BANK BAILOUT PROGRAMS IN EUROPE: A SEQUENTIAL ANALYSIS OF DRIVERS AND OUTCOMES

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Abstract. The determinants and effects of bank bailout programs on the economy and society are still controversial. Using a Propensity Score Matching approach relying on 22 European countries, it was identified economic growth, economic freedom, total banking assets, and liquid assets to deposits and short-term funding ratio as the main drivers for the decision to adopt a bank bailout program. The results show that the adoption of bank bailout programs did not lead to an improvement in the banks' solvency indicators or financial performance. Still, it has amplified financial stress and income inequality instead, hampering political stability, as well as social and economic conditions. The novelty of this research resides in adding a contribution to scarce literature covering the determinants of the decision to adopt a bank bailout program, also by comprehensively expanding the set of candidate variables that may have impacted the decision for Government intervention.

Keywords: banking system, bailout program, economic indicators, institutional indicators, financial indicators, propensity score matching.

JEL Classifications: C31, G01, G28, H5.

Introduction

The decision to adopt a bank bailout program is generally taken in a period of financial turmoil and usually overlaps with political and social tensions. Most often, the authorities launch bailouts programs in the context of a severely deteriorated state of the banking system generated by impaired liquidity indicators, low capitalization, and the too-big-to-fail or too-interconnected-to-fail concerns. The most convincing argument in favor of adopting a bank bailout program is related to the adverse economic and social effects of the alternative of not pursuing such a path. The European Central Bank, the European Commission, and

numerous central banks have repeatedly argued that allowing banks to fail would lead to unavoidable interbank contagion effects, severe deterioration of confidence across consumers, companies, and investors. Moreover, it will disrupt the ability of central banks to ensure financial stability and will diminish the volume of loans in the real economy. However, the factors triggering this decision, the associated costs, and socioeconomic benefits are still controversial.

The 2007–2008 global financial crisis triggered unprecedented bank bailout programs in terms of number and size. These bailout programs were a controversial topic due to the sizeable budgetary effort, the ambiguities regarding the selection of the beneficiary banks, and the general effects on the banking systems. Across Europe, regulators' choice to adopt the Bank Resolution Directive with a focus on bail-in is a proof of the limited effectiveness of these government support programs and an invitation to involve other market players in infusing the bank capital needed.

Although the economic literature has developed many approaches related to state aids, it is witnessed a reiteration of the bank bailout concept (which can materialize in loans, stock, cash, bonds, or other forms of money) given the recession generated by COVID19. Furthermore, the recent attempts to bring the concept of bank bailout to the forefront of the public agenda has motivated us to analyze the determinants and effects of bailout programs applied in banking systems from multiple perspectives, with emphasis on economic and social determinants.

Generally, the bank bailout programs belong in these two categories: systemic measures designed for all banking institutions regardless of the gravity of the state of their balance sheets and single-policy instruments intended to rescue particular banks. According to the European Commission, during the financial turmoil which started in 2007–2008, state aids occurred on both sides of the banks' balance sheet, and an amount of 600 billion EUR (4.6% of 2012 European GDP) was provided to restore financial stability (Benczur et al., 2017). As regards the US experience, the total direct costs incurred with banks' bailout amounted to 3.55% of GDP in 2009 (Lucas, 2019).

According to Grossman and Woll (2014), the nature and features of decision-makers' interventions during the financial crisis varied widely among European and North American countries. These interventions, tailored to country-specific economic and financial sector conditions, are also determined by political stability and banks-state relations. Large-scale state aid was necessary to maintain the functioning of the banking system. However, some voices argued that authorities and governments are stimulating private banks in taking on additional risks. Another question is whether the banking system rescue strategies align with the need to diminish the severity of the financial crisis, or they represented the result of lobby actions initiated by banks to obtain increased support. Although there is doubt related to governments' freedom in designing the rescue plans, there is no linear relationship between the amplitude of the crisis and the scale of public interventions.

Against this background, the paper has a two-fold objective. First, to uncover the economic, financial and institutional driving factors that determine decision-makers to adopt the bailout decision (a pre-bailout analysis), and second, to investigate the effectiveness of such a Government intervention by considering a broad array of banking sector, economic,

political and social indicators (a post-bailout analysis). Thus, by reconciling the two edges of a bailout intervention, namely its determinants but also its consequences, this paper explores a new, original research direction in the existing field of literature. The research relies on a balanced panel with annual data spanning from 2007 to 2015, using a sample of 24 European countries.

The novelty of the present research resides in adding a contribution to scarce literature covering the determinants of the decision to adopt a bank bailout program, also by comprehensively expanding the set of candidate variables that may have impacted the decision for Government intervention. As documented in the literature review section, there are only a few studies on the determinants of bank bailouts, which focus on a narrow list of candidate variables, most of them belonging to bank-specific features. The variables considered can be divided into three main categories: macroeconomic variables, financial system-specific indicators, and institutional factors. Hence, the paper fills a gap in this regard as existing literature relies preponderantly on banking system-specific indicators and some economic growth indicators.

Another original feature is related to the methodological phases developed to support the hypothesis testing. First, it were identified those variables that may determine decision-makers to adopt a bank bailout program and computed the propensity scores through a binary logit model specification. The propensity model allows predicting the odds for a country to implement a bailout program, given the behavior of a set of explanatory variables. Second, the application of a Propensity Score Matching (PSM) model is meant to assess the average treatment effect of bailouts on several outcome variables in the countries witnessing government bailout interventions. This technique is frequently used in experimental or observational studies for causal effects, belonging to the medical field of research. To date, the treatment effect approach, usually employed to different topics across economics and finance (inflation targeting, financial sector development, bank acquisitions), is used for the first time in connection with the field of research related to state interventions.

A third feature that distinguishes this empirical approach from existing literature is the employment of country-level data and the exclusive focus on European countries, while most studies rely on bank-level data and focus on US, selected European or Asian countries.

