The calm before the storm? Insolvencies during the COVID-19 pandemic

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We employ firm-level data on insolvencies from the Austrian insolvency register to document the incidence of insolvencies before and during the COVID-19 pandemic in Austria (January 2019 to March 2021). From the onset of the first national lockdown in March 2020, we observe 31% fewer insolvencies in 2020 than in 2019 and a marked deviation from previous levels, which is likely due to the multitude of government measures taken to contain the economic impact of the pandemic. We merge insolvency data with data from several other sources at the firm level to (1) deepen our descriptive analysis along several dimensions, such as region, sector classification, number of employees and equity capital, and to (2) analyze the loans of insolvent firms linked to Austrian banks. We find insolvencies to be below pre-crisis levels especially among smaller firms in sectors most hit by the crisis, and we also expect to see most future insolvencies in this group, although the further development of insolvencies will depend on possible changes to insolvency law, potential further government support measures and the size and speed of the economic recovery. With regard to financial stability, our results caution against directly associating firm insolvencies with bank losses; there are three reasons for this: (1) Less than 40% of firms turning insolvent have a loan above EUR 25,000 at Austrian banks, (2) a significant share of these loans is fully or at least partially secured and (3) nearly 30% of firms that turned insolvent were already marked as "defaulted" in banks' risk management twelve months before filing for insolvency. The crisis increased differences between particularly weak borrowers and those in better financial shape: While the former were more likely to file for insolvency, the latter were partly saved by government programs. More detailed firm-level data on policy measures are necessary to evaluate the effectiveness of the measures used and deliver guidance for future policies.

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The COVID-19 pandemic has had a significant impact on the financial situation of firms. However, these effects differ a lot among countries and economic sectors (ESRB, 2021b). Firms in the leisure industry, tourism and close-contact services have seen the largest losses, while others, such as local food suppliers, drugstores, online shops or suppliers of protective clothing gained economically. A recent IMF analysis suggests that without policy support, the share of illiquid firms would have more than doubled and that of insolvent firms would have almost doubled by end-2020 (IMF, 2021).

The COVID-19 crisis has affected businesses through various channels. The first channel is a direct one: workers and consumers get sick, become contagious, stay absent from work and refrain from consumption. The second channel is a

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result of government measures against the spread of coronavirus. Governments have imposed massive restrictions on citizens' private and economic lives. Many businesses have been forced to close for long periods of time. Even without these measures, people would have sought to avoid exposure to the virus, thereby reducing their demand for particular services. These changes in behavior raise uncertainty about firms' future cash flows and investment needs (see also Albacete et al., 2021, for effects on households).

Altogether these effects triggered by the pandemic amount to a huge negative shock and had a strong impact on companies' cash flows. Economic theory would suggest a strong increase in insolvencies, but as a matter of fact, during the COVID-19 pandemic fewer insolvencies occurred than before due to far-reaching government rescue programs. This does not mean that these insolvencies will not happen, however, and it remains unknown how insolvency statistics would have looked in a counterfactual situation without the multitude of government interventions.

Our contribution is a microdata-driven description of the insolvency dynamics of the last two years. By merging firm-level data with insolvencies, balance sheets and the AnaCredit credit register, we obtain deeper insights into structural changes from 2019 to 2020 and the differences between firms turning insolvent and those that do not. Our selection of firms (see section 1) and a unique combination of data sources form the basis for an effective and timely monitoring of insolvency events.

Firms may address their solvency problems by using cash buffers, adjusting working capital, new loans or new equity and/or by government support. Our data allow us to follow corporate debt dynamics. However, we would need granular data on the financial support from COFAG (COVID-19 Finanzierungsagentur des Bundes), the state-owned limited liability company through which support measures are organized and operationalized in Austria, in order to understand the effectiveness of policy measures and related risks to financial stability (see Brandner and Traumüller, 2020; see also section 1.1).

The remainder of the paper is structured as follows. Section 1 introduces the basic data we use, the data we combine them with, our definition of insolvency and the target population of firms (subsection 1.1). It also discusses data gaps which currently prevent serious policy evaluation and counterfactual estimation (subsection 1.2). Section 2 delivers the main stocktaking exercise of the paper, documents the insolvencies that occurred during the pandemic and compares them to the pre-crisis year 2019. Section 3 presents results for financial stability we obtain through linking insolvent firms to firm-level loan data and the Austrian banking system. Section 4 delivers a summary and conclusions.

1 Data

1.1 Data sources and definitions

We use the event-level data on insolvencies from the Austrian insolvency register[2]. The concept "insolvency" refers to a rather complex process, and there is no clear-cut definition of when a firm is considered insolvent. In Austria, there are several private associations engaged in creditor protection that gather and process data on

[2] *The Austrian insolvency register is published via the Ediktsdatei (legal notices database) website.*

Table 1

Data sources merged at individual firm level

Data source	Units	Reference time/period	Frequency
Insolvency data from the Austrian insolvency register	Events	2019–2021	Daily
OeNB Master Data (OBServ)	Firms	End-2018; 2019; 2020	3 points in time
Structural business statistics	Firms	End-2018	1 point in time
SABINA	Firms	End-2018	1 point in time
AnaCredit	Loans	2019–2020	Monthly

Source: OeNB.

insolvencies, such as Kreditschutzverband von 1870 (KSV 1870), Österreichischer Verband Creditreform (Creditreform), Alpenländischer Kreditorenverband (AKV) or Insolvenzschutzverband für Arbeitnehmerinnen/Arbeitnehmer (ISA). They all use data from the insolvency register, but also enrich these data with information on court cases and the use of other firm-level databases. Further, Statistics Austria has recently started to provide figures tracking insolvencies in Austria[3]. We combine several data sources which are briefly described in table 1.

In a first step, we merge the data from the insolvency register with an internal OeNB database on economically active units (OeNB Master Data – OBServ). Insolvencies of sole proprietorships sometimes show up as personal bankruptcies and are therefore difficult to unambiguously identify. Therefore we take a sectoral approach to be able to work with a well-defined set of firms, namely all entities registered in the Austrian business register without registered sole proprietorships. Note that in the other sectors there are also nonregistered entities, such as NGOs and public companies, which are excluded from our analysis.

We exclude the household sector from our analysis for several reasons: First, we are mainly interested in risks to financial stability channeled through non-performing loan risks for Austrian banks. The bulk of loan volumes are held by firms in the nonfinancial corporate sector and not sole proprietorships. Second, only for these registered entities can we identify a meaningful population of firms, which in turn allows us to define meaningful insolvency ratios, as with sole proprietorships and self-employed persons, it is practically and legally difficult to distinguish between business and private. Third, while sole proprietorships and the self-employed might be hit hardest by the crisis and are therefore likely the ones showing the largest increase in insolvencies once the impact of policy support measures fades out, they are typically those with the lowest loan volumes, which are additionally secured by private assets. Finally, we consider the nonfinancial corporate sector as the key driver of innovation and future growth. For these reasons, we define an insolvency according to the procedure laid out in box 1.

[3] *See http://www.statistik.at/web_de/statistiken/wirtschaft/unternehmen_arbeitsstaetten/unternehmensdemografie_ab_2015/index.html#index4.*

Box 1

How do we define insolvencies in this study?

In the data provided by the Austrian insolvency register, we find different events ("Verfahren") which each relate to a certain step toward an or within an insolvency proceeding.

