Significant Determiners of Greek Debt Crisis: A Comparative Analysis with Probit and MARS Approaches

Filiz Mızrak
PhD Candidate in İstanbul Medipol University

Serhat Yüksel
Assoc. Prof. in İstanbul Medipol University

Abstract

The purpose of this study is to determine major indicators of the Greek crisis that started in 2009 and the effects of which can still be observed. In this regard, 8 independent variables were applied so as to fulfill the objective. Besides, the annual data between the years 1984 and 2016 was analyzed with Probit model. As a consequence of this study, it was concluded that inflation and gross savings are the leading meters of Greek crisis based on probit method. On the other hand, according to the MARS results, 3 different variables are identified as the indicators of the debt crisis in Greece. It is concluded that there is a negative relation between financial crisis with saving ratio and current account balance. Additionally, it is also identified that high unemployment ratio leads to financial crisis. While comparing the results of these two approaches, it is concluded that MARS is much more successful than the probit method to predict the debt crisis in Greece. It is strongly recommended that saving ratio should be increased in Greece. For this purpose, governments should take some actions in order to increase this ratio more than 15.5%. Within this framework, media channels can be used by the government to tell the people about the importance of the savings to have sustainable economic development.

Keywords: Greece; Debt Crisis; Probit; MARS

JEL classification: G21; G28; G35
Introduction

The integration of national and international financial markets, which started after the Second World War and gained momentum after 1990, led to the emergence of financial crisis (Selvarajan et al., 2018; Ocampo, 2018). In the period when many developed and developing countries liberalized their financial systems and made their capital account open, there were extraordinary increases in the international movement of capital from one side to the other, and the long-term financial crisis arose (Naqvi, 2018; Özbay et al., 2011; Dinçer et al., 2019f). A new and broader literature has emerged recently in this framework, emphasizing the causes and solutions of these crises in developing countries and developed countries (Jha, 2019; Dinçer, 2015). They mainly tried to understand how to prevent new financial crisis so that people and the companies will not be affected negatively (Ülgen, 2019; Naveed and Mahmood, 2019).

One of the most contagious and destructive financial crises in the recent past without doubt, was in 2007 which started in the US and spread to many developed and developing countries (DesJardine et al., 2019; Helleiner et al., 2018). The economy of some countries was threatened in such a catastrophic way that it took ages and costed fortunes for these countries to overcome this situation. Many different companies went bankrupt and a lot of people have lost their jobs (Armstrong and Read, 2018; Bell and Hindmoor, 2018). This crisis has also affected other regions of the world negatively, such as Europe. In order to overcome the negative effects of this crisis, the government has taken many different actions (Lane and Milesi-Ferretti, 2018; González et al., 2018). For instance, interest rate was lowered in order to increase the trade volume in the market (Zhang and Broadstock, 2018; Steinkamp and Westermann, 2018).

Greece is also a country which suffered from a significant financial crisis after this mortgage crisis. The main point of Greek crisis is that this country declares that it cannot pay its foreign debts. In this framework, the main problem is that Greece borrow money in an uncontrolled manner. Especially after the Euro implementation, all European Union member countries got the opportunity to borrow money at a lower cost. However, most of these countries increased the debt amount in this process without any budgeting control. Greece is an example for these kinds of countries. It is very important to understand the main indicators of this crisis in order to make necessary precautions to prevent a new crisis in the future.

In this study, it is aimed to examine major sources of the financial crisis occurred in Greece using Probit and MARS methods. While it is not possible to evaluate this crisis separately from the global economic crisis that began in the United States in the summer of 2007 and spread to the whole world, it would be a more correct approach to relate the situation predominantly to the economic background and conditions of Greece. As a consequence of this study, the goal is to determine the main indicators of Greek financial crisis. This study is significant and contributes the literature well, being the first study that analyze the Greek financial crisis with probit and MARS methods.

The organization of the paper will be as followed. After the introduction part, brief information regarding similar studies in the literature will be given. The second part will discuss possible causes and outcomes of the Greek crisis. Furthermore, in the third part, the details of the methods used in this study will be given. Moreover, leading indicators of this crisis will be identified in the application part. Last but not least, the conclusion part will consist the results of the analysis.

Literature Review

There are many studies related to financial crisis and their possible indicators in empirical and theoretical literature. Some of them are given in the Table 1.
Table 1: Studies related to financial crisis

