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Does the real estate market behavior predict the trust crisis in the financial sector? The case of the ECB and the Euro

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Keywords: trust crisis; financial sector; real estate market; behavioral approach; real house price index

Abstract

Research background: Based on the history of financial crises, real estate market behavior could be thought of as a key benchmark of trust shifts in the financial sector of the economy. Plunging real estate asset prices accompanied by the financial "bubbles" explosion could be viewed as the harbinger — even the cause — of the public trust crash in the financial sector.

Purpose of the article: This study intends to assess the extent to which the real estate market behavior determinants, along with financial sector consumers' feelings, are able to predict trust

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crises in the financial sector, namely to its primary institutions — European Central Bank and the Euro.

Methods: In order to estimate the probability of a trust crisis in the financial sector, two logistic regression logit models were developed based on two types of dependent variables as they reflect trust violations in the financial system primary institutions — net trust in European Central Bank (Model I) and net support for the Euro (Model II). The research was conducted on quarterly panel data of the EU countries from the euro area covering the period from 2000 to 2019. Logit regressions employed for data processing and analysis were performed in the computational system STATISTICA.

Findings & value added: The logit-modeling results show that determinants of irrational real estate buyers' behavior are powerless in predicting the escalation of the trust crisis in the Euro. However, binary models of real estate market behavior could be successfully used to predict the probability of the trust crisis in the European Central Bank. The results show that real house price indices, price to income ratio, price to rent ratio, and rent prices accompanied by the financial sector consumers' feelings are statistically significant, providing the best distribution between the normal times and periods of trust crisis in the European Central Bank. Irrational real estate market behavior may indicate serious problems in the trust violations in the European Central Bank, and it should be a signal for policymakers to take actions towards more efficient financial and real estate market regulation following the behavioral approach.

Introduction

Macroeconomic stability and development have long been a question of great interest in a wide range of fields over the years and do not diminish its relevance (Vasilyeva *et al.*, 2019; Bilan *et al.*, 2020, Zolkover & Renkas, 2020). The debate about the root causes of national economies destabilization has raged unabated for over a century. Some studies have been focused primarily on the role of corporate governance and corporate social responsibility (Taliento & Netti, 2020); while others have been directed towards assessing the risks associated with economic deformations (Djalilov *et al.*, 2015; Yarovenko *et al.*, 2021). The investment (Bilan *et al.*, 2019b) and insurance markets (Kozmenko *et al.*, 2009) were a matter of close attention, while the real estate market (Sanchez, 2020) began to be studied in connection with the unprecedented boom and busts in housing prices over the past decade.

The real estate price boom-busts and the severity of financial turmoil that followed it highlight the importance of real estate market behavior as a critical factor affecting the acceleration trust crisis in the financial sector. This study is not intended to identify what drives the housing market, especially property price levels — investors' overconfidence or sentiments; however, one of the objectives is to determine how information about real estate market behavior can be used for cumulative predicting trust crisis in the financial sector.

Throughout the history of the financial crises, if the real estate market is weakened, the financial sector deals with financial distress, which can develop into a trust crisis, and thus the collapse of the financial sector is imminent. The main instrument that regulators can use to discern signs of impending trust crisis in the financial sector is the analysis of the real estate market behavior based on information about housing and rent prices and other related relative indicators. This study deals with predicting the trust crisis in the financial sector, which is heavily connected with real estate market irrationality reflected in house price boom-busts.

In boom times, optimistic expectations of households about financial gains turned into reality, since the level of return on investments (ROI) in real estate became higher than the bank interest rate. Bearing this fact in mind, the real estate market behavior is getting irrational, considering that the significant increase in prices for real assets followed by increased mortgage lending (sometimes unaffordable) is determined solely by expectations. In times when real estate prices do not have a single economic reason or objective basis to increase, an explosion occurs. Mounting plunge real estate asset prices eventually lead to financial flows being reversed (the explosion of the financial "bubbles"), which puts pressure on banks and produces liquidity problems and tightening monetary conditions that are often accompanied by difficulties in the financial sector. Financial woes are affecting not only the economic development, but also the households' feelings concerning suffered heavy financial losses owing to a significant downturn in housing prices and a substantial rise in interest rates on mortgage loans. Pessimism, anxiety, psychological and cognitive biases have been the spur to crunch that has spread from the real estate market to other sectors of the economy and then led to another social-psychological phenomenon as a trust crisis in the financial sector.

Despite a growing body of research exploring the driving forces for trust (Calderón *et al.*, 2002; Roth, 2009; Ennew *et al.*, 2011; Savchenko *et al.*, 2017; Van der Crujisen *et al.*, 2019; Zandi *et al.*, 2020; Sági *et al.*, 2020; Khadidja, 2020), confidence (Owens, 2012; Gower *et al.*, 2019; Abunyuwah, 2020), sentiment (Dow, 2011; Uygur & Taş, 2014; Yacob *et al.*, 2020) in the financial sector, surprisingly, little attention has been directed to the real estate market behavior that might warn of an impending trust crisis in the financial sector. Therefore, this study is intended to fill the gap in the literature by incorporating the real estate market behavior along with financial sector consumers' feelings to predict trust crises in the financial sector. This study will help the regulators to understand the importance of factors describing the real estate market behavior in predicting trust crises in the financial sector. For the first time, the present research explores the

relationship between real estate market behavior and trust crisis in the financial sector and is a continuation of research started by authors previously.

