Monetary policy and credit allocation in Slovenia through the lens of survey data

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Abstract

Protracted periods of accommodative monetary policy may adversely affect aggregate productivity by, among other things, facilitating the entry and delaying the exit of non-viable firms and distorting the allocation of financing across incumbent firms. In the case of Slovenia, characterised by a low level of financial deepening, banks play an important role in providing external financing to firms and, as such, in allocating financing across the distribution of firms. To assess the latter, this paper uses firm-level data from the joint survey of Banka Slovenije and SID Bank on firm financing, and balance sheet and income statement data from AJPES for the 2011−2019 period. The findings indicate that while access to finance has improved for the whole spectrum of firms in Slovenia as financing conditions have eased, it has improved to a significantly lesser extent for vulnerable firms across several dimensions. As the survival of vulnerable firms has been sustained for longer on account of accommodative monetary policy, the recovery rate of such firms has also increased. However, their share of the total pool of firms in Slovenia has been continuously falling and remains at a historic low. The results are commensurate with the findings of the ECB's workstream on productivity, innovation and technological progress based on data from 11 European countries (excluding Slovenia). These findings imply that from the credit allocation dimension at least, the protracted accommodative monetary policy of recent years has not adversely affected aggregate productivity dynamics.

JEL Classification Numbers: D24, E52, G21, G32, O16

Keywords: monetary policy, financing conditions, credit allocation, productivity.

Povzetek

Daljše obdobje spodbujevalne denarne politike, ki pospešuje vstop novih podjetij na trg, a hkrati omogoča preživetje finančno ranljivih, običajno tudi manj produktivnih podjetij, lahko negativno vpliva na agregatno produktivnost. V Sloveniji, za katero je značilna nizka stopnja finančne globine, imajo banke ključno vlogo pri zagotavljanju zunanjega financiranja podjetij in razporejanju sredstev med njimi. Empirične ocene v tem gradivu temeljijo na podatkih raziskave Banke Slovenije in SID banke o dostopnosti finančnih virov za podjetja ter bilancah stanja in izkazih poslovnega izida (AJPES) za obdobje 2011–2019. Glavna ugotovitev je, da se je ob sprostitvi posojilnih pogojev dostop vseh podjetij do bančnih posojil izboljšal, vendar bistveno manj za finančno najranljivejša. Kljub temu je spodbujevalno naravnana denarna politika ta podjetja ohranjala pri življenju. Njihov delež se sicer še naprej znižuje in dosega zgodovinsko nizke ravni. Rezultati so skladni z ugotovitvami raziskave ECB, ki je bila opravljena za 11 evropskih držav in dokazuje, da akomodativna denarna politika zadnjih let ni imela negativnega vpliva na agregatno produktivnost.

1 Introduction

Monetary policy can affect productivity through numerous channels.[1] By easing financing conditions, an accommodative monetary policy can stimulate aggregate demand, facilitate investment in productivity-enhancing technologies, lower the productivity threshold required for the profitability of firms and support more efficient resource allocation across incumbent firms (ECB, 2021). However, protracted periods of accommodative monetary policy may also inflict adverse effects on productivity through both the intensive and extensive margin. First, an accommodative monetary policy may facilitate the entry as well as survival of vulnerable[2] firms through the lens of the extensive margin, by easing financing conditions and potentially lowering the productivity threshold required for profitability (Anzoategui et al., 2019; Hamano & Zanetti, 2020; Colciago & Silvestrini, 2020; Hartwig & Lieberknecht. 2020). Second, at the intensive margin, it may distort banks' incentives to lend to more productive firms, thereby increasing resource (credit) misallocation (Storz et al., 2017; Banerjee & Coricelli, 2017; Banerjee & Hofmann, 2018; Albrizio et al., 2019; Andrews & Petroulakis, 2019; Altavilla et al., 2021; Schivardi et al., 2021). Misallocation of credit, identified as the incidence of credit allocated to non-viable rather than viable firms (which are financially constrained), can be a key factor underpinning lower productivity and an underperforming aggregate economy (Bleck & Liu, 2018). This is particularly important for economies characterised by a low degree of financial deepening, as is the case in Slovenia. In these economies, banking loans serve as the main source of external financing for firms; a possible misallocation can therefore have significant adverse implications for financial and macroeconomic developments (Banerjee et al., 2017).

To evaluate the impact of accommodative monetary policy on financing conditions and the allocation of credit across firms in Slovenia, this paper follows the methodology employed by the ECB's workstream on productivity,

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[1]The reverse also holds, as productivity dynamics can have important implications for monetary policy. For one, productivity dynamics can play a significant role in driving potential economic growth, with implications for the natural rate of interest (the *unobserved* theoretical short-term real rate of interest consistent with a neutral policy stance, which "corresponds to a situation in which the economy is operating at potential and inflation is at its target value, such that there is no reason for the central bank to either inject or withdraw stimulus" (Lane, 2019)). This in turn then determines the monetary policy space available to achieve the price stability mandate over the medium term. The natural rate of interest is estimated to have been continuously decreasing, underpinned by a confluence of factors. Consequently, the ECB's toolkit has expanded beyond the key ECB interest rate to include, @textitinter alia, forward guidance and quantitative easing (Altavilla et al., 2021). While this remains an important topic from the perspective of monetary policy, the implications of productivity on monetary policy are beyond the scope of this paper.

[2]In this paper, the terms *vulnerable* and *non-viable* are used interchangeably to refer to firms that are financially distressed and/or characterised by low (labour and total factor) productivity.

technological progress and innovation as part of the ECB's strategy review undertaken in 2020 and 2021. The paper combines the firm-level joint survey of Banka Slovenije and SID Bank on firm financing with balance sheet and income statement data from AJPES for the $2011-2019$ period.[3] The period under review encompasses the accommodative monetary policy measures undertaken and/or announced since 2012, i.e. those aimed primarily at stabilising dysfunctional financial markets (Altavilla et al., 2021), such as the Securities Markets Programme (SMP) and Outright Monetary Transactions (OMT), and those enacted to achieve the ECB's price stability objective.[4] In terms of cyclical developments in Slovenia, the period under review corresponds with the Sovereign Debt Crisis $(2011-2013)$ and the subsequent recovery $(2014-2019)$. Beyond some initial "stylised facts" emerging from the descriptive statistics, the paper employs a logit estimation in which the probability of increased access to finance at the level of the individual firm is linked to the type of firm (vulnerable or otherwise), perceived lending conditions (including interest rates, collateral requirements, maturity and loan size), and an interaction term between the type of firm and perceived lending conditions. The model is augmented with other key firm characteristics (e.g. ownership and size) and with sector- and year-specific dummies.

Our results confirm that the accommodative monetary policy stance during the period under review has indeed succeeded in transmitting easier financing conditions to the whole spectrum of firms in Slovenia. These findings are commensurate with the results obtained from the ECB (2021) for other euro area countries. While this holds, the results also show that as access to finance has improved for all firms with the easing of lending conditions, this has, for the most part, been significantly more pronounced for healthier than for vulnerable firms. As this result may mask heterogeneity among firm types, disaggregated results by age and size of firm show that, as collateral requirements have eased, the probability of obtaining bank loans has been significantly lower for younger and smaller vulnerable firms. The results imply that, at least at the intensive margin, the protracted accommodative monetary policy of the recent period has not adversely distorted resource allocation and, as such, adversely affected productivity. However, despite the relative results at the intensive margin, the confirmed transmission of easier financing conditions to all types of firm, including vulnerable ones, may imply that accommodative monetary policy has indeed prolonged the survival of vulnerable firms. This in turn would have adverse implications for productivity through the extensive margin. While this remains a topic for future research, descriptive statistics alone suggest that, rather than extending the survival of vulnerable firms, accommodative

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[3]While AJPES data is available for 1995 onwards, the sample period considered in the analysis is constrained by the firm-financing survey, for which data is available only from 2011.

[4]For an overview of the monetary policy measures enacted since 2014 by the ECB, see Altavilla et al., 2021.

policy in Slovenia during the period under review allowed a significant share of these vulnerable firms to recover, with higher productivity levels arriving when healthy status was regained. Moreover, the share of vulnerable firms in the population of Slovenian firms has been continuously falling and, as of 2019, remained at historically low levels, suggesting very limited impact on aggregate productivity.

