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EFFECTS OF GOVERNMENT INTERVENTIONS ON BANK PERFORMANCE

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Effects of Government Interventions on Bank Performance

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Abstract:
This paper evaluates the effects of government bailout policies on bank performance in the EU banking sector. Using a unique dataset of government supports, I identify banks which received state support in years 2008-2014 and corresponding control group of banks. I apply difference-in-differences method and extend it by propensity score matching and inverse probability of weighting methods to account for non-randomness of a treatment. My results suggest that aided banks overtook non-aided ones in terms of lending activity in both, the EU Core and EU Periphery, but it was accompanied by increased non-performing loans ratio (NPL) in the EU Periphery. Finally, I show these results differ from the developments in the US. TARP recipients improved their capital adequacy compared to non-intervened banks and returned to pre-crisis level in terms of NPL and profitability.

JEL: G21, G28
Keywords: bailout, financial crisis, bank performance

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1 Introduction

Following the outbreak of the 2008 financial crisis, European governments injected unprecedented amounts of money into their banking systems in order to safeguard failing institutions. Such expensive government policies obviously provoked a storm of criticism, because interventions into the banking sector are often associated with the moral hazard problem and excessive risk-taking. Indeed, Hryckiewicz (2014) and Igan *et al.* (2011) found an increased risk-taking of rescued banks in the post-bailout period despite the fact that lending activities of assisted banks had been reduced, suggesting the lower market discipline. Similarly, Brei & Gadanecz (2012) find no evidence of reduced riskiness of the new syndicated loans signing in intervened banks relative to non-intervened ones. Also, Gietl & Kassner (2020) show that government guarantees negative impact on risk-taking is intensified by managerial overconfidence.

Moreover, costly government bailouts have a negative effect on fiscal discipline. Detragiache & Giang (2010), Laeven & Valencia (2018) and Cuadros-Solas *et al.* (2021) claim that fiscal costs associated with crisis resolution were substantial, accounting for 13.3 percent of GDP on average, often reaching 55 percent of GDP.

On the other hand, bank bailouts effectively helped to maintain lending activities (Grande *et al.*, 2011; Taliaferro, 2021), contributed to restoring bank funding (Grande *et al.*, 2011) and reduced risk of default (Grande *et al.*, 2011; Panetta *et al.*, 2009). However, less certain is their impact on bank performance, both in the EU and the US. Kryg (2020) shows on cross-country and multiple crisis sample that only nationalisation leads to better bank performance and the impact of other interventions is inconclusive. In the US, the TARP has resulted in lower profitability and operational efficiency (Harris *et al.*, 2013), it has had an uncertain impact on liquidity creation (Zgenh, 2017; Acharya *et al.*, 2011) and has impacted positively market share and market power of rescued banks (Berger & Roman, 2015).

The assessment of the effects of government bailouts in the EU has been provided by Gerhardt & Vander Vennet (2017) who evaluated the ex-post performance two years after

bailouts using logit regression on the sample of 114 bailed-out banks in 22 European countries. They claim that bank performance of aided banks improves only slowly. Jayasinghe (2019) carries out a study on 16 banks that benefited from government support in the years 2007-2009 in the UK and EU and estimates the impact on bank performance and risk-taking in the years 2009-2015. By means of panel regression, the author found a subsequent reduction in bank profitability and increased leverage and non-performing loans.

This paper provides estimates of the effect of government bailout policies on bank performance in the EU with a focus on a comparison of effects between the EU Core and Periphery. I also compare the impact of government interventions in the EU with the effects of the Troubled Assets Relief Program (TARP), a resolution scheme implemented in the US. To do so, I use a unique dataset of government supports in the EU based on the case-by-case search in the European Commission Database on State Aid. These data are matched with balance-sheet data from The Banker Database allowing studying the effects on the micro level. I focus on banks that were bailed out and continued to exist as separate entities, i.e. were not sold, split or merged.

I apply the difference-in-differences method to estimate the average change over time in the supported banks' performance compared to non-supported banks. In contrast to the previous studies, I cover a longer time span, since the effect of interventions may not appear immediately, but rather several years after a rescue. Next, to address a possible endogeneity of a treatment assignment and confoundedness bias I estimate the average treatment effect on the treated by propensity score matching and inverse probability of treatment weighting.

My main results are as follows. First, I confirm that government interventions have helped to end the credit crunch and support lending in the EU. However, bailouts have had a diverse effect on overall bank performance within the European Union. While EU Core countries' banks report higher capital adequacy and improved lending activity, the rescued banks of the EU Periphery increased lending is, however, accompanied by a growing ratio of non-performing loans compared to never-aided peers. The difference between the post-

bailout performance of EU Periphery and EU Core banks confirms the fragmentation of Euro area financial markets during the EU debt crisis.

The rest of this paper is organized as follows. Chapter 2 provides a theoretical underpinning of government interventions, chapter 3 summarizes existing research on government interventions and their effects. Chapters 4 and 5 describe used methodology and data, respectively. Finally, Chapter 6 presents a discussion of the results and their implications.

2 Government interventions

2.1 Systemic risk in the banking sector

Government intervention into the banking sector is often exposed to a huge wave of criticism and questioning because they are costly and induce a moral hazard problem. Nevertheless, the importance of government bailouts is mainly connected to the avoidance of systemic risk and related risk of contagion effect spread within the financial system. Government interventions can have various forms. According to the number of subjects they are addressed to, Farhi & Tirole (2012) defines two categories:

- individual policy measures offered to a particular financial institution;
- system-wide programs offering remedies to all institutions in the financial system.

Note that the majority of the interventions after the financial crisis of 2008 had system-wide character (Hryckiewicz, 2014; Panetta *et al.*, 2009) since the financial troubles were spilling from one institution to another affecting the whole financial system. Government support measures can be implemented through different tools. Most of the literature classifies three basic types of bailout instruments:

- explicit guarantees on liabilities and liquidity provisions;
- capital injections and government-assisted mergers;

- asset protection schemes.

Government interventions can be also classified as measures entering the asset side and interventions affecting the liability side of the balance sheet. (Gerhardt & Vander Vennet, 2017)

- Liability side measures:
  - explicit guarantees on liabilities;
  - liquidity provisions.
- Asset side measures:
  - capital injections;
  - government-assisted mergers;
  - asset protection schemes.

Credit guarantee schemes and liquidity provisions are mostly used in the first stage of support to troubled banks as argued by Jayasinghe (2019) and Hryckiewicz (2014). They are intended to prevent endangered banks from bank runs and substantial decrease of liquidity in the initial phase of a crisis, when banks face mistrust on the part of their depositors and to prevent transmission of financial instability to other institutions. Grande *et al.* (2011) claim that government guarantees represented ,,the most valuable tool against bank defaults since they on bank fixed income debt and other non-deposit liabilities, which helped banks to preserve access to medium-term funding at a reasonable cost, offsetting the drying-up of alternative sources (such as securitization) and the widening of spreads."

If liquidity problems transform into solvency troubles, governments usually offer capital aid to support banks' capital position. In fact, recapitalization was the most commonly used tool in the last financial crisis. (Brei *et al.*, 2013) The aim of recapitalization is to allow the continuation of lending activities since banking regulation requires banks to have a strong capital base as a condition for lending.

Recapitalization can be done either through capital injection, which entails the provision of funds by the government, often in exchange for the bank's ownership, or through government-assisted mergers when government helps to recapitalize a troubled bank by finding an institution willing to merge, which is often accompanied by a government-assisted restructuring of the debts and guarantees on future losses of newly acquired institution (Hryckiewicz, 2014).

The last stage of government aid vis-a-vis banks is assets protection schemes which comprise purchases or guarantees of impaired legacy assets aiming to reduce banks' exposure to large losses (Panetta *et al.*, 2009) wither through "Asset Management Companies" (AMCs) or "Bad Banks". In the case of AMC, non-performing loans are transferred to a newly created fund, where the debt is then restructured either by the private sector or the government. In the case of the "Bad Banks", a portion of the debt by which the bank's assets have decreased is transferred to the government which, however, does not take part in the bank's operations (Hryckiewicz, 2014).

2.2 Government interventions in the European Union

The financial crisis of 2007-2008 spread from the United States to the whole world, including the European Union, and caused worldwide financial instability. Mutually interconnected financial institutions got into trouble which resulted in the international banking crisis which started with the interbank market freeze in August 2007 associated with an enormous drop in the stock market prices of the banking sector, comprising high losses. Moreover, a hike in CDS premia was signifying the approaching defaults of financial institutions. (Brei *et al.*, 2013)

Governments and central banks played a crucial role in preventing the economy from the loss of trust in financial markets, the inability of banks to provide its services including lending activities and associated decline in consumption and production. Furthermore, banks were lacking liquidity and it was necessary to maintain the availability of money withdrawals

for their clients forcing EU governments and the ECB to act.

