IMPACT OF THE COVID-19 CRISIS ON SPANISH FIRMS' FINANCIAL VULNERABILITY

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Abstract

This paper analyses the impact of the COVID-19 crisis on the financial vulnerability of the Spanish corporate sector. The simulations conducted show that the crisis significantly increased firms' liquidity needs in 2020, although the measures adopted by national and international authorities eased access to credit under favourable conditions, which substantially mitigated the short-term liquidity risks. However, the sharp fall in profitability levels, coupled with debt growth, appears to have resulted in a marked increase in the proportion of vulnerable firms (i.e. those with negative equity or high debt levels), which would be more pronounced among SMEs and the sectors hardest hit by the pandemic. The projections for the period 2021-2023 indicate a gradual decline in these percentages, in keeping with the expected recovery in activity. The results also suggest that, as a result of the crisis, the proportion of firms at risk of becoming non-viable on account of persistent losses through to 2023 would rise by between 2 pp and 3 pp, while the proportion of those that will remain viable but struggle to repay their debts out of their expected future earnings (overindebted firms) would rise by between 3 pp and 4.7 pp. In addition, the simulations show that the unsustainable debt of firms that have become overindebted but remain viable would stand between €9 billion and €18.6 billion, depending on the scenario considered, with the bulk of this amount accounted for by SMEs.

Keywords: COVID-19, liquidity needs, profitability, indebtedness, credit, solvency, viability.

JEL classification: E51, E52, G21.

Resumen

En este documento se analiza el impacto de la crisis del COVID-19 sobre la vulnerabilidad financiera del sector corporativo español. Las simulaciones realizadas muestran que la crisis habría elevado significativamente las necesidades de liquidez de las empresas en 2020, si bien las medidas adoptadas por las autoridades nacionales e internacionales facilitaron el acceso al crédito en condiciones favorables, lo que mitigó sustancialmente los riesgos de liquidez a corto plazo. Sin embargo, la fuerte caída de los niveles de rentabilidad, unida al crecimiento del endeudamiento, se habría traducido en un aumento notorio de la proporción de compañías vulnerables (es decir, aquellas con patrimonio neto negativo o con niveles de endeudamiento elevados), que habría sido más acusado dentro de las pymes y en los sectores más afectados por la pandemia. Las proyecciones para el período 2021-2023 anticipan una progresiva disminución de estos porcentajes, en línea con la reactivación prevista de la actividad. Los resultados también apuntan a que, como consecuencia de la crisis, se produciría un incremento de entre 2 puntos porcentuales (pp) y 3 pp de la proporción de empresas con riesgo de ser inviables por tener pérdidas continuadas hasta 2023, y de entre 3 pp y 4,7 pp en la de aquellas que seguirían siendo viables pero que tendrían dificultades para hacer frente a sus deudas con sus ingresos futuros esperados (empresas sobreendeudadas). Asimismo, las simulaciones realizadas muestran que la deuda no sostenible de las empresas que habrían pasado a encontrarse en esta última situación se situaría entre los 9 mm y los 18,6 mm de euros, según el escenario considerado, concentrándose la mayor parte de este importe en el segmento de las pymes.

Palabras clave: COVID-19, necesidades de liquidez, rentabilidad, endeudamiento, crédito, solvencia, viabilidad.

Códigos JEL: E51, E52, G21.

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1 Introduction[1]

Global economic activity suffered an unprecedented contraction in 2020 as a consequence of the COVID-19 pandemic and the containment measures adopted by authorities to limit its spread. Spain has been one of the hardest-hit advanced economies, with GDP declining by 10.8% in 2020. This has severely impacted many firms' business activity, increasing the corporate sector's financial vulnerability. Depending on their scale, these problems could have adverse implications for the pace of economic recovery. This underscores the importance of evaluating the degree of damage inflicted by the crisis on corporate balance sheets.

This paper presents the results of simulations quantifying the impact of the COVID-19 crisis on the liquidity needs and financial position of Spanish non-financial corporations.[2] First, the number of firms presenting liquidity shortfalls in 2020 as a result of the crisis is estimated, together with their approximate amount. Further, changes in firms' profitability and debt in the period 2020-2023 are simulated, with a breakdown by size and sector of activity. Next, the effects of the crisis on firms' solvency and viability are discussed. To this end, firms at risk of becoming non-viable are identified, with these understood to be those firms whose ordinary earnings would be negative in 2023. Meanwhile, overindebted firms are defined as those that would be unable to repay their debts out of their expected future earnings. Lastly, the unsustainable debt of the group of firms that would become overindebted but remain viable (i.e. those that should be provided with public support) is calculated; that is, the amount by which they would have to reduce their debt for overindebtedness to cease to be a problem. These exercises take into account the main corporate income support measures introduced by the economic authorities since the outset of the crisis (furlough schemes, moratoria on rent payments, etc.) but not the more recent measures aimed at reinforcing business solvency, which had not yet been implemented at the time the exercises were conducted.

The simulations take into account the highly heterogeneous changes in firms' activity in 2020 across sectors and different firm sizes, and also within each sector and firm size bracket. The results show that ignoring intra-sectoral heterogeneity would lead to an underestimation of the corporate sector's financial vulnerability.

The rest of the paper comprises four sections. The second section briefly describes the methodology used; the third presents the results of the analysis of firms' liquidity needs in 2020; the fourth discusses the impact of the crisis on firms' profitability and debt in 2020-2023; and the fifth summarises the results regarding the impact of the crisis on firms' solvency and viability.

1 The authors would like to thank the AEAT (State tax revenue service) for the information provided to prepare this paper. They would also like to thank David López and those attending the internal presentations of this paper at the Banco de España for their comments and suggestions, in particular Óscar Arce and Carlos Thomas.

2 This paper updates that published in December 2020 analysing the impact of COVID-19 on non-financial corporations (see Blanco et al. (2020)), adding new assumptions and updating the scenarios. The quantitative results obtained in this new analysis are set out in Chapter 3 of the Banco de España *Annual Report 2020,* published in May 2021.

2 Methodology

The exercises conducted in this paper are based on simulations of the main income statement and balance sheet items in the period 2020-2023 for a sample of some 300,000 Spanish firms for whom such information is available in the Central Balance Sheet Data Office integrated database (CBI). The results are presented both for the corporate sector as a whole and broken down by firm size and sector. The aggregate figures for the corporate sector are obtained by grossing up the results for the sample drawing on information from the Central Companies Directory regarding the number of firms in the different sector and size brackets.

The income statement items for 2020 are simulated on the basis of their observed levels in 2019 (the latest year for which CBI data are available) and projecting their change in 2020 based on different assumptions. The key variable in those assumptions is growth in the firms' sales. Given that sales growth information is not available for each firm in 2020, that change is simulated using the statistical distribution of the change in firm-level turnover in 2020 for 25 sectors and four firm sizes (100 groups), provided by the AEAT. This approach allows us to capture the high cross-sectoral and intra-sectoral heterogeneity in firms' activity change in 2020. Specifically, 100 alternative simulations were performed using a random level of sales growth consistent with the distributions observed. The other main items (inputs and personnel costs) are calculated by applying the estimated elasticity of their growth relative to sales growth. This elasticity is obtained based on the change in these items in 2020 according to the Central Balance Sheet Data Office Quarterly Survey (CBQ), so as to factor in the impact of the income support measures approved by the economic authorities.[3] As Annex 2 shows, the dispersion of the 100 alternative simulations is quite low for most of the variables analysed. In the main text, the results show the median of the distribution of the 100 simulations for each item analysed in order to simplify the presentation.

The key variable in the projections for 2021-2023 is the expected nominal gross value added (GVA) growth for the 25 sectors considered. This change is projected under two alternative scenarios that are consistent with the baseline and severe scenarios of the macroeconomic projections published by the Banco de España in March 2021.[4] First, the cumulative change in the relevant items is simulated for 2019-2023. To this end, the long-term elasticities[5] (estimated using CBI data) between GVA growth and sales growth are applied to the nominal

3 The CBQ includes income statement and balance sheet information for around 800 non-financial corporations, primarily large firms. Owing to the low number of firms, this information is of little use for approximating changes in firms' sales in 2020 (AEAT data are better suited for this purpose, given their broader coverage of the corporate sector). However, CBQ information is considered relevant for estimating the short-term elasticities in 2020 between sales and other items, such as inputs and personnel costs. These elasticities are thought to have been significantly affected by the intensity of the crisis and the measures introduced to mitigate its effects; accordingly, they are not estimated using historical CBI data. Specifically, the furlough schemes appear to have increased the elasticity of personnel costs to sales insofar as firms have been able to adjust these costs more flexibly than in the past. Similarly, the moratoria on rent payments appear to have increased the elasticity of inputs to sales.

4 For more details, see Banco de España (2021).

5 Whereas short-term elasticities were used to simulate the growth of income statement items in 2020, here long-term elasticities are calculated (i.e. taking into account firms' medium and long-term performance). These long-term elasticities are deemed unaffected by the crisis or the measures introduced to mitigate its effects, meaning they can be estimated based on historical CBI data.

sectoral GVA growth projected for 2019-2023, which yields the change in turnover in that period.[6] In turn, the cumulative growth of inputs and personnel costs is obtained in an equivalent fashion, by applying the estimated elasticities between these items and sales. For the intermediate years (2021 and 2022), the level of the different items is obtained by interpolating the data between 2020 and 2023 based on the changes in nominal GVA for each sector during these years.

The change in financial assets and debt is obtained assuming that firms with net financing needs (those whose operating income less investment in fixed assets[7] is negative) cover these by resorting to debt,[8] while those in the opposite situation use the excess funds available to build up their liquid assets.

In addition, all of the above items are simulated for the period 2020-2023 under a counterfactual scenario of no pandemic. These simulations take the variables' levels in 2019 and project their change based on the nominal GDP growth included in the Banco de España's December 2019 macroeconomic projections.[9] Specifically, the growth in sales, inputs and personnel costs is calculated by applying the same elasticities to nominal GDP growth as are used to obtain the variables' 2023 levels under the pandemic scenarios described above.

Drawing on the above results, the exercises first simulate firms' liquidity needs from the onset of the pandemic in March 2020 to end-2020 and compare them with those of a hypothetical counterfactual scenario of no pandemic. Liquidity needs are understood to be the shortfall between revenue and outlays, with the latter including operating activity-related costs (inputs, salary costs, debt interest), the repayment of outstanding financial and non-financial debt and fixed asset investment. Operating activity-related income and outlays are obtained from the simulations of the different income statement items. Bank debt maturities are taken from the Central Credit Register (CCR) as at March 2020, while for other debt the outstanding amount of short-term debt on firms' balance sheets in 2019 (according to the CBI) is used.

The changes in firms' profitability in 2020-2023 are then simulated under the two macroeconomic scenarios considered (baseline and severe). Also calculated are the percentage of financially vulnerable firms and their share in employment and debt. Firms are deemed vulnerable when their financial ratios exceed certain levels.[10]

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6 This approach implicitly assumes that the intra-sectoral heterogeneity observed in 2020 disappears in 2023.

7 Section 9 of Annex 1 explains how investment in fixed assets is simulated.

8 This assumption is considered realistic under normal conditions of access to external finance, since firms prefer to hold a certain volume of liquid assets in order to withstand liquidity shocks and resort to capital increases less frequently. The main results of the analysis would be unaffected were the firms to cover a portion of these needs by making use of their liquid assets, since debt is measured in net terms (i.e. net of liquid assets). By contrast, if a portion of the needs is covered with capital increases, the results presented will tend to exaggerate the degree of financial vulnerability.

