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**THE EFFECT OF THE MORTGAGE CRISIS ON
THE U.S STOCK MARKET PRICES
“AN EMPIRICAL STUDY USING THE
HISTORICAL DATA OF THE S&P 500 STOCK
INDEX PRICES “**

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PRICES.

TEZ SAVUNMA SINAVI, İÜ Lisansüstü Eğitim-Öğretim Yönetmeliği'nin 36. Maddesi uyarınca yapılmış,
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ABSTRACT

THE EFFECT OF THE MORTGAGE CRISIS ON THE U.S STOCK MARKET PRICES

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HOURIA MOHAMED

The last financial Crisis is considered the worst economic trouble in the U.S after the great depression in the 1930s. The Housing bubble forced many banks to go bankrupt as most borrowers were unable to pay back the money. Others appealed for help from the Fed to get loans and cover the maximum of their loss. At the same time, the stock exchange market had seen a big decline in its value, especially the U.S stock market. It faced on its own a loss of more than \$7 trillion within a year, which was considered the highest stock market loss at that time. This thesis attempts to: (i) explain the major reasons that led to the financial crisis, (ii) describe the relationship between financial sectors and (iii) apply an empirical study on one of the largest stock indexes in the U.S stock market (Standards and Poor's 500) using a time series analysis.

Keywords: The mortgage crisis, Stock market, Standards and Poor's 500, Effect.

ÖZ

MORTGAGE KRİZİNİN ABD BORSA FİYATLARINA ETKİSİ “S&P 500 HİSSE SENEDİ FİYATLARI GEÇMİŞİNE AİT VERİLERİ KULLANARAK YAPILAN DENEYSEL BİR ÇALIŞMA“

HOURIA MOHAMED

Son mali kriz, 1930'lardaki büyük buhranın ardından ABD'deki en kötü ekonomik sorun olarak değerlendirilmiştir. Emlak Balonu birçok bankanın iflas etmesine neden olmuştur çünkü borç alanlar parayı geri ödeyememiştir. Diğerleri, kredi alabilmek ve zararlarının çoğunu karşılayabilmek için FED'e yardım çağrısında bulunmuştur. Aynı zamanda, borsa piyasasında da özellikle de ABD borsalarında önemli bir çöküş görmüştü. Bir yıl içinde 7 trilyon doların üzerinde olduğu tahmin edilen bir zararla karşı karşıya kalındı ve bu da o zamanki en büyük borsa kaybıydı. Bu tez, (i) bu finansal krize yol açan temel nedenleri açıklamaya, (ii) finansal sektörler arasındaki ilişkiyi tanımlamaya ve (iii) krizin etkisini ABD borsalarındaki en büyük borsa endekslerinden biri olan (Standards and Poor's 500) üzerinde bir zaman serisi analizi kullanarak ampirik bir çalışma ile ölçmeye çalışmaktadır.

Anahtar Kelimeler: Mortgage krizi, Borsa, Standards and Poor's 500, Etki.

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LIST OF ABBREVIATIONS

Abbreviation	Definition
AIG	American International Group
ARMA	Autoregressive Moving Average
CDS	Collateralized Debt Security
CEO	Chief Executive officer
CPFF	Commercial Paper Funding Facility
CRA	credit rating agency
FDIC	Federal Deposit Insurance Corporation
Fed	Federal reserve System
FHFA	Federal Housing Finance Agency
FOMC	Federal Open Market Committee
GSE	Government-sponsored enterprises
IMF	International Monetary Fund
MBS	Mortgage-backed Security
S&P 500	Standards and Poor's 500
SLF	Short-Term Liquidity Facility
TAF	Term Auction Facility
TARP	Troubled Assets Relief Program
U.S	United States

INTRODUCTION

The purpose of this thesis is to contribute in defining and the explaining the main causes leading to the mortgage crisis held at the beginning of the 2008 and study its effect on the U.S market, especially on the Standard and Poor's 500 stock index. The empirical study methodology was applied to define scientifically the fluctuation in the prices of the stock index at that time. A pseudo forecast process was implemented based on a pre-crisis estimation period to investigate the impact of the crisis factors.

To start the study, we need to take into consideration previous studies from the same field, collect and review existing literature, understand the methodologies followed by the researchers and define their limitations.

Objectives of the study

General objective

The main objective is to study the effect of the mortgage crisis on the change of the S&P 500 stock index prices.

Special objectives

Along with the main objective we aim to cover other specific objectives:

1. Understand the events leading to the mortgage crisis.
2. Define the consequences of the crisis on the financial market.
3. Evaluate the changes in the S&P stock prices during the financial crisis.
4. Determine the event causing the degradation in the value of the S&P 500 stock index.
5. Analyze how deep the effect of the crisis extended to the stock market.

Research questions

- What were the events leading to the mortgage crisis?
- What were the consequences of the non-conforming loans on the financial market?

- Did the mortgage crisis effect reach the U.S stock market?
- Was there any remarkable change in the prices of the S&P 500 during the default crisis?
- How could the stock market react to face the meltdown?

Hypothesis

In this research, a theory had been developed by the researcher to examine the relationship between the mortgage crisis of 2008 and the meltdown in the stock market. Thus, based on the reviewed literature, it is possible for the researcher to estimate the relationship between the mortgage crisis of 2008 and the meltdown in the stock market based on experimental evidence illustrated in the literature parts. Since the null hypothesis is the proposition or statistical hypothesis that is tested (Brooks, 2008). The hypothesizes are:

H0: The mortgage crisis has no significant effect on the stock market meltdown.

H1: The mortgage crisis has a significant effect on the stock market meltdown.

Importance of the study

This study attempts to develop a model that can be used to analyze the performance of the S&P 500 stock index pre, during and post to the financial crisis of 2008. The results from this study will be added to the existing literature and facilitates future studies.

This study will also cover the literature of both the mortgage crisis and the S&P 500 stock index price changes.

As we found difficulties in finding previous researches about this subject, in this study, we tried to illustrate, explain and reference every detail to provide future researchers with a valuable file.

The study will support previous propositions were proven correct and add value to them. It will give a clear idea about the cumulative reasons that lead to the crisis and how the market faced it. It also provides a numerical result of the S&P 500 stock index prices changes.

The study will provide scientists with a better understanding of the subject. It will help potential traders to visualize the historical performance of the S&P 500 stock index. It will also allow financial advisors and brokers to understand the sensitivity of making an unappropriated loan and its effects.

Scope of the study

In previous studies, researchers talked about the profitability, credibility, and friability of the S&P 500 stock index in the period after the crisis. They conducted that the drop-in value did not affect negatively since the stock index was strong enough.

The scope of this study is on applying technical analysis on forecasting the S&P 500 stock index prices not only after the crisis but during and after it in reliance to the pre-period. Conceptually, it compares the actual and forecasted values to approve or reject the hypothesis introduced in the previous part for this study. It shed light on the direct impact of the Lehman Brothers collapse in the devaluation of the S&P 500.

CHAPTER ONE

LITERATURE REVIEW

1.1. INTRODUCTION

The latest crisis of 2008 is considered the most significant recession in the last fifty years; it has affected all sectors and spread in nearly every country. We always see the financial crisis combined with the stock market crash as a decrease in economic growth and other social problems.

The shocks in the financial market had a direct impact on the rate of employment; in 2008 the rate of unemployment increased hastily in various countries, in the US almost 9 million workers lost their jobs (JCHS, 2018). The new workers and the newly qualified were the most affected.

This crisis was not easy to prevent or even understand. However, some economists were right on their prognostics. At the pre-crisis time, many economists mentioned the possibility of facing a global crisis in the coming years, some of them have determined the causes to be prevented, and some have approximated.

In 2006, Nouriel Roubini, chairman of Roubini global economics mentioned to the IMF the possibility of facing a recent global mortgage crisis, which has proved it in 2008 by publishing a paper under the title “The Rising Risk of a Systemic Financial Meltdown: The 12 Steps to Financial Disaster”(Cameron Cooper, 2015). Susan Wachter, a professor at Wharton, University of Pennsylvania, explained that all the previous meltdowns were primarily in the banking sector rather than the coming global crisis which will affect the non-banking industries as well (Bianco, 2008).

Ann Pettifor, the director of Policy Research in Macroeconomics, (Cooper, 2015) had also launched a book under the title “The Coming First World Debt Crisis.” (Pettifor,

2006). In his book, which was the best seller at that time, the writer blamed the US federal reserve for supporting the unaffordable loans.

In August 2006, Peter Schiff, CEO and chief policy strategist at Euro Pacific Capital, declared: “The United States is like the Titanic, and I am here with the lifeboat trying to get people to leave the ship ... I see a real financial crisis coming for the United States.” (Cooper, 2015).

1.2.EVENTS LEADING TO THE HOUSING BUBBLE:

The housing bubble started at the begging of 2001 and reached its peak by the end of 2005. This phenomenon did not let any country untouched. The symptoms of this bubble were the unjustified increase in the housing price collaterally with the rise in the mortgage loans volume.

In this chapter, we will be introducing the significant events leading to the housing bubble, their effects on the short-term and long-term run and finally the consequences of this dilemma in bursting the global financial crisis.

There is not only one event that caused the housing bubble, but almost all the economists outbalanced the fact of the decline in house price. By the end of 2005, the real estate market lived through a real disorder in prices, housing starts, and mortgage interest rate.

The story started after the market correction made by the federal reserve, when the former chairman, Alan Greenspan said that they did not recognize the bubble until it widespread (Bianco, 2008).

Going back to the 90s, people were benefiting from the peak in stock prices by making a good wealth. This increase in prices did not stay for a long time and finished by the

stock market meltdown in the late 90s known by the Dot-Com bubble. It forced investors to find an alternative way of spending their money rather than stocks (Baker, 2008).

The real estate was the safest and the most appropriate investment at that time. People had been investing their money on buying new houses even if they do not need them, just for reasons of speculation. That is justified by the increase in the vacancy rate on rents in 2001 when it raised by nearly 3% in comparison to the late '90s (Weaver, 2008).

By 2001, The Fed decided to decrease the short-term interest rate from 6.5% in 2000 to 1.75% in December 2001 (Bianco, 2008). This resolution created a lot of liquidity in the market.