In the EU, State aid was approved either on an individual basis or through national state aid schemes. For example, a financial assistance program for the recapitalization of financial institutions was approved in Spain in 2012. Almost €39 billion was used for capital injections to banks involved in restructuring and resolution plans. Remaining €2.5 billion served for financing Sareb - the 'bad bank' of the Spanish government which absorbed risky assets of the four nationalized financial institutions.

According to Gerhardt & Vander Vennet (2017), between October 2008 and October 2013, the European Commission treated more than 400 requests on granting state aid to the financial institutions of the member states. European Commission reports that more than 4 billion euro was spent on all forms of bailouts in the EU member states between the years 2008 and 2013. A decomposition of this amount according to member states and years is shown in Table 2.1. Governments spent more than €3,5 trillion on guarantees, €470 billion on impaired assets measures and €400 billion accounted for recapitalizations (EuropeanCommission, 2020).

The size of interventions differs among countries according to the importance of the banking sector for a particular economy. Countries with large banking systems relative to the real economy, such as the United Kingdom or the Netherlands, were severely hit by the crisis and, thus, injected into their banks sums representing 44.1 and 16.6 percent of their GDP, respectively. On the other hand, the banking sector of Italy, which covers mostly traditional credit activities, was not affected by the crisis to such an extent and also the size of bailouts reached only 0.1 percent of GDP (Panetta *et al.*, 2009, pg. 1).

2.3 US TARP program

The worldwide financial crisis of 2008 originated in the United States with the outbreak of the subprime mortgage crisis. So, the US had to cope with a larger number of failing financial institutions. As Brei *et al.* (2013) argue, 372 FDIC-insured banks defaulted, even

Table 1: State aid to the financial sector in the EU between years 2008 and 2013 (in mil. EUR).

Country	2008	2009	2010	2011	2012	2013
Austria	2 325	22 833	21 876	18 344	14 769	11 109
Belgium	24 018	54 367	32 925	28 858	46 155	40 235
Bulgaria	0	0	0	0	0	0
Czechia	0	0	0	0	0	0
Cyprus	0	0	0	0	2 050	1 000
Denmark	67	534	690	463	74	0
Estonia	0	0	0	0	0	0
Finland	0	0	0	0	0	0
France	21 056	98 983	83 883	62 561	54 675	61 616
Germany	28 725	155 510	222 282	92 080	135 226	82 816
Greece	0	5 519	24 307	56 969	90 044	66 820
Ireland	65 111	228 281	344 665	219 992	42 572	23 729
Italy	0	4 050	0	375	85 441	87 965
Latvia	0	879	1 022	269	121	14
Lithuania	0	0	0	2	0	231
Luxembourg	2 878	2 303	1 410	1 013	1 935	2 160
Hungary	0	107	0	0	0	0
Malta	0	0	0	0	0	0
Netherlands	21 000	42 505	42 836	37 048	21 023	26 320
Poland	0	0	0	0	0	0
Portugal	438	5 238	4 988	8 539	26 450	15 513
Romania	0	0	0	0	0	0
Spain	0	35 266	66 666	70 482	149 354	71 407
Slovakia	0	0	0	0	0	0
Slovenia	0	1 000	2 150	2 450	1 683	3 667
Sweden	3 728	28 436	18 989	12 542	4 112	1 283
UK	96 385	197 177	136 513	100 023	22 458	14 611
Total	**265 731**	**882 986**	**1 005 202**	**712 011**	**698 142**	**510 494**

though the most important bank failures were avoided thanks to government rescues. To address the financial crisis, the government of the US approved the Troubled Assets Relief Program (TARP) under the Emergency Economic Stabilization Act in 2008. TARP aimed to purchase troubled assets and equity from financial institutions. However, TARP was not limited to the banking industry but aimed also to save more than a million jobs, e.g. in the automobile industry.

The cornerstone of TARP is the Capital Purchase Program (CPP). CPP is a revision of TARP from October 2008 which aimed to stabilize the US banking system during the financial turmoil through the purchase of bank equity and preferred stocks. CPP aimed to restore lending activities, thus improving the tight credit market conditions. Overall, 250 billion out of the 700 billion TARP money were allocated for these purchases. Under CPP, 707 financial institutions in 48 states received capital help from the US Treasury.

3 Literature Review

Literature on the effects of government interventions is quite rich. A part of existing research deals with the positive impact of bailouts on the economic activity and stability of the banking sector. Grande *et al.* (2011) claim that government guarantees adopted in the last financial crisis in the EU helped to keep medium-term bank funding accessible, restore banks' solvency, and, thus, avoid unwanted bankruptcies. This is in line with findings that government bailouts of 2008-2009 are associated with immediate reduction of CDS premia of concerned banks after the announcement of such measures, as found by Panetta *et al.* (2009) on the sample of 11 large economies as well as by Fratzscher & Rieth (2015) who studied European Union banks. Panetta *et al.* (2009) further claim that it is especially important in the case of capital injection announcements and that reduction of default risk is correlated with the size of the intervention.

In addition, government bailouts appeared beneficial in terms of the ongoing growth of

bank lending activities and prevention of credit crunch, as found by Taliaferro (2021) and, studying EU banks, by Grande *et al.* (2011). However, Brei *et al.* (2013) and Homar (2016) claims that recapitalization has to be sufficiently large to sustain new lending. Taliaferro (2021) also found that undercapitalized banks use capital injections primarily to increase their capital base although an increase in loan issuance is still present. Nevertheless, governments with tight fiscal resources are unable to sufficiently recapitalize their banks and apply forbearance instead which forces banks to hold risky government bonds rather than issue new loans (Acharya *et al.*, 2020).

However, Black & Hazelwood (2013) argue that increased bank lending is associated with increased risk-taking, but while large banks' risk increased, the risk of small TARP recipients decreased. It can be explained by two counterintuitive objectives of TARP – first, bank capitalization to reduce risk-taking and, second, increased lending aimed to stabilize the economy in the recession which, however, could trigger risk for large banks. Assisted banks, surprisingly, continue to increase the share of leverage loans in their portfolio as argued by Black & Hazelwood (2013).

A link between government interventions and competition on financial markets was studied by d'Udekem & Van Audenrode (2020) who found that nationalized European banks do not benefit from lower bond spreads compared to the non-aided banks and that temporarily state-owned large banks do not benefit from lower wholesale funding costs, as could be thought.

Fratzscher & Rieth (2015) further state that a decrease in credit risk following government interventions is in many cases associated with an increase in sovereign risk. In the EU, this fact appeared as a serious concern resulting in the sovereign debt crisis affecting mainly the periphery member states. However, this topic is beyond the scope of this paper.

A large number of studies have been made on the post-bailout bank performance and the results of these studies are mixed. Out of these, only Gerhardt & Vander Vennet (2017) and Jayasinghe (2019) deal with the performance of European banks after bailouts related to

the 2008 financial crisis. This might be caused by poor data availability on EU government support cases.

Gerhardt & Vander Vennet (2017) investigate the bank distress predictors as well as the performance of EU banks benefiting from bailouts in the crisis of 2008 two years after bailouts. They find a narrowing difference in capital adequacy between the aided and non-aided banks. More importantly, they find an increasing trend of non-performing loans as well as loan loss provisions among supported banks following bailouts which is, according to authors, attributed to stricter post-crisis regulation and to the fact that banks were forced to disclose their NPLs and account for bad loans by increasing their provisioning. However, the profitability of aided banks did not improve. The negative association between bank profitability and government bailouts in the EU is found by Jayasinghe (2019). This author also claims that aided banks increased their risk-taking in the post-crisis period.

More studies have been done on US banks and their post-bailout performance. The results are, however, mixed. Harris *et al.* (2013) show deteriorating patterns in aided banks' operational efficiency and lower profitability. A positive effect of state interventions on bank profitability is found by Chen *et al.* (2021), who claim that state ownership is associated with better performance indicators and with lower risk in the post-crisis period since, as they argue, it strengthens stability and confidence. Thus, it is admitted that potential negative consequences of state ownership such as the potential of corruption can be in times of crisis overweight by the positive impact on a bank's profitability and risk-taking.

Berger & Roman (2015) find that TARP-participant banks received competitive advantages and improved both their market shares and market power. On the other hand, Zgenh (2017) reports that TARP recipients tend to decrease their liquidity creation. However, Acharya *et al.* (2011) argues that it depends on whether liquidity support is given unconditionally or conditionally. While the former reduces incentives to hold liquidity, the latter affects liquidity holding in the opposite direction.