9 In contrast with the pandemic scenarios, the counterfactual scenario of no pandemic assumes a homogeneous GVA performance across the different sectors. This simplifying assumption is introduced owing to the difficulties in obtaining sector-differentiated trajectories and because the sectoral differences under this scenario would, it is considered, have been considerably smaller than those that have been observed following the pandemic.

10 Vulnerable firms are identified using different alternative indicators. Specifically, firms are considered vulnerable if they have negative equity or debt levels (relative to earnings and to assets) that exceed certain thresholds. Section 4 of this paper details the definitions used.

In this paper, firms are classified according to their solvency and viability based on the concepts of net debt and expected long-term earnings. Net debt is defined as financial and non-financial debt (trade debt and other non-trade payables) less liquid assets and other current assets (trade receivables, inventories and other debt). Expected long-term earnings, which reflect the level at which ordinary earnings are expected to converge in the long term, are approximated using the ordinary earnings that firms would obtain in 2023, applying the approach described above.

Firms are defined as overindebted when they have positive net debt in 2022 and a ratio of net debt to expected long-term earnings that exceeds a certain threshold. This indicator is based on estimated debt for 2022 rather than 2020 so as to factor in the cash flows generated by firms in 2021 and 2022, since these affect their ability to repay debt.[11] Two alternative thresholds are considered: 9 times (more stringent threshold applicable in the less benign scenario) and 12 times (used in the more benign scenario). These thresholds were obtained under the implicit assumption that firms are able to refinance their debts with a 10-year or 15-year loan, respectively, at the market interest rate.[12]

Firms at risk of becoming non-viable are deemed to be those whose expected long-term earnings are negative, i.e. firms whose income cannot cover their operating expenses in the long term.[13]

Further details on the methodology used in the simulations can be found in Annexes 1 and 2.

11 In particular, firms with financing needs in 2021 and 2022 will see a deterioration in their ability to repay the debt assumed up to 2020, which will be reflected in the indicator as an increase in net debt between 2020 and 2022. The opposite will be true for firms with a net lending position in those years.

12 A 15-year (10-year) loan at the market interest rate (3% for these terms) for an amount equal to 12 (9) times expected long-term earnings has an annual repayment instalment equal to those earnings. Accordingly, a firm funding its debt with a loan for a higher amount at these maturities would be unable to cover the loan repayment out of its earnings. Although the average maturity of the forborne credit in the CCR stands at around four years, there are transactions with far longer maturities, some as long as 30 years.

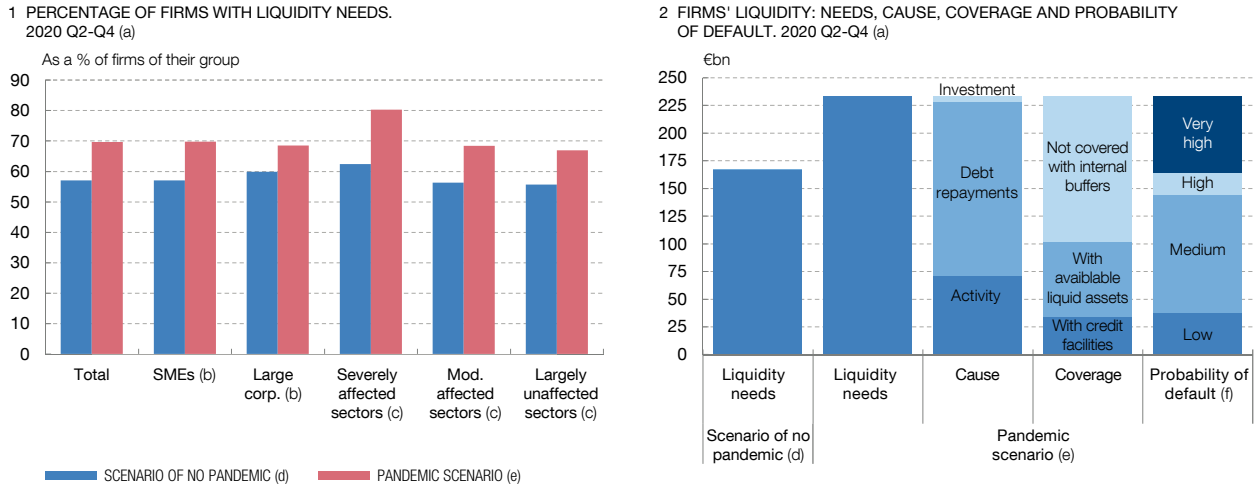
13 The academic literature considers firms non-viable when their going-concern value is lower than their liquidation value. An equivalent definition is used in this paper, under the assumption that the liquidation value is close to zero, since in that case non-viability would imply a negative value for expected long-term cash flows.

3 Firms' liquidity needs in 2020

According to the simulation results, which are set out in Chart 1.1, 70% of Spanish non-financial corporations had liquidity needs between April and December 2020, which is 13 percentage points (pp) more than under the scenario of no pandemic.[14] In any event, the crisis appears to have had a highly uneven impact on firms' liquidity needs. By size, the proportion of firms with liquidity needs would have increased somewhat more markedly among SMEs (by 13 pp) than larger firms (9 pp). By sector, those severely affected by the crisis would have shown a higher proportion of firms with liquidity shortfalls (80%, 18 pp more than under the scenario of no pandemic), while this percentage would have grown by a lesser 12 pp in both the moderately affected and largely unaffected sectors, to 68% and 67%, respectively.[15]

The fiscal policies to support income (such as the furlough schemes and deferral of rent, social security contributions and tax payments) helped reduce the corporate sector's aggregate liquidity needs. Even so, between 2020 Q2 and Q4 these needs are estimated to

Chart 1
FIRMS' LIQUIDITY NEEDS IN 2020



SOURCE: Banco de España.

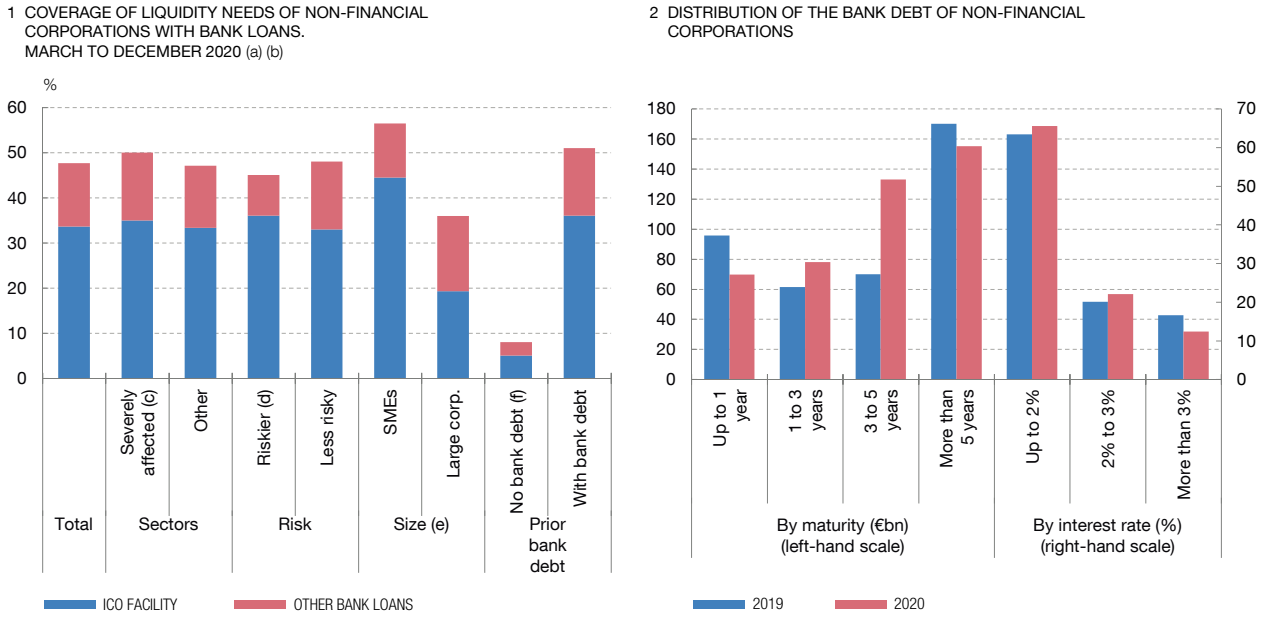
a Excludes holding companies and financial services sector firms.
b The definition of size is in line with European Commission Recommendation 2003/361/EC.
c Sectors are defined as severely affected if their sales fell by more than 15% in 2020 and as moderately affected if their sales fell by between 8% and 15%. Other sectors are deemed to be largely unaffected.
d Counterfactual scenario under which GDP growth is in line with the scenario published by the Banco de España in December 2019.
e The results shown correspond to the median of 100 microsimulations in which each firm is randomly allocated a variation in 2020 sales such that the distribution of sales growth for each sector and firm size is replicated.
f Probability of default is considered very high if it exceeds 5%, high if it is between 3% and 5%, medium if it is between 0.5% and 3%, and low if it is below 0.5%.

14 The fact that 57% of firms have liquidity needs under a scenario of no pandemic is largely attributable to debt repayments (owing to the high weight of short-term financing) and higher fixed asset investments that are undertaken under normal conditions.

15 Sectors are defined as severely affected if their sales fell by more than 15% in 2020 and as moderately affected if their sales fell by between 8% and 15%. Other sectors are deemed to be largely unaffected. Chart A2.1 of Annex 2 shows the sectors included in each group.

Chart 2

COVERAGE OF LIQUIDITY NEEDS WITH BANK DEBT. IMPORTANCE OF THE ICO GUARANTEE FACILITIES



SOURCE: Banco de España.

a Includes new credit transactions (drawn and undrawn), but not drawdowns on previously granted credit facilities.
b Only credit transactions maturing after 2020 are considered, as those maturing in 2020 would have to be refinanced. Firms' liquidity needs are identified based on a simulation of their ordinary activities during 2020 and debt repayments between March and December 2020.
c Severely affected sectors are those whose turnover fell by more than 15% in 2020, namely: accommodation and food service activities, the manufacture of refined petroleum products, social and cultural services, transportation and storage, the manufacture of textiles, and the manufacture of transport equipment.
d Riskier companies are those with a probability of default of over 5%.
e The definition of size is in line with European Commission Recommendation 2003/361/EC. Small firms forming part of a business group are not classified as SMEs.
f Firms with no prior debt with credit institutions are those that neither had credit drawdowns nor held any credit facilities in early February 2020, on the information available in the Banco de España Central Credit Register.

amount to some €233 billion, standing around €67 billion higher than under a counterfactual scenario of no pandemic (see Chart 1.2). Two-thirds (67%) of the estimated liquidity shortfall generated owes to the repayment of outstanding debt, 31% to losses generated in operating activities and just 2% to productive investments. To address such needs, firms that struggle to access external financing could resort to their liquid assets and the undrawn amount on existing credit facilities. Indeed, firms, particularly SMEs, had progressively built up liquid assets during the years leading up to the outbreak of the health crisis.[16] Nevertheless, even if firms had made full use of their buffers, it is estimated that the corporate sector as a whole would have been able to cover a maximum of 44% of its liquidity needs generated in 2020 Q2-Q4. Further, around 38% of these needs (nearly €90 billion) would have been generated at firms with a high or very high probability of debt default (more than 3% and 5%, respectively).[17]

16 For more details, see Blanco et al. (2020).

17 Probabilities of debt default are obtained drawing on the statistical models developed by the Banco de España's Financial Risk Department for credit assessment. The main variables used in these models to categorise firms by credit quality are their profitability, liquidity, debt coverage and financial structure (share of debt and equity) ratios. Probabilities of default are estimated based on the simulated levels for the ratios in 2020. For further details on these models, see Gavilá et al. (2020).

