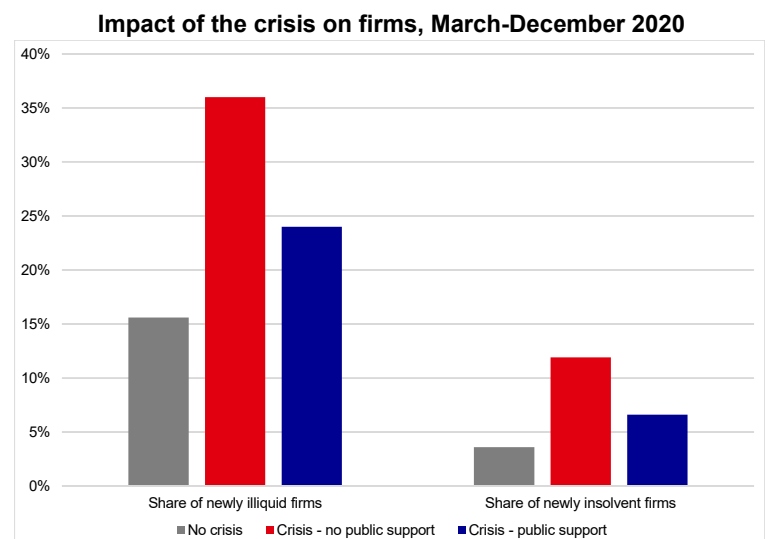


The impact of the COVID-19 pandemic on French firms

Benjamin Hadjibeyli, Guillaume Roulleau, Arthur Bauer

- The COVID-19 pandemic had a very severe impact on the financial situations of French firms: they experienced a sharp drop in turnover, which in some sectors was unprecedented, and were forced to cut their expenses and borrow to meet their obligations. At the same time, they received large-scale public support.
- We use a microsimulation model to study the changes in the financial situation of nearly 2 million French firms in response to the shock to business activity. It incorporates firm-level data from 2020, including changes in turnover and payroll, and use of public support measures. We were able to estimate the number of firms that would become illiquid (cash flow exhausted without additional borrowing) or insolvent (amount of debt exceeding assets).
- The share of newly illiquid firms is estimated to be 8.4 percentage points higher in 2020 than in a non-crisis year. The number of newly insolvent firms is estimated to be 3.0 percentage points higher. The results show the effectiveness of public support in reducing the impact of the crisis: without it, the increase in the number of newly insolvent firms (compared to a non-crisis year) would have been 8.3 percentage points.
- Firms made insolvent by the crisis are on average more productive than those that become insolvent in normal times. Public support did not discriminate between firms according to productivity.
- The effect of the crisis on firms' balance sheets is likely to impair corporate investment during the economic recovery. Econometric modelling suggests that crisis-related debt overhang could curtail investment by some 2% in the medium term, which justifies the use of specific measures, such as those in the recovery plan. R&D spending, traditionally less correlated with the business cycle, appears to be more resilient.



Source: DG Trésor.

1. A microsimulation model is used to estimate the impact of the COVID-19 pandemic on French firms^{1,2}

The COVID-19 pandemic triggered a sharp drop in economic activity: according to INSEE,³ France's gross domestic product (GDP) fell by 8.3% in 2020, the largest drop since the Second World War. Firms' financial soundness has been substantially affected, but the blow has been softened by public support

measures (see Box 1). For the most part, 2020 income statements and balance sheets have not yet been published. However, microsimulation tools⁴ can be used to quantify the impact of the pandemic on firm-level financial health.

Box 1: Business support measures included in the model

To provide support for businesses in 2020, the public authorities introduced several emergency measures. The short-time working scheme, which covers the salaries of employees placed on short-time working, was streamlined and extended so that the residual wage costs to firms is zero for salaries up to 4.5 times the French minimum wage (SMIC). A solidarity fund was also established to support firms, originally for those with fewer than ten employees and covering losses of up to €1,500. Over the course of the year, the fund evolved and, at December 2020, included all firms in certain sectors particularly affected by the crisis. Provided certain conditions are met, the fund provides up to €200,000 per month (or even more as part of the scheme to cover fixed costs that was introduced on 31 March 2021). In addition, tax and social security deferrals have been granted, as well as exemptions for the sectors hardest hit by the crisis. At 31 December 2020, the short-time working scheme had provided firms with €25.1bn in compensation, the solidarity fund had allocated €11.8bn, exemptions from social security contributions amounted to nearly €8bn and deferrals of social security contributions nearly €49bn.^a

The model does not take into account all the public measures put in place to respond to the crisis. Government-backed loans are not specifically modelled, although they are the source of the lack of lending constraint assumed in the simulation (see Box 2), nor are tax deferrals and exemptions.

a. The amount indicated here corresponds to the total amount of deferrals granted in 2020, not deferrals still outstanding, which is lower because some have already been repaid.