Many financial institutions and Banks did their best to benefit the most from this situation and turn this liquidity into assets. Banks took action and started borrowing short-term loans at a low-interest rate and giving long-term loans at a moderate interest rate to create an arbitrage opportunity.

As the rate of liquidity was too high, banks moved to the stage of giving loans to unregulated people, by issuing subprime, Adjustable-rate, interest-only, and stated income loans. For the subprime mortgage, the borrowers' documentation was over graded by the responsible committee. People benefiting from this category of loans were obliged to pay a higher interest rate than the intermediate and prime borrowers because they were classified as risky investors and the ability to default was too high. In 2007, the percentage of both intermediate and subprime mortgages represented more than half the number of loans. The stated income loans were a type of mortgage where the lender does not check the historical income documentation of the borrower or do not even ask for a proof of income capacities.

The adjustable-rate mortgage is another kind of loan; it spread by the end of 2002 as an alternative for the fixed rate mortgage. It is based on giving the borrowers a teaser rate for a limited period named the initial period, then increase it in a significant way to collect back the missed amount in the previous period. (Bianco, 2008).

Figure 1 represents the evolution of its spread during the period between 2002 and 2007.



Figure 1 : *The adjustable rate mortgages*

Source: Mortgage Bankers Association, National Delinquency Survey

All these kinds of loans gave low-income people the opportunity of possessing a house or even make a small real estate investment. Figure 2 represents the rate of real estate ownership and the subprime share of mortgages in the US in the period between 1993 until 2007.

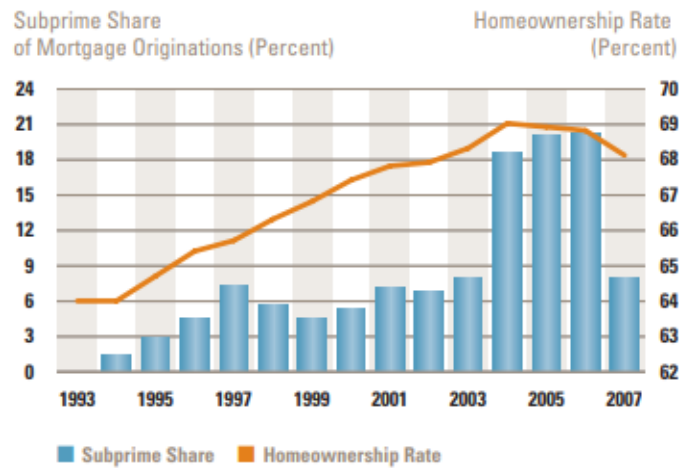


Figure 2: *Homeownership and subprime share mortgages rates*

Source: US Census Bureau, Housing Vacancy Survey; Inside Mortgage Finance, 2008 Mortgage Market Statistical Annual.

From the graph presented in figure 2 above, the homeownership got its high level by the end of 2004 when it reached nearly 70%. For the subprime share of mortgages, we see a remarkable increase in the period between 2004 and 2006. It increased from 1.5% in 1994 to 20% in 2006 (Nation, 2008) which justify the housing boom in 2007.

As we discussed before, the lax of lending requirement and low-interest rates drove housing prices higher. This situation was analyzed by the Fed that posted a report showing the relationship between the interest rate and house price (see figure 3 below).

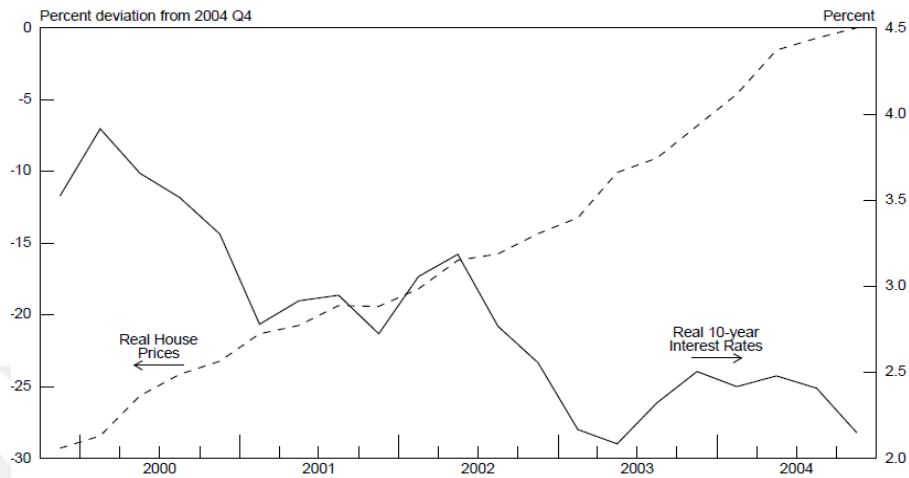


Figure 3: *The relationship between interest rate and house prices*

Source: Federal Reserve System.

Figure 3 shows that the decrease in the interest rates affects the house prices negatively. Regarding Ahearne, Alan G, Ammer, Matthew, Doyle, Brian, and others (2005), In the third quarter of 2000, the percentage of the interest rate started decreasing and reached its lowest value in the fourth quarter of 2003 when the housing boom began. In the same chart, we see a synchronized increase in house prices over the same period of the time. As banks were aware of the risky part of these loans, they did not want to assume the fact that borrowers might default. Therefore, they started making the securitization process for current loans by putting them in a pool of assets regarding the quality and selling it as collateral for a third-party investment (Ferguson, 2010).

The third-party investments in this situation were often investment banks; they took advantage of buying a large number of individuals' loans, bundle them all together, and sell shares of that pool to investors related to their rate of risk. The share securitized of subprime mortgages increased by almost 25% in the period between 2001 and 2006 (Weaver, 2008).

As we introduced before, many loans issued by banks were hazardous, investment bank used to turn to Standard & Poor's (S&P), Moody's, and Fitch Groups as they are the big three rating agencies in the US in order to grade their Mortgage-backed securities. These credit rating agencies also contributed to the process leading to the financial crisis when overvalued assets by giving AAA (the highest rate) to MBSs which contained subprime mortgages which are risky in the first place.

We believe that this action was a “moral hazard” since each part was looking for its interest by collecting profit at the expense of risk. We also saw the interference of mortgage brokers who also did not act conscientiously and ethically; the only goal was getting a high commission since they were not lending their own money.

According to Rugh and Massey (2010), wall street was part of the game by encouraging the packaging loans and selling them to pension funds and others. The worst part was played by investors who bought it; they were either big money or wealthy global investors without financial knowledge, they were focusing on buying more and more of these securities without knowing the risk behind them. In addition to that, they trusted the rating agencies on their evaluating rates, and this encouraged them to purchase more securities and invest their money in. Lenders did not miss this opportunity as well. They created more and more mortgages which made them less and less safe over time.

Over these securities, traders started selling new products; collateralized debt securities which were considered riskier than the MBSs. The rating agencies also rated this kind of securities and sold in correspondence to their risks. As we mentioned earlier, the rating agencies information was not accurate; it was rather biased.

We find that these deregulations and facilities have on one hand encouraged people to buy unconsciously, and on the other hand, inflated the price of houses which was generated by the law of demand and supply. In the period between 1996 and 2005, the

houses' value increased by 124% reaching 2,700,000 (Ahearne, Alan G, Ammer, Matthew, Doyle, Brian, and others 2005).

But the over-supplying and the overpricing of houses could no longer be supported. By mid-2006, the housing prices reached its highest level then began to head down to show an accelerated process through the fall of 2007 when the price fell by 15% from its last peak (Baker, 2008).

After getting the loans, borrowers started facing the monthly obligations that were more than their monthly income. Because of the lack of fund, they started requesting second mortgage loans by asking for an equity loan defaulting.

As a reaction to the increase in the number of loans and houses sold in the United States, the Fed decided to increase the interest rate successively from 1% in June 2003 to 5.25% in 2006. The decline in the house prices affected the, and as a result, they faced voluntary and involuntary foreclosure (Baker, 2008).

1.3. DURING THE HOUSING BUBBLE

As mentioned in the previous section, the house prices have seen inflation starting in 2001 (JCHS, 2018), the fed stated that this increase was sending shocks waves to the market and started looking for effective policies to deflate the value. The rise in the interest rate was the first decision made.

Regarding the emergency economic stabilization act (Shah, 2008) , the Fed had risen in between the periods of 2004 and 2006 the interest rate seventeen times.

The new policies were surprising for borrowers, especially those who had been taking loans at an adjustable rate. As the rate of interest rate increased, the adjustable monthly

debt obligation had risen as well. The new amounts could not be afforded by all income levels of the subprime borrowers.

By the second quarter of 2006, the value of the national house price index reached its peak at the amount of 183.24 (“national-home-price-index,”) then began to decrease once again. Borrowers realized that their debt obligations are much higher in term of value than the houses they hold, so they started defaulting on their loans (Mayer, Pence, and Sherlund, 2009).

This reaction had increased the number of houses backed to the market which created a free fall in the housing market (Bianco, 2008). The *National Delinquency Survey* had shown that more default rate was increasing in a markedly way (Herbert and Apgar, 2012)

The situation started exacerbating when supply went up, and demand went down. A collapse in home prices followed this situation. Homeowners started facing foreclosure; for some of them, dropping payment was the best solution since their equities were lower than their obligations. The Fed declared in one of its semiannual reports issued in April 2008 that this strategy followed by borrowers could lead to losses estimated by 564 billion dollars.

Goldstein and Urevick-Ackelsberg (2008) stated that the story behind the collapse had spread over all financial sectors which pushed the financial institutions and investors to stop buying MBSs and CDSs from banks. The same period had also seen an increase in the default rate when borrowers started facing their monthly payments.

Another major player in the crisis burst was the credit default swaps, may financial institutions hold on their books this kind of unregulated over the corner derivative. It was estimated by \$45 billion before 2008. This type of assets insures the buyer against any default until the maturity date. In the case of any default, the lender pays the borrower both the premium and interests until the maturity date. Insurance companies

often ensure this risk, American Insurance Group (AIG) was one of them that insured exclusively the investment bank Lehman Brothers. AIG had lost \$99.2 billion during the crisis and bailed out by the government on September 16, 2008 (Kim, 2014).

