THE SEVENTEENTH YOUNG ECONOMISTS' SEMINAR

TO THE THIRTIETH DUBROVNIK ECONOMIC CONFERENCE

Organized by the Croatian National Bank

Bruno Huljić

NPL Market: Negative Externality or Efficient Market Mechanism?

Hotel " Sun Gardens Dubrovnik "

Dubrovnik

June 13 – 15, 2024

Draft version

Please do not quote

NPL market: negative externality or efficient market mechanism?

Bruno Huljić

Croatian National Bank

Zagreb, Croatia

bruno.huljic@hnb.hr

April, 2024

Abstract: Non-performing loans sale is considered to be a useful instrument for credit risk resolution as it allows credit institutions to disburse troubled assets, reduce costs and improve their capital positions creating solid ground for future credit growth. Therefore, since NPLs stuck in banks` balance sheets are often perceived as a testament of market failure, NPL sales are seen as market efficiency boosting mechanism. However, while the interaction of non-performing loans and bank's resilience is a well-researched area, there has been limited work questioning the impact of loan sales on distressed firms' performance and their survival. This paper utilises the detailed micro data and aims to assess the impact of a cession between a credit institution and an NPL investor on the individual borrower's risk of going into bankruptcy while taking into account the quality of the insolvency regime. Our initial results, based on Cox proportional hazard model suggests that NPL investors generally take into account firm fundamentals when deciding on bankruptcy initiation and therefore are contributing to market efficiency.

Keywords: NPL sales, Corporate sector, Insolvency regime, Cox proportional hazards model

1. Introduction

Resolution of troubled assets in financial institutions' balance sheets became one of the main concerns for regulators after the onset of the global financial crisis in 2008 and subsequent economic crises that manifested themselves in many economies. After the initial economic slowdown, a sharp rise in defaults of the private sector in the coming years led to an increase in the non-performing loan ratio throughout the euro area, which proved to be a significant burden for the resilience of banks and their ability to provide credit for the economy (Huljak et al. 2020). Faced with difficulties of asset recovery and requirements of a new framework to monitor credit risk, credit institutions used the option to sell distressed loans to NPL investors to improve their liquidity and strengthen their capital positions.

While the aforementioned mechanism of asset restructuring benefited banks in the wake of the NPL cycle that followed the downturn in the economic cycle, little attention was given to the effects of a cession between banks and NPL investors on firm outcomes and survival. Although prospects of distressed debtors aren't necessarily in the focus of regulators after they have left the balance sheets of financial institutions through the channel of NPL sales, they could have a significant impact on the functioning of the economy given the corporate sectors` role in employment, innovation and growth. Specifically, the future of firms after defaulting on their debt can influence the capital reallocation mechanism and productivity in the economy if relatively inefficient firms prolong their stay on the market or completely avoid bankruptcy.

Croatian banking sector experienced similar developments regarding the accumulation of NPLs in the early 2010s, which were only amplified by the process of financial deepening that took place before the GFC and which greatly exposed it to a materialization of credit risk in the private sector. While the initial rise of the non-performing loan ratio in the Croatian banking system wasn't exceptional relative to the experience of similar countries in the European Union, it was against the background of a weak institutional setting and non-adequate insolvency regime which greatly affected non-performing loan resolution. Furthermore, the recession following the global financial crisis was prolonged in Croatia therefore not allowing for "growing out of NPLs" witnessed in some countries and with NPL ratio in certain segments of the corporate portfolio reaching 55% in 2011.

Before the judicial reform in 2015, the insolvency regime in Croatia was characterised by low efficiency, delayed openings of bankruptcy procedures, and low recovery rates. Even

though the reform did increase the efficiency of the judiciary system and improved the prospect of debt recovery, it still lags behind insolvency regimes of other advanced economies in terms of efficiency and prospects of asset recovery according to the data from the Doing Business Report of the World Bank. This setting significantly limited options for creditors who tried to recover their distressed assets, which could have incentivized them to remove those assets from their balance sheets by selling them at a discount to NPL investors. If the aforementioned mechanism played a significant role in banks' strategies of asset recovery, it could have increased the role of NPL investors in debt resolution procedures and amplified their effect on dynamics in the corporate sector and subsequently on the reallocation of capital from distressed companies to more efficient and resilient companies.

Prospects of severely limited loan recovery meant that banks were faced with a large stock of impaired loans for which they had to recognise large write-offs and which had a negative impact on their capital position. In this environment, distressed loan sales became a viable mechanism for the resolution of bad loans and allowed banks to salvage some value for loans for which they had to fully recognize write-offs[1]. At the same time, a relatively large volume of corporate NPL sales and sufficient data coverage, allow for a study of NPL investor's impact on firms' survival probability and effect on cleansing the sector of non-financial corporates of inefficient market participants.

This paper acknowledges and goes beyond different strands of literature regarding the determinants of NPLs, the impact of non-performing loans on a bank's resilience and lending, incentives for NPL sales, the importance of corporate demographics for aggregate productivity growth, and the importance of institutional setting for efficient market outcomes. However, the contribution of the paper is its focus on the aftermath of the NPL sale with a special interest in the NPL buyers` perspective and its effect on the market structure. The paper is structured as follows: section 2 provides the overview of related literature, section 3 describes the dataset and methodology used to estimate the effect that NPL investors have on distressed firms, section 4 presents the empirical results of survival models and linear probability model, while section 5 concludes.

[1] During the first half of the 2010s, Croatia had a strict regulatory regime regarding write-offs for loans in the default status. Termed "NPL calendar", regime required banks to aggressively acknowledge write-offs for defaulting loans, which eventually led to a high volume of loans which were fully written-off from balance sheets. Thus, NPL salaes evenutally enabled banks to recover some value and even recognise revenue from selling loans which were fully written-off.

2. Literature review

While sources of NPL accumulation are widely understood and generally well-researched area in the domain of financial stability, monetary policy and bank supervision, significant research opportunities are left on the table. Micro data regarding sales, bank and corporate performance, allows for further inquiring, especially regarding the aftermath of the NPL sale itself. The main question one could ask is: what are the chances of debtor surviving after the sale? Furthermore, taking into account determinants of NPLs in banks' balance sheets, one could relate this research question to the interpretation of estimated effects that NPL investors exert on firms' length of stay on the market. If the sale of distressed loans to NPL investors leads to a higher survival probability of debtors who were granted loans due to inadequate screening practices of a certain credit institution, it could be argued that the mechanism of loan sale represents an inefficient market mechanism that doesn't induce earlier exit of inefficient market participants.