| Authors                          | Scope                              | Method                  | Result                                                                                                                                 |
|----------------------------------|------------------------------------|-------------------------|---------------------------------------------------------------------------------------------------------------------------------------|
| Avci and Altay (2013)            | Turkey, Argentina, Thailand and England | Signal approach         | Interest rate, exchange rate and increase in domestic loans are the main reason of financial crisis in mentioned countries.          |
| Baltas (2013)                    | Greece                             | Descriptive Statistic   | Volatility in growth performance, high inflation, successive currency devaluations and structural weakness trigger the financial crisis |
| Broome (2004)                    | East Asian countries               | Monetary Model          | Domestic stock and US prices are important factors that cause financial crisis.                                                       |
| Bucevska (2015)                  | Croatia, Macedonia and Turkey      | Logit                   | Short term external debt and high amount of public spending are leading indicators of the currency crisis for EU candidate countries. |
| Burkarta and Coudert (2002)      | 15 emerging countries              | Linear discriminant analysis | The study suggests that overvaluation resulted from long-term periods, short term debt, inflation and decrease in foreign reserves are leading indicators of financial crisis. |
| Bustelo et. al. (2000)           | Global crisis                      | Descriptive Statistic   | According to the study, there are different causes of each financial crisis. Mexican crisis resulted from overconsumption; however, excessive investment triggered Asian crisis. |
| Carmassi et. al. (2009)          | 2007-2008 Global crisis            | Descriptive Statistic   | Uncontrolled monetary policy is a significant factor that cause financial crisis.                                                      |
| Catullo et. al. (2015)           | Japan                              | Simulation              | It is concluded that extraordinary increase in loans leads to financial crisis.                                                        |
| Cebeci (2012)                    | Turkey                             | Probit                  | Inflation, exchange rate, unemployment rate and lower GDP growth result in financial crisis.                                             |
| Corsetti et. al. (1999)          | Asian Countries                    | Descriptive Statistic   | Ineffective political decisions and banking problem are the main determiners of the financial crisis.                                   |
| Edison (2003)                    | Global crisis                      | Descriptive Statistic   | As a result of the study, It was found that some of the indicators to determine the financial crisis are too vulnerable. These indicators are real exchange rate, high ratio of short-term debt reserves and declining equity prices. However, early warning system approach is concluded to be a diagnostic tool to predict the crisis. |
| Author(s) (Year) | Region/Countries | Methodology | Findings |
|------------------|------------------|-------------|----------|
| Firtescu (2012)  | Emerging countries | Regression | Exports, domestic credit, lending rate, government expenditure have impact on financial crisis, but FDI does not have a role in this topic. |
| Frankel and Saravelos (2011) | 2008-2009 Global crisis | Linear Regression, Probit/Logit | International reserves and real exchange rate overvaluation are the leading determiners of the crisis. |
| Glick and Hutchison (2000) | 90 industrial and developing countries | Probit | In the study, it was emphasized that banking crises is assumed to be one of the indicators of currency crisis. |
| Hana and Al-Ghani (2016) | Jordan | Probit | Volatility in exchange rate, decrease in bank deposit and reserves lead to financial crisis. |
| Karmakar and Vani (2014) | USA, India and Europe | Probit | Export rate and inflation are major indicators of crisis. |
| Kaur (2015) | USA | Probit | Short term debt is the most effective indicator of the crisis in USA. |
| Kruger and Page (1998) | Developing countries | Panel Regression | While the relation between gross savings and financial crisis is positive, relation of current account deficit is inverse. Besides, external debt of a country is not found to be an indicator of crisis. |
| Lauridsen (2004) | Thailand | Descriptive Statistic | Non-performing loans and current account problems have significant impacts on financial crisis. |
| Lin (2009) | Taiwan | MDA, logit, probit, ANNs | The study concludes that the models applied in this study, are successful to predict the financial crisis, yet the probit model achieved the most accurate results. |
| Oktar and Yüksel (2015) | Turkey | MARS | Derivatives with speculative purposes, inflation rates, net profit and short-term foreign debt trigger financial crisis. |
| Öztürk and Sözdemir (2014) | Greece | Descriptive Statistic | Ineffective economic, political decisions and unreliability of political institutions are important determiners of financial crisis. |
| Reinhart and Rogoff (2010) | European debt crisis | Descriptive Statistic | In the study it is concluded that local and regional market sentiment accompanied by worsening values of macro fundamental variables and contagion had predominantly significant effect on the origin of the European sovereign debt crisis. |
| Rodionov (2015) | Russia | Descriptive Statistic | Lack of proper banking control results in financial crisis. |
Ruscakova and Semancikova (2016) | Europe | Descriptive Statistic | Uncontrolled fiscal policy and monetary policies lead to financial crisis.
---|---|---|---
Sztojanov and Stamatescu (2015) | Hungary | Fuzzy Logic | Credit growth, housing prices and GDP lead to crisis.
Sztojanov et. al. (2016) | Romania | Fuzzy Logic | Credit growth and real estate prices are two significant determiners of potential financial crisis.
Wade (1998) | Asian Countries | Descriptive Statistic | Asian capitalist system and debt deflation lead to financial crisis.
Yuksel and Zengin (2016) | 2007-2008 Global crisis | Mars and Logit | It was concluded that non-performing loans and bank derivatives lead to crisis according to MARS method, whereas the amount of total assets and non-performing loans are the indicators of crisis based on the logit method

With respect to studies regarding the financial crisis, it is obvious that different indicators have been found for the financial crisis occurred in the past. One of the variables which has been frequently suggested is “exchange rate”. Avci and Altay (2013), Baltas (2013), Cebeci (2012), Frankel and Saravelos (2011), Hana and Al-Ghani (2016), Edison (2003) reached to a conclusion that exchange rate is an important factor for the financial crisis. They used different methods and analyzed different countries in their studies. Another important factor according to the findings of the studies is “inflation”. Baltas (2013), Cebeci (2012), Karmakar and Vani (2014), Oktar and Yüksel (2015), Burkarta and Coudert (2002) indicated that inflation is an economy leads to financial crisis applying different methods.

Some of the studies given in the table conclude that “total assets” is a significant determiner of the crisis. Although Avci and Altay (2013), Catullo et. al. (2015), Firtescu (2012), Lauridsen (2004), Yuksel and Zengin (2016), Sztojanov and Stamatescu (2015), Sztojanov et. al. (2016) analyzed different crisis applying divergent methods, they refer “total loans” as being the possible cause of the financial crisis. Furthermore, “external debt” is founded to be among the crucial variables of the financial crisis. Bucevska (2015), Kaur (2015), Oktar and Yüksel (2015), Wade (1998) involved this factor in their studies. “GDP growth” has been suggested to be the one of leading indicator of the crisis by Baltas (2013), Cebeci (2012), Sztojanov and Stamatescu (2015). Other important variables are interest rate, public spending, unemployment rate, gross savings, incorrect political decisions, unreliability of political institutions, lack of proper banking control. They are among the major factors which result in the severe financial crisis in the history.

Greece Debt Crisis

Integration process between the European Union and Greece dates back to the year when the free trade agreement was signed in 1961. Until the end of 1970s the EU was the biggest commercial partner of Greece; however, the economic development of Greece was always behind the other countries in the region. In 1981 when Greece joined the Union, per capita GDP was 68% of the EU average, which is the lowest rate after Ireland. Greece was exposed to a high level of competition from the EU countries in the first decade of membership, which combined with local populist policies that hampered efforts to secure macroeconomic stability, lowering the economic performance of the country and opening the economic gap between Greece and other countries (Othelen et. Al, 2003). In the second decade of membership, the economic performance of Greece has increased significantly following a successful macroeconomic stabilization program. Eurozone membership required to adhere to the EU's approximation criteria for fiscal and monetary policy, and in the 1990s an external discipline was provided for Greece’s economic policy. Greece has also been the most important beneficiary of the funds the EU has provided for economic and social cohesion within the framework of regional policies (Rathbun et al., 2019; Othelen et. Al, 2003).
Between 2000 and 2008, Greece's debt stock was around 100% of GDP. During this period, Greece grew by an average of 4% per annum and interest rates remained at low levels. Despite the growth in the Greek economy, fiscal imbalances have remained high for many years. For the last six years, production has increased by 40% in nominal terms and expenditures by the central government by 87%, while tax revenues have increased by only 31% in the same period. In November 2009, the announcement that the new government, which was elected in power in Greece, distorted financial data could be considered the official beginning of Greece's economic crisis (Gogstad et al., 2018; Neaime et al., 2018). The 2008 budget deficit was revised from 5% to 7.5% of GDP. At the same time, the budget deficit foreseen for 2009 was revised to 12.7% from 3.7% of GDP. In April 2010, the European Statistical Office (Eurostat) stated that Greece's 2009 budget deficit was 13.6% of GDP instead of 12.7% of the previously reported GDP, or in other words 32, 4 billion euros. The public debt ratio, estimated at 99.6% of GDP, was also revised to 115.1% of GDP at the end of 2009 (IMF, 2010; Daniel and Peters, 2018; Offe, 2018).