All these bad bets, manipulations and unregulated decisions threw in a very complicated web of assets, liabilities, and risks. The collapse circulated in all the financial systems.

No one knew what was happening exactly; the complicated and unregulated assets on the financial institutions' balance sheets made the situation unclear.

Some major financial institutions declared bankruptcy, and others got the way of mergers.

Panic sat in, trading and credit markets froze, and the stock market crashed. The US economy as one of the tops economies in the world found itself in a disastrous recession (JCHS, 2018).

1.4. TIMELINE OF CONSEQUENCES OF THE BUBBLE OVER THE FINANCIAL MARKET

The reaction policies of the U.S government face to these consequences were very similar to those taken during the great depression in 1929.

Amadeo (2019) stated that from the first quarter of 2007, the financial sector was considered as unsettled. The effects of the crisis started appearing. The Fed's chairman, Alan Greenspan, predicted an occurrence of recession by the end of 2007.

The story started showing its effects on February when the Federal Home Loan Corporation **Freddie Mac** decided to stop being a jeopardize by taking risky mortgages(Griffith, 2014). This decision came after the soared in subprime mortgages.

As we have discussed in previous parts, the number of foreclosures in the market was justified by the unregulated loans, both S&P's and Moody's rechecked their historical grades over the subprime mortgages and downgraded almost 100 bonds.

The Federal Open Market Committee (FOMC) in a press conference announced that it is going to increase the federal fund rate to 5.25% (Reinhart and Rogoff 2009). Some economists rely the peak of the home sales at that period to this decision. Four months later, it reduced it by 50 to face the meltdown in the market (Wheelock, 2018).

Many banks and other financial institutions that were considered too big to fail had resorted to the government to bail them out. The U.S government faced this by injecting money into banks to prevent collapses. Another program was enacted by the Fed chairman Ben Bernanke and the U.S Treasury Secretary Henry Paulson, the Troubled Assets Relief Program (TARP), where \$ 700 billion were earmarked to shore up the banks. It ended up spending \$250 billion bailing out the banks and expended later to help AIG and homeowners (Kim, 2014). In combination with lending by the FED, this program helped stop the cascade of panic in the financial system (lucca and Trebbi, 2009).

The domino effect had begun to spread from one institution to another. The historical data shown that the first week of March was not lucky for the stock market (Mauro F. Guillén, 2007); it had been the worst week of the year where the most popular index Dow Jones Industrial Average lost 600 points from its last peak on February the 20th. The run-up in the bubble also forced the Bear Stearns to liquidate two hedge funds in July 2007. With regard to Lifland (2007), the degradation could not be supportable after the change in the decision of the lending money by the Federal Reserve Bank of NEW YORK, on March the 16, 2008, Bear Stearns declared its merge with JPMorgan.

Regarding Larry Elliott (2011), the panic went globally when the BNP Paribas, the largest bank in France stopped activities in three hedge funds as a result of an overvaluation of derivatives. The spread into banking systems had promoted waves of scare in the baking system, an overnight lending stopped, and banks stopped the

interbank activities to avoid getting bad debt in their books (Larry Elliott, 2011). The Fed launched a new innovative program called The Term Auction Facility (TAF) to create liquidity in the market. The benefit of banks did not last too much since they were paying loans by getting a loan (Guillén, 2007).

By December 2007, RealtyTrac end of year report posted with references an increase of 97% in foreclosure rate in the period between December 2006 and 2007 (Thaden, 2011). The rate was estimated to be higher the following period since the default in mortgage loans was increasing rapidly (Amadeo, 2019). The gradation of events had also led to a decrease of 1.12% in the house process Median (Jan, 2011).

The year of 2007 was over, but the decline in the market persisted. On January 11, 2008, Bank of America decided to buy Countrywide Financial for nearly \$ 4 billion in stock (Carolina, 2008).

On the 22nd of January, the FOMC voted to cut 70 basis from the fed funds rate in a way to contain the widespread of the bust. One week later, 50 basis were additionally reduced (Reinhart and Rogoff 2009).

The president of America at that time, Bush, had enacted a law of Tax rebate under the Economic Stimulus Act (Davig and Leeper, 2008). Individuals that their liabilities were less than what they have already paid in term of taxes were lucky by this law.

On March the 11th, the Fed issued approximately \$220 billion in bonds to save those dealers suffering from unsold MBS's, CDS's and credit default swaps. The excess in such assets blighted the credit market (Amadeo, 2009).

March 24, nearly one year from the decision of JPMorgan on purchasing Bear Stearns. The Fed launched policies to facilitate the transaction.

From April to June, the FOMC kept reducing the fed funds rate until it reached 2% and the Fed expanded TAF auctions to \$ 75 billion.

Facing all these changes in rates and policies, investors and traders lost confidence in the debt instruments; this absence of trust reigned the market. The chain of collapse began to fill up again.

IndyMac, Ex largest savings and loans association, declared its fail on July 11; and confiscated later by the United States Federal Deposit Insurance Corporation (FDIC) (Adler, 2009) .

Regarding Ivashina and Scharfstein (2010) the month of September 2008 was the most critical period in the history of the mortgage crisis many banks and financial institutions went bankrupt; others were nationalized. The stock market also saw significant changes and crushes.

On September 7, the Federal Housing Finance Agency (FHFA) stated that both Fannie Mae and Freddie Mac must be under the auspices of the government until their recovery. The U.S treasury accepted this decision under three main workable agreements (Griffith, 2014).

The day of September 15 assisted two crucial events that drew the path of the crisis. The American bank declared its willingness to buy the Merrill Lynch & Co and the Fed dropped its promises on giving the Lehman brothers loans; this last went bankruptcy regards to Swedberg (2010).

From this date, the U.S economy started collapsing, September 26 experienced the biggest collapse of the U.S bank, Washington Mutual. Other banks changed their status to be bailed out by the Fed, Goldman Sachs was one of them. On September 29, the

stock exchange faced the worst one-day point drops, the House of Representatives refused the TARP submitted by Henry Paulson. In response, the largest indexes dropped in value; Regarding Rastogi (2014), Dow Jones lost approximately 770 points, S&P 500 nearly 8.81% which represents the 7th worst day during the crisis.

To face this crush and avoid the recession of the market, the Fed increased its swap lines with central banks of other countries such as England, Japan, and European countries (Amadeo, 2009). By October the 3rd, the Congress finally passed a version of the TARP, and President Bush signed it. This action gave Treasury the qualification to buy troubled shares.

Besides, new commercial papers appeared, the Commercial Paper Funding Facility (CPFF). It was created by the federal reserve board in intention to provide more liquidity in the short-term.

October 29, The International Monetary Fund (IMF) created a new program; the Short-Term Liquidity Facility (SLF) which aim to provide more liquidity for countries touched despite their strong economy (J. Adler, 2009).

November 12, Henry Paulson announced the negative decision of the U.S treasury on buying illiquid mortgage-related assets using the TARP funds.

November 25, the Fed launched the Term Asset-Backed Securities Lending Facility (TALF), which guaranty the lending of \$200 billion for the triple-A assets backed securities holders. It had also covered some credit cards, students, and cars debts that came to a stalemate (Amadeo, 2009). It also launched a new program that allows the Federal Reserve Bank to purchase mortgage-backed securities from The Government-sponsored enterprises (GSEs)

December 11, the National Bureau of Economic Research stated that December 2007 was the period on which the last peak in the U.S economy happened. December 16, the FOMC voted to reduce the fed funds rate to almost 0% the lowest in history. In response, the fed decreased the primary credit rate to reach 0.5%.

Another year passed, but the breakdown did not stop. On January the 5th, the federal reserve bank started practicing its program on purchasing obligations from GSEs proclaimed on September 25, 2008.

Banks had declared a wide loss since the beginning of 2007. During intermittent phases of January, the U.S Treasury put in place the capital purchase program to purchase a total of \$ 7.676 billion in preferred stock.

February 17, in response to the great recession, a massive stimulus package was signed by the new president of U.S, Baraka Obama (Act, 2011). This American Recovery and Reinvestment Act of 2009 was the largest reaction made in the economic recovery history of the U.S. It was exclusively launched to support sectors suffering from the crisis by adding almost \$780 billion in total. Its major policies were The Making Homes Affordable Program, cutting taxes, boosting unemployment benefits, reducing taxes on car sales, recovering students' loans and many other sectors.

February 18, Obama launched a new plan "The Homeowner Affordability and Stability Plan" to stop the foreclosure. It was designed to refinance home mortgages mainly guaranteed by Fannie Mae and Freddie Mac as they represented 75% of the total underlying assets.

Another black Monday bear since the great depression; March 03 was not lucky neither for the Dow Jones that dropped by 53% from its last peak nor for the S&P 500 which marked its lowest value since 1996 (Antila, 2011).

May 8, the FHFA, conservator of Fannie Mae since September 7, 2008, asked the U.S Treasury for \$ 19 billion to cover its expenses. May 8, FHFA appealed the U.S Treasury to pay off the \$19 billion due to Fannie Mae under a previous agreement. This appeal came after a report made by Fannie Mae where it declared a loss of \$ 23.2 billion at the beginning of 2009.

August 20, S&P 500 closed above 1,000 for the first time since November 4, 2008.

September 14, the launch of the “The Next Phase of Government Financial Stabilization and Rehabilitation Policies” report, it announced the ending of the first stage and put into consideration new policies for the following periods.

October 14, Dow Jones Industrial Average closed above 10,000 for the first time over one year regarding Healy (2009).

1.5. THE LEHMAN BROTHERS' EVENT

Many studies assumed that the collapse of the Lehman Brothers was a substantial factor in increasing the degradation of the financial system.

Lehman Brothers Inc was one of the largest global financial services firm before the financial crisis in 2008. The firm faced a significant loss because of the high amount of leverage, lack of liquidity and the profound contribution to mortgage securities. During the crisis, the responsible and the government could not recover this loss which finished by bankruptcy just after the negative response of the treasury secretary Henry Paulson on September the 15th, 2008 (Becchetti and Ciciretti, 2011).