In this study we take all events from the beginning of 2019 until March 2021 which refer to registered entities. We exclude all events related to the household sector (ESA 1400), sole proprietorships (including registered ones) and firms with a head office outside Austria (i.e. branches). Note that in the other sectors there are also nonregistered entities (such as NGOs and public companies) which are excluded from our analysis. An insolvency case in this study is defined by the occurrence of at least one of three events, namely

(1) bankruptcy proceedings have been initiated and/or
(2) reorganization proceedings have been initiated and/or
(3) insolvency proceedings have not been initiated due to a lack of sufficient assets to cover the costs.

The table below shows the detailed mapping from the data provided by the Austrian insolvency register to these three events matched to the OeNB Master Data (OBServ).

Table

Mapping insolvency data to OeNB Master Data

Insolvency data from the Austrian insolvency register				→	OeNB Master Data
Abbreviation	Full text	Category	Category content		Event
KV	Opening of bankruptcy	Opening		→	Bankruptcy initiated
SVME	Reorganization proceedings with self-administration	Opening		→	Reorganization initiated
SVOE	Reorganization proceedings without self-administration	Opening		→	Reorganization initiated
KV	Bankruptcy proceedings	Legal force	"Failure to open proceedings due to lack of cost-covering assets"	→	Not initiated due to lack of assets
KEV	Bankruptcy opening proceedings	Legal force	"Failure to open proceedings due to lack of cost-covering assets"	→	Not initiated due to lack of assets

Source: OeNB, OeNB Master Data (OBServ), Austrian insolvency register.

While the events "bankruptcy initiated" as well as "reorganization initiated" are unambiguously defined by a combination of two variables in the insolvency data from the Austrian insolvency register[4], the third one requires text mining of a third variable (category content). Events which refer to insolvency proceedings not initiated due to a lack of sufficient assets to cover the costs are identified by an additional text mining algorithm searching for specific related strings pointing toward such an event. An example is the string "Failure to open proceedings due to lack of cost-covering assets" ("Nichteröffnung mangels Kostendeckung").

During the insolvency process, the status of a firm may change between bankruptcy, reorganization and not initiated. Only the first event for each firm remains in our dataset and is counted as an insolvency case with the date when it occurred.

Note that we end up with a firm-level dataset in which all firms are included once if at least one of the three events occurred during the period we analyze (January 2019 to March 2021). This ensures that we do not double count firms. At the same time, some firms may have exited the insolvency process and still exist (e.g. because of successful reorganization) during the observation period but turn insolvent (i.e. show up as being affected by one of the three events) once more. We also count these firms only once on the basis of the first event.

[4] *Namely "Verfahrenskurztext" (abbreviation) and "Baustein-Name" (category).*

Table 2 shows the number of relevant events as well as the number of firms to which our definition applies as shown in the insolvency data of the Austrian insolvency register combined with the OeNB Master Data (OBServ). As expected, our numbers are markedly lower than those provided by other institutions. AKV reports 5,191 insolvencies of firms in 2019 and 3,175 in 2020, Creditreform reports 5,235 in 2019 and 3,063 in 2020, and KSV 1870 reports 5,018 in 2019 and 3,034 in 2020.[5] This difference is mostly due to our exclusion of firms belonging to the household sector, but also due to our restrictive approach based on head office location and, importantly, by preventing double counting by only allowing one event – also across the three different events we use – per firm for the whole time period. According to our definition, about 31.5% fewer firm-level insolvencies were recorded in 2020 compared to 2019. We see that the number of events is twice as high as the number of firms these events are related to. In 2019 and 2020, about two-thirds of the first firm-level events/events were initiated bankruptcies, less than 10% were initiated reorganizations and about a quarter were not initiated due to a lack of assets. For the remainder of this study, we do not distinguish between these three different events but consider the first firm-level event to be an insolvency case.

In the next step, we match our data at the firm level to three further data sources. The SABINA database comprises balance sheets reported under the national generally accepted accounting principles (GAAP) framework of a subset of our insolvency cases. Here, the latest available information is balance sheet data from 2018. We use these data for the equity capital ratios of firms which later (2019 to 2021) turned insolvent. Note that equity capital ratios compiled under national GAAP rules may differ from those observed in other economies with different reporting standards.

We also merge our data with data from the structural business statistics compiled by Statistics Austria to be able to include information on the number of employees of insolvent firms. These data refer to 2018 as well, and therefore the information is missing for a few firms we observe in 2020 and 2021.

Table 2

Events we relate to insolvencies and related firms

Year	Events/firms	Bankruptcy initiated		Reorganization initiated		Lack of assets		Total
		Number	% of yearly total	Number	% of yearly total	Number	% of yearly total	
2019	Events	3,034	68.1	305	6.8	1,117	25.1	4,456
2019	Firms (first event)	1,509	70.1	107	5.0	536	24.9	2,152
2020	Events	2,171	65.9	279	8.5	846	25.7	3,296
2020	Firms (first event)	976	66.4	129	8.8	364	24.8	1,469
2021	Events	401	68.1	43	7.3	145	24.6	589
2021	Firms (first event)	180	67.7	20	7.5	66	24.8	266

Source: OeNB, OeNB Master Data (OBServ), Austrian insolvency register.

[5] *AKV: https://www.akv.at/wp-content/uploads/AKV-Insolvenzstatistik-Gesamt-2020.pdf; Creditreform: https://www.creditreform.at/fileadmin/user_upload/Oesterreich/Downloads/Presse/Insolvenzstatistik_Oesterreich/2020/Insolvenztrends_2020.pdf; KSV 1870: https://www.ksv.at/KSV1870_Insolvenzstatistik_Unternehmen_2020_final.*

Finally, we merge our data with AnaCredit's granular credit data available to the OeNB. This is the key comparative advantage of our approach: we are able to directly link the loans of firms turning insolvent to Austrian banks and therefore are able to analyze the direct effects of these potential losses on banks (see section 3).

1.2 Caveats

There are three main caveats which should be considered when interpreting our analyses.

The first one results from our data selection procedure discussed in section 1.1. We exclude the household sector as well as all sole proprietorships and all non-registered entities from our analysis of insolvencies for the reasons discussed in section 1.1. However, this comes with a trade-off in that our figures do not represent all insolvency cases that refer to firms usually counted in other statistics presented by Statistics Austria and other insolvency statistics providers. While there exist other differences in definitions, this restriction is the one explaining most of the difference between our data and the statistics presented by other providers.

Secondly, to be able to get an idea of insolvency patterns regarding other firm-level variables, we have to merge the insolvency data as explained in section 1.1. For some of the data, such as number of employees, total assets or equity capital, the information we can merge is not contemporaneous with the time of the insolvency but can be rather outdated as it refers to the end of 2018. In some cases, other mergeable datasets are in principle available (such as social security data for the number of employees) but we have no access. In other cases, such as equity capital ratios, more recent data do not exist. On top of that, for some firms the data for employees or NACE sectors are missing, while equity capital data are missing for many firms because there is no obligation to report that information up to a certain firm size and due to other inclusion restrictions.