A fourth feature of the research is to provide additional insights of the effectiveness of bank bailout programs on a broad array of banking sector, economic, political and social indicators, in the conditions in which the evidence from the literature about the overall cost and benefits of bank bailout programs is mixed.

The paper has the following structure: the first section summarizes the research directions explored so far in the field of bank bailout programs. Section 2 presents the research methodology. Section 3 explains the data; the fourth section describes the findings, while last Section concludes.

1. Literature review

The first strand of literature is related to the effectiveness of bailouts programs but it is reporting mixed results. For example, Gropp et al. (2011) highlight the positive impact of

regulatory action when it comes to systemic risk mitigation. A similar conclusion belongs to Roman et al. (2016), which have studied the effects of the US TARP program on systemic risk, with beneficial influence. More specifically, the governmental support had a statistically significant contribution to curbing systemic risk and maintaining financial stability. However, a recent paper by Del Viva et al. (2020), studying also the effects of the US TARP program, showed that it has led to more risk taking by banks, contributing thus to increased moral hazard.

By focusing on systemic risk and potential systemic banking crises, McDonagh (2020) argues that there are signs of institutional evolution, as a direct consequence of the bank bailout policy's global spread. The author notices that the state-backed bank bailouts have emerged as the de facto global response undertaken by governments to banking crises and highlights the trade-off between bank bailouts benefits, in terms of solving the banking crisis, and their drawbacks – public coverage of private losses, disruption of the market competition, high economical costs taken on by the state.

Moreover, Dam and Koetter (2012), using data from the German banking industry, pointed out that bailout programs, reinforced by restrictive regulatory measures, have increased banking performance.

On the contrary, Gerhardt and Vander Vennet (2017), based on a sample of European state-aided banks, bring strong empirical evidence that bailouts are not enough to restore the bank's health. A similar conclusion was reached by Hryckiewicz (2014), who revealed that bailouts harm banking sector stability. According to him, the effectiveness of government interventions in ensuring financial stability may be evaluated by answering a series of questions such as i) did the banks without severe financial problems receive government support? ii) was the government support used strictly to solve the issues faced by the banks? iii) was the government support provided promptly? iv) did government interventions effectively restore the stability of the banking sector? v) which intervention mechanisms were the most important for the recovery of the entire banking system?

A more nuanced finding belongs to Bersch et al. (2019), which recognize that bank bailouts have positively contributed to the stability of the German banking system, but at the same time uncover the presence of a transmission channel of bank distress shocks into the real economy. More specifically, there is evidence of a potential curbing effect on the real economy, due to the negative effects induced to corporate borrowers linked to rescued banks.

If they are effective, government bailout actions should strengthen the financial position of the bank or increase the likelihood of its improvement. Also, government support can prove ineffective when it comes too late, when it is insufficient or not properly implemented. In this regard, the study of Hryckiewicz (2014) indicates that the performance of the banks that benefited from state support deteriorated in the period immediately following the intervention. On the other hand, in the case of banks that did not receive government support, bank performance improved slightly.

The nexus between government support and the moral hazard in the financial system had been investigated by Dell'Ariccia and Ratnovsky (2012), which show that the state aid channeled towards banks triggers moral hazard and increases risks. However, this drawback is alleviated by the positive effects brought by bailout measures, which ensure financial stability,

as banks are heavily interconnected. Consequently, the authors outline the trade-off between bailout advantages and the moral hazard and risks incurred.

The same concern regarding the moral hazard determined by bailout measures is shared by Dam and Koetter (2012). Their research started from the fact that governments emphasize only the scale and features of bailout measures, without explaining the associated risks. By investigating German banks benefitting from state support during 1995–2006, the authors claim that the banking risks increase up to 9.4%.

Another issue of interest is the relationship established between bailout programs (especially state guarantees) and banking competition. Gropp et al. (2011) have assessed this interplay by considering a sample of banks operating in OECD countries. They conclude that banks receiving government guarantees distort the market competition and lead to a significant increase in risks at the level of the competing banks. Competitive changes in the banking market, as a result of public guarantees provided to individual banks, can undermine financial stability as they cause a higher risk preference for competing banks.

Fratzscher and Rieth (2019) have analyzed the effects triggered by specific bank bailout announcements (debt guarantees, deposit guarantees, and capital injections) on sovereign risk and bank risk in the euro-area countries. Their findings on bailout announcements are highly statistically significant and validate their hypothesis that the public reports of bank bailouts determined a reduction of credit risk in the banking sector. As regards the results for sovereign risk during bailout periods, some rescue packages increase sovereign risk (debt guarantees and capital injections) while others diminish it (deposit guarantees).

Casiraghi (2020) has implemented another approach, by considering the effects of expected bailouts on banks' portfolio decisions, by controlling for the sovereign risk. Empirical findings revealed that distressed banks tend to decrease lending to real economy and to increase purchases of government bonds, in cases of an increasing probability for a bank bailout, if the risk of sovereign default is sufficiently low.

The main beneficiaries of a bailout were the uninsured creditors and the financial institutions. Although it is argued that the amounts injected into banks' capital have been quickly recovered, however, the costs suggest that it would be necessary to review these ways of supporting banks in the event of similar situations (Lucas, 2019).

The consequences of capital injections into distressed banks have been investigated by Schroth (2020), which claims that a provision of capital involves a trade-off between increasing the lending activity immediately and distortive levies that compress the credit supply in the future. There is presence of a redistribution effect from poor to wealthy households, the later having most benefits from an increased return on savings.

A second but very limited and scarce strand of literature focuses on assessing the various determinant factors that had an impact on the decision-making process related to applying for a bailout program in a given country. The importance of corporate governance, the degree of bank concentration, and the degree of international openness are decisive factors that have impacted on bailout decisions through government support programs.