A report submitted by the court-appointed examiner stated that the Lehman executives were making some makeups at the end of each quarter of the year to make the balance sheet adjusted (Fleming Sarka, 2010) which mislead the final picture of the current situation and lead to the collapse as well.

Many economists and politicians agreed that the collapse of the Lehman Brothers had deteriorated the financial sector. According to the economist Robert Lucas, “Until the Lehman failure, the recession was pretty typical of the modest downturns of the post-war period. After Lehman collapsed and the potential for the crisis had become a reality, the situation was altered entirely.” Swedberg (2010).

In one of the studies, Becchetti and Ciciretti (2011) explained the reaction of the stock market on the financial crisis by highlighting the Lehman Brothers collapse as a path-breaking event.

The study shows that the Lehman Brothers manipulated significant illiquid assets face to its liabilities which put it in a risky position. Adding to that, Lehman’s contributed highly to the process of securitization of mortgages with 246 billion dollars between 2006 and 2007.

The asymmetric information had also been a factor of the collapse when people were transmitting their predictions for the collapse of the firm, and the share prices had fallen. Until September 15, 2008, many solutions had been implemented in an attempt to solve or improve the situation, but the gap was much more significant.

At the event day, many financial systems had been affected negatively; the author shows this panic in one of the best-performed stock indexes; the S&P 500 which devaluated by 4.7% from its previous value, and that was the starting point of the burst.

1.6. THE PREVIOUS RESEARCH ABOUT THE CREDIBILITY OF THE S&P 500.

In this research (Fahad Balubaid, 2015), the researcher hypothesized that the S&P 500 index did lose its credibility and profitability during and post to the financial crisis of 2008; especially in the period between 2007 and 2008. To approve this hypothesis, he tested it using the two types of methodologies: the quantitative and the qualitative. The research question used for this study was “Whether S&P is a useful and profitable index.”

In this study, the positivism method was used to analyze the objective criteria's' as part of the quantitative methodology, and the subjective method as part of the qualitative methodology.

The analysis was carried out by studying the changes in the S&P 500 value over the crisis period and compare it to Dow Jones Industrial Average which is one of the largest U.S stock markets. The model created will also study the effect of removing some companies from the S&P index since some companies had a deeper relationship with the crisis than others.

The descriptive and inferential analysis introduced by Healey (2012) had been used to show the result obtained. Fahad Balubaid (2015) selected the Dow Jones Industrial average as a dependent variable and the S&P as an independent variable where the results show us how the two variables are moving in the same direction and with an equal level. The linear regression and the Black-Scholes model were used to examine the changes in the different values of variables. The results were shown in graph lines and Scatter-plots. All the analysis was done using the packages Stata.

While analyzing the available figures, the researcher observed a high increase in the S&P value before the crisis, and it did not respond instantly to the crisis. The following

year, the value dropped rapidly and lost almost 50% in comparison to its last peak value. The hedge exercised at that time explained the delay in devaluation.

The S&P and other well-known indices started showing a decline in value; many investors switched to more safety investment like government debt.

The analysis had focused on monthly data for the period between 01/2004 and 09/2014; the linear regression shows a very close relationship between the S&P 500 and the DIJA which explain the same perspective for each of them.

According to the author, it is quite challenging to identify the value of any stock, investment, company or other from just one side. Therefore, a set of factors (price/book value ratio, price/cash flow ratio, and price/earnings ratio) had been selected to analyze the S&P and prepare a more reliable platform to make the best decision in the future. The result of each of them are shown as follow:

For the earnings and dividends part, it states that the earnings show some dips, but this did not affect the increase of distribution in dividends from the S&P. Only in the period of the 2008 crisis, the decline in earnings followed by a decrease in the dividends as well. This situation took three years to be backed up.

For the price/book value, the S&P has lost its credibility in the 2008 crisis comparing to the period of 2000 where the market was willing to pay five times the equity per shares value. While during the crisis, it dropped to 1.8 and it started to increase in a very slow range.

The researcher Fahad Balubaid (2015) concluded that the crisis did not necessarily cause the decrease in the price to book value, it might be affected by other factors that keep it in a stable range regarding the value in the crisis period.

The earnings growth is also a factor of credibility as the author assumed, the results stated that the S&P had got a negative value mainly in the Black Monday, 1987 even

during the Dot-Com bubble and the last degradation in value recorded in the 2008 crisis where the earning rate decreased to -90. It had also shown the speed in recovery in less than one year.

The last factor analyzed by the author is the dividend yield of the S&P 500 which represent the value of money paid against the worth of the stock, the period of the study was between 1884 and 2014. The results illustrated the two main crashes in the history of the stock market, the great recession of 1939 and the black Monday, in both cases the value of the dividend yield increased just after the crash. The troughs explained this increase in the stock prices.

The conclusion obtained from the indicators analysis is that the S&P 500 is a secure index that provides the best performance even in pivotal situations. It ensures profitability for the holders and flown off rapidly.

In conclusion, the author shows the results that approve his hypothesis. He states that the index during the financial crisis dropped in value for a short term then risen back to its normality in a short period of time. He defends his hypothesis that the index had been affected by the crisis as any other declines in some critical period and gave some examples from history, the significant drop in value during the second world war and during the invasion of South Korea by North Korea where the index dropped by 30%.

All the explanations and results presented lead to reject the idea which assumed that the S&P 500 did lose its credibility and usefulness in the long term. At the end, the author rejected the ideas presented by other researchers trying to say that the S&P did benefit from the crisis and made a profit, he illustrated this by comparing the index's performance with DIJA.

1.7. S&P GLOBAL INC

S&P Global, Inc is an American publicly listed company, known by McGraw Hill financial, Inc in 2016 and McGraw Hill companies in 2013.

It is known in the market by its financial information and analytics services. It has three main elements (see Figure 4 below):

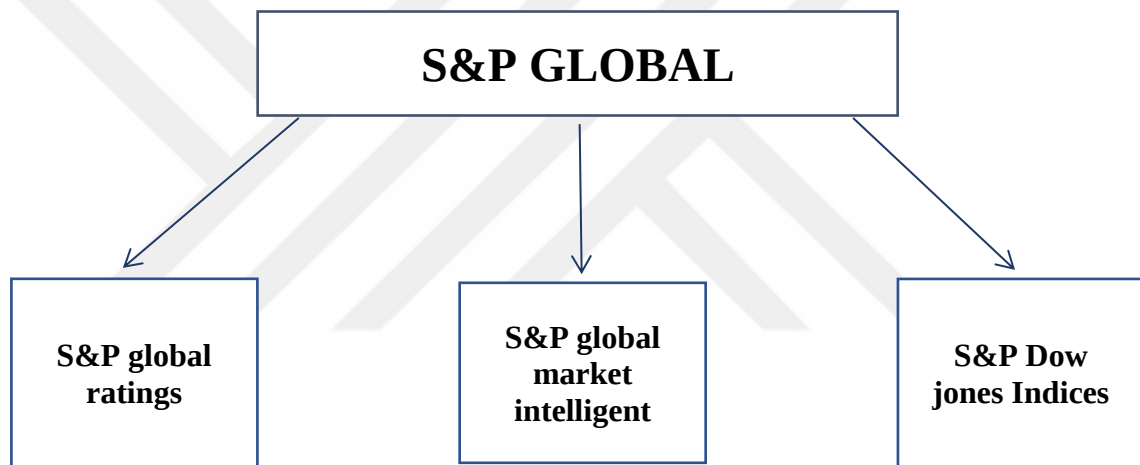


Figure 4: Diagram of the S&P Global Branches

1.7.1. S&P Global Ratings

It is a credit rating agency (CRA) represented in 28 countries around the world. It is considered as one of the three biggest CRAs; its purpose is to determine short and long-term ratings for the debt of both public and private borrowers as well as companies. It grades the credits on a scale from Aaa to D for the long-term and from A-1 to D for the short term depending on the borrower's ability to pay back their lenders.

The U.S. Securities and Exchange Commission¹ has considered the S&P global rating agency as one of the national rating organizations in the U.S.

This kind of agencies had a critical role in the mortgage crisis of 2007, where many debts had been mis-rated in terms of default possibilities. Further details will be introduced in the literature review.

1.7.2. S&P Global Market Intelligent

It is a platform which helps investors in finding companies, investors, markets and people all over the world. It provides them with historical and real-time financial data to adapt them to the changes over time in the market. It also proposes research and other intelligent facilities. All these services are provided to make the investor's decision more manageable.

1.7.3. S&P Dow Jones Indices

It is a Joint venture between S&P Global, CME Group and New Corp. It represents a pool of the most significant worldwide indices that display approximately 835,000 indices. The index follows a pack of sectors, assets, and markets to supply investors with a single value which summarize all the fluctuations over a particular selection.

It manages the Dow Jones transportation index that goes back to 1882, this makes it the oldest index in the history of the U.S. It also leads the two largest indices in the US, S&P 500 and Dow Jones industrial average (DJIA).

1.7.4. Standard and Poor's 500 Index

¹ an independent federal government agency responsible for protecting investors, maintaining fair and orderly functioning of securities markets and facilitating capital formation.

Standard and Poor 500, or S&P 500 is one of the most significant stock market indexes in the U.S. It tracks 500 components that are strictly selected by the index committee and within some specific criteria. All these companies are listed in both NYSE and NASDAQ.

S&P 500 is a large-cap² index that deals with more than \$5 billion. This characteristic gave it the aptitude to be a benchmark in the U.S market.

Over the last ten years, the S&P 500's return had been estimated by almost 9.5% and has reached 23% by the end of 2017. The name of standard and Poor had been introduced in 1941 when the Poor's company founded by Henry Varnum Poor in 1860 agreed to merge with the Standard statistic based in 1906. The company started by providing financial information and analysis, and in 1957 it merges into the stock market.

In 1923, Peer's had launched the first stock index under the name of "composite index". It reached 90 stocks in 1926. Along with the standard statistic, the stock took the name of the Standard and Poor corporation and expanded its shares to 500 by 1957. Figure 5 represents the distribution of the S&P 500 stock prices since its launch.