Thirdly and most importantly, we do not have access to firm-level data on the current government support measures. It would be crucial to know which insolvent (and solvent) firm got which form of government support, at what time and in what amount. These data would not only be needed for analyzing the implications for firms, banks and financial stability as a whole, but also for engaging in a serious estimation of the (relative) effects of policies and their (relative) effectiveness. They are also important for gauging potential market distortions and identifying those benefiting or losing out. Valid predictions of future insolvencies depend on this information, which, unfortunately, is not available.[6]

[6] *In OECD (2020) the authors perform an accounting exercise to simulate the consequences of the pandemic for leverage ratios and investment activity. Firm-level data on government support measures would facilitate more precise simulations.*

2 Insolvencies before and during the pandemic (2019 to 2021)

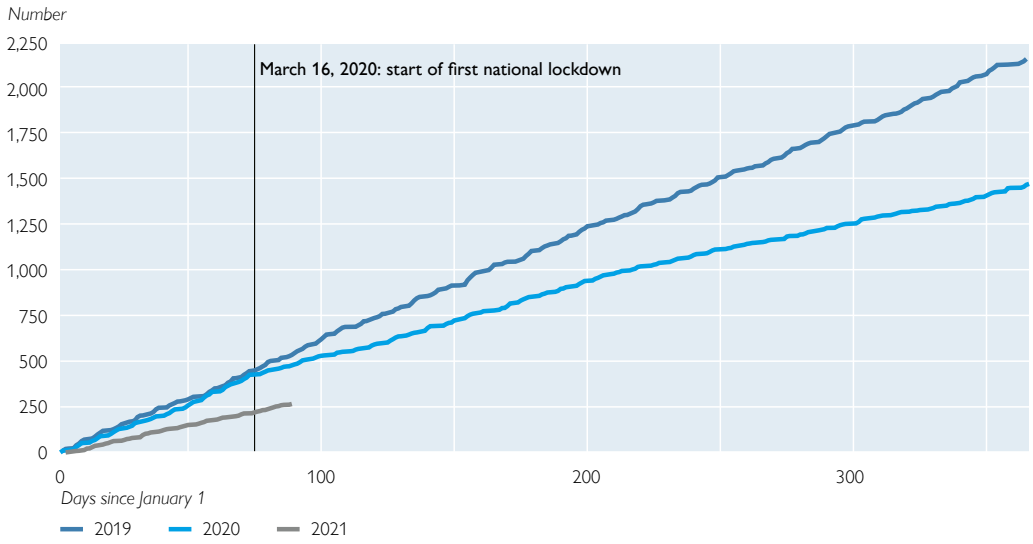
Chart 1 shows the yearly cumulated incidence of firm-level insolvencies as recorded on a day-by-day basis for the full time period. We can clearly see that since the first national lockdown starting in mid-March 2020, the insolvency numbers have been markedly lower than in the comparable pre-crisis period 2019, and the latest available data suggest that this trend continued in the first few months of 2021 (up to March 2021).

Note that the insolvency ratios implied – given our subset of firms – are about 0.83% for 2019 and 0.56% for 2020[7]. These numbers tie in with the somewhat higher insolvency ratios calculated by the private creditor protection firm Creditreform, which also include all sole proprietorships. Combining insolvency statistics from KSV and Statistics Austria with the total number of active firms provided by Statistics Austria's business demography statistics (roughly 550,000) also results in insolvency ratios of about 0.9% for 2019 and 0.5% for 2020[8]. Note however, that these are rather ad hoc figures as it is difficult to define and observe a correct target population of firms once sole proprietorships are included. As smaller firms seem to have slightly higher rates of insolvencies, it is expected that the figures are slightly lower for our subsample, which excludes sole proprietorships. Recent attempts to forecast insolvencies based on microdata of Creditreform (see Schwaiger, 2021) point toward potentially large numbers of insolvencies but still relatively low risks to financial stability.

Chart 1

Cumulated insolvencies in Austria

Sharp drop since first national lockdown



Source: Austrian insolvency register.

[7] *These figures exclude firms for which the economic sector is missing in the database. The figures including those firms are somewhat lower at about 0.6% for 2019 and 0.4% for 2020. As a large part of those might be economically inactive, the figures mentioned in the text are likely more economically interesting and reliable.*

[8] *See https://www.creditreform.at/presse/insolvenzstatistik-oesterreich.html for Creditreform figures; see https://www.ksv.at/insolvenzstatistik/insolvenzstatistik-2020-final for KSV figures; see http://www.statistik.at/web_de/statistiken/wirtschaft/unternehmen_arbeitsstaetten/unternehmensdemografie_ab_2015/index.html#index4 for Statics Austria figures.*

Table 3

Insolvencies by NACE sectors

NACE sector	2019		2020		2021		Change from 2019 to 2020	
	Number of insolvencies	Number of firms	Number of insolvencies	Number of firms	Number of insolvencies	Number of firms	Number of firms	2020 in % of 2019
		Thousand		*Thousand*		*Thousand*		
Wholesale and retail trade; repair of motor vehicles and motorcycles	433	46.4	255	45.7	42	44.4	–178	58.9
Construction	430	25.4	337	25.8	94	25.1	–93	78.4
Accommodation and food service activities	311	22.1	191	21.7	24	20.8	–120	61.4
Transportation and storage	205	10.1	114	9.9	14	9.3	–91	55.6
Professional, scientific and technical activities	186	42.6	132	43.9	25	44.0	–54	71
Administrative and support service activities	135	10.9	107	11.0	27	10.6	–28	79.3
Real estate activities	123	32.4	71	34.3	15	35.6	–52	57.7
Manufacturing	123	15.2	107	15.2	8	14.8	–16	87
Information and communication	88	12.3	60	12.6	6	12.6	–28	68.2
Arts, entertainment and recreation	38	5.4	26	5.5	2	5.6	–12	68.4
Other service activities	29	13.1	16	13.4	5	13.9	–13	55.2
Financial and insurance activities	20	10.6	25	10.5	0	0.0	5	125
Human health and social work activities	7	3.6	3	3.7	1	3.7	–4	42.9
Electricity, gas, steam and air conditioning supply	6	2.4	2	2.4	1	2.4	–4	33.3
Water supply, sewerage, waste management and remediation activities	6	2.8	2	2.9	1	2.9	–4	33.3
Education	5	3.8	10	3.9	1	3.9	5	200
No information available	7	–	11	–		–	–	–
Total	2,152		1,469		266			

Source: OeNB, OeNB Master Data (OBServ), Austrian insolvency register.

Table 3 shows insolvency statistics by NACE sectors. While our data allow an analysis down to the most detailed NACE 5 level, we only show NACE 1 levels here. Table 3 illustrates that in all sectors of a relevant size the trend of fewer insolvencies in 2020 compared to pre-crisis levels is evident. Especially in those sectors heavily hit by the crisis – and therefore heavily supported by the government – the drop in the number of insolvencies was particularly pronounced.

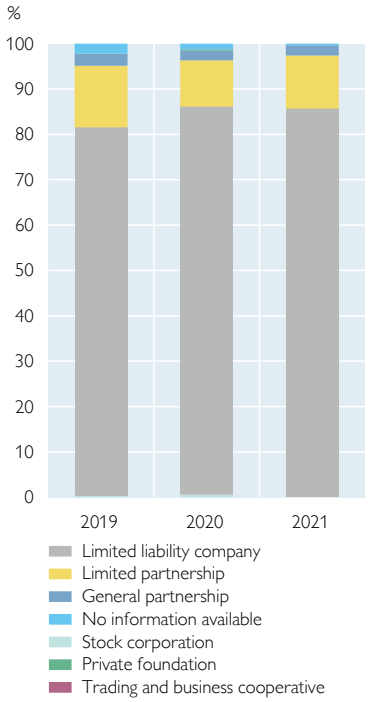
Almost all insolvencies in our data (which exclude the household sector) took place in the nonfinancial companies sector, and only in few cases are we not able to determine the economic sector of the insolvent entities.