The bulk of the literature on crises prediction was in agreement that a multivariate discriminant model is a well-established approach. However, a great deal of research conducted in developed countries has demonstrated inadequacies of the multivariate discriminant model. Furthermore, it has also suggested that binary and multinomial choice models provide more accurate results. In this study, logit regression models were conducted based on two types of dependent variables along with two types of datasets (narrow and extended). The selection of the trust crisis indicators is based on variables that clearly depict the trust crisis in the financial sector as they reflect trust violations in the financial system primary institutions — net trust in European Central Bank (Model I) and net support for the Euro (Model II). In both models real estate market behavior (narrow) was incorporated along with financial sector consumers' feelings (extended) to predict the trust crisis in the European Central Bank and the Euro. The proposed prediction models of the trust crisis in the financial sector were developed using quarterly data set of the Eurozone covering the period from 2000 to 2019. The data were collected from the European Commission's Eurobarometer surveys, Organisation for Economic Cooperation and Development dataset, and Eurostat to carry out analysis in line with the most current dataset. The overall performance, probability of the observed results, the goodness of fit, and accuracy diagnostics of the constructed logit models have been assessed by log-likelihood (-2LL) estimate, p-value criterion, classification accuracy matrixes, more specific misclassification rates (Type I Error and Type II Error), and Receiver Operating Characteristic (ROC) curves.

The overall structure of this study consists of five sections. The paper begins with the findings of an extensive review of the literature. The next section elaborates on the data description, measurement of different variables, research model, and methodology to predict the trust crisis in the financial sector. This is followed by empirical findings for all predicting models with narrow and extended data, accuracy classification, and study results discussion. The final section is devoted to the conclusion, empirical implications, and future research directions.

Literature review

The boom and busts in the real house prices that had anterior to most of the financial crisis taking place over the last decades have provided scope for behavioral science to explain real estate market behavior. This is exemplified in the studies undertaken by Soy Temür *et al.* (2019), Hott (2012) and Shiller (2005), in which deviation of house prices from their fundamental values was explained by herding behavior; Kivedal (2013) and Shiller (2006) in which "irrational bubbles" or also referred to irrational investors were viewed as psychological factors driving the real estate price; Hwang *et al.* (2020) and Shiller (2006) in which imperfect public information was served as a cause of the prediction failure in real estate prices. Some academics favor the optimism or pessimism concept (investors sentiments or personal feels), for example, Lam and Hui (2018), Gerardi *et al.* (2010), Koklic and Vida (2009), among others, while others (Hwang *et al.*, 2020; Bao & Li, 2016; Gallimore & Gray, 2002) focusing on overconfidence (investor expectations) to predict future real estate returns and to discover potential house price bubbles.

A considerable amount of literature has been published on financial behavior (Njegovanović, 2018, 2020; Gavurova *et al.*, 2019; Hadbaa, 2019; Dewi *et al.*, 2020; Hartanto *et al.*, 2020; Bukalska, 2020). A number of cross-sectional studies suggest that various cognitive limitations and psychological bias change household decision-making in general (Bacik *et al.*, 2020; Jordão *et al.*, 2020; Minasyan *et al.*, 2020), and particularly on consumption/savings (Mody *et al.*, 2012; Ceritoğlu, 2013; Mastrogiacomo & Alessie, 2014; Nguyen *et al.*, 2019; Praditha *et al.*, 2020) and debt/savings (Nofsinger, 2012; Kośny & Piotrowska, 2013; Kłopocka, 2017) ratios in boom-busts periods. However, the study by Zwerenz (2018) also finds that the behavior of real estate prices also significantly influences the cost of capital.

One of the most significant challenges of financial behavior in the market, Hadbaa (2019) singled out investors' overconfidence. This view is supported by a quantitative study conducted by Huck *et al.* (2020), who provided a stylized model for disruptive and toxic economic behaviors according to the predatory market concept. Based on data about the subprime crisis of 2007–2009 in the US, the authors found that predatory behaviors of consumers, suppliers, regulations and toxic products during extraordinary market conditions lead to financial markets dysfunction.

Optimistic sentiments and confidence in the real estate market fuelled by economic growth times lead to increased mortgage loans. Thus, credit expansion (credit "boom") indicates growing trust in the financial system.

The choice of real estate financing through a centralized financial system shows that there is a low probability of a trust crisis.

Up to now, there are only a few research studies that establish a causal relationship between the trust crisis in the financial sector and real estate market irrationality. Theoretical studies conducted by Edelstein and Edelstein (2020) and Brzezicka *et al.* (2014), based on historical economic-financial frenzies, panics, and crises, demonstrated that the real estate market behavior was a trigger event that created the trust crisis. The authors proved that the real estate price bubble could not exist if its emergence were not accompanied by behavioral aspects (limited rationalism) of the real estate market participants. The over-optimism of investors has caused the erroneous actions of entities contributing to the destruction of their trust and the deep financial sector crisis.

Detailed examination by Yap *et al.* (2000) showed that the collapse of the real estate market in Bangkok in 1997 was the cause of the large-scale and rapid disruptions to the financial sector and the economy of Thailand. Due to the availability of cheap loans and irrational demand for housing, financial institutions did not conduct thorough market research and invested in dubious projects. As a result, there was an oversaturation of the real estate market with unprofitable buildings. This situation undermined the public trust and international investors' trust in the financial sector, which led to capital outflow and a severe financial and economic crisis. A small-scale study by Bertrand (2010) reached the same conclusions, finding irrational behavior of investors and financial companies — over-optimism and over-investment — in the real estate market had led to the 1997 Asia Financial Crisis. Bertrand (2010) argues for improvements in the real estate market infrastructure needed to lower the crisis risk.

Most researchers investigating crises prediction have used multiple regression using principal components, factor analysis, discriminant analysis, and canonical correlation (Hampton & Rayner, 1977). Using multiple discriminant analyses, researchers have been able to anticipate and prevent some financial problems (Skomp *et al.*, 1986). At present, integrating behavior aspects into the prediction of the financial crisis has attracted more and more attention; most of this research has been conducted with logit regression models (Jemović & Marinković, 2021; Demyanyka & Hasanb, 2010; Vermeulen *et al.*, 2015). All the above-reviewed studies support the hypothesis that the real estate market behavior and the trust crisis in the financial sector are connected. Still, the systematic and vector of this relationship remains unknown. By applying binary models, this study investigated whether the real estate market's irrational behavior is able to predict the trust crisis in the financial sector.

