic has greatly receded since its peak in March and April. However, there is a concrete possibility of a second wave of the epidemic after the summer. Cerved sectoral experts have also produced sales growth predictions in this pessimistic case. The predictions are based on the assumption that the contagion comes back starting in September and picks up in October with a less strict lockdown due to the experience of the first phase, which has made the population more aware of how to contain the contagion. Also in this case, the impact and length of the new lockdown are differentiated by sector to take social distancing needs into account. The last column of Table 3 in the Appendix reports the sectoral growth rates at the yearly level under this pessimistic scenario. GDP would fall by 12% in 2020 and sales would decrease on average by 18%, with a more than 20% drop for 33 out of 79 sectors.

Figure 6, Panel a) reports the results for the number of firms. By construction, the number of illiquid firms is the same until August and jumps discontinuously in October to 236,000 against less than 200,000 in the basic scenario. It remains stable around that value until the end of the year. Workers in illiquid firms (unreported for brevity) jump to 4 million, with an increase of 600,000 units with respect to the basic scenario.

Panel b) of Figure 6 plots the TLS. The increase is more substantial than it is for the number of firms because in this case, not only does the extensive margin contribute to the increase (more firms become illiquid), but so does the intensive margin (illiquid firms accumulate further negative cash flows). At the peak in December, TLS reaches 106 billion, 34 billion above the basic scenario. This indicates that despite the fact that the learning

Figure 6: Illiquid firms and TLS in the base and pessimistic scenarios



(a) Number of illiquid firms (b) TLS

Note: The figure reports the number of illiquid firms and the TLS for the basic and the pessimistic scenarios.

process of the first lockdown might mitigate the adverse consequences during the second wave, the impact on the economic system will be substantial.

5.2 Elasticities of inputs

As discussed above, the preferred values of $\varepsilon_{WS} = 0.75, \varepsilon_{MS} = 0.5$ were based on modifying the regression elasticities to take into account a policy intervention (the temporary layoff scheme that increases the labor elasticity with respect to the estimated value) and the speed of the crisis, for which the elasticity of intermediates expenditure was lowered with respect to the estimated value. We now assess how results change if we stick to the estimated values. We consider 3 scenarios: one in which the labor cost elasticity is equal to its estimated value of 0.46 while keeping the intermediate cost elasticity at 0.5, one in which the labor cost elasticity is at its basic value of 0.75 while the intermediate elasticity equals its estimated value of 0.7, and one in which both elasticities are at their estimated values of 0.46 (labor) and 0.7 (intermediates).

Figure 7, Panel a), plots the number of firms for the basic and three alternative scenarios. When we decrease the elasticity of the cost of labor from 0.75 to 0.46, more firms become illiquid, as the cost reduction following a drop in sales gets smaller. The effect is however not dramatic: at peak (September), 15,000 more firms, employing 445,000 workers, become illiquid. The increase in TLS (Panel b) at the end of the year is around 7 billion, a 10% increase with respect to the basic parametrization.

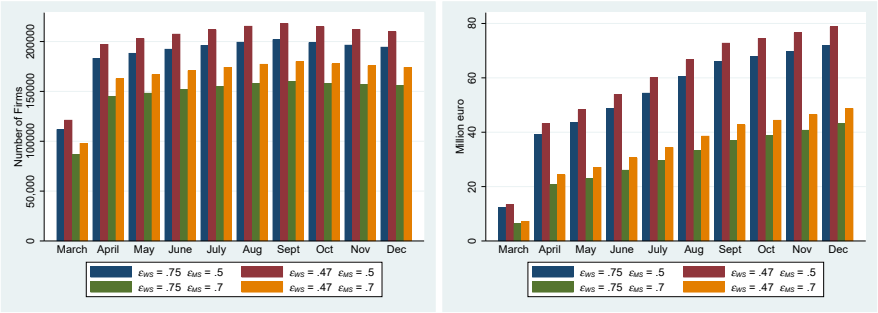
When we increase the elasticity of intermediates from 0.5 to 0.7, the changes are more substantial. The total number of illiquid firms in September drops by 40.000, which represents a 20% decrease. TLS also drops substantially from 72 to 43 billion, a 40% drop. The stronger influence of intermediates is a consequence of the fact that they represent a much larger share of costs than labor: for the median firm, the ratio of labor to intermediate costs is in fact 20%.

In the final experiment, we change both elasticities simultaneously, setting them to their estimated values of 0.46 for labor and 0.7 for intermediates. In line with the previous results, the increase in the elasticity of intermediates more that counteracts the decrease in the labor elasticity so that the number of illiquid firms and the TLS is lower than in the basic case.