Chart 2 shows insolvencies by firm type. More than 80% of insolvencies affected limited liability companies, followed by limited partnerships (10% to 14%). Again, for less than 2.5% of insolvencies (depending on the year) we are not able to determine the type of the insolvent entity.

Chart 3 shows insolvencies by number of employees. While the share of entities for which no information on the number of employees is available increases over time (as the data merged are from the end of 2018), it seems that the share of firms with fewer employees has decreased since the beginning of the pandemic (see left-hand panel). Note also that generally, the share of firms with fewer employees is somewhat lower among insolvent firms than among solvent ones.

Chart 2

Insolvency cases by firm type



Source: OeNB, OeNB Master Data (OBServ), Austrian insolvency register.

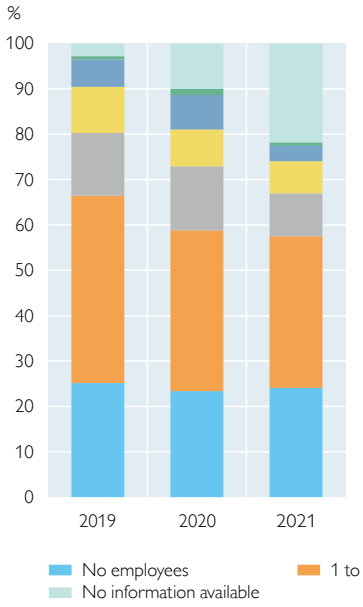
Figure 1 shows insolvencies in 2020 as a percentage of 2019 insolvencies across Austrian provinces. In all provinces, there were fewer insolvencies in 2020 than in 2019, with particularly low numbers – about 62% to 63% – in Lower Austria and Salzburg and the largest number – about 83% – in Carinthia. Lower insolvency ratios are therefore not a regional phenomenon but observed in all nine Austrian provinces.

Chart 4 shows insolvencies by equity ratio as measured in the SABINA database at the end of 2018 for those firms for which such information is available. While for 2019, we do not have this information for 77% of the firms, this share of firms is only about 40% for 2020 and 38% for 2021. Note that missingness is partly due to the fact that not all companies have to report the specific information needed. In general, only corporations and limited liability companies or limited partnerships

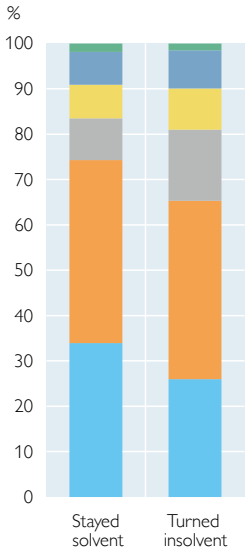
Chart 3

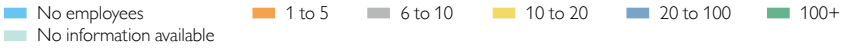
Insolvencies by number of employees

Insolvency cases by number of employees



Solvent vs. insolvent firms by number of employees in 2020

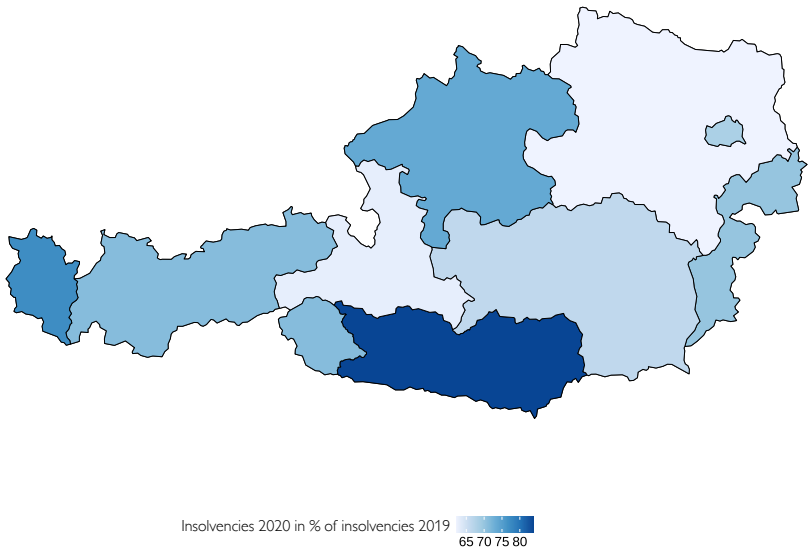




Source: OeNB, OeNB Master Data (OBServ), Austrian insolvency register, SABINA 2018.

Figure 1

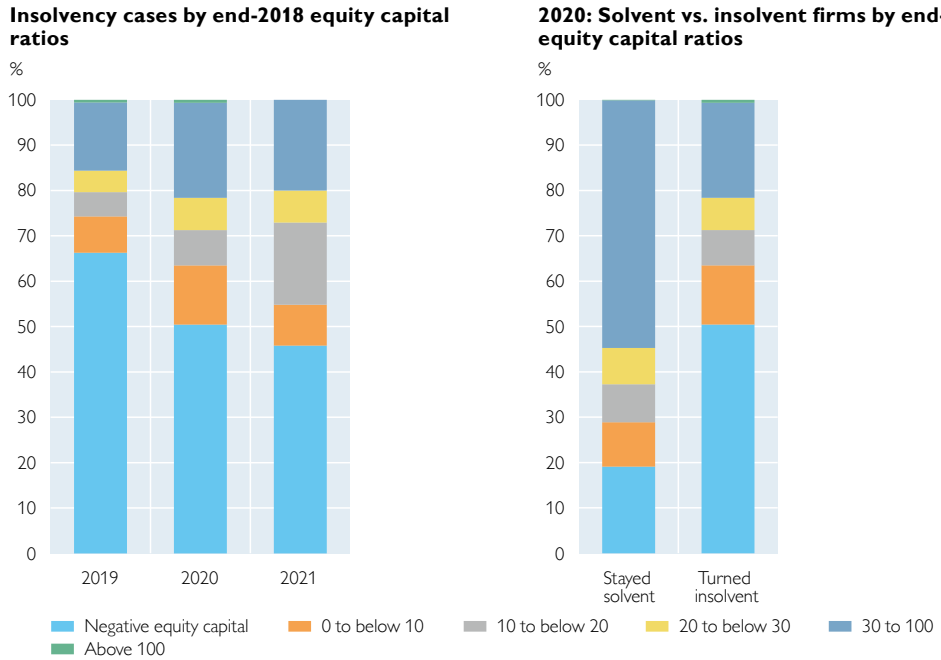
Change in insolvencies between 2019 and 2020 by provinces



Source: Austrian insolvency register.

Chart 4

Insolvencies by equity capital ratios



Source: OeNB, OeNB Master Data (OBServ), Austrian insolvency register, SABINA 2018.