Finally, I mention two works on the post-bailout performance based on the worldwide

sample. These studies were not limited to bailouts relating to the financial crisis in 2008 and, thus, provide more general findings regarding the state aid effects on banks. Hryckiewicz (2014) claims that although the overall performance of assisted banks improved after the bailouts, the performance indicators of these banks were still at a significantly lower level four years after the bailout than indicators of non-assisted banks in the same countries. The author thus suggests that bailouts were not completely effective in restoring banking sector stability.

Similar research was recently done by Kryg (2020) on the sample 1992-2017. She found that only nationalization had a positive impact on all bank performance measurers. In the case of government-assisted mergers and restructuring processes results are mixed, depending on what is the aim of a rescue. She further argues that a 'one-size-fits-all' intervention approach is suboptimal and that governments should implement their interventions on an individual basis.

4 Data

4.1 Sample selection

I collected the data on state aid from the database of the European Commission on competition allowing me to search for case-by-case information on state aid approvals granted by European Commission. In many cases, a state aid scheme was approved for the member state with specific conditions on granting state aid to its national banks. State aids falling under these schemes did not have to be approved by European Commission, and, thus, are not included in the EC state aid database. For this reason, information on particular state aid cases was taken also from news websites and government and central bank reports containing summaries and evaluations of state recapitalization and deposit guarantee schemes. As a control group, I use banks which did not benefit from government bailouts in the selected period.

The data on bank performance are taken from The Banker Database. This database contains over 5000 banks in more than 190 countries, out of which 17 countries are European. The majority of banks which received bailouts were large banks because the failure of a large bank is most likely to disrupt financial stability. Thus, I restrict my sample to banks with total assets higher or equal to $5bn. I use a sample of EU member states banks including the United Kingdom. My source database does not cover banks in Bulgaria, Czech Republic, Estonia, Romania, Slovakia, Hungary, Latvia, Lithuania, Poland and Slovenia, so these are not included in the sample. As a final step, I drop banks with missing values in the pre- or post-intervention period. The final sample consists of 15 EU countries including the United Kingdom.

Note that my sample includes exclusively parent banks since almost all bailouts were performed at the parent company level, while the subsidiaries did not benefit from any state help, in general, (Gerhardt & Vander Vennet, 2017, pg. 14-15). One famous exception is the Belgian Dexia bank case, which received support not only from the Belgian government but also from the French and Luxembourg. Importantly, non-intervened parent banks which acquired any other intervened bank during the treatment period are in my sample treated as non-intervened banks. Table 2 presents the summary of the final sample of banks.

I compare bank performance dynamics in the post-bailout period within EU Core and EU Periphery. Periphery states of the EU are, by convention, Portugal, Italy, Greece and Spain. Ireland is sometimes included, sometimes not. Along with those, I treat Ireland as a periphery state too because its financial sector was severely hit by the crisis. Similarly, I include Cyprus among the Periphery as well.

To complement the research on the impact of government bailout programs, I compare the effects on EU bank performance with the post-bailout performance of US TARP recipients. To this end, I use a set of banks created in the same way as in the EU case - by taking all banks with assets higher than $5bn dollars which are available in The Banker Database. Next, I detect which of these banks benefited from the TARP program which is available in

Table 2: Banks sample.

Country	*Bailed banks*	$Non-bailed\ banks$	*Periphery*
Austria	3	2	0
Belgium	2	1	0
Cyprus	1	1	1
Denmark	1	6	0
France	4	0	0
Germany	5	11	0
Greece	3	0	1
Ireland	1	0	1
Italy	1	14	1
Luxembourg	0	1	0
Netherlands	2	3	0
Portugal	2	1	1
Spain	0	10	1
Sweden	1	1	0
UK	2	3	0
Total - EU	**28**	**54**	
Total - US	**57**	**42**	

the Treasury's TARP Transaction Report. The report includes the identity and location of the institution, the date when the entity received TARP support together with the received amount. Finally, I drop banks with missing values in the pre-TARP period. I end up with a sample of 57 TARP-aided banks and 42 non-aided ones.

4.2 Choice of variables

To assess post-bailout banks' performance, I use four performance indicators - capital adequacy, asset quality, earnings and lending activity. The bank-level data are taken from The Banker Database which contains a limited number of bank balance sheet datapoints and calculated ratio indicators.

Capital position is proxied by the Total tier 1 capital ratio. Bank's earnings or profitability are proxied by Return on assets (ROA). Higher ROA means higher profitability towards the bank's assets. It shows the bank's ability to transform its assets into profits thereby indicating its efficiency level.

Bank's risk position (asset quality) is represented by the non-performing loans ratio (NPL). This measurer is important in the comparison of pre- and post-bailout bank performance since it shows how risky the balance sheets are.

Finally, I proxy bank lending activity by loans to assets ratio. The higher this ratio is, the lower the liquidity of a bank is and, thus, its portfolio is more risky.

I consider two types of control variables - bank-specific and country-specific. As bank-specific controls, I include bank size proxied by the natural logarithm of total assets, operational efficiency measured by cost-income ratio (CIR) and dependent variables served as control variables in models where they do not represent an outcome variable. E.g. if I estimate a model with total capital adequacy as a dependent variable, ROA, loans to assets and NPLs serve as control variables. Moreover, I specify two main country-specific control variables - GDP growth rate and inflation which serve as controls for the country-level macroeconomic condition.

Table 3: Variables description

Variable	*Description*	*Proxy*	*Source*
BIS Capital Adequacy Ratio	The sum of Tier 1 Capital and Tier 2 Capital, divided by Total Risk Weighted Assets, expressed as a %	Capital adequacy	The Banker
Total Assets	Total Assets held on the balance sheet (in millions USD) expressed in logarithm	Bank size	The Banker
Loans to Assets Ratio	Gross Total Loans as a percentage of Total Assets	Liquidity	The Banker
Cost-Income Ratio	Operating Costs excluding Total Impairments Charges and Provisions divided by Total Operating Income	Operational Efficiency	The Banker
Non-Performing Loans	Gross non-performing loans, whether impaired or not, divided by Gross Total Loans, expressed as %	Asset quality	The Banker
Return on Assets	Net Income for the year divided by Total Assets expressed as %	Profitability	The Banker
GDP Growth Rate	Annual percentage growth of rate of GDP	-	World Bank Development Indicators
Inflation	Annual percentage change in consumer price index	-	OECD

Table 4 presents the descriptive statistics of bank performance indicators split into treated and non-treated banks as well as into pre- and post-intervention periods. Next, I report the differences between intervened and non-intervened banks as well as the between the pre- and post-intervention periods. The right bottom corner of the table shows the difference-in-differences (DID) coefficients indicating a relative change in performance measurers of aided banks to non-aided ones.

Differences in loans to assets ratio as well as in non-performing loans in the post-bailout period tend to be significantly higher among treated banks. These results suggest that intervened banks increased their lending compared to their non-intervened peers and reduced their liquidity. Also, higher NPLs among intervened banks give an impression of lower credit quality and ongoing risk-taking. The improvement is present also in the case of total capital adequacy. On the contrary, the DID coefficient for ROA suggests that there is no significant distinction between treated and control groups in the post-bailout period in profitability.

Table 4: Descriptive statistics - EU banks.

	Non-treated		Treated		Difference	
	Mean	St. error	Mean	St. error	Mean	St. error
			Pre-bailout period			
Capital Adequacy	10.199	(0.3418)	8.734	(0.4094)	-1.4649*	(0.5715)
Return on Assets	1.1569	(0.0571)	0.7491	(0.0435)	-0.4078***	(0.0805)
Loans to Assets	53.252	(1.3773)	44.0505	(1.5301)	-9.201***	(2.218)
Non-Performing Loans	2.541	(0.1898)	2.701	(0.1895)	0.1605	(0.7297)
			Post-bailout period			
Capital Adequacy	16.70	(0.3373)	17.62	(0.4838)	0.923	(0.5838)
Return on Assets	0.4624	(0.0395)	0.1728	(0.0719)	-0.2896***	(0.0754)
Loans to Assets	60.664	(1.2965)	59.238	(1.8233)	-1.426	(2.228)
Non-Performing Loans	5.248	(0.3698)	7.868	(0.9046)	2.62**	(0.8353)
			(Post-bailout)-(Pre-bailout)			
Capital Adequacy	6.4996***	(0.4723)	8.8875***	(0.6338)	2.3879**	(0.8082)
Return on Assets	-0.6945***	(0.0665)	-0.5762***	(0.0841)	0.1183	(0.1138)
Loans to Assets	7.412***	(1.833)	15.188***	(2.38)	7.775*	(3.137)
Non-Performing Loans	2.7067***	(0.5919)	5.1662***	(1.0132)	2.4596*	(0.977)

Note: This table provides descriptive statistics (mean and standard errors) for EU banks differentiated by the period before and after treatment and by a treatment and control group. Differences are calculated across both dimensions. Difference-in-differences are provided in the bottom-right corner. Standard errors are in brackets
*p<0.05; **p<0.01; ***p<0.001

A DID computation with the split on EU core and EU periphery from Table 5. gives interesting results suggesting that government bailouts had dissimilar effects on banks in these two groups of states. The first contrast is noticeable in capital adequacy and profitability measurers. While the capital adequacy and profitability of core countries' bailed banks increased, the periphery states' banks did not improve in terms of capital adequacy and became relatively less profitable in the post-intervention period with respect to the non-intervened group of banks. Diverging results between the two groups of states are apparent also in terms of the quality of bank lending. While in core countries' banks, government bailouts did not have an important effect on the loans to assets ratio nor on non-performing loans, a significantly growing trend in both indicators can be seen in the EU periphery.