As of spring 2020, several microsimulation tools were being developed in various institutions with a view to assessing the impact of the crisis on firms (see in particular the work of the OECD,⁵ the OFCE⁶ and Gourinchas *et al.*, 2020⁷). These models can be used to simulate the income statements and balance sheets of a wide range of firms and to identify those at increased risk of financial difficulty, either because they become illiquid, i.e. they cannot cover their short-term

expenses without external financing, or because they become insolvent, i.e. their total debt exceeds the value of their assets. What distinguishes the work presented here is that it is based on data observed at firm level over all or part of 2020. It thus includes data on changes in turnover and wage bills, and on the use of public support measures: short-time working scheme, solidarity fund and social security contribution deferrals (see Box 2).

(1) This work was carried out as part of the committee monitoring the implementation and assessment of financial support measures for businesses affected by the COVID-19 pandemic.

(2) Access to some confidential data, which this work is based on, was made possible within a secure environment provided by CASD – *Centre d'accès sécurisé aux données* (Ref. 10.34724/CASD).

(3) "GDP declined in Q4 2020 (–1.3%), marked by the second lockdown; over the year 2020, GDP declined by 8.3%", Insee, *Informations rapides* no. 026, 29 January 2021.

(4) Hadjibeyli B., Roulleau G. and A. Bauer (2021), "Live and (Don't) Let Die: The Impact of Covid-19 and Public Support on French Firms", *DG Trésor Working Document*.

(5) Demmou L., Franco G., Calligaris S. and Dlugosch, D., (2020a), "Corporate Sector Vulnerabilities During the Covid-19 Outbreak: Assessment and Policy Responses", OECD Tackling Coronavirus Series, and also Demmou L., Franco G., Calligaris S. and Dlugosch, D. (2020b), "Insolvency and Debt Overhang Following the COVID-19 Outbreak: Assessment of Risks and Policy Responses", *OECD Working Papers*.

(6) Guerini M., Nesta L., Ragot X. and Schiavo S. (2020), "Firm Liquidity and Solvency under the Covid-19 Lockdown in France", *OFCE Policy Brief* no. 76.

(7) Gourinchas P-O., Kalemli-Özcan S., Penciakova V. and Sander N. (2020), "Covid-19 and SME Failures", *NBER Working Papers*, 2020.

Box 2: Methods and data

The model simulates the financial situation of French firms between March and December 2020. It is based on Fare 2018 (INSEE) data, which draws from the accounting statements of firms' 2018 tax returns, providing detailed information on their income statements (revenue and expenses, by way of which their cost structure) and balance sheets (liabilities, particularly debts; and assets, particularly cash balances).

We consider a firm's income I to correspond to turnover T less expenses, namely wages W , with other expenses distributed between fixed expenses FC (rent, taxes, etc.) and variable expenses VC (goods, outsourcing, etc.):

$$I = T - W - VC - FC$$

It is assumed that turnover is reduced by a shock x , which has a resulting impact on variable expenses but not fixed expenses, which remain stable. There is assumed to be some delay in the adjustment of variable expenses to the shock (modelled by a time-variable factor α_t). Payroll is subject to a shock y , which reflects both potential labour market adjustments and support from the short-time working scheme. Other public support measures PP , such as the solidarity fund and social security deferrals and exemptions, are treated as subsidies.^a Overall, the firm's income is calculated as:

$$I = (1 - x)(T - \alpha_t VC) - (1 - y)W - FC + PP$$

The model uses 2020 data for the shock x to turnover and for the shock y to payroll, as well as data on amounts allocated from the solidarity fund and deferrals of social security contributions.^b

Income is estimated on a monthly basis and applied to the cash balance. If a firm's cash balance is depleted, it is deemed illiquid and incurs debt in an amount equal to its cash shortage. Once its debt level exceeds the value of its assets, the firm is deemed insolvent.