The Greek economy has been at a high growth rate in GDP for more than a decade. However, according to the IMF (2010), this rapid growth has two important characteristics. The first was supported by easy-to-access loans with low interest rates provided to businesses and households, along with the adoption of euro, based on substantial increases in demand. Secondly, the twin has existed with openness, budget deficit and current account deficit emerging together. This points to the lack of willingness to maintain fiscal discipline and the loose fiscal position on the external balance of the economy, accompanied by significantly competitive international competitiveness.

Greece, which is a member of the EU for more than thirty years, has long been a country with a high current account deficit, in other words the net income transfer. The current account deficit / GDP ratio in the Greek economy has remained well above the 5% level, which is considered as a dangerous limit in the literature. In 2008, the current account deficit / GDP ratio reached 16.3% and the historical record broke. Another source of Greece's high current account deficit is the continuing high foreign trade deficits of the country. As the Greek economy grew, imports grew and the gap between exports and imports widened. In the country's economy, the ratio of exports to imports has gradually decreased and the expanding foreign trade deficit has been another factor that increases the current deficit (Trebesch and Zettelmeyer, 2018).

On the other hand, Greek households have become increasingly indebted to over-consumption habits despite increased income on productivity. Loans (housing, consumer and other loans) opened up in the finance sector in Greece seem to have increased rapidly in recent years compared to previous years. The total loan volume opened in 1995 was € 4.82 billion, up 10 times from 2004 to € 51.63 billion (Athanassiou, 2007). Although the annual growth rate of lending has changed, it has generally remained close to 30% on average, and the economy increased by about 40% in 2007 compared to 2007 in the previous year (2008). A similar trend is observed in the household debt ratio. For example, “GDP grew at an average annual rate of 8% in 2000-2004 with current prices, while the household debt rate grew by 29% in the same period.” (Athanassiou, 2007: 92-93). It was also influenced by the fact that households borrowed more to buy housing. As a result, they have consumed households above their income and spent more on borrowing more.

The Greek debt crisis and the future of the European Economic and Monetary Union are on the agenda of the world, with Papandreou, the ruling Greek government in October 2009, declaring that the country's public budget deficit to GDP is not actually 6.7% but 12.7% he sat at an important place. In front of the country, there were two basic options for abandoning the European Economic and Monetary Union and the second for international financial support. Greece preferred the second. The economic program for Greece, prepared for exit from the crisis, aims to restore confidence, financial stability and competitiveness and ensure the stability of the financial sector. It is foreseen that all financial and structural policies will be used to get out of the crisis. Measures to be taken within the framework of the financial aid package are mainly aimed at reducing expenditures, increasing incomes and undertaking structural fiscal reforms. As a result, while Greece is struggling to reduce its budget deficit and reduce the debt to GDP ratio, on the other hand, aims to provide the necessary conditions for economic development in the coming years, targeting ongoing structural weaknesses for a long time. Thus, Greece aims to bring new and sustainable growth to its economy by coming from the top of the current crisis (Bekiros et al., 2018).
Models Used in the Study

Probit Model

Probit is a type of regression analysis. In this approach, dependent variable has two different alternatives. Therefore, this approach is accepted very appropriate for financial crisis evaluation. The main reason is that in the crisis studies, the dependent variable is selected as the occurrence of this crisis. This means that this variable can take either 0 (no crisis) or 1 (crisis). In the literature, many different studies considered this methodology, such as Filippini et al. (2018), Meyer et al. (2019), Lacombe and LeSage (2018), Yüksel (2017), Kalkavan and Ersin (2019), and Eti (2019).

Multivariate Adaptive Regression Splines (MARS) Model

The MARS method was first developed in 1991 by physicist and statistician Jerome Friedman. This method can be used when there are too many variables. The MARS method offers the best model by selecting from the candidate models. In this way, regression analysis is performed between dependent and independent variables (Friedman, 1991). In view of the above, it is possible to mention the many advantages of the MARS method. In conventional regression models, the independent variable takes place in the model once and takes a single coefficient. However, in the MARS method, these variables may take different coefficients for different conditions. In the MARS method, the ideal model is formed in two stages. First, all possible functions, also called basic functions, are generated using independent variables. The second stage is the stage from the most complex to the best. Yüksel (2016a,b), Oktar and Yüksel (2016), Yüksel et al. (2018), Dinçer et al. (2018a,b), Dinçer et al. (2019), Tunay (2001), Tunay (2011), Yüksel and Zengin (2017), Tunay (2010) and Uzunkaya et al. (2018) are some example studies in the literature in which MARS method was considered.

An Evaluation on Greece Debt Crisis

Data Set and Variables

In this study, the annual data between the years 1984 and 2016 provided from the website of World bank was used. Table 2 presents annual data of growth rate and inflation before and during the crisis.

Table 2: Inflation, GDP deflator (annual %) and Growth Rate of Greece (2003-2016)

| Year | Inflation | Growth Rate |
|------|-----------|-------------|
| 2003 | 3.45      | 5.79        |
| 2004 | 3.06      | 5.06        |
| 2005 | 2.24      | 0.59        |
| 2006 | 3.49      | 5.65        |
| 2007 | 3.42      | 3.27        |
| 2008 | 4.34      | -0.33       |
| 2009 | 2.56      | -4.30       |
| 2010 | 0.67      | -5.47       |
| 2011 | 0.79      | -9.13       |
| 2012 | -0.37     | -7.30       |
| 2013 | -2.35     | -3.24       |
| 2014 | -1.83     | 0.73        |
| 2015 | -1.02     | -0.29       |
| 2016 | -0.95     | -0.24       |

Source: World Bank

It is clear in table above that the effects of crisis started to be felt in 2009 when there is a sharp decline in inflation, GDP deflator (annual %) and growth rate; however, having analyzed the data, it is also clear that the effects can still be seen in 2016. Thus, it is assumed that the crisis is between the years 2009 and 2016. Based on these findings, dependent value “crisis” takes the value “1” between the years 2009 and 2016, on the other hand, other years until 2009 takes the value of “0”. Apart from the dependent variable, 8 independent variables which are supposed to be the major indicators of the crisis in the light of the literature, were analyzed in the study. Table 3 will shed light upon the details of the variables.
In the study, 8 independent variables were used all of which are macroeconomic variables with the aim of predicting the leading indicators of the Greek crisis. The first variable is the USA crisis since the 2008 financial crisis, originating from the USA, affects the entire financial and real sector, as well as being the country attracting the most foreign capital from international markets, where capital flows have been increasingly liberalized since the 1980s has been transformed into a global crisis by the influence of the size of the economy. (Taylor, 2009). For this reason, it is expected that there is a positive relationship between the USA crisis and the Greek Crisis. Furthermore, the value “1” is given to the years 2008 and 2009, the rest was valued as “0” in the USA crisis data. On the other hand, other variables which is expected to have positive relation with the Greek Crisis are exchange rate, inflation, unemployment and current account deficit. When the values in these variables increases, the crisis is predicted to be more severe. On the contrary, the relation of household consumption, gdp growth rate, gross savings with the crisis is expected to be negative. As the values in these independent variables decrease, the risk of a possible crisis is supposed to increase.

