Financial vulnerabilities and debt at risk of CESEE borrowers: a cross-country analysis

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We employ OeNB Euro Survey data to provide an assessment of the financial vulnerability of indebted households in nine Central, Eastern and Southeastern European (CESEE) economies for the first two years of the COVID-19 pandemic (2020 and 2021). Given the considerable exposure of Austrian banking subsidiaries in this region, it is of crucial policy relevance to swiftly identify potential risks stemming from household debt. Against this background, we calculate debt at risk, i.e. the outstanding debt held by financially vulnerable households as a share of overall outstanding household debt in each country, including nonbank debt. To determine which indebted households are vulnerable, we calculate five different indicators of financial vulnerability commonly used in the literature and combine them into one vulnerability index. Using our vulnerability index, we observe considerable heterogeneity across countries with respect to the debt-at-risk level. In six out of nine countries, vulnerable borrowers hold an overproportionate share of debt. Given the ongoing surge in consumer prices and rising interest rates, constant and in-depth monitoring of credit risks is crucially important.

The Austrian banking sector is traditionally tightly linked to Central, Eastern and Southeastern Europe (CESEE). At end-2021, the exposure of Austrian subsidiaries to the region as a whole amounted to EUR 277 billion, which corresponds to two-thirds of all foreign claims (Bank for International Settlements) or 24% of all Austrian banking system assets (see box 1). From a financial stability perspective, these strong interlinkages require in-depth surveillance of CESEE financial institutions. This is especially true against the background of the COVID-19 pandemic, which has decisively influenced economic developments since the beginning of 2020. The banking system has so far proven resilient in terms of credit risks. Nonperforming loan (NPL) ratios of Austrian subsidiaries in CESEE have remained low (2% in Q4 21) and capitalization is strong (see OeNB, 2022a; OeNB, 2022b).

However, while banking sector indicators are important in monitoring credit risks, a comprehensive financial stability assessment has to take the borrower's perspective into account to swiftly detect potential vulnerabilities building up (ESRB, 2018). The financial resilience of indebted households and firms in CESEE may have weakened as a result of the COVID-19 pandemic and the recent energy price shock. This could be further aggravated by rising interest rates due to monetary tightening, and CESEE borrowers are particularly challenged due to the predominance of variable interest rate loans (Riedl, 2019). Information on the financial resilience of borrowers is therefore crucial to quantify the group of debtors

at higher risk of being unable to repay their loans in the event of a shock and to assess the associated credit risks. This is where this study contributes.

Using OeNB Euro Survey data from fall 2020 and 2021, we aim to shed light on potential credit risks arising from the household sector in the CESEE-9 region.[2] As the OeNB Euro Survey is a priori harmonized, household financial distress and the associated credit risks can be assessed comparably across the nine countries. With this paper, we also contribute to the literature on household financial vulnerability and the related literature on household overindebtedness, which both mostly rely on single-country household survey data.[3]

We proceed in two steps. First, we compare the share of financially vulnerable households across countries. We understand this to include indebted households at risk of failing to meet their financial obligations in due time and completely. We aim not to calculate the share of indebted households closest to default, but rather to assess how many debtors are in repayment difficulties or could run into difficulties paying back their loans in the event of a shock, given their current financial situation.[4] As this concept of vulnerability is multidimensional, where one way of measurement does not fit all households equally, we consider a heterogeneous set of debt burden indicators usually applied in the literature (including debt service-to-income ratio and debt-to-income ratio). We condense the information included in these indicators into one vulnerability index to facilitate cross-country comparison of vulnerable indebted households.

In a second step, we calculate the outstanding debt held by vulnerable households as a share of overall outstanding household debt in each country. The derived debt-at-risk measure reflects the exposure to vulnerable households not only of banks,[5] but also of private lenders and financial intermediaries outside the traditional banking sector. This is due to the survey also asking about informal debt. As nonbank finance may also become a source of systemic risk through its potential interconnectedness with the banking system, our derived measure provides a comprehensive picture of financial stability risks. Due to data limitations, we are however unable to assess how much of vulnerable households' estimated debt at risk could be covered by their assets (see for example Albacete et al., 2020), as information on the latter is not available in the OeNB Euro Survey. However, we can make use of some survey questions about household ownership of real estate to distinguish less wealthy from wealthier households.

[2] The CESEE-9 are Bulgaria (BG), Czechia (CZ), Croatia (HR), Hungary (HU), Poland (PL), Romania (RO), Bosnia and Herzegovina (BA), North Macedonia (MK) and Serbia (RS). Note that the OeNB Euro Survey is conducted in ten CESEE economies (the CESEE-9 and Albania), but we exclude Albania from our analysis due to ongoing data checks for this country for the survey waves 2020 and 2021.

[3] The literature on household financial vulnerability aims to assess financial stability risks by taking the borrower's perspective into account. Due to the lack of credit register data, most papers employ survey data to investigate financial vulnerability issues. Single country studies include Room and Merikull (2017), Banbula et al. (2016), Albacete et al. (2014), and Albacete and Fessler (2010). Studies analyzing financially vulnerable households across several countries include: Albacete et al. (2020), Ampudia et al. (2016), Fessler et al. (2017), and Riedl (2021, 2019). Literature on household overindebtedness looks rather at direct implications for financially vulnerable households, like poverty, and has a stronger consumer-protection angle (e.g. Betti et al., 2007; D'Alessio and Iezzi, 2013).

[4] Note that the real default rate is likely to be much lower, as only some of these loans will eventually be defaulted on.

[5] However, we do not know at which banks vulnerable households hold their debt and therefore cannot isolate the debt at risk to Austrian subsidiaries.

The timeliness of the data allows us to analyze a period which was very much shaped by the COVID-19 pandemic. Enzinger et al. (2021) report that the share of households exhibiting a negative income shock doubled in the CESEE region in 2020 compared to the years prior to the crisis (from 15% to 30%). According to the OeNB Euro Survey wave in fall 2021, 42% of all households had been negatively financially affected by the COVID-19 pandemic.[6] The potential negative impact of these shocks on the resilience of indebted households is therefore reflected in our analysis.

Our contribution is most closely related to Albacete et al. (2020), Riedl (2019) and Fessler et al. (2017), who study household vulnerability across a set of CESEE economies. Riedl (2019) employs almost the same country set as we do (for the year 2017), but does not estimate debt at risk due to data limitations. Albacete et al. (2020) and Fessler et al. (2017) present a broad selection of vulnerability indicators but for a quite different country sample.[7] The indicators presented in our study have not been available for most of the countries in the CESEE-9 region so far and the financial vulnerability of borrowers could not be assessed to such an extent.

This study is structured as follows. In section 1, we describe the OeNB Euro Survey data and the debt burden indicators we construct. Based on these indicators, we briefly discuss the financial situation of indebted households in the CESEE-9. Box 1 highlights the importance of this region for the Austrian banking sector. Section 2 explains how we condense these debt burden indicators into a single financial vulnerability index and provides descriptive evidence on financial vulnerability across the CESEE-9. In section 3, we assess the credit risk from (less wealthy) vulnerable households by calculating the share of debt held by these households in the total amount of household debt in each country. Section 4 concludes.