This paper is organised as follows: Section 2 presents a brief overview of corporate financing in Slovenia and underpins the paper's focus on bank financing. Section 3 provides a short review of relevant literature. Section 4 describes the data, introduces variables of interest and showcases some summary statistics. Section 5 briefly describes the modelling framework used in the empirical exercise, presents the results, and touches upon descriptive statistics pertaining to dynamics at the extensive margin in Slovenia. Section 6 contains the conclusions.

2 A brief overview of corporate financing in Slovenia

Following the Sovereign Debt Crisis, which was, *inter alia*, characterised by significant constraints in loan supply, particularly concerning corporate lending, the Slovenian economy started to gradually recover, along with firm financing. However, in an effort to deleverage from peak debt levels back in 2008−2009 and improve their balance sheets, firms in Slovenia started to lower their debt exposure and to increasingly rely on other sources of financing, particularly internal financing.[5] Since the peak in 2009,[6] amounting to EUR 48.2 billion, the indebtedness of Slovenian firms declined steadily, reaching a low of EUR 34.4 billion in 2016 (Figure 1). Thereafter, the dynamics reversed and started to accelerate, albeit at a much slower pace that observed in the period before the onset of the Global Financial Crisis. In 2019, total corporate debt stood at EUR 39.2 billion, which was around 19% below the peak of 2009 and around 11% above the low of 2016. While the evolution of bank debt held by firms has

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[5]From a macroeconomic perspective, the deleveraging efforts of the corporate sector in Slovenia have had negative consequences for investment activity and productivity growth. The decomposition of growth in real GDP per capita in Slovenia through the lens of a Cobb-Douglas production function shows that the average contribution of both productivity and capital to growth in real GDP per capita in Slovenia over the 2014−2019 period decreased by about half compared to the respective average contribution over the 1996−2007 period (see Figure A.1 in Annex A). Specifically, as of 2019 the level of gross fixed capital formation in Slovenia barely reached the level that prevailed back in 2005, standing approximately 60% below an extrapolated trend based on investment dynamics until 2005 (i.e. excluding the overheating period during the Great Financial Crisis) (see Figure A.2 in Annex A).

[6]The data presented hereafter comes from the AJPES database, cleaned by the authors for the purpose of this analysis. More details are presented in Section 4.

historically been roughly proportionate to total corporate debt, this relationship has changed following the Sovereign Debt Crisis. Firms have started to replace bank financing with other short-term operating liabilities (Figure 2).

Figure 1: Evolution of debt in the Slovenian corporate sector

Source: AJPES, authors' calculations.
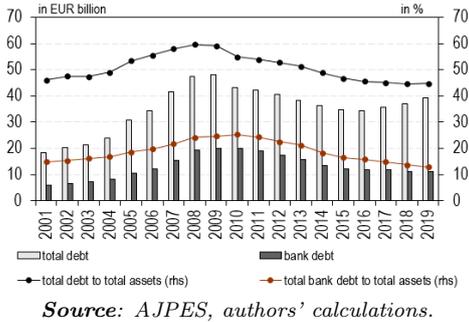
Figure 2: Decomposition of total debt

Source: AJPES, authors' calculations.
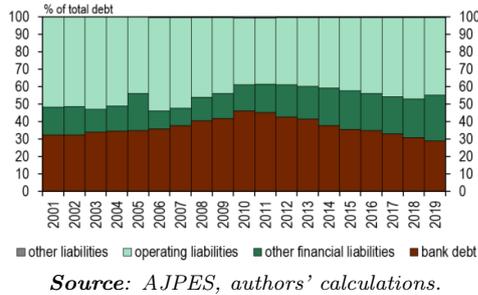
While total corporate debt has been gradually increasing since 2016, bank debt has been persistently falling. In 2019, it reached the lowest level of bank debt held by firms in over 20 years (Figure 1). Between 2009 and 2019, the stock of bank debt declined by EUR 8.8 billion, a reduction of somewhat less than half. In 2019, it accounted for over a quarter of total corporate debt, significantly less than around the time of the Global Financial Crisis, when the share exceeded 40%. We find that the reduced reliance on bank funding by firms in Slovenia is also confirmed by survey data from the joint survey of Banka Slovenije and SID Bank on firm financing. Despite these dynamics, bank funding remains an important source of financing for firms in Slovenia, accounting for almost 30% of total debt held by the corporate sector (Figure 2).[7] While this reflects the share of bank debt for the total pool of non-financial firms, the dynamics may differ across the distribution of firms, whether by age, size and (especially) vulnerability, as shown in Section 4 for the latter group. It is exactly this dimension that motivates the current analysis, which aims to evaluate whether the accommodative monetary policy stance in the euro area of recent years has enabled/facilitated any misallocation of resources (i.e. credit) by banks to vulnerable firms at the expense of healthy ones, with adverse implications for aggregate productivity in Slovenia.

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[7]Going beyond the perspective of firms, from the perspective of the banks' balance sheets, based on 2019 data, loans to the corporate sector accounted for around 45% of total loan stock held by banks, and contributed 0.5 percentage points to the total loan growth of 2.9% (see Figure B.1 in Annex B). For comparison purposes, in the EA as a whole, loans to the corporate sector accounted for about 38% of total loan stock held by banks (see Figure B.2 in Annex B). Similar shares prevailed for both Slovenia and EA in 2020 and 2021 as well.

3   Literature review

The current paper relates to two broadly interlinked strands of literature. More broadly, it touches upon a wider discussion of the relationship between monetary policy and productivity; more narrowly it focuses on one of the channels through which the former affects the latter, i.e. the role of banks in allocating resources (credit) across incumbent firms. For the purpose of this analysis, the following review will touch upon related studies that focus on the narrower scale of the literature, i.e. that evaluate prevalence and degree of credit misallocation by banks during different monetary policy stances and the ensuing macroeconomic implications.

Several studies have recognised misallocation of credit as one of the reasons underpinning lacklustre productivity dynamics. Recently, most studies have argued that this is particularly pronounced in periods of accommodative monetary policy. Using firm-level data for the US over the 2008−2016 period, Albrizio et al. (2019) show that the additional access to finance through unconventional monetary policy resulted in credit misallocation, which had an adverse effect on aggregate productivity. Specifically, unconventional monetary policy enabled vulnerable (low-productivity) firms to accumulate fixed capital and grow disproportionately more than healthy ones (i.e. those characterised by higher productivity). From a general equilibrium perspective and empirically using data for the US and Spain, Asriyan et al. (2021) show that low interest rates had an adverse effect on resource allocation by favouring investment by unproductive firms and crowding out investment by more productive firms. Using firm-level data on listed firms in 14 advanced economies, Banerjee & Hofmann (2018) show that, after an increase in risk appetite, banks tend to increase their lending to zombie firms. While this seems to hold at the intensive margin, they argue that the effects on aggregate productivity are ambiguous and depend on the extensive margin, as the whole spectrum of firms may benefit from the low interest rates. Using detailed bank-firm data over the 2009−2014 period for EU countries, Acharya et al. (2019) show that, following the Outright Monetary Transactions (OMT) announcement, banks that experienced capital gains increased their lending to vulnerable firms more than to healthy ones, which adversely affected macroeconomic aggregates. In a similar vein, using granular bank-firm data from five stressed and two non-stressed euro area economies, Storz et al. (2017) show that vulnerable firms continued to lever up during the 2010−2014 period, particularly those tied to weak banks in periphery euro area countries, including Slovenia. This in turn extended the survival of these vulnerable firms, with adverse implications for macroeconomic aggregates. Similar results were also produced for Slovenia by Brezigar-Masten et al. (2015), who showed that weaker banks maintained looser financing conditions in favour of vulnerable firms during the Sovereign Debt Crisis. Moreover, using firm-level data from AJPES and the bank and credit registry from Banka Slovenije over the 2006−2014 period, Banerjee et

al. (2017) showed that while bank loan allocation was inefficient in Slovenia before the Global Financial Crisis, it deteriorated further during the Sovereign Debt Crisis.

While adding to the literature on credit misallocation, the current paper primarily complements the studies for Slovenia currently available. In contrast to the studies referred above, the paper expands on the most recent period to cover the arsenal of measures enacted by the ECB since 2014 in response to low inflation dynamics. Moreover, in contrast to the broader literature beyond Slovenia that has been referred to, it aims to evaluate the prevalence of credit misallocation using survey data, which reflects the perception/opinions of individual firms regarding financing and lending terms and conditions for the period under review.