Table 5: Descriptive statistics - EU Core and Periphery.

	Non-treated		Treated		Difference	
	Mean	St. error	Mean	St. error	Mean	St. error
	(Post-bailout)-(Pre-bailout)					
EU Core						
Capital Adequacy	7.3626***	(0.7369)	10.0396***	(0.7957)	2.677*	(1.1417)
Return on Assets	-0.4151***	(0.0735)	-0.1401*	(0.0597)	0.2749*	(0.114)
Loans to Assets	16.076***	(2.527)	14.58***	(2.419)	-1.496	(3.914)
Non-Performing Loans	0.8647*	(0.3368)	0.5555	(0.3971)	-0.3091	(0.4699)
EU Periphery						
Capital Adequacy	5.5702***	(0.5106)	6.0073***	(0.9012)	0.437	(1.0526)
Return on Assets	-0.9953***	(0.1085)	-1.6664***	(0.204)	-0.6711**	(0.2238)
Loans to Assets	-1.917	(2.431)	16.708**	(5.37)	26.150***	(5.229)
Non-Performing Loans	4.8911***	(0.8267)	16.83***	(2.126)	11.9394***	(1.7044)

Note: This table provides descriptive statistics (mean and standard errors) of the difference between post-bailout and pre-bailout period for EU Core and EU Periphery banks differentiated by a treatment and control group. Difference-in-differences are provided in the bottom-right corner. Standard errors are in brackets. $^{*}p<0.05$; $^{**}p<0.01$; $^{***}p<0.001$

The average treatment effect for US banks is shown in Table 6. As displayed in the right-bottom corner, the US banks' performance followed a different trend than that of the EU banks. Capital adequacy of US TARP recipient banks in the post-bailout period increased relative to that of non-recipient banks. As opposed to EU intervened banks, the change in profitability (ROA) and loans to assets ratio are for US banks with the opposite sign,

but coefficients are insignificant for both variables, implying no crucial variation in the post-bailout period. Similarly, the level of non-performing loans did not significantly diverge from the non-TARP recipients' NPL.

Table 6: Descriptive statistics - US banks.

	Non-treated		Treated		Difference	
	Mean	St. error	Mean	St. error	Mean	St. error
			Pre-bailout period			
Capital Adequacy	15.43	(0.4416)	12.91	(0.1488)	-2.5217***	(0.3428)
Return on Assets	1.706	(0.0598)	1.8487	(0.0881)	0.1428	(0.0838)
Loans to Assets	65.64	(0.7003)	65.311	(0.8998)	-0.3291	(1.2639)
Non-Performing Loans	0.5402	(0.0293)	0.6558	(0.0286)	0.1155*	(0.0518)
			Post-bailout period			
Capital Adequacy	14.84	(0.2263)	14.33	(0.1317)	-0.5081*	(0.2476)
Return on Assets	1.0235	(0.0244)	1.0852	(0.0185)	0.0616*	(0.0301)
Loans to Assets	66.28	(0.7936)	64.168	(0.9673)	-2.1161	(1.317)
Non-Performing Loans	0.7032	(0.0425)	0.8342	(0.0411)	0.131*	(0.0603)
			(Post-bailout)-(Pre-bailout)			
Capital Adequacy	-0.5849	(0.3678)	1.4287***	(0.1988)	2.0136***	(0.4847)
Return on Assets	-0.6823***	(0.0899)	-0.7635***	(0.0899)	-0.0812	(0.1185)
Loans to Assets	0.6437	(1.3563)	-1.1433	(1.3212)	-1.787	(1.7875)
Non-Performing Loans	0.1631**	(0.0556)	0.1784***	(0.0501)	0.0154	(0.0733)

Note: This table provides descriptive statistics (mean and standard errors) for US banks differentiated by the period before and after treatment and by a treatment and control group. Differences are calculated across both dimensions. Difference-in-differences are provided in the bottom-right corner. Standard errors are in brackets
*p<0.05; **p<0.01; ***p<0.001

5 Methodology

5.1 Hypotheses

Based on the previous research on the effects of government intervention on bank performance, three research hypotheses are defined.

Hypothesis 1

Under the first hypothesis, I examine whether *bank performance of EU banks that received*

any form of bailout did improve compared to banks that did not benefit from any government intervention in the defined period.

The expected bailouts' impact on bank performance indicators is uncertain and hard to define. Capital adequacy is expected to improve as a result of recapitalizations as well as due to stricter capital requirements introduced by Basel III. Banks' profitability is expected to decrease due to restrictions and requirements that are imposed on banks when they receive bailouts. On the other hand, assuming that banks increase their lending and improve credit quality, profitability might rather improve, e.g. due to higher interest rates. Loans to assets ratio can either grow as a result of increased lending, but it can further decline due to de-risking efforts of banks' portfolios. The credit activity influences also the ratio of non-performing loans. While less risky lending and better credit quality should result in lower NPLs, higher lending activity might be associated with poorer credit quality with subsequent higher NPLs.

Hypothesis 2

Under the second hypothesis, I test whether *intervened banks of periphery EU member states gained less in performance than their counterparts in the EU core countries.*

Hypothesis 3

Finally, I want to detect whether *there is any difference in the post-bailout improvement of bank performance in the European Union and the United States*, which constitutes my third hypothesis.

5.2 Difference-in-differences

My empirical strategy is based on the difference-in-differences approach. As treated banks are considered these which benefited from government bailouts between years 2008 and 2014. Note that government bailouts were in many cases provided and drawn repeatedly. E.g., the first bailout for the Franco-Belgian Dexia bank group took place in 2008. The repeated

bailout for Dexia was approved in 2011 when a Belgian subsidiary was nationalized by the Belgian government. One year later, Dexia received another capital injection. For this reason, the whole period between years 2008 and 2014 is set as a treatment period, years 2003-2007 represent a pre-treatment period and years 2015-2019 constitute a post-treatment period.

The control group consists of banksthath did not benefit from any government intervention between the years 2008 and 2014.

I estimate the following equation with bank-specific and country-specific control variables:

$$performance\ indicators_{i,t} = \beta_0 + \beta_1(treated_j\ \times\ period_t)_{i,t} +$$

$$\beta_2 bank\ specific\ controls_{i,t} + \beta_3 country\ specific\ controls_{i,t} +$$

$$\gamma_1 time_t + \gamma_2 bank_i$$

where indices i and t denote bank and time, respectively. Outcome variable $performance\ indicators_{i,t}$ enclose four bank performance indicators. For each of these indicators, I estimate the separate equation. I include the interaction term composed of two dummy variables - $(treated_j\ \times\ period_t)$, where $treated_j$ equals one for bailed banks and zero for non-bailed ones and, similarly, $period_t$ equals one for post-bailout period and zero otherwise. This term measures the change of performance indicators in the post-intervention period in the group of banks which benefited from government bailouts with respect to non-intervened banks.

To track for any other heterogeneity affecting either individual banks or separate years, I include two fixed effects terms. First, $\beta_5 time_t$ which controls for heterogeneity across the time periods and, second, $\beta_6 bank_i$ serving as a control variable for bank heterogeneity which is persistent over time.

Another issue that has to be addressed is that in difference-in-differences setup implies a within-unit serial correlation (Bertrand *et al.*, 2004). Also, the treatment assignment can be correlated within clusters at different level. Therefore, Abadie *et al.* (2017) argue that

standard errors should be clustered at the level of treatment assignment and levelsould be done at the highest possible level of aggregation. Since government bailouts are assigned at the bank level, I use robust standard errors and cluster them on the bank level. By this approach, potential heteroscedasticity is prevented.