Analysis Results with Probit Method

As it was previously mentioned, 8 variables are used to determine the significant meters of Greek Crisis. Although there was not any multicollinearity problem in the application process, all the variables applied are not significant to explain the dependent variable. All the details regarding the analysis were given in Table 4.

| The Type of the Variables | The Name of the Variables | Reference |
|---------------------------|---------------------------|-----------|
| Macroeconomic Variables | Inflation                  | Baltas (2013), Cebeci (2012), Karmakar and Vani (2014), Oktar and Yüksel (2015), Dinçer et al. (2019a,b,d), Burkarta and Coudert (2002), Nonejad (2019), Fong and Leibrecht (2019), Szyszko et al. (2019) |
| GDP Growth Rate           | Baltas (2013), Dinçer et al. (2019e), Cebeci (2012), Sztojanov and Stamatescu (2015), Cherp et al. (2016), Dinçer et al. (2018c,d), ERsin and Baş (2019), Leimbach et al. (2017), Feldstein (2017) |
| Current Account Deficit   | Lauridsen (2004), Abbasoğlu et al. (2019), Ferrero (2015), Göktén and Karatepe (2016), Dinçer et al. (2019c), Fayaz and Kaur (2016), Brumm et al. (2019), Ersin (2018), Zoega (2019), Aliber and Zeoga (2019) |
| Household Consumption     | Bucevska (2015), Ivanova et al. (2016), Constantinides and Ghosh (2017), Di Maggio et al. (2017), Kumar and Jia (2019), Felix and Caskey (2019) |
| Unemployment Rate         | Cebeci (2012), Caggiano et al. (2017), Dinçer and Hacıoğlu (2017), Hall (2017), Ergeç and Ersin (2019), Kaufman (2017), Dinçer et al. (2016) |
| Exchange Rate             | Avcı and Altay (2013), Dinçer et al. (2015), Baltas (2013), Cebeci (2012), Frankel and Saravelos (2011), Dinçer and Hacıoğlu (2015), Hana and Al-Ghani (2016), Hacıoğlu and Dinçer (2013), Dinçer et al. (2016) |
| Gross Savings             | Kruger and Page (1998), Dinçer et al. (2017), Gruber and Kamin (2015), Dinçer and Yüksel (2018), Wan (2015), Ersin and Eti (2017) |
Table 4: The Results of Probit Analysis

| Independent Variable | Coefficient | Significance |
|-----------------------|-------------|--------------|
| Exchange Rate         | 1.25        | 0.9125       |
| Gross Savings         | -0.074      | 0.0029       |
| Gdp Growth Rate       | -0.005      | 0.9817       |
| Inflation             | 0.037       | 0.0027       |
| Household Consumption | -0.007      | 0.7535       |
| Unemployment          | 0.024       | 0.1021       |
| Current Account Deficit | 0.018    | 0.3507       |

Dependent Variable: Greek crisis
Adjusted R-squared: 0.88

In the Table 4, it can be deduced that only 2 variables whose probability values are below “0.05” are statistically important to indicate the financial crisis. Inflation has the most significant value to explain the crisis. Since its coefficient is 0.037, the relation between this variable and the financial crisis is direct. Namely, when the inflation goes up, the economy of that country starts to fluctuate. Moreover, it was seen in the table that “Gross Savings” is an important independent variable that signals the possibility of a financial crisis. The coefficient value of this variable is -0.074, so it proves the inverse relationship between the financial crisis and gross savings. It means, when the gross savings of a country declines, the risk of the financial crisis starts to threaten economies. It can also be assumed that less savings resulted from the high current account deficit and this situation drags the economies into a recession. Additionally, this table also demonstrates that the value of Adjusted R-squared is 0.88. It states that the dependent variable of this study “the Greek financial crisis” can be explained by %88 in this study.

Analysis Results with MARS Method

In the first stage of MARS analysis, all possible models are created by the system. In this circumstance, it is defined that 9 different methods are produced which are given on Table 5.

Table 5: All Possible Models

| Basis Functions | Total Variables | Direct Variables | Effective Variables | GCV  | GCV R-Square |
|-----------------|-----------------|------------------|---------------------|------|--------------|
| 9               | 4               | 4                | 28.000              | 0.071| 0.636        |
| 8               | 4               | 4                | 25.000              | 0.028| 0.856        |
| 7               | 4               | 4                | 22.000              | 0.016| 0.920        |
| 6               | 4               | 4                | 19.000              | 0.010| 0.949        |
| **5**           | 3               | 3                | **16.000**          | **0.008**| **0.957**   |
| 4               | 3               | 3                | 13.000              | 0.010| 0.950        |
| 3               | 3               | 3                | 10.000              | 0.009| 0.953        |
| 2               | 3               | 3                | 7.000               | 0.015| 0.921        |
| 1               | 2               | 2                | 4.000               | 0.021| 0.891        |

Table 5 states that the model that has 5 different basis functions is accepted as the best model. It has 3 different variables, lowest GCV and highest GCV R-Square values. The details of this model are shown on Table 6.
Table 6: The Details of the Best Model

| PARAMETER          | ESTIMATE | S.E. | T-RATIO | P-VALUE |
|--------------------|----------|------|---------|---------|
| Constant           | 0.002    | 0.012| 0.185   | 0.855   |
| Basis Function 2   | 0.043    | 0.010| 4.127   | .315681E-03 |
| Basis Function 3   | 0.021    | 0.002| 9.194   | .835372E-09 |
| Basis Function 5   | -0.032   | 0.006| -4.934  | .363897E-04 |
| Basis Function 8   | -0.007   | 0.001| -6.028  | .196282E-05 |
| Basis Function 9   | 0.012    | 0.003| 4.392   | .155920E-03 |

F-STATISTIC = 443.520  S.E. OF REGRESSION = 0.052
P-VALUE = .999201E-15  RESIDUAL SUM OF SQUARES = 0.073

Table 6 gives information that all 5 different basis functions are significant because their p values are lower than 0.05. Additionally, the p value of F statistic is also lower than 0.05. This situation explains that the model is statistically significant. Another important factor is that adjusted R-Squared value is 0.986. This situation states that this model is so successful that it can explain the debt crisis in Greece 98.6% correct. Table 7 indicates the details of the basis functions.