Two other scenarios are also simulated. First, a no-crisis scenario corresponding to a "normal" year: in the firm's income I , shock x on economic activity and shock y on employment are nil and there are no public support measures, which means the firm's income is at its usual level (in practice, the most recent income figure available in the data). Second, a scenario without public support: in contrast to the scenario including public support, the amounts of public support measures PP are zero. This alternative scenario is purely for comparative purposes and is not meant to simulate a counterfactual of firms' behaviours; for instance, without any support, it is likely that firms would have further adjusted their expenses by terminating employees.

The simulations involve 1.8 million firms representing more than 80% of the value added of French firms.^c On an aggregate basis, these firms are shown to have suffered a 14% loss of turnover for the period from March to December 2020 compared to the previous year, and an 11% drop in payroll.^d

- a. Deferrals are treated as subsidies in income, but generate a simultaneous increase in debt.
- b. The shock x on turnover is measured using monthly VAT returns provided by the Public Finances Directorate General (DGFIP) and the shock y to payroll is measured using data from the INSEE's Epure database based on firms' Single Staff Reporting Statements (DSNs). Amounts allocated by the solidarity fund were provided by the DGFIP. Data on social security deferrals were provided by the Central Social Security Agency (ACOSS).
- c. Simulations did not include certain industries (the NAF 2.1 categories of agriculture (A), finance and insurance (K), public administration (O) and human health and social work services (Q)) or firms under the microenterprise tax regime.
- d. The majority of this decrease is due to salaries being covered by the short-time working scheme.

2. Public support has significantly mitigated the shock to firms

A firm suffering a sharp decline in turnover may not be able to adjust its expenses to the extent necessary to avoid incurring losses. Initially, its cash balance may allow it to absorb a negative income shock, but if the situation goes on too long, the firm will run out of cash and become illiquid. That will mean having to go into debt in order to keep making its payments.⁸ A lack of liquidity could then lead to insolvency, if the firm's accumulated debt exceeds the value of its assets. Insolvency does not necessarily mean bankruptcy: although the risk is greater, not every insolvent firm ends up going bankrupt.

The model assumes that any firm might go into debt to cover a cash flow shortage. There is no mechanism for new firms to emerge or existing ones to disappear in the simulation. The results are compared to a non-crisis scenario in which there is no shock to economic activity or employment, and which assumes performance levels identical to the most recent year available. In the non-crisis scenario,⁹ the model suggests that 15.6% of firms would have had a cash flow shortage in 2020, generating €72bn in debt, and 3.6% would have become insolvent (see Table 1).

Table 1: Simulation of the impact of the crisis on firms in 2020

	Share of newly illiquid firms (%)	Share of newly insolvent firms (%)	Debt incurred to cover cash flow shortage (€m)
No crisis	15.6	3.6	72
Crisis – no public support	36.0	11.9	168
Crisis – public support	24.0	6.6	148

Source: DG Trésor.

How to read this table: At year-end 2020, the percentage of newly illiquid firms would have been 15.6% in a non-crisis situation. With the crisis, this figure is estimated to be 24.0% with public support, but would have been 36.0% without.

Our simulations show that the crisis had a major impact on firms' cash flow positions, causing substantially more of them to become illiquid than would have otherwise (see chart on first page). However, the support measures introduced by the government had a substantial mitigating effect on the shock:¹⁰ the increase in the percentage of firms becoming illiquid in 2020 compared to a non-crisis year falls from 20.4 percentage points to 8.4 percentage points when public support is factored in.¹¹

The effect of support measures can also be seen in

firms' solvency rates: the percentage of insolvent firms would have increased by 8.3 percentage points without public support, versus 3.0 percentage points with the support measures. The impact on debt levels is less apparent, with support measures only reducing crisis-related excess debt from €96bn to an estimated €76bn. While public support was crucial for many small businesses, it did not prevent some large firms from taking on significant debt loads. The model only reflects debt incurred to meet a liquidity shortage, and not for other needs (cash reserve, investment, etc.).

(8) In 2020, bank credit was made more accessible via a system of government-backed loans. In the event a firm becomes illiquid, it could also sell off assets to cover its payments, but that could hurt its productive capacity. Furthermore, a firm making a sale motivated by an urgent cash flow need is not in a position to negotiate the best financial terms. Another option would be to raise equity.