Different strands of literature postulate distinct determinants of NPLs which could roughly be distinguished as related to bank characteristics, industry dynamics, and macroeconomic conditions (Huljak et al. 2020). While authors point to bank management as the most prominent explanation of a higher share of non-performing loans concerning the effect of bank characteristics, there is no overall consensus regarding the impact of industry-specific factors on a proportion of non-performing loans in a certain banking system (Beck, De Jonghe and Schepens 2013; Goetz 2018). Furthermore, macroeconomic conditions seem to have a significant impact on the transition of loans from performing to non-performing status, and authors have found that economic activity, inflation, interest rates, and the exchange rate seem to be the most relevant drivers of higher NPL ratios (Anastasiou and Tsionas 2016; Jimenez and Saurina 2006; Louzis, Vouldis, and Metaxas 2012).

While bank management and macroeconomic conditions seem to be the most important sources of credit risk and potentially influence the supply and composition of non-performing loans, some findings argue that incentives for loan sales also have to be taken into account when evaluating which loans become available on secondary markets. Gryglewicz et al. (2023) proposed a framework for evaluating dynamics and lender incentives when it comes to loan sales, under which it is possible to infer the effect of a decision to sell a part of the loan on

overall loan performance expectations. Specifically, authors argue that initial retention of the loan on a credit institution's balance sheet decreases with borrowers' intrinsic credit risk, which could point to a conclusion that banks are more willing to offer riskier loans or loans for which they don't have a clear recourse in the case of a credit risk materialisation. The focus of the aforementioned paper was on the sale of loans through the process of securitisation of performing loans, however, it could provide some insight into the decision-making of loan sellers concerning the overall characteristics of the debtor.

The importance of firm survival and market outcomes plays a major role in the functioning of the economy through the effect on productivity. While many authors analysed the effect of firm demographics on industry structure and aggregate productivity, the idea was first introduced with the term "creative destruction" coined by the economist Joseph Schumpeter (Schumpeter 1942). The proposed mechanism postulates that new entrants (i.e. new firms on the market) introduce new and innovative solutions which make the technology and business practices of old participants obsolete, thus leading to their eventual exit with an overall positive impact on aggregate productivity and economic growth. Under the proposed theory, market inefficiencies that distort the aforementioned mechanism could be relatively costly in terms of foregone economic growth.

More recent empirical findings tend to confirm the initial hypothesis of the role that "creative destruction" plays in the development of aggregate productivity. Foster et al. (1998) used establishment-level data in the United States to examine the effect of microeconomic productivity dynamics and aggregate productivity growth. Authors find that entering plants tend to displace less efficient plants and contribute positively to overall productivity. The evidence of the positive effect of resource allocation is also evident in cross-country analyses such as in Bartelsman et al. (2003). In this study, authors use data from ten OECD countries in order to assess how are findings on firm demographics and firm survival verified by evidence in a broader range of countries with different institutions and economic growth performances. The paper concludes with findings that overall dynamics in the corporate sector are impacted by barriers to entry of new firms, which is contingent on an institutional setting of economic policies in a specific economy.

The impact of institutional setting on firm demographics is usually connected to the functioning of the insolvency regime in certain jurisdictions and its ability to efficiently resolve cases to avoid congestion and lower recovery rates. Studies of insolvency regime impact on

economic performance and adjustment mechanism of economic agents to exogenous shocks demonstrated that the overall quality of courts could have a significant impact on firms' behaviour and decision to settle their claims outside the court. Fazio et al. (2021) use firm-level data from Brasil to estimate the likelihood that firms sell their accounts receivables at a discount depending on the congestion of courts in their jurisdictions as a proxy of their efficiency. The findings point to the conclusion that in an environment of exogenous liquidity shock, firms that are located in jurisdictions with lower court quality tend to sell their accounts receivables for a discount to get quicker access to liquidity. This conclusion points to the fact that economic agents such as banks could decide to avoid settlement of distressed assets in court and instead offer them on secondary markets to NPL investors in an environment of inadequate insolvency regime. Furthermore, some policy notes such as Menezes et al. (2021) argue that efficient legal regimes that promote effective insolvency and creditor/debtor rights facilitate debt recovery, reduce the cost of credit by reducing the overall risk level, and help lower NPL levels in the financial system.

Besides the impact on overall economic performance, certain authors have also proposed that firm demographics could have an impact on the transmission of monetary policy. Gertler and Gilchrist (1994) analyse the asymmetries in responses to monetary policy tightening between firms of different sizes and find that small firms account for a significant drop in manufacturing that follows the introduction of restrictive monetary policy while larger firms tend to initially accumulate a larger share of inventories. If the economy suffers from an overhang of larger and less productive corporates it could lead to a less efficient monetary policy channel.

3. Data

To study the NPL investors` effect on firm survival probability, this paper uses a novel dataset that was constructed using various sources on banks' NFC exposures and defaulting borrowers, bankruptcy procedures, loan sales, and firms' financial statements. The dataset on NFC exposures came from the corporate credit register of the CNB which contains information on banks' exposures towards corporates on a borrower level and which is regularly collected on a monthly basis. Information regarding the defaulting corporate borrowers came from a separate dataset from the CNB which regularly collects data on borrowers that are late on their

payments in different buckets, depending on the length of payment delay. Specifically, buckets are divided into the following categories: delayed payment between 0 and 15 days, delayed payment up to 1 month, delayed payment up to 2 months, delayed payment up to 3 months, delayed payment up to 6 months, delayed payment up to 1-year, delayed payment up to 2-years, delayed payment up to 3-years, delayed payment up to 5-years, delayed payment up to 10-years and delayed payment of more than 10-years. To identify corporates that entered into a default status in a certain month, filter was applied in order to extract information regarding the first month that a specific corporate entered the bucket of delayed payment up to 3 months (i.e. 90 days). The dynamics and systemic importance of defaulting corporates are presented in Table 1. below.