Table 7: The Details of the Basis Functions

BF2 = max (0, 15.552 - SAVING)
BF3 = max (0, CURRENT ACCOUNT BALANCE + 14.476) * BF2
BF5 = max (0, - 6.229 - CURRENT ACCOUNT BALANCE)
BF8 = max (0, UNEMPLOYMENT - 7.024) * BF2
BF9 = max (0, UNEMPLOYMENT - 7.024) * BF5

Table 7 gives information that 3 different variables mainly explain the debt crisis in Greece. According to basis function 2, there is negative relationship between saving amount and this debt crisis. This situation mainly shows that when there is uncontrolled consumption, it has a negative influence on the performance of the Greek economy. In order to have more sustainable economy, the saving ratio should be higher than 15.5%. In addition to this variable, basis functions 3 and 5 define that there is also negative relationship between current account balance and debt crisis. In other words, in case of high current account deficit, Greece has an enormous risk of financial crisis. According to the results of the MARS method, higher current account deficit ratio than 14.47% is accepted as the significant indicator of the financial crisis. Finally, it is determined that unemployment ratio positively affects financial crisis. Table 7 shows that when this ratio exceeds 7.024%, it should be accepted as a leading indicator of the financial crisis.

Comparison of Probit and MARS Results

The findings of the study show that both probit and MARS approaches underline the importance of different variables for Greek debt crisis. With respect to the adjusted R-Squared ratio, it can be seen that MARS is more successful than the probit to explain this crisis. Graph 1 compares the analysis results of probit and MARS according to Greek debt crisis.
Graph 1 illustrates that MARS method is much more successful than the probit model in order to predict the Greece debt crisis.

Conclusions

The economic crisis in Greece is at risk of spreading to other countries. Since the effect of a particular policy on the budget of a country depends on foreign trade, interest rates and exchange rate it can infect other countries. The fact that most of Greece's public borrowing belongs to foreign creditors strengthens its spreading effect. Actually, Greece, a thirty-year-old EU member, has settled on both the EU and the world agenda with the sovereign debt crisis. Although Greece has a small share in total output, the Greek debt crisis has almost turned into Euro Zone debt crisis. In the literature, the early warning system has been proved to be a beneficial tool to predict the crisis. Therefore, in this study, I tried to find out the leading indicators of the Greek crisis which started in 2009. In order to achieve this objective, 8 variables were utilized. In addition, annual data of Greece between the years 1984 and 2016 were analyzed with Probit and MARS methods.

As a result of the analysis with Probit method, only 2 variables were found to be meaningful to explain the Greek crisis. The main determiner of the Greek crisis is inflation which occurs as a result of the gap between the amount of money in circulation and sum of goods that can be purchased. The simplest definition is the continuous increase in the general price level and the decline in the value of money, and the fact that the total goods and service offer cannot meet the total demand, in other words, the imbalance can be regarded as the main feature of inflation. Once the inflation starts to increase, the risk of a possible crisis starts to be a threat for the economies. According to the findings, second significant indicator is gross savings that can be defined as the sum of the value of a country's total of goods and services produced for a given year, against a certain currency. Namely, when the value of a country’s goods and services declines dramatically, financial crisis gives the alarm in that country.

On the other side, according to the MARS results, 3 different variables are identified as the indicators of the debt crisis in Greece. First of all, saving amount has a negative influence on the financial crisis. That is to say, in case of high and uncontrolled consumption, there is an important risk of the financial crisis for Greece. Another important indicator of this debt crisis is current account deficit. When the ratio of the current account...
deficit to GDP exceeds 14.47%, it is accepted as the crucial indicator of the financial crisis. Furthermore, when unemployment is higher than 7.024%, it leads to financial crisis for Greece. By comparison these two different results, it is determined that MARS provide better results than probit to predict this crisis. While considering these results, it can be strongly recommended that saving ratio should be higher. In this circumstance, governments should take some actions in order to increase this ratio more than 15.5%. Media channels can be used by the government to tell the people about the importance of the savings to have sustainable economic development.

References

Abbasoğlu, O. F., İmrohoroğlu, A., & Kabukçuoğlu, A. (2019). The Turkish Current Account Deficit. Economic Inquiry, 57(1), 515-536.

Aliber, R. Z., & Zoega, G. (2019). A Retrospective on the 2008 Global Financial Crisis. In The 2008 Global Financial Crisis in Retrospect (pp. 1-15). Palgrave Macmillan, Cham.

Armstrong, H. W., & Read, R. (2018). The impact of the 2008 global crisis on small economies in the Caribbean. Canadian Journal of Latin American and Caribbean Studies/Revue canadienne des études latino-américaines et caribéennes, 43(3), 394-416.

Avcı, M. A., & Altay, N. O. (2013). Finansal Krizlerin Sinyal Yaklaşımı ile Öngörülenmesi: Türkiye, Arjantin, Tayland ve İngiltere İçin Bir Analiz. Pamukkale Üniversitesi Sosyal Bilimler Enstitüsü Dergisi, 14(1), 47-58.

Bekiros, S., Hammoudeh, S., Jammazi, R., & Nguyen, D. K. (2018). Sovereign bond market dependencies and crisis transmission around the eurozone debt crisis: a dynamic copula approach. Applied Economics, 50(47), 5031-5049.

Bell, S., & Hindmoor, A. (2018). Are the major global banks now safer? Structural continuities and change in banking and finance since the 2008 crisis. Review of International Political Economy, 25(1), 1-27.

Borio, Claudio E. V. and Disyatat, Piti, Global Imbalances and the Financial Crisis: Link or No Link? (May 1, 2011). BIS Working Paper No. 346. Available at SSRN: https://ssrn.com/abstract=1859410 or http://dx.doi.org/10.2139/ssrn.1859410

Broome, S., & Morley, B. (2004). Stock prices as a leading indicator of the East Asian financial crisis. Journal of Asian Economics, 15(1), 189-197.

Brumm, J., Georgiadis, G., Gräb, J., & Trottner, F. (2019). Global value chain participation and current account imbalances. Journal of International Money and Finance.

Bucevska, V. (2015). Currency crises in EU candidate countries: An early warning system approach. Panoeconomicus, 62(4), 493.

Bustelo, P., Garcia, C., & Aldasoro, I. O. (2000). Crisis financieras en economías emergentes: enseñanzas de Asia oriental. Agencia Española de Cooperación Internacional.

Caggiano, G., Castelnuovo, E., & Figueres, J. M. (2017). Economic policy uncertainty and unemployment in the United States: A nonlinear approach. Economics Letters, 151, 31-34.

Carmassi, J., Gros, D., & Micossi, S. (2009). The global financial crisis: Causes and cures. JCMS: Journal of Common Market Studies, 47(5), 977-996.