This perspective has been implemented by the ECB's workstream on productivity, innovation and technological progress (2021), but does not include Slovenia. As they conclude, the impact of monetary policy on productivity may vary over time and be heterogeneous across regions as a result, *inter alia*, of the interaction of monetary policy with other institutions and regulations, market concentration or the link between banks and firms' health. This provides further motivation for this paper, which, in addition to expanding the results of the workstream to Slovenia, also qualifies as the first study for Slovenia that aims to shed light on the impact of accommodative monetary policy on credit misallocation through the lens of survey data.

4   Data

The firm-level data used in the analysis comes from two distinct sources. The following subsections present in detail the datasets used, the definition of key variables of interest, and relevant summary statistics underpinning the empirical exercise presented in Section 5.

4.1   Data description

The analysis makes use of two sets of data. The first source is Banka Slovenije's survey on firms' access to finance, which was launched in 2011 and has been conducted in conjunction with SID Bank since 2016. The sample of firms surveyed is stratified on the basis of size and sector.[8] The survey provides information on firms' access to finance and financing conditions, the purpose of use of the financing obtained and firms' future financing expectations. While some questions in the survey have been modified over the years, the core questions and overall structure of the survey have remained broadly consistent.

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[8]For an overview of the methodology, see Raziskava o dostopnosti finančnih virov za podjetja, Banka Slovenije.

Over the 2011−2019 period, up to 1,600 non-financial firms have been interviewed each year.

The second source of data is the database of the Agency of the Republic of Slovenia for Public Legal Records and Related Services (AJPES), which records balance sheet and income statement data of Slovenian firms on an annual basis. Under the Companies Act, firms are required to submit their annual reports to AJPES. This dataset consists of firms that belong to the non-financial corporations sector, the government sector and the financial corporations sector, and excludes those that fail to report any value in a given year. In addition to firms' financial statements, which are unaudited, the dataset includes firm demographics, such as size, age, sector and ownership. For the purpose of this paper, the AJPES dataset has been cleaned so as to exclude financial and public sector firms, firms that record negative value-added and tangible assets, firms with no employees and firms that do not have the sector in which they operate specified.[9] The cleaned AJPES dataset comprises between 22,000 and 43,000 firm observations per year over the 1995−2019 period.

For the purpose of the analysis, the two datasets have been matched using unique firm-specific identifiers. Given the starting period of the dataset on firm financing, the sample period considered in this analysis starts in 2011. The final merged dataset is limited to firms participating in the survey and includes 6,294 firms and 7,981 observations for the 2011−2019 period, as the majority of firms (70.4%) participated in the survey for a single year only.

4.2 Definition of the variables of interest

The variables of interest for the analysis draw upon information from the merged dataset.

The key variable of interest pertains to that of the vulnerable firm. As the latter can encompass several dimensions, and in order to provide a more comprehensive assessment, the paper follows ECB (2021) and considers three definitions of a vulnerable firm: *zombie firm, firm with low Altman Z-score* and *low-productivity firm.*[10] For the latter, two definitions of productivity are considered: labour productivity and total factor productivity. The corresponding definitions and details of the vulnerability indicators are presented in Table 1,

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[9]The cleaning of the dataset is done in such a way as to conform to the estimations set out in the analysis.

[10]Regarding zombie firms, the authors acknowledge the range of alternative specifications present in the literature. While not shown here, the analysis has also been undertaken for other specifications of zombie firms, and the results are similar to those shown in the paper. Different specifications also prevail for the calculation of the Altman Z-score. The specification used in this analysis corresponds to Altman & Hotchkiss (2006), which is similar to that set out in ECB (2021).

and draw upon balance sheet and income statement data from AJPES. While the definitions point to separate groups of vulnerable firms, there are many firms that fall into more than one category. For example, looking at the whole sample of vulnerable firms identified by AJPES, about 20% fall into more than one of the identified definitions pertaining to a vulnerable firm. As such, beyond the separate groups of vulnerable firms identified above, the paper also sets out a broader definition for *vulnerable firm*, one that includes all firms that belong to one or more of the four categories specified above.

Table 1: Definition of vulnerable firms

Vulnerable firm indicator	Definition	Details
Zombie	Firms with an interest coverage ratio below one for three consecutive years	Interest coverage ratio is defined as the ratio of *earnings before interest and taxes (EBIT)* and *financial expenses from financial liabilities.*
Altman	Firms with an Altman Z-score lower than 1.8	The Z-score is widely used to predict the probability that a firm will go into bankruptcy within two years. The formula used in the analysis is that calculated for private firms: $Z = 0.717a + 0.847b + 3.107c + 0.420d + 0.998e$ where $a = working\ capital/total\ assets$ $b = retained\ earnings/total\ assets$ $c = earning\ before\ interest\ and\ taxes/total\ assets$ $d = equity/total\ liabilities$ $e = sales/total\ assets$
Low labour productivity	Firms belonging in the bottom 10% of the sector-year distribution of labour productivity	Labour productivity is defined as real value-added per employee.
Low total factor productivity	Firms belonging in the bottom 10% of the sector-year distribution of total factor productivity	Total factor productivity is defined as a Solow residual from ordinary least squares regression estimates of sectoral production functions.
Vulnerable	Firms belonging to one or more of the categories specified above	

Notes: The estimation of the total factor productivity at the level of the firm is based on a standard Cobb-Douglas production function, depicted here in its logarithmic transformation: $logY_{it} = logA_{it} + \alpha logK_{it} + (1 - \alpha)L_{it} + \epsilon_{it}$, where Y_{it} represents the level of output of firm i at period t, K_{it} is physical capital, L_{it} represents the labour input, and α the capital share of output. A_{it} represents the unobserved inputs, other than labour and capital, such as technological factors, managerial ability and similar, referred to as total factor productivity (TFP), and ϵ represents the measurement error in output, or any shock affecting output that is unknown to the firm when it decides its capital and labour inputs. In the estimation, Y is approximated by value-added, which is derived by subtracting costs from sales, K is approximated by tangible fixed assets, and L by the number of employees per firm. Value-added and physical capital are deflated by sector-specific deflators from the national accounts to obtain variables in real terms. The model is estimated using fixed effects.
Source: ECB, authors' calculations.

The second important set of variables relates to those retrieved from Banka Slovenije's firm-financing survey. As discussed in the previous section, the sur-

vey comprises various questions pertaining to the financing of firms in Slovenia. In the current analysis, two sets of information are relevant: a firm's assessment of access to bank financing, and a firm's assessment of the financing terms and conditions offered. These two dimensions are approximated by two sets of standard questions in the questionnaire.[11] To identify whether a firm has received bank financing, *Question 5* in the questionnaire is used. This question asks firms to evaluate how the access (offer) to bank financing has changed in a given year, i.e. whether access to finance has increased/improved, remained unchanged or decreased/deteriorated. To approximate the perceived evaluation of different lending terms and conditions applied to bank loans, *Question 13* is taken into account. Similar to the question on access to finance, this question asks firms to evaluate how certain bank financing terms and conditions have changed from the perspective of the firm, i.e. whether they have improved, remained unchanged or deteriorated. The set includes, among others, *interest rates*, *collateral requirements*, *available size of the loan* and *available maturity of the loan*. The specification of the variables for the estimation is explained in more detail in Section 5 of this paper.

4.3 Summary statistics

The following section looks at the dynamics of the variables of interest and underpins the empirical exercise that follows. To get a broader perspective and a comparison with healthy firms, the summary statistics presented in this section focus on the broader definition of a *vulnerable* firm, which incorporates firms that qualify as zombie, have an Altman Z-score of less than 1.8 and/or belong to the lowest 10% of the sector-year labour productivity/TFP distribution. Given the prevalence of the zombie phenomenon in the literature, zombie firms are highlighted separately for comparison. The data presented is based on the merged dataset, i.e. it only takes into account firms participating in the survey and answering the questions specified in the previous section.