Data on firm demographics is obtained through court registry datasets on procedures of new business registrations, pre-bankruptcy cases, bankruptcy cases, liquidations, and voluntary exits. Court registry data consists of daily observations for specific openings of legal procedures which allows precise identification of the date when a certain firm exited the market through bankruptcy or voluntary exit. Besides providing information regarding the event of interest for survival analysis of defaulted corporates, data from the court registry was also used to clear the dataset of defaulted companies that entered the bankruptcy procedure before entering default status. In this way, a sample of defaulted corporates is restricted to entities that firstly defaulted on their debt obligations, and then later potentially experienced an event of interest (bankruptcy) to study risk mechanisms that govern the exit of distressed companies.

Table 1. Descriptive statistics of defaulting corporates

Year	#defaults	#employees	Mean loan amount (EUR)	Median loan amount (EUR)	Std. dev. of loan amount (EUR)	Total loan amount (EUR)
2011	2,085	48,033	1,125,974	64,216	8,927,264	2,323,246,528
2012	1,521	26,094	813,968	53,089	4,621,540	1,083,123,295
2013	1,232	21,566	865,628	54,638	4,545,136	931,102,527
2014	905	17,428	616,136	31,672	3,721,074	464,891,422
2015	735	7,522	500,850	33,232	1,967,841	342,415,560
2016	520	3,929	347,463	19,877	1,529,231	155,587,831
2017	502	19,968	993,140	28,855	4,204,781	414,291,860
2018	555	6,872	806,207	25,198	8,875,543	267,765,178
2019	581	4,854	479,880	20,899	2,544,816	206,927,776
2020	858	10,111	690,286	27,130	11,707,988	591,993,245
2021	679	15,766	251,555	26,412	920,428	144,435,636
2022	603	5,931	255,443	35,393	765,199	144,606,566

Note: Total loan amount refers to the total of defaulting loans at the end of the year.
Source: CNB; author's calculations

Data on loan sales also came from a regularly updated dataset of the CNB, which collects data on banks' loan sales and the percentage of write-offs for specific loans. The dataset enables the identification of borrowers who experienced the cession between creditors and dates on which the specific bank sold their distressed loans to an NPL investor, which facilitates the distinction of borrowers for whom the loan sale occurred before the opening of the bankruptcy procedure. Distinguishing borrowers depending on the time of loan sale, prevents false identification of corporates whose banks sold their placements after they entered bankruptcy, which could introduce bias in the final results.

Finally, after cleaning and joining data on defaulted corporates, bankruptcy procedures, and information on loan sales, the dataset was joined with indicators from borrowers' balance sheets and income statements. Data on financial indicators came from a state-owned entity FINA, which regularly collects data from firms' financial statements on an annual basis. The final dataset comprised annual data for corporates that defaulted in the period from 2010 to 2022 and information on whether they went into a bankruptcy procedure, did their creditors sold their debt obligations to NPL investors between the dates of entering default status and

potential opening of the bankruptcy procedure and information regarding specific financial indicators. Dynamics and heterogeneity of performance between identified corporates are presented in Table 2. below. Figures in the table show that firms who experienced the sale of their debt to NPL investors have, on average, lower liquidity, and profitability and are less efficient in using their assets to generate revenue. Furthermore, identified firms are more indebted than those who haven't experienced the sale of their liabilities to NPL investors, and there is a relatively higher share of companies with negative equity indicating a higher prevalence of firms with unsustainable business models.

Table 2. Performance of identified corporates

Loan sale[2]	Indicator	Construction	Industry	Retail	Services
No	Cash/Current liab.	0.94	0.90	0.94	0.81
No	Non-current assets/ (Equity + Non-current liab.)	0.30	0.81	0.22	0.58
No	Total debt/Total assets	0.96	0.86	0.95	0.92
No	Sales/Current assets	0.89	1.38	1.16	1.53
No	EBIT/Total assets	0.00	0.01	0.00	0.00
No	Non-current assets/Total assets	0.16	0.39	0.12	0.26
No	Non-current assets/Sales	0.25	0.54	0.14	0.29
Yes	Cash/Current liab.	0.94	0.82	0.82	0.69
Yes	Non-current assets/ (Equity + Non-current liab.)	0.32	0.89	0.27	0.52
Yes	Total debt/Total assets	0.99	0.94	0.99	0.99
Yes	Sales/Current assets	0.43	1.11	0.96	1.36
Yes	EBIT/Total assets	-0.01	-0.01	-0.01	-0.01
Yes	Non-current assets/Total assets	0.16	0.41	0.11	0.26
Yes	Non-current assets/Sales	0.45	0.81	0.23	0.49

Source: CNB; FINA; author's calculations

As pointed out earlier, the evolution of NPLs in Croatia following the global financial crisis and specific characteristics of the insolvency regime, allow for a study that focuses on the legacy of corporate NPL resolution through NPL sales. In the first half of the 2010s, during

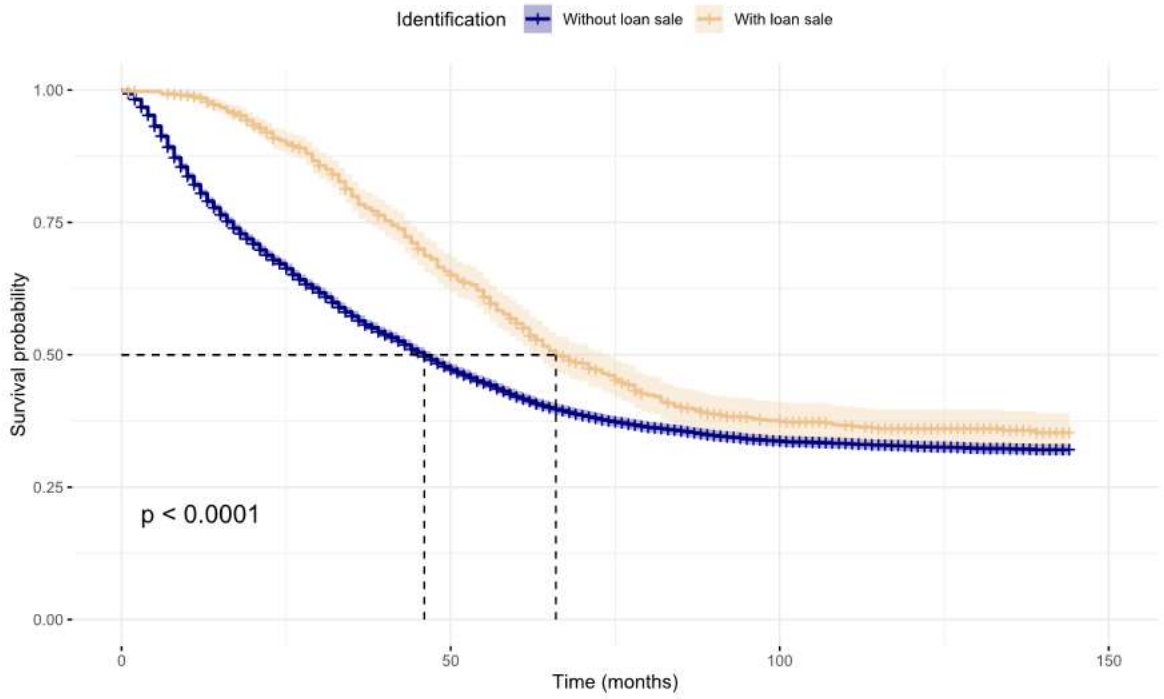
[2] Column *loan sale* identifies treated and untreated groups of corporates. *Yes* refers to the group of firms that have experienced the sale of loans from their creditors to NPL investors, while *No* defines the group firms that haven't experienced the sale of their debt to NPL investor.