Catullo, E., Gallegati, M., & Palestrini, A. (2015). Towards a credit network based early warning indicator for crises. Journal of Economic Dynamics and Control, 50, 78-97.

CEBECİ, İpek, “Krizleri İncelemede Kullanılan Nitel Tercih Modelleri: Türkiye İçin Bir Probit Model Uygulaması (1988-2009)”, İstanbul Üniversitesi İktisat Fakültesi Mecmuası, 2012, s. 127-146.
Cherp, A., Jewell, J., Vinichenko, V., Bauer, N., & De Cian, E. (2016). Global energy security under different climate policies, GDP growth rates and fossil resource availabilities. Climatic Change, 136(1), 83-94.

Constantinides, G. M., & Ghosh, A. (2017). Asset pricing with countercyclical household consumption risk. The Journal of Finance, 72(1), 415-460.

Corsetti, G., Pesenti, P., & Roubini, N. (1999). What caused the Asian currency and financial crisis?. Japan and the world economy, 11(3), 305-373.

Daniel, V., & Peters, R. (2018). Greece and the media–A qualitative assessment of the media impact on credit conditions in the Greek debt crisis. Journal of Sociocybernetics, 16, 70.

DesJardine, M., Bansal, P., & Yang, Y. (2019). Bouncing back: Building resilience through social and environmental practices in the context of the 2008 global financial crisis. Journal of Management, 45(4), 1434-1460.

Di Maggio, M., Kermani, A., Keys, B. J., Piskorski, T., Ramcharan, R., Seru, A., & Yao, V. (2017). Interest rate pass-through: Mortgage rates, household consumption, and voluntary deleveraging. American Economic Review, 107(11), 3550-88.

Dincer, H. (2015). Profit-based stock selection approach in banking sector using Fuzzy AHP and MOORA method. Global Business and Economics Research Journal, 4(2), 1-26.

Dincer, H., & Hacioglu, U. (2015). A comparative performance evaluation on bipolar risks in emerging capital markets using fuzzy AHP-TOPSIS and VIKOR approaches. Engineering Economics, 26(2), 118-129.

Dincer, H., & Hacioglu, U. (2017). Investigating the Economic Vulnerability Factors of Emerging Markets After the Global Financial Crisis of 2008 With a Hybrid Multi-Criteria Decision-Making Approach. In Handbook of Research on Economic, Financial, and Industrial Impacts on Infrastructure Development(pp. 313-333). IGI Global.

Dincer, H., Hacioglu, U., Tatoglu, E., & Delen, D. (2016). A fuzzy-hybrid analytic model to assess investors' perceptions for industry selection. Decision Support Systems, 86, 24-34.

Dincer, H., Uzunkaya, S. S., & Yüksel, S. (2019e). An IT2-Based Hybrid Decision-Making Model Using Hesitant Fuzzy Linguistic Term Sets for Selecting the Development Plan of Financial Economics. International Journal of Computational Intelligence Systems, 12(2), 460-473.

Dinçer, H., & Yüksel, S. (2018). Financial sector-based analysis of the G20 economies using the integrated decision-making approach with DEMATEL and TOPSIS. In Emerging trends in banking and finance (pp. 210-223). Springer, Cham.

Dinçer, H., Hacioglu, Ü., & Beyaztaş, F. (2015). Financial Problems of the Small-and Medium-Sized Enterprises and Solution Suggestions. In Handbook of Research on Developing Sustainable Value in Economics, Finance, and Marketing (pp. 355-372). IGI Global.

Dinçer, H., Hacioglu, Ü., & Yüksel, S. (2016). The Impacts of Financial Variables on Employment Planning in Turkish Banking Sector. International Journal of Sustainable Entrepreneurship and Corporate Social Responsibility (IJSECSR), 1(2), 1-20.

Dinçer, H., Hacioglu, Ü., & Yüksel, S. (2017). A Strategic Approach to Global Financial Crisis in Banking Sector: A Critical Appraisal of Banking Strategies Using Fuzzy ANP and Fuzzy Topsis Methods. International Journal of Sustainable Economies Management (IJSEM), 6(1), 1-21.

Dinçer, H., Hacioglu, Ü., & Yüksel, S. (2018a). Determining Influencing Factors of Currency Exchange Rate for Decision Making in Global Economy Using MARS Method. In Geopolitics and Strategic Management in the Global Economy (pp. 261-273). IGI Global.
Dinçer, H., Hacıoğlu, Ü., & Yüksel, S. (2018b). Evaluating the Effects of Economic Imbalances on Gold Price in Turkey With MARS Method and Discussions on Microfinance. In Microfinance and Its Impact on Entrepreneurial Development, Sustainability, and Inclusive Growth (pp. 115-137). IGI Global.

Dinçer, H., Hacıoğlu, Ü., & Yüksel, S. (2018d). Conflict Risk and Defense Expenses and Their Impact on the Economic Growth. In Handbook of Research on Military Expenditure on Economic and Political Resources (pp. 1-23). IGI Global.

Dinçer, H., Yüksel, S., & Adali, Z. (2019a). Economic Effects in Islamic Stock Development of the European Countries: Policy Recommendations for Ethical Behaviors. In Handbook of Research on Managerial Thinking in Global Business Economics (pp. 58-78). IGI Global.

Dinçer, H., Yüksel, S., & Adali, Z. (2019d). Determining the Effects of Monetary Policies on Capital Markets of the Emerging Economies: An Evidence from E7 Countries. In Handbook of Research on Economic and Political Implications of Green Trading and Energy Use (pp. 18-38). IGI Global.

Dinçer, H., Yüksel, S., & Kartal, M. T. (2019). The Role of Bank Interest Rate in the Competitive Emerging Markets to Provide Financial and Economic Stability. Ekonomi, İşletme ve Maliye Araştırmaları Dergisi, 1(2).

Dinçer, H., Yüksel, S., & Kartal, M. T. (2019b). The Role of Bank Interest Rate in the Competitive Emerging Markets to Provide Financial and Economic Stability. Ekonomi, İşletme ve Maliye Araştırmaları Dergisi, 1(2).

Dinçer, H., Yüksel, S., & Şenel, S. (2018c). Analyzing the global risks for the financial crisis after the great depression using comparative hybrid hesitant fuzzy decision-making models: policy recommendations for sustainable economic growth. Sustainability, 10(9), 3126.

Dinçer, H., Yüksel, S., Eti, S., & Tula, A. (2019f). Effects of Demographic Characteristics on Business Success: An Evidence From Turkish Banking Sector. In Handbook of Research on Business Models in Modern Competitive Scenarios (pp. 304-324). IGI Global.

Edison, H. J. (2003). Do indicators of financial crises work? An evaluation of an early warning system. International Journal of Finance & Economics, 8(1), 11-53.