Table 2: Vulnerable vs. healthy firms

	2011–2013	2014–2019	total
		mean	
number of firms			
vulnerable firms	284	120	175
healthy firms	247	190	209
zombies	*59*	*12*	*28*
all others	*472*	*298*	*356*
number of employees			

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[11]The ordering/numbering of selected questions referred to hereafter pertains to the 2020 questionnaire; however, as the questionnaires have been subject to change over the years, the 2020 ordering may not reflect that used in previous questionnaires, even if the selected questions have remained the same throughout the survey's history.

vulnerable firms	147	130	136
healthy firms	114	113	113
zombies	*113*	*128*	*123*
all others	*135*	*119*	*124*
nominal value-added*			
vulnerable firms	6.0	6.2	6.1
healthy firms	4.9	4.8	4.9
zombies	*3.3*	*5.0*	*4.4*
all others	*5.8*	*5.4*	*5.5*
sales*			
vulnerable firms	27.3	25.9	26.4
healthy firms	42.2	34.4	37.0
zombies	*15.6*	*21.7*	*19.6*
all others	*35.9*	*31.2*	*32.7*
tangible fixed assets*			
vulnerable firms	17.0	27.7	24.8
healthy firms	7.3	7.0	7.1
zombies	*6.8*	*36.3*	*26.5*
all others	*13.3*	*15.2*	*14.6*
equity to total assets**			
vulnerable firms	24.7	32.0	29.6
healthy firms	44.2	44.8	44.6
zombies	*21.6*	*25.0*	*23.9*
all others	*34.8*	*40.5*	*38.6*
liabilities to total assets**			
vulnerable firms	71.2	65.2	67.2
healthy firms	52.7	52.3	52.4
zombies	*73.8*	*71.6*	*72.3*
all others	*61.6*	*56.7*	*58.3*
bank loans to total assets**			
vulnerable firms	27.5	22.5	24.2
healthy firms	15.0	14.4	14.6
zombies	*24.2*	*23.0*	*23.4*
all others	*21.4*	*17.2*	*18.6*

Note: * In EUR million, ** in %.
Source: AJPES, authors' calculations.

As expected, the demographics of vulnerable firms deviate markedly from those of healthy firms (see Table 2). On average, looking at the whole 2011−2019 period, vulnerable firms tend to be larger, i.e. they have a higher number of employees and produce higher value-added (depicted here in nominal terms). These firms, while generating lower sales relative to healthy firms, do possess higher tangible fixed assets. This can, for example, be attributed to the construction sector, which while characterised by low productivity, is also physical capital-extensive. Turning to zombies alone relative to all other firms, we observe that they are relatively scarce in number and, on average, tend to generate lower value-added and sales. As far as financial demographics are concerned, vulnerable firms tend to be more indebted and have lower levels of

equity. They are also more reliant on external financing, as seen in the higher share of bank loans to total assets. Similar characteristics also apply to zombies alone, albeit in a somewhat more pronounced form and particularly with regard to total liabilities. The prevailing dynamics mask some heterogeneity for the period during and after the Sovereign Debt Crisis, particularly as regards indebtedness. The data shows that the total indebtedness of vulnerable firms decreased in the 2014−2019 period, with a particularly noteworthy reduction for bank financing. This is commensurate with the aggregate deleveraging efforts of firms highlighted at the beginning of the paper.

Figure 3: Reported assessment of the availability of bank loans

(a) By type of firm (b) Across a firm's productivity distribution
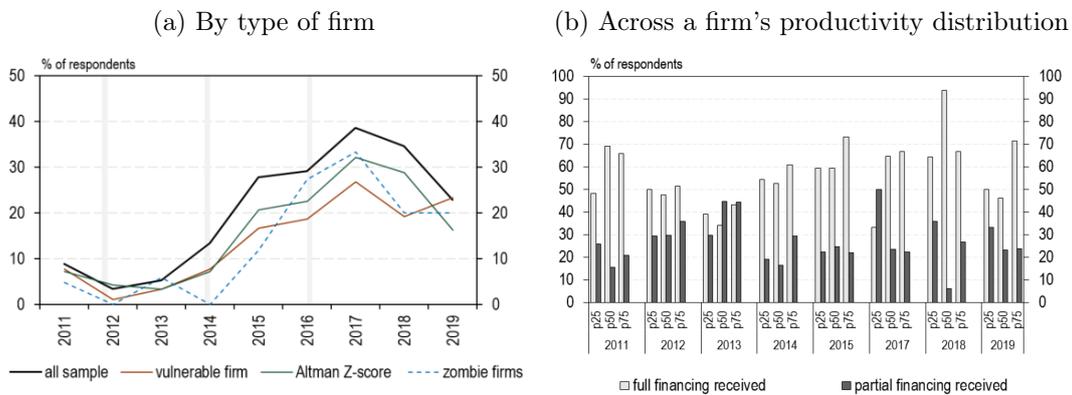
Note: The shaded lines correspond to the monetary policy measures announced/enacted during the period under review, starting with the OMT in 2012, the TLTRO I and the negative rate policy in 2014, and TLTRO II and CSPP in 2016. Productivity in b) refers to labour productivity and is defined as real turnover over employees, while p25, p50 and p75 refer to the 25th, 50th and 75th percentile of the labour productivity distribution of firms, respectively. Data for 2016 is not shown as a result of the change in the question on loan application success.
Source: Banka Slovenije, authors' calculations.

Turning to perceptions of financing, firms participating in the survey believe that the availability of bank loans appears to have improved continuously for the whole spectrum of firms following the selected monetary policy decisions announced/enacted from 2012−2016 (Figure 3a). However, the share of firms reporting an increase in the availability of bank loans decreased by 16 percentage points to 23% between 2017 and 2019. Similar dynamics are observed across vulnerable firms. However, the share of vulnerable firms reporting improved access to finance has been persistently lower than for firms as a whole. However, this changed in 2019, when the two groups coincided. Looking at the disaggregation across types of vulnerable firm relative to the total pool of firms, while the share of low productivity firms reporting improvement in access to finance increased, it remained lower for financially distressed firms (i.e. zombies and those with an Altman Z-score of below 1.8). Turning to acquired financing, based on survey data the incidence of obtaining 100% of bank funds requested is the highest among high productivity firms, i.e. firms

that belong to the 75th percentile of the productivity distribution (Figure 3b). In 2019, more than 70% of these firms obtained all the funds applied for, which was approximately 5 percentage points higher than in the previous two years. The share of firms that belong to 25th percentile of productivity distribution receiving 100% of bank funds applied for is much lower, and it has fluctuated around 50% throughout the period under review. While the probability of receiving full financing appears to increase the more productive a firm is, in the last three years, the probability of partial financing has seemed to decrease. In other words, since 2017 the probability of obtaining only partial funding is much more pronounced for firms belonging to the 25th percentile of the probability distribution than those in the 75th percentile. This suggests that, in the assessment of firms, banks tend to be selective in the amount of funding provided to different types of firm.

Figure 4: Evaluation of lending terms and conditions
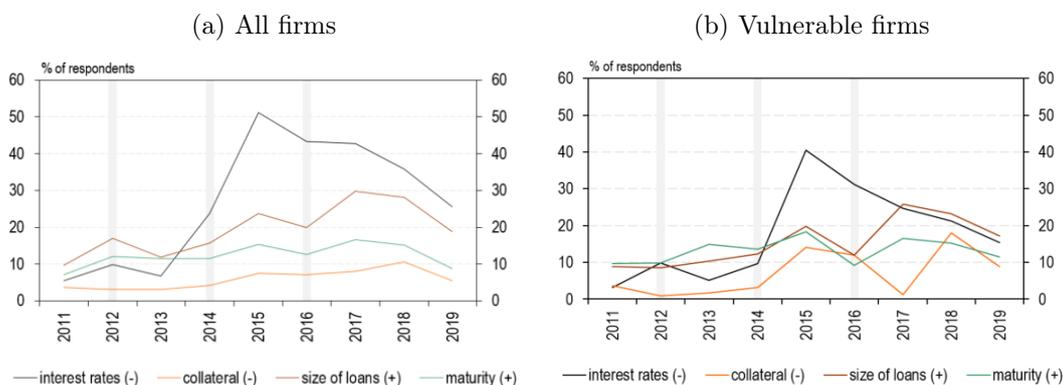
(a) All firms   (b) Vulnerable firms

Turning to lending terms and conditions, we observe that, for the whole pool of firms considered in the sample, the share of those reporting improvement in financing terms and conditions increased after 2014. For price-related terms of financing, i.e. a decline in the interest rate, the share of firms reporting improvement peaked in 2015, standing at around 50%, and started to decelerate thereafter, with fewer than 30% of firms reporting decreases in interest rates by 2019. This coincides with the accommodative monetary policy measures enacted in 2014. The improvement in other financing conditions was more gradual, and somewhat more pronounced for loan size, with about 20% of firms reporting improvement by 2019. Compared to the spectrum of firms as a whole, the dynamics seem somewhat more muted for vulnerable firms, particularly concerning lower interest rates. In 2015 for example, only 40% of vulnerable firms reported improvement in interest rates offered for banking

loans, which was 10 percentage points lower than for the total pool of firms. From the presented summary statistics, it appears that as monetary policy has become more accommodative, so has access to finance and financing terms and conditions. This suggests a successful transmission of favourable financing conditions through the banking channel to the economy. While this holds for the whole spectrum of firms in Slovenia, the data shows that, for the most part, financing conditions have improved only to a lesser extent for vulnerable firms. This is particularly evident in relation to the amount of financing granted, with lower productivity firms acquiring only partial funding relative to higher productivity ones, which appear to be more likely to receive the total amount of funding requested. To formally evaluate these observations, the paper employs a microeconometric exercise explained in detail in the following section.