Research method

The conceptual basis of the models exploited, data considered, sample design, as well as variables selection process are outlined in this part of the study. In this research, a binary mathematical-statistical method was used to construct a trust crisis in the financial sector prediction model. Logit regressions employed for data processing and analysis were performed in the computational system STATISTICA.

Data description

The sample period for this study is from the first quarter of 2000 to the fourth quarter of 2019 for the nineteen EU countries from the Euro area, namely Belgium, Germany, Ireland, Spain, France, Italy, Luxembourg, the Netherlands, Austria, Portugal, Finland, Greece, Slovenia, Cyprus, Malta, Slovakia, Estonia, Latvia, and Lithuania. The data were collected quarterly for 19 years from the European Commission's Eurobarometer surveys, Organization for Economic Cooperation and Development dataset, and Eurostat to carry out analysis in line with the most current dataset.

As a basis for the construction trust crisis in the financial sector prediction models, the initial dataset is generated from 26 explanatory variables that have been found significant in previous studies. After eliminating the multicollinearity problem, the final set of variables is drawn from 4 (narrow) and 6 (extended model) explanatory variables in two categories. The independent (explanatory) variables include real house price indices, price to income ratio, rent prices, price to rent ratio, unemployment rate, consumer confidence index (CCI). The set of variables for models' construction, together with their labels, category, and measurements, are depicted in Table 1.

In line with previous research, for the purpose of this study, the variables selection process is based on indicators that would best reflect the real estate market behavior and those that would clearly depict the trust crisis in the financial sector. Two types of dependent variables were significant in previous behavioral literature on trust to estimate the probability of a trust crisis in the financial sector. These ratios are net trust in European Central Bank (ECB) for model I and net support for the Euro for model II in percentage points. In line with given model specifications, binary regressions were performed to identify the observation as a crisis period. In this model type, dependent variables were re-coded as binary variables that may gain only two types of values. In this study, the dependent variable is a dummy reporting the occurrence of an event (trust crisis in the financial sector or

no) expressed by value 1 in case of trust crisis or 0 — if no trust crisis occurs. The applied research methodology would help to quantify the relationship between the probability of a trust crisis in the financial sector and behavioral characteristics of the real estate market (explanatory variables).

The data for models' development about net trust in European Central Bank (ECB) and net support for the Euro were collected from the Eurobarometer surveys published by the European Commission. Figure 1 illustrates public opinion on the currency union and the European Central Bank (ECB) in twelve member-countries of the euro area covering the 2000-2019 period. Net trust both for the ECB and the Euro is calculated as the difference between the share of citizens who have expressed trust in the ECB and the Euro and those who do not have expressed it. In both cases, citizens who did not have a clear answer (provided with a "do not know" response) had been excluded from this study.

Figure 1 represents trust in the financial sector for each of the twelve member countries of the euro area.

According to the data, it could be stated that the overwhelming majority of respondents in nearly every EU country in the Euro area have expressed favor of the European currency throughout. The only exceptions to this are Finland in the pre-crisis period and Greece in the post-crisis period. Furthermore, while the fall in trust in the European currency below zero is confined to these two countries, notable shifts are occurring across the euro area, both sharp drops and climbs. From the data in Figure 1, it is apparent that the trust in the European currency at the moment is the highest in nine of the twelve-euro area country-members. The exceptions to the general observation are France, Greece, and Italy.

However, the difference between the level of European currency support and trust in the ECB, both during and after the crisis periods, is strikingly large. Thus, eight out of twelve-euro area member-countries demonstrated trust crisis in the European Central Bank in the aftermath of the financial crisis, three of which (including France, Greece, and Italy) to date have not renewed trust in the central monetary authority (net trust in the ECB is below zero). Since the founded difference is big enough, it is likely to be explained by distinguishing between efficiencies in performing standard functions of the Euro and the European Central Bank. Since the Euro perfectly performs its functions of money, including a medium of exchange, a store of value, a unit of account, acting as a source of stable purchasing power, the level of its support is significant even in the most challenging times of the financial crisis.

In the European Central Bank case, its performance is measured from the perspective of the monetary policy's ability to avoid financial crises and

respond to macroeconomic challenges, such as protracted stagnation, high unemployment, and the lack of foreseeable opportunities. And therefore, the ECB's inefficiency as a policymaker has resulted in substantial deterioration and inability to rehabilitate public trust in the institution framing and implementing monetary policy in the euro area.

Research model and methodology

The basic statistical equation for logit model regression that was previously used in scientific research in different fields of study (Vohra & Pavleen, 2015; Kovacova & Kliestik, 2017; Václav & Hampel, 2017; Waqas & Rohani, 2018; Arroyave, 2018; Dawood *et al.*, 2019; Saima, 2019; Akhter & Butt, 2019) is as follows:

$$Z_i = \beta'x_i + \mu_i, \quad (1)$$

where β' are values of coefficients estimated from the dataset by maximizing the log-likelihood function, x_i represents the value of vector of indicators that describes the real estate market behavior (independent variables), μ_i is an error term, and Z_i is the probability of the trust crisis in the financial sector.

The logit transformation via the ratio of the probability of the trust crisis in the financial sector (P_1) against the probability of non-occurrence of the trust crisis ($1 - P_1$), the probability and likelihood cumulative logistic distribution function for the non-trust crisis in the financial sector could be calculated as follows:

$$P_1 = E(Y = 2|x_i) = 1 / (1 + \exp^{-(\beta'x_i + \mu_i)}) = 1 / (1 + \exp^{-Z_i}), \quad (2)$$

The following could be rearranged as

$$P_1 = e^z / (e^z + 1), \quad (3)$$

Consistent with Kovacova and Kliestik (2017) and Hebak (2015), the logit likelihood function is given by:

$$\text{Logit}(P_1) = \ln(P_1 / (1 - P_1)) = f(x, \beta) = \beta_0 + \beta_1x_1 + \beta_2x_2 + \dots + \beta_nx_n, \quad (4)$$

In this function, \ln denotes logit transformation of the dependent variable; the probability ratio of the trust crisis in the financial sector (P_1) against the probability of no trust crisis ($1 - P_1$) represents the task estimation.