Ergüç, E. H., & Ersin, İ. (2019). The Relationships between Public Expenditure and Sectorial Employment in Turkey. BİLTÜRK Ekonomi ve İlişkili Çalışmalar Dergisi, 1(2), 150-168.

Ersin, İ. (2018). İhracata Dayalı Büyüme Hipotezinin Test Edilmesi: MINT Ülkeleri Örneği. Ekonomi İşletme ve Maliye Araştırmaları Dergisi, 1(1), 26-38.

Ersin, İ., & Baş, H. (2019). Güney Avrupa Refah Ülkelerinde Sosyal Harcamalar ve Ekonomik Büyüme Arasındaki İlişkinin İncelenmesi. SGD-Sosyal Güvenlik Dergisi, 9(1), 193-213.

Ersin, İ., & Eti, S. (2017). Measuring the Waste-Conscious and Saving Habits of the Youth in Turkey: The Sample of Istanbul Medipol University. Uluslararası İslam Ekonomisi ve Finansı Araştırmaları Dergisi, 3(3), 41-49.

Eti, S. (2019). The Use of Quantitative Methods in Investment Decisions: A Literature Review. In Handbook of Research on Global Issues in Financial Communication and Investment Decision Making (pp. 256-275). IGI Global.

Fayaz, M., & Kaur, S. B. (2016). Trends, patterns and determinants of Indian current account deficit. Applied Econometrics and International Development, 16(1), 167-186.

Feldstein, M. (2017). Underestimating the real growth of GDP, personal income, and productivity. Journal of Economic Perspectives, 31(2), 145-64.
Felix, D., & Caskey, J. (2019). The road to default: an assessment of debt crisis management in Latin America. Debt and Transfiguration: Prospects for Latin America's Economic Revival: Prospects for Latin America's Economic Revival.

Ferrero, A. (2015). House price booms, current account deficits, and low interest rates. Journal of Money, Credit and Banking, 47(S1), 261-293.

Filippini, M., Greene, W. H., Kumar, N., & Martinez-Cruz, A. L. (2018). A note on the different interpretation of the correlation parameters in the Bivariate Probit and the Recursive Bivariate Probit. Economics Letters, 167, 104-107.

Fişescu, B. (2012). Causes and effects of crises on financial system stability in emerging countries. Procedia Economics and Finance, 3, 489-495.

Fong, J. H., & Leibrecht, M. (2019). Determinants of second pillar pension reforms: economic crisis and globalization. Journal of Pension Economics & Finance, 1-17.

Frankel, J. (1996). Currency Crashes in Emerging Markets: Empirical Indicators, (No. w5437), National Bureau of Economic Research.

Friedman, J. H. (1991). Multivariate adaptive regression splines. The annals of statistics, 19(1), 1-67.

Glick, R., & Hutchison, M. M. (2000). Banking and currency crises: how common are the twins?.

Gogstad, M., Kutan, A. M., & Muradoglu, Y. G. (2018). Do international institutions affect financial markets?: evidence from the Greek Sovereign Debt Crisis. The European Journal of Finance, 24(7-8), 584-605.

Gokten, S., & Karatepe, S. (2016). Electricity consumption and economic growth: A causality analysis for Turkey in the frame of import-based energy consumption and current account deficit. Energy Sources, Part B: Economics, Planning, and Policy, 11(4), 385-389.

González, S., Oosterlynck, S., Ribera-Fumaz, R., & Rossi, U. (2018). Locating the global financial crisis: Variegated neoliberalization in four European cities. Territory, Politics, Governance, 6(4), 468-488.

Gruber, J. W., & Kamin, S. B. (2015). The corporate saving glut in the aftermath of the global financial crisis. FRB International Finance Discussion Paper, (1150).

Hacíoğlu, Ü., & Dinçer, H. (2013). Evaluation of conflict hazard and financial risk in the E7 economies' capital markets. Zbornik radova Ekonomskog fakulteta u Rijeci, časopis za ekonomsku teoriju i praksu-Proceedings of Rijeka Faculty of Economics, Journal of Economics and Business, 31(1), 79-102.

Hall, R. E. (2017). High discounts and high unemployment. American Economic Review, 107(2), 305-30.

Hana, A. H., & AL-GHANI, Y. H. A. (2016). Towards Building an Early Warning Model to Predict the Financial Crises of Jordanian Islamic Banks. Journal of Management Research, 8(2), 48-65.

Helleiner, E., Pagliari, S., & Spagna, I. (Eds.). (2018). Governing the world's biggest market: The politics of derivatives regulation after the 2008 crisis. Oxford University Press.

IMF (International Monetary Fund) (2010), Country Report, Greece: Staff Report on Request for Stand-By Agreement, No:10/110.

Ivanova, D., Stadler, K., Steen-Olsen, K., Wood, R., Vita, G., Tukker, A., & Hertwich, E. G. (2016). Environmental impact assessment of household consumption. Journal of Industrial Ecology, 20(3), 526-536.

Jha, C. K. (2019). Financial reforms and corruption: Evidence using GMM estimation. International Review of Economics & Finance, 62, 66-78.

Kalkavan, H., & Ersin, I. (2019). Determination of Factors Affecting the South East Asian Crisis of 1997 Probit-Logit Panel Regression: The South East Asian Crisis. In Handbook of Research on Global Issues in Financial Communication and Investment Decision Making (pp. 148-167). IGI Global.
Karmakar, Y. (2014). Early Warning Signal System for Economic Crisis: A Threshold and Indicators Approach. Pacific Business Review International, 6(8), 60-70.

Kaufman, R. (2017). Why the US unemployment rate is so high. In Unemployment and Inflation (pp. 155-169). Routledge.

KAUR, Inderjit. "Early Warning System of Currency Crisis: Insights from Global Financial Crisis 2008", IUP Journal of Applied Economics, 2015, 14(1), s. 69-83.

Kruger, M.; Osakwe, P. N. and Page, J. (1998), "Fundamentals, Contagion and Currency Crises:An Empirical Analysis", Bank of Canada Working Papers, No:10, s.1-36,

Kumar, S., & Jia, P. (2019). Financial crisis and persistence: evidence from sticky expectations consumption growth model. Applied Economics, 51(17), 1799-1807.

Lacombe, D. J., & LeSage, J. P. (2018). Use and interpretation of spatial autoregressive probit models. The Annals of Regional Science, 60(1), 1-24.

Lane, P. R., & Milesi-Ferretti, G. M. (2018). The external wealth of nations revisited: international financial integration in the aftermath of the global financial crisis. IMF Economic Review, 66(1), 189-222.

Lauridsen, L. S. (2004). Foreign direct investment, linkage formation and supplier development in Thailand during the 1990s: The role of state governance. The European Journal of Development Research, 16(3), 561-586.