Fernandes et al. (2016) explain that there is a complex array of factors that impacts on the probability of saving the European banking system, among which: the governance characteristics of the banks, in particular the features of the boards of directors, the banking risks,

as well as the characteristics of the banking sector-specific to each country. The experience and expertise of the board of directors, the long term duration of directors' mandate, and the existence of a corporate governance committee reduce the probability that banks will participate in a bailout program. On the contrary, high exposures to credit and liquidity risks increase the likelihood of banks being saved. An essential idea the authors advocate is that a concentrated and internationally exposed banking sector will have more lobbying resources and is more likely to have access to government funding compared to a more dispersed banking system.

A complementary research direction belongs to Lu and Whidbee (2016), which have investigated various causes of bailout interventions, represented by bank-level characteristics, the economic and regulatory environment. Their empirical results show that large amounts of non-performing loans or low quality of a bank's asset portfolio have decreased the likelihood of a bank bailout through receiving capital purchase program (CPP) funds. Other findings of the studies examining bailouts through capital purchase programs uncovered that the presence of some bank characteristics determines in a greater extent the occurrence of a bailout, namely: larger size and higher systemic risk (Bayazitova & Shivdasani, 2012; Mitrică et al., 2010), low capital ratios (Li, 2013), higher asset quality (Taliaferro, 2009; Bayazitova & Shivdasani, 2012; Li, 2013), increased liquidity needs (Ng et al., 2015), lower exposure to real estate loans (Taliaferro, 2009), more politically connected banks (Duchin & Sosyura, 2012) or a lending activity more exposed to areas with higher unemployment rates (Li, 2013).

Davila and Walther (2020) explored if the share of large banks in the banking system play a role in the overall level of leverage in the system, which further influences the possibility of a bank bailout if needed. They showed that a more significant presence of large banks increase leverage in the system, for all banks irrespective of their size, making bank bailouts more likely.

Kolliopoulos (2020) analyzes the factors contributing to the bank rescue package design, through a study on the three Greek bank bailouts which have occurred after the financial crisis. The main findings point out that a banking system's institutional features do matter in the decision making process of a bailout, especially in terms of systemic banks and of interbank relationships.

A singular study which includes gender diversity among the determinants of bank bailouts belongs to Cardillo et al. (2020), and has been performed for a sample of listed EU banks. Their findings validated the assumption that gender diversity at the level of banks' boards significantly impacts on the probability and size of public bailouts. More specifically, banks with more gender-diverse boards were less likely to witness a public bailout and use to receive a lower amount of bailout funds as a percentage of total assets. The explanation resides in the fact that female directors are likely to exert stronger monitoring of the banking business and are also more risk averse than their male counterparts.

A complementary research is the one conducted by Gietl and Kassner (2020), which have empirically uncovered that managerial overconfidence contributes significantly to a behavior of excessive risk-taking in the banking industry. Overconfident managers are usually associated with banks benefiting from large government guarantees, low bonus taxes, and lax capital requirements.

Another approach has been followed by Jenkner and Lu (2014), which argue that the initial fiscal position of the state budget and the relative size of the financial obligations taken on by public authorities may determine financial markets' reaction to a bailout program and hence bailout's effectiveness.

The third strand of literature is related to uncovering the specific profile of banks that should receive state aids. Thus, Roman et al. (2016) identified the characteristics of the banks benefiting from the rescue programs in such a way as to contribute effectively to reducing the systemic risk, respectively: big, strong, and healthy banks, rather than weak and problematic banks. Supporting healthy banks, rather than weak banks, are a direction for improving systemic stability more efficiently, as is the idea advocated by Choi (2014).

During 2008–2013, at the European level, 114 banks had received government support in the form of emergency programs. Gerhardt and Vander Vennet (2017) investigated the financial status of these banks before and after they benefited from the bailout. The results of the study indicate that for the selection of the beneficiary banks for the bailout programs, a series of indicators were taken into consideration, of which the equity ratio, the weight of non-performing loans, and the size of the banks were decisive. Another idea advocated by the authors is that banks do not improve their performance in the period immediately following the government support and maintained their risk profile.

Another newly emerged strand of literature is represented by the paper of Bustos-Contell et al. (2020), which have configured a model for predicting the likelihood of bank failure in order to give time for a potential bank bailout strategy. The sample of banks included both savings banks and commercial banks from the Spanish banking system. The findings have indicated that both higher bank leverage and higher staff costs increase the probability of bank survival, whereas the risk-weighted assets acts as a reliable predictor of bank failure.

By relying on the previous discussion, the following hypotheses were formulated and tested in this paper:

H1. The drivers of bailout implementation are complex, gathering economic, financial, and institutional determinant factors.

H2. The adoption of a bailout program triggers large-scale effects, which exceed the banking or financial system scope.

2. Research design

The cornerstone of the present analysis is to identify bailouts' driving forces and to assess the effectiveness of bank bailout programs using the Propensity Score Matching approach, which relies on binary models such as LOGIT regression. More to the point, the empirical approach aims at investigating whether countries ("treated") that were subject to bailout programs ("the treatment") experienced more rapid growth or improvement of a series of economic, financial and institutional indicators than countries that did not ("untreated"). It includes three steps.

Step 1: Bailouts determinants.
The first step of the analysis is to identify which covariates are likely to exhibit a powerful influence over a country's decision to adopt a bank bailout program. In line with the first

hypothesis (H1) it is employed a LOGIT model which examines the relationship between a categorical variable, i.e., the bailout dummy and a set of independent variables denoted $X_{i,t}$ gathering economic, financial and institutional determinant factors in country i in the year t:

$$Y_{i,t} = \log it(P) = \ln\left(\frac{p_{i,t}}{1 - p_{i,t}}\right) = \beta_0 + \beta_i X_{i,t}. \tag{1}$$

In Eq. (1), p reflects the odds for a country i to implement a bailout program in year t. Analogous, $1-p$ corresponds to the odds of not adopting such a program. Consequently, a logarithm transformation of $\frac{p}{(1-p)}$, denoted the Odds Ratio, is measuring the relationship between the bailout dummy and the series of covariates $X_{i,t} = \left(X_{i_1,t}, X_{i_2,t}, \ldots, X_{i_n,t}\right)$. To assess robustness, it will be used a generalized boosted modeling (GBM) approach, which is capable of classifying each variable according to its relative influence on bailout decision.