The high liquidity risks faced by the corporate sector were significantly cushioned by the credit support measures adopted by the ECB and the Government (particularly, by public guarantee schemes), which led to favourable financing conditions. Against this backdrop, a large number of firms resorted to debt, chiefly bank credit, to cover their liquidity needs. Thus, it is estimated that Spanish non-financial corporations as a whole covered almost half of their liquidity needs (48%) through bank loans maturing beyond 2020, of which just over 80% are loans under public guarantee schemes (see Chart 2.1). The guarantee facilities managed by the Official Credit Institute (ICO by its Spanish initials) appear to have been essential in enabling many firms, especially those with a priori more difficult access to external financing (smaller firms and those with a higher credit risk), to raise funds and meet their needs. Moreover, the use of these facilities has helped extend the term to maturity of firms' debt and lower their average financing costs (see Chart 2.2). At the same time, some firms would have increased their borrowing not only to finance their more immediate liquidity shortfalls, but also to use at least part of the funds raised to increase their liquidity buffers, as a precautionary measure.[18]

18 For further details, see Chapter 3 of the Banco de España *Annual Report 2020*.

4 Profitability and debt

As discussed above, the COVID-19 crisis led to a sharp fall in firms' turnover, causing a large number of them to post steep declines in their profitability levels and, coupled with debt growth, a significant deterioration of their financial position. Chart 3.1 shows the simulated changes in the quartiles of the distribution of firms' return on assets, broken down by firm size. A significant drop in profitability is observed in 2020 across the entire distribution, the fall being somewhat sharper in the SME segment, with a decline in median profitability of 5 pp, compared with that of 4.3 pp for large corporations. In the 25th percentile, below which the least profitable firms are concentrated, the drop is steeper, particularly for SMEs (almost 34 pp to -35%). The breakdown by sector (see Chart 3.2) shows that the drop in profitability in 2020 appears to have been sharper in the sectors hardest hit by the COVID-19 crisis. Thus, the results show that the median of this indicator for the severely affected sectors group would have fallen by more than 13 pp, from 4.1% to -9.4%, while the decline in median profitability would have been smaller in the moderately affected and largely unaffected sectors (5 pp and 3.5 pp to stand at -0.7% and -0.1%, respectively).

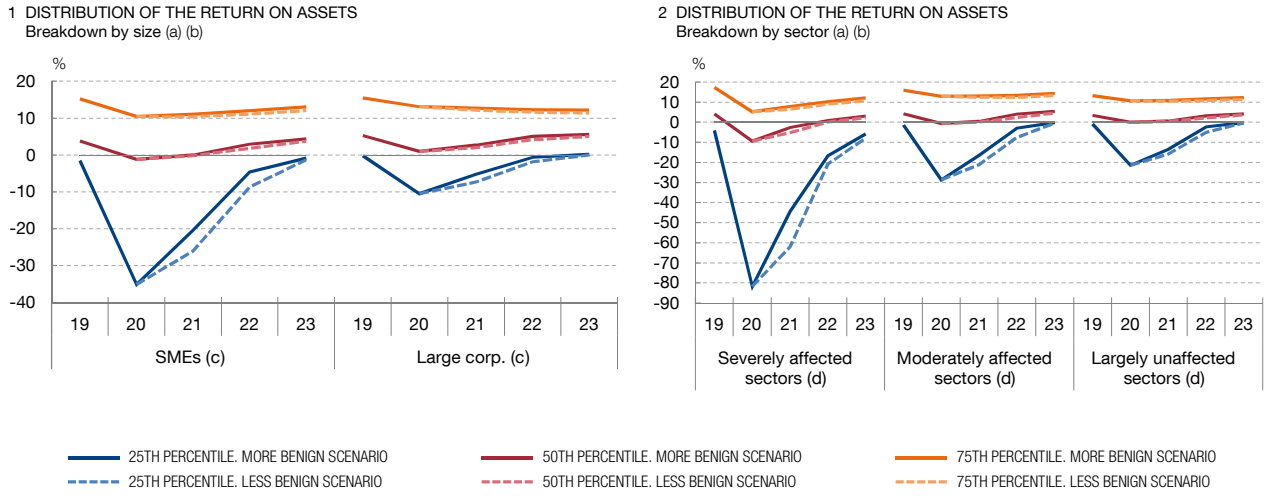
The decline in profitability is estimated to have caused a significant increase in businesses with negative values for this indicator in 2020. According to the simulations, more than one half of the firms (55%) would be in this situation (see Chart 3.3), 24 pp more than in 2019. Moreover, these firms would account for 48% of the employment and 39% of the debt of the corporate sector. The increase is somewhat smaller for large corporations, a segment in which the share of companies with negative profitability would have risen by 18 pp, to 45%. Again, the sectoral breakdown shows that the sectors severely affected by the crisis would have fared worse. In this aggregate, 66% of firms would have had negative profitability in 2020, 22 pp more than in 2019.

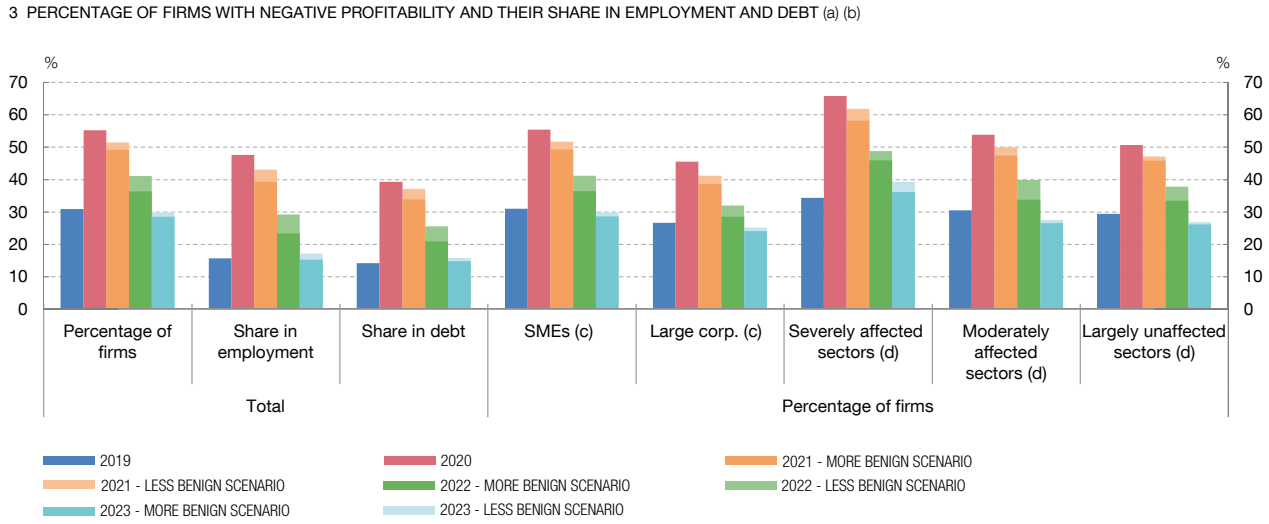
Chart 3 also shows how this indicator is expected to perform in the period 2021-2023 under the two alternative scenarios considered (more and less benign). According to these simulations, from 2021 there will be a gradual recovery in corporate profitability and a progressive decline in the share of firms with negative values for this indicator, which will be somewhat faster in the more benign scenario. In the less benign scenario, profitability would remain at slightly lower levels, especially in 2021 and 2022. However, the median enterprise would not return to pre-pandemic profitability levels until 2023 under both scenarios. The information by sector shows that the return to pre-pandemic levels is highly uneven. As was to be expected, it would be slower in the sectors severely affected by the crisis. Thus, in 2023 median profitability in the moderately affected and largely unaffected sectors is expected to surpass its pre-pandemic levels, but remain below pre-crisis levels in the severely affected sectors.

The simulations performed also make it possible to analyse the deterioration in firms' financial position. Three indicators are used for this analysis: one based on the level of equity and the other two, on indebtedness. The first indicator looks at the proportion of firms with

Chart 3

CHANGES IN FIRMS' RETURN ON ASSETS AND THE PERCENTAGE OF FIRMS WITH NEGATIVE PROFITABILITY (2019-2023)





SOURCE: Banco de España.

a Results obtained based on simulations consistent with the economic developments projected under the baseline scenario of the macroeconomic projections published by the Banco de España in March 2021. The results shown in these panels correspond to the median of 100 microsimulations in which each firm is randomly allocated a variation in 2020 sales such that the distribution of sales growth for each sector and firm size is replicated.
b Scenarios consistent with the baseline scenario (more benign) and severe scenario (less benign).
c The definition of size is in line with European Commission Recommendation 2003/361/EC.
d Sectors are defined as severely affected by the COVID-19 crisis if their sales fell by more than 15% in 2020 and as moderately affected if their sales fell by between 8% and 15%. Other sectors are deemed to be largely unaffected.

negative equity.[19] Although such a position, resulting mainly from the accumulation of losses over an extended period of time, does not automatically imply a firm's bankruptcy, it does represent an important factor of vulnerability since it increases the likelihood of bankruptcy

19 Equity is defined as the sum of the "Own funds", "Valuation adjustments", and "Grants, donations and legacies received" items.

in the future. As for the debt-based indicators, one of them, which is more structural in nature, estimates the ratio of net financial debt[20] to net financial debt plus equity at each firm, while the other, which is calculated as the ratio of net financial debt to ordinary earnings (defined as gross operating profit plus financial revenue), measures firms' ability to service their financial debt with the profit for the year generated by its activity.

Chart 4.1 shows that, as a result of the crisis, in 2020 there would have been a noticeable increase (of around 10 pp) in the percentage of firms with negative equity, to almost 25%. This increase would have been somewhat more moderate in larger firms, where this proportion would have risen from 8.6% to 15.3%. Once again, the sectors severely affected by the crisis would have seen the sharpest rise, with the number of firms with negative equity rising to 34%, almost 15 pp more than in 2019 (see Chart 4.2). Employment and debt in such firms show an upward profile similar to that of the number of firms, both overall and in the breakdown by size and sector, but with lower percentages (see Charts 4.3 to 4.6). This suggests that, on average, firms with negative equity have smaller workforces and are less indebted than the rest of the firms in their respective aggregates.