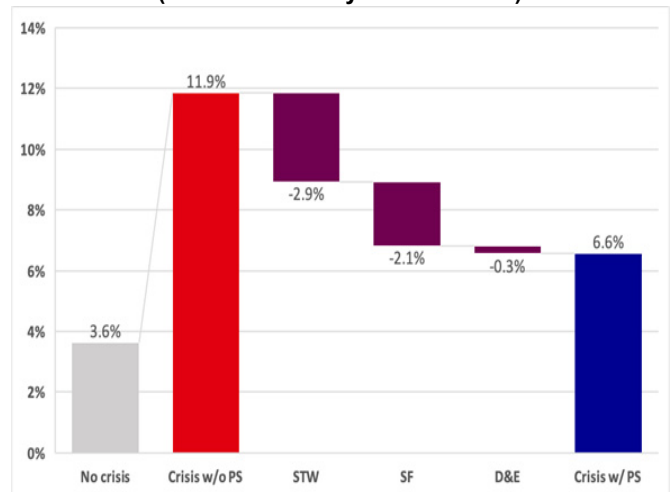
(9) In this scenario, only firms with negative profits according to the Fare 2018 data can be considered illiquid, since they are the only ones to record losses.

(10) The simulation tends to overestimate the effect of the crisis without public support, as it does not assume additional terminations to compensate for the lack of short-time working support, which would have had a weaker effect on firms' financial health and led to job losses.

(11) These are simulated figures. Although the model does use 2020 data, it is insufficient to produce actual figures for these indicators.

The government's short-time working scheme appears to have had a significant impact on insolvency, with a 2.9 percentage point reduction (see Chart 1). The solidarity fund is estimated to have reduced it by a further 2.1 percentage points.¹² The relative effectiveness of the short-time working scheme is stronger if the number of jobs is considered rather than the number of firms. This can be explained by how the support measures were targeted: whereas the solidarity fund helped a large number of small businesses, larger firms relied more on the short-time working scheme.

Chart 1: Impact of different support measures on the percentage of newly insolvent firms during the crisis (as a % of initially solvent firms)



Source: DG Trésor. The order in which the government measures are applied in this exercise is an arbitrary choice and influences the estimated effects of each measure, which should not be over-interpreted as a result.

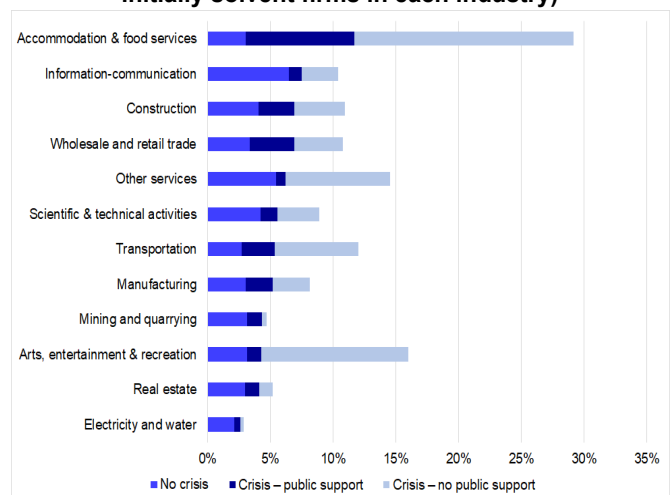
Legend: PS = public support; STW = short-time working scheme; SF = solidarity fund; D&E = deferrals and exemptions.

3. Insolvency has impacted industries differently and affected more productive firms than usual

The impact of the crisis varied widely by sector (see Chart 2). Without any support measures, the crisis would have led to a steep increase in insolvencies among accommodation and food service firms and, to a lesser extent, those in the construction, trade and transportation industries. Public support measures had a particularly strong effect in the hardest-hit industries, with certain measures having been tailored specifically to them.¹³

The impact of the crisis also varies depending on firm size: after factoring in public support, the percentage of insolvent firms grew larger among mid-tier firms and SMEs than both large enterprises and microenterprises. There was higher uptake of public support measures among microenterprises, due in particular to the solidarity fund being targeted to small businesses in 2020.

Chart 2: Newly insolvent firms by industry (as a % of initially solvent firms in each industry)



Source: DG Trésor.