Step 2: Propensity scores estimation and matching.

The second step is strongly connected to the estimation results from Step 1 since propensity scores are the fitted values from Eq. (1). Reliance on LOGIT regression is due to its superiority against other parametric and non-parametric methods that register major disadvantages such as complex algorithms, problems with subsequent interpretations (Littnerova et al., 2013). More to the point, after estimating Eq. (1) the propensity scores are given by:

$$\hat{p}_{i,t} = \frac{e^{\hat{\beta}_0 + \hat{\beta}_1 X_{i1} + \hat{\beta}_2 X_{i2} + \ldots + \hat{\beta}_n X_{in}}}{1 + e^{\hat{\beta}_0 + \hat{\beta}_1 X_{i1} + \hat{\beta}_2 X_{i2} + \ldots + \hat{\beta}_n X_{in}}}. \tag{2}$$

In Eq. (2) the propensity scores $\hat{p}_{i,t}$ denotes the probability of bailout adoption for each country i in the year t.

Once the propensity scores are estimated, the "treated" observations can be matched with their corresponding "untreated". In this case, it is used the Nearest Neighbor Matching (NN) approach without replacement. Based on it, each individual from the "treated" is matched to one or more individuals from "untreated" group with the closest propensity score(s). The choice for the PSM framework is closely connected with the research hypotheses to be tested. In addition, this method brings several advantages, such as: the matching algorithm focuses on causality; the "treatment" estimates are robust to potential hidden/omitted variables selection bias or endogeneity (Peel, 2018). Furthermore, reliance on this method is due to its superiority against other parametric and non-parametric methods that register major disadvantages such as complex algorithms or problems with subsequent interpretations (Littnerova et al., 2013).

Step 3: The average treatment effect on the treated.

As mentioned, to assess the average effect of a "treatment", policy or intervention (in this case the effect of bailouts) on the "treated" entity (countries witnessing government bailout interventions) regarding a specific outcome variable (banking system access, banking system

efficiency, financial stress, shadow economy, income inequality and human development), it is followed Rosenbaum and Rubin (1983). According to them the average treatment effect on the treated (ATT) can be estimated as follows:

$$ATT = E\left[Z_{i,t}^1 \,|\, T_{i,t} = 1 \right] - E\left[Z_{i,t}^0 \,|\, T_{i,t} = 1 \right]. \tag{3}$$

In Eq. (3), $Z_{i,t}^1 \,|\, T_{i,t} = 1$ is the observed value of the outcome for the country i if the bailout program was active during year t while $Z_{i,t}^0 \,|\, T_{i,t} = 1$ is the same outcome that would have been observed otherwise. Usually, if the treatment had been fully randomized, the ATT could be calculated as a simple average difference in outcomes between treated and non-treated. For this reason, the problematic part of this analysis is to find a proxy for $Z_{i,t}^0 \,|\, T_{i,t} = 1$ since it cannot be quantified. However, it can be estimated Eq. (3) starting from the premise that the outcome variable is independent of the dummy variable conditional on a set of control variables (covariates) denoted in the previous section with X_{it}. In fact, PSM approach is replacing $Z_{i,t}^0 \,|\, T_{i,t} = 1$ with $Z_{i,t}^0 \,|\, T_{i,t} = 0$, which is observable, based on a score assumed to be the probability that a certain country i will be involved into a bailout program in year t. Therefore, ATT can be written as:

$$ATT = E\left[Z_{i,t}^1 \,|\, T_{i,t} = 1, X_{i,t} \right] - E\left[Z_{i,t}^0 \,|\, T_{i,t} = 0, X_{i,t} \right]. \tag{4}$$

Rosenbaum and Rubin (1983) showed that after determining the propensity scores p_{it}, the ATT can be computed as:

$$ATT = E\left[Z_{i,t}^1 \,|\, T_{i,t} = 1, p_{i,t} \right] - E\left[Y_{i,t}^0 \,|\, T_{i,t} = 0, p_{i,t} \right]. \tag{5}$$

3. The data

It is considered a balanced panel with annual data spanning from 2007 to 2015, using a sample of 22 European countries[1].

The dataset the research approach relies upon has specific analytical particularities and hence it is difficult to expand it with more recent observations. Bailouts have represented a widespread solution in the aftermath of the 2008 financial crisis, although controversial from the standpoint of effects on financial market competition, public budget, taxpayers etc.

The choice to focus on a timeframe till 2015 is justified by the fact that no other bailouts have been implemented so far. In addition, the specific methodology applied (propensity score matching) requires holding a concentrated sample of many bailout episodes in order

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[1] Similar to Gerhardt and Vander Vennet (2017), it weren't included in the analysis EU countries such as Bulgaria, Estonia, Czech Republic, Latvia, Lithuania, Romania and Slovenia where the governments did not intervene because the banking sector is mainly foreign-owned. The states and de bailout years are as follow: Austria (2008, 2009), Belgium (2009), Cyprus (2009, 2013), Denmark (2009), France (2008, 2012), Germany (2007–2009), Greece (2009, 2011), Hungary (2009), Ireland (2008, 2010), Italy (2009), Netherlands (2008, 2009), Norway (2009), Portugal (2008, 2009, 2012, 2013), Slovakia (2009), Spain (2009–2012), Sweden (2008, 2009), Switzerland (2008), and UK (2007–2009). Finland, Luxembourg Malta, and Poland were included for two reasons: i) they applied for a bailout but have never received state aids; ii) to expand the control group. In this way, it was constructed the dummy variable from Eq. (1).

to perform the matching algorithm and assess bailout impact in the next year and second year. Another argument for this choice relies on the previous economic literature; although scarce, this literature relies too on a timeframe closely gravitating around the bailout occurrence (see Gerhardt & Vander Vennet, 2017).