(GmbH and KG) are obliged to submit their annual financial statements to the commercial register. Furthermore, the scope of disclosure depends on firm size and legal form.[9] However, it can be clearly seen that more than half of the insolvent

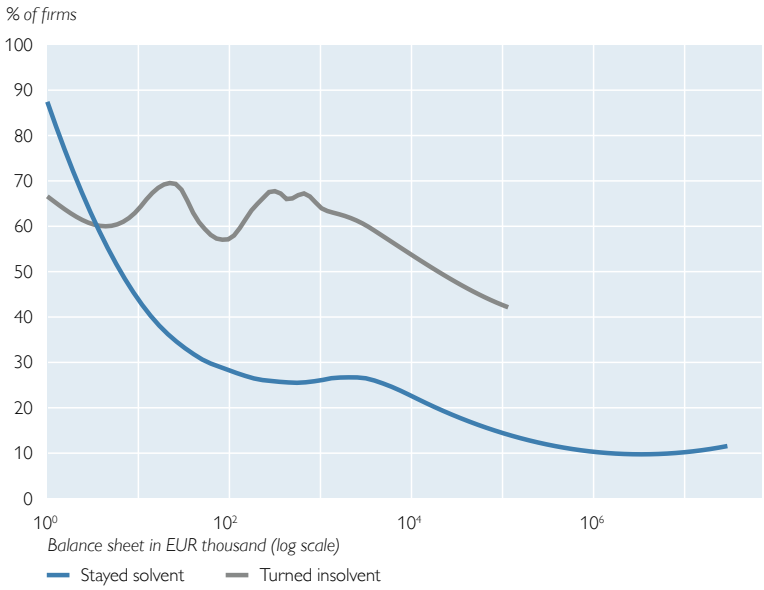
[9] *According to Articles 277 and 221 Austrian Commercial Code.*

firms already showed negative equity capital[10] for the year 2018 and more than 70% had negative equity capital or equity capital ratios below 20%. In short, most insolvent firms already showed low equity capital long before the pandemic and were already particularly vulnerable to shocks (see left-hand panel of chart 4). Again, the right-hand panel compares insolvent firms in 2020 to solvent firms. Those firms which turned insolvent in 2020 (right bar in right-hand panel, middle bar in left-hand panel) showed far lower values in equity capital already at the end of 2018 compared to the set of solvent firms.

This finding is also confirmed across balance sheet size. Chart 5 shows the share of solvent and insolvent firms along the balance sheet distribution in 2020 that had an equity capital ratio below 8% at the end of 2018. Among firms with a balance sheet total of more than EUR 50,000, a markedly larger share of firms with an equity capital ratio below 8% turned insolvent.

Chart 5

Share of firms with an equity capital ratio below 8%



Source: Austrian insolvency register, SABINA.

3 Implications for financial stability

Merging these data on insolvencies with our firm-level loan data (AnaCredit) provides us with the unique opportunity to explore the potential consequences of current and future insolvency developments for financial stability. For this purpose, we restrict the dataset to nonfinancial corporations[11] and merge the data with the AnaCredit loan dataset that contains reports of all loans issued by Austrian banks above EUR 25,000. As AnaCredit has only been available since March 2019, we set our comparison period to the year 2020 from March 2019 to March 2020. We thereby ensure that the comparison covers a pre-lockdown period, but at the disadvantage of a slight overlap of samples (an insolvency in the first quarter of 2020 enters both datasets).

First, we find that the share of firms turning insolvent while having a loan above the materiality threshold of EUR 25,000 with an Austrian bank is surprisingly small. Only 39.9% of firms turning insolvent in the course of 2020 had a loan above the materiality threshold at the beginning of the year. During our comparison period (March 2019 to March 2020), this share is not substantially different at 36.8%. These figures suggest that most firms turning insolvent only have liabilities vis-à-vis tax authorities, social security institutions, suppliers and other creditors

[10] *Based on a positive business continuity forecast ("Fortbestehensprognose"), a firm may continue operations despite negative equity.*

[11] *We exclude firms from the NACE sectors financial and insurance activities (64–66), public administration and defense; compulsory social security (84) and extra-territorial organizations and bodies (99). Note that households are already excluded from the set in the whole paper.*

and none to banks (above the materiality threshold of EUR 25,000). This is one reason why we caution against associating insolvency events directly with bank losses. Banks' total exposure affected by insolvencies dropped from EUR 530 million in our comparison period to EUR 499 million in 2020, i.e. less than the decline in the number of insolvencies of firms with a loan at an Austrian bank (750 to 569).[12] Against these EUR 499 million of exposure toward firms filing for insolvency, banks had booked EUR 90 million in loan loss provisions and held EUR 116 million of collateral (banks' internal estimates).

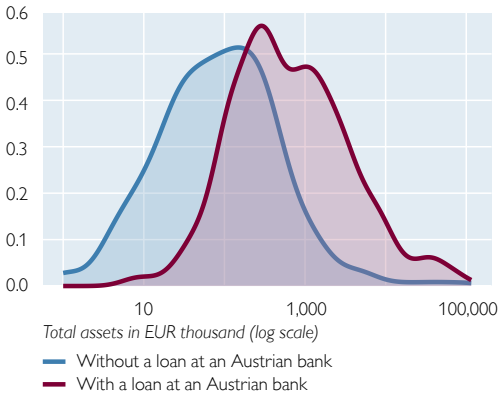
Which firms in our sample have a loan at an Austrian bank? We suspect that larger firms – measured by total assets – also tend to rely on financing through bank loans. Indeed, as chart 6 shows, those firms that file for insolvency but do not show up in our credit data are on average much smaller firms.

Chart 7 contrasts those firms that had loans and turned insolvent in 2020 with those that did not. In the left-hand panel, we see a substantial difference in the sum of exposures[13]. Firms turning insolvent are strongly overrepresented in smaller loans (up to EUR 50,000), and less so in loans up to EUR 130,000; in loans larger than that, these firms are underrepresented. Again, we see the credit selection mechanism of banks at work. In the right-hand panel of chart 7, we see the distribution over collateral levels. If the banks' internal value of collateral associated with the exposure is >90% of the outstanding amount, we classify the loan as "secured;" the rest of the classification looks like this: internal collateral values >50% – "mostly secured," >10% – "partly secured," and ≤10% – "unsecured." Compared to customers that stayed solvent, we see that insolvent firms tend to have less exposure that is either secured or unsecured, i.e. at the far ends. Naturally, banks are unwilling to lend to risky customers without security, and, on the other hand, firms in financial trouble struggle to provide collateral on par with their obligations, resulting in the distribution we see above.

Chart 6

Density of total assets

Of firms filing for insolvency in 2020



Source: OeNB, AnaCredit.

On both accounts, i.e. the distribution over the size of the loans and their collateral values, we see no noteworthy shift between firms turning insolvent until March 2020 and in the course of 2020.