5 Methodological framework and empirical results

5.1 Methodological framework

This section provides an overview of the modelling framework used in the empirical exercise.

The empirical model[12] follows a logit regression in which firms' perceived improvements in the availability of bank loans are regressed against the type of firm, i.e. vulnerable or otherwise, and the perceived easing of several lending terms and conditions. The type of firm is specified as a dummy variable that takes the value of 1 if a firm qualifies as vulnerable based on the pre-specified definitions, and 0 otherwise. For the qualitative data retrieved from the survey on firm financing, for estimation purposes the variables of interest defined in Section 4, i.e. the evaluation of access to finance and lending terms and conditions by the firm, are specified as follows:

$$x_{it} = 1 \; if \; a \; firm \; reports \; \textbf{improvement}$$
$$x_{it} = 0 \; if \; a \; firm \; reports \; \textbf{deterioration} \; or \; \textbf{no change} \tag{1}$$

In order to study whether vulnerable firms were particularly favoured by the accommodative monetary policy stance, the model includes interactions be-

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[12]The empirical model is similar to that employed by the Workstream on productivity, innovation and technological progress (2021). In their study, the regression model is estimated for each definition of vulnerable firm, including all lending conditions in the regression. In this paper, however, regressions are estimated for each definition of vulnerable firm and each set of lending conditions. Using this approach, the paper accounts for any multicollinearity that may be present within the survey variables (i.e. lending conditions) and safeguards degrees of freedom given the smaller dataset considered for the case of Slovenia.

tween each set of lending terms and conditions and the dummies identifying vulnerable firms. Formally, the model is set as follows:

$$prob(F_{it}) = \beta_0 W_{it} + \beta_1 W_{it} C_{it} + \beta_2 C_{it} + \beta_3 X_{it} + \beta_4 D_{it} + u_{it} \qquad (2)$$

where F_{it} denotes the evaluated availability of financing, i.e. bank loans, at the level of the firm i in period t; W_{it} is a dummy variable taking the value of 1 if a given firm i is characterised as vulnerable in period t according to one of the pre-specified definitions set out in Table 1; and C_{it} refers to the set of variables that summarise perceived bank lending terms of conditions, including *interest rates*, *other costs of financing (such as charges, fees and commissions)*, *available size of loans*, *available maturity*, and *collateral requirements* for firm i in period t. All these variables are equal to 1 if the lending conditions have improved.[13] The empirical specification also controls for a set of firm characteristics denoted by X_{it}, which refer to ownership (family-owned or otherwise), firm size (approximated by number of employees) as well as the main sector (industry) in which the firm operates. As the model hinges upon perceptions of firms that may be affected by the macroeconomic developments of the time, we also introduce a set of year dummies to account for each round of the survey. Finally, in the model, u_{it} refers to the error term. The coefficients of direct interest for the economic inference are those related to W_{it}, and to the interactions $W_{it} C_{it}$, which show whether access to finance for vulnerable firms has improved more relative to healthy ones as financing conditions have eased.

The model is estimated in annual frequency, with errors clustered at the level of the firm.

5.2 Logit estimation results

The following section presents the empirical results of the logit estimation. To ensure interpretation, the results depicted pertain to marginal effects.

The econometric results shown in Table 3 confirm that, for the period under review and the data considered, the perceived improvement in financing conditions has increased the perceived availability of bank loans for all incumbent firms in Slovenia.[14] This is observed in the highly statistical and positive coefficients associated to each of the four types of lending terms and conditions falling under C_{it}. For example, as lending terms and conditions (i.e. interest rates, loan size, collateral requirements and maturity) improved, the probability that access to finance improved increased from about 12 percentage points in the case of collateral to 28 percentage points in the case of

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[13]For example, if interest rates went down, loan size increased, maturity was extended and collateral requirements decreased.

[14]Table 3 also includes details regarding the models' goodness of fit, with the AUC reaching approximately 80%.

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interest rates. However, while access to finance has improved for the whole spectrum of firms, it has improved significantly less so for vulnerable firms. For a vulnerable firm, the probability of access to bank loans has been reduced by about 6 percentage points relative to a healthy firm. While this holds, access to finance has improved less for vulnerable firms, as lending terms have eased on account of monetary policy, but significantly so when collateral requirements and loan maturity are taken into account. This is shown by the negative coefficients associated with the interaction terms of lending terms and conditions with vulnerable firms. For example, as collateral requirements have improved, vulnerable firms have faced a lower probability of improved access to finance (by 22 percentage points) compared to healthy ones. The probability of improved access to finance for healthy firms (as collateral requirements improved) amounts to 39%, while the same probability for a vulnerable firm is smaller, at 17%. These aggregate results are also estimated for each group of vulnerable firm identified in Section 4. The results, shown in Table C.2. in Annex C, confirm the results for vulnerable firms considered together, and are more marked for financially distressed firms, i.e. those with a low Altman Z-score and those with low productivity.[15]

Table 3: Marginal effects

variables	interest rate	collateral	loan size	maturity
change in estimated probability[1]				
vulnerable firm (W_{it})	-0.049***	-0.067***	-0.054***	-0.071***
	(0.01)	(0.01)	(0.01)	(0.01)
improvement in terms and conditions (C_{it})	0.278***	0.119***	0.280***	0.218***
	(0.02)	(0.03)	(0.02)	(0.03)
interactions with vulnerable firms ($W_{it}C_{it}$)	-0.031	-0.218***	-0.027	-0.086*
	(0.04)	(0.06)	(0.04)	(0.05)
observations	2918	2722	2777	2707
firm characteristics	yes	yes	yes	yes
sector dummies	yes	yes	yes	yes
year dummies	yes	yes	yes	yes
pseudo R^2	0.2155	0.1526	0.2250	0.1827
AUC	0.8085	0.7671	0.8126	0.7859

Notes: *Cluster robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.10.* [1]*Change in estimated probability due to a 1-unit increase (0 to 1 for binary variables).*
Source: *Authors' estimates.*

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[15]For robustness checks, we included sector-year dummies in the models, and the outcomes exhibited no notable discrepancies.

These results may, however, mask potential heterogeneity across different types of firm. For example, as set out by the ECB (2021), when interest rates declined, larger vulnerable firms (in their case, zombies) tended to report an increase in the availability of bank loans relative to larger healthy firms, while smaller ones experienced lower increases in access to finance. In order to account for any potential heterogeneity across the pool of firms considered in this analysis, the sample is split according to firm size and age. In terms of size, approximated by number of employees, firms are split into two groups: micro/small firms and medium-sized/large firms. In terms of age, the firms are split into young firms (operating for ten years or less) and old firms (operating for more than ten years). While prone to caveats on account of the small sample available, the results depicted in the second panel of Table C.3. and C.4. in Annex C show that the improvement in lending terms and conditions has significantly increased the probability of access to finance for the whole spectrum of firms. This effect is markedly more pronounced for medium-sized and large firms, as well as older firms. These results are in line with Matavulj (2021), who finds that, in the case of Slovenia, large and older firms are more likely to obtain bank loans. Turning to vulnerable firms, the results show that as collateral requirements have improved, while lower relative to healthy firms, the probability of improved access to bank loans has been slightly higher for medium-sized and large vulnerable firms as well as for mature firms (third panel in Table C.3. and Table C.4. in Annex C). In terms of age, as collateral requirements have eased relative to healthy firms, the probability of access to finance has been lower by 20 percentage points for older vulnerable firms, as opposed to 30 percentage points for younger vulnerable ones. Concerning size, the results are somewhat more comparable, with micro and smaller vulnerable firms facing a probability of access to loans that is three percentage points lower relative to healthy medium-sized and larger firms, as collateral requirements have improved.

Contingent on the dataset and period considered, the results of the empirical exercise show that while financing conditions have eased and the availability of financing has improved for the whole spectrum of firms in Slovenia, this has been less so for vulnerable firms.[16] Consequently, in line with the ECB (2021) and contrary to the prevailing findings in reviewed studies that exclude the most recent period of accommodative monetary policy, there does not appear to be evidence of pronounced credit misallocation in Slovenia.