Summing up, a second lockdown would have strong consequences on firms' liquidity needs. In terms of input elasticity, the results are more sensitive to the intermediates; elasticity than they are to the labor elasticity, as the former represents a larger share of

Covid Economics 35, 7 July 2020: 51-69

Figure 7: Illiquid firms and TLS under different elasticities of inputs



(a) Number of illiquid firms (b) TLS

Note: The figure reports the number of illiquid firms and the TLS for four different parametrizations of the elasticities of inputs.

firms' expenditures.

6 Conclusions

We have constructed an accounting scheme to predict firms' liquidity needs during the Covid-19 crisis. We have applied it to the universe of incorporated firms in Italy. We find that a substantial number of firms become illiquid early on. At the same time, the liquidity shortage is large but not unbearable: it amounts to less than 4% of Italian GDP. This is because the large drop in sales goes together with a drop in costs, which limits the effects on the cash flow. We also show that the measures enacted by the Italian government, in the form of credit guarantees to supply firms with liquidity, can cover pretty much all the liquidity needs. An important issue is then the speed of implementation: given that we find that many firms become illiquid very quickly, it is of paramount importance that governments' measures are enacted quickly. Finally, a second lockdown would have large effects on liquidity needs.

References

Bank of Italy (2020), Rapporto sulla stabilità finanziaria. Number 1/2020, April.

Carletti, E., Oliviero, T., Pagano, M., Pelizzon, L. & Subrahmanyam, M. G. (2020), The Covid-19 shock and equity shortfall: Firm-level evidence from Italy. CEPR Discussion Paper No. DP14831.

De Vito, A. & Gomez, J.-P. (2020), 'Estimating the COVID-19 cash crunch: Global evidence and policy', *Journal of Accounting and Public Policy* **39**.

European Commision (2020), Identifying Europe's recovery needs. Commission Staff working document.

Kalemli-Ozcan, S., Sorensen, B., Villegas-Sanchez, C., Volosovych, V. & Yesiltas, S. (2015), How to construct nationally representative firm level data from the Orbis global database: New facts and aggregate implications. National Bureau of Economic Research WP No. 21558.

Khan, A. & Thomas, J. K. (2007), 'Inventories and the business cycle: An equilibrium analysis of (s, s) policies', *American Economic Review* **97**(4), 1165–1188.

Covid Economics 35, 7 July 2020: 51-69

McGeever, N., McQuinn, J. & Myers, S. (2020), SME liquidity needs during the COVID-19 shock. Bank of Ireland Financial Stability Note, No. 2.

OECD (2020), Corporate sector vulnerabilities during the Covid-19 outbreak: Assessment and policy responses. OECD policy briefs on Tackling Coronavirus.

Pozzi, A. & Schivardi, F. (2016), 'Demand or productivity: What determines firm growth?', *The RAND Journal of Economics* **47**(3), 608–630.

Schivardi, F., Sette, E. & Tabellini, G. (2020), 'Identifying the real effects of zombie lending', *Review of Corporate Fiance Studies* . Forthcoming.

Covid Economics 35, 7 July 2020: 51-69

A Sectoral growth forecasts

Sectoral forecasts are produced by Cerved, which adopted a sectoral methodology to forecast the 2020/2019 growth rate of sales for the Italian firms. This was based on both quantitative evidence (i.e. sectors in lockdown, length of lockdown, % of smart working) and qualitative assessment (i.e. impact of social distancing) by sector experts. In particular, Cerved analysts considered the following factors:

- **Lockdown provisions.** The Italian government introduced lockdown provisions relating to commercial and production activities in order to contain the spread of contagion, with less restrictive measures on certain activities specifically indicated on the basis of Ateco codes ("essential activities"). A detailed breakdown of Ateco classification has been considered to take into account different periods of lockdown for different sectors.

- **Operability of firms during lockdown.** Many firms continued to operate in spite of the lockdown through smart working or e-commerce. When available, statistics on smart working and e-commerce intensity by sector have been considered.

- **Social distancing impact on demand and supply.** Social distancing impact on demand and supply is strongly dependent on the firm sector: for example, restaurants must guarantee a minimum distance between tables (impact on supply); on the other hand, Covid-19 can change the customer preferences. For example, customers may lower their demand of services if they perceive a risk of contagion (e.g. local transport services)

- **Impact of lower mobility on demand and supply.** Lockdown provisions and the necessity of social distancing have strongly reduced mobility, with effects beyond transport services (e.g. tourism services). Forecasts considered such impacts.