Another interesting observation we can make from our merged data is the distribution of ratings prior to a firm turning insolvent. For financial stability,

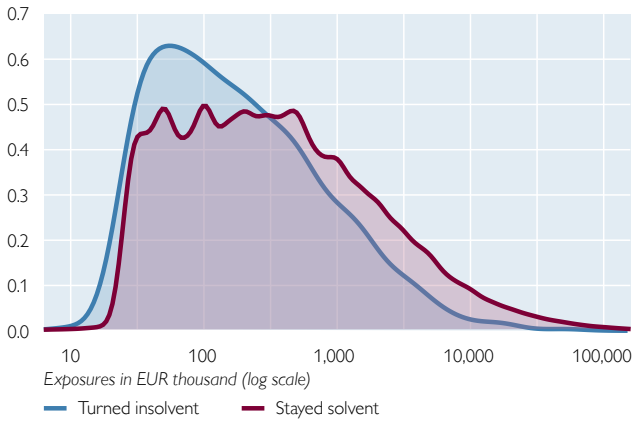
[12] *For reference, EUR 499 million is about 0.05% of the Austrian consolidated total assets of the Austrian banking system (i.e. including foreign subsidiaries) or 0.6% of the consolidated CET1 capital. If the whole amount were performing at end-2019 and nonperforming at end-2020, the NPL ratio in Austria would increase from 1.73% (Q4 2019) to 1.86% in total and from 2.5% to 2.85% if we consider only lending to nonfinancial corporations. Tables A1 and A2 in the annex provide more detailed statistics about the size of loans and ratings of firms that turned insolvent in 2020 and 2019.*

[13] *We aggregate all liabilities of a firm toward one bank and refer henceforth to this sum of exposures of one firm to one bank as its "loan", although it can be composed of several contracts.*

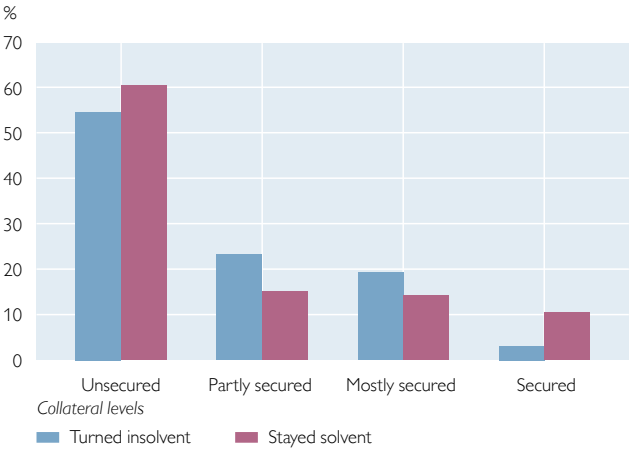
Chart 7

Comparison of exposures and levels of collateral

Density of exposures – exposures to firms that turn insolvent are often lower



Distribution over collateral levels – exposures are often "partly" or "mostly secured"



Source: OeNB, AnaCredit.

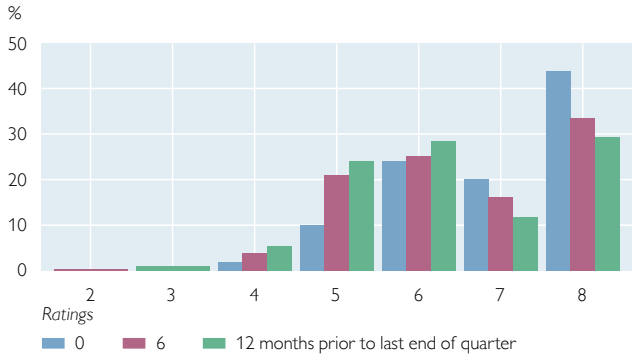
the early identification of problematic bank customers and bad loans is important: it helps avoid losses and spreads those losses that occur over longer periods, thus smoothening their impact. Our data allow to assess whether the crisis of 2020 has decreased or increased the ability of banks to anticipate insolvencies. Some early considerations suggest the hypothesis that this ability may have declined: (1) a large economic shock such as the pandemic may have driven otherwise financially sound customers into insolvency and (2) debt moratoria may have clouded banks' ability to anticipate losses as they render one of their predictors – the days-past-due counter – inoperative.

To collect ratings up to a year before insolvency, and for the purpose of comparison also for those filing for insolvency in 2019, we draw on another micro loan dataset, the central credit register, which predated AnaCredit. As the central credit register has a different reporting threshold, we need to filter AnaCredit data for the common reporting threshold of EUR 350,000.

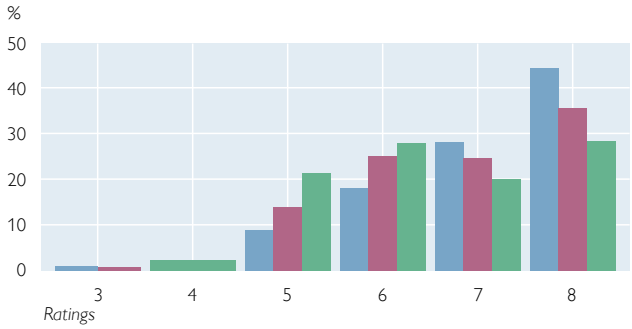
Chart 8

Distributions of ratings of firms that filed for insolvency in 2019 and 2020

2019



2020



Source: OeNB, AnaCredit.

Chart 8 displays the distribution of ratings of those firms that turned insolvent in 2019 (left-hand panel) and 2020 (right-hand panel) at three different points in time: "0" means at the last end of quarter before entering insolvency, "6" and "12" mean six and twelve months, respectively, prior to the last end of quarter before entering insolvency. The x-axis displays a time-invariant rating scale that maps banks' internal probabilities of default (PDs)[14].

Interestingly, between 28% and 30% of firms are already in default status (equal to rating 8) twelve months before turning insolvent. Note that default is either "unlikely to pay" or "90 days past due" (according to Article 178 Capital Requirements Regulation). Insolvency is a trigger for "unlikely to pay" but banks are required to use earlier indicators to anticipate insolvencies among their borrowers, and, in fact, do so (as shown in chart 8).

As firms are given two months to file for insolvency after turning illiquid or overindebted[15], it is not surprising that close to 50% are already in default at the last end of quarter before filing for insolvency. The phenomenon that insolvencies are a lagging rather than a leading indicator of defaults is even stronger when one considers exposure-weighted figures instead of numbers of firms as in chart 8. Over 50% of the exposure to firms which turned insolvent within the next quarter are already booked at default status at Austrian banks. One year ahead of the insolvency event, almost 40% of the exposure is in default. Yet not all cases of insolvencies are detected before their filing. Surprisingly, around 25% of firms even have ratings as low as 5, associated with a PD of 0.95%, one year prior to filing for insolvency. This share drops to 8% to 10% one quarter before insolvency.

Both in 2019 and 2020 we observe the expected shift toward worse ratings at time points closer to insolvency, but comparing the two panels, we see that the anticipation of insolvencies was better for the 2020 insolvencies, as the rating distribution shifted to the right. To quantify the different levels of anticipation, we compute the receiver operating characteristic (ROC), a measure of the predictive power of a binary classifier system. The ROC curve is created by plotting the true positive rate (correctly identified insolvencies) against the false positive rate (incorrectly identified insolvencies) at various thresholds corresponding to ratings in our case[16]. First developed and applied by electrical engineers, the ROC is now widely applied in the field of medicine (e.g. to describe the accuracy of a diagnosis) but also in the field of rating model validation and development to describe their predictive power.[17]

By computing the ROC of two years with regard to insolvencies, we measure if the insolvencies of 2020 were indeed better predicted than those of 2019.