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[16]This is further supported by the estimated logit model, in which the dependent variable represents the perceived deterioration of lending terms and conditions. The marginal effects, as displayed in Table C.5 in Annex C, indicate that healthy firms are less likely to report a deterioration in financing conditions relative to vulnerable firms.

5.3 The extensive margin through the lens of summary statistics

While the results of the empirical exercise suggest no pronounced evidence of credit misallocation in Slovenia over the period under review, they may imply that favourable financing conditions and access to finance have indeed enabled vulnerable firms to survive for longer. This, in turn, can affect aggregate productivity through the extensive margin. These are the conclusions reached by Banerjee & Hofmann (2018), who argue that the effects of accommodative monetary policy on productivity depend on the balance of entry and exit of vulnerable firms. To address this dimension, this section digs into the data and presents a set of summary statistics extracted from the AJPES dataset only, i.e. not merged with the dataset on the firms' financing survey.

Figure 5: Importance of vulnerable firms

(a) Vulnerable firms   (b) Zombie firms
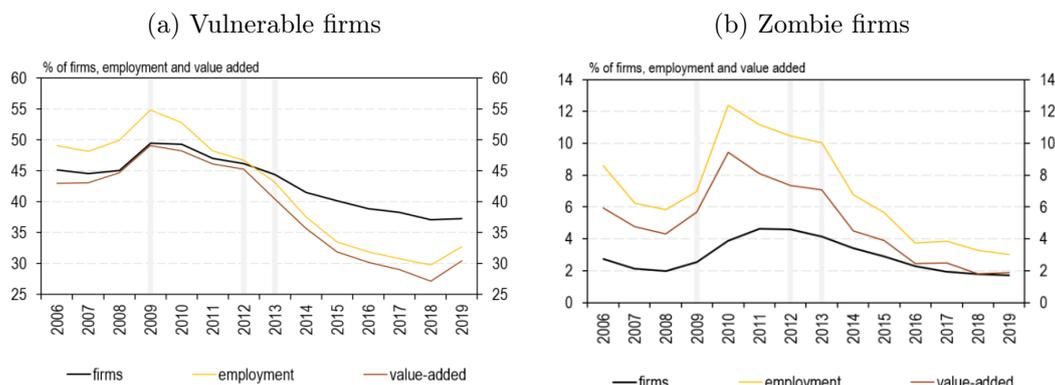
Note: The shaded lines correspond to the years of the financial and debt crisis in Slovenia. Value-added is expressed in nominal terms.
Source: AJPES, authors' calculations.

The prevalence rate of vulnerable firms in the pool of firms in Slovenia changed over the 2006−2019 period. Before the onset of the Global Financial Crisis, the prevalence rate of vulnerable firms and their share in total employment and value-added amounted to more than 45%. Their prevalence has been continuously decreasing thereafter, with the share of total employment and value-added generated by these firms amounting to around 30% as of 2019 (Figure 5a). As mentioned earlier, the broad definition of a vulnerable firm considered in this analysis encompasses low productivity firms and/or those that are financially distressed, including zombie firms. For the latter group, we find that the prevalence rate and importance for employment and total value-added is much lower. Immediately after the Global Financial Crisis, their share increased to about 4% in 2010, and remained at the same level throughout the Sovereign Debt Crisis. The trend then started to decelerate, with zombie firms

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accounting for just about 2% of all firms and total value-added in 2019, and around 3% of total employment (Figure 5b).

Figure 6: Share of firms entering and exiting from distress
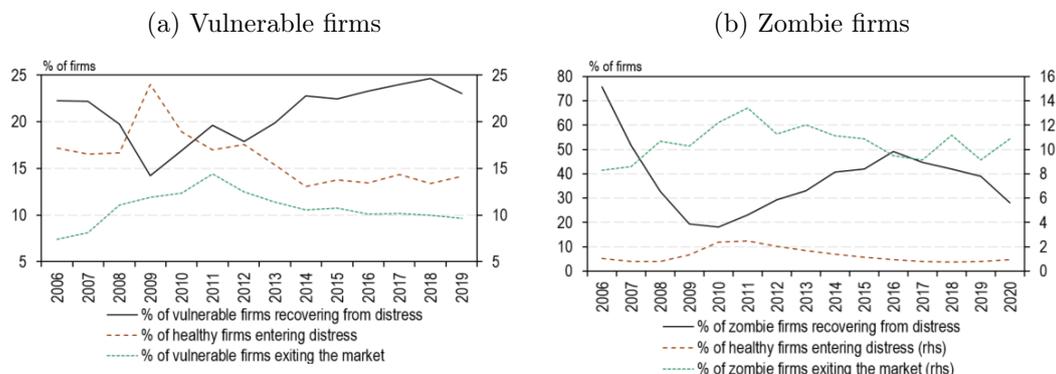
(a) Vulnerable firms   (b) Zombie firms

The evolution of vulnerable firms for the period under review masks significant heterogeneity in terms of those firms' entry and exit dynamics. As Figure 6a shows, the share of healthy firms entering distress, i.e. qualifying as vulnerable, peaked during the Global Financial Crisis, but has been decreasing ever since, remaining broadly constant at just below 15% since 2014. On the other hand, the share of vulnerable firms exiting the market peaked with the onset of the Sovereign Debt Crisis, but also started to decelerate thereafter, fluctuating at around 10% over the recent period. As the share of vulnerable firms exiting the market falls short of the share of healthy firms entering distress, this may suggest some adverse impact on aggregate productivity through the extensive margin since 2014. This trend has been notable since 2014, coinciding with the adoption of an increasingly accommodative monetary policy stance. Notwithstanding this, over the same period the share of vulnerable firms recovering from distress has been continuously increasing. It has reached approximately 25% in the last two years, which in turn offsets the potential adverse effects on productivity stemming from the longer survival period for vulnerable firms. Similar dynamics are also the case for zombie firms. Despite the higher share of zombie firms exiting the market, the higher level of zombie firms following the Global Financial Crisis reflects the lower recovery rate of zombie firms as well as the higher share of healthy firms entering distress (Figure 6b). Since 2014, as monetary policy became increasingly more accommodative, the share of zombie firms exiting the market remained relatively stable at around 10%. At the same time, the share of zombie firms in the pool of firms in Slovenia has been continuously falling, reflecting an increasingly higher recovery rate of zombie firms and a historically low rate of firms entering distress.

Figure 7: Productivity of vulnerable firms relative to healthy firms in the
same sector and the prevalence rate for the 2011−2019 period

(a) Vulnerable firms   (b) Zombie firms
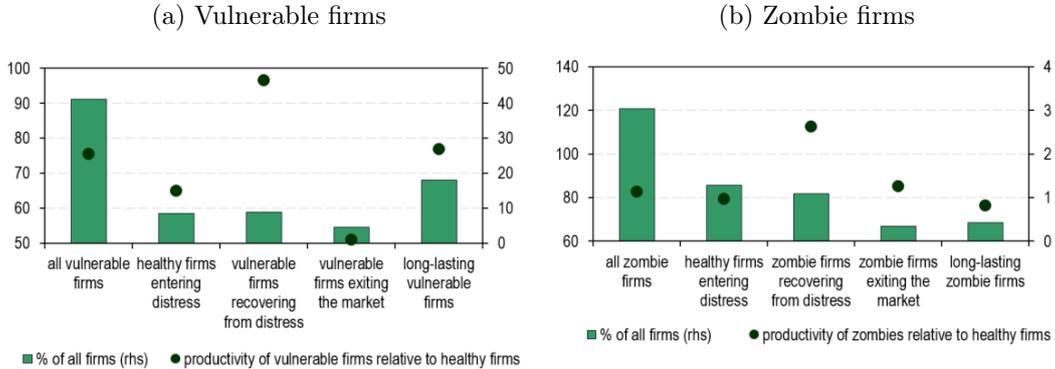
Note: *The dots plot the median of relative productivities. The bars show the share of each type of firm in*
the total pool of firms. Long-lasting vulnerable/zombie firms are those firms that qualify as
vulnerable/zombie throughout the sample considered.
Source: *Banka Slovenije, authors' calculations.*