the prolonged recession, there was a clear upward trend in the share of NPLs in total loans of the private sector and a subsequent decrease following the rebound in economic activity after 2015. While there was a significant increase in distressed loans in both sectors, it was especially acute in the corporate loan portfolio, indicating a higher risk and procyclicality associated with it. Besides a more favorable macroeconomic conditions after 2015, NPL sales also contributed to a decrease in the stock of bad loans as shown in Figure A.2. in the appendix.

4. Empirical analysis

After constructing the sample of defaulting corporates between the years of 2010 to 2022 and joining it with data on corporate bankruptcies, loan sales to NPL investors, and firms' balance sheet and income statement indicators, in the first step of the analysis we used the Kaplan-Meier estimates of survival curves to analyse survival probability of firms concerning the fact that firms experienced the sale of their debt obligations to NPL investors. The methodology refers to the process of estimating survival probabilities of firms for each period after default conditional on surviving the previous period (Kaplan and Meier 1958.). Estimated survival curves, presented in Figure, suggest that the sale of loans to NPL investors could have a positive effect on survival probability after the firm went into default. Furthermore, the median survival of firms that haven't experienced the sale of their debt to NPL investors is around 4 years, while the median survival of firms that have experienced the sale of their debt obligations is slightly more than 5 years. Taking into account the indicators presented in Table 2, the fact that debtors, after the sale of loans to NPL investors have a higher probability of avoiding bankruptcy could point to a conclusion that NPL investors prolong the stay of inefficient firms on the market, and thus impose a negative burden on overall productivity and capital reallocation in the economy.

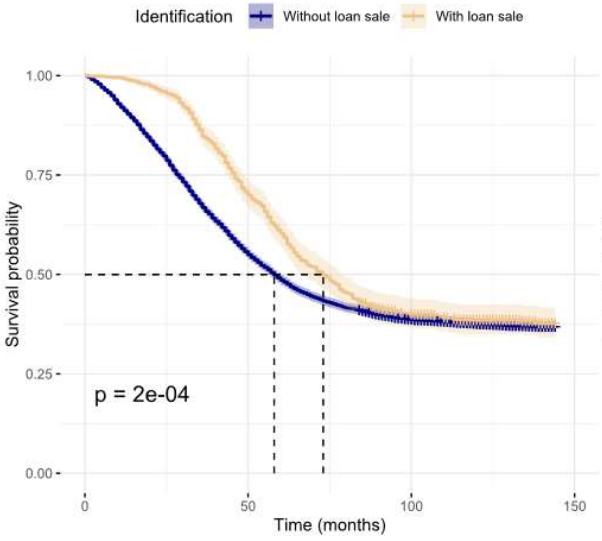
Figure 1. Kaplan-Meier survival estimate for the full sample



Source: CNB; Court registry; author's calculations

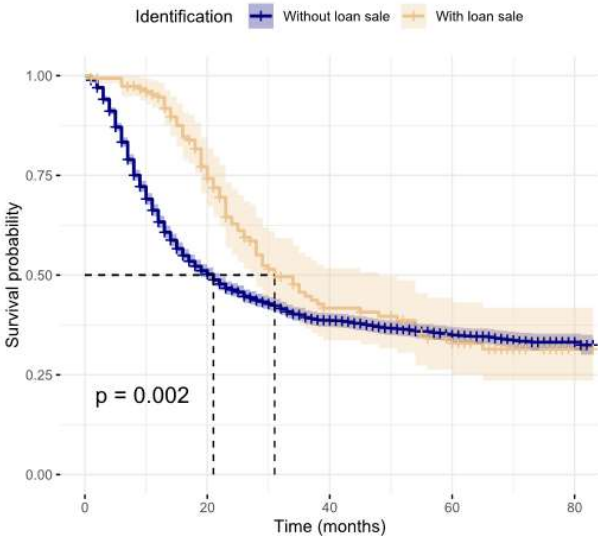
To study the possible effect of insolvency regime reform that occurred in 2015, the sample was further divided into two separate time frames, depending on the date when firms defaulted on their debt. Specifically, the sample was divided into groups of those who defaulted on their debt from 2010 to the end of 2015, and those who defaulted on their debt in the period from 2016 to 2022. Estimates of survival curves in Figures 2 and 3 show that the survival probability of defaulted corporates generally decreased in the period after the introduction of the new law that regulates insolvencies. Corporates that entered into default before 2015 had a median survival of more than 5 years while those that defaulted on their debt after 2015 had a median survival of 2.5 years. Furthermore, the difference between survival times of treated and untreated corporates decreased after 2015, indicating a decreasing role that NPL investors have in procedures of debt resolution. These results would tend to confirm the positive impact that the reform of the insolvency regime had on the efficiency of opening a bankruptcy procedure on a distressed company and removing it from the market. However, to test the results more formally, it is necessary to introduce firm-level covariates that control for certain firm characteristics, which could introduce bias when observing results from K-M estimates of survival curves.