1 The financial situation of indebted CESEE households

1.1 Data

This paper uses newly available micro-level data for nine CESEE economies on households' indebtedness obtained from the OeNB Euro Survey 2020 and 2021 waves. The OeNB Euro Survey – conducted annually in fall – is based on approximately 1,000 randomly selected individuals per year and country and is harmonized across countries. The survey uses face-to-face interviews and is largely tablet-based (only for some cases in Czechia and Poland is it paper-based). In addition to information on debt, the survey elicits unique data on net disposable income, savings, euroization, respondents' "economic" expectations, sociodemographic variables and some broad measures on asset ownership.[8] The advantage of eliciting net

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[6] *This figure represents an unweighted average over all (nine) countries. The share ranges between 23% in Czechia and 51% in Bosnia and Herzegovina.*

[7] *Albacete et al. (2020) and Fessler et al. (2017) employ data from the Household Finance and Consumption Survey (HFCS), which includes eight CESEE economies in its most recent (third) wave. Of the nine economies captured in the OeNB Euro Survey, only three are currently included in the HFCS. The surveys are thus more complementary than redundant with respect to country coverage.*

[8] *For detailed information on the OeNB Euro Survey, visit OeNB Euro Survey - Oesterreichische Nationalbank (OeNB).*

Summary statistics on CESEE-9 households

	BG	HR	CZ	HU	PL	RO	BA	MK	RS	CESEE-9
Household size (number of persons)	2.4	2.9	2.4	2.3	2.8	2.7	3.0	3.4	2.9	2.7
Equivalized, monthly median household income (EUR, adjusted for purchasing power parity)	801.4	1,037	1,204	866.9	940	765.4	489.1	575.3	647.1	813.3
Household experienced income shock in previous year (% of all households)	29	22	28	21	24	27	19	36	23	25
Household owns main residence (% of all households)	94	90	72	88	79	90	95	83	93	87
Household owns secondary residence (% of all households)	14	13	6	4	10	7	11	9	16	10
Household owns other real estate (% of all households)	17	25	17	8	11	8	12	17	11	14
Number of observations	2,006	2,026	2,000	2,000	2,015	2,064	2,000	2,020	2,017	18,148

Source: OeNB Euro Survey 2020 and 2021.

disposable income directly is that a household's debt (service) amount can be related to the share of available income for spending. Moreover, the resulting debt burden indicators are more comparable across countries. However, the OeNB Euro Survey does not cover the full balance sheet of households, as complete value information on the asset side is missing. We will therefore approximate wealth.

While most survey questions focus on the individual, in some cases, respondents were asked to report about their household's financial situation. We use these questions to analyze household indebtedness. We pool the data over the 2020 and 2021 survey waves in order to increase sample size and employ household weights (based on the region and size of the household) to obtain indicators representative of the target population. Weighted summary statistics on some basic characteristics of households are presented in table 1.

Furthermore, like Hake and Poyntner (2022) and other surveys on household indebtedness (e.g. HFCS: Albacete et al., 2019; SCF: Kennickell, 1998), we correct for item nonresponse using imputation techniques. This is necessary as data are not missing completely at random (MCAR), and the usage of listwise deletion could seriously bias our estimates (Van Buuren, 2018). Subsequently, in line with Albacete et al. (2019), we use multiple imputation by chained equations. This procedure relies on the assumption that item nonresponse depends only on observed variables and is random if the correlation with those variables is considered (MAR) – still a strong assumption, but weaker than MCAR. We compute five imputed datasets and employ Rubin's rules for the statistics based on the data (see e.g. Little and Rubin, 2019). In general, all standard errors and p-values reported use the mentioned household weights and account for multiple imputation. Details on imputation technique, imputed variables and missingness can be found in the online supplement, section 2.

1.2 The debt burden indicators

We calculate five commonly used indicators for household financial vulnerability, summarized in table 2. The debt-to-income ratio (DTI) and the debt service-to-income ratio (DSTI) both link indebtedness to households' net income. The first

relates the outstanding debt of an indebted household (D_i) to yearly net disposable income, illustrating how many years a household will need to repay its debt if its income is used exclusively for debt repayment but without taking actual loan maturity into account. Usually, an indebted household is classified as vulnerable if the DTI ratio is greater than or equal to 3. In the OeNB Euro Survey, the household's total outstanding debt includes bank loans as well as loans from other sources, like family, employer, stores, Internet lenders or leasing companies.[9] Unlike the DTI, the DSTI ratio is more of a liquidity than a solvency concept (Leika and Marchettini, 2017). It relates monthly loan installment payments (DS_i) to the monthly net disposable income of an indebted household (I_i) and therefore takes interest rate levels and loan maturities into consideration. By measuring short-term debt commitments, the DSTI is an indicator of the burden that debt holdings represent for current income. For the DSTI indicator, we define households as vulnerable when DSTI is equal to or exceeds 40% (see Noerhidajati et al., 2021).

In line with the DSTI ratio, the financial margin (FM) quantifies financial vulnerability according to the liquidity definition but, in addition to debt payments, considers other regular household expenses. It is obtained by subtracting loan installment payments and basic living costs in a country c (BLC_i^c) from a household's net disposable income.[10] Based on this indicator, indebted households are classified as vulnerable if their FM is negative. Unlike the DSTI indicator, the FM takes the relative income position of the borrower into account. This is because BLC_i^c are the same for all households within a country, irrespective of income. Accordingly, indebted low-income households have less financial capacity after deducting basic living costs.

The final two indicators are obtained from survey questions which directly address financial distress. Respondents are asked whether their household's expenses[11] were (1) higher, (2) roughly equal to or (3) lower than their income in the 12 months preceding the interview. If expenses were higher (i.e. *E>I=1*), indebted households are classified as vulnerable. Like the FM, the *E>I* indicator considers the household's expenses, but focuses more on a medium-term perspective. Finally, the arrears indicator provides information on whether an indebted household was behind on its loan repayments once or more often during the past 12 months on account of financial difficulties. If this is the case (*arrears=1*), the indebted household is classified as vulnerable. Like the *E>I* indicator, arrears captures a medium-term perspective, i.e., both indicators point to households that have been in financial distress but might be doing well now. Moreover, the arrears indicator captures any duration of late payment, even if the delay was only a few days. The survey questions used to construct the indicators can be found in the online supplement (section 1).