Considering that the logit model regression provides estimations that lie from 0 to 1, the observation is classified as a trust crisis in the financial sector in the case obtained predicted probability greater than 0.5, the observation is not classified as a trust crisis in the financial sector in the case obtained probability score lesser than 0.5.

Assessment of the overall performance, probability of the observed results, the goodness of fit, and accuracy diagnostics of constructed logit models had been carried out through the log-likelihood (-2LL) estimate, p-value criterion, classification accuracy matrix (overall accuracy and more specific misclassification rates) and ROC curve. In order to test the power explanation of the constructed logit regressions, -2 Log likelihood will be used. If -2 Log-likelihood statistics are relatively high, the constructed model has a high likelihood of obtaining results and so fits the real data well. A statistically significant model would be chosen based on the probability of getting the chi-square statistic. The overall constructed model would be statistically significant in case a p-value less than 0.05.

Accuracy diagnostics for comparison with other empirical models were held with the help of the classification accuracy matrix (see Table 2). Based on the accuracy matrix overall accuracy rate, Type I Error and Type II Error (specific misclassification rates) were determined.

The overall accuracy rate helps to analyse the ability of the constructed logit models to correctly classify the normal times and trust crisis in the financial sector. The following formula is used for its calculations:

$$\text{Overall accuracy rate} = \left(\frac{\text{Times correctly classified}}{\text{Total number of observations}} \right) * 100 = \left(\frac{TP + TN}{TP + FP + TN + FN} \right) * 100, \quad (6)$$

The Type I Error evaluates the number of observations representing trust crisis in the financial sector was classified as normal times. Therefore, it was calculated as the ratio of false negatives to the sum of true positives and false negatives:

$$\text{Type I Error} = \left(\frac{FN}{TP + FN} \right) * 100, \quad (7)$$

In contrast, the Type II Error evaluates the number of observations representing normal times that were classified as trust crises in the financial

sector. Thus, it was represented as the ratio of false positives to the sum of false positives and true negatives:

$$\text{Type II Error} = (\text{FP} / (\text{FP} + \text{TN})) * 100, \quad (8)$$

The discriminant ability of both logit models was presented via the Received Operation Characteristic Curve (ROC Curve). The graphical ROC curve was created based on calculated data about overall accuracy rate, Type I Error and Type II Error. The ROC curve was used to assess the diagnostic accuracy.

Results and discussion

During the research process of this study, two types of models (two types of dependent variables) with two types of datasets (narrow and extended) via logit regressions were conducted.

Logit regression results for Model I

Table 3 reports results of logit Model I (both narrow and extended datasets) in predicting trust crisis in the financial system. In Model I, the real estate market behavior (narrow Model I) was incorporated along with financial sector consumers' feelings (extended Model I) to predict the trust crisis in the European Central Bank that is responsible for carrying out monetary policy and ensuring financial system stability in the euro area.

Table 3 shows that real estate market behavior is significant in predicting the trust crisis in the financial system represented by the leading institution responsible for carrying out monetary policy and ensuring financial system stability in the euro area. Real house price shows a negative relationship with the probability of a trust crisis in the European Central Bank. This finding suggests that as real house price indices increase, the probability of the trust crisis in the European Central Bank decreases. The calculated odds ratio bolsters this conclusion. According to Table 3, the odds of having a trust crisis in the ECB is 33% (narrow data model) or 60% (extended data model) lower if the real house price indices were increased. Similar results were found in previous studies (Bilan *et al.*, 2019a), which showed the trust cycle peak at the time of the real estate asset prices increase, despite the aggravation of instability in the financial sector. The results show that the real house price index indicates strong demand, optimistic sentiments of real estate market behavior, and clearly manifests in

fast-growing economies. Thus, an increase in the real house price index implies an increasing demand for financing, thereby indicating growing trust in the financial system (decreasing the trust crisis probability).

Rent prices serve as an additional fundamental determinant that may indicate a shift in the real estate market as long as it is compared year over year, along with potential real estate correction and fluctuations. The results in Table 3 indicate that rent prices are significant at the 5% level. The positive coefficient depicts that a period of sharp rent prices increases faces a far greater chance of the trust crisis in the European Central Bank. The odds ratio for rent prices says that holding all other variables at a fixed value results in a 17.7% increase in the odds of facing a trust crisis in the European Central Bank for a one-unit increase in rent prices score. Based on extended data that includes behavioral aspects of financial consumers, the odds of having a trust crisis in the ECB is 2.7 times higher if the rent prices increase.

The price to income ratio is generally considered as a measure of long-term affordability or attainability. The rise of the price to income ratio means that house prices have outstripped the rise of nominal disposable income per head, and thus real estate is becoming less affordable. Overall, the price to income ratio reflects unsustainable developments in real estate and mortgage markets. This study's results reveal that as real estate prices against income increase, the probability of adverse social and economic consequences in the form of trust crisis in the financial market, particularly the European Central Bank, also increases. This point was underpinned by an odds ratio for a price to income ratio, which means there is a 12.2% (narrow data model) or 10.7% (extended data model) increase in the odds of a trust crisis in the ECB with a given exposure. These results reflect those of Sani and Rahim (2015), Zhang *et al.* (2016), Chen and Cheng (2017), Pažický (2018), Ryczkowski (2019), who also pointed that central banks' inaccurate detection of unsustainable developments and speculative behavior in the real estate market expressed by the rapid rise of price to income ratio leads to exhibit explosive housing market bubbles. The bursting of the bubble had brought long-term negative social and economic consequences. As a result, economic agents had grown distrustful of central banks of advanced economies since they had failed to take appropriate control of house prices. Therefore, any further policy changes, including unconventional monetary policy, may not yield the necessary outcomes due to behavioral biases.