The impact on aggregate productivity through the extensive margin hinges
upon the productivity level of firms exiting and entering the market. As ob-
served in Figure 7, the pool of vulnerable firms in general, and zombies in
particular, masks significant heterogeneity over the 2011−2019 period. This
variation is evident in their status, prevalence rate, and their productivity
relative to healthy firms. In terms of composition, long-lasting vulnerable
firms, i.e. firms that qualify as vulnerable throughout the sample, account for
the bulk of firms within the total pool of vulnerable firms. This is followed
by healthy firms entering distress and vulnerable firms recovering from dis-
tress. The prevalence rate of vulnerable firms exiting the market is the lowest.
Looking at the respective median productivity level of the respective groups of
vulnerable firms relative to healthy ones, Figure 7a shows that vulnerable firms
exiting the market have the lowest relative productivity. On the other hand,
vulnerable firms recovering from distress experience a significant increase in
productivity, reaching a level comparable to that of healthy firms. A similar
picture also prevails for zombie firms, albeit with a significantly lower preva-
lence rate than for the total pool of vulnerable firms. As observed in Figure 7b,
zombie firms exiting the market account for the lowest relative productivity.
However, for those that recover from distress, the prevailing productivity is not
only higher, but outweighs the median productivity of healthy firms.[17] For the
period under review, the data shows that, in Slovenia's case, the accommoda-

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[17]To prevent any misclassification of fast-growing young firms that might not yet be
profitable, we conducted an assessment of zombie firms' productivity in relation to healthy
ones using an alternative definition. This new definition of zombie firms incorporates firm
age (requiring a minimum of five or ten years in operation). Our investigation revealed no
substantial deviations, thereby reinforcing the validity of our findings.

tive policy of the recent decade, while allowing vulnerable firms to survive for longer, has also enabled them to recover, and by doing so, increase their level of productivity. Although an econometric analysis would be required for any formal conclusions, a first glance at the data suggests that, at the extensive margins as well, the adverse impact of protracted accommodative monetary policy has been limited in Slovenia's case.

6   Conclusions

While accommodative monetary policy can stimulate aggregate demand and investment in productivity-enhancing technologies, thus positively affecting productivity growth, protracted periods of accommodative monetary policy may have adverse implications. On the one hand, accommodative monetary policy may, by easing financing conditions, lower the productivity threshold for firm profitability, facilitating the entry and survival of non-viable firms. On the other hand, it can affect banks' lending decisions and distort their incentives to lend to vulnerable firms at the expense of healthy ones, resulting in credit misallocation. The latter channel is especially relevant for Slovenia, where banking loans are the main source of external financing for firms; possible misallocation can therefore have significant macroeconomic consequences (Banerjee et al., 2017). To evaluate the prevalence of credit misallocation in Slovenia as monetary policy has become more accommodative, this paper combines firm-level data on firm financing from the joint survey conducted by Banka Slovenije and SID Bank with firm-level balance sheet and income statement data from AJPES for the 2011−2019 period. The paper employs logit regression, the results of which show that as financing conditions have eased, access to finance has improved for all incumbent firms in Slovenia, but significantly less so for vulnerable firms. As such, based on the data considered in the analysis, accommodative monetary policy does not seem to have adversely distorted banks' incentives in Slovenia during the period under review. This implies that, at least at the intensive margin, protracted accommodative monetary policy did not have pronounced adverse effects on productivity in Slovenia. However, given that the easing of financing conditions prevailed for the whole spectrum of firms, the results may also imply that accommodative monetary policy has indeed prolonged the survival of vulnerable firms, with adverse implications for productivity through the extensive margin. While an empirical assessment of the latter remains a topic for future research, the summary statistics from the AJPES dataset suggest that the accommodative monetary policy seems to have enabled many vulnerable firms to recover and, in doing so, record higher levels of productivity. Despite the extra accommodative monetary policy of recent years, vulnerable firms, particularly financially distressed firms such as zombies, account for a continuously decreasing proportion of Slovenian firms and, as of 2019, remained at historically low levels.

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Appendices

A Decomposition of real GDP per capita and investment dynamics in Slovenia

The decomposition of growth in real GDP per capita into three major growth factors, namely total factor productivity (TFP), capital and labour as shown in Figure A.1, assumes that the production (or supply) side of the economy can be appropriately explained by a Cobb-Douglas production function ($Y_t = A_t K_t^\alpha L_t^{1-\alpha}$). The estimate of capital in the base year follows an equation that equates the capital share of output (K/Y) with the ratio of the capital share in output (α) and the user cost of capital (long-term real interest rate on capital investment and the depreciation rate, i.e. $r + \delta$). The evolution of capital is then determined by the law of motion of capital, as follows $K_{t+1} = (1 - \delta)K_t + I_t$. The labour component is represented by the series for employment (domestic concept) from the national accounts, while total factor productivity represents the residual.

Figure A.1: Drivers of growth in real GDP per capita in Slovenia
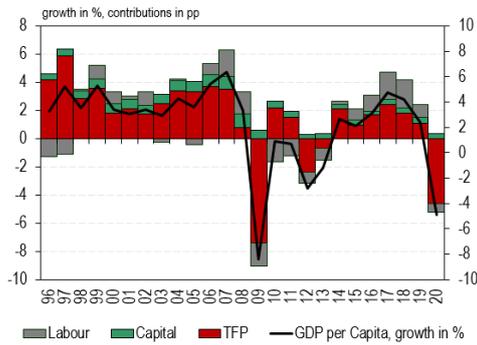
Figure A.2: Level of gross fixed capital formation in Slovenia

Source: SORS, Authors' calculations.

Source: SORS, Authors' calculations.

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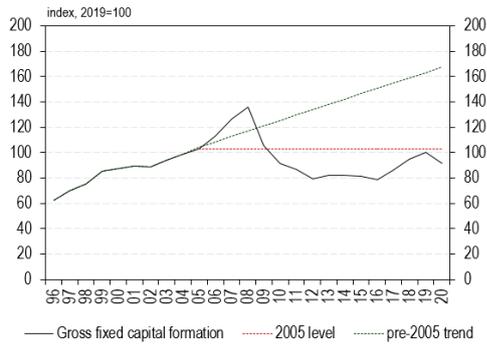
B Banks' balance sheets in Slovenia and EA

Figure B.1: Banks' balance sheet - Slovenia

(a) Structure of total loans

(b) Decomposition of total loan growth
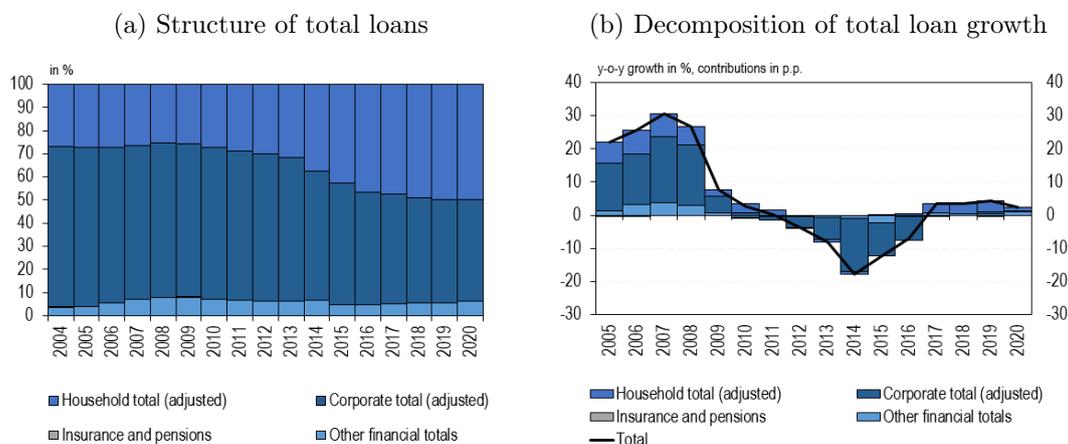
Source: ECB, Authors' calculations.