Table 1 presents a detailed description regarding the explanatory variables of bailout programs and the output variables considered for the PSM treatment estimation approach. As regards candidate variables' selection process, the indicators considered in this study are based on the conceptual-theoretical considerations developed by practitioners and economic literature, but also on the results obtained by previous studies that explored the determinants of bailout interventions. It was considered 3 categories of candidate variables that may have impacted the decision to adopt a bank bailout: macroeconomic variables, financial system-specific indicators, and institutional factors. As for the candidate variables susceptible to be influenced by a bank bailout program, it has been tested solvency and financial indicators of the banking system, banking competition indicators and also other socio-economic indicators.

Table 1. List of candidate variables used in the study

Description and source	
Explanatory variables of the bailout program ()	
GDP Growth	Annual percentage growth rate of GDP at market prices based on constant local currency. *Source: World Bank Indicators Database*
Economic Freedom	The Overall index of economic freedom has ten components grouped into four broad categories: Rule of Law; Limited Government; Regulatory Efficiency and Open Markets. The overall economic freedom is scored on a scale of 0 to 100, where 100 represent the maximum freedom. Source: *The Heritage Foundation*
Total Banking Assets	Total assets held by deposit money banks as a share of GDP. Assets include claims on domestic real nonfinancial sector which includes central, state and local governments, nonfinancial public enterprises and private sector. Deposit money banks comprise commercial banks and other financial institutions that accept transferable deposits, such as demand deposits. *Source: The International Monetary Fund*
Credits to Deposit Ratio	The financial resources provided to the private sector by domestic money banks as a share of total deposits. Domestic money banks comprise commercial banks and other financial institutions that accept transferable deposits, such as demand deposits. Total deposits include demand, time and saving deposits in deposit money banks. *Source: The International Monetary Fund*
Liquid Assets to Deposits and Short Term Funding	The ratio of the value of liquid assets (easily converted to cash) to short-term funding plus total deposits. Liquid assets include cash and due from banks, trading securities and at fair value through income, loans and advances to banks, reverse repos and cash collaterals. Deposits and short term funding includes total customer deposits (current, savings and term) and short term borrowing (money market instruments, CDs and other deposits). *Source: Bankscope*
Inflation	The annual percentage change in the cost to the average consumer of acquiring a basket of goods and services that may be fixed or changed at specified intervals, such as yearly. *Source: World Bank Indicators Database*
Unemployment	The share of the labor force that is without work but available for and seeking employment. *Source: World Bank Indicators Database*

Description and source	
Foreign Direct Investment, percent of GDP	The net inflows of investment to acquire a lasting management interest (10 percent or more of voting stock) in an enterprise operating in an economy other than that of the investor. It is the sum of equity capital, reinvestment of earnings, other long-term capital, and short-term capital as shown in the balance of payments. *Source: World Bank Indicators Database*
Current account balance as percent of GDP	The sum of net exports of goods and services, net primary income, and net secondary income. *Source: World Bank Indicators Database*
Government spending as percent of GDP	General government final consumption expenditure (formerly general government consumption) includes all government current expenditures for purchases of goods and services (including compensation of employees). It also includes most expenditure on national defense and security, but excludes government military expenditures that are part of government capital formation. *Source: World Bank Indicators Database*
EURO Area dummy	Dummy variable equal to 1 if EUR is the national currency and 0 otherwise.
Output variables ()	
Solvency indicator	Indicates bank's capital adequacy for withstanding unexpected shocks. *Source: AMECO*
Financial stress index	Measures the financial system's current stress level on three financial market segments: equity markets, bond markets and foreign exchange markets. *Source: European Central Bank*
ATMs	Number of ATMs per 100,000 adults. *Source: World Bank Indicators Database*
Bank concentration	Percent of bank assets held by top three banks. *Source: World Bank Indicators Database*
Bank branches	Number of commercial bank branches per 100,000 adults. *Source: World Bank Indicators Database*
Return on Assets	Commercial banks' pre-tax income to yearly averaged total assets. *Source: Bankscope*
Return on Equity	Commercial banks' pre-tax income to yearly averaged equity. *Source: Bankscope*
Cost to Income	Operating expenses of a bank as a share of the sum of net-interest revenue and other operating income. *Source: Bankscope*
Shadow Economy	Represents business activity hidden from public authorities in order to avoid paying taxes, fees, and social contributions. *Source: Medina and Schneider (2018)*
GINI Index	Gini index measures the extent to which the distribution of income (or, in some cases, consumption expenditure) among individuals or households within an economy deviates from a perfectly equal distribution. *Source: World Bank Indicators Database*
Political Stability	The index of Political Stability and Absence of Violence/Terrorism measures perceptions of the likelihood that the government will be destabilized or overthrown by unconstitutional or violent means, including politically-motivated violence and terrorism. *Source: World Bank Indicators Database*
Human Development Index	Represents a statistical variable devoted to measure a country's overall achievement in its social and economic dimensions. *Source: Human development reports (http://hdr.undp.org/en/data)*

4. Results

4.1. The bailout determinants

As mentioned in Section 2, in the first step of the analysis it is estimated the impact coefficients exerted by different economic, financial, and institutional factors on bank bailout decisions using a LOGIT representation. To assess the robustness of results[2] it were tested six model specifications:

– Model 1: Economic Growth;
– Model 2: Model 1 + Economic Freedom;
– Model 3: Model 2 + Banking stability and system depth;
– Model 4: Model 3 + Labor market and international trade;
– Model 5: Model 4 + Government spending;
– Model 6: Model 5 + EURO Area dummy.