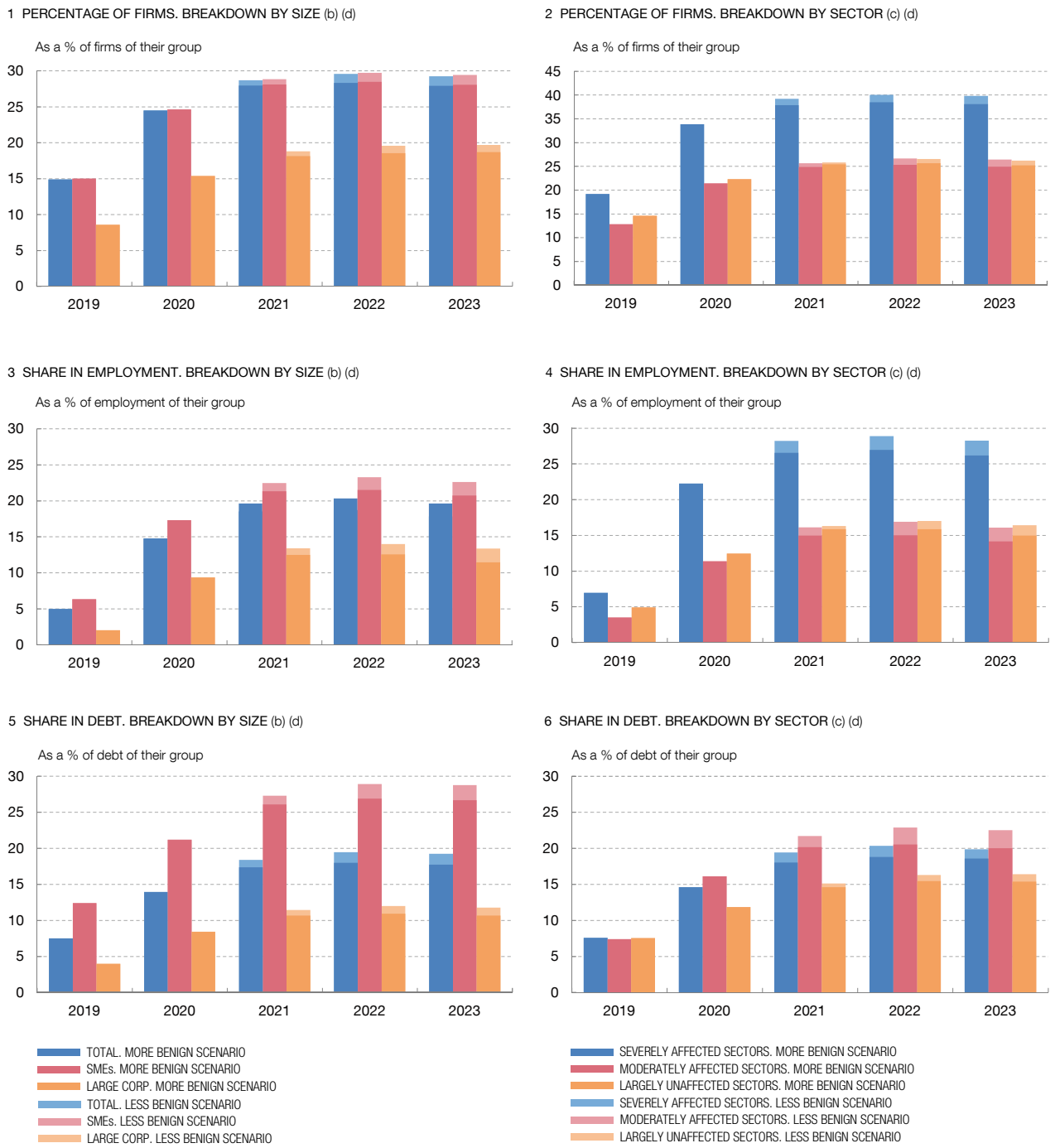
Charts 5 and 6 show the changes in the proportion of firms with high debt ratios as a result of the crisis, with a breakdown by size and sector. According to the debt-to-assets ratio, the percentage of more vulnerable firms (defined as those where this indicator exceeds the value of 0.75) would have increased by some 7 pp in 2020 to around 22% (see Chart 5.1). Again, SMEs and, particularly, firms operating in the sectors hardest hit by the crisis would see the highest growth in the percentage of vulnerable firms, which would stand close to 30% in the case of the latter (see Chart 5.2). Regarding these firms' share in employment, the increases would be similar to those of the number of vulnerable firms (see Charts 5.3 and 5.4). As for cumulative debt, the breakdown by size shows that, yet again, SMEs built up a greater proportion of vulnerable debt (more than 30% of their aggregate's debt) while, by contrast, of the three groups of sectors, vulnerable firms' debt would increase somewhat more in the moderately affected sector (by 6 pp, to stand at 31%) (see Charts 5.5 and 5.6).

Analysing the proportion of vulnerable firms from the standpoint of the net debt-to-earnings ratio (approximated as those with a value greater than ten or with positive net debt and negative earnings), a sharper rise is seen in 2020 (see Chart 6.1). This suggests that the decline in earnings would have had a more significant impact on firms' financial vulnerability than the increase in debt. Notable in the breakdown by sector is the particularly sharp rise in the percentage of vulnerable firms in the sectors severely affected by the crisis, with an increase of more than 22 pp to 40.8% in 2020 (see Chart 6.2). Employment and debt in firms classified as vulnerable according to this indicator would have grown somewhat more markedly, with the sectors hardest hit by the crisis accounting for up to 44% of employment in the aggregate (compared with 11.4% in 2019) and for more than 60% of debt (28 pp more than in 2019) (see Charts 6.3 to 6.6).

20 Net financial debt is calculated as the difference between gross financial debt and liquid assets.

Chart 4

FIRMS WITH NEGATIVE EQUITY (a)



SOURCE: Banco de España.

a Results obtained based on simulations consistent with the economic developments projected under the baseline and severe scenarios of the macroeconomic projections published by the Banco de España in March 2021. The results shown in these panels correspond to the median of 100 microsimulations in which each firm is randomly allocated a variation in 2020 sales such that the distribution of sales growth for each sector and firm size is replicated.

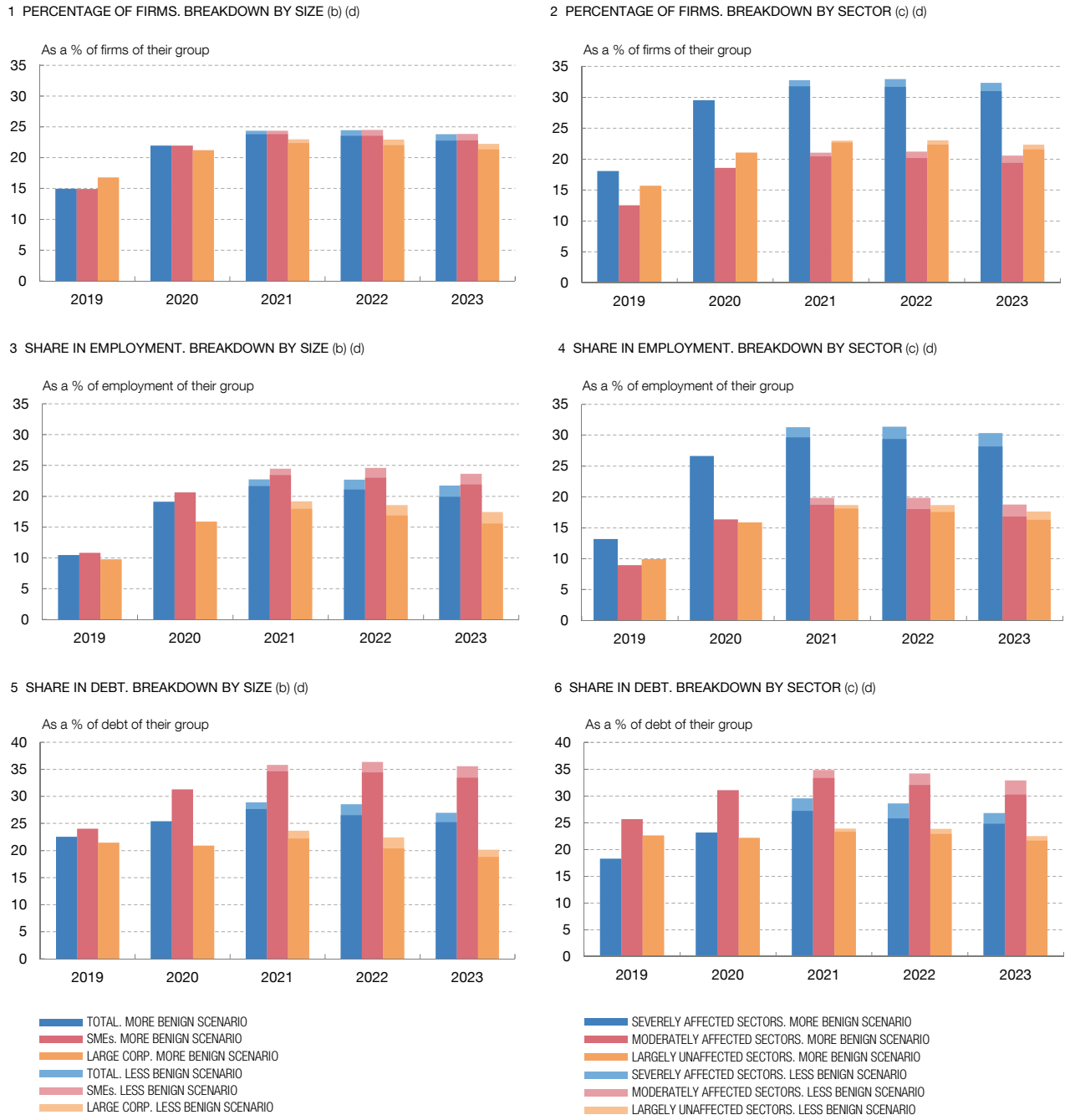
b The total excludes holding companies, financial services firms, property development and buying and selling of own real estate. The definition of size is in line with European Commission Recommendation 2003/361/EC.

c Sectors are defined as severely affected if their sales fell by more than 15% in 2020 and as moderately affected if their sales fell by between 8% and 15%. Other sectors are deemed to be largely unaffected.

d Scenarios consistent with the baseline scenario (more benign) and severe scenario (less benign).

Chart 5

MORE VULNERABLE FIRMS BASED ON THE RATIO OF NET FINANCIAL DEBT / (NET FINANCIAL DEBT + EQUITY) (a)



SOURCE: Banco de España.

a Net financial debt is defined as interest-bearing borrowing less liquid assets and short-term financial investments. More vulnerable firms are defined as those whose Net financial debt / (Net financial debt + Equity) ratio is higher than 0.75. Results obtained based on simulations consistent with the economic developments projected under the baseline and severe scenarios of the macroeconomic projections published by the Banco de España in March 2021. The results shown in these panels correspond to the median of 100 microsimulations in which each firm is randomly allocated a variation in 2020 sales such that the distribution of sales growth for each sector and firm size is replicated.