Figure B.2: Banks' balance sheet - Euro Area

(a) Structure of total loans

(b) Decomposition of total loan growth
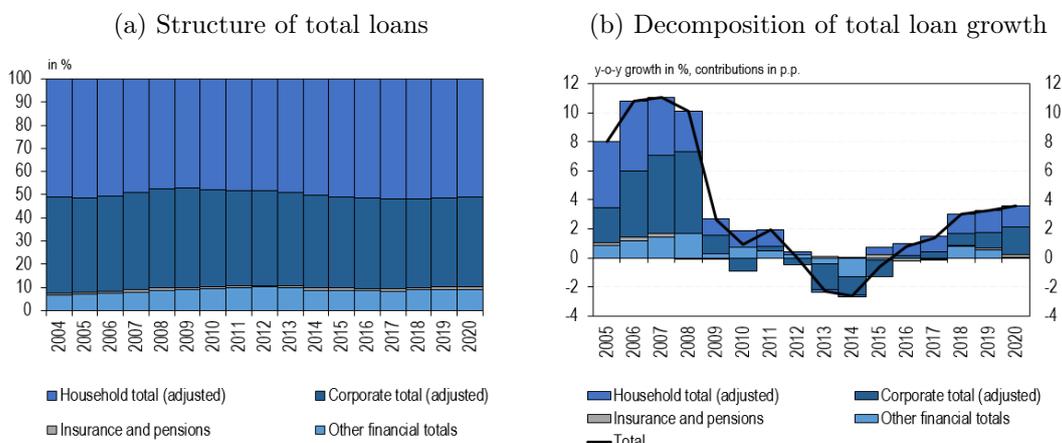
Source: ECB, Authors' calculations.

C Marginal effects

Table C.1: Marginal effects

variables	interest rate	collateral	loan size	maturity
estimated probability				
vulnerable firm ($W_{it} = 1$)	0.162***	0.142***	0.155***	0.145***
	(0.01)	(0.01)	(0.01)	(0.01)
healthy firm ($W_{it} = 0$)	0.211***	0.209***	0.209***	0.216***
	(0.01)	(0.01)	(0.01)	(0.01)
improvement in terms and cond. ($C_{it} = 1$)	0.391***	0.293***	0.411***	0.376***
	(0.02)	(0.03)	(0.02)	(0.03)
deterioration in terms and cond. ($C_{it} = 0$)	0.113***	0.174***	0.131***	0.158***
	(0.01)	(0.01)	(0.01)	(0.01)
improvement in terms and cond. for vulnerable firms ($W_{it} = 1$, $C_{it} = 1$)	0.374***	0.169***	0.397***	0.328***
	(0.04)	(0.04)	(0.04)	(0.04)
improvement in terms and cond. for healthy firms ($W_{it} = 0$, $C_{it} = 1$)	0.405***	0.387***	0.424***	0.414***
	(0.02)	(0.05)	(0.03)	(0.03)

Notes: *Cluster robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.10.*
Source: *Authors' estimations.*

Table C.2: Marginal effects, all firms

Variables	zombie firms				Altman Z-score				low productivity firms				low productivity firms (TFP)			
weak firms																
zombie	-0.063* (0.04)	-0.081*** (0.03)	-0.079*** (0.03)	-0.104*** (0.03)												
Altman					-0.053*** (0.01)	-0.069*** (0.01)	-0.052*** (0.01)	-0.074*** (0.01)								
low prod.									-0.020 (0.03)	-0.047 (0.03)	-0.029 (0.03)	-0.043 (0.03)				
low prod. TFP													-0.032 (0.03)	-0.044* (0.04)	-0.032 (0.03)	-0.049* (0.03)
improvement in terms and conditions																
interest rate	0.276*** (0.02)				0.277*** (0.02)				0.279*** (0.02)				0.278*** (0.02)			
collateral		0.131*** (0.04)				0.105*** (0.03)				0.138*** (0.03)				0.132*** (0.04)		
loan size			0.280*** (0.02)				0.281*** (0.02)				0.281*** (0.02)				0.280*** (0.02)	
maturity				0.219*** (0.03)				0.218*** (0.03)				0.217*** (0.03)				0.216*** (0.03)
interactions weak firms with																
interest rate	-0.120 (0.13)				-0.051 (0.04)				-0.051 (0.11)				-0.081 (0.08)			
collateral		0.020 (0.11)				-0.252*** (0.07)				-0.257*** (0.08)				-0.118 (0.09)		
loan size			-0.132 (0.11)				-0.016 (0.05)				-0.017 (0.11)				-0.071 (0.10)	
maturity				-0.119 (0.09)				-0.119** (0.05)				0.045 (0.14)				-0.041 (0.10)
N	2918	2722	2777	2707	2918	2722	2777	2707	2918	2722	2777	2707	2918	2722	2777	2707
pseudo R²	0.2104	0.1461	0.2204	0.1779	0.2153	0.1526	0.2247	0.1827	0.2089	0.1454	0.2180	0.1744	0.2093	0.1441	0.2181	0.1745
AUC	0.8041	0.7620	0.8083	0.7810	0.8085	0.7669	0.8122	0.7858	0.8020	0.7600	0.8057	0.7785	0.8021	0.7603	0.8058	0.7787

Notes: Cluster robust standard errors in parentheses, *** $p<0.01$, ** $p<0.05$, * $p<0.10$. Firms characteristics, sector and time dummies included.
Source: Authors' estimations.

Table C.3: Marginal effects, **by size classes**

Variables	micro and small firms				medium-sized and large firms			
vulnerable firms	-0.051***	-0.062***	-0.050***	-0.061***	-0.035	-0.071***	-0.054**	-0.081***
	(0.02)	(0.02)	(0.02)	(0.02)	(0.03)	(0.03)	(0.02)	(0.03)
improvement in terms and conditions								
interest rate	0.273***				0.300***			
	(0.03)				(0.04)			
collateral		0.092**				0.162**		
		(0.04)				(0.06)		
loan size			0.259***				0.334***	
			(0.03)				(0.04)	
maturity				0.229***				0.218***
				(0.04)				(0.04)
interactions of vulnerable firms with								
interest rate	0.001				-0.048			
	(0.00)				(0.07)			
collateral		-0.239***				-0.210*		
		(0.07)				(0.11)		
loan size			-0.053				0.038	
			(0.05)				(0.08)	
maturity				-0.093				-0.048
				(0.07)				(0.07)
N	1981	1830	1865	1807	923	878	899	886
pseudo R^2	0.1768	0.1131	0.1798	0.1440	0.2992	0.2376	0.3120	0.2590
AUC	0.7869	0.7387	0.7882	0.7576	0.8516	0.8242	0.8571	0.8359

Notes: *Cluster robust standard errors in parentheses, *** $p<0.01$, ** $p<0.05$, * $p<0.10$. Firms characteristics, sector and time dummies included.*
Source: *Authors' estimations.*

Table C.4: Marginal effects, **by age classes**

Variables	young firms (up to 10 years)				old firms ($\geq$ 10 years)			
vulnerable firms	-0.032	-0.038	-0.035	-0.049	-0.052***	-0.071***	-0.056***	-0.074***
	(0.03)	(0.03)	(0.03)	(0.03)	(0.02)	(0.02)	(0.02)	(0.02)
improvement in terms and conditions								
interest rate	0.341***				0.263***			
	(0.05)				(0.03)			
collateral		0.167**				0.111***		
		(0.07)				(0.04)		
loan size			0.259***				0.287***	
			(0.05)				(0.03)	
maturity				0.192***				0.222***
				(0.07)				(0.03)
interactions of vulnerable firms with								
interest rate	0.110				-0.046			
	(0.10)				(0.04)			
collateral		-0.304**				-0.201***		
		(0.13)				(0.07)		
loan size			0.011				-0.022	
			(0.09)				(0.05)	
maturity				0.076				-0.100*
				(0.13)				(0.05)
N	644	596	612	589	2263	2116	2155	2107
pseudo R^2	0.1743	0.1241	0.1751	0.1324	0.2419	0.1798	0.2568	0.2142
AUC	0.7654	0.7282	0.7751	0.7403	0.8291	0.7895	0.8317	0.8097

Notes: Cluster robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.10. Firms characteristics, sector and time dummies included.
Source: Authors' estimations.

Table C.5: Marginal effects: **perceived deterioration of financing conditions**

dependent variable	interest rate	collateral	loan size	maturity
estimated probability				
healthy firm	0.601***	0.845***	0.536***	0.603***
	(0.01)	(0.01)	(0.02)	(0.02)
vulnerable firm	0.695***	0.901***	0.683***	0.638***
	(0.01)	(0.01)	(0.02)	(0.02)
change in estimated probability				
healthy firm	-0.094***	-0.056***	-0.147***	-0.035
	(0.02)	(0.02)	(0.03)	(0.03)
N	2079	1287	1364	892
control dummies	yes	yes	yes	yes
pseudo R^2	0.3668	0.1249	0.1719	0.1193
AUC	0.8772	0.7485	0.7656	0.7296

*Notes: Cluster robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.10. Dependent variable: 1 if firm reported a deterioration in lending terms and conditions and 0 otherwise. Control dummies: firm characteristics, sector dummies, year dummies.*
Source: Authors' estimations.