The results in Table 3 illustrate that the price-to-rent ratio is positive and significant in predicting the trust crisis in the financial sector. This result implies that a high price to rent ratio leads to a higher probability of a trust

crisis. Therefore, the odds of having a trust crisis in the European Central Bank is around 10% (both data set models) higher if the price to rent ratio increases. While preliminary, this finding provides further support for the hypothesis that economic agents evaluate whether real estate markets are fairly valued or in a bubble based on information about price to rent ratio. Relying upon previous experiences, such as the 2008–2009 housing market crash, the high price-to-rent ratio level can face more chances of a trust crisis in the financial sector.

This study has used two indexes that describe financial sector consumers' feelings to predict the trust crisis in the European Central Bank. The results show that the unemployment rate is significant in predicting the trust crisis with a positive coefficient sign. This positive relationship illustrates that an increased unemployment rate in the euro area leads to a higher probability of the trust crisis in the European Central Bank. The likelihood of having a trust crisis in the ECB is represented as 82.2% higher odds. This is the most obvious finding to emerge from the analysis since one of the European Central Bank's objectives is to achieve a low level of unemployment. Therefore, a fall in employment is seen as a failure to fulfill the functions of the European central bank and, accordingly, a loss of trust in it.

The results in Table 3 reveal that the Consumer confidence index is positive and significant. This result is unexpected and remarkable as it illustrates that as the consumer confidence index increases, the probability of the trust crisis in the European Central Bank also increases. According to Table 3, an odds ratio for a consumer confidence index of 1.104 means there is a 10.4% increase in the odds of a trust crisis in the ECB. This is the single most striking observation to emerge from the data. Theoretically, this relationship should be negative, as previous comprehensive cross-sectional studies guide that increases in the Consumer confidence index disclose improvements in consumer real estate buying patterns along with expanding financial strength to comply with a future mortgage payment plan (Gibler & Nelson, 2003; Koklic & Vida, 2011; Ma *et al.*, 2017; Kłopotcka, 2017; Mukhtarov *et al.*, 2018). The obtained research results lead to the conclusion that, despite the anticipated increase in bank lending activity and mortgage applications, as a result of consumer confidence grows, the dominating overoptimism raises the probability of the trust crisis in the European Central Bank. Moreover, this positive coefficient is likely to be related to the consumer confidence index (CCI) lagging.

Logit regression results for Model II

Table 4 reports results of logit Model II (both narrow and extended datasets) in predicting trust crisis in the financial system. In Model I, the real estate market behavior (narrow) was incorporated along with financial sector consumers' feelings (extended) to predict the trust crisis in the Euro. Given that the Euro and the European Central Bank are intimately related at the institutional level, economic agents' opinions towards the two had demonstrated divergent trends over the analyzed period.

It can be seen from the data in Table 4 that real house price indices, price to income ratio, price to rent ratio, rent prices, unemployment rate, consumer confidence index are all significant in predicting trust crisis in the Euro at a 5% level of significance. Similarly to predicting the trust crisis in the European Central Bank, there is a negative coefficient for the real house price index. The negative coefficient depicts that as real house price indices increase, the probability of the trust crisis in the Euro decreases. Accordingly, the odds of having a trust crisis in the Euro is 30.1% (narrow data model) or 35.5% (extended data model) lower if the real house price indices were increased. Optimistic sentiments expressed in increasing real house price indices stipulate an increasing demand for mortgage loans, thereby facing fewer chances of the trust crisis in the Euro.

However, three other variables used for the explanation of real estate market behavior exhibit positive coefficients. The results obtained from the analysis presented in Table 4 that in a period with high rent prices, real estate price against income, price against rent, there are more chances of adverse social and economic consequences as a trust crisis in the financial sector, in particular, the Euro. The estimated odds ratios for these variables are above 1 and below 2; therefore, the likelihood of having a trust crisis in the Euro is represented as from 12.6 to 18.0% higher odds for the narrow data set. Based on extended data that includes behavioral aspects of financial consumers, the odds of having a trust crisis in the Euro are 42.4%, 10.5%, and 10.3% higher accordingly if there is an increase in price to income ratio, price to rent ratio, and rent prices.

Table 4 illustrates that similarly with Model I, the unemployment rate is significant in predicting the trust crisis in the Euro with a positive coefficient sign. This positive relationship illustrates that an increased unemployment rate leads to a higher probability of the trust crisis in the Euro. The odds ratio for the unemployment rate says that holding all other variables at a fixed value, it is an 18.1% increase in the odds of facing a trust crisis in the Euro for a one-unit increase in the unemployment rate score.

As can be seen in Table 4, the consumer confidence index is significant but, in contrast to Model I, with a negative sign. This result illustrates that as the consumer confidence index increases, the probability of the trust crisis in the Euro decreases. This view is strengthened by the fact that the odds ratio for the consumer confidence index is lower than 1; therefore, the likelihood of having a trust crisis in the Euro is 10% lower. Similar results were found by Gibler and Nelson (2003), Koklic and Vida (2011), Ma *et al.* (2017), Kłopocka (2017). Interestingly, a positive coefficient can be explained by the increased demand for the Euro in times of consumer confidence growth.

Classification accuracy

Table 5 presents the classification accuracy of models predicted probability of the trust crisis in the financial sector (trust crisis in the European Central Bank (Model I) and trust crisis in the Euro (Model II)) for both narrow and extended datasets.

As can be seen from Table 6, the estimated logit Model I (narrow) classifies normal times with an accuracy rate of 90.91 percent and a trust crisis in the European Central Bank with an accuracy rate of 73.33 percent. The overall accuracy rate for the estimated Model I (narrow) is 83.78 percent. The classification accuracy table demonstrates that Model I (extended) yields a much higher overall accuracy rate that is 94.59 percent. Model I (extended) predicts the normal times as normal with an accuracy rate of 95.45 percent and the trust crisis in the European Central Bank with an accuracy rate of 93.33 percent. Table 5 further shows that Model I (extended) has a higher classification accuracy rate for both normal times and times of trust crisis in the European Central Bank than Model I (narrow).