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[9] *For an overview of nonbank loans of CESEE borrowers, see Allinger and Beckmann (2021a).*

[10] *Basic living costs of a household are defined as 40% of a country's median equivalized income adjusted by the equivalized household size. Furthermore, for tenants this threshold is set at 50% to account for rent payments (Ampudia et al., 2016). To calculate the household's equivalence factor, we follow the OECD-modified scale. It assigns a value of 1 to the household head, 0.5 to each additional adult and 0.3 to each child.*

[11] *Expenses exclude purchases of assets but include loan installment payments.*

Table 2

Debt burden indicators

Indicator	Vulnerability threshold	Formula
Debt-to-income (DTI) ratio	DTI ≥ 3 years	$DTI_i = \dfrac{D_i}{I_i * 12}$
Debt service-to-income (DSTI) ratio	DSTI ≥ 40%	$DSTI_i = \dfrac{DS_i}{I_i} * 100$
Financial margin (FM)	FM < 0	$FM_i = I_i - DS_i - BLC_i^c$
Expenses > income (E>I)	E>I = 1	$E>I = \begin{cases} 1 \ for \ E>I \\ 0 \ for \ E \leq I \end{cases}$
Arrears	Arrears = 1	$Arrears = \begin{cases} 1 \ for \ arrears \ in \ last \ 12 \ months \\ 0 \ for \ no \ arrears \ in \ last \ 12 \ months \end{cases}$

Source: OeNB Euro Survey 2020 and 2021; Albacete et al. (2020); Ampudia et al. (2016); Fessler et al. (2017).

Note: D_i is the outstanding debt amount, D_{Si} are the monthly loan installment payments, I_i is the monthly net income and BLC_i^c are the monthly basic living costs of a household i. Financial margin and Expenses > income are indicators that can be meaningful for nonindebted households as well. However, for our debt burden indicators, we only consider indebted households.
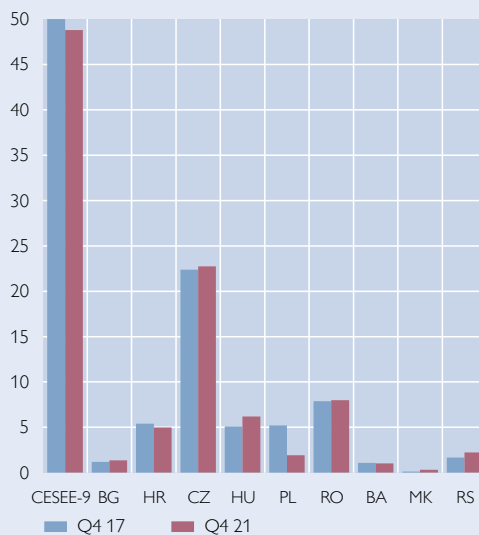
Box 1

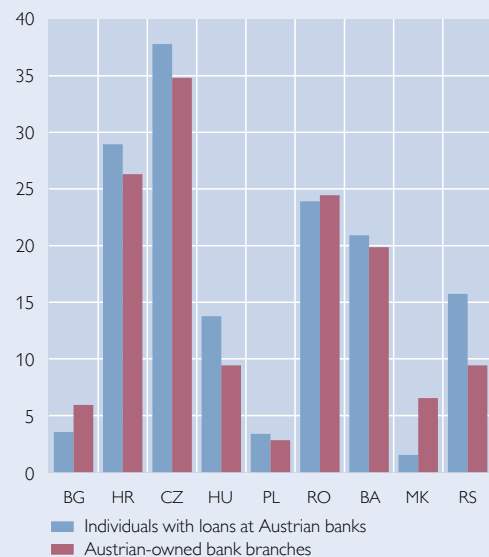## Austrian banks and the CESEE-9

Chart 1

Austrian bank lending

Consolidated foreign claims of Austrian banks

% of total foreign claims

Austrian bank lending to households

% of individuals with bank loans and % of bank branches

Source: Bank for International Settlements.

Source: OeNB Euro Survey 2017; Beckmann et al. (2018).

CESEE is the most important foreign market for the business activities of Austrian banks. Moreover, by the end of 2021, roughly 50% of all foreign claims by Austrian banks were located in the nine CESEE countries covered in the OeNB Euro Survey (see chart 1, left panel). This totals around EUR 200 billion or 17% of all total assets. The distribution is rather uneven though, with claims in Czechia amounting to more than 20% of the total. Claims in Croatia,

Hungary and Romania combined make up another 20%, whereas claims in the other six countries are below 3% each. Except for Poland, the share of exposures Austrian banks hold in the nine countries has changed little over recent years. In the four CESEE-9 countries where the most claims are located, at least half of Austrian bank branches' lending activities comprise consumer and mortgage loans (see Wittenberger, 2018). Unfortunately, we do not know at which bank the households interviewed in the OeNB Euro Survey in 2020 and 2021 have taken out their loans.

However, we have some bank information for respondents surveyed in 2017: In this survey, respondents with a bank loan were asked which bank they borrowed from. If they had several loans, they were asked to refer to their largest loan. For each country, tailor-made lists including all banks active in this country were provided. For all the listed banks, bank ownership data are available. The blue bars in the right-hand panel of chart 1 depict the weighted share of all indebted individuals who have their only or largest loan at an Austrian-owned bank. Austrian-owned banks in that case are defined as banks whose ultimate global owner was registered in Austria at the time of the survey. Respondents who could not or did not want to answer at which bank they hold their loan (around 7%) are treated as not having the loan at an Austrian bank. Thus, the plotted share is a lower bound, and the share is almost 40% still in Czechia. In Bosnia and Herzegovina, Croatia and Romania, the share is at least above 20%.

The red bars in the right-hand panel of chart 1 indicate the share of all bank branches in a country that belong to Austrian banks. Branch data were partially hand-collected and compiled by the OeNB for the year 2013 and are described in Beckmann et al. (2018). As can be seen, the share of individuals with a loan at an Austrian bank and the share of Austrian bank branches are strongly correlated. Both partially reflect the sum of foreign claims but also highlight the different credit volumes across countries.

Overall, households in the CESEE-9 owe substantial amounts to Austrian banks and their subsidiaries, making monitoring their financial vulnerability highly important for the Austrian central bank.

Table 3 summarizes household debt statistics for each country separately and the (unweighted) CESEE-9 average. The first row shows the share of households with any form of debt. Differences across countries are already evident as the share of indebted households ranges from 19% in Romania to 36% in Hungary. The next rows illustrate the proportion of indebted households at risk for our five financial distress indicators. The share of indebted households who are financially vulnerable according to the DSTI ratio is highest in Romania (25%) and in Bosnia and Herzegovina (27%), whereas Czechia (4%) and Hungary (3%) have the lowest shares. The picture is similar but not the same for the DTI ratio. Households in Romania (10%) and Bosnia and Herzegovina (12%) are again most heavily exposed, but households in Croatia, which were below average for the DSTI indicator, are here heavily exposed too (9%). Moreover, the percentage of vulnerable households in some countries more than halves under the DTI as opposed to the DSTI indicator. A larger share of indebted households may therefore have liquidity rather than solvency issues.

