Box 3.1
ASSESSING CREDIT RISK ON THE BASIS OF STOCK MARKET INFORMATION

Despite the sizeable downturn in economic activity over the last year, the NPL ratio in the banking sector's credit portfolios has yet to increase significantly (see Chapter 2). This is due mainly to the economic support measures implemented during the pandemic. Moreover, these measures are being extended selectively so that they are not withdrawn abruptly, which could lead to cliff effects for many firms and households. Nonetheless, it is important to investigate whether the economic downturn is causing a build up of risks that may materialise as credit losses in the near and medium term.

This box applies a methodology that is consistent with recent academic work assessing the impact of the COVID 19 crisis. This method enables an assessment of the probability of default (PD) of listed firms using the Merton model[1,2]. In this model, a firm's value is the sum of its debt and stock market capitalisation. Assuming the limited liability of its shareholders,

a firm will default when its value is less than the nominal value of the debt on its maturity date[3]. The resulting model estimates a firm's PD using a statistical formula that depends on debt, stock market capitalisation, expected growth and volatility of the stock market return on the share. Higher debt levels or greater volatility will tend to increase PD, whereas greater expected growth in the share price will tend to lower it.

This exercise focuses on firms listed on the STOXX Europe 600 Index (see sectoral breakdown in Chart 1). Consistent with previous papers that have used this methodology, these firms' long-term debt was chosen as the value of debt. Also in line with some previous academic papers, it was assumed that the expected stock market return would be equal to the real interest rate of three-year sovereign debt. Lastly, the volatility of the stock market returns was estimated using a

Chart 1
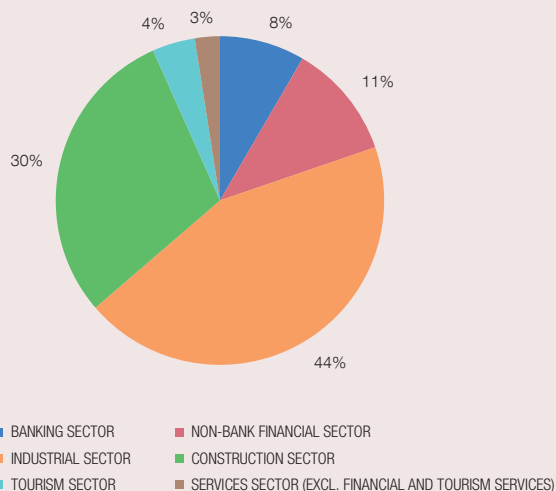SECTORAL DISTRIBUTION OF THE FIRMS ANALYSED (a)

- BANKING SECTOR
- NON-BANK FINANCIAL SECTOR
- INDUSTRIAL SECTOR
- CONSTRUCTION SECTOR
- TOURISM SECTOR
- SERVICES SECTOR (EXCL. FINANCIAL AND TOURISM SERVICES)

Chart 2
DISTRIBUTION OF IMPLIED PDs OF EUROPEAN FIRMS, 2007-2021. PERCENTILE RANGES AND AVERAGE (b)

- 25th PERCENTILE-75th PERCENTILE
- 10th PERCENTILE-90th PERCENTILE
- AVERAGE
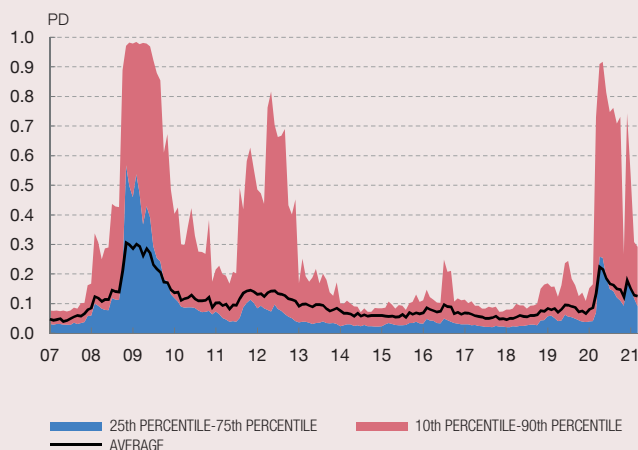
SOURCES: Refinitiv and Banco de España.