According to the results reported in Table 2[3], GDP growth is significantly and negatively associated with the probability of a country adopting a bank bailout program in all specifications. Thus, the lower the rate of economic growth, the higher the likelihood for banks to be in distress and consequently for the implementation of a bailout program. These findings are confirmed by Grossman and Woll (2014), who conclude that bailout strategies implemented in Europe and the US are dependent on economic pressures, among others. Ijaz et al. (2020) claim the importance of having a resilient banking system, from the standpoint of stability and competition indicators, during times of economic recession. Otherwise, the financial system distress will overlap on the economic distress and will put enhanced pressure on decision-makers. In addition, in countries facing an increased level of the shadow economy, the public trust in the EU authorities may be severely hampered (Remeikienė et al., 2018).

Table 2. LOGIT model results

Variables	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
GDP Growth	−0.4664***	−0.4869***	−0.5306***	−0.5510***	−0.5737***	−0.5837***
Economic Freedom		0.0575*	0.1172**	0.1281***	0.1259**	0.1448***
Total Banking Assets			0.4168**	0.4448**	0.4490**	0.4620**
Credits to Deposit Ratio			−0.0007	0.0008	0.0017	0.0021

[2] Given the relatively small size of the sample, the propensity score's estimations urge for additional robustness. For this reason, the paper estimates three more specification, which are highlighted in the Appendix. In model A it is estimated Model 6 without Greece, Portugal, Ireland, Spain and Cyprus, which were forced to seek help from other nations. In model B, it is estimated the Model 6 without Finland, Luxembourg Malta, and Poland, which applied for a bailout but have never received state aids. Finally in Model C it is included among the covariates the public debt to GDP and non-performing loans. Regardless of the specification, the statistically significant coefficients summarized in Table 2 do not change remarkably.

[3] It was checked the correlation among the covariates before running the regressions. The results have revealed that there is no correlation higher that 50% in absolute values, indicating that the covariates are at most moderate correlated.

End of Table 2

Variables	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Liquid Assets to Deposits			–0.0363**	–0.0391**	–0.0367*	–0.0360*
Inflation Rate				0.1288	0.1413	0.1827
Unemployment				–0.0442	–0.0486	–0.0626
Foreign Direct Investment (%) GDP				–0.0143	–0.0124	–0.0152
Current account balance (%GDP)				–0.0486	–0.0521	–0.0424
Government Spending (%GDP)					–0.0725	–0.0822
EURO Area dummy						0.7753
Pseudo-R^2	0.1945	0.2038	0.2759	0.2906	0.2942	0.3043
GINI Index	0.7030	0.7284	0.7591	0.7804	0.7880	0.8052
Observation	154	154	154	154	154	154

Note: Statistical significance at the 1, 5 and 10 confidence levels is indicated using ***, ** and *.

Economic freedom is significantly and positively associated with the probability of a country adopting a bailout program. This result may indicate that countries experiencing an excellent regulatory efficiency and compliance (regulations are understood and applied by market participants) are more prone to bank bailout programs if decision-makers and financial supervisory authorities identify this need. Among the reasons explaining this result may be the lower moral hazard and political costs associated with a bailout program as a result of increased transparency, efficient supervision, and high compliance rates. A study which reinforces paper's finding belongs to Baier et al. (2012), which examined the relationship between banking crises and economic freedom and uncovered that higher economic freedom is associated with a lower probability of a banking crisis. Thus, a bailout program represents an extraordinary event which may require Government intervention to reinstitute the regular operation of the banking system, without creating too much moral hazard.

The higher the banking system assets size is, the greater the likelihood of a country adopting a bailout program. This result is intuitive and fully confirmed by the practice, as many banks were bailed out because they were deemed "too-big-to-fail" by national regulators. Large banks are more likely to be rescued with public funds because of their significant role in a country's economic performance and because of interconnections with other banks (Fernandes et al., 2016). The failure of a large bank may trigger an interbank contagion or spillover effects for other financial institutions and, therefore, a systemic risk. Stern and Feldman (2004) warned that due to the moral hazard problem created by bailout programs, banks tend to increase their size boosting their chances to be saved in cases of financial crises or simple insolvency events. Another finding indicates that the lower the liquid assets to

deposits ratio, the higher the probability of a bailout. Impairment of banks' liquidity position may trigger bailout measures, as financial regulatory and supervisory authorities may want to prevent banks' temporary illiquidity turning into banks' insolvency.

Findings revealed no statistically significant evidence indicating a potential link between loans to deposit ratio, inflation, unemployment, foreign direct investments, current account balance, government spending, a country's membership to euro area (the EURO adoption) and the probability of bank bailout.

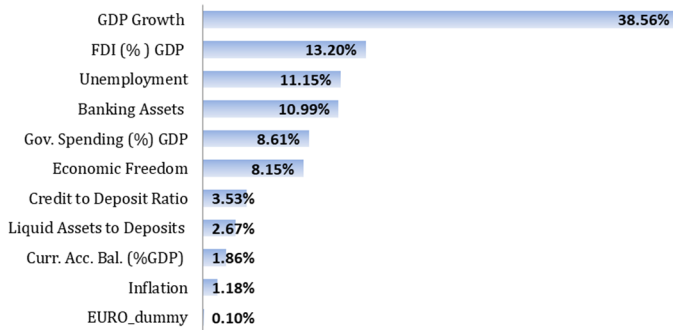|	
GDP Growth	38.56%
FDI (%) GDP	13.20%
Unemployment	11.15%
Banking Assets	10.99%
Gov. Spending (%) GDP	8.61%
Economic Freedom	8.15%
Credit to Deposit Ratio	3.53%
Liquid Assets to Deposits	2.67%
Curr. Acc. Bal. (%GDP)	1.86%
Inflation	1.18%
EURO_dummy	0.10%

Figure 1. Relative influence over bailout decision

According to Louviere et al. (2000), a pseudo-R-squared of 0.2 is equivalent to an adjusted R-squared of 0.7 in a linear model. For this reason, all six models are showing a good discrimination power among bailout and non-bailout situations generated by the explanatory variables. This conclusion is confirmed by the Gini index which measures how well the model is performing compared to random bailout adoption. A Gini equal to 0% shows a LOGIT regression which is no better than random adoption or, in other words, has no prediction power. On the other hand, a Gini value equal to 100% will indicate a perfect prediction regarding the bailout decision conditioning on the set of covariates.