Figure 2. Kaplan-Meier survival estimate for subperiod 2010-2015



Source: CNB; Court registry; author's calculations

Figure 3. Kaplan-Meier survival estimate for subperiod 2016-2022



Source: CNB; Court registry; author's calculations

While K-M estimates of survival curves provide somewhat convincing evidence that NPL investors prolong the survival of distressed firms on the market, there are important caveats that have to be taken into account. Mechanically, since NPL investors have to acquire bad loans after firms already ran into trouble with their debt servicing – and banks decided to put their loans on a secondary market, there is an inherent delay in restructuring or bankruptcy procedure for the firms that ended up in the portfolio of NPL investors. Furthermore, after acquiring the loan, NPL investor have to conduct their due diligence and define strategies for asset recovery. Estimating survival curves for treated and untreated corporates without controlling for firm-specific covariates could introduce bias in the analysis since companies whose banks decided to sell their loan obligations could be less efficient, as shown in Table 2., and their obligations could hide limited legal recourse for creditors. For this reason, the next step includes the estimation of the Cox proportional hazards model in order to study the relationship between time to the bankruptcy of companies that defaulted on their loans. Instead of directly estimating survival curves, as is the case of the K-M approach, in the Cox proportional hazards model the aim is to estimate the effect of various firm-level covariates on the baseline hazard function (Cox, 1972; Cox and Oakes, 1984). Instead of modelling survival curves, this approach focuses on the underlying hazard function, so the interpretation of estimated coefficients focuses on the effect on the risk of event materialization. The approach of this paper also closely follows the one presented in Srhoj and Žilić (2020), who focused on

estimating the effect that unemployment grants have on the duration of employment for individuals who received them. In particular, the estimation involves the following relation:

$$h_{i,e}(d|Loan\ sale, X) = h_0(d)\exp\{\theta Loan\ sale_i + \gamma X_{i,t}\} \quad (1)$$

where d is the duration in years to opening a bankruptcy procedure of a defaulted firm, Loan sale is an indicator of whether the firm j experienced the sale of their loan to the NPL investors, is a vector of firm-specific indicators from financial statements, which are allowed to dynamically change over time, and is the baseline hazard function. The parameter of interest measures the change in probability of going into bankruptcy procedure at a specific year associated with receiving the treatment in the form of a loan sale to an NPL investor. The results of the estimated model are presented in Table 3., while also taking into account different samples depending on the date of going into default status and the timing of insolvency regime reform. Column (1) represents the results of a full sample, while (2) and (3) represent samples before and after the aforementioned reform.

Table 3. Results, bankruptcy: Cox proportional hazards model

	Dependent variable:		
	Bankruptcy		
	(1)	(2)	(3)
Loan sale	0.852***	0.952***	0.498**
	(0.081)	(0.088)	(0.198)
Cash/Current liabilities	0.012	0.007	0.007
	(0.029)	(0.037)	(0.050)
Total debt/Total assets	0.334***	0.293***	0.451***
	(0.018)	(0.021)	(0.031)
Non-current assets/(Equity + Non-current liabilities)	0.026	0.004	0.104*
	(0.026)	(0.030)	(0.056)
Sales/Current assets	0.122***	0.100***	0.200***
	(0.010)	(0.012)	(0.022)
EBIT/Total assets	0.033	0.030	0.308***
	(0.068)	(0.085)	(0.112)
Observations	32,793	25,670	7,123
R^2	0.021	0.017	0.044
Max. Possible R^2	0.613	0.569	0.655
Log Likelihood	-15,201.030	-10,590.870	-3,624.196
Wald Test (df = 6)	862.800***	535.580***	376.770***
LR Test (df = 6)	711.582***	436.334***	323.015***
Score (Logrank) Test (df = 6)	921.565***	575.500***	395.476***
Note:			*p<0.1; **p<0.05; ***p<0.01

Note: **(1)** Total sample – all defaulting corporates between year 2010 and 2022 are included. **(2)** Sample before new solvency law was implemented – all defaulting corporates between years 2010 and 2015 are included. **(3)** Sample after new solvency law was implemented – all defaulting corporates between year 2016 and 2022 are included.
Source: author's calculations

Contrary to the results of the K-M approach, estimated coefficients of the Cox proportional hazards model, point to the fact that the treatment in the form of loan sale increases the risk of going into bankruptcy after controlling for firm liquidity, indebtedness, activity, and profitability. This result could be interpreted with the assumption that banks sell the loans of counterparties that have a lower chance of recovering revenues and, subsequently, a lower ability to repay their loans. Concerning the date when a certain company defaulted on their loans, loan sales had a larger effect on reducing the survival probability of firms before the reform of the insolvency regime, indicating a smaller effect of NPL investors on firm survival after the aforementioned reform. Besides loan sales, firm indebtedness measured as total debt over total assets, and firm activity measured as sales over current assets had a statistically significant effect on the risk of going into bankruptcy. Those results could point to the fact that creditors and NPL investors take into account the structure of firm funding sources and firm activity for feeling the pulse of the firm, and the aforementioned indicators could guide their strategies for distressed assets resolution. Higher activity of firms could point to a viable business model that ran into trouble and deserves a second chance, while high indebtedness could signal a company that is not able to generate enough revenue to sustain their debt and/or constantly operates at a loss.

In order to test the robustness of the estimated Cox proportional hazards model, a linear probability model with the same covariates and firm fixed effects was estimated for different windows of time until bankruptcy. Specifically, three samples were constructed with different dependent variables, depending if the firm wasn't in the active bankruptcy procedure two, three, or four years after defaulting on its loan. In particular the following was estimated:

$$Y_{i,t} = \alpha + \beta Loan\ sale_i + \gamma X_i + \xi_i + \epsilon_{i,t} \quad (2)$$

were $Y_{i,t}$ indicates whether the firm *j* was alive in period *t*, *Loan sale* indicates whether the firm *i* experienced the sale of their loan to the NPL investors, $X_{i,t}$ is a vector of firm-specific indicators from financial statements and ξ_i represents firm fixed effects which captures firm-specific characteristics that might affect the risk of going into bankruptcy. In line with the results of the Cox model, estimated coefficients show that the treatment in the form of loan sale to NPL investors decreases the probability of avoiding bankruptcy after defaulting on debt liabilities.