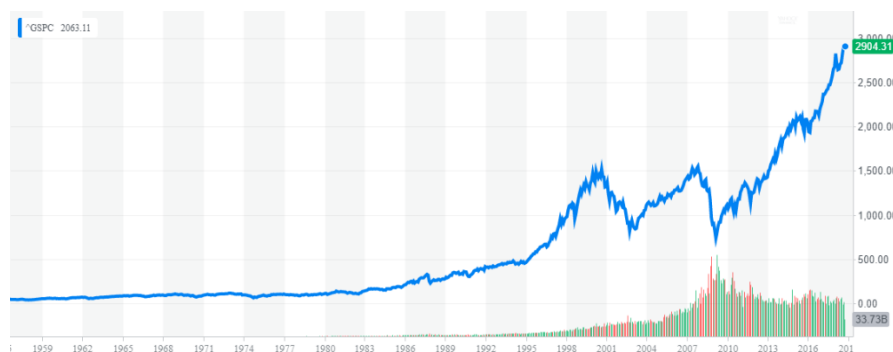


Figure 5: The distribution of the S&P 500 Stock prices from 1957

Source : <https://finance.yahoo.com/>

²Refers to a company with a market capitalization value of more than \$5 billion.

S&P 500 provides three types of indexes: (1) the price index which does not account the dividends part, (2) the total return that show the effect of the dividends reinvestment and (3) the net total return that deduct the taxes from the returns obtained.

The S&P 500 is weighted by the float-adjusted market capitalization since 2005. It is determined by dividing the market capitalization of an underlying company by the total market capitalization of the index. Its changes according to the value in the component's values.



CHAPTER TWO

METHODOLOGY

2.1.INTRODUCTION

In this chapter we will define the methodology followed while carrying out our research. We will also focus on explaining the research design, the data collection, the methods applied, and how the inputs are analyzed and reported.

2.2.RESEARCH DESIGN

In this research, we conducted a quantitative time series forecasting method to analyze the S&P 500 stock index.

Our analyses are based, first, on descriptive statistics to measure the changes that occurred over our series. The sample in this part was divided into three periods: pre-crisis, during the crisis and post- crisis with the same number of observations for each set.

Then, an Autoregressive Moving Average Model was applied. This type of research design analyzes all the historical data values, build an appropriate model to generate the past data and finally forecast the future values. All results are reported based on statistical tests and measurements. Our data were generated through the EViews 9 software.

2.3.DATA COLLECTION

This research treats the S&P500 stock index, one of the broad market capitalizations in the U.S equity market.

To achieve the goal of this study, a historical time series data was collected. It is a secondary data gathered from an international trading website “investing.com”.

The data is composed of six components namely, open price, high price, low price, closing price, volume and percentage of changes in the price. To achieve consistency, the closing price is used in this study.

The data was collected for the period 01/04/2004 to 01/05/2014, which covers the periods of pre, during and after the mortgage crisis. In this study, the pre-period is defined from 07/16/2006 to 7/15/2007, and the periods during and post are from 9/14/2008 to 01/05/2014.

As discussed in the literature review, the collapse of Lehman Brothers was a breakpoint for many financial institutions. It also caused a drop-in value of many stock indexes. In this study, we will see if this event had any significant effect on the S&P 500 stock closing price index.

2.4.CONCEPTUAL FRAMEWORK OF BOX-JENKINS MODEL

According to Kirchgässner, Wolters and Hassler (2008) the steps followed to forecast the S&P 500 STOCK price index are shown in figure

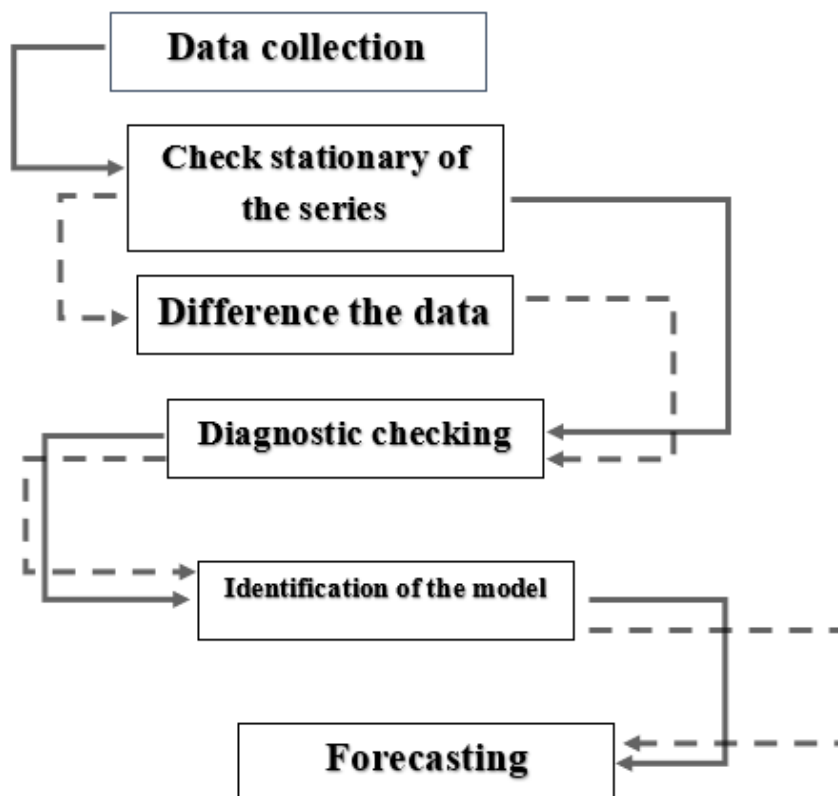


Figure 6: *Conceptual Framework of BOX-JENKINS MODEL*

CHAPTER THREE

DATA ANALYSIS AND PRESENTATION OF FINDINGS

3.1. INTRODUCTION

This section presents the analysis and discussions made by the researcher about these findings. The data is then interpreted in relation to the research objectives.

3.2. DESCRIPTIVE STATISTICS

In this section, we present the descriptive statistics of the raw data. The aim is to provide a better understanding of data's features for the analysis before introducing our regression analysis. This method gives (i) the values of the central tendency using the mean and the median, (ii) the measure of dispersion using the following values: range, variance, Standards deviation, minimum, and maximum, (iii) the normality of the data based on the Jarque-Bera test.

To reach our aim behind this section, we need to divide the data into two parts for analysis:

First, all periods from 01/01/2004 to 01/05/2014 are examined, with a total observation of 523. Second, the data is divided into three different periods according to the stock crisis with the same number of observations then analyzed:

- Before the stock crisis: from 07/16/2006 to 7/15/2007
- During the stock crisis: from 9/14/2008 to 09/13/2009
- Post the stock crisis: 02/13/2011 to 02/12/2012.

The results are, then, compared. Table 1 illustrates the results of the first part.

Table 1: Descriptive Statistics in S&P 500, all the period.

The period between 01/04/2004 and 01/05/2014.	
Central tendency	
Mean	1274.694
Median	1268.250
Measure of dispersion	
Variation	0.16287
Standards Deviation	207.6184
Maximum	1842.370
Minimum	683.380
Measure of normality	
Skewness	0.128102
Kurtosis	3.275107
Jarque-Bera	3.079678
Probability	0.214416

The results in table 1 show that the minimum value the S&P 500 stock price reached was 683.380, which represents nearly a third of the maximum value. From the value of the standards deviation, we can say that most of the observations lie between -207.6184 and +207.6184 from the mean.

Regarding the normality measurement results, this data is fairly symmetrical with skewness value equal to 0.128102 and leptokurtic distribution with Kurtosis >3. The Jarque-Bera test measures the difference between the Skewness and Kurtosis measurements for each of these variables with those of the normally distributed variable. The probability of the Jarque-Bera test for our data is below the significance level of 0.5. with P-Value= 0.214416, we cannot reject the null hypothesis. Our data is normally distributed (see figure 7 below).

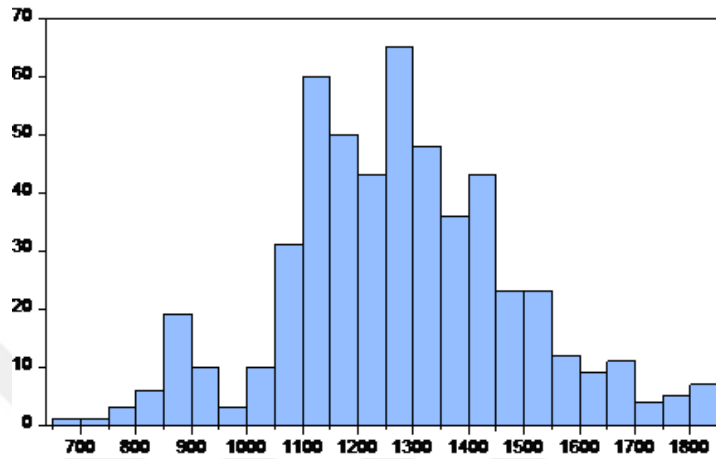


Figure 7: The distribution of the S&P 500 stock closing price index, All the period

Source: Own calculations

Second, we introduce the three periods separately, results are shown in table 2.

Table 2: Descriptive Statistics in S&P 500 stock closing price index, three periods.

	Before the crash	During the crash	After the crash
Central tendency			
Mean	1414.318	912.4870	1272.221
Median	1418.300	890.3500	1285.090
Measure of dispersion			
Variation	0.057107	0.115733	0.053252
Standards Deviation	80.76705	105.6052	67.74850
Maximum	1552.500	1255.080	1363.610
Minimum	1240.290	683.38000	1123.530
Measure of normality			
Skewness	-0.208623	0.890107	-0.683709
Kurtosis	2.209781	4.790750	2.332596
Jarque-Bera	1.763411	14.08022	5.112867
Probability	0.414070	0.000876	0.077581

From the results presented in table 2 above, we see that the S&P 500 stock index reached its lowest mean, median and closing price during the period of the crisis.

Both the mean and the standard deviation over the three periods are different. To be able to compare the spread of the data, we need to exploit the coefficient of variation. The period during the crisis has the highest value of variation, 11.57% to the mean. This explains that the data set over this period is more spread out comparing to the pre and post crisis.