Leimbach, M., Kriegler, E., Roming, N., & Schwanitz, J. (2017). Future growth patterns of world regions–A GDP scenario approach. Global Environmental Change, 42, 215-225.

Lin, T. H. (2009) A cross model study of corporate financial distress prediction in Taiwan: Multiple discriminant analysis, logit, probit and neural networks models. Neurocomputing, 72(16), 3507-3516.

Meyer, M. J., Morris, J. S., Gazes, R. P., Hampton, R. R., & Coull, B. A. (2019). Ordinal Probit Functional Regression Models with Application to Computer-Use Behavior in Rhesus Monkeys. arXiv preprint arXiv:1901.07976.

Mimikou, M. A., & Baltas, E. A. (2013). Assessment of climate change impacts in Greece: a general overview. American Journal of Climate Change, 2(01), 46.

Naqvi, N. (2018). Finance and industrial policy in unsuccessful developmental states: The case of Pakistan. Development and Change, 49(4), 1064-1092.

Naveed, S., & Mahmood, Z. (2019). Impact of domestic financial liberalization on economic growth in Pakistan. Journal of Economic Policy Reform, 22(1), 16-34.

Neaime, S., Gaysset, I., & Badra, N. (2018). The eurozone debt crisis: A structural VAR approach. Research in International Business and Finance, 43, 22-33.

Nonejad, N. (2019). Has the 2008 financial crisis and its aftermath changed the impact of inflation on inflation uncertainty in member states of the european monetary union?. Scottish Journal of Political Economy, 66(2), 246-276.

Ocampo, J. A. (2018). International asymmetries and the design of the International Financial System 1. In Critical Issues in International Financial Reform (pp. 45-74). Routledge.

Offe, C. (2018). Narratives of Responsibility: German Politics in the Greek Debt Crisis. Europe's Crises, 269.

Oktar, S., & Yüksel, S. (2015). Bankacilik Krizlerinin Erken Uyari Sinyalleri: Turkiye Uzerine Bir Uygulama. Istanbul Ticaret Universitesi Sosyal Bilimler Dergisi, 14(28), 37.

Oktar, S., & Yüksel, S. (2016). Bankalarin Turev Urunden Kullanimini Etkileyen Faktorler: Mars Yontemi ile Bir Incelme/Determinants of the Use Derivatives in Banking: An Analysis with MARS Model. Finans Politik & Ekonomik Yorumlar, 53(620), 31.
Oltheten, E., Pinteris, G. ve Sougiannis, T. (2003), “Greece in the European Union: Policy Lessons from Two Decades of Membership”, The Quarterly Review of Economics and Finance, 43, 774-806.

Ozturk, S., & Sozdemir, A. (2015). Effects of Global Financial Crisis on Greece Economy. Procedia Economics and Finance, 23, 568-575.

Özbay, R. D., Dinçer, H., & Hacıoğlu, Ü. (2011). Internet based innovation strategy for the banks in the era of 2008 global financial crisis. International Journal of Business and Social Science, 2(22).

Rathbun, B. C., Powers, K. E., & Anders, T. (2019). Moral Hazard: German Public Opinion on the Greek Debt Crisis. Political Psychology, 40(3), 523-541.

Reinhart, C., & Rogoff, K. (2010). From Financial Crash to Debt Crisis. Cambridge: The National Bureau of Economic Research

Rodionov, D. G., Pshenichnikov, V. V., & Zherebov, E. D. (2015). Currency crisis in Russia on the spun of 2014 and 2015: causes and consequences. Procedia-Social and Behavioral Sciences, 207, 850-857.

Ruščáková, A., & Semančíková, J. (2016). The European debt crisis: a brief discussion of its causes and possible solutions. Procedia-Social and Behavioral Sciences, 220, 399-406.

Selvarajan, S. K., Ab-Rahim, R., & Awg-Marikan, D. A. (2018). Does financial liberalization foster economic growth? Empirical evidence from ASEAN-6 countries. development, 23, 24.

Steinkamp, S., & Westermann, F. (2018). Systemic crisis and growth revisited: Has the global financial crisis marked a new era?. Economics Letters, 170, 50-54.

Sztojanov, E., & Stamatescu, G. (2015). Adaptive Neuro-Fuzzy Model Tuning For Early-Warning of Financial Crises. Journal of Applied Quantitative Methods, 10(2), 53-63.

Sztojanov, Erika and Grigore STAMATESCU, “Early-Warning of Financial Crises Based on Fuzzy Logic”, In Soft Computing Applications, Springer International Publishing, 2016, s. 1109-1118.

Szyszko, M., Rutkowska, A., & Kliber, A. (2019). Inflation expectations after financial crisis: are consumers more forward-looking?. Economia, 170, 50-54.

Uzunkaya, S. Ş., Dinçer, H., & Yüksel, S. (2018). A Historical Analysis of The Economic Development of The USA (1947-2017). MANAS Sosyal Araştırmalar Dergisi, 8(1), 209-222.

Ülgen, F. (2019). Stabilizing Endogenous Instability: Proposals for An Institutionalist Reform of Financial Regulation. Journal of Economic Issues, 53(2), 488-495.

Wade, R., & Veneroso, F. (1998). The Asian crisis: the high debt model versus the Wall Street-Treasury-IMF complex. New Left Review, (228), 3.

Wan, J. (2015). Household savings and housing prices in china. The World Economy, 38(1), 172-192.
Yuksel, S., & Zengin, S. (2017). Influencing factors of net interest margin in Turkish banking sector. International Journal of Economics and Financial Issues, 7(1).

Yuksel, S. (2016a). Türkiye’de Cari İşlemler Açığının Belirleyicileri: Mars Yöntemi ile Bir İnceleme. Bankacılar Dergisi, 96(27), 102-121.

Yuksel, S. (2016b). Bankaların Takipteki Krediler Oranını Belirleyen Faktörler: Türkiye İçin Bir Model Önerisi. Bankacılar Dergisi, 98, 41-56.

Yuksel, S. (2017). Determinants of the credit risk in developing countries after economic crisis: A case of Turkish banking sector. In Global financial crisis and its ramifications on capital markets (pp. 401-415). Springer, Cham.

Yuksel, S., & Zengin, S. (2016). Leading indicators of 2008 global crisis: An analysis with logit and mars methods.

Yuksel, S., Mukhtarov, S., Mahmudlu, C., Mikayilov, J., & Iskandarov, A. (2018). Measuring International Migration in Azerbaijan. Sustainability, 10(1), 132.

Zhang, D., & Broadstock, D. C. (2018). Global financial crisis and rising connectedness in the international commodity markets. International Review of Financial Analysis.

Zoega, G. (2019). Greece and the Western Financial Crisis. Atlantic Economic Journal, 1-14.