Table 5 presents that the overall accuracy rate for the estimated Model II (narrow) is 72.97 percent, which is lower than 83.78 percent obtained in Model I (narrow). Model II (narrow) classifies normal times with an accuracy rate of 36.36 percent and a trust crisis in the Euro with an accuracy rate of 88.46 percent. The classification accuracy table demonstrates that Model II (extended) yields a slightly lower overall accuracy rate that is 70.27 percent. Model II (extended) predicts the normal times as normal with an accuracy rate of 45.45 percent and the trust crisis in the Euro with an accuracy rate of 100.00 percent. Table 5 further shows that Model II (extended) has a much lower classification accuracy rate than all estimated models.

Overall, the logit regressions have provided consistent results for all estimated models. However, a comparison in overall accuracy rates shows

that the accuracy rate from the estimated Model I (extended) is higher than the accuracy rate from the estimated Model I (narrow) and both narrow and extended Model II. This finding shows that Model I (extended) can be used to predict trust crises in the financial sector, particularly in the European Central Bank.

Table 6 provides results for the more specific misclassification rates.

It can be seen from the data in Table 6 that Model I (extended) can be used to predict trust crises in the financial system. Therefore, Table 6 provides evidence of higher accuracy of Model I (extended) since the probability of correct classification is the highest (94.39 percent). According to the obtained results in the case of the logit model applied on the extended dataset, there is only 4.55 percent of false-negative classification and 6.67 percent of false-positive classification (the lowest values among all models and datasets). And consequently, the highest values of truly positive cases (sensitivity (TPR)) and truly negative cases (specificity (TNR)) that were correctly identified by Model I (extended).

In addition to other instruments of prediction accuracy of proposed models, ROC curves were plotted. Graphical illustration of trade-offs between the sensitivity and the specificity of the classification table constructed for each data set (narrow and extended) of both models (trust crisis in the European Central Bank (Model I) and trust crisis in the Euro (Model II)) are shown in Figure 2.

The ROC curves were constructed and compared in order to conclude where Model I (narrow or extended) was more accurate compared to Model II (narrow and extended). As can be seen from the graphic illustrations (above), the area under the ROC curve is higher for the Model I extended dataset than other models (Model I (narrow); Model II (narrow); Model II (extended)) representing a metric for classification accuracy for various cut-off points. This visual matching of the ROC curves helps to conclude that Model I (extended) is the most efficient model.

Given the significance of the individual explanatory variable on the dependent variable – trust crisis in the European Central Bank, the final logit function involves six variables and constant, which are statistically significant. The resulting logit function providing the probability of trust crisis in the European Central Bank is:

$$P_I = 1 / (1 + e^{-(-0,14426 - 0,89996 * HOUSEp + 1,00000 * RENTp + 0,10196 * PIR + 0,09902 * PTR + 0,60009 * UNEMP + 0,09927 * CCI)}), \quad (6)$$

Conclusions

Although extensive worldwide research has been carried out on bankruptcy and financial distress prediction, up till now, no single model could predict the trust crisis in the financial sector considering specifics of real estate market behavior in the Euro area. Thus, different prediction models with different dependent variables that describe the trust crisis in the financial sector based on narrow and extended datasets via logit regressions were constructed to fill this gap. The selection of the trust crisis indicators is based on indicators that clearly depict the trust crisis in the financial sector as they reflect trust violations in the financial system primary institutions — net trust in European Central Bank (Model I) and net support for the Euro (Model II). The proposed prediction models of the trust crisis in the financial sector were developed using quarterly data set of the Euro area covering the period from 2000 to 2019. The overall performance of the constructed models has been evaluated by classification accuracy matrixes, more specific misclassification rates, and Receiver Operating Characteristic (ROC) curves. The choice of independent input variables was made based on the most relevant explanatory variables of the real estate market's behavioral characteristics and consumers' feelings.

Another research finding of this study has shown that real estate market behavior is powerless in predicting trust crisis in the Euro. This conclusion was made based on the log-likelihood (-2LL) estimate, which is less than the critical value and p-value of z-statistics, which is greater than the critical value of 0.05. Additionally, the overall prediction accuracy rate of Model II, both narrow and extended data sets, is slightly higher than 70%.

The present study reveals that the trust crisis in the European Central Bank significantly depends on real estate market behavior and financial sector consumers' feelings. The results show that all variables representing real estate market behavior, such as real house price indices, price to income ratio, price to rent ratio and rent prices are important determinants of the trust crisis in the European Central Bank. The findings unfold that the estimated trust crisis prediction model provided more precise results with an overall accuracy of 83.78 and 94.59 percent for the estimation narrow sample and the extended sample, respectively. The constructed logit regression Model I produced better results, and this accuracy improved when applied to the extended dataset.

Furthermore, real estate market behavior accompanied by the financial sector consumers' feelings are statistically significant, providing the best distribution between the normal times and periods of trust crisis in the financial sector. The logit model predicting trust crisis in the European Cen-

tral Bank (extended sample) predicts the normal times as normal with an accuracy rate of 95.45 percent and the trust crisis with an accuracy rate of 93.33 percent. Results stress the importance of variables explaining financial sector consumers' feelings and demonstrate that the unemployment rate and consumer confidence index are essential in predicting trust crisis in the European Central Bank. However, a sign of consumer confidence index is contrary to previous studies. This result is unexpected and remarkable, as it illustrates that as the consumer confidence index increases, the probability of the trust crisis in the European Central Bank also increases. Obtained research results lead to the conclusion that despite the anticipated increase in bank lending activity and mortgage applications as a result of consumer confidence grows, the dominating overoptimism increases the probability of the trust crisis in the European Central Bank.