- **Impact on some specific sectors in terms of extra demand.** Covid-19 has raised the demand of particular goods or services. For example, demand of medical protection, plexiglass articles, and e-commerce services boomed after Covid. Analysts considered this factor in their forecasts.

- **International trade impact.** Covid-19 has strongly affected international trade with an impact on both demand and supply. The dependence on international trade in terms of intermediates and the impact of Covid-19 on destination markets have been considered.

- **Other relevant variables for specific sectors.** Other variables or law provisions have been considered if they influence the trend of specific sectors (e.g. raw materials prices, government incentives on demand of bikes).

Based on such factors, Cerved produced forecasts for more than 500 sectors, characterised by homogenous law provisions and homogenous supply and demand conditions.

For each sector, analysts produced differentiated year on year growth rate forecasts for four different periods in 2020:

- Normal: January and February 2020

- Lockdown: since March 9th, with a length depending on the specific sector;

- Transition: a period which depends on the social distancing provisions and/or impact of Covid-19 on demand and supply;

- New normal: time left to the end of 2020, given the lockdown and the transition period.

Covid Economics 35, 7 July 2020: 51-69

Covid Economics 35, 7 July 2020: 51-69

The forecast exercise has then been made coherent with a consensus macroeconomic scenario, thanks to the correlation between firm sales, firm value added and GDP. Based on the described assumptions and the bottom-up approach, sales of Italian firms would decrease by 12.9% between 2020 and 2019 (from 2,411 billions to 2,100 billions in the sample analyzed). The sectoral variability of forecasts is very high. If we consider the detailed breakdown of more than 500 sectors, the strongest loss is in Ateco 591400 (Film projection activity, -65%), while Ateco 479110 (E-commerce) is the best performer (+35%). In Table 3, we show an Ateco 2 digit aggregation of the sectoral forecasts, ranked by loss. We consider the four clusters (based on the magnitude of the sales loss in 2020) used to split firms in descriptive Table 1.

The first group is comprised by 16 Ateco 2 digit sectors with a major loss of more than 20% between 2020 and 2019. There are different sub-groups according to the main causes of the fall in turnover. First, sectors majorly impacted by lockdown, social distancing and reduced mobility: transport, travel agency activities, accommodation services, catering, film production. Second, oil extraction activities, which are affected by the lockdown by the sharp reduction in the oil price and by reduced mobility. Finally, the manufacturing of motor vehicles is expected to be affected by the sharp decline in international trade and by more cautious consumer behavior.

In the second cluster, we identify 27 sectors with a drop in turnover between 10% and 20% and four main subgroups. First, non-essential manufacturing sectors that have suffered from the impact of the lockdown on production and can be hit by difficulties in supplying components from abroad due to the disruption of global supply chains. Second, real estate and related activities which suspended activity during the lockdown. Another sector that has suffered a drop in turnover due to the lockdown is the retail trade (other than food, i.e. especially clothing), for which the social distancing measure are expected to make recovery slower. Finally, the last group of sectors includes recreational activities for which supply will continue to be reduced in order to comply with social distancing measures.

The third cluster includes 27 sectors with a drop of sales between 10% and 0%. These sectors include activities that have been classified as essential but were nevertheless impacted by Covid-19 due to the decline in demand of downstream sectors: suppliers of electricity and gas, professional and technical services, accounting, wholesale trade. Health services are also part of this group because despite being at the forefront of addressing the health emergency, many activities not related to the emergency were suspended. In addition, another group of sectors is penalized by the collapse of non-home consumption (e.g. drinks and fisheries/aquaculture).

The last cluster includes sectors that have experienced a stable growth in turnover in spite of Covid-19, such as utilities less linked to industrial production (water supply) and food-related sectors. Finally, the best performers are the pharmaceutical sector, which has received a strong boost to directly address the health emergency, and e-commerce, which has benefited from a surge in demand from consumers.