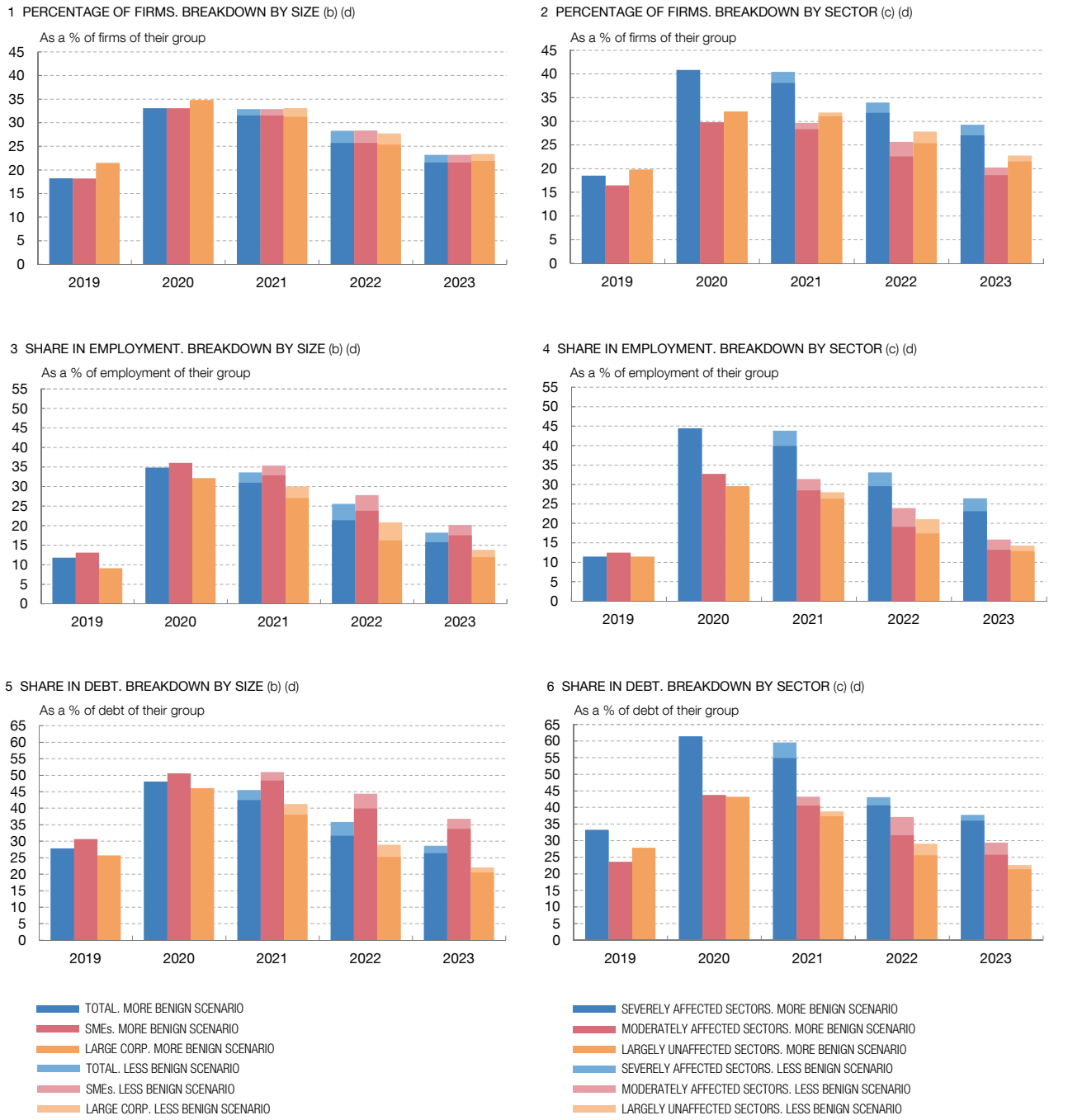
b The total excludes holding companies, financial services firms, property development and buying and selling of own real estate. The definition of size is in line with European Commission Recommendation 2003/361/EC.

c Sectors are defined as severely affected if their sales fell by more than 15% in 2020 and as moderately affected if their sales fell by between 8% and 15%. Other sectors are deemed to be largely unaffected.

d Scenarios consistent with the baseline scenario (more benign) and severe scenario (less benign).

Chart 6

MORE VULNERABLE FIRMS BASED ON THE RATIO OF NET FINANCIAL DEBT / (GROSS OPERATING PROFIT + FINANCIAL REVENUE) (a)



SOURCE: Banco de España.

a Net financial debt is defined as interest-bearing borrowing less liquid assets and short-term financial investments. More vulnerable firms are defined as those whose ratio is higher than 10 or that have positive net financial debt and negative or zero earnings. Results obtained based on simulations consistent with the economic developments projected under the baseline and severe scenarios of the macroeconomic projections published by the Banco de España in March 2021. The results shown in these panels correspond to the median of 100 microsimulations in which each firm is randomly allocated a variation in 2020 sales such that the distribution of sales growth for each sector and firm size is replicated.

b The total excludes holding companies, financial services firms, property development and buying and selling of own real estate. The definition of size is in line with European Commission Recommendation 2003/361/EC.

c Sectors are defined as severely affected if their sales fell by more than 15% in 2020 and as moderately affected if their sales fell by between 8% and 15%. Other sectors are deemed to be largely unaffected.

d Scenarios consistent with the baseline scenario (more benign) and severe scenario (less benign).

Lastly, Charts 4, 5 and 6 also show the expected performance of these three indicators up to 2023. The most notable feature of the first two (negative equity and debt-to-assets above 0.75) is a trend towards stabilisation, both in the number of vulnerable firms and in their share in employment and debt, which in the less benign scenario would hold at slightly higher values than in the more benign scenario (see Charts 4 and 5). Conversely, the indicator based on net debt-to-earnings progressively declines from 2021 onwards, in keeping with the expected rebound in activity and corporate earnings in the scenarios considered. This would allow almost pre-pandemic values to be recorded in 2023, particularly in the more benign scenario, although both SMEs and the sectors severely affected by the crisis would continue to post higher figures, as these aggregates would follow a slower recovery path.

5 Viability and solvency

The deterioration in firms' profitability in 2020 and its subsequent persistence appears to have translated, in some cases, into an increase in the number of firms at risk of becoming non-viable, defined as those with negative earnings in 2023. Thus, according to the outcome of the simulations performed, the proportion of such firms would rise, compared with a counterfactual scenario of no pandemic, by between 2 pp and 3 pp, depending on whether the more or the less benign scenario is considered (see Chart 7.1). The increase in these firms' share in total employment in the non-financial corporations sector, compared with the counterfactual scenario, would be somewhat higher (between 2.7 pp and 3.7 pp), while the increase in their share in cumulative debt would be lower (0.6 pp and 1 pp, depending on the scenario considered). In any event, it should be borne in mind that these estimates do not take into account the possible structural changes in demand associated with the crisis.[21] These results might therefore underestimate the impact of the crisis on the proportion of non-viable firms. By size, the increase in the percentage of firms at risk of becoming non-viable, caused by the crisis, would be higher for SMEs (between 2 pp and 3 pp, depending on the scenario) than for large corporations (between 1.4 pp and 2.2 pp). Lastly, the sectoral breakdown shows that this percentage would rise far more markedly (by between 4.9 pp and 7.2 pp) in the sectors severely affected by the crisis.

Moreover, the increase in Spanish firms' indebtedness since 2020 Q1, together with the decline in expected future cash flows, appears to have led to a worsening of their solvency. Thus, as Chart 7.2 shows, the proportion of overindebted but viable firms, defined as those with positive profitability in 2023 but which would have trouble meeting the interest and principal repayments on their (financial and non-financial) debt out of their expected future earnings, would, as a result of the COVID-19 crisis, rise by between 3 pp and 4.7 pp, depending on the scenario considered (more or less benign). The more benign scenario was obtained using the baseline macroeconomic scenario and a threshold of 12 to determine overindebtedness. The less benign scenario combines the severe macroeconomic scenario with a threshold of 9. In terms of the share of employment, the change would be somewhat higher (between 3.5 pp and 6.1 pp) while the increase in the percentage of debt held by these firms would be slightly lower (between 2.8 pp and 3.9 pp). By size, the increase in the proportion of overindebted viable firms, caused by the crisis, for SMEs (ranging from 3 pp to 4.7 pp) would be higher than for large corporations (1.9 pp to 3.3 pp). By sector, the worsening of solvency would, again, be more intense in the sectors hardest hit by the crisis, where the share of overindebted but viable firms would grow by between 5.1 pp and 6.7 pp, compared with a scenario of no pandemic. As noted in relation to the above estimates for the increase in firms at risk of becoming non-viable, these figures do not capture the possible effects of the crisis on the deterioration of corporate sector solvency associated with potential structural changes in demand. However, in this case, it should be borne in mind that the assumption that firms will cover their financing needs over the coming years exclusively with debt would tilt the results in the opposite direction.[22]

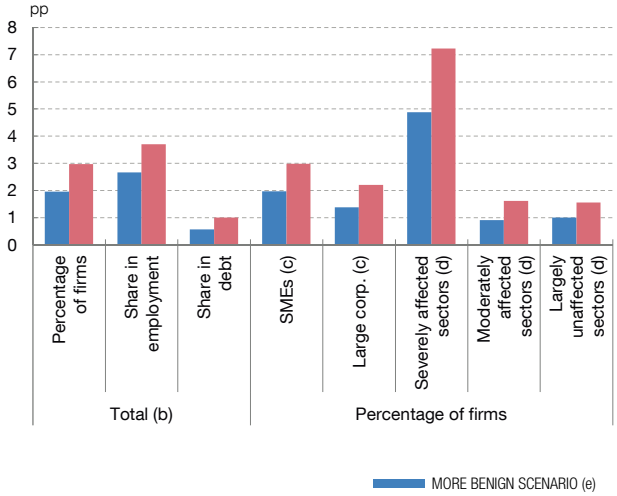
21 These changes in demand would have a negative impact on the profitability of the firms affected.

22 Indeed, if firms were to cover their liquidity needs using own funds, their solvency would not be impaired.

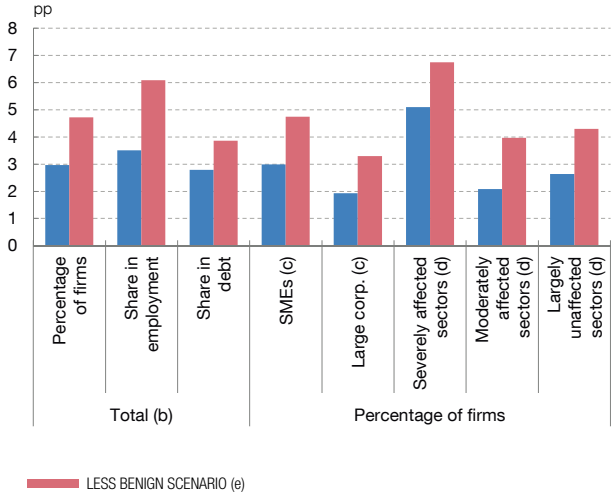
Chart 7

FIRMS AT RISK OF NON-VIABILITY AND INSOLVENCY OWING TO COVID-19

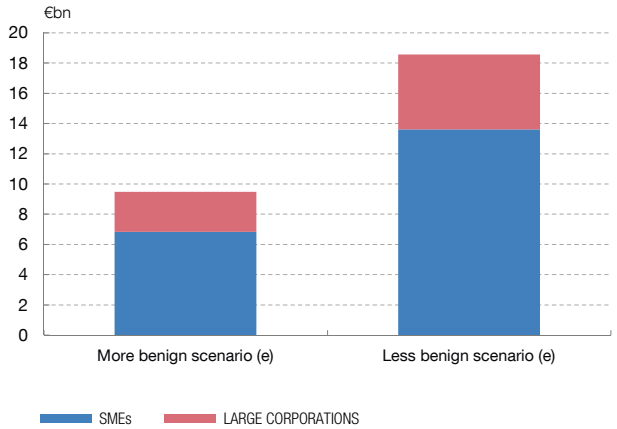
1 INCREASE, OWING TO THE COVID-19 CRISIS, IN THE PERCENTAGE OF FIRMS AT RISK OF NON-VIABILITY. SHARE IN EMPLOYMENT AND DEBT (a)