The principal theoretical implication of this study is that Central banks should monitor real estate market behavior since the likely consequence of increased real estate bubble risk is a decrease in public trust in central banks and an increase of support for populist movements. Therefore, while formulating and implementing macro-prudential and monetary policies, central banks should also have regard to the real estate market behavior that may play down the dangers of a housing bubble burst for price stability and allow the real estate market to grow safely. Moreover, clear communication of central banks that inform market participants about observed tensions in the real estate market might shield investors from the consequences of irrational decisions and, therefore, central banks from sowing the seeds of future trust crises.

The results of this study are subject to certain limitations. The first limitation of this research is that the study's sample period is from the first quarter of 2000 to the fourth quarter of 2019, and the trust crisis in the Euro is identified as net support for the Euro according to the Eurobarometer surveys published by the European Commission. Nevertheless, despite the Euro being launched on January 1, 1999, only after February 28, 2002 did national currencies of twelve EU member states cease to be legal tender, and the Euro became the sole currency in circulation. The other seven EU countries under investigation of this study joined the European Union in 2004 and adopted the Euro currency between 2007 and 2015. Secondly, the real estate market behavior variables were selected as predictors in pursuance of their standing and high visibility in the academic literature. Moreover, the logit regression usability and functionality among the predicting models have encouraged its application in this study. In order to compare the accuracy of the developed models in future studies, other models like the Hazard Model or Neural Network Model could be used.

The logit regression model predicting trust crisis in the European Central Bank (Model I extended) can serve as a basis for future research and practice due to their quite high accuracy prediction. For future studies, other behavioral indicators, such as an average or marginal propensity to save, an average or marginal propensity for financial savings, and other indexes may be considered for predicting trust crisis in the European Central Bank. Considerably more work will need to be done to determine the probability of trust crisis in the financial sector independently for each country of the Euro area.

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Annex

Table 1. Dependent and independent variables used for construction trust crisis in the financial sector prediction models

Variable name	Label	Category
Net trust in the ECB	TRUST _{ECB} ¹	Trust in the financial sector
Net support for the Euro	TRUST _{euro} ²	
Real house price indices	HOUSEp	Real estate market behavior
Price to income ratio	PIR	
Rent prices	RENTp	
Price to rent ratio	PTR	
Unemployment rate	UNEMP	Financial sector consumers' feelings ³
Consumer confidence index	CCI	

Notes: ¹ Net trust is calculated as the share of respondents answering "Tend to trust" minus the percentage answering "Tend not to trust" to the question "Please tell me if you tend to trust it or tend not to trust it?: The European Central Bank." Respondents who answered "do not know" are excluded in both cases. ² Net support for the Euro is calculated as the share answering "for" minus the share answering "against" to the question "Please tell me whether you are for or against it: A European economic and monetary union with one single currency, the euro." ³ Variables that describe financial sector consumers' feelings were used only for extended models.

Table 2. Classification accuracy matrix for models testing

Observed	Predicted	
	Normal times (T)	Trust crisis (F)
Normal times (T)	True positives (TP)	False positives (FP)
Trust crisis (F)	False negatives (FN)	True negatives (TN)

Table 3. Estimated logit regression model I coefficients

Variables in the Equation	Model I (narrow)			Model I (extended)		
	Coefficient (B)	Significance	Exp (B)	Coefficient (B)	Significance	Exp (B)
b ₀	3.33840	0.017**	28.174	-0.14426	0.011**	0.866
Real house price indices	-0.39822	0.010**	0.671	-0.89996	0.030**	0.406
Rent prices	0.16322	0.000*	1.177	1.00000	0.062***	2.718
Price to income ratio	0.11532	0.000*	1.122	0.10196	0.000*	1.107
Price to rent ratio	0.10047	0.000*	1.106	0.09902	0.015**	1.104
Unemployment rate				0.60009	0.061***	1.822
Consumer confidence index				0.09927	0.023**	1.104
Statistical significance						
Chi2	23.42135			39.87975		
p-value	0.00010			0.00000		
Final loss	13.26965			5.04040		
-2*Log-likelihood	26.53930			10.08080		

Notes: Exp (B) refers to odds ratio; * significant at 1%; ** significant at 5%; *** significant at 10%

Table 4. Estimated logit regression model II coefficients

Variables in the Equation	Model II (narrow)			Model II (extended)		
	Coefficient (B)	Significance	Exp (B)	Coefficient (B)	Significance	Exp (B)
b ₀	-1.86073	0.021**	0.156	-0.76207	0.004*	0.467
Real house price indices	-0.35833	0.009*	0.699	-0.43766	0.006*	0.645
Price to income ratio	0.12001	0.005*	1.127	0.35380	0.000*	1.424
Price to rent ratio	0.11870	0.011**	1.126	0.10030	0.052***	1.105
Rent prices	0.16575	0.000*	1.180	0.09845	0.000*	1.103
Unemployment rate				0.16667	0.020**	1.181
Consumer confidence index				-0.10433	0.031**	0.900
Statistical significance						
<i>Chi2</i>	9.45003			12.86817		
<i>p-value</i>	0.05081			0.04521		
<i>Final loss</i>	17.79159			16.08252		
<i>-2*Log-likelihood</i>	35.58318			32.16504		

Notes: Exp (B) refers to odds ratio; * significant at 1%; ** significant at 5%; *** significant at 10%

Table 5. Classification accuracy for logit models

<i>Classification results (trust crisis in the European Central Bank)</i>				
	Observed	Predicted		Percentage correct
		Normal times (0)	Trust crisis (1)	
Model I (narrow)	Normal times (0)	20	2	90.91%
	Trust crisis (1)	4	11	73.33%
Overall accuracy rate				83.78%
	Observed	Predicted		Percentage correct
		Normal times (0)	Trust crisis (1)	
Model I (extended)	Normal times (0)	21	1	95.45%
	Trust crisis (1)	1	14	93.33%
Overall accuracy rate				94.59%
<i>Classification results (trust crisis in the Euro)</i>				
	Observed	Predicted		Percentage correct
		Normal times (0)	Trust crisis (1)	
Model II (narrow)	Normal times (0)	4	7	36.36%
	Trust crisis (1)	3	23	88.46%
Overall accuracy rate				72.97%
	Observed	Predicted		Percentage correct
		Normal times (0)	Trust crisis (1)	
Model II (extended)	Normal times (0)	5	6	45.45%
	Trust crisis (1)	0	26	100.00%
Overall accuracy rate				70.27%