Covid Economics 35, 7 July 2020: 51-69

Table 3: Annual sales growth by sector, base and pessimistic scenarios

Nace code	Sector Description	Base	Pess
51	Air transport	-46.0	-55.4
79	Travel agency, tour operator and related activities	-43.8	-55.0
55	Accommodation	-41.6	-51.2
56	Food and beverage service activities	-30.1	-44.9
59	Motion picture, video television, sound recording	-29.4	-43.4
6	Extraction of crude petroleum and natural gas	-27.8	-36.3
9	Mining support service activities	-27.7	-36.3
29	Manufacture of motor vehicles. trailers and semi-trailers	-25.3	-35.2
49	Land transport and transport via pipelines	-24.1	-33.1
50	Water transport	-23.2	-33.8
52	Warehousing and support activities for transportation	-22.9	-31.7
45	Trade and repair of motor vehicles and motorcycles	-21.9	-28.9
14	Manufacture of wearing apparel	-21.3	-29.6
91	Libraries, archives, museums and other cultural activities	-20.6	-25.3
93	Sports activities and amusement and recreation activities	-20.6	-25.3
24	Manufacture of basic metals	-20.4	-28.5
92	Gambling and betting activities	-19.8	-26.8
90	Creative arts and entertainment activities	-19.7	-24.5
41	Construction of buildings	-19.2	-27.0
8	Other mining and quarrying	-17.7	-25.3
82	Office administrative and other business support activities	-17.7	-23.9
28	Manufacture of machinery and equipment n.e.c.	-17.5	-24.5
31	Manufacture of furniture	-16.9	-25.7
15	Manufacture of leather and related products	-16.9	-25.7
23	Manufacture of other non-metallic mineral products	-16.4	-24.1
25	Manufacture of fabricated metal products†	-16.2	-22.9
19	Manufacture of coke and refined petroleum products	-16.0	-25.1
47	Retail trade†	-15.6	-21.5
43	Specialised construction activities	-15.4	-21.8
18	Printing and reproduction of recorded media	-15.4	-21.3
71	Architectural and engineering activities	-14.8	-19.5
30	Manufacture of other transport equipment	-14.5	-22.6
13	Manufacture of textiles	-14.3	-21.3
77	Rental and leasing activities	-14.2	-20.3
58	Publishing activities	-13.4	-17.7
16	Manufacture of wood and wood products, except furniture	-13.4	-18.6
22	Manufacture of rubber and plastic products	-13.3	-19.3
42	Civil engineering	-11.8	-17.2
26	Manufacture of computer, electronic and optical products	-11.7	-16.9
72	Scientific research and development	-11.6	-17.8
27	Manufacture of electrical equipment	-10.9	-17.4
53	Postal and courier activities	-10.5	-7.4
73	Advertising and market research	-10.5	-16.0
35	Electricity, gas, steam and air conditioning supply	-9.4	-12.1
74	Other professional, scientific and technical activities	-9.1	-12.8
86	Human health activities	-8.6	-12.3
78	Employment activities	-8.5	-10.7
69	Legal and accounting activities	-8.2	-12.4

46	Wholesale trade, except of motor vehicles and motorcycles	-8.0	-12.0
85	Education	-7.9	-15.2
62	Computer programming, consultancy and related activities	-7.9	-9.2
80	Security and investigation activities	-7.8	-11.2
96	Other personal service activities	-7.6	-9.6
12	Manufacture of tobacco products	-7.6	-12.8
3	Fishing and aquaculture	-6.7	-10.6
11	Manufacture of beverages	-6.4	-10.5
33	Repair and installation of machinery and equipment	-6.2	-8.3
32	Other manufacturing	-6.1	-10.4
20	Manufacture of chemicals and chemical products	-5.9	-8.6
63	Information service activities	-5.3	-6.2
70	Activities of head offices; management consultancy activities	-5.0	-6.1
60	Programming and broadcasting activities	-5.0	-8.0
88	Social work activities without accommodation	-4.9	-6.5
5	Mining of coal and lignite	-4.5	-7.8
81	Services to buildings and landscape activities	-4.0	-6.3
17	Manufacture of paper and paper products	-3.6	-5.4
61	Telecommunications	-2.5	-3.4
1	Crop and animal production and related service activities	-2.3	-5.0
38	Waste collection, treatment and disposal activities	-1.5	-2.5
39	Remediation activities and other waste management services	-1.5	-2.5
66	Activities auxiliary finance and insurance	0.0	0.0
68	Real estate activities	0.0	-1.7
10	Manufacture of food products	0.0	-0.2
87	Residential care activities	0.4	-1.8
36	Water collection, treatment and supply	0.6	0.6
37	Sewerage	0.6	0.6
47.1+47.2	Other in-store retail trade‡	9.9	10.7
21	Manufacture of basic pharmaceutical products	10.2	13.0
4791	Retail sale via mail order houses or via Internet	30.2	40.0

§ Except machinery and equipment
† Except for motor vehicles and motorcycles. Food, beverages, tobacco, via mail order or via internet
‡ Retail sale of food, beverages and tobacco in specialized stores and in non-specialized stores

Note: The table reports sectoral growth rates on 2020 with respect to 2019 under the basic and pessimistic scenarios.

Covid Economics 35, 7 July 2020: 51-69