We also see that the value of variation for both periods, before and after the crisis are almost the same; this explains the stability of prices in the normal period for the S&P 500 stock index.

The analysis gives us also information about the distribution of the series. The period before the crisis shows that the data was symmetrical and short of distribution.

During the crisis, the data was moderately skewed right, means that most the values are spread in the right side. The kurtosis value is higher than three which is justified by a high peak. In this period, the number of times the stock index was priced less than the average was greater.

Finally, the after-crisis data distribution was negatively skewed; most variables were situated on the left side of the histogram. It was also short of the tail with the kurtosis less than 3. Figure 8 below, shows the different distributions introduced above.

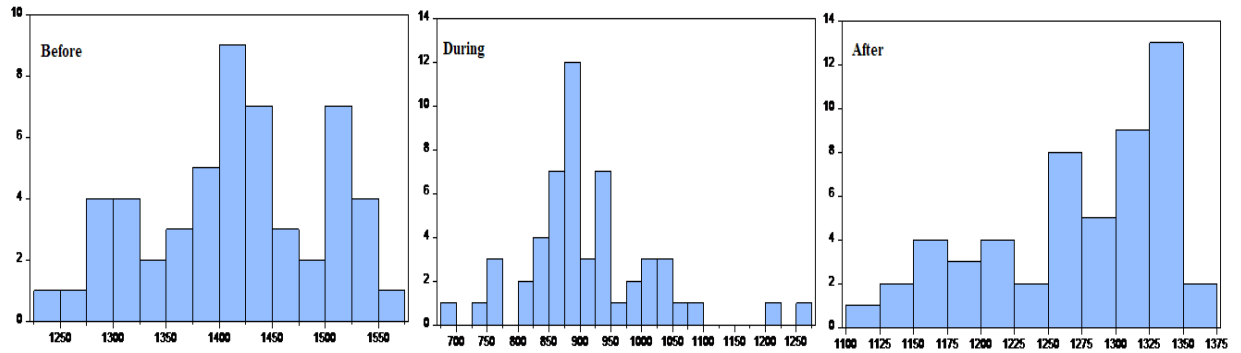


Figure 8: *Histograms of the three periods*

Source: Own calculations

By comparing the result of the three periods, we conclude that the S&P 500 stock index was remarkably affected by the crisis as other sectors, but it recovered in the period it followed.

3.3. ANALYTICAL MODEL

As introduced in the previous section, the S&P 500 stock index got its piece of degradation in the mortgage crisis period.

In this section, a regression analysis is presented using the ARMA model; it is followed by a stock forecast to compare the real values with the forecasted ones.

In this part, we are trying to strengthen the result included in the descriptive statistics. The tool used for the implementation is EVIEW statistical software version 9.

The ARIMA model, known by BOX-Jenkins model was introduced by the Statisticians George Box and Gwilym Jenkins in 1970 (Kirchgässner, Wolters and Hassler, 2008). It applies either autoregressive moving average (ARMA) model for the stationary series or

autoregressive integrated moving average (ARIMA) model for the non-stationary series to identify, estimate and diagnose an event over a specific period depending on the historical data. The forecasted value depends on previous values of time series plus past errors terms. The ARIMA (p, d, q) model is presented as followed:

$$y_t = \mu + \varphi_1 y_{t-1} + \dots + \varphi_p y_{t-p} + \theta_1 e_{t-1} + \dots + \theta_q e_{t-q}$$

y_t : The actual Value.

μ : The constant coefficient.

φ : The Autoregressive coefficient at lag p.

θ : The Moving average coefficient at lag q.

e_t : The random error at period t.

p: Number of AR terms.

d: Number of transformations.

q: Number of MA terms.

To apply this method and get a reliable result, the following steps are carried out:

Step one: Checking the stationary of the data series over the ACF and PACF.

Step two: If the data series are not stationary, the first differentiation is applied.

Step three: Re-checking the stationary of the data with correlogram and unit root test.

Step four: identifying the Model's parameters and refine the model.

Step five: Making the forecast.

Fist, to test the stationary of the data, two hypotheses are introduced and tested.

- NUL H: the series is Stationary.
- ALT H: the series is not Stationary.

Figure 9 below shows the graphical representation of the S&P stock prices over the pre-determined period.

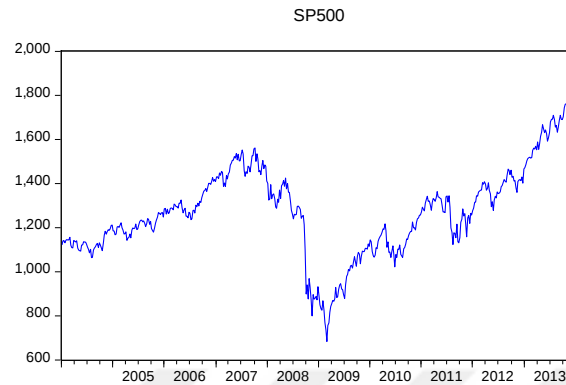


Figure 9: Graphical Representation of the S&P 500 Stock closing Price Index.

Source: Own calculations on EViews

From the graph, in principle, we can say that the data has a random walk pattern. An Autocorrelation test is applied to confirm the non-stationary of the data. Normally the stationary series show small random values of the autocorrelation function. The result of our analysis is shown in Figure 10.

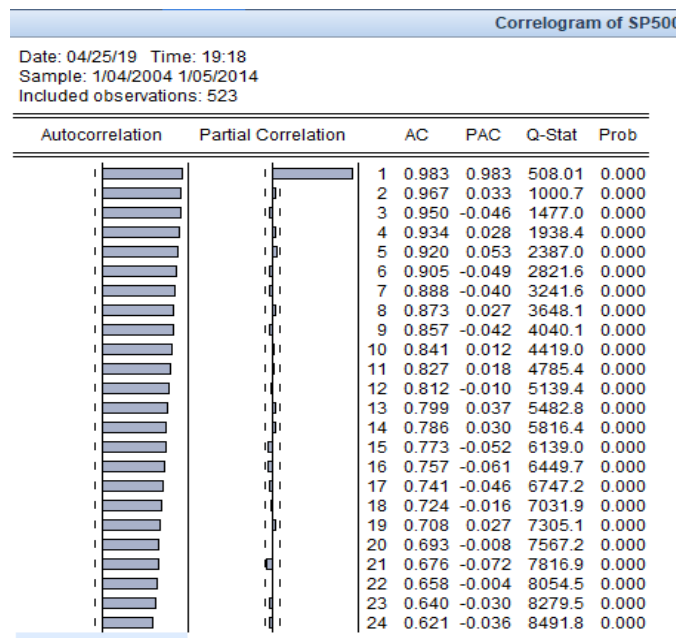


Figure 10: The Correlogram of the S&P 500 stock closing Price index

Source: Own calculations on EViews

We see high values of the autocorrelation that slowly decreases over the lags introduced. Besides that, the last value of the Q-stat is 8491.8 with a 0.000 in probability. This result rejects the NUL hypothesis and approves the non-stationary of the data.

Since the results obtained confirm the nonstationary of the data series, Step Two is proceeded. The series S&P500 have been generated and converted into a stationary by applying the first difference equation; $DS\&P500 = d(S\&P500)$. figure 11 illustrates the application.

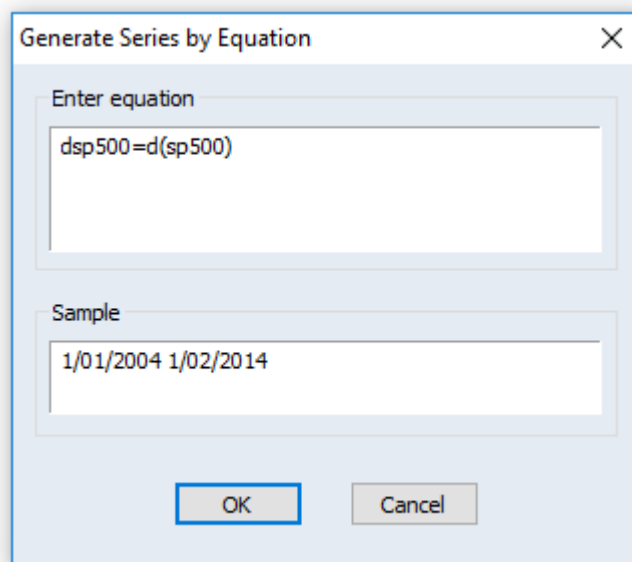


Figure 11: Equation of the first differentiation.

Source: Own calculations on EViews

The first differentiation contains values occurred by making a change from one period to the next, the value of Y at the period T is equal to the change between $Y_t - Y_{t-1}$. After the first differentiation, the forecasting equation becomes:

$$y_t = y_t - y_{t-1}$$

To confirm the stationary of the new series (DS&P500), the correlogram test is applied for the new series. Figure 12 displays the results obtained.

Contrary to the results abstained before the integration, the ACF values are small and change randomly. The probability of the last Q-stat value is 0.198 which confirms the Null hypothesis and the stationary of the series (DS&P 500).