Table 6. Classification results for logit estimated models

	AUC	Sensitivity (TPR)	False negative rate (FNR) ¹	Specificity (TNR)	False positive rate (FPR) ²
<i>Classification results (trust crisis in the European Central Bank)</i>					
Model I (narrow)	83.97	83.33	16.67	84.62	15.38
Model I (extended)	94.39	95.45	4.55	93.33	6.67
<i>Classification results (trust crisis in the Euro)</i>					
Model II (narrow)	66.90	57.14	42.86	76.67	23.33
Model II (extended)	90.62	100.00	0.00	81.25	18.75

¹ False negative rate (FNR) is referred to as Type I Error. ² False positive rate (FPR) is referred to as Type II Error.

Figure 1. Net trust in the ECB and Net support for the Euro over 2000-2019 in twelve member-countries of the Eurozone

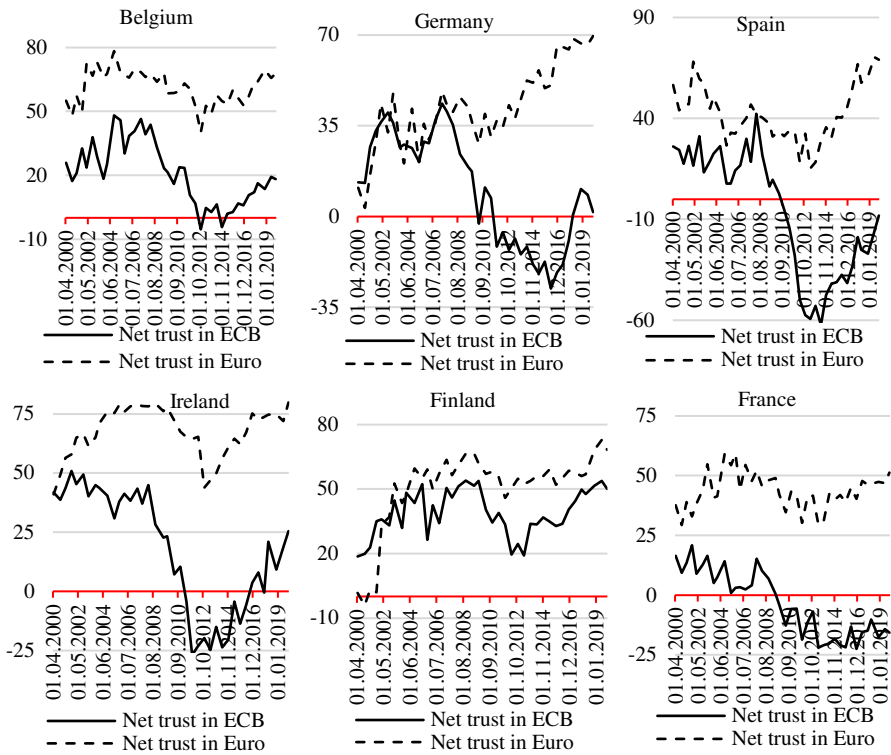
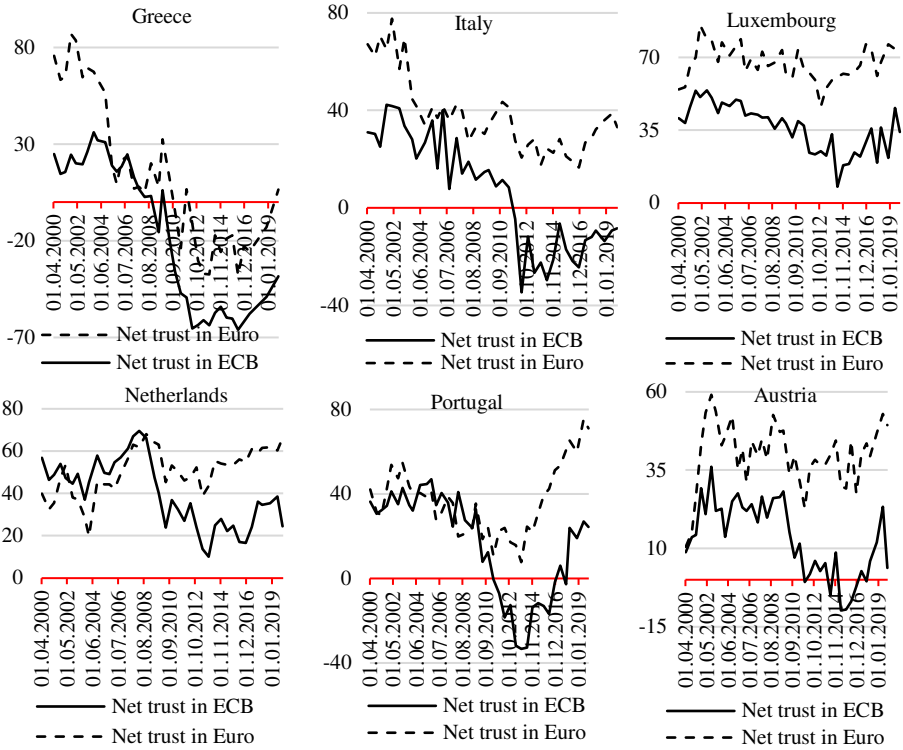


Figure 1. Continued



Sources: own calculations based on Eurobarometer.

Figure 2. ROC curves for estimated logit model: (a) Model I (narrow); (b) Model I (extended); (c) Model II (narrow); (d) Model II (extended)