a Distribution by economic sector of the firms included in the exercise listed on the STOXX Europe 600 Index as at November 2020. The sample totals 479 firms with the available information required to perform the exercise's calculations.
b The vertical axis represents the implied PD. The black line shows the average distribution of PDs in each month and the blue and red shaded areas represent the range between the 25th and 75th percentiles and the 10th and 90th percentiles of that distribution, respectively.

---

1 See H. J. Reinders, D. Schoenmaker and M. A. Van Dijk (2020), "Is COVID-19 a threat to financial stability in Europe?" CEPR Discussion Paper DP14922. See also a prior application of the methodology in A. A. Dar and S. Qadir (2019), "Distance to default and probability of default: an experimental study", Journal of Global Entrepreneurship Research, 9, 32.
2 See R. C. Merton (1974), "On the Pricing of Corporate Debt: The Risk Structure of Interest Rates", Journal of Finance, Vol. 29, pp. 449-470.
3 The debt maturity parameter is calibrated in the model using an average empirical time to maturity of three years, consistent with Reinders et al. (2020), cited in footnote 1.

time series econometric model enabling the cyclical changes in this variable to be captured[4].

The results show that the implied PD of the firms underwent sizeable increases in 2020 after the outbreak of the pandemic (see Chart 2). Nonetheless, on average these increases were not of the magnitude of those in the 2009 global financial crisis. The riskiest firms (above the 90th percentile) have, however, shown very high PDs[5]. Most of the increase in these PDs occurred during the first wave of the pandemic. They fell gradually after that wave, until the third wave gave rise to a temporary surge. However, PDs have subsequently resumed their downward pattern, although they are yet to return to their pre-health crisis values.

Meanwhile, a characteristic of this crisis has been its much deeper adverse impact on certain economic sectors, such as tourism. For instance, PD in the tourism sector rose sharply during the first wave of the pandemic. This increase is more than twice as large as that observed during the global financial crisis (see Chart 3). The

worsening eased during the second wave, when several vaccines were approved, but it deteriorated again during the third wave. This reveals the sector's fragile position, which may constitute an important source of latent risk. The improved performance of stock prices in 2021 Q1 has moderated the increase in this sector's PDs to levels more comparable to, albeit still higher than, those of the global financial crisis. The increases in PD during the pandemic have also been significant for the banking sector. This may have reflected market expectations regarding the impact on the banking sector of credit impairment in the non-financial sectors. After the third wave, the increase in the banking sector's implied PDs has edged down significantly, although it still exceeds that in other sectors, except for the tourism sector. In these other sectors, such as the non bank financial sector, other services (excluding tourism) and the industrial sector, the situation appears to have returned to pre-crisis levels during the second wave and, despite some surges during the third wave, continued to rise moderately in 2021 Q1.