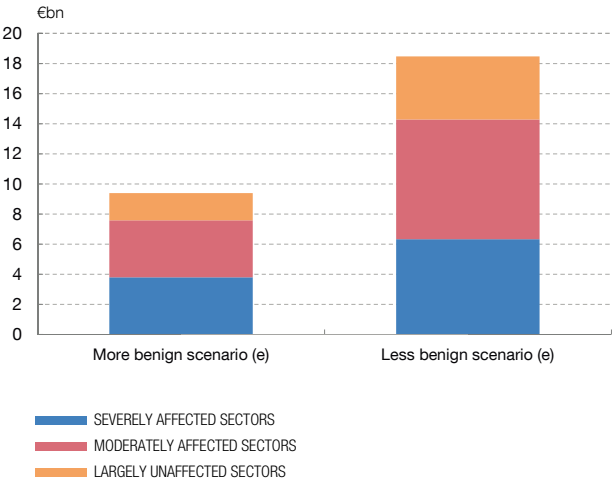
1 INCREASE, OWING TO THE COVID-19 CRISIS, IN THE PERCENTAGE OF VIABLE BUT OVERINDEBTED FIRMS. SHARE IN EMPLOYMENT AND DEBT (a) (f)



3 UNSUSTAINABLE DEBT OF FIRMS THAT WOULD BECOME OVERINDEBTED BUT REMAIN VIABLE. BREAKDOWN BY SIZE (c) (f)



4 UNSUSTAINABLE DEBT OF FIRMS THAT WOULD BECOME OVERINDEBTED BUT REMAIN VIABLE. SECTORAL BREAKDOWN (d) (f)



SOURCE: Banco de España.

a Changes, with respect to a counterfactual scenario of no pandemic, in the median of 100 microsimulations in which each firm is randomly allocated a variation in 2020 sales such that the distribution of sales growth observed for each sector and firm size is replicated. The counterfactual scenario is consistent with the Banco de España's December 2019 macroeconomic projections. Firms at risk of non-viability are defined as those with negative ordinary earnings (the sum of gross operating profit and financial revenue) in 2023.
b Excludes holding companies and firms in the following sectors: financial services, property development and buying and selling of own real estate.
c The definition of size is in line with European Commission Recommendation 2003/361/EC.
d Sectors are defined as severely affected if their sales fell by more than 15% in 2020 and as moderately affected if their sales fell by between 8% and 15%. Other sectors are deemed to be largely unaffected.
e Scenarios consistent with the baseline scenario (more benign) and severe scenario (less benign) of the Banco de España's March 2021 macroeconomic projections. The results shown correspond to the median of 100 microsimulations in which each firm is randomly allocated a variation in 2020 sales such that the distribution of sales growth observed for each sector and firm size is replicated.
f Overindebted firms are defined as those with positive net debt in 2022 and whose debt ratio (calculated as Total net debt for 2022 / Ordinary earnings for 2023) exceeds 12 in the more benign scenario and 9 in the less benign scenario. Net debt is defined as borrowings (interest-bearing or non-interest-bearing) less cash and cash equivalents, short-term financial investments, inventories and debts pending collection.

Lastly, the total volume of unsustainable (financial and non-financial) debt is estimated for firms that would have become overindebted as a result of the crisis but would still be viable. Unsustainable debt is considered to be the excess debt above the overindebtedness threshold. This amount indicates the amount by which a firm's debt must be reduced for it to cease to have solvency problems. The results of this exercise show that the unsustainable debt of these firms would be between €9 billion and €18.6 billion, depending on the scenario considered (see Chart 7.3). SMEs would account for the bulk of this amount (between €6.8 billion and €13.6 billion). By sector, this unsustainable debt would largely be concentrated in the sectors severely affected by the crisis, for an amount of between €3.8 billion and €6.3 billion, depending on the scenario considered. However, the remaining sectors of activity (moderately affected and largely unaffected) would also account for a significant amount, of up to €12.3 billion in the less benign scenario (66% of the total).

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Annex 1 Definition of variables and assumptions

The variables and assumptions used in the microsimulations performed are summarised below.

1 Baseline data

These correspond to 2019, which is the latest year available in the Central Balance Sheet Data Office integrated database (CBI). The following sectors are excluded:[1]

a) Financial services.

b) Head offices.

c) Development of building projects and buying and selling of own real estate.

Simulations of the performance of different balance sheet and income statement items of Spanish firms are obtained on CBI information, by applying year-on-year changes and on an accrual basis.

2 Output, inputs, personnel costs, GVA and gross operating profit

Growth in these items is calculated using both the information in the macroeconomic projections published by the Banco de España and the information provided by the Spanish tax authority (AEAT by its Spanish abbreviation), drawing on 2020 data for more than a million non-financial corporations (obtained from their tax returns for VAT and withholdings on income from work). Specifically, use was made of the AEAT's statistical distribution of the rate of change of sales for the 100 combinations of 25 sectors and four firm sizes (large, medium, small and micro), defined on the basis of employee numbers.[2] The short-term elasticity between sales and inputs and between sales and personnel costs is calculated on 2020 information from the Central Balance Sheet Data Office Quarterly Survey (CBQ) (for a sample of around 800 primarily large firms). Lastly, the long-term elasticities between these variables and the elasticity between GVA and sales are calculated on CBI data.

a) Calculation of sales growth in 2020:

Each firm in a given sector (among the 25 considered) and with a given size (among the four considered) is randomly allocated a change in sales between 2019 and 2020, such that the distribution of sales growth for each sector and firm size according to AEAT information is replicated. Once the sales growth

1 Financial services and head offices are excluded from this analysis, as their activity is eminently financial (head offices obtain financing to subsequently distribute it to the rest of the group's subsidiaries). The real estate sector is excluded since, owing to its activity, the assets included as inventories (land plots and real estate assets) serve as collateral for the loans received and would distort the viability and overindebtedness analysis performed in this paper.

2 The size of the firm is approximated by the number of employees: micro (fewer than 10 employees), small (between 10 and 50 employees), medium (between 50 and 250 employees) and large (more than 250 employees).

in 2020 has been obtained, the rest of the items are calculated as described below. The results presented in the charts of the main text are based on the median, for each item, obtained from 100 random simulations following this procedure. Annex 2 describes this procedure in greater detail, illustrates the dispersion for some of the indicators used and discusses the advantages of this procedure.

b) Value of output in 2020:

The rate of change of sales obtained above is used directly. This rate of change of sales is applied to the value of output in 2019 (obtained from the CBI) to calculate the value of output in 2020 for each firm:

$$\text{Output}_{2020} = \text{Output}_{2019} \times (1 + \text{Rate of change of sales}_{2020}) \quad (1)$$

c) Inputs in 2020 (Inputs_{2020}):

The rate of change of inputs for 2020 is obtained from the rate of change of sales and the beta_1 coefficient, which measures the short-term elasticity of inputs to sales:[3]

$$\text{Rate of change of inputs}_{2020} = \text{Rate of change of sales}_{2020} \times \text{beta}_1 \quad (2)$$

Inputs for each firm are obtained from this rate:

$$\text{Inputs}_{2020} = \text{Inputs}_{2019} \times (1 + \text{Rate of change of inputs}_{2020}) \quad (3)$$

d) Personnel costs in 2020 (PC_{2020}):

The rate of change of personnel costs for 2020 is obtained from the rate of change of sales and the beta_2 coefficient, which measures the short-term elasticity of personnel costs to sales in each sector:[4]

$$\text{Rate of change of PC}_{2020} = \text{Rate of change of sales}_{2020} \times \text{beta}_2 \quad (4)$$

PC for each firm in 2020 are obtained from this rate:

$$\text{PC}_{2020} = \text{PC}_{2019} \times (1 + \text{Rate of change of PC}_{2020}) \quad (5)$$

Since some of the costs are fixed, the beta_1 and beta_2 coefficients are less than one.

3 The beta_1 coefficient is obtained from a regression analysis estimating the relationship between sales growth and inputs growth between 2020 and 2019, based on the CBQ firm sample.

4 The beta_2 coefficient is obtained from a regression analysis estimating the relationship between sales growth and personnel costs growth between 2020 and 2019, based on the CBQ firm sample.

e) Gross value added in 2020. It is calculated as the difference between output and inputs:

$$GVA_{2020} = Output_{2020} - Inputs_{2020} \quad (6)$$

f) Gross operating profit in 2020 (GOP_{2020}). It is defined on the basis of the following equation:

$$GOP_{2020} = GVA_{2020} - PC_{2020} \quad (7)$$

g) Calculation of output, inputs, personnel costs, GVA and GOP in 2023

The calculation of these items for 2023 is based on the macroeconomic projections for 2021-2023 published in March 2021 by the Banco de España. Specifically, those projections' baseline and severe scenarios are used, with a sectoral breakdown compatible with that provided by the Spanish tax revenue service (AEAT) (25 sectors).[5] It is therefore assumed that the idiosyncratic intra-sectoral effects observed in 2020 are temporary since they will disappear completely in 2023.

Based on these projections, and for each scenario, a cumulative nominal GVA growth rate is calculated for each sector for the period 2019-2023. With this rate, the sales growth rate is obtained using the historical elasticity between the two variables (long-term alpha), obtained from CBI data.[6]

$$\text{Rate of change of sales}_{2020\text{-}2023} = \text{Rate of change of GVA}_{2020\text{-}2023} \times alfa_{lt} \quad (8)$$

Output in 2023 is calculated as follows using this cumulative rate of change of sales:

$$Output_{2023} = Output_{2019} \times (1 + \text{Rate of change of sales}_{2020\text{-}2023}) \quad (9)$$

Then, to calculate inputs and personnel costs, long-term elasticities (drawing on CBI data) between sales and inputs ($beta_{1lt}$) and between sales and personnel costs ($beta_{2lt}$) are also used.[7] The betas being long term entails assuming that

5 The basis for preparing the sectoral projections is the information from the second wave of the Banco de España Business Activity Survey (EBAE), conducted in March 2021. In particular, the levels of sectoral GVA in 2023 (2019=100 in each sector) are determined on the basis of the information drawn from the firms' responses to EBAE question 8 on the expectations of recovering the pre-COVID-19 level of activity.

6 The coefficient is obtained from a regression analysis estimating the relationship between the logarithm of sales and that of GVA for the period 2007-2018, using the CBI sample of firms. In addition, a series of additional regressors is used to control for the effect of solvency, liquidity, profitability and age of the firm on the dependent variable. The estimate is therefore based on a cross-section for a time horizon that is long enough to ensure that the estimated elasticities are long-term ones.

7 The coefficients $beta_{1lt}$ and $beta_{2lt}$ are obtained from two regression analyses that estimate the relationship between the logarithm of inputs and that of sales, and between the logarithm of personnel costs and that of sales, respectively. The sample period, the controls and the methodology are similar to those used to estimate $alpha_{lt}$ (see footnote 6).

firms have the flexibility to adjust their costs in the face of a change in their sales between 2019 and 2023.