Row 4 of table 3 suggests that in Czechia, the share of vulnerable households according to the FM amounts to only 6%, while it is nearly three times higher in Bulgaria. The FM is usually higher than DSTI. This is because the share of vulnerable households in the low-income group is higher than among high-income households. The FM places more weight on the relative income position than the DSTI, thus increasing the share of financially vulnerable households. Compared to the E>I, the FM shows fewer households as vulnerable for many countries. The E>I indicator

Table 3

Share of indebted households at risk by various debt burden indicators

	BG	HR	CZ	HU	PL	RO	BA	MK	RS	CESEE-9
	%									
Debt participation	20	33	28	36	32	19	31	33	21	28
DSTI ≥ 40%	13	7	4	3	6	25	27	11	6	11
DTI ≥ 3 years	6	9	5	5	6	10	12	7	4	7
FM < 0	16	10	6	9	14	22	25	13	11	14
E>I = 1	18	21	17	11	19	21	21	33	23	20
Arrears = 1	40	30	30	24	38	26	16	43	39	32
	Number									
Observations	2,006	2,026	2,000	2,000	2,015	2,064	2,000	2,020	2,017	18,148

Source: OeNB Euro Survey 2020 and 2021.

identifies the highest proportion of vulnerable households in North Macedonia (33%) and Serbia (23%). Strikingly, only 6% of indebted households in Serbia are vulnerable according to the DSTI measure. The arrears indicator reports the highest share of distressed households for nearly all countries – in some extreme cases, it is ten times higher than the indicator reporting the smallest share. This number is comparable to other countries and data sources.[12] Given that even short-term delinquency is counted in, these numbers are not surprising. Here, Bosnia and Herzegovina stands out again. However, this time in the opposite direction. It has by far the lowest share of indebted households who report having been in arrears.

In short, in each country, the share of indebted households which could be classified as vulnerable varies considerably depending on the debt burden indicator used.[13] In the most extreme case, North Macedonia, it varies from 7% to 43%. Moreover, there are large differences in the proportion of indebted households at risk between countries for all observed indicators. However, these differences are not the same for each indicator. Some countries rank higher for one measure but lower in another.[14] In that sense, individual debt burden indicators are not rank-preserving. Thus, relying on only one indicator to determine the financial vulnerability of an indebted household seems too narrow.

2 Financial distress – the vulnerability index

In measuring financial vulnerability, we rely on so-called objective debt burdens, which define indebted households as vulnerable if a certain quantitative threshold is crossed. In comparison to subjective debt burdens, which rely mostly on personally perceived household financial distress, they have the disadvantage of taking the

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[12] For example, a report by Eurofound using similar arrears data from EU-SILC shows that in 2018, 8.9% of the whole EU-28 population was in some form of arrears, while four out of the six CESEE-9 EU economies ranked above average (see Eurofound, 2020). For the CESEE-9 countries, the population share of households in loan arrears amounts to 8.8%.

[13] A high variation can also be observed in Austria. Employing the latest wave of the Austrian Household Finance and Consumption Survey (HFCS, 2017), Albacete et al. (2022) find that the share of vulnerable households in Austria ranges between 2.3% and 15.8%, depending on the vulnerability indicator used.

[14] This variation within and between countries can also be seen when we look at households with consumer loans only, excluding households with mortgage loans. The variation does not therefore seem driven by pooling of both loan types.

individual situation less into account (for a discussion on debt burden indicators, see e.g. Disney et al., 2008; D'Alessio and Iezzi, 2013). However, their strong advantages are that they are less biased by personal factors like risk aversion or optimism and that – given their objectivity – households can be compared more easily. Still, it is not clear how to rank indebted households in terms of vulnerability given the five different indicators. As can be seen in section 1, one measure of financial vulnerability does not seem to fit all households equally well. It is therefore common in the literature to use several indicators that reflect different kinds of vulnerability.

In general, indebted households may show one dimension of vulnerability but still do relatively well in other dimensions of financial distress. For example, although a household's DSTI is larger than 40%, its income may still exceed its expenses considerably, making payment difficulties less likely. Another important point is that single indicators are not always easy to compare across countries. This is well illustrated by table 3. An indicator's bite can depend on local and institutional factors. In debt-averse countries, for instance, going into arrears is socially stigmatized, so a household's DSTI may be already alarmingly high, but the arrears symptom might not pop up – as in Bosnia and Herzegovina.

Table 4 again illustrates the issue of different dimensions of vulnerability well. Almost all vulnerability indicators are statistically significantly correlated, but the correlation for most pairings is still weak in size. While a DSTI ≥ 40% is fairly correlated to a negative financial margin, the relationship between a DTI ≥ 3 years and expenses larger than income and being in arrears is very weak. Thus, looking at only one indicator neglects or overstates the vulnerability that might be revealed in a different dimension. Overall, a single indicator is only one symptom of financial vulnerability.

In order to compare household vulnerability across countries, it would be preferable to synthesize the different symptoms of household financial distress into a single measure. This allows for more consistent country comparisons than choosing a different indicator for each country, as the exact same measure is used for every country. In principle, such a combined indicator can be constructed in various ways. A simple and straightforward way would be to look at the share of indebted households that show at least one symptom of vulnerability, meaning the vulnerability threshold is crossed for at least one of the five debt burden indicators.

In chart 2, this share is depicted across the CESEE-9. In each country, at

Table 4

Correlation of vulnerability indicators

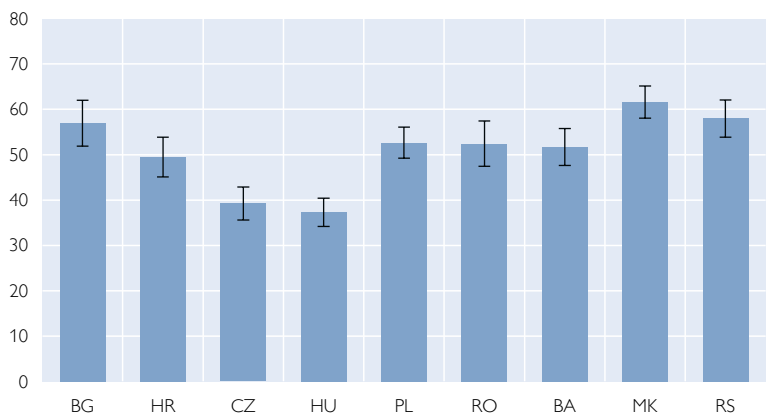|	DSTI ≥ 40%	DTI ≥ 3 years	FM < 0	E>I = 1
DTI ≥ 3 years	0.316***			
FM < 0	0.599***	0.247***		
E>I = 1	0.010***	0.051***	0.153***	
Arrears = 1	0.065***	0.018	0.096***	0.202***

Source: OeNB Euro Survey 2020 and 2021.

Note: * p-value < 0.10, ** p-value < 0.05, *** p-value < 0.01.

Chart 2

Households displaying at least one symptom of vulnerability

% of all indebted households

Source: OeNB Euro Survey 2020 and 2021.

least a third of all indebted households suffer from some form of vulnerability. Having at least one symptom of financial vulnerability is thus quite common everywhere. Chart 3 complements that picture, plotting the distribution of the number of symptoms of a subsample of households with at least one symptom of vulnerability. This share varies considerably across countries. In Hungary and Serbia, more than 65% of vulnerable households show only one symptom and households have rarely more than two. In Bosnia and Herzegovina, North Macedonia and Romania, the fraction with more than one symptom is much higher. Overall, there is considerable heterogeneity across countries both in the fraction of indebted households with any symptom of financial vulnerability at all and in how many symptoms households have if they have any symptom at all. This compromises the use of an indicator which is based on having at least one symptom. For example, in Poland and Romania the share of indebted households with at least one symptom is almost the same (see chart 2), but in Romania, there are more indebted households with at least two symptoms (see chart 3). This means vulnerability is potentially overestimated in Poland relative to Romania if households are only classified by showing at least one symptom or not.