Chart 3
CHANGE IN IMPLIED PD OF EUROPEAN FIRMS BY SECTOR AFTER THE PANDEMIC AND IN THE GLOBAL FINANCIAL CRISIS (a)
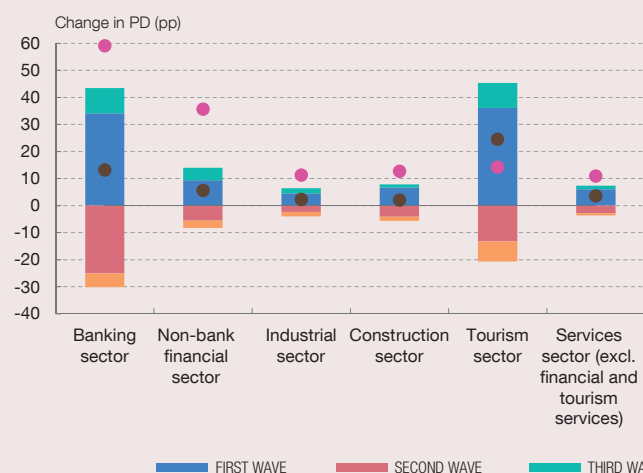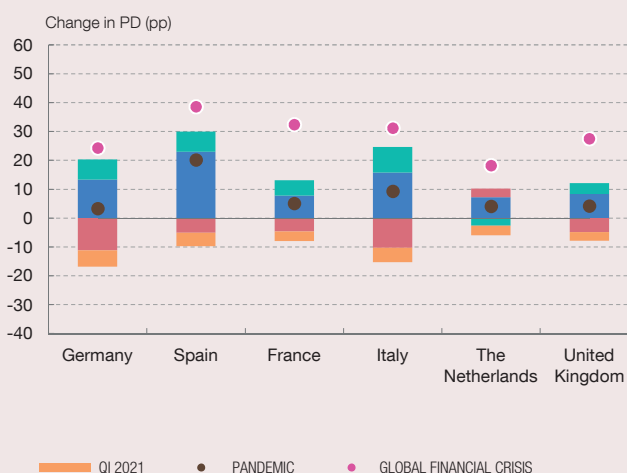

Chart 4
CHANGE IN IMPLIED PD OF EUROPEAN FIRMS BY COUNTRY AFTER THE PANDEMIC AND IN THE GLOBAL FINANCIAL CRISIS (a)

FIRST WAVE   SECOND WAVE   THIRD WAVE   QI 2021   ● PANDEMIC   ● GLOBAL FINANCIAL CRISIS

SOURCES: Refinitiv and Banco de España.

a Charts 3 and 4 depict the change in aggregate PD by sector in pp, after weighting the PD of each firm by its market value within the corresponding sector and country, respectively. The brown dot represents the change between the average pre-pandemic value (January-February 2020) and the value at end-2021 Q1. The stacked bars depict the change attributable to the first wave of the pandemic (March-May 2020), to the period between the first and second waves (June-November 2020), to the third wave (December 2020-February 2021) and to the period of 2021 Q1 after the third wave (February-March 2021). The pink dot represents the peak change in 2008-2009 with respect to the 2006-2007 average.

4   A GARCH model. See T. Bollerslev (1986), "Generalized Autoregressive Conditional Heteroskedasticity", Journal of Econometrics, Vol. 31, pp. 307-327.

5   The average stands above the 75th percentile due to the influence of the values at the upper end of the distribution (75th percentile–90th percentile).

Comparing the main European economies, Spanish and Italian firms were the hardest hit during the first wave of the pandemic (see Chart 4). There was a widespread recovery during the second wave, although it displayed cross-country heterogeneity. Conversely, PDs rose during the third wave (except for in the Netherlands). Improved stock prices in 2021 Q1 have generally moderated the implied increases in PDs, although they remain at higher levels in Spain and Italy. In any event, in all countries's PDs have worsened substantially less than during the global financial crisis.

To prevent a downturn in activity, the economic policy response to a sudden shock like the COVID-19 crisis cannot wait for risks that behave inertially, such as credit risks, to materialise. These market information based indicators are thus useful to steer possible economic policy response actions ahead of time.

However, using the indicators is also subject to caveats. Specifically, PDs depend on investors' valuations of firms via stock prices. For example, optimistic (pessimistic) valuations would result in lower (higher) estimates than the actual PDs. As stated in Chapter 1 and Box 1.1, there are some signs of overpricing in the financial markets, which could also result in sudden increases in the PDs estimated by investors in response to a worsening of their expectations for economic activity or the duration of the support measures. It is therefore advisable to use these models alongside the broadest possible regulatory and supervisory information. Lastly, it should also be borne in mind that listed firms are not necessarily representative of a country's overall productive system, in which smaller firms are of greater significance. In this connection, the results may represent a lower bound of the actual impacts.