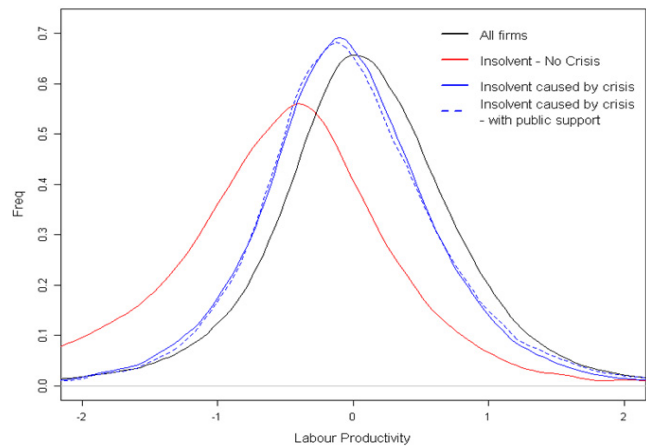
The simulations can also be used to analyse the productivity¹⁴ of firms experiencing financial difficulty as a result of the crisis (see Chart 3). In a non-crisis situation, firms that become insolvent are markedly less productive than the economy-wide average. Our

(12) The order in which the public support measures are applied in this exercise (short-time working scheme > solidarity fund > deferrals and exemptions of social security contributions) influences the effects estimated in percentage points, although only to a limited extent.
 (13) Financing from the solidarity fund in particular is granted on more favourable terms for the hardest hit industries, and deferrals and exemptions of social security contributions were targeted to these same industries.
 (14) In the sense of apparent labour productivity.

modelling shows that this pattern generally holds true for 2020, but to a lesser extent – the crisis created difficulties for more productive firms than usual. This suggests the crisis may have undermined the effectiveness of the creative destruction process:¹⁵ if failures were concentrated among lower-productivity firms, it would allow production factors to be usefully reallocated throughout the economy; but if more productive firms are prone to failure, it threatens to destroy more value than what would be generated by capital being reallocated to existing firms and new ones being created.

At the same time, support measures had virtually no impact on the productivity of ailing firms. This shows that productivity was not a factor for public support, which was not in fact the objective since the measures primarily targeted firms affected by the crisis.

Chart 3: Labour productivity distribution of different populations of firms (adjusted for size and industry)



Source: DG Trésor.

How to read this chart: Labour productivity (in logarithm), adjusted for the effects of firm size and industry. Public support measures include the short-time working scheme, the solidarity fund, and deferrals and exemptions of social security contributions.

4. The crisis threatens to have a lasting effect on business development

4.1 Corporate debt levels could slow investment

According to the economic literature, although corporate investment is predominantly driven by demand, it is also influenced by variables relating to firms' financial situations, such as profit and debt levels. One explanation is the credit market information asymmetry between firms and banks, with banks having difficulty evaluating the quality of an investment and the likelihood it will generate future profits. To reduce the risk of non-payment, interest rates offered by banks are higher the more debt a firm has and the lower its earnings performance. A second explanation¹⁶ is that if a firm has a high level of debt, any profits generated by a new investment will go toward paying creditors before shareholders, who therefore have little incentive to invest.¹⁷

An econometric analysis (see Box 3) can be used to measure the impact on corporate investment of financial constraints such as those simulated by the model (debt and profit levels): if growth in turnover and profitability are decisive factors for investment, then debt levels have a negative impact on corporate

investment. In manufacturing, for example, a 1 percentage-point increase in the ratio of debt to tangible assets in year t-1 will cause a 0.03-point decrease in investment ratio in year t.

The combination of the results of this econometric model and those of the microsimulation can be used to measure the effect that crisis-related excess debt levels will have on future corporate investment. Assuming demand and corporate profit levels return to pre-crisis levels, the level of corporate debt generated by the crisis is estimated to cause a roughly 2% decrease in investment compared to the trend (this decrease would have been 2.5% without any public support measures during the crisis). At the level of the national economy, debt overhang is estimated to result in €4bn less tangible investment compared to the trend. This figure does not account for other potentially investment-friendly factors present during the recovery, in particular recovery plan measures such as France Relance participating loans and France Relance bonds, which are expected to provide up to €20bn in financing for firms.

(15) David C., Faquet R. and C. Rachiq (2020), "The Contribution of Creative Destruction to Productivity Growth in France", *Trésor-Economics* no. 273.

(16) Myers S. (1977), "Determinants of Corporate Borrowing", *Journal of Financial Economics* (5).

(17) See for example: Kalemli-Özcan S. et al. (2019), "Debt Overhang, Rollover Risk, and Corporate Investment: Evidence from the European Crisis", *Working Paper Series*; or Bond S. and C. Meghir (1994), "Dynamic Investment Models and the Firm's Financial Policy", *Review of Economic Studies* (61).