Another way of taking all symptoms into account is to simply add them up. This would give us a vulnerability score ranging from 0 to 5, where 0 means not vulnerable and 5 most vulnerable. In this score, all symptoms get equal weight. However, it is not clear that this is justified. A more structured way is to consider the correlation between symptoms and to get to the core of what they all measure. We therefore conduct a principal component analysis (PCA) over the whole sample. A PCA reduces the multidimensionality of the indicators by identifying the common grounds (components) of the five indicators. Calculating the principal components over the whole sample means each country's distribution of vulnerability indicators is considered when constructing the overall index.[15] Importantly, this index allows for a cross-country comparison, as the same metric is considered for all countries.

Indeed, the first component from that PCA seems to reflect vulnerability. All five measures load the first component in the same direction, which is not the case for the second and third. The second and third principal components seem to capture other underlying factors. Vulnerability is one common ground these indicators measure but very likely not the only one. The first

Chart 3

Household vulnerability by number of indicators

% of all households that are vulnerable at least according to one indicator
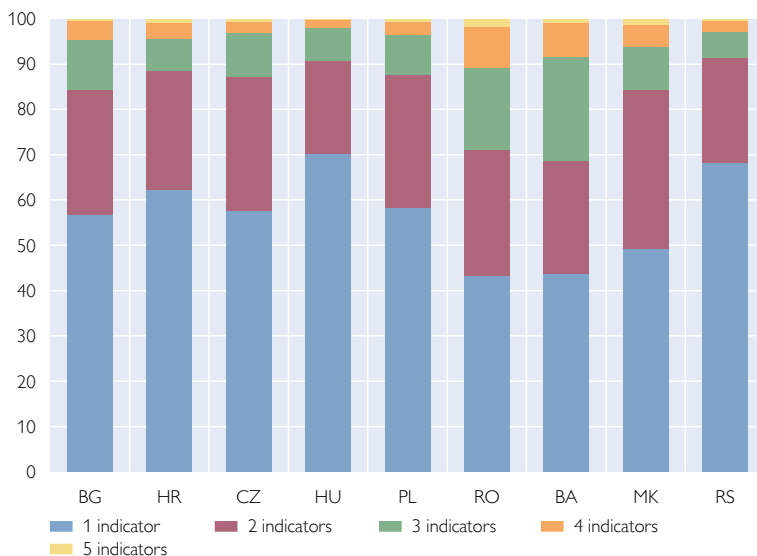
Source: OeNB Euro Survey 2020 and 2021.

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[15] *Note that each country impacts the index with a slightly different weight, as the number of observations (i.e., debt participation) is not the same across countries.*

component explains around 37% of the variation and has an eigenvalue of about 1.9, again showing that the correlation between the individual debt burden measures is far from perfect but still there and sizable. Moreover, the PCA clearly does not assign each indicator an equal weight. In the first component, much more weight is given to the DSTI

Table 5

Vulnerability index: summary

	Minimum	Maximum	Mean	Median	Standard deviation
Index	−0.82	5.57	0.0	−0.44	1.37

Source: OeNB Euro Survey 2020 and 2021.

and FM indicator than to the arrears indicator.[16] Still, given the correlation structure for the first component, we interpret it as measuring overall financial vulnerability and call it vulnerability index (see Noerhidajati et al., 2021; Anderloni et al., 2012, who use a similar procedure). The index is a discrete measure and assigns one particular value out of 32 possible values to each indebted household. Higher values reflect higher degrees of vulnerability. The minimum number the index takes is −0.82 and the maximum 5.57. The mean value lies around zero and the standard deviation is 1.37 (see table 5).[17] The minimum and maximum values correspond to indebted households having no symptom at all and having every symptom. The charts in the annex show the distribution of the index and how the index values correspond to our single vulnerability indicators. We classify households as vulnerable based on this synthesized vulnerability index.

3 Debt at risk

Usually, single debt burden indicators are used to define the share of vulnerable households and calculate financial stability risks stemming from the household sector.[18] In this paper, we use the previously derived vulnerability index to identify financially distressed households. Given the common approach, regardless of the specific design of such an indicator, a threshold has to be set to calculate the share of households ultimately classified as vulnerable. Setting the threshold between the lowest and the second-lowest index value would classify households with at least one symptom as vulnerable (see also chart 2). By moving further up the index scale, the different weighting of individual vulnerability symptoms (determined by PCA) starts to play a role and households with certain combinations of symptoms get ranked accordingly. For instance, indebted households with one symptom can be scored higher than those with two.[19] Out of the overall 32 scores of the vulnerability index, we set the threshold between the ninth and tenth, which corresponds to an index value centered around 1 standard deviation (sd) of the index. That is,

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[16] The average loadings for the first component are as following: 0.61 for DSTI ≥ 40%, 0.41 for DTI ≥ 3 years, 0.24 for E>I=1, 0.18 for Arrears=1 and 0.6 for FM<0=1.

[17] Notably, the correlation between that vulnerability index and simply counting the number of symptoms is very high (0.9). As mentioned, the difference is that the first component of the PCA does not weight all symptoms equally.

[18] For instance, Johansson and Persson (2007) and Albacete and Fessler (2010) calculate the share of debt held by households with a financial margin less than zero. Albacete and Lindner (2013) estimate the share of debt held by four different groups of vulnerable households (debt to assets ≥ 75%, DSTI ≥ 40%, expenses > income, inability to meet expenses). Ampudia et al. (2016) define financial vulnerability based on the household's financial margin to calculate the share of debt at risk. Additionally, they contrast their results with debt shares derived using a broad set of alternative household distress metrics.

[19] For example, a household with a DTI ≥ 3 years is considered more vulnerable than one exhibiting the two symptoms E>I=1 and arrears=1.

we define households as vulnerable, if their individual index score lies above 1 sd from the mean of the vulnerability index.[20] Above this threshold, households turn out to have at least two symptoms of vulnerability. The DSTI determines strongly if an indebted household's index score exceeds our threshold. In contrast, the arrears symptom mostly does not matter for our threshold (see also table A1). This corresponds to how these symptoms load on the vulnerability index.

As discussed in the previous section, we consider the whole sample (rather than individual country samples) to construct the PCA-based index and define the threshold value. The resulting shares of vulnerable households in each country can thus be set in relation to the (unweighted) average share of vulnerable households in the CESEE-9 region. Based on our threshold (mean + 1 sd), 12% of all indebted households are vulnerable in the entire region with large variation across countries (blue bars in chart 4). In two countries, Romania and Bosnia and Herzegovina, the share of vulnerable households is significantly higher than the CESEE-9 average. In Bosnia and Herzegovina, which exhibits the highest share, every fourth indebted household is vulnerable according to our definition. In contrast, in three out of the nine countries – Czechia, Hungary and Serbia – the share of vulnerable households is significantly lower than average.