[14] *For the purpose of this article we map each customer to a suitable rating scale consisting of seven nondefaulted and one defaulted rating classes. The central PDs for each class are (1) 0.004% (2) 0.016% (3) 0.063% (4) 0.251% (5) 0.951% (6) 3.284% (7) 9.750% and (8) 100%.*

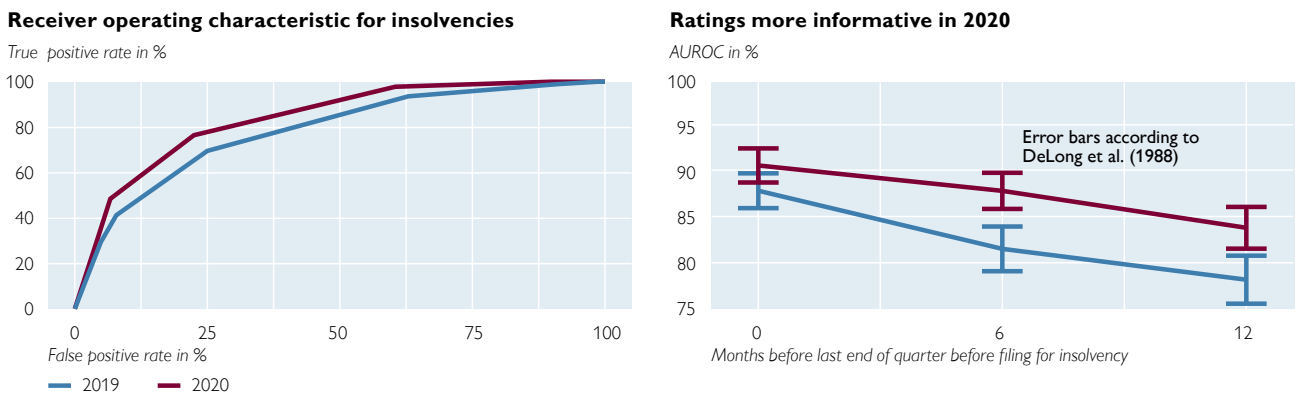
[15] *See the Austrian Insolvency Act (Bundesgesetz über das Insolvenzverfahren), Article 69 (2), and Article 66 on illiquidity and Article 67 on overindebtedness.*

[16] *After a year of pandemic reporting one may also know the true positive rate to be "sensitivity" and the false positive rate to be "1-specificity".*

[17] *Note that rating models are built to predict the status of "default," which also covers (but is not limited to) insolvencies. As described in the next paragraph, we do not want to judge the predictive power of banks' models but gauge how foreseeable insolvencies were in 2019 and 2020.*

Chart 9

Accuracy in prediction twelve months ahead (left) and over various time horizons (right)



Source: Authors' calculations, AnaCredit.

Note: AUROC 2020: 84%; AUROC 2019: 78%; AUROC Comparision Test according to Venkatraman (2000); p-value (H0: equal AUC): 0.138%.

The left-hand panel of chart 9 plots the ROCs for the two years where we use ratings twelve months prior to the last end of quarter before the firm filed for insolvency. The measure of the predictive power of banks' ratings are the areas under the curves. A value of 84% in 2020 and of only 78% in 2019 suggests that the insolvencies of 2020 were indeed better predicted. We employ the test of Venkatraman (2000), testing the null hypothesis of equal predictive power of two ROC. We obtain a p-value of 0.138%, thus reject the null and conclude that this difference is statistically significant. Also, a comparison at different prediction horizons (0 and 6 months prior to the last end of quarter) as depicted in the right-hand panel of chart 9 confirms this conclusion.

There is no reason to believe that there have been substantial improvements in the predictive power of banks' models from one year to the next and therefore we attribute this shift to the markedly different insolvency developments of 2020 compared to previous years. We interpret the finding as follows: In 2020, government measures (or other effects) helped medium-rated firms survive which otherwise – without the crisis and policy measures – would have filed for insolvency. At the same time, the crisis led to increased insolvency events among firms with the riskiest ratings (rating 7), probably as those companies were deemed noneligible for government rescue programs and too risky (especially in a crisis environment) for further bank funding. The crisis thus increased differences between particularly weak firms, which had to file for insolvency, and those in better financial condition, which were partly saved by government programs. This means, in turn, that there will be a backlog of insolvencies, especially in the medium to risky portfolio, and that defaults will increase in 2021 among firms in these rating classes (5 to 6) once rescue measures are lifted. As some insolvencies are likely to be prevented beyond 2021 and these rating classes generally do not show a high default ratio, it is unlikely that the dissolution of the backlog, and the increase in defaults resulting thereof, will be of systemic size.

4 Summary and conclusions

We employ data from the Austrian insolvency register to analyze how the number of insolvencies evolved before and after the onset of the COVID-19 pandemic. We exclude sole proprietorships, which are part of the household sector. The remaining insolvencies mainly affected limited liability companies and limited partnerships in the nonfinancial corporate sector, which is particularly important to financial stability. This confinement allows us to meaningfully combine insolvency data with data from other sources to enrich our data with further firm-level information.

We find that since the start of the first national lockdown in mid-March 2020, the number of insolvencies has decreased markedly, which is likely due to government measures taken to cushion the economic impact of the pandemic. This decrease can be found across almost all NACE sectors but is especially pronounced in sectors hit strongly by the crisis, which also received the most government support, such as retail trade and accommodation and food services. We find some evidence that the share of insolvent firms with fewer employees has decreased since the beginning of the pandemic, which points to a stronger insolvency-dampening effect for smaller firms. Regional variation at the province level is limited – in all provinces, the insolvencies recorded in 2020 were between 62% and 84% of those seen in 2019. Available equity ratios show that most firms that turned insolvent between March 2020 and March 2021 had operated under low equity capital long before the pandemic and had thus already been vulnerable to shocks. More than half of the insolvent firms already showed negative equity capital in 2018, and more than 70% had negative equity capital or equity capital ratios below 20%. This finding is also confirmed across balance sheet size. Among firms with a balance sheet total of more than EUR 50,000, a markedly larger share of firms with an equity capital ratio below 8% (already in 2018) turned insolvent.

Combining the data with loan-level information, we document that caution is warranted when directly associating insolvency events with bank losses for the following three reasons: (1) less than 40% of firms turning insolvent have loans above EUR 25,000 at Austrian banks, (2) a significant share of these loans is fully or at least partially secured and (3) nearly 30% of firms turning insolvent were already marked as "defaulted" in banks' risk management twelve months before filing for insolvency. However, for quite a substantial fraction of firms, filing for insolvency is the default trigger at banks and probably also reduces recoveries and collateral realizations.

Analyzing changes in the predictive power of ratings, we find that the crisis increased predictive power as it increased the difference between particularly weak borrowers, who filed for insolvency more frequently, and those in better financial condition, who were partly saved by government programs. Finding out whether these firms will default at a later stage would be of utmost importance, but given the available data, this issue is beyond the scope of this paper. However, some of our findings suggest that the threat to financial stability arising from insolvencies is limited at least for the second half of 2021. Insolvency numbers have remained low up to now, and further support measures are being discussed or already in place. We also found evidence that the potential lag in insolvencies seems to be most prevalent among smaller firms. Finally, the finding that only a relatively low share (less than 40%) of firms have loans (above EUR 25,000) at Austrian banks points toward the fact that there is no one-to-one direct link between insolvencies and bank losses. Recent research by the Bank for International Settle-

ments also suggests that the additional availability of loans to firms may have led to a potentially longer delay of insolvencies but at the same time to markedly lower earnings-to-debt ratios (Banerjee et al., 2021). Firm-level data on the government support measures, which are available but not accessible at this point, are a necessary precondition for gaining an – urgently needed – deeper understanding of the future risks to financial stability through the impact of the crisis on firm insolvencies and related bank loans.