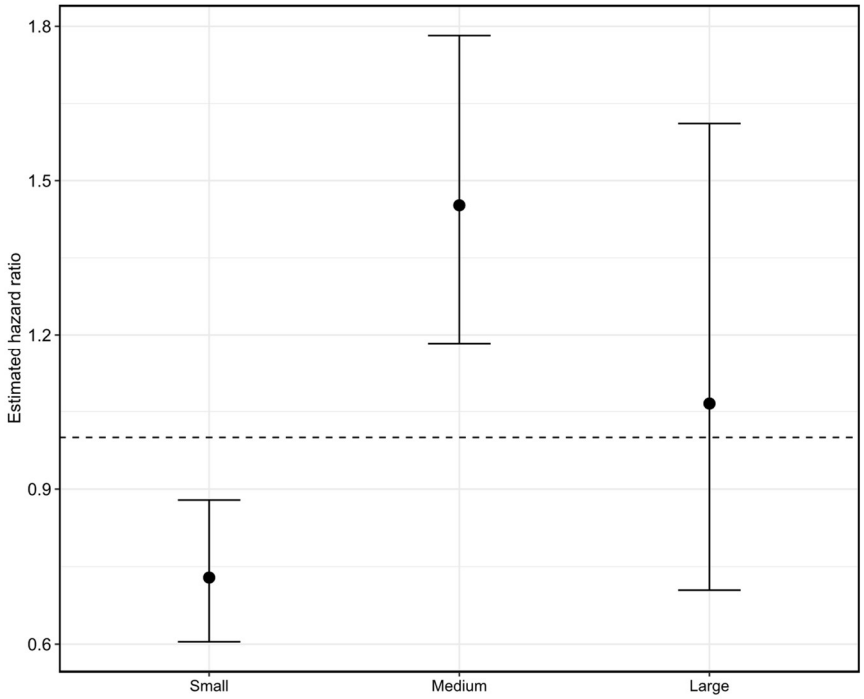
Table 4. Results, bankruptcy: Linear probability model

	Not in bankruptcy (2 years)	Not in bankruptcy (3 years)	Not in bankruptcy (4 years)
Loan sale	-0.0148***	-0.0378***	-0.0137**
Firm based covariates	Yes	Yes	Yes
Firm fixed effects	Yes	Yes	Yes

Source: author's calculations

In the next step, the estimated Cox model was expanded to study the effect of firm size and economic activity on the probability of bankruptcy after the company defaulted on its debt. Model (1) was expanded with a dummy variable, and estimated for different size attributes and different classifications of economic activities. Later, estimated hazard ratios were extracted and plotted in Figures 4. and 5. to show the heterogenous impact of different firm-specific characteristics on the probability of going into bankruptcy. Figure 4. shows estimated hazard ratios for different firm sizes. The hazard ratio is higher for medium-sized companies, which could mean that creditors tend to initiate bankruptcy procedures earlier for firms that have a larger asset base, and presumably higher potential for asset seizure to recover invested funds. On the other hand, the probability of bankruptcy procedure is lower for small companies, and no significant effect was found for large companies.

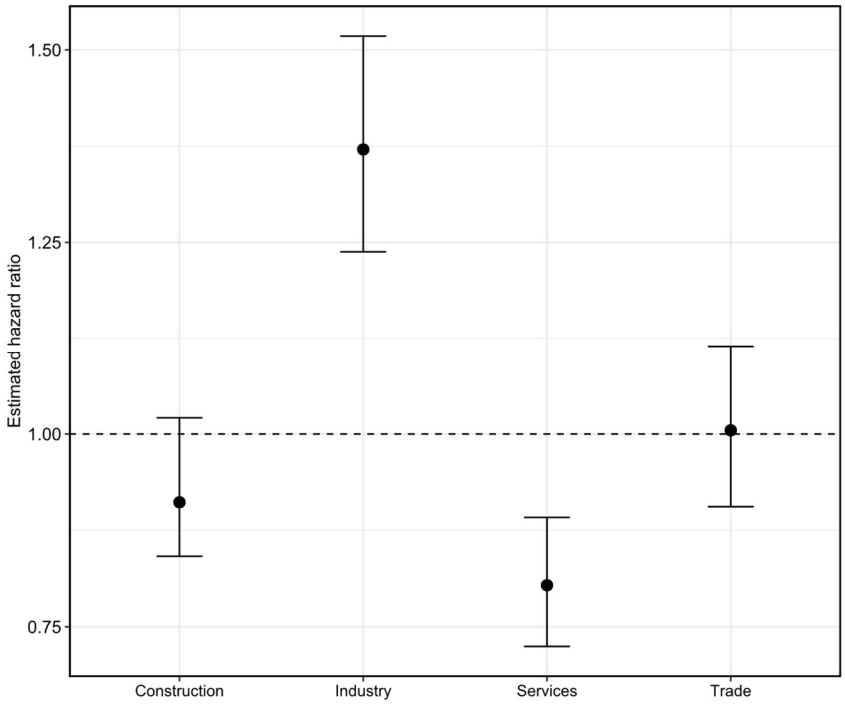
Figure 4. Heterogeneous effects of firm size



Source: author's calculations

Regarding the economic activity of distressed companies, estimated hazard ratios seem to go in line with findings related to the effect of firm size on the risk of going into bankruptcy. Firms in industry sectors have a higher probability of going into bankruptcy after defaulting on their debt, while firms who operate in service sectors have a lower chance of exiting the market by the process of bankruptcy. Concerning the specificities of business models related to different sectors, these results would tend to point to the fact that creditors of firms who operate in more capital-intensive sectors are more likely to initiate bankruptcy earlier, presumably due to the higher asset base of their debtors which could serve as a pool for recovering invested funds. Firms in service sectors tend to be smaller with a lower capital base, which could make it difficult for creditors to recover their distressed assets and incentivize them to seek alternative ways of asset recovery, such as forbearance and loan restructurings with different payment schedules.

