Abstract
We propose a simple method based on firms balance sheets to determine the firms that will become illiquid month by month as the crisis unfolds. We apply the method to the population of Italian incorporated businesses under two scenarios on the severity of output fall up to the end of 2020. Under the preferred parametrization, around 100,000 companies would require a liquidity injection in the mild scenario and 50,000 more in the pessimistic scenario. The liquidity needed to “rescue” them would be 30 billion euros in the first case and 80 billion in the second. Even in the case in which the injections are provided as credit, the financial structure of the companies receiving them would remain sustainable, with leverage going from 73% pre crisis to 117 % post intervention in the pessimistic scenario.

Introduction
A fundamental question to predict the economic effects of the Corona virus is to understand if the shock will be temporary, that is, if after the lockdown the economy will return to its previous level, or if the fall in output will be persistent. This depends on how many companies will go bankrupt for the liquidity crisis due to the fall in sales. Bankruptcies take a long time to reabsorb, prolonging the effects of the shock; they could also amplify the financial contagion to other companies, with a chain effect on the entire economy. Bad loans would grow, and the infection would also extend to the financial sector. At this stage, it is therefore important to provide firms with liquidity to avoid bankruptcies. It is a shared goal and the answer of policymakers has generally been whatever it takes. But it needs to be credible, and therefore it is useful to have an idea of how much it takes.

The use of firm level information, specifically from balance sheets, can help to channel resources in a surgical way to the companies that need them, maximizing the benefits and minimizing the amount of funds required. Just as people are affected by the virus with different intensity and have different abilities to react, companies also have different degrees of exposure (drop in production sales) and immune defenses (financial reserves): not all of them need intensive care.

In this article we illustrate a simple accounting exercise that, based on assumptions on the evolution of sales and of the elasticity of costs to sales, allows to determine which firms will become liquidity constraint, and to what extent. We apply the method to the population of Italian incorporated businesses, 720,000 companies producing one third of the Italian GDP. We consider the period from March 2020 to the end of the year under two scenarios: a mild one, according to which the crisis ends by September, and a pessimistic one, in which it goes on until the end of the year. For our preferred parametrization, the liquidity injections required to cover cash shortfalls would range from 30 billion in the basic scenario to 80 in the pessimistic one. This would allow to “save” 145,000 companies employing almost 3.2 million workers. If liquidity injections are provided as credit, in the pessimistic scenario their leverage would go from73% before the crisis to 117% at the end of 2020, a value financially sustainable, also considering the low interest rates. The funds could be provided by the banking system, possibly with a government guarantee on the credit supplied. Given that public guarantees on credit have a high degree of leverage, a limited amount of public resources could strongly mitigate the long term consequences of the crisis.

The scheme to compute liquidity needs
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. Specifically, assume that the firm outflows are costs of production (for labor and intermediates, investment spending is assumed to be zero) and financial payments (interest rates and mortgage payments). The evolution of liquidity is as follows:

\[ \text{liquidity}_{it} = \text{liquidity}_{it-1} + (\text{sales}_{it} - \text{costs}_{it}) - \text{financial payments}_{it} \quad (1) \]

where \( i \) is the firm and \( t \) the month. Given an initial value of the stock of liquidity and an estimate of the evolution of cash flow (sales minus costs) and financial payments, the equation allows to detect when liquidity turns negative and for what amount. Adding up all negative liquidity stocks delivers the total liquidity need.

In our application, we compute the values of the variables above at the firm level based on the balance sheets of 2018 (the most recent available). In particular,

1. For liquidity, we assume that the initial stock is that reported in the balance sheets;
2. 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 if the total sales of 2018. We then apply forecasts of sales growth for 230 sectors, based on the consideration of the effects of the lockdown. This is a forecast carried out by Cerved researchers specialized in sector analyses.
3. Firms costs are intermediate goods and services (\( M \)) and cost of labour (\( W \)). To compute their evolution, we need the elasticity of each of them to sales, \( e_{\text{MS}} \) and \( e_{\text{WS}} \).
4. Finally, for financial payments we assume that interest expenses are each month equal to 1/12 of the total interest expenses of 2018. Based on an average duration of long term debt is of B years, we compute the mortgage payments as the stock of long term debt from the balance sheets divided by (12*B).

Based on these assumptions, the equation becomes:

\[ \text{liquidity}_{it} = \text{liquidity}_{it-1} + (1 - d_{it}) \frac{5}{12} - (1 - e_{\text{MS}} d_{it}) \frac{M}{12} - (1 - e_{\text{WS}} d_{it}) \frac{W}{12} + \text{int.exps} + \text{LTD}_{i}/(12*B) \]

In each month, we can count the number of firms for which liquidity turns negative and sum over their liquidity shortages to have a measure of the total liquidity needs.

It is useful to comment on the logic underlying the exercise and on its limits. The total fall in sales, summed over all firms, is not a correct indicator of the system's need for liquidity. A decrease in sales by a company is partially passed over to suppliers, reducing the impact on cash flow for the original firm. Consider a Hotel that shuts down, reducing revenues by €100. At the same time, the hotel will reduce cleaning expenses to contractors by 50 euros. The drop in cash flow for the hotel is 50 euros, while the other 50 constitute a fall in cleaning companies' revenues. If the sectoral growth forecast takes into account the decline both for hotels and for the cleaning companies, the sum of the total drop in sales (€100 for the hotel and 50 for cleaning companies) overstates the decline of actual drop in resources for companies as an aggregate. This mechanism is captured in the scheme by the elasticity of costs to sales. A more rigorous analysis requires to relate sectoral declines in sales to the elasticity of intermediates to sales through the input-output matrix. The methodology proposed here does not impose this internal consistency. Numbers should therefore be taken with caution.