To assess robustness of results, it was employed a machine learning method (GBM) to estimate the relative influence of each of the covariates over a country's decision to adopt a bank bailout program. GBM relies on the regression tree mechanism, and it starts by dividing the sample across values of the explanatory variables that best predict the bailout decision among all covariates. Furthermore, the algorithm implements new splits by identifying the best predictor out of the remaining covariates, leading to a standard regression tree. Given the dimension of the dataset, it was used 500 trees to generate a smoothed function for the relative influence estimation. Additional details can be explored in Friedman (2001). The results presented in Figure 1 partially confirm the empirical findings reported in Table 1. More to the point, GDP growth exhibit the most significant influence over a country's decision to adopt a bank bailout program regardless of the methodology used. This empirical fact is a logical result since the bailout necessity appears, especially during economic recessions. Furthermore, the GBM approach confirms the Economic Freedom and Total Banking Assets among the key drivers of the bailout programs; still, it fails to report a significant influence generated by Liquid Assets to Deposits Ratio. FDI, Unemployment, or Government exerts

stronger influences over the bailout adoption according to GBN compared to the LOGIT model. Similar to LOGIT specification loans to deposit ratio, inflation, the current account balance, or a country's membership to euro area (the EURO adoption) have a small impact on the probability of bank bailout.

4.2. Propensity scores estimation

The computation of the propensity scores based on the LOGIT specifications is outlined in the previous section. Even though the pseudo-R-squared in Model 6 is significantly larger compared to Model 1, the correlation among the propensity scores is very high. This empirical approach assesses the robustness of the propensity scores estimation and supports the choosing of Model 6 as the baseline specification for ATT estimation. Additional details regarding the propensity scores distribution and correlation are in Figure 2.
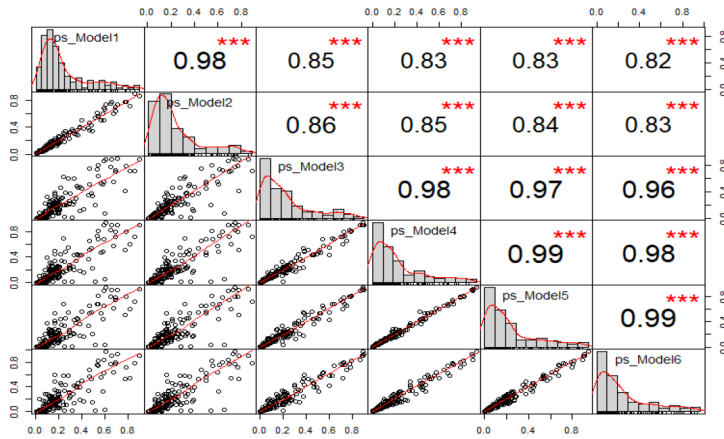

Figure 2. Propensity scores correlation matrix

4.3. ATT results

Once estimated the propensity scores, it is calculated the average treatment effect on the treated by using a series of matching methods. Specifically, it is applied the nearest-neighbor (NN) approach, which matches each treated unit to the n control units possessing the closest propensity score (it was considered n = 1, n = 2 and n = 3). However, NN algorithm exhibits the risk of bad matches if the nearest neighbor is not close enough. This limitation was overcome by setting a tolerance level on the highest score distance denoted caliper equal to one standard deviation of propensity scores distribution. The results on ATT are summarized in Table 3.

The results reported in Table 3 provide several important insights on the effects of government bailout interventions. First, there is no statistically significant relationship between bailout programs and improvement in the banks' solvency indicators or financial performance, as measured by the return on equity, return on assets and cost to income ratios.

Table 3. ATT's estimation results based on propensity scores generated by Model 6

Impact of bailout during	Matching Method	Solvency Indicator	Financial Stress Index	ATM's (100 000 adults)	Bank concentration
Current Year	1-NN	−1.0009	0.0682**	12.7850	−1.8070
	2-NN	−0.8489	0.0992***	16.124**	−1.0820
	3-NN	−0.8974	0.0989***	22.088***	0.4857
Next Year	1-NN	−1.0130	0.0757**	11.208	−3.0190
	2-NN	−0.6617	0.0805***	14.423**	−2.0690
	3-NN	−0.8979	0.0735***	20.602***	−0.2965
Next Two Years	1-NN	−1.4478	0.0364	8.421	−1.3550
	2-NN	−1.2666	0.0357	12.515	−0.6174
	3-NN	−1.3701	0.0296	18.816**	0.9769
Impact of bailout during	Matching Method	Bank branches (100 000 adults)	Return on Assets	Return on Equity	Cost to Income ratio
Current Year	1-NN	1.5130	−0.2942	−3.1350	−1.6830
	2-NN	5.1820	−0.5275*	−7.0760*	−0.5468
	3-NN	5.0990	−0.7387***	−10.0430***	−0.0243
Next Year	1-NN	1.5980	0.1025	−1.6370	−2.3450
	2-NN	4.7720	−0.2589	−5.6910	0.5069
	3-NN	4.6090	−0.3315	−5.8600	1.2660
Next Two Years	1-NN	1.0360	−0.5861	−4.2436	−0.2267
	2-NN	4.0580	−0.6774**	−5.4250	1.7340
	3-NN	3.6780	−0.8451**	−7.8560*	2.5350
Impact of bailout during	Matching Method	Shadow Economy	Income Inequality	Political Stability	Human development
Current Year	1-NN	0.7467	0.6556*	−0.1800**	−0.0176**
	2-NN	1.0126	1.1472*	−0.2024**	−0.0137**
	3-NN	0.5008	1.3463**	−0.2321**	−0.0078*
Next Year	1-NN	0.7467	0.5222	−0.1472**	−0.0166**
	2-NN	1.0126	1.0222	−0.1926**	−0.0137**
	3-NN	0.5008	1.2580**	−0.2169***	−0.0077*
Next Two Years	1-NN	0.3633	0.3750	−0.1072	−0.0163**
	2-NN	0.6542	0.4111	−0.1360	−0.0126*
	3-NN	0.0426	0.8556	−0.1652**	−0.0070*

Note: Statistical significance at the 1, 5 and 10 confidence levels is indicated using ***, ** and *. Robust estimates are in bold type.