Figure 5. Heterogeneous effects of economic activity



Source: author's calculations

5. Conclusion

Contrary to the findings of the K-M approach of estimating survival curves for distressed firms concerning the treatment of loan sale to NPL investors, models suggest that

NPL investors tend to initiate bankruptcy sooner compared with banks, after controlling for firm performance and specific firm characteristics. There are a couple of potential channels for this relationship. First, NPL investors are generally faced with significantly higher cost of capital as unlike banks, they don't collect deposits and use less financial leverage in general. This directly affects individual debt collection profitability and therefore reacquires faster decision making. Additionally, the number of agents involved around an individual case is far lower in NPL investors compared with the banks. This, "incentives" channel is additionally amplified by the fact that in the early years of Croatian NPL market, the sales were often "bulk and blind". Furter on, judging from the NPL price and NPL coverage data, banks did tend to dispose loans with lower fundamentals, weak financial position of debtor and possibly complicated legal recourse schemes.

Heterogenous effects of specific firm characteristics could also provide insight into creditors' strategy for recovering distressed assets, indicating that a higher asset base might increase the risk of going into bankruptcy. However, while this study offers some insight into risk mechanisms that govern the process of firm demographics after they have defaulted on their debt liabilities, and generally suggest that indeed, there are still ways to improve the understanding of mechanisms that NPL investors use after acquiring debt of distressed companies and are they more efficient in reallocating capital from those debtors to more efficient market participants.

Future work should focus on continuing with the promising micro approach. After looking at the bankruptcy procedures, the logical next step is to observe debtors who did not end up in bankruptcy after the sale or even more, went to bankruptcy and managed to become "born again debtors". Adding this angle could help in confirming the positive role of NPL investors for market efficiency. Finally, after looking at the process from the debtor's perspective, buyers and sellers should be also included. This way, additional information could be provided about the decision-making process in those firms, which becomes ever more important in the environment of decreasing importance of corporate loan portfolio in banks' balance sheets.

Literature

Anastasiou D., Louri H., Tsionas M. (2018), Non-performing Loans in the Euro Area: Are Core-periphery Banking Markets Fragmented?, *International Journal of Finance & Economics*, 24(1), 97-112.

Bank for International Settlements (2016), *Prudential Treatment of Problem Assets – Definitions of Non-performing Exposures and Forebearance* [e-publication], available at https://www.bis.org/bcbs/publ/d403.htm

Bartelsman E., Scarpetta S., Schivardi F. (2003, January), *Comparative Analysis of Firm Demographics and Survival: Micro-Level Evidence for the OECD Countries* (OECD Economics Department Working Papers), available at https://www.oecd-ilibrary.org/economics/comparative-analysis-of-firm-demographics-and-survival_010021066480

Baudino P., Yun H. (2017), *Resolution of Non-performing Loans – Policy Options* (FSI Insights on Policy Implementation), available at https://www.bis.org/fsi/publ/insights3.pdf

Bellini T. (2019), *IFRS 9 and CECL Credit Risk Modelling and Validation: A Practical Guide with Examples Worked in R and SAS*, Amsterdam: Elsevier

Carreira C., Nieto-Carrillo E., Teixeira P. (2022), Giving Zombie Firms a Second Chance: An Assesment of the Reform of the Portuguese Insolvency Framework, *Economic Analysis and Policy*, 76, 156-181.

Cox, D. R. (1972), Regression Models and Life Tables, *Journal of Royal Statistical Society. Series B (Methodological)*, 34(2), 187 – 220

Cox, D. R., Oakes, D. (1984), *Analysis of Survival Data*, 1st edition, Boca Raton: Champan and Hall

Dahiya S., Puri M., Saunders A. (2003), Bank Borrowers and Loan Sales: New Evidence on the Uniqueness of Bank Loans, *The Journal of Business*, 76(4), 563-582.

European Commision (2019), *Fourth Progress Report on the Reduction of Non-performin Loans and Further Risk Reduction in the Banking Union* [e-publication], available at https://finance.ec.europa.eu/publications/fourth-progress-report-reduction-non-performing-loans-npls-and-further-risk-reduction-banking-union_en

Fazio D., Silva T., Skrastins J. (2021, March), *Court Quality and Economic Resilience*, available at https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3517257

Foster, L., Haltiwanger, J., Krizan C. J. (1998, November), *Aggregate Productivity Growth: Lessons from Microeconomic Evidence* (NBER Working papers), available at https://www.nber.org/papers/w6803

Goraya S., Zrnc J. (2022), Procurement, Competition and Market Power

Gryglewicz S., Mayer S., Morellec E. (2023), The Dynamics of Loan Sales and Lender Incentives, *Swiss Finance Institute Research Paper*, 21-82.

Huljak I., Martin R., Moccero D., Pancaro C. (2020, May), *Do Non-performing Loans Matter for Bank Lending and the Business Cycle in Euro Area Countries?* (ECB Working Paper Series), available at https://www.ecb.europa.eu/pub/pdf/scpwps/ecb.wp2411~839bc74726.hr.pdf?bd527c481da64b39be467b557501c1c0

Jimenez G., Saurina J. (2006), Credit Cycles, Credit Risk, and Prudential Regulation, *International Journal of Central Banking*, 2(2)

Kaplan, E. L., Meier, P. (1958), Nonparametric Estimation from Incomplete Observations, *Journal of the American Statistical Association*, 53(282), 457 - 481

Lopez-Garcia P., Puente S. (2006), *Business Demography in Spain: Determinants of Firm Survival* (Banco de Espana Working Paper), available at https://www.bde.es/f/webbde/SES/Secciones/Publicaciones/PublicacionesSeriadas/DocumentosTrabajo/06/Fic/dt0608e.pdf

Mendezes A. P., Muro S. A., Pereira C. M. (2021), *How Insolvency and Creditor-Debtor Regimes Can Help Address Non-performing Loans* [e-publication], available at https://documents.worldbank.org/en/publication/documents-reports/documentdetail/163151612172227669/how-insolvency-and-creditor-debtor-regimes-can-help-address-nonperforming-loans