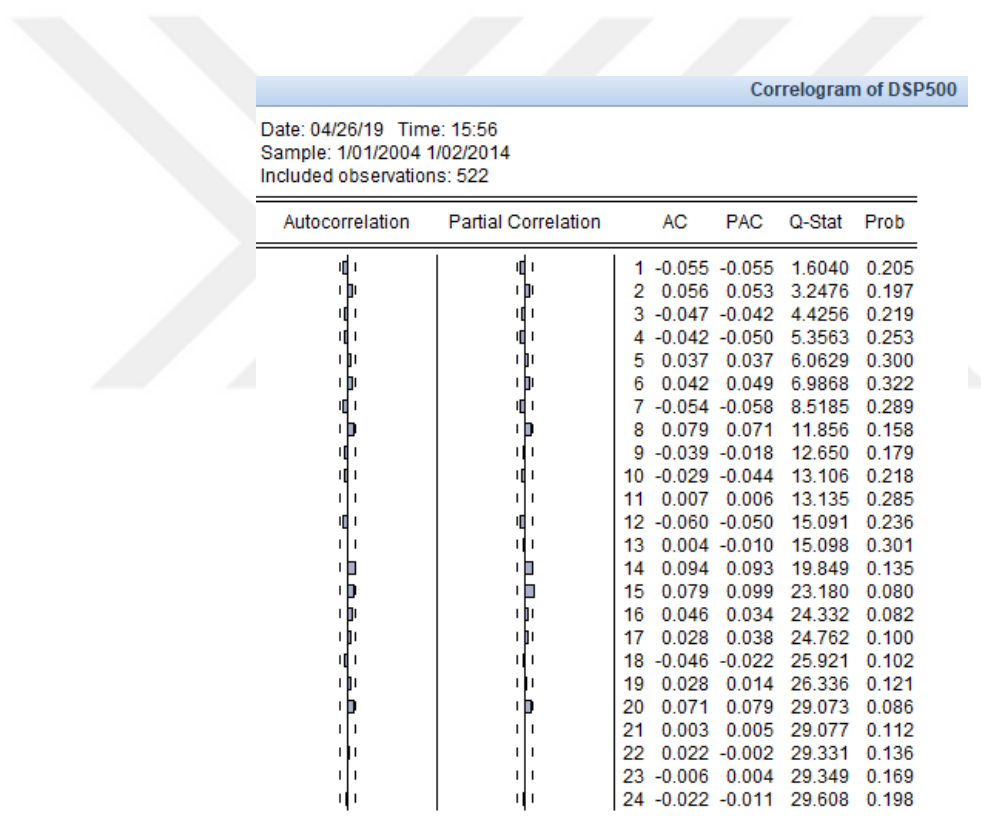


Figure 12: The Correlogram the S&P 500 stock closing price index after the first differentiation.

Source: Own calculations on EViews

To be sure about the stationary of the series after the conversion, a further test was applied to the main new series which is the Augmented Dickey-Fuller (ADF) unit root test. The results are illustrated in table 3 below.

Source: Own calculations on EViews

Table 3: ADF test results.

	T statistics	P-values	Comments
Main series	-0.481715	0.8918	Non-stationary
New Series	-24.08307	0.0000	Stationary

From the results, we can say that the series don't have a unit root square ($P\text{-value}=0.000$) which confirm its stationary after the first differencing. Figure 13 shows the graphical representation of the new series.

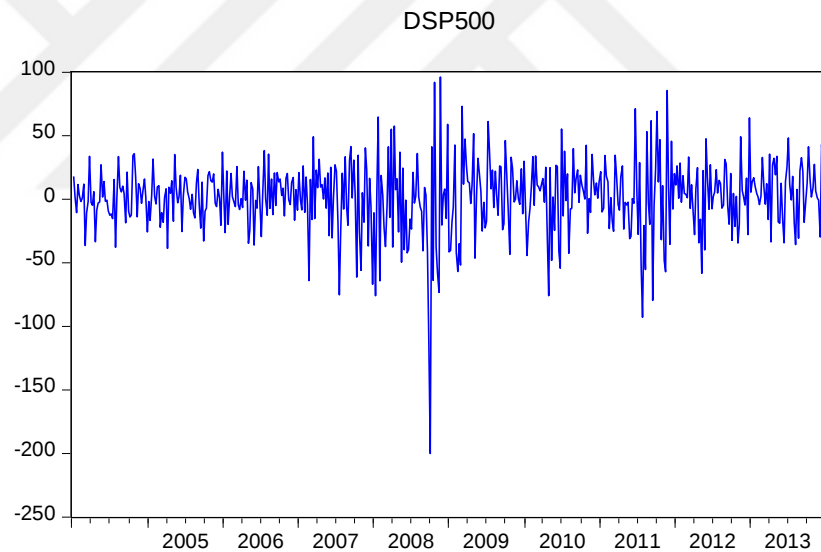


Figure 13: Graphical Representation of the New Series DS&P 500.

Source: Own calculations on EViews

After checking the stationary and converting the data, our series are compatible with estimating the parameters of $AR(p)$ and $MA(q)$, mentioning that after the first differentiation the number of observations decreased to 522.

To define the best parameters that give the best forecast performance. The criteria's taking into consideration in this step are:

- The lowest value of the Akaike information criterion (AIC) (Burnham, Anderson, Burnham, and Anderson, 2004).
- The lowest Schwarz information criterion (SIC) (Kirchgässner, Wolters and Hassler, 2008).
- The adjusted R^2 (Kirchgässner, Wolters and Hassler, 2008).
- standards error of regression (S.E of regression) (Kirchgässner, Wolters and Hassler, 2008).
- P-value of the T-statistic.

We experimented different values of parameters to select the best p and q values. Table 4 shows the result of the different lags for S&P 500 stock closing price index.

Table 4: The Result of the Different lags for S&P 500 stock closing price index.

Model	AIC*	SIC
(0, 1)	9.110737	9.153610
(1, 0)	9.108991	9.151864
(0,2)	9.127835	9.170707
(2,0)	9.130372	9.173751
(1,1)	9.117893	9.175732
(2,4)	9.133614	9.190777
(0,0)	9.114576	9.128867
(2, 2)	9.134937	9.192100
(4,2)	9.127835	9.170707
(3,0)	9.130768	9.173641
(0,3)	9.130767	9.173640
(1,2)	9.115812	9.138831
(2,1)	9.116054	9.173218

In our estimation, we introduced the number 4 as a maximum of lags for both Autoregressive and moving average. After the comparison shown in table 4, concluded

that ARIMA (1, 1, 0) is the best model for our data. the decision was taking regarding the smallest values of both Akaike information criterion and Schwarz information criterion.

After estimating the parameters of the model, it is required to check the white noise of the residual to confirm the suitability of the model. Figure 14 shows the correlogram of residuals with AR (1).

Correlogram of Residuals						
A	B	C	D	E	F	G
Date: 04/27/19 Time: 17:11						
Sample: 1/01/2004 9/11/2008						
Included observations: 245						
Q-statistic probabilities adjusted for 1 ARMA term						
Autocorrelation	Partial Correlation	AC	PAC	Q-Stat	Prob	
		1	0.004	0.004	0.0047	
		2	0.034	0.034	0.2983	0.585
		3	0.012	0.012	0.3352	0.846
		4	-0.059	-0.060	1.2015	0.753
		5	-0.047	-0.047	1.7496	0.782
		6	-0.029	-0.025	1.9635	0.854
		7	-0.130	-0.126	6.2816	0.392
		8	0.062	0.062	7.2485	0.403
		9	0.039	0.043	7.6353	0.470
		10	-0.010	-0.017	7.6594	0.569
		11	-0.003	-0.024	7.6613	0.662
		12	0.008	0.003	7.6774	0.742
		13	-0.070	-0.068	8.9571	0.707
		14	-0.018	-0.030	9.0449	0.770
		15	0.004	0.026	9.0494	0.828
		16	-0.012	-0.003	9.0846	0.873
		17	0.060	0.044	10.032	0.865
		18	-0.115	-0.131	13.545	0.699
		19	-0.030	-0.036	13.789	0.743
		20	0.054	0.045	14.567	0.750
		21	-0.001	0.011	14.568	0.801
		22	0.066	0.071	15.756	0.783
		23	0.065	0.053	16.892	0.769
		24	0.062	0.065	17.962	0.760

Figure 14: The correlogram of Residuals for AR (1).

Source: Own calculations on EViews

The ACF and PACF values are close to zero with a random interval, the P-values of the Q-stat are greater than 5%. The residual is white noise with the AR (1). The ARIMA (1,1,0) is valid for the following steps.

Table 5: The Regression analysis of ARIMA (1, 1, 0).

Dependent Variable: D(SP500)				
Method: ARMA maximum likelihood (OPG-BHHH)				
Sample: 01/08/2004 9/18/2008				
Included observations: 246				
Convergence achieved after 3 iterations				
Coefficient covariance computed using outer product of gradients				
Variables	Coefficient	St. Error	t. statistic	P-Value
C	0.533139	1.338383	0.398345	0.6907
AR (1)	-0.14092	39.55822	13.04965	0.0183
R-squared	0.021760	Mean Dependent var		0.543755
Adjust R-squared	0.013676	S.D. dependent var		23.01883
S.E. of R-Squared	22.86089	Akaike info criterion		9.108991
Sum squared resid	1266474.1	Schwarz criterion		9.151864
Log likelihood	-1112.851	Hannan-Quinn criter		9.126256
F-Statistic	2.691565	Dourbin-Waston stat		1.988805
Prob (F-Statistic)		0.069804		

3.3.1. Model Estimation

All the previous steps are in service of the equation estimation. The final model is then, ARIMA (1, 1, 0). Table 6 summarizes the estimated coefficients of the equation.

Table 6: The Estimated coefficients of the equation

Variables	Coefficient	St. Error	t-Statistics	prob
C	0.533139	1.338383	0.398345	0.6907
AR (1)	-0.147092	0.061907	-2.376003	0.0183

$$\Delta \mathbf{y}_t = 0.533139 - 0.147092 \Delta \mathbf{y}_{t-1} + \varepsilon_t; \text{ where } \Delta \mathbf{y}_t = \mathbf{y}_t - \mathbf{y}_{t-1}$$

3.3.2. Forecast Analysis for the Standard and Poor's 500 Stock Closing Price Index

In this section, we are using the ARIMA (1, 1, 0) for the D(SP500) data series to forecast the values of the S&P 500 stock closing price index for the periods, during and after the crisis. The estimation sample taking in this part is the period between 01/04/2004 and 09/14/2008. We selected this sample as a reference to predict the following period's values regarding the historical events and prices, then compare them to the original ones. The static forecast is selected in this analysis.

The relative error is calculated to compare the forecasted and the original values. It also shows the forecasting performance and the feasibility of the model in predicting. The following formula is used to calculate the relative error:

$$\mathbf{R. Error} = (\text{original value} - \text{forecasted value}) / \text{original value}$$

Table 7 shows the original values, forecasted values, relative error, % error, the average error for each month, and the average error for all period during the crisis.