After defining the group of vulnerable households, we estimate the share of debt held by these households as a percentage of the country's total household debt. We define that share in country c as

$$debt\ at\ risk^c = \frac{\sum_{i=1}^{N} v_i^c D_i^c}{\sum_{i=1}^{N} D_i^c},$$

where v_i^c is equal to 1 if household i is vulnerable and 0 otherwise[21] and D_i^c is a household's total outstanding debt.[22] It is noteworthy that, unlike in previous studies, we do not focus exclusively on banks' exposure to potentially vulnerable households but also on informal debt. For the purpose of this paper, this is very favorable, as nonbank finance could become a source of systemic risk through its potential interconnectedness with the banking system (and possible contagion effects). In 2020, the share of households with loans exclusively held by banks amounted to 79% (unweighted average over countries), meaning 21% of all indebted households had at least one loan from other sources.[23] Our derived measure of debt at risk therefore also reflects the exposure of private lenders and financial intermediaries outside the traditional banking sector to distressed households, providing a more comprehensive picture of financial stability risks.

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[20] In addition, as a less conservative measure of vulnerability, we define households with values above 2 standard deviations (corresponding to the 17th score) from the mean as most vulnerable. Most of these households have at least three symptoms of vulnerability. We report the results in chart A2 in the annex.

[21] This implies that the whole debt amount of a vulnerable household is classified to be at risk. While such a binary assignment (i.e. 0 or 1) is common in the literature, there are also other approaches. Ampudia et al. (2016), e.g. assign different fractions of outstanding debt to be at risk depending on the liquid assets a vulnerable household has.

[22] Note that the debt-at-risk measure is often termed "exposure at default" in the literature (e.g. Ampudia et al., 2016). Still, we intentionally call it debt at risk in order to reflect the fact that the share of vulnerable households in our paper will be more broad-based and does not only reflect the households closest to default.

[23] The share of households with only nonbank loans amounted to 6%, whereas 15% of all indebted households had loans from both sources (not imputed). In 2021, respondents were not asked about the source of their finance.

Chart 4

Vulnerable households and their debt at risk

% of all indebted households and % of all outstanding debt
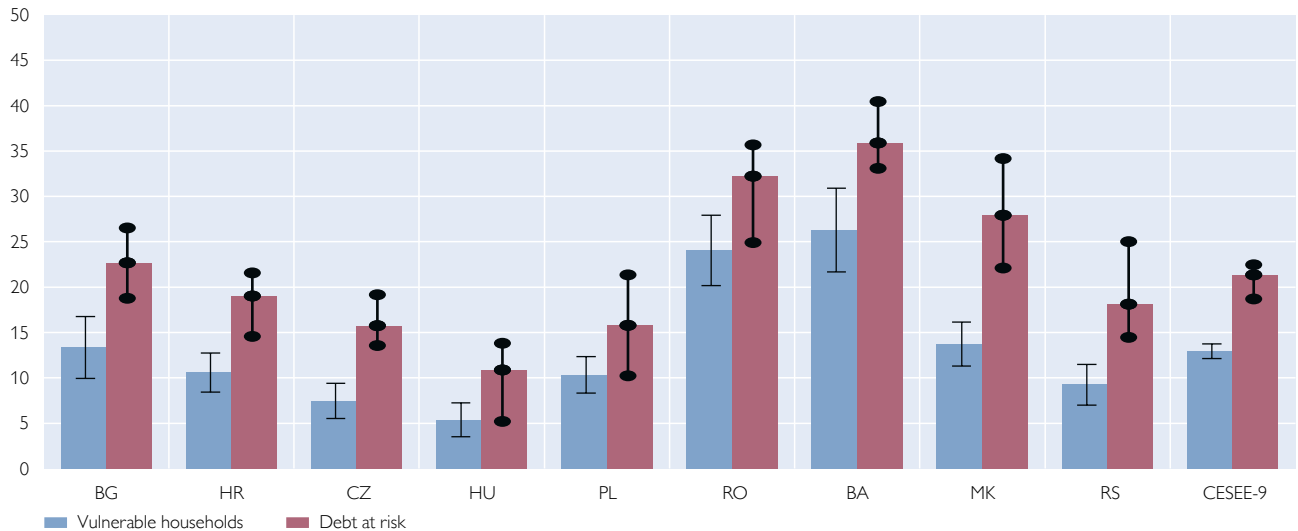
Source: OeNB Euro Survey 2020 and 2021.

Note: 90% confidence intervals for the share of indebted households; minimum and maximum value over all imputations for debt at risk.

We report the debt-at-risk estimates in chart 4 (red bars). Again, we observe high cross-country heterogeneity. Again, in Romania and Bosnia and Herzegovina, vulnerable households hold a substantial share of overall household debt in the country (36% and 32%), while in Hungary debt at risk is rather small (11%). These results are partially driven by the simple fact that the share of vulnerable households differs across countries. However, debt seems more concentrated in countries exhibiting a lower share of vulnerable households. In Czechia, for example, the share of debt at risk is twice as high as the share of vulnerable households, while in Romania the respective shares are much closer together. On average, if a single vulnerable household in Czechia defaults, the impact on the local debt market is greater than in Romania. What all countries have in common, though, is that vulnerable borrowers hold more debt proportionally. Considering the uncertainty surrounding the presented indicators (reflected by the vertical confidence lines), debt is significantly concentrated among vulnerable households in six out of nine countries. Using additional information on the main purpose of the loans, we find that this is related to the share of housing loans – with amounts typically exceeding those in other loan categories (e.g. consumer or business loans) – being higher among vulnerable households in most countries. Moreover, looking at the number of loans alone, vulnerable borrowers tend to have more loans on average than nonvulnerable indebted households.

3.1 Considering household assets

While the presented debt-at-risk indicator tells us how much of the overall debt burden is concentrated among vulnerable households, it does not reflect the potential losses to creditors in the event of default. It is therefore common in the literature to take the asset side of households' balance sheets into account in order to assess