5.3 Identification assumption

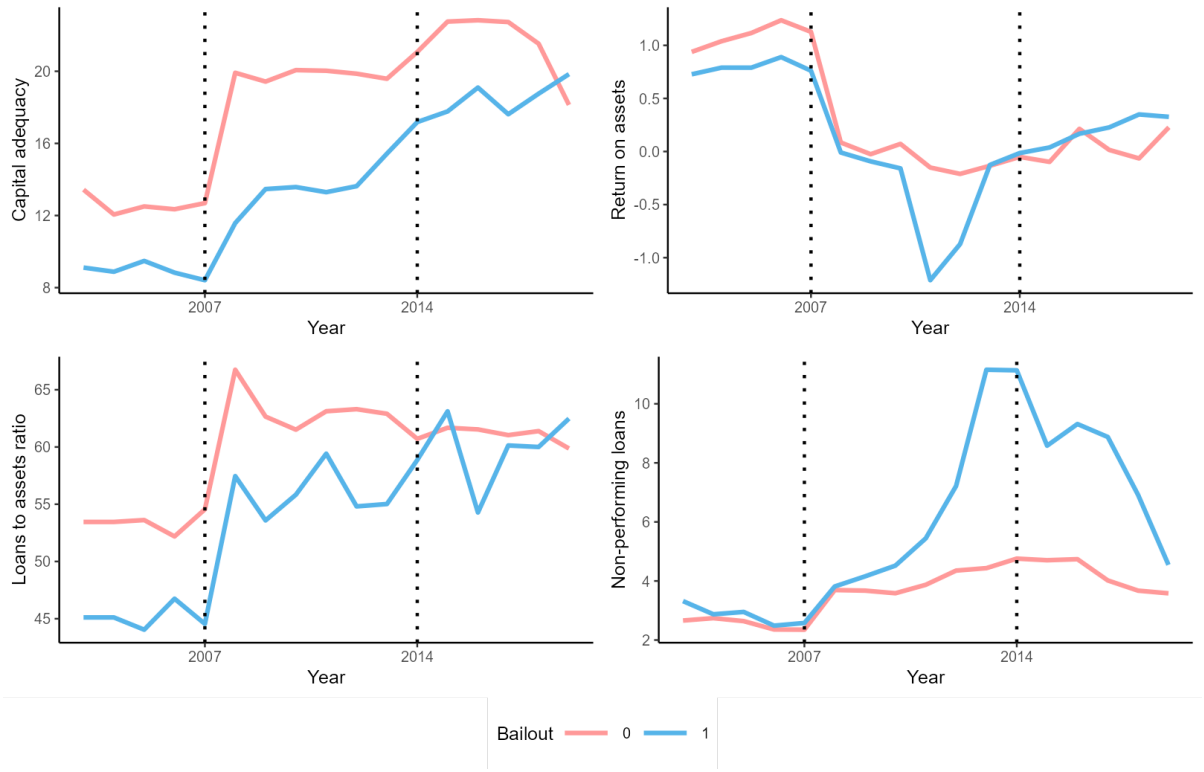
The difference-in-differences method assumes that, without being exposed to a treatment, the treatment and control groups would follow the same path over time (parallel time trend assumption). Subplots of Figure 1 show the evolution of four performance measurers in the EU. Even though the pre-treatment period is short, the trends seem to be similar for all four variables of interest.

Starting from the year 2007, the performance of aided and non-aided banks diverges quite significantly. Most importantly, after the bailout period ending in 2015, the banks follow very different trends, so it is presumable that government interventions did have some effect on bank performance. Most striking is the evolution of intervened banks' non-performing loans which soars markedly and returns to pre-crisis level only slowly. On the other hand, aided banks overtook non-aided ones in terms of profitability measured by ROA.

Subplots of Figure 2 depict the banks' performance indicators evolution in time for US banks. Unlike EU banks, the evolution of profitability and NPLs for the US indicates that TARP recipients returned to a non-recipient level right after the bailout period. The level of capital adequacy of aided banks was significantly lower compared to non-aided banks in the pre-crisis period and had a converging trend in the post-bailout period. The lending activity of TARP recipients returned to the pre-crisis level in 2015 but remained at a smaller level compared to non-intervened banks.

Even though the graphical analysis approved the presence of a similar path over time, this problem will be addressed formally by the propensity score matching and inverse probability of treatment weighting methods.

Figure 1: Parallel time trend - EU banks.



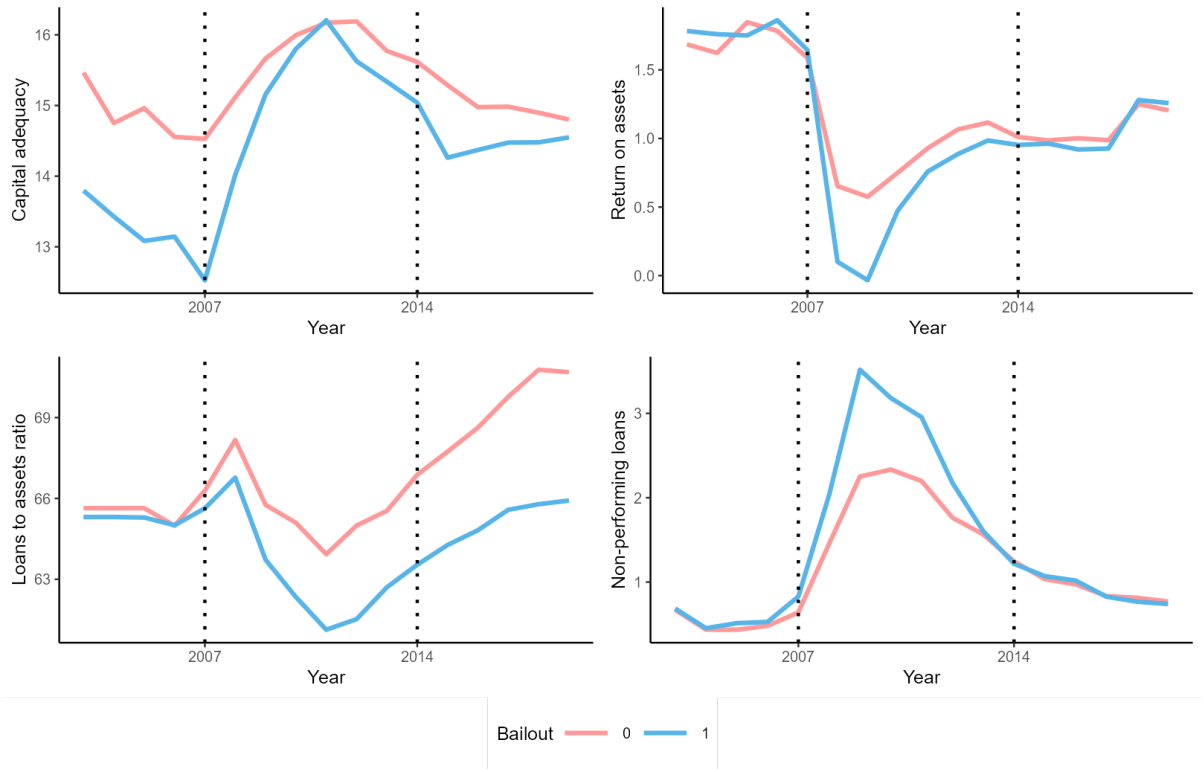
Author's calculation based on The Banker Database.

5.4 Propensity score matching

Apart from the uncertainty of parallel time trends assumption fulfillment, there is also a potential problem of endogeneity. The reason is that the decision about a bank bailout is not a random choice, but rather a targeted action to rescue the most important banks which suffer from solvency and liquidity problems. I address these issues by propensity score matching and inverse probability of treatment weighting methods which allow me to reduce the confounding bias.

I pair the treated banks with non-treated ones by nearest neighbor matching without replacement based on the propensity score. This is done using the matching technique by Ho *et al.* (2011). The propensity score, i.e. the probability of a bank receiving bailout, is estimated by a probit model, specifically by regressing the bailout dummy variable on these covariates: the amount of assets, total capital adequacy, ROA and loans to assets ratio. The

Figure 2: Parallel time trend - US banks.



Author's calculation based on The Banker Database.

choice of predictors is inspired by Gerhardt & Vander Vennet (2017) who found that the size of a bank, its capital buffer and bank business strategy (CIR, net interest margin) are among the best predictors of receiving a bailout in the EU during the 2008 financial crisis. I include also the loans to assets ratio since its level is very different between my treatment and control group of banks. For the purpose of propensity score estimation, only covariates two years prior intervention period (years 2006 and 2007) are used, since I assume that the performance two years before the crisis contributed at most to the need for government interventions in the following period.

Figures 3 and 4 show the distribution of the propensity score of the matched treated and control banks for the EU and US banks respectively. For the EU sample, the matching procedure left 26 control banks unmatched and, as expected, they are far from the treated banks. The balance of matched control and treated banks' propensity scores is satisfactory.