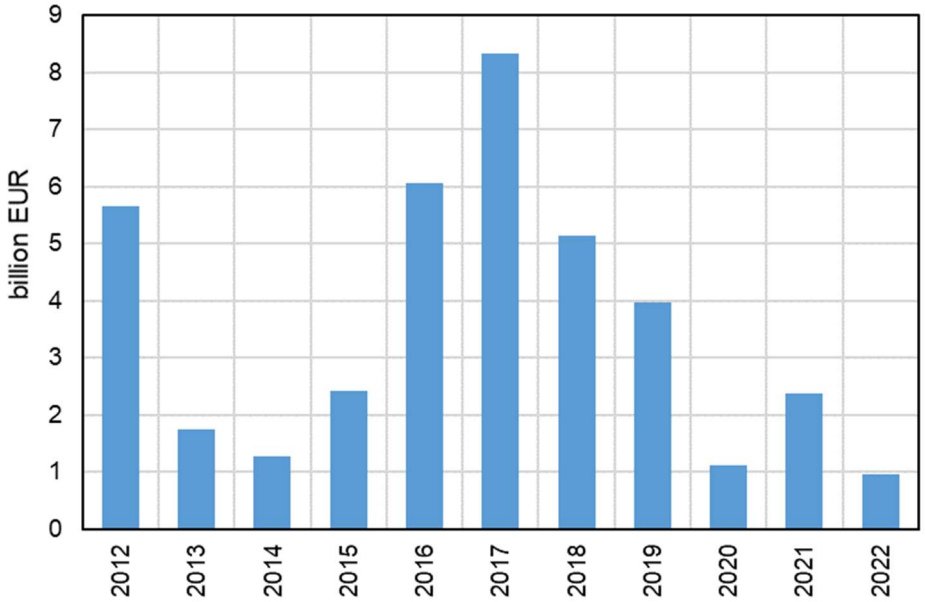
Schumpeter J. A. (1934), *The Theory of Economic Development*, London: Routledge

Schumpeter J. A. (1942), *Capitalism, Socialism and Democracy*, London: Routledge

Srhoj S., Žilić I. (2020, January), "Fine.. I'll do it myself": Lessons from Self-employment Grants in a Long Recession Period (EIZ Working Papers), available at https://hrcak.srce.hr/232616

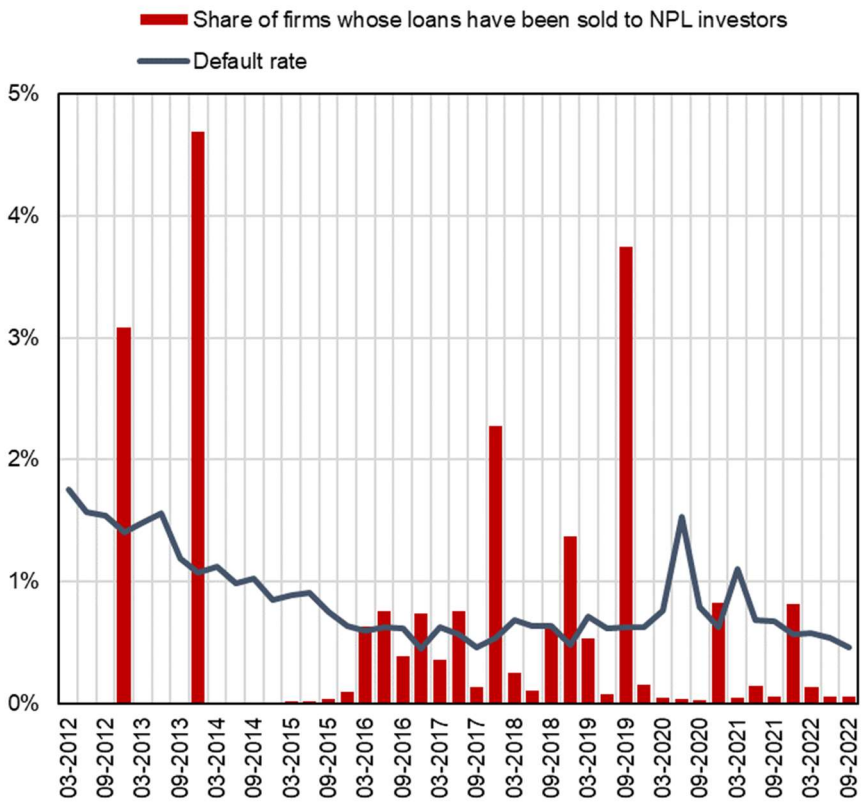
Appendix

Figure A.1. NPL sales throughout the years



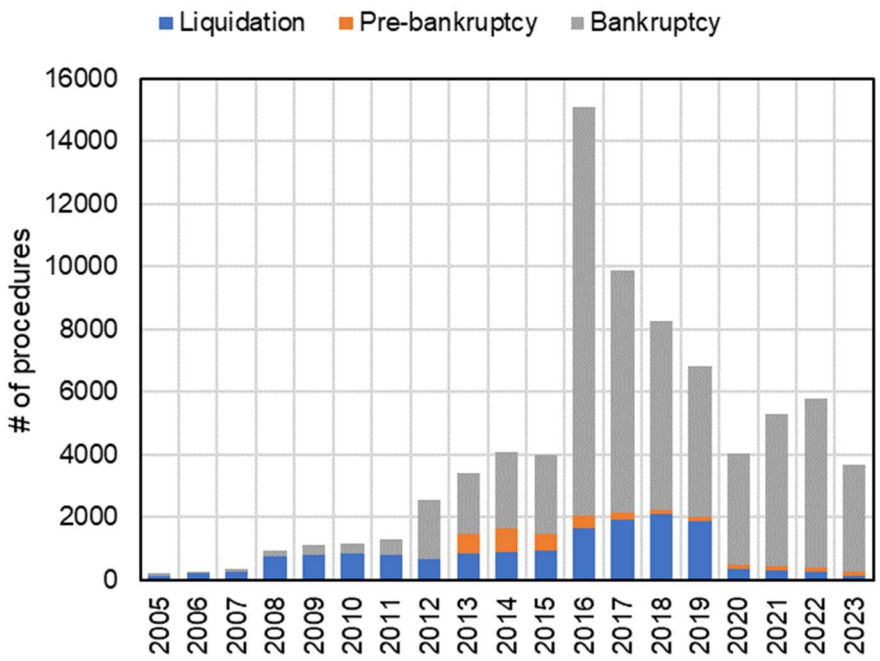
Source: CNB

Figure A.2. Default rates of corporate loan portfolio



Source: CNB

Figure A.3. Bankruptcy procedures in Croatia



Source: Court registry