Chart 5

Debt at risk

% of all outstanding debt
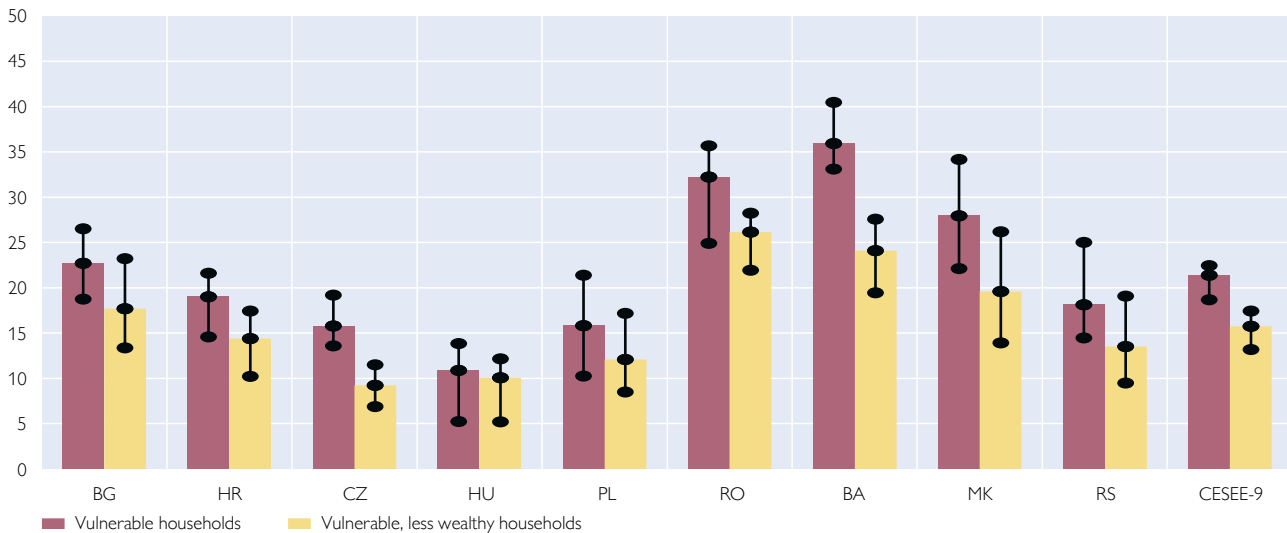
Source: OeNB Euro Survey 2020 and 2021.

Note: Minimum and maximum value over all imputations for debt at risk.

which fraction of the vulnerable borrowers' outstanding debt could not be recovered by the bank (Albacete et al., 2020; Ampudia et al., 2016). Unfortunately, the OeNB Euro Survey does not contain information on the amount of households' wealth. However, respondents are asked whether someone in the household owns the (1) main residence, (2) a secondary residence and (3) other real estate. We use this information to identify wealthier households. Unlike in Austria, the share of homeowners in the CESEE-9 region is very high due to the expansion of private ownership in the transition from a planned to a market economy (see table 1). This is why, on average, 87% of all CESEE-9 households own their main residence (see e.g. Beckmann et al., 2019). To determine wealthier households, we therefore narrow the definition of vulnerable households to those that do not own any secondary residence or other real estate. Out of all respondents in CESEE, only 20% report their household to have either a secondary residence or other real estate – meaning 80% of households qualify as less wealthy.

In chart 5, we display the share of debt held by vulnerable households (red bars) and contrast it with the debt-at-risk measure for the group of vulnerable, less wealthy households (yellow bars). This excludes the share of debt held by vulnerable but wealthier households. The underlying assumption is that the outstanding debt amount of borrowers who own real assets in addition to their main residence could be recovered fully by the creditor in the event of default. Under this – rather strict – assumption, we observe that debt at risk decreases in almost all countries, except Hungary. This is because almost all vulnerable households there are less wealthy. However, significant reductions are observed only in Czechia and Bosnia and Herzegovina, where the debt-at-risk indicator drops by 42% and 33%, respectively. Conversely, in Romania, the debt share held by vulnerable households falls

by only 19% after the exclusion of wealthier households, making it the highest in the region.

3.2 Discussion

We will now discuss the implications of our results by drawing on the findings in box 1, where we characterized the distribution of Austrian banking exposure across the CESEE-9 countries. Recalling that a significant share of consolidated foreign claims of Austrian banks is located in Romania (9% of all foreign claims), particular emphasis should be placed on monitoring the development of household debt there. In October 2018, the Romanian government introduced a DSTI cap of 40%, which came into force in January 2019, as a response to rising vulnerabilities associated with household indebtedness (IMF, 2018). The other countries exhibiting relative high debt-at-risk values, Bosnia and Herzegovina, North Macedonia and Bulgaria, have no borrower-based measures in place so far. In the case of Bulgaria, the European Systemic Risk Board (ESRB) has already recommended the introduction of borrower-based measures to mitigate the buildup of risks (ESRB, 2022). In contrast to Romania though, these countries do not account for a large part of the Austrian banking sector's exposure.

A far higher share of Austrian foreign claims in the CESEE-9 region is located in Czechia (23% of all foreign claims). Moreover, around 37% of all individuals in Czechia have at least one loan from an Austrian bank according to 2017 OeNB Euro Survey data. Although debt at risk in the Czech household sector is estimated to be among the lowest in the CESEE-9 countries, high interconnection with the Austrian banking sector requires a continued surveillance of household indebtedness there. Following the 2019 ESRB recommendations, Czechia adopted a legal framework for existing borrower-based measures in 2021 (i.e., upper limits for loan-to-value, DTI and DSTI credit ratios). This should mitigate systemic risks associated with loose lending standards by ensuring all credit providers comply fully (ESRB, 2019; CNB, 2022).

4 Summary and outlook

Austrian banks' strong ties to CESEE demand close and timely supervision of financial institutions and borrowers there. In the last three years, the COVID-19 pandemic has put a strain on many indebted households. Using OeNB Euro Survey data from 2020 and 2021, we consistently estimate the share of financially vulnerable households and associated credit risk for nine different CESEE countries. In contrast to previous studies, we have a large set of financial vulnerability indicators for countries for which these have not been analyzed jointly before. Considering several indicators is important as one single measure does not sufficiently capture the multidimensional issue of household vulnerability and makes country comparisons difficult. Although the five vulnerability indicators calculated in our study are interrelated, they draw distinct and often discordant pictures, both within and across countries. For a more consistent and nuanced picture, we combine the indicators into one vulnerability index using principal component analysis. Indebted households are deemed financially vulnerable where the index value lies 1 standard deviation above the mean.

We calculate the outstanding debt held by these vulnerable households as a share of overall outstanding debt in each country. This reveals high cross-country

heterogeneity. However, what most countries have in common is that vulnerable households have an overproportionately large share of debt. One country where Austrian exposure is large and where credit risks are high is Romania. Unfortunately, we cannot assess how much of the vulnerable households' estimated debt at risk could be covered by their assets because detailed data on households' wealth position are not available for our sample. We therefore approximate who can be classified as wealthier based on ownership of real estate. In most countries, debt at risk does not drop significantly if only less wealthy indebted households are considered.

With the pandemic and continuing global disruptions, what is the outlook for vulnerable households in the region? In response to the COVID-19 shock, loan moratoria were initiated in all countries, but often only for households directly affected by the pandemic. Moreover, most of these COVID-related moratoria expired in spring 2021. In fall 2020, most of our individuals reported never having used any moratoria during the pandemic or not using them anymore (see Beckmann and Allinger, 2021b). When asked in fall 2021 if the financial situation of their household would improve over the next year, nonborrowers were more likely to disagree with this statement than borrowers. However, respondents from (less wealthy) vulnerable households were also more likely to disagree as well. This means vulnerable households already had a grimmer outlook before further shocks materialized in 2022. Given the ongoing surge in consumer prices and rising interest rates, it seems that debt at risk will not decrease soon. With the data at hand, it is not clear what share of vulnerable households' debt could be recovered in the event of default. To ensure constant and in-depth monitoring of credit risks in the region, more detailed data on the whole balance sheet of households are essential.