Box 3: Impact of financial constraints on corporate investment

Using a sample of firms (n = 90,590) created using data from the INSEE's Fare database between 2009 and 2018, we modelled^a the investment ratio (tangible investment I_{it} to the firm's lagged tangible assets K_{it-1}) as a function of:

- the ratio of investment in year $t-1$
- the growth in turnover in year t and year $t-1$
- the ratio of the firm's cash flow in year $t-1$ approximated by its gross operating surplus, to its tangible assets
- the ratio of the firm's debt in year $t-1$ to its tangible assets
- an error corrections term to estimate the impact of the difference between the firm's current level of capital and its optimal level – measured as the difference in year $t-2$ between the logarithm of its tangible assets and the logarithm of its turnover ($\log(K_{it-2}) - \log(\text{Turnover}_{it-2})$)
- individual and time fixed effects, controlling for the impact of the individual shock and the business cycle.

The final regression is calculated for each industry using the generalized method of moments (GMM):

$$\begin{aligned} \text{InvestRatio}_{it} = & \beta_1 \text{InvestRatio}_{it-1} + \beta_2 \Delta \text{Turnover}_{it} + \beta_3 \Delta s \text{Turnover}_{it-1} \\ & + \beta_4 \text{CashFlowRatio}_{it-1} + \beta_5 \text{DebtRatio}_{it-1} + \rho \text{ErrorCorrection}_{it-2} + \alpha_i + \mu_t + \varepsilon_{it} \end{aligned}$$

The following table shows the main results (for turnover growth and profit and debt levels) for industries with high levels of tangible investment (see the working paper for more details):

Table 2: Impact of financial constraints on investment – estimation results

	β_1	β_2	β_4	β_5	ρ
Manufacturing	0.0649*	0.223***	0.0715***	-0.0264*	-0.0731***
Trade	0.275	0.332**	0.221***	-0.0621**	-0.0290
IT and communication	0.104***	0.274***	0.0475***	-0.0251**	-0.0274
Specialist, scientific, technical activities	0.0556	0.286***	0.0986***	-0.0189	-0.0500*

Source: DG Trésor.

Note : * p < 0.10, ** p < 0.05, *** p < 0.01. The table shows the GMM results on turnover growth, profit ratio and debt ratio for four industries. For manufacturing, a 1 percentage point increase in the turnover growth rate increases the investment ratio by 0.223 percentage points.

a. Model inspired by Mairesse *et al.* (2000) "Firm Level Investment and R&D in France and the United States: A comparison", *NBER Working papers*.

4.2 R&D investments appear to be more resilient

A similar model for R&D¹⁸ suggests that the increase in crisis-related financial constraints (lower profit levels and higher debt levels) does not have a significant impact on R&D expenditure, which is consistent with the conclusions of the economic literature.¹⁹ For firms regularly investing in R&D (intensive margin), it is a long-term investment that comes with high adjustment costs (closing/opening labs, losing human capital, etc.). For that reason, these firms tend to have the financial

capacity to withstand the impact of a shock and decide to maintain their investment.

However, the increased financial constraints associated with the crisis could have a negative impact on firms making one-off R&D investments (extensive margin).²⁰ The uncertainty involved in any new R&D project makes this kind of investment extremely sensitive to financial constraints. Increased financial constraints could also see high-risk R&D investments reallocated to less risky innovation projects.

(18) Data was matched to the research tax credit (CIR) database for the years 2009-2016 to obtain R&D figures for firms.

(19) For example, Bond S. *et al.* (2005), "Investment, R&D and Financial Constraints in Britain and Germany", *Annales d'Economie et de Statistiques*, estimate that financial constraints have a non-significant impact on firms' research and development. Conversely, Brown J. *et al.* (2012), "Do Financing Constraints Matter for R&D?", *European Economic Review*, find financial constraints do have a negative effect on R&D after controlling for other explanatory variables (use of external equity finance, in particular). However, this effect is not significant for France.

(20) For France-specific data, see Savignac F. (2006), "The Impact of Financial Constraints on Innovation: Evidence from French Manufacturing Firms", *Cahier de la MSE*.

Publisher:

Ministère de l'Économie, des Finances, et de la Relance
Direction générale du Trésor
139, rue de Bercy
75575 Paris CEDEX 12

Publication manager:

Agnès Bénassy-Quéré

Editor in chief:

Jean-Luc Schneider
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English translation:

Centre de traduction
des ministères économique
et financier

Layout:

Maryse Dos Santos
ISSN 1962-400X
eISSN 2417-9698

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This study was prepared under the authority of the Directorate General of the Treasury (DG Trésor) and does not necessarily reflect the position of the Ministry of Economy and Finance.