These results are in line with those obtained by Gerhardt and Vander Vennet (2017) and Hryck-iewicz (2014). Second, a statistically significant relationship between bailout programs and bank competition, as measured by the number of ATMs, bank branches and the degree of concentra-tion, was also not observed. Third, there is no evidence supporting an impact of a bank bailout program on the shadow economy which may increase during a banking crisis, as pointed by Colombo et al. (2016). Fourth, it is found robust evidence indicating that bailout programs are amplifying financial stress during the implementation year and the year after. That is consistent with an increase in sovereign risk associated to large bailout programs, as pointed by Fratzscher and Rieth (2019). Thus, the large impact of bailout programs on public debt and consequently on the risk premia, in the context of already high levels of public debt pre-bailout, may have amplified financial stress. Fifth, it is also found robust evidence indicating that bailout programs lead to deteriorating political and social conditions. Thus, the adoption of a bailout program is found to lead to increased income inequality during the adoption year, decreased political stability during the implementation year and the year after and a persistent deterioration in the human development index lasting 2 years after the adoption year. These results could be linked with the salvation of large uninsured creditors limiting the losses of rich individuals, while transferring the risk to taxpayers, with the political costs associated to banks' bailouts and with the budgetary outlays of bailout programs which impeded the ability of Governments to improve social and economic conditions.

Conclusions

This paper has investigated the economic, financial, and institutional factors driving the deci-sion to adopt a bank bailout program. Also, it has assessed the impact of such a Government intervention on a broad array of banking sector, economic, political, and social indicators, based on a balanced panel with annual data covering the 2007–2015 period, using a sample of 22 European countries. First, it had been identified economic growth, economic freedom, total banking assets, and liquid assets to deposits and short-term funding ratio as the main drivers for the decision to adopt a bank bailout program. Second, the estimates suggest that the adoption of a bank bailout program has not led to an improvement in the banks' sol-vency indicators or financial performance, as measured by the return on equity, return on assets, and cost to income ratios. Also, the analysis showed that launching a bailout has no impact on the level of competition in the banking system or across the shadow economy. On the contrary, it was found robust evidence indicating that bailout programs are amplifying financial stress and income inequality, hampering political stability, and social and economic conditions. Summarizing, the adoption of a bank bailout program carries out substantial economic, social, and political costs.

Considering the determinants of bank bailouts identified in this paper and also their as-sociated costs, several recommendations for policymakers come to light. Thus, by promoting sound and counter-cyclical monetary and fiscal policies, enhancing regulatory efficiency and compliance, imposing adequate liquidity indicators for banks, promoting bank competition, alongside close monitoring of large banks, the probability of adoption of a bank bailout program will be lower.

Although several solid reasons are pointing in favor of bailing out banks, most of them focusing on the adverse economic and social effects of the alternative of not pursuing such a path, policymakers should carefully consider the costs implied by such a decision. Moreover, they should consider putting in place mechanisms for alleviating the negative impact. Thus, a fairer distribution of the direct financial implications associated with bank bailouts while protecting the economic agents which are the most affected by the redistribution of public resources needed to sustain such programs could diminish the social and political costs of bank bailouts.

The main limitation of all the empirical or qualitative analyses related to the topic of bank bailouts resides in addressing various episodes of bank bailouts which occurred in the last decade, as a direct result of the global financial crisis. Therefore, access to data is quite scarce and the analyses are mostly conducted at country-level, lacking cross-country comparative features.

On the background of a revival of the public interest on bailouts, as a consequence of the pandemic turmoil that simultaneously affects the global economy some issues need to be further investigated. Future research should address the interplay between bank bailout strategies and the stance of monetary policy, but also the prospects of the increased sovereign – bank nexus. The effects of the new wave of bailouts envisaged by the International Monetary Fund, that are going to occur to restore the financial sector and economy's functioning, have to be further investigated due to the unprecedented scale and spread of the pandemic.

Also, additional research on this topic may assess the efficiency of this traditional rescuing tool, which involves government's direct support, against the newest resolution tools used by the resolution authorities in order to solve the situation of banks in difficulty.

Author contributions

Teodora-Cristina Barbu conceived the study and was responsible for the introduction, data collection, the literature review, and the discussion of results. Iustina-Alina Boitan was responsible for the introduction, the literature review, data collection, and the presentation of results. Cosmin Octavian Cepoi conceived the research design and statistical analysis. Bogdan Andrei Dumitrescu was responsible for the introduction, data collection, the discussion of results, and the conclusions.

Disclosure statement

The authors declare no conflict of interest.

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APPENDIX

Variables	Model A	Model B	Model C
GDP Growth	−0.5694***	−0.5108***	−0.5711***
Economic Freedom	0.1767**	0.1275**	0.1123*
Total BankingAssets	0.8492***	0.3120*	0.4655**
Credits toDeposit Ratio	0.0026	0.0014	0.0029
Liquid Assets to Deposits	−0.0448**	−0.0152	−0.0296
Inflation Rate	0.4479	0.1050	0.1116
Unemployment	−0.0321	−0.0530	−0.0201
Foreign Direct Investment (%) GDP	−0.0151	−0.0183	−0.0347
Current account balance (% GDP)	−0.0151	−0.0411	−0.0634
Government Spending (% GDP)	−0.0816	−0.0474	−0.0251
EURO Area dummy	1.0792	1.0491	1.2833*
Public debt (% GDP)	−0.5694	−0.5108	−0.0167
Non-performing loans	0.1767	0.1275	−0.0415
Pseudo-R^2	0.3390	0.2806	0.3467
Observation	119	127	154