**An application to the Italian incorporated businesses**

We now apply the methodology to the Italian population of incorporated businesses for 2020. In the web page http://www.eief.it/eief/index.php/covid-19-forum we post a stata code and two data files allow to replicate the procedure on mock data.
situation is unprecedented so that the estimates combine formal models with subjective assessments of the effects of the epidemic on the different sectors. We consider two scenarios:

- a mild one, according to which the acute phase of the crisis lasts until June and then the economy quickly goes back to trend, returning to the pre-COVID19 level in September;
- a pessimistic scenario, according to which the emergency lasts until the end of the year, assuming that sales remain at the low level of March until December.

To determine the elasticity of costs to sales, we have regressed the percentage change in intermediate expenditure and in the wage bill on the percentage change in sales, obtaining $e_{MS} = 0.9$ and $e_{WS} = 0.27$. The regression uses annual data in “normal” periods. To consider the lower adjustment capacity in the short term and the exceptional nature of the crisis, we assume more conservative values, i.e. 0.5 for intermediate expenditure and 0.15 for labor costs. We show below how the numbers change when we change these parameters. Finally, we assume that the average duration of long term debt $B$ is 4.5 years. This is an estimate based on a Cerved’s dataset of about 20,000 firms, with details on medium/long term debts and mortgages. For financial charges, we consider two scenarios: one in which companies continue to pay interest on debt and mortgage payments and one in which these payments are suspended for a moratorium. In the basic exercise, we exclude the companies with negative cash flow (sales minus costs) in 2018 (185 thousand companies). At the end of the note we report the numbers when including these companies in the scheme.

According to the cautious scenario, 124 thousand companies would become illiquid (17.2% of the sample), with the peak reached in July. Subsequently, the cases would decrease rapidly. In the pessimistic scenario, the number of companies would rise to 176 thousand (33% of the total) at the end of the year. In both cases, the social cost of these failures would be important: workers at risk would be 2.8 million in the cautious scenario and 3.8 million in the pessimistic scenario, 16% of total employment.

These numbers assume that companies continue to pay interest and mortgage payments. A full use of the debt moratorium (suspension of all financial payments until the end of the year) would allow to “save” about 31 thousand companies in the base scenario (400 thousand workers) and about 30 thousand in the pessimistic scenario (600 thousand workers). Urgent action is needed, because a substantial number of companies would leave the market from the first months of the crisis.

Next, we calculate the liquidity injections necessary to avoid failures, that is the amount of funds necessary to cover the accumulation of losses once the company has “burned” all its liquidity. Under the hypothesis of
a moratorium on debt, in the base scenario about 30 billion euros would be needed between March and August, with a monthly flow that would reach a maximum of 8 billion in June. In the pessimistic scenario, the injections would amount to 80 billion: to the 30 spent between March and August according to the base scenario, 50 more must be added to cope with the protraction of the crisis. The necessary injections would rise to 42 and 107 billion respectively without a moratorium on debt.

In the pessimistic scenario, the companies turning illiquid would burn 21 billion of initial liquidity, which may have to be reconstituted at least in part to allow them to operate. The total amount of the financial debt of these companies is 136 billion, a figure that would weigh on the banks’ balance sheets if they had to go bankrupt. They also account for 161 billion of trade payables which, if unpaid, would spread the crisis to businesses less directly affected.

Under the assumption that liquidity is provided in the form of bank debt, it is useful to understand if, after the crisis, these companies would still have a sustainable financial structure, or if they would be overwhelmed by debt. The leverage (ratio between financial debt and equity) of the companies requiring liquidity injections would increase from 73% to 117%. Even if the increase is substantial, Italian companies strongly deleveraged since the beginning of the financial crisis, so that the value would remain sustainable, also considering the low interest rates on debt. In fact, the average leverage of Italian firms in 2007 was around 120%. Note also that these companies have a total of 174 billion in trade receivables. It would be enough for the financial system to discount just over half of it to cover the liquidity needs of these businesses in the pessimistic scenario.

The estimates of this note depend on a series of assumptions illustrated above and must therefore be taken with a grain of salt. We provide two examples to give an idea of how the numbers change when modifying some of them:

1. If we assume that the elasticity of expenditure for intermediates is 0.7 instead of 0.5 and that for wages is 0.3 instead of 0.15 (for example because firms can use publicly funded temporary layoff schemes), the financial needs would be halved: 15 billion in the base scenario and 40 in the pessimistic one.

2. We excluded companies with a negative value of cash flow in 2018. If we include them in the scheme, the liquidity needs increase to 57 billion in the basic scenario and 138 billion in the pessimistic one.

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Conclusions
Even though the numbers must be interpreted with caution, there are some lessons that are generally valid. The first is that immediate action is essential because there are many businesses at risk. The second is that the liquidity injections are significant, but they do not make the financial structure of companies unsustainable. The third is that it is worth investing public resources to save businesses. Public guarantees have a high leverage. Some schemes used in the past were able to mobilize for each euro of public guarantee 14 euro of loans to businesses. With this value, to cover the 80 billion of the pessimistic scenario, it would take less than 6 billion euros of Government funds. Of course, the leverage might be different during this crisis, but the general point is that the joint intervention of governments and banks can strongly reduce the risk of persistent effects of the Covid 19 crisis. The last is that the use of analytical tools allows to channel resources in a surgical way to the companies that need them most.