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Annex

Distribution of values: vulnerability index
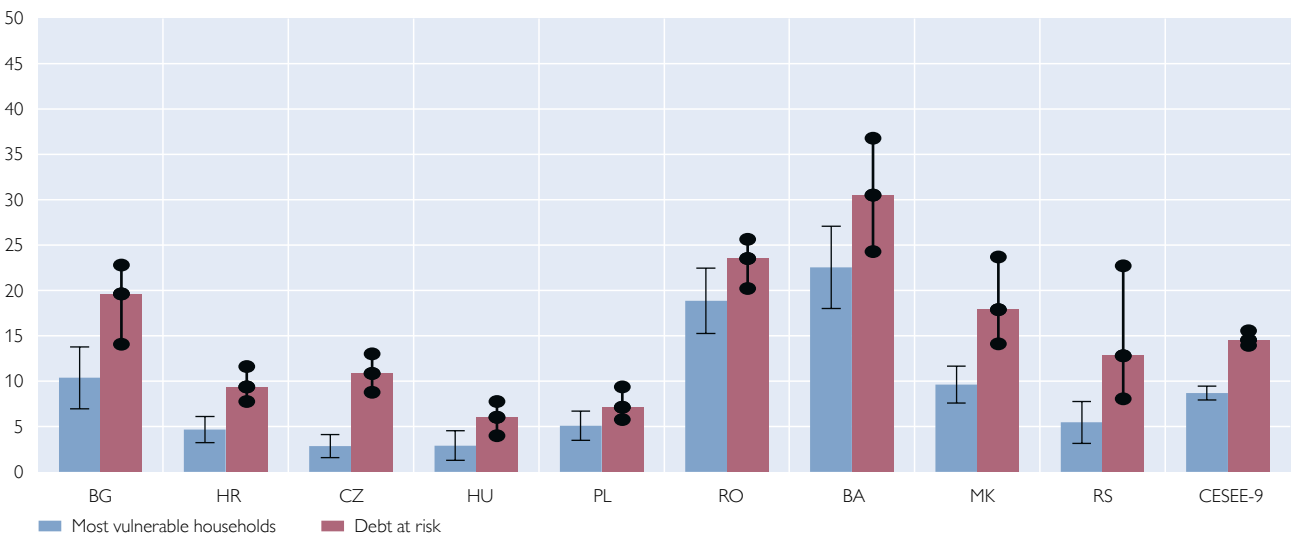
% of indebted households
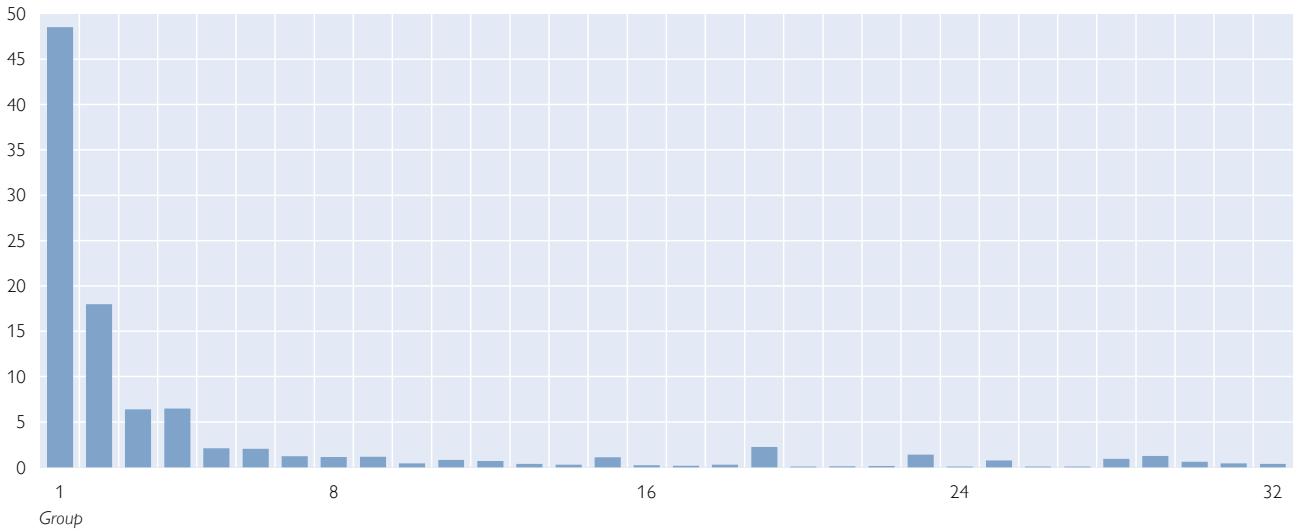
Source: OeNB Euro Survey 2020 and 2021.

Note: Index (principal component analysis – PCA) values are obtained by averaging over five imputed datasets. The 32 unique values (groups) represent the combinations of vulnerability
indicators according to table A1.

Most vulnerable households and their debt at risk

% of all indebted households and % of all outstanding debt

■ Most vulnerable households ■ Debt at risk

Source: OeNB Euro Survey 2020 and 2021.

Note: 90% confidence intervals for the share of indebted households; minimum and maximum value over all imputations for debt at risk.
Most vulnerable households are indebted households with an index value above two standard deviations from the mean of the vulnerability index.

Table A1

Index composition

	E>I = 1	DSTI ≥ 40%	DTI ≥ 3 years	FM < 0	Arrears = 1	Number of symptoms	Group	Vulnerability index
						0	1	−0.81
					X	1	2	−0.43
	X					1	3	−0.21
	X				X	2	4	0.18
			X			1	5	0.79
				X		1	6	0.94
		X				1	7	1.16
			X		X	2	8	1.17
				X	X	2	9	1.32
> mean + 1 sd	X		X			2	10	1.39
	X			X		2	11	1.54
		X			X	2	12	1.55
	X	X				2	13	1.77
	X		X		X	3	14	1.78
	X			X	X	3	15	1.93
	X	X			X	3	16	2.15
			X	X		2	17	2.54
> mean + 2 sd		X	X			2	18	2.76
		X		X		2	19	2.92
			X	X	X	3	20	2.93
	X		X	X		3	21	3.15
		X	X		X	3	22	3.15
		X		X	X	3	23	3.30
	X	X	X			3	24	3.37
	X	X		X		3	25	3.52
	X		X	X	X	4	26	3.53
	X	X	X		X	4	27	3.75
	X	X		X	X	4	28	3.91
		X	X	X		3	29	4.52
		X	X	X	X	4	30	4.90
	X	X	X	X		4	31	5.12
	X	X	X	X	X	5	32	5.51

Source: OeNB Euro Survey 2020 and 2021.

Note: sd = standard deviation; PCA = principal component analysis; index (PCA) values are obtained by averaging over five imputed datasets. In one of the imputed datasets, households with E>I = 1 and DTI ≥ 3 years are already above the threshold of mean + 1 sd and thus are counted as vulnerable. Similarly, in one of the imputed datasets, households with DTI ≥ 3 years and FM < 0 have crossed the mean + 2 sd threshold.