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Annex

Table A1

Firm types across economic sectors

Name	German (original or translation)	Non-financial corporations	Financial corporations	General government	Households	Nonprofit institutions serving households
Limited liability company	Gesellschaft mit beschränkter Haftung	Yes	Yes	Yes		Yes
Limited partnership	Kommanditgesellschaft	Yes	Yes	Yes		Yes
Sole proprietorship	Einzelunternehmer				Yes	
General partnership	Offene Gesellschaft	Yes	Yes	Yes		Yes
Private foundation	Privatstiftung		Yes	Yes		Yes
Trading and business cooperative	Erwerbs- und Wirtschaftsgenossenschaft	Yes	Yes		Excluded	Yes
Stock corporation	Aktiengesellschaft	Yes	Yes	Yes	area	
Savings bank	Sparkasse		Yes			
Other legal entity	Sonstiger Rechtsträger	Yes	Yes	Yes		
Mutual insurance company	Versicherungsverein auf Gegenseitigkeit		Yes			
European Economic Interest Grouping	Europäische wirtschaftliche Interessen-vereinigung	Yes				
European Cooperative Society	Europäische Genossenschaft	Yes				
Societas Europaea	Societas Europaea	Yes	Yes			

Source: OeNB.

Note: The highlighted area, namely sole proprietorships as well as the household sector, is excluded from our analysis. Note that while in principle all other firms are theoretically included almost all insolvencies recorded affect limited liability companies or limited partnerships in the nonfinancial corporations sector.

Table A2

Descriptive statistics by firm characteristics – firms filing for insolvency from March 2019 to March 2020

Indicator	Category	Share of firms with bank[2] liabilities > EUR 25,000	Mean number of bank connections[1]	Median loan size[1,3]	Mean loan size[1,3]	Share of firms with a default rating at end-March 2019[1]
		% of all firms entering insolvency in 2019	*Number*	*EUR thousand*	*EUR thousand*	*% of all firms with a bank liability > EUR 25,000*
Number of employees	0	23	1.20	120.95	496.17	38
	1 to 5	34	1.23	88.42	335.32	35
	6 to 10	47	1.29	87.39	223.82	19
	10 to 20	55	1.40	153.64	447.65	29
	20 to 100	66	1.72	321.67	1,167.45	23
	100+	50	4.25	832.87	1,714.05	34
	No information	5	1.00	47.52	47.52	0
NACE sectors	Construction	35	1.36	110.31	397.08	20
	Administrative and support service activities	34	1.32	103.89	469.08	20
	Real estate, renting and business activities	41	1.20	475.74	841.06	47
	Information and communication	32	1.16	161.90	346.39	22
	Transportation and storage	37	1.39	79.38	169.43	22
	Wholesale and retail trade; repair of vehicles	40	1.36	126.20	477.42	38
	Manufacturing	58	1.75	334.17	1,334.20	39
	Professional, scientific and technical activities	32	1.35	116.45	539.45	26
	Hotels and restaurants	31	1.16	76.32	163.49	28
	Other service activities	42	1.18	70.00	100.80	38
	Education	43	1.33	156.47	492.71	25
	Arts, entertainment and recreation	24	1.00	105.08	502.75	30
	Water supply	17	2.00	342.37	342.37	100
	Health and social work	60	1.33	334.45	322.57	0
	Electricity, gas, etc.	50	1.00	156.46	156.46	100
Equity ratios	Negative equity	52	1.32	171.33	396.91	30
	0 to below 10	68	1.42	300.00	996.52	10
	10 to below 20	55	1.63	483.89	832.47	8
	20 to below 30	46	1.35	62.26	317.44	0
	30 to and including 100	20	1.33	80.44	711.57	17
	Over 100	0	-	-	-	-
Regions	No information	31	1.34	93.36	504.43	36
	Lower Austria	43	1.41	119.06	424.72	32
	Styria	46	1.60	185.00	893.00	40
	Vienna	26	1.23	82.73	466.56	24
	Salzburg	44	1.43	100.32	590.37	36
	Tyrol	37	1.37	131.55	375.57	15
	Upper Austria	51	1.35	161.41	398.16	31
	Carinthia	53	1.18	139.55	389.61	36
	Burgenland	35	1.25	155.00	268.09	9
	Vorarlberg	30	1.38	227.18	1,172.58	12

Source: OeNB, OeNB Master Data (OBServ), AnaCredit.

[1] *Conditional on having bank liabilities above EUR 25,000.*
[2] *Bank liabilities with at least one Austrian bank.*
[3] *Loans are defined here as the sum over all bank liabilities one firm has with one bank.*

Table A3

Descriptive statistics by firm characteristics 2020

Indicator	Category	Share of firms with bank[2] liabilities > EUR 25,000	Mean number of bank connections[1]	Median loan size[1,3]	Mean loan size[1,3]	Share of firms with a default rating at end-2019[1]
		% of all firms entering insolvency in 2020	*Number*	*EUR thousand*	*EUR thousand*	*% of all firms with a bank liability > EUR 25,000*
Number of employees	0	23	1.16	147.52	936.39	60
	1 to 5	38	1.18	90.96	316.91	34
	6 to 10	57	1.35	141.18	412.73	26
	10 to 20	63	1.35	180.00	470.33	21
	20 to 100	72	1.49	336.91	830.41	12
	100+	70	2.00	1,375.12	4,661.33	36
	No information	15	1.05	78.80	352.92	0
NACE sectors	Administrative and support service activities	35	1.19	125.14	460.53	12
	Construction	39	1.36	102.51	454.63	18
	Real estate, renting and business activities	39	1.21	595.79	1,873.72	61
	Wholesale and retail trade; repair of vehicles	46	1.32	150.00	578.58	33
	Manufacturing	63	1.51	383.06	1,660.62	38
	Transportation and storage	35	1.38	56.59	221.42	20
	Information and communication	36	1.19	208.54	265.19	32
	Professional, scientific and technical activities	33	1.16	218.24	514.63	42
	Hotels and restaurants	33	1.06	72.20	238.70	28
	Other service activities	31	1.40	95.82	200.07	14
	Education	50	1.20	113.55	358.27	33
	Arts, entertainment and recreation	35	1.00	100.81	411.95	14
	Health and social work	67	1.00	1,484.52	1,484.52	50
	Electricity, gas, etc.	50	1.00	411.42	411.42	100
	Negative equity	48	1.25	166.35	630.53	37
Equity ratios	0 to below 10	65	1.41	313.30	1,139.39	17
	10 to below 20	71	1.39	128.52	588.60	16
	20 to below 30	54	1.45	204.35	400.92	10
	30 to and including 100	32	1.29	129.88	444.27	20
	Over 100	0	–	–	–	–
	No information	26	1.23	98.62	695.37	38
Regions	Vienna	24	1.26	86.98	401.51	20
	Burgenland	45	1.12	484.70	1,619.19	29
	Styria	57	1.42	154.91	503.22	30
	Lower Austria	50	1.23	107.55	411.89	26
	Vorarlberg	44	2.06	394.54	1,873.43	28
	Tyrol	48	1.37	200.79	542.38	27
	Salzburg	51	1.18	153.39	869.32	34
	Upper Austria	53	1.27	235.74	1,183.66	43
	Carinthia	54	1.18	208.64	370.22	36
	No information	33	1.00	208.02	439.35	67

Source: OeNB, OeNB Master Data (OBServ), AnaCredit.

[1] *Conditional on having bank liabilities above EUR 25,000.*
[2] *Bank liabilities with at least one Austrian bank.*
[3] *Loans are defined here as the sum over all bank liabilities one firm has with one bank.*