Thus, the growth rate of inputs is calculated as follows:

$$\text{Rate of change of inputs}_{2020\text{-}2023} = \text{Rate of change of sales}_{2020\text{-}2023} \times \text{beta}_{1lt} \quad (10)$$

And the inputs for 2023 are obtained as follows:

$$\text{Inputs}_{2023} = \text{Inputs}_{2019} \times (1 + \text{Rate of change of inputs}_{2020\text{-}2023}) \quad (11)$$

Lastly, the rate of change of personnel costs is obtained using the long-term elasticity between sales and personnel costs (beta_{2lt}):

$$\text{Rate of change of PC}_{2020\text{-}2023} = \text{Rate of change of sales}_{2020\text{-}2023} \times \text{beta}_{2lt} \quad (12)$$

The 2023 personnel costs are calculated as follows:

$$\text{PC}_{2023} = \text{PC}_{2019} \times (1 + \text{Rate of change of PC}_{2020\text{-}2023}) \quad (13)$$

Having calculated output, inputs and personnel costs for 2023, GVA and GOP are obtained the same way as for 2020 (see Equations 6 and 7).

h) Calculation of output, inputs, personnel costs, GVA and GOP in 2021 and 2022.

It is assumed that growth in output, inputs and personnel costs between 2020 and 2023 is distributed during this period in line with the projected nominal GVA growth in each sector. To obtain these aggregates, first an index for nominal GVA (2020 = 100) is calculated based on the nominal rate of change of GVA (consistent with the March 2021 Banco de España macroeconomic projections). The weight of the increase in each year vis-à-vis the cumulative increase between 2020 and 2023 is then calculated:

$$\text{Weight}_{2021} = (\text{Index}_{2021} - 100) / (\text{Index}_{2023} - 100) \quad (14)$$

$$\text{Weight}_{2022} = (\text{Index}_{2022} - \text{Index}_{2021}) / (\text{Index}_{2023} - 100) \quad (15)$$

The variables for 2021 and 2022 (output, inputs and personnel costs) are calculated using these weights. For example, for output:

$$\text{Output}_{2021} = \text{Output}_{2020} + \text{Weight}_{2021} \times (\text{Output}_{2023} - \text{Output}_{2020}) \quad (16)$$

$$\text{Output}_{2022} = \text{Output}_{2021} + \text{Weight}_{2022} \times (\text{Output}_{2023} - \text{Output}_{2020}) \quad (17)$$

3 Financial revenue

Financial revenue (FR) between 2020 and 2023 is obtained from interest income and dividends in 2019, which are adjusted gradually according to the decline observed in the CBQ in the first three quarters of 2020 (37%):

$$\text{Interest income}_{2019} = \text{FR}_{2019} - \text{Dividends}_{2019} \tag{18}$$

$$\text{FR}_{2020} = \text{Interest income}_{2019} + (1 - 0.37) \times \text{Dividends}_{2019} \tag{19}$$

$$\text{FR}_{2021} = \text{Interest income}_{2019} + \left(1 - 0.37 \times \tfrac{2}{3}\right) \times \text{Dividends}_{2019} \tag{20}$$

$$\text{FR}_{2022} = \text{Interest income}_{2019} + \left(1 - 0.37 \times \tfrac{1}{3}\right) \times \text{Dividends}_{2019} \tag{21}$$

$$\text{FR}_{2023} = \text{Interest income}_{2019} + \text{Dividends}_{2019} \tag{22}$$

4 GOP + FR age adjustment factor

The earnings (GOP + FR) of firms aged 10 or under are adjusted upwards to reflect the fact that over time their earnings tend to edge upwards. This adjustment is calculated for each year "y", taking into account the age of the firm in each year:[8]

$$\text{GOPFR}_{y} = \text{GOPFR}_{0y} + \text{Young firms adjustment}_{y} \tag{23}$$

where GOPFR_{0y} is the sum of non-age adjusted GOP and FR. This item is called *ordinary earnings.*

5 Financial costs

To calculate financial costs (FC), a distinction is drawn between whether or not firms had financial debt in 2019 and whether, according to data available in the CCR, they were granted a loan by a credit institution in 2020:

a) Firms with no debt in 2019 that were not granted a bank loan (according to the CCR) in 2020: it is considered that, while these firms have deficits, they will not fund them by taking debt (rather, they will do so via equity) and, therefore, they do not and will not have financial debt and their financial costs will always be zero.

8 To adjust earnings according to the firm's age, a regression analysis is conducted enabling the estimation of the lower earnings associated with firms at the beginning of their lifecycle, so as to gradually adjust them on the basis of the firm's age. The dependent variable is the firm's earnings as a percentage of total assets, while the independent variable of interest is the firm's age. The analysis also uses a series of regressors in order to control for the effect of the firm's insolvency, liquidity and profitability, and fixed effects at the sectoral and provincial level to control for the unobservable heterogeneity in those dimensions. Once the coefficient of the variable of interest is estimated, the earnings for each year are estimated according to the firm's age at that point in time, provided that it is less than 10 years old.

b) Firms with no debt in 2019 that, according to the CCR, were granted a bank loan: from 2020 they are processed like the other firms which already had financial debt, their deficits are funded via an increase in debt and their financial costs are calculated as described in the following section.

c) Firms with financial debt in 2019: if they have deficits it is assumed that they will fund them via financial debt. In this case, the financial costs for 2020 (and subsequent years) will be obtained by adding:

i) Financial costs for the previous year

ii) Financial costs of the new debt (for the deficits incurred). Two items are required to calculate them: the cost of debt (R.2) and the increase in average financial debt estimated for each year (to fund the deficits) (see Section 11).

$$FC_y = FC_{y-1} + (\Delta \text{Average gross financial debt}_y \times R.2_{2019}) \quad (24)$$

where the cost of debt (R.2) is defined as:

$$R.2_{2019} = \text{Interest on borrowed funds and similar expenses} / \text{Average financial debt in 2019} \quad (25)$$

It is therefore assumed that the average cost of debt does not change over the simulated time horizon. The cases for which no data are available on any one of the variables used to define R.2 (e.g. because average financial debt is equal to 0) or for which there are data, but the ratio of Equation 25 results in outliers, must be addressed when defining R.2. The following procedure is used in these cases. Firms whose average financial debt is zero are assigned the median cost of debt for their sector and firm size. The median is calculated using the R.2 values above zero, establishing the lowest and highest values as the 10th and 90th percentiles, respectively. Where the R.2 values are abnormally high, they are replaced with the 90th percentile value, calculated on the basis of the same sub-sample used to define the median and the aforementioned percentiles.

6 Depreciation

The calculation is explained in Section 9, which details how maintenance investment (MI), which is equal to depreciation, is proxied.

7 Corporate income tax

Corporate income tax paid is obtained in a two-stage approach. First, the approximate tax rate for each firm is defined:

$$\text{Tax rate}_{2019} = \text{Corporate income tax}_{2019} / (\text{Corporate income tax}_{2019} + \text{Net profit/loss}_{2019} - \text{Dividends received}_{2019}) \quad (26)$$

To address the cases for which there are no data on any one of the variables used to calculate the tax rate or for which there are data, but they present outlier values, a similar procedure to that described in Section 5 on R.2 is used.

Once the tax rate for all firms is obtained, the corporate income tax paid is calculated as follows:

$$\text{Corporate income tax paid}_y = \text{Tax rate}_y \times (\text{GOPFR}_y - \text{FC}_y - \widehat{\text{MI}}_y) \tag{27}$$

At firms incurring losses, corporate income tax equals zero.

8 Operating income (OpInc):

$$\text{OpInc}_y = \text{GOPFR}_y - \text{FC}_y - \text{Corporate income tax paid}_y \tag{28}$$

9 Fixed asset investment

To calculate the investment, the amount the firms invested in 2019 (according to the CBI) and their depreciation charges (adjusted in proportion to the decline in their GVA) are used as a reference value. First, a maintenance investment or minimum investment for 2019 (MI_{2019}) and the gross fixed capital formation in 2019 are calculated, depending on whether the firm appears in the Central Balance Sheet Data Office Annual Survey (CBA) or in the database of information filed at the Mercantile Registries (CBB).[9] If the firm is from the CBA, the MI is defined as the sum of depreciation and amortisation. If the firm is from the CBB, the MI is defined as depreciation, impairment and operating provisions.

The MI is censored depending on whether it is positive or negative in 2019.

$$\begin{aligned} \widehat{\text{MI}}_{2019} &= \text{MI}_{2019}, \text{ if } \text{MI}_{2019} > 0 \\ \widehat{\text{MI}}_{2019} &= 0, \text{ otherwise} \end{aligned} \tag{29}$$

The MI in subsequent years is obtained as follows:

$$\widehat{\text{MI}}_y = \widehat{\text{MI}}_{y-1} \times (1 + \text{Rate of change of GVA}_y) \tag{30}$$

As with MI, gross fixed capital formation (GFCF) is also censored:

$$\begin{aligned} \widehat{\text{GFCF}}_{2019} &= \text{GFCF}_{2019} \text{ if } \text{GFCF}_{2019} > 0 \\ \widehat{\text{GFCF}}_{2019} &= 0, \text{ otherwise} \end{aligned} \tag{31}$$

For the years following 2019, firms with an operating deficit are expected to invest the lower of the two aforementioned variables (maintenance investment and gross fixed

9 The information for the CBB firms is less detailed than that for the CBA firms.

capital formation in 2019), and negative investment is not permitted (e.g. if it was negative in 2019 due to divestments in that year, investment of zero is assumed for 2020). In other words, if the firm has an operating deficit on account of activity in the year, investment is defined as:

$$\text{Investment}_y = \min(\widehat{\text{MI}}_{2019}, \widehat{\text{GFCF}}_{2019}) \tag{32}$$

For firms with an operating surplus, investment is expected to be the higher of maintenance investment (depreciation) and the investment actually made in 2019, up to the limit of its surplus.

10 Net lending

Net lending (NL) is calculated as the difference between operating income and investment:

$$\text{NL}_y = \text{OpInc}_y - \text{Investment}_y \tag{33}$$

11 Financial debt and liquid assets

It is assumed that firms with financing needs (negative net lending) cover them by taking new debt, provided that the firm had financial debt in 2019 or bank debt in any month of 2020 according to the CCR (in this case, see Section 5 in this annex).

$$\text{Gross financial debt}_y = \text{Gross financial debt}_{y-1} - \text{NL}_y \text{ , if } \text{NL}_y < 0 \tag{34}$$

Firms with a positive net lending position are expected to build up surplus funds in the form of liquid assets (cash and cash equivalents plus short-term financial investments, except loans).

$$\text{Liquid assets}_y = \text{Liquid assets}_{y-1} + \text{NL}_y \text{, if } \text{NL}_y > 0 \tag{35}$$

12 Classification of overindebted and non-viable firms

The following firm categories were defined to analyse firms' solvency and viability:

Non-viable firms: those with negative ordinary earnings in 2023.

Overindebted viable firms: those with positive net debt whose debt ratio (Net debt_{2022} / GOPFR_{2023}) is greater than 12 under the more benign scenario or 9 under the less benign scenario.