In the case of US banks, I use a caliper distance of 0.5 for matching due to the large

distance of propensity scores between the treated and control banks leading to poor performance of matching without replacement. A treated bank for which there are no available controls within the caliper width is dropped from the sample. The final matched sample consists of 37 control and treated banks.

Figure 3: Matching without replacement - EU banks

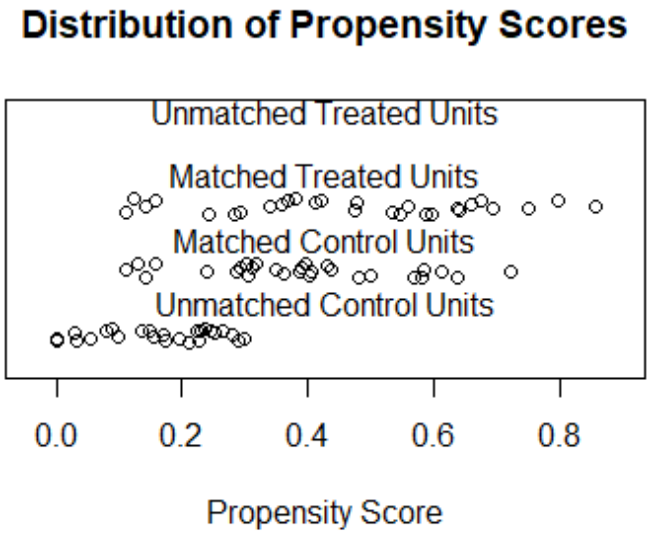
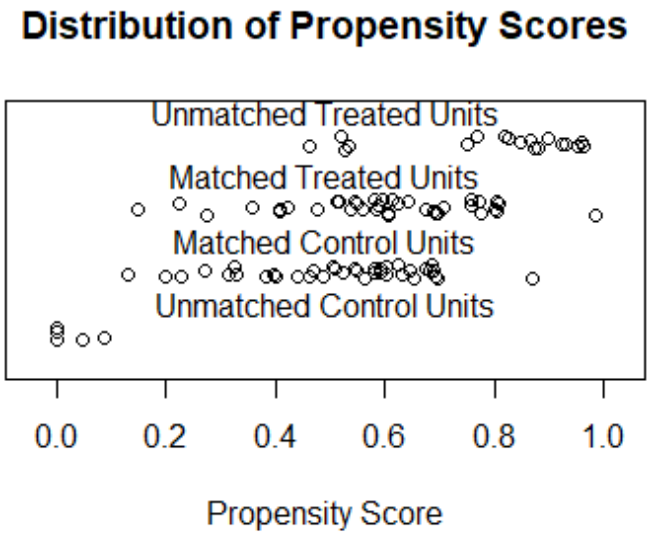


Figure 4: Matching without replacement - US banks



5.5 Inverse probability of treatment weighting

Second used balancing method is the inverse probability of treatment weighting (IPTW), which, instead of reducing the sample, allows using all available observations by assigning weights to each bank based on the inverse of its probability of being intervened and thus creating a weighted sample with equal distribution of treated and control banks' confounders. (Austin & Stuart, 2015)

Firstly, I pair the treated banks with non-treated ones by optimal full matching without replacement, which matches every treated unit to at least one control and every control to at least one treated unit based on the propensity score. The same approach as in the PS matching in section 4.5 is applied. The second step is the weight assignment. The weight of treated banks is equal to 1 and control banks are assigned weights based on the likelihood that they would be bailed out as defined by an inverse of propensity score. The weights are then used in a DID regression to estimate the causal effect.

By this approach, the regression gives more importance to non-aided banks that are similar to the aided banks, using the estimated propensity score.

Figure 5: Full matching - EU banks

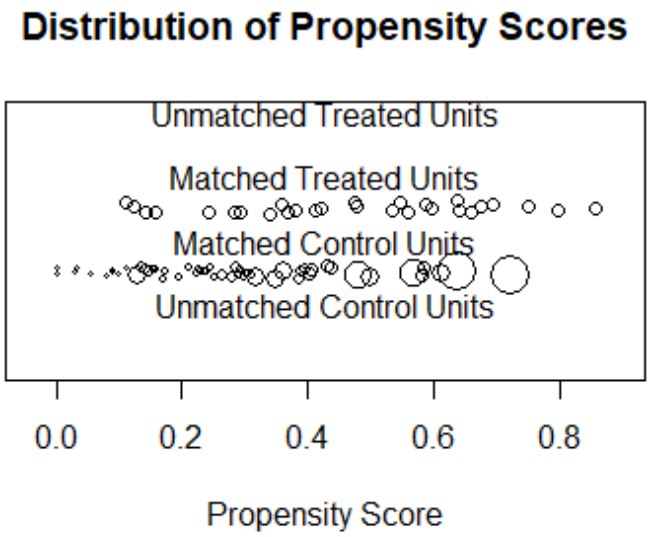
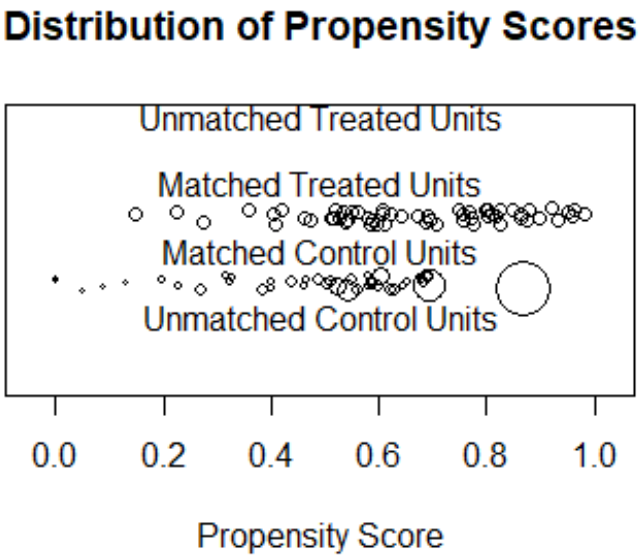


Figure 6: Full matching - US banks



6 Results

6.1 EU banks results

Table 7 provides the regression results on the full EU sample for four bank performance indicators. The table contains the results of difference-in-differences (DID), propensity score matching (PS matching) as well as the inverse probability of treatment weighting (IPTW) methods. The key variable of interest is the DID coefficient (i.e. the interaction term) which shows the causal effect of government bailouts on the bank performance variables in the post-bailout period.

The main results are as follows. Capital adequacy seems to be improved in rescued banks. However, while DID coefficient in the regression with the capital adequacy as a dependent variable produces positive and significant result only in case of difference-in-differences, the propensity score matching and IPTW gives insignificant results.

An impact on the profitability of bailed EU banks measured by ROA is inconclusive. While it improved according to DID method, PS Matching and IPTW give opposite results

and all three coefficients are insignificant.

The DID term in the regression with loans to assets ratio as the dependent variable is significant and positive in the case of a full EU sample and is robust across all three methods. This may entail two things. Firstly, lending activities of intervened banks after the financial crisis improved implying the end of credit crunch. In addition to government interventions, this is also the result of the ECB's relaxed policy which aimed to support the economy. Overall, these results can be interpreted as the success of an effort to boost lending.

But, at the same time, the higher ratio of loans to assets might point to continued risky lending of intervened banks. This is highlighted by a rise in NPL after government interventions which can be seen from DID coefficients in regressions (10)-(12). A rise in defaulted contracts might be caused by the poor quality of issued loans. Keeton & Morris (1987), for instance, found that banks with low-quality credit pursue moral hazard and expand the riskiness of their loan portfolio which, in turn, leads to higher NPL. As Gerhardt & Vander Vennet (2017) claim, a hike in NPL in the post-intervention period can be explained by regulatory pressure for disclosure of non-performing loans, which were hidden before. Moreover, higher NPL might be partially attributed to the ongoing recession in the European Union, especially in the Periphery states.