Net debt for a specific year is defined as:

$$\text{Net debt}_y = \text{Gross debt}_y - \text{Liquid assets}_y - \text{Trade receivables}_{2019} - \text{Other receivables}_{2019} - \text{Inventories}_{2019} \tag{36}$$

where gross (financial and non-financial) debt:

$$\text{Gross debt}_y = \text{Gross financial debt}_y + \text{Payables to suppliers}_{2019} + \text{Other non-interest-bearing payables}_{2019} \quad (37)$$

and liquid assets:

$$\text{Liquid assets}_y = \text{Cash and cash equivalents}_y + \text{Short-term financial investments other than loans}_{2019} \quad (38)$$

Unsustainable debt

Calculated for overindebted viable firms as follows:

$$\text{Unsustainable debt} = \text{Net debt}_{2022} - (\text{Solvency threshold} \times \text{GOPFR}_{2023}) \quad (39)$$

where the solvency threshold is set on the basis of the scenario. Under the more and less benign scenarios, this threshold is 12 and 9, respectively.

13 Grossing up the results to cover the entire non-financial corporations sector

Given that a sample of firms (CBI), rather than the entire population, was used, the results obtained from the sample have been grossed up. To do so, the factors used were those used by the Central Balance Sheet Data Office when grossing up to cover the entire non-financial corporations sector, obtained on the basis of the number of firms in the Central Companies Directory and the CBI sample in each sector (using the two-digit NACE Rev. 2 codes) and size bracket (broken down as follows: no employees, 1-9 employees, 10-19 employees, 20-49 employees, 50-199 employees, 200-499 employees, 500-999 employees, 1,000-4,999 employees and 5,000 or more employees). Different grossing-up factors were used for public limited companies and other firms.

Annex 2 Introduction of intra-sectoral heterogeneity: bootstrapping

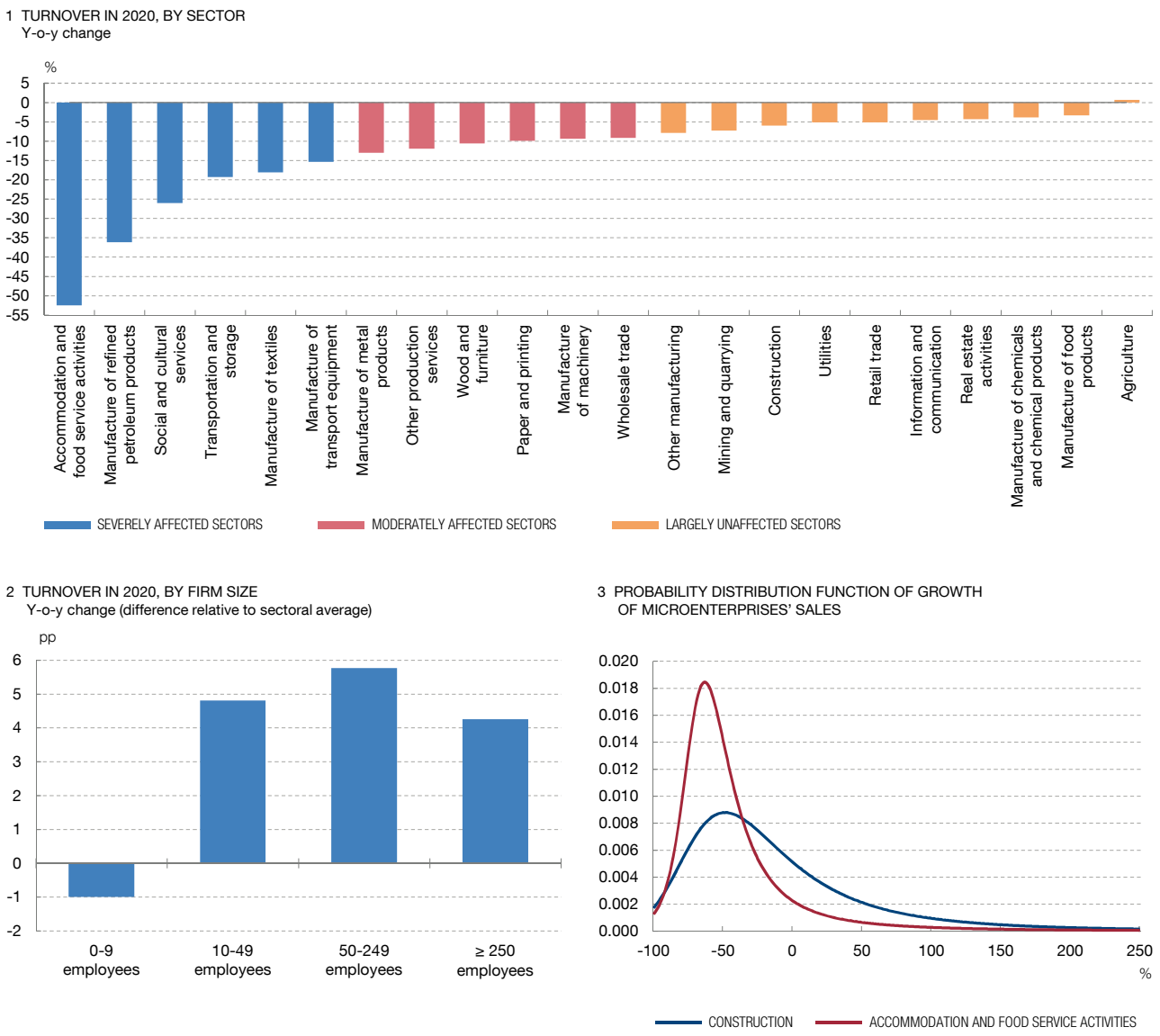
The analysis conducted in this paper captures the highly heterogeneous impact of the COVID-19 crisis on firms' activity, drawing on data provided by the Spanish tax revenue service (AEAT). The impact was highly heterogeneous across sectors. In particular, the decline in turnover in 2020 was comparatively sharper in accommodation and food service activities, the manufacture of refined petroleum products, social and cultural services, transportation and storage, the manufacture of textiles and the manufacture of transport equipment. All these sectors posted declines of more than 15% (see Chart A2.1.1). It was also highly heterogeneous across firm sizes. Specifically, firms with fewer than 10 employees (microenterprises) recorded an average decline in sales in 2020 of between 5 pp and 7 pp more than other firms, compared with their sector's average (see Chart A2.1.2). Lastly, notable heterogeneity is also detected within each sector and firm size bracket, as shown, for example, by the distribution of sales growth in the construction and accommodation and food service activities sectors for the microenterprises segment (see Chart A2.1.3).

To reflect this heterogeneity in turnover in 2020, and given that the change actually observed for each firm is unavailable, microsimulations are performed based on the bootstrapping technique. Specifically, 100 alternative simulations were performed with a random firm sales growth value consistent with the distribution of sales growth according to a series of percentiles provided by the AEAT for the firms in each sector and size bracket. Based on the simulation of the change in sales in 2020, the other items are obtained as detailed in Annex 1.

The introduction of intra-sectoral heterogeneity for each firm size bracket enables the tail risks associated with developments in firms' activity to be assessed more satisfactorily. In particular, this approach would be expected to produce more adverse results in terms of the percentage of vulnerable firms (e.g. firms with negative profitability or whose financial ratios surpass certain thresholds) than those obtained under an alternative estimation in which intra-sectoral homogeneity is assumed. The results shown in Table A2.1 confirm this hypothesis in the case of firms with a more vulnerable financing structure in 2020, deemed to be those firms whose ratio of net financial debt to ordinary earnings is greater than 10 or that have positive net financial debt and zero or negative earnings. In particular, the results of the bootstrapping exercise are compared with those produced by an alternative simulation obtained by maintaining the same assumptions, except for sales growth, which is assumed to be the same for all firms in the same sector and identical to the growth in this item for the aggregate of the firms in that sector. It is observed that, for the results of the median of the bootstrapping simulations, the percentage of vulnerable firms according to the indicator used is 2.8 pp higher than the case where intra-sectoral heterogeneity is not taken into account. The difference in 2021 increases to 5.7 pp and 6 pp under the more and less benign scenarios, respectively, whereas it declines in later years. Furthermore, the interquartile range, defined as the difference between the 25th and 75th percentiles of the results obtained in the 100 simulations, is relatively small. This suggests that the error of estimation associated with the fact that only the statistical distribution of the change in sales (and not the actual change in each firm's sales) is available is very small.

Chart A2.1

IMPACT OF COVID-19 ON FIRMS' REVENUE



SOURCES: Agencia Estatal de Administración Tributaria and Banco de España.

Table A2.2 shows the increase in the percentage of overindebted viable firms and in their share of employment and of debt as a result of the COVID-19 crisis. Once again, and based on the assumptions used, the median of the distribution of the results obtained for the various simulations of the bootstrapping exercise (which captures the intra-sectoral heterogeneity in activity) produces a more adverse result than that obtained when assuming homogeneous sales growth within each sector. While the interquartile range remains small, it is larger when considering overindebted viable firms' share of employment and of debt compared with the results obtained in terms of the percentage of firms in that category. This

Table A2.1

PERCENTAGE OF MORE VULNERABLE FIRMS ACCORDING TO THE RATIO OF NET FINANCIAL DEBT TO (GROSS OPERATING PROFIT + FINANCIAL REVENUE). DISTRIBUTION CALCULATED ON THE BASIS OF 100 MICROSIMULATIONS (%)

	More benign scenario				Less benign scenario			
	2020	2021	2022	2023	2020	2021	2022	2023
With bootstrapping								
25th percentile	33.00	31.43	25.61	21.53	33.00	32.78	28.24	23,13
50th percentile	33.05	31.49	25.67	21.56	33.05	32.85	28.30	23,17
75th percentile	33.12	31.56	25.73	21.59	33.12	32.91	28.35	23,21
Without bootstrapping	30.21	25.81	21.89	19.81	30.21	26.86	23.67	21,78

SOURCE: Banco de España.

Table A2.2

INCREASE CAUSED BY THE COVID-19 CRISIS IN THE PERCENTAGE OF OVERINDEBTED VIABLE FIRMS AND IN THEIR SHARE OF EMPLOYMENT AND OF DEBT. COMPARISON OF RESULTS

pp

	More benign scenario				Less benign scenario			
		With bootstrapping				With bootstrapping		
	Without bootstrapping	25th percentile	50th percentile	75th percentile	Without bootstrapping	25th percentile	50th percentile	75th percentile
Overindebted viable firms								
Increase in percentage of firms	1.47	2.95	2.96	2.98	2.29	4.69	4.71	4.74
Increase in share of employment	2.45	3.38	3.50	3.58	3.42	5.95	6.09	6.28
Increase in share of debt	1.83	2.64	2.78	2.98	2.35	3.66	3.86	4.08

SOURCE: Banco de España.

result, which could be due to some severe drops in the sales of firms with a high number of employees or particularly indebted firms, suggests that the approach used yields a somewhat bigger error when analysing the results in terms of vulnerable firms' share of employment and of debt compared with the error when the analysis focuses on the percentage of firms.

These results have two important implications. First, they show that the use of the bootstrapping methodology is a reasonable alternative for capturing intra-sectoral heterogeneity in firms' activity when only the distribution of sales growth (rather than the actual change therein for each firm) is available, especially when the variable of interest is the percentage of vulnerable firms. Second, the results show that ignoring this intra-sectoral heterogeneity leads to the corporate sector's financial vulnerability being underestimated.

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