Table 7: Effect of government bailouts on EU banks

	Dependent variable:											
	Capital Adequacy			Return on Assets			Loans to Assets Ratio			Non-performing Loans		
	DID	Matching	IPTW	DID	Matching	IPTW	DID	Matching	IPTW	DID	Matching	IPTW
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Capital Adequacy				0.011**	0.009*	0.009*	-0.077	0.181	0.176	-0.025	-0.040	-0.036
				(0.004)	(0.004)	(0.004)	(0.188)	(0.190)	(0.156)	(0.033)	(0.040)	(0.038)
Return on Assets	0.823***	0.925*	0.754*				0.442	1.250	-0.948	−1.292*	−2.311***	−1.890***
	(0.244)	(0.398)	(0.363)				(1.499)	(2.848)	(2.042)	(0.504)	(0.436)	(0.390)
Loans to Assets Ratio	-0.006	0.015	0.014	0.0005	0.001	-0.001				0.007	0.009	0.002
	(0.015)	(0.016)	(0.012)	(0.002)	(0.002)	(0.002)				(0.009)	(0.010)	(0.014)
Non-Performing Loans	-0.044	-0.071	-0.065	−0.031**	−0.039***	−0.039***	0.153	0.192	0.049			
	(0.053)	(0.065)	(0.067)	(0.010)	(0.011)	(0.011)	(0.199)	(0.227)	(0.322)			
Assets	-0.055	-0.118	-0.188	-0.009	-0.014	-0.012	-0.354	-0.077	-0.493	-0.019	-0.007	-0.010
	(0.137)	(0.159)	(0.118)	(0.014)	(0.017)	(0.014)	(0.445)	(0.532)	(0.448)	(0.148)	(0.162)	(0.100)
Cost-Income Ratio	-0.023	-0.028	−0.028**	-0.004	-0.002	−0.004*	0.006	0.016	0.033	0.004	0.0004	0.0004
	(0.013)	(0.015)	(0.009)	(0.002)	(0.002)	(0.002)	(0.020)	(0.024)	(0.024)	(0.006)	(0.007)	(0.006)
GDP Growth	0.141	-0.026	0.019	0.021	0.010	0.003	1.651***	1.658***	1.823**	−0.737***	−0.798***	−0.753***
	(0.175)	(0.217)	(0.146)	(0.045)	(0.047)	(0.040)	(0.440)	(0.460)	(0.572)	(0.207)	(0.206)	(0.129)
Inflation	-0.070	0.140	-0.168	0.159	0.130	0.097	3.397	2.151	2.637	−3.133***	−2.908***	−2.958***
	(0.583)	(0.706)	(0.405)	(0.081)	(0.070)	(0.059)	(2.005)	(2.041)	(1.728)	(0.641)	(0.611)	(0.384)
Difference-in-differences	**3.427***	**1.819**	**2.998**	**0.083**	**-0.015**	**0.124**	**13.450****	**16.510****	**12.537*****	**3.491***	**3.945****	**4.436*****
	(1.425)	(1.816)	(0.886)	(0.148)	(0.155)	(0.094)	(4.694)	(5.405)	(3.219)	(1.486)	(1.423)	(0.668)
Observations	700	470	700	700	470	700	700	470	700	700	470	700
R^2	0.059	0.056	0.576	0.155	0.228	0.789	0.067	0.086	0.934	0.326	0.398	0.828

Note: Year and bank fixed effects are included. Clustered robust standard errors are in brackets.
*p<0.05; **p<0.01; ***p<0.001

6.2 Core vs Periphery

Table 8 and 9 provides results of estimation of the average treatment effect on the treated in the EU Core and EU Periphery banks, respectively. These results suggest that government interventions have had dissimilar effects on the two groups of states.

One can observe that, albeit insignificant, improved capital position in the EU Core bailed-out banks is in contrast to the impact in the EU Periphery when the total capital adequacy even decreased compared to non-aided banks.

The effect of government interventions on profitability is small and positive in the case of EU Core countries' banks, but the coefficient is insignificant. Based on the PS matching, in the EU periphery aided banks profitability even decreased in the post-bailout period compared to non-aided banks. This is in line with the findings of Gerhardt & Vander Vennet (2017) and Jayasinghe (2019) who found a negative association between government bailouts and profitability, too. However, the other two methods do not confirm these findings, since DID coefficients are insignificant.

DID coefficient in regressions with loans to assets as a dependent variable suggests that government interventions have had a positive and strong effect on lending activity, especially in the EU Periphery banks. This effect, albeit smaller, is also visible in the EU Core countries' banks but is significant only in the case of two methods - PS Matching and IPTW.

The last three specifications (10)-(12) imply that a rise in non-performing loans in the post-bailout period found on the full sample (Table 6) is mostly driven by the EU Periphery banks. Based on the IPTW, there is a significant positive effect also in the EU Core, but we can not conclude it based on the results of other methods.

Overall, results show that there are substantial differences in effects between banks in the EU Core and EU Periphery with the latter performing more risk-taking behavior in the post-intervention period.

Table 8: Effect of government bailouts on EU Core banks.

	Dependent variable:											
	Capital Adequacy			Return on Assets			Loans to Assets Ratio			Non-performing Loans		
	DID	Matching	IPTW	DID	Matching	IPTW	DID	Matching	IPTW	DID	Matching	IPTW
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Capital Adequacy				0.007*	0.004	0.009*	-0.259	0.051	0.080	-0.016	-0.024	-0.025
				(0.003)	(0.003)	(0.004)	(0.220)	(0.187)	(0.169)	(0.023)	(0.026)	(0.046)
Return on Assets	1.510*	1.269	0.948				0.800	4.765	-3.506	-0.005	-0.364	-0.031
	(0.761)	(1.105)	(0.782)				(3.041)	(4.577)	(2.986)	(0.286)	(0.359)	(0.290)
Loans to Assets Ratio	-0.032	0.007	0.011	0.0005	0.002	-0.001				-0.008	-0.005	-0.009
	(0.027)	(0.026)	(0.022)	(0.002)	(0.002)	(0.002)				(0.006)	(0.005)	(0.005)
Non-Performing Loans	-0.160	-0.230	-0.231	-0.0002	-0.012	−0.039***	-0.606	-0.369	−0.616**			
	(0.161)	(0.135)	(0.340)	(0.014)	(0.010)	(0.011)	(0.383)	(0.265)	(0.225)			
Assets	-0.230	-0.232	-0.331	-0.016	-0.017	-0.012	−1.730***	−1.525**	−1.855***	-0.147	-0.183	-0.170
	(0.227)	(0.215)	(0.177)	(0.013)	(0.014)	(0.014)	(0.482)	(0.523)	(0.483)	(0.156)	(0.170)	(0.115)
Cost-Income Ratio	−0.032*	−0.039**	−0.032**	-0.001	-0.0003	−0.004*	-0.009	0.008	0.019	−0.004**	−0.004*	-0.003
	(0.014)	(0.014)	(0.011)	(0.002)	(0.002)	(0.002)	(0.025)	(0.026)	(0.025)	(0.002)	(0.002)	(0.005)
GDP Growth	0.464	0.019	0.040	0.069*	0.080*	0.003	0.160	0.293	1.734	0.162	0.116	-0.050
	(0.421)	(0.655)	(0.420)	(0.029)	(0.037)	(0.040)	(1.078)	(1.575)	(1.037)	(0.156)	(0.200)	(0.128)
Inflation	-0.550	-1.067	-0.982	0.151**	0.102*	0.097	4.635**	4.182**	4.802**	0.129	0.191	0.028
	(0.960)	(0.935)	(0.828)	(0.055)	(0.042)	(0.059)	(1.477)	(1.411)	(1.585)	(0.234)	(0.192)	(0.184)
Difference-in-differences	**4.847**	**0.879**	**4.877**	**0.236**	**0.238**	**0.124**	**7.735**	**13.452***	**11.965****	**-0.280**	**0.232**	**1.171***
	(2.670)	(4.196)	(1.356)	(0.163)	(0.204)	(0.094)	(6.073)	(6.150)	(3.784)	(0.878)	(0.998)	(0.559)
Observations	360	270	360	360	270	360	360	270	360	360	270	360
R^2	0.102	0.054	0.583	0.091	0.095	0.789	0.063	0.093	0.946	0.027	0.035	0.804

Note: Year and bank fixed effects are included. Clustered robust standard errors are in brackets.
*p<0.05; **p<0.01; ***p<0.001

Table 9: Effect of government bailouts on EU Periphery banks.

	Dependent variable:											
	Capital Adequacy			Return on Assets			Loans to Assets Ratio			Non-performing Loans		
	DID	Matching	IPTW	DID	Matching	IPTW	DID	Matching	IPTW	DID	Matching	IPTW
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Capital Adequacy				0.019	0.021*	0.009*	0.384	0.615	0.484	0.011	0.013	0.039
				(0.011)	(0.010)	(0.004)	(0.284)	(0.433)	(0.325)	(0.061)	(0.065)	(0.051)
Return on Assets	0.637*	0.895*	0.675				0.498	0.289	0.187	-0.596	-1.051	-0.983
	(0.259)	(0.364)	(0.346)				(1.762)	(3.681)	(2.598)	(0.537)	(0.657)	(0.539)
Loans to Assets Ratio	0.018	0.024	0.020	0.001	0.0003	-0.001				0.003	-0.004	-0.005
	(0.013)	(0.018)	(0.013)	(0.003)	(0.003)	(0.002)				(0.017)	(0.014)	(0.024)
Non-Performing Loans	0.009	0.010	0.035	-0.016	-0.019	−0.039***	0.059	-0.089	-0.110			
	(0.056)	(0.050)	(0.046)	(0.013)	(0.014)	(0.011)	(0.316)	(0.269)	(0.517)			
Assets	0.115	-0.091	-0.092	0.003	0.014	-0.012	0.448	1.471	0.786	0.063	0.246	0.195
	(0.150)	(0.182)	(0.142)	(0.022)	(0.029)	(0.014)	(0.755)	(1.050)	(0.726)	(0.167)	(0.163)	(0.129)
Cost-Income Ratio	-0.005	0.006	-0.005	−0.008***	−0.008**	−0.004*	0.011	-0.019	0.030	0.020	0.013	0.010
	(0.016)	(0.019)	(0.017)	(0.002)	(0.003)	(0.002)	(0.035)	(0.050)	(0.060)	(0.012)	(0.023)	(0.014)
GDP Growth	-0.005	-0.054	0.010	0.039	0.036	0.003	2.044**	1.634**	1.819*	−1.016***	−0.987***	−1.004***
	(0.237)	(0.240)	(0.184)	(0.056)	(0.052)	(0.040)	(0.770)	(0.632)	(0.868)	(0.171)	(0.184)	(0.164)
Inflation	-0.127	-0.248	0.323	0.031	0.015	0.097	3.583	4.112	4.558	−3.306*	−2.636*	−2.731**
	(0.637)	(0.667)	(0.582)	(0.149)	(0.121)	(0.059)	(3.938)	(4.567)	(3.778)	(1.386)	(1.134)	(0.935)
Difference-in-differences	**0.315**	**-0.024**	**-0.315**	**-0.470**	**−0.647***	**0.124**	**20.491****	**24.163****	**21.280****	**9.092****	**10.436*****	**10.304*****
	(1.495)	(1.840)	(0.0943)	(0.271)	(0.295)	(0.094)	(7.733)	(7.746)	(7.299)	(2.964)	(2.754)	(1.387)
Observations	340	200	340	340	200	340	340	200	340	340	200	340
R^2	0.025	0.035	0.556	0.131	0.241	0.789	0.095	0.133	0.929	0.436	0.514	0.890

Note: Year and bank fixed effects are included. Clustered robust standard errors are in brackets.
*p<0.05; **p<0.01; ***p<0.001

6.3 US banks

Table 10 presents the results of TARP effects on the US banks. It seems that the TARP program has had an effect only on the capital adequacy of aided banks. TARP recipients increased their capital adequacy more compared to non-intervened banks in the post-crisis period.

The remaining model specifications give insignificant DID coefficients meaning that government interventions did not have an impact on bank performance in the United States. An interesting pattern is the inconclusive effect on loans to assets ratio indicating no change in the lending behavior of aided banks. This finding is in line with previous research by Duchin & Sosyura (2014) who found no significant effect of the TARP program on credit supply. Besides, neither profitability (ROA) nor credit quality (NPL) of aided institutions did not significantly change proportionately to non-aided ones.

Overall, my results suggest that TARP recipient used received support to increase their capital base rather than to boost their lending activities compared to non-intervened banks. A such phenomenon might be explained by two contradictory objectives of TARP, as argued by Black & Hazelwood (2013). Whereas, on one hand, participants were motivated to increase credit supply, the aim was also to reduce risk-taking. So, given that US banks put their effort into de-risking their portfolio, they were careful in the issuance of new loans.

Table 10: Effect of TARP on US banks.

	Dependent variable:											
	Capital Adequacy			Return on Assets			Loans to Assets Ratio			Non-performing Loans		
	DID	Matching	IPTW	DID	Matching	IPTW	DID	Matching	IPTW	DID	Matching	IPTW
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Capital Adequacy				-0.011	-0.010	-0.007	-0.512^{***}	-0.627^{***}	-0.441^{***}	0.018	0.002	0.013
				(0.021)	(0.019)	(0.012)	(0.131)	(0.115)	(0.108)	(0.015)	(0.012)	(0.013)
Return on Assets	-0.099	-0.086	-0.051				0.223	0.174	0.201	-0.029	-0.016	-0.024
	(0.158)	(0.122)	(0.062)				(0.448)	(0.364)	(0.339)	(0.032)	(0.031)	(0.029)
Loans to Assets Ratio	-0.096^{**}	-0.125^{***}	-0.070^{***}	0.004	0.004	0.004				0.007	-0.001	0.008^{*}
	(0.032)	(0.033)	(0.013)	(0.007)	(0.007)	(0.006)				(0.007)	(0.005)	(0.004)
Non-Performing Loans	0.671	0.107	0.386	-0.116	-0.082	-0.108	1.491	-0.260	1.554^{*}			
	(0.543)	(0.511)	(0.285)	(0.075)	(0.123)	(0.713)	(1.529)	(1.109)	(0.714)			
Assets	-2.076^{***}	-1.569^{**}	-1.251^{***}	-0.723	-0.843	-0.898	-2.094	-0.937	-1.241	0.001	0.098	-0.018
	(0.552)	(0.572)	(0.246)	(0.488)	(0.554)	(0.507)	(2.095)	(2.386)	(0.763)	(0.102)	(0.080)	(0.055)
Cost-Income Ratio	-0.041	-0.027	0.008	-0.039^{**}	-0.039^{**}	-0.053^{***}	-0.039	-0.021	-0.088^{**}	0.005	0.005	0.009^{**}
	(0.026)	(0.027)	(0.036)	(0.013)	(0.014)	(0.015)	(0.033)	(0.034)	(0.031)	(0.003)	(0.004)	(0.004)
GDP Growth	0.150	0.053	0.106	-0.083	-0.060	-0.137	-0.223	-0.139	-0.804	-0.264^{***}	-0.243^{***}	-0.160
	(0.402)	(0.466)	(0.281)	(0.196)	(0.192)	(0.206)	(1.264)	(1.613)	(1.151)	(0.065)	(0.072)	(0.098)
Inflation	-1.651	-1.796	0.049	-0.135	-0.117	0.028	2.180	1.359	3.238	-0.460^{***}	-0.463^{***}	-0.358^{**}
	(1.026)	(1.103)	(0.307)	(0.217)	(0.209)	(0.328)	(1.371)	(1.522)	(2.076)	(0.116)	(0.137)	(0.109)
Difference-in-differences	**1.829***	**1.753***	**1.883*****	**-0.005**	**-0.096**	**0.202***	**-0.670**	**-1.813**	**0.852**	**-0.012**	**-0.024**	**−0.211****
	(0.720)	(0.689)	(0.434)	(0.100)	(0.121)	(0.080)	(1.964)	(2.073)	(0.686)	(0.086)	(0.088)	(0.075)
Observations	990	840	990	990	840	990	990	840	990	990	840	990
R^2	0.164	0.166	0.982	0.220	0.224	0.853	0.072	0.106	0.995	0.055	0.046	0.870

Note: Year and bank fixed effects are included. Clustered robust standard errors are in brackets.
*p<0.05; **p<0.01; ***p<0.001

7 Conclusion

This paper aimed to answer the question of whether government bailouts for EU banks, which were granted by European governments in the aftermath of the financial crisis of 2008-2009, did improve banks' performance.

Using the hand-collected data on government interventions in the EU banking sector, I identified banks that received state support in the years 2007-2013 and their corresponding control group of banks. Difference-in-differences method with the support of propensity score matching and the inverse probability of weighting method were used to estimate the causal effect of bailouts.

My main findings suggest that government bailouts have led to higher loans ratio, especially in the EU periphery, suggesting the end of the credit crunch and resuming lending activity. However, rescue policies have had a negative effect on non-performing loans in the EU Periphery which indicates continuous risk-taking and potential moral hazard problems.

Moreover, I find a positive effect on capital adequacy only on the EU full sample and only in case of difference-in-differences, making the results not robust. Effects on banks' profitability appear inconclusive, too.

In the US, the TARP program has had an effect only on capital adequacy. No other significant impact is apparent in either of the used methods. This suggests that whereas US banks have used government support to increase their capital adequacy, banks of the EU periphery have invested in increased lending, but the de-risking of their credit portfolio might be questioned.

Overall, there is much difference between the behavior of EU Core and Periphery banks with the latter pursuing more risk-taking in the post-bailout period. This finding implies a distinction in crisis resolution policies within the European Union and might be attributed to the ongoing recession in the EU Periphery as well as to the fragmentation of financial markets in the Euro Area after the year 2009 caused by a rise of credit risk leading to the core's interruption of the lending to the periphery.

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