Figure 15 illustrates the graphical representation of the static forecast; it also represents statistical measurements that specify the fitness of the model used.

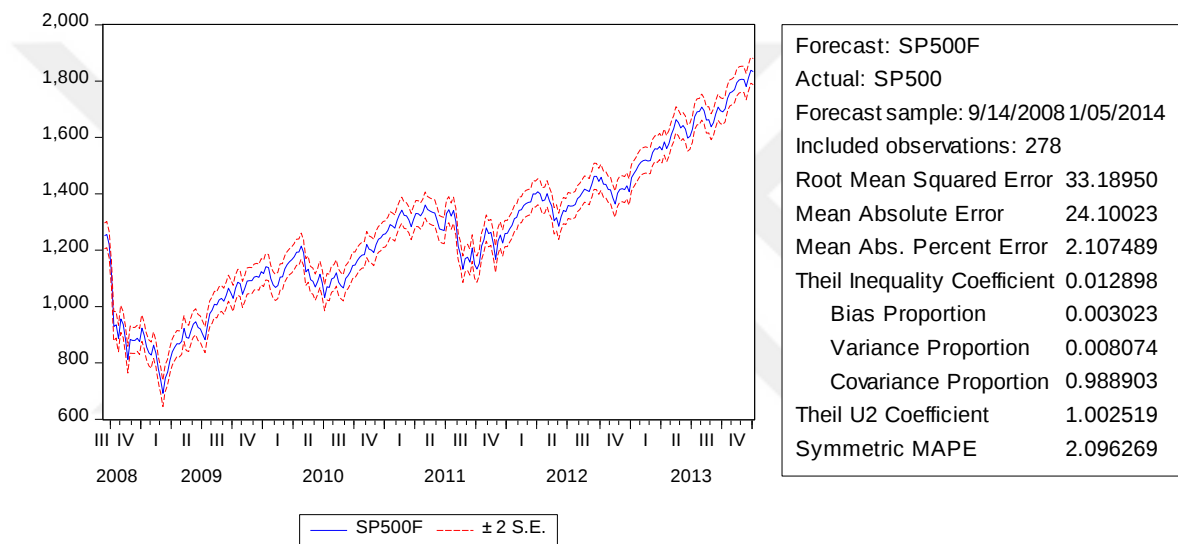


Figure 15: Graph of the static forecast with $\pm$ the standards errors, and statistic measurements.

Source: Own calculations on EViews

In figure 14, the table on the right gives information about the feasibility of the model. We have the value of the Theil inequality coefficient is 0.012898 which is less than one (Murphy, 1985).

The variance is small and near zero. The covariance is very close to one.

All these statistic indicators explain the excellent performance of our forecast and the huge fusibility of our model.

Table 7: Results of the forecast and the relative errors for the period during the crisis.

Date	Original value	Forecasted value	Relative error	% change	Monthly average Error	(Absolute value)
9/14/2008	1255,08	1250.93	0.0033	0%	5%	4%
9/21/2008	1213.27	1255.19	-0.0346	-3%		
9/28/2008	1099.23	1220.03	-0.1099	-11%		
10/05/2008	899.22	1116.62	-0.2418	-24%	10%	
10/12/2008	940.55	929.25	0.0120	1%		
10/19/2008	876.77	935.08	-0.0665	-7%		
10/26/2008	968.75	886.76	0.0846	8%		
11/02/2008	930.99	955.83	-0.0267	-3%	6%	
11/09/2008	873.29	937.16	-0.0731	-7%		
11/16/2008	800.03	882.39	-0.1029	-10%		
11/23/2008	896.24	811.42	0.0946	9%		
11/30/2008	876.07	882.70	-0.0076	-1%		
12/07/2008	879.73	879.65	0.0001	0%	2%	
12/14/2008	887.88	879.80	0.0091	1%		
12/21/2008	872.8	887.29	-0.0166	-2%		
12/28/2008	931.8	875.63	0.0603	6%		
1/04/2009	890.35	923.73	-0.0375	-4%	3%	
1/11/2009	850.12	897.06	-0.0552	-6%		
1/18/2009	831.95	856.65	-0.0297	-3%		
1/25/2009	825.88	835.23	- 0.0113	-1%		
2/01/2009	868.6	827.38	0.0475	5%	6%	
2/08/2009	826.84	862.93	-0.0436	-4%		
2/15/2009	770.05	833.59	-0.0825	-8%		
2/22/2009	735.09	779.01	-0.0598	-6%		
3/01/2009	683.38	740.84	-0.0841	-8%		

3/08/2009	756.55	691.60	0.0859	9%	6%	4%
3/15/2009	768.54	746.40	0.0288	3%		
3/22/2009	815.94	767.39	0.0595	6%		
3/29/2009	842.5	809.58	0.0391	4%		
4/05/2009	856.56	839.20	0.0203	2%	1%	
4/12/2009	869.6	855.10	0.0167	2%		
4/19/2009	866.23	868.29	-0.0024	0%		
4/26/2009	877.52	867.34	0.0116	1%		
5/03/2009	929.23	876.47	0.0568	6%	3%	
5/10/2009	882.88	922.24	-0.0446	-4%		
5/17/2009	887	890.31	-0.0037	0%		
5/24/2009	919.14	887.01	0.0350	3%		
5/31/2009	940.09	915.02	0.0267	3%		
6/07/2009	946.21	937.62	0.0091	1%	2%	
6/14/2009	921.23	945.92	-0.0268	-3%		
6/21/2009	918.9	925.52	-0.0072	-1%		
6/28/2009	896.42	919.85	-0.0261	-3%		
7/05/2009	879.13	900.34	-0.0241	-2%	4%	
7/12/2009	940.38	882.28	0.0618	6%		
7/19/2009	979.26	931.98	0.0483	5%		
7/26/2009	987.48	974.15	0.0135	1%		
8/02/2009	1010.48	986.88	0.0234	2%	1%	
8/09/2009	1004.09	1007.71	-0.0036	0%		
8/16/2009	1026.13	1005.64	0.0200	2%		
8/23/2009	1028.93	1023.50	0.0053	1%		
8/30/2009	1016.4	1029.13	-0.0125	-1%		
9/06/2009	1042.73	1018.85	0.0229	2%	2%	
9/13/2009	1068.3	1039.47	0.0270	3%		

Comparing the error's percentages presented in table 7, we see that the average error for all the period during the crisis is less than 5%. This result confirms what we have concluded previously about the performance of our forecast. It also confirms the effect of the period before the crisis on the values of the S&P 500 stock closing price index.

We notice that the sub-period between 09/28/2008 and 10/05/2008 had a significant rate of error comparing to the other periods. We can explain that by the occurrence of new significant events in the financial market that changed the stability of the prices. Since these events were not included in the estimation period, our forecast did not consider their effects in the calculation.

if we go back to our literature, we link this result to (i) the collapse of the Lehman brothers, (ii) the failure of the Washington Mutual bank (iii), the one day drop in the U.S stock market where the S&P 500 stock index decreased by 8.81%.

Despite these shocks, the S&P 500 stock index gets its stability Quickly. This remark is revealed (i) in the result of the periods "12/07/2008; 4/19/2009; 8/09/2009" where the forecasted and the original values were equal, (ii) the percentage of error close to zero over the remaining periods.

In the descriptive statistic part, the result indicates that the minimum value the S&P 500 stock closing price index had reached was 683,38. Table 7 determines the period between 02/22/2009 and 03/01/2009 as a week on which this lowest price attained.

To see the performance of the S&P stock closing price index over the forecasted period, table 8 gives the relative yearly errors; and the average error. And figure 16 gives the graphical image of the forecasted and original values.

Table 8: The Error analysis

Year	Relative Error	Average Error
2008	6%	0%
2009	3%	
2010	2%	
2011	0%	
2012	1%	
2013	1%	0%

We conclude from table 8 that (i) the year 2008 was the most significantly touched by the crisis; (ii) the average error is 0% which confirms the recovery of the S&P 500 stock index and the stability of the index.



Figure 16: Graphical representation of the original and forecasted values.

Source: Own calculations on EViews

CONCLUSION

In this study, we tried to measure the performance of the S&P 500 stock index during and after the financial crisis mater to see the credibility of the index.

In the Hypothesis part, we introduced the idea that either the mortgage crisis affected the stock market significantly by taking the S&P 500 stock index as a benchmark or not. The aim of this research was also disusing the events leading to this meltdown, and the manner the market reacted to face all these degradations.

In the literature part, we faced a lack of researches talking about the effect of the mortgage crisis on (i) the stock market in general, and (ii) the S&P 500 stock index in particular.

Many existing studies deal with the application of the Box-Jenkins method on forecasting stock prices, but almost all of them do not include the effect of the 2008's crisis.

Since we had faced difficulties in finding references giving a clear idea about the relation between the crisis and the stock market, we tried to make a work that will facilitate the touch for the following researchers in this area of study.

In our empirical part, we presented two types of analysis. The descriptive statistics was the first to analyze the data and explain the relationship between the change in the S&P 500 stock closing price index and the mortgage crisis among different periods.

Then, we analyzed the data using the ARIMA model, we built an appropriate model and applied a forecast for the periods during and after the crisis depending on a determined estimation period.

The result of both analyzes approves our hypothesis on the significant effect of the mortgage crisis over the S&P 500 stock index. The index dropped by almost 45% from its last peak in the period during the crisis.

The decline in value during this crisis is not shocking; there were significant declines in the S&P 500 stock index during wars and crisis through history. Also, the fact that the financial sectors are intertwined, this facilitate the spread of any negative event over all sectors.

The forecasted values were a result of the stage that experienced mostly the crisis. The error terms were too small only in some periods where the distribution got shocks from unexpected events.

We can conclude from all the part of this theses is that the S&P 500 stock index had been affected in value during the crisis, but this did not make it lose its credibility and profitability. The index came back to its normality after the crisis.

In this research, the empirical study was based only on one variable “S&P 500 stock closing price index”. The next researchers can extend it by including more independent variables as House prices, Default rate, Sub-prime mortgage loans rate and others.

The method also can be replaced by the GARCH model. Or even using a panel data to compare the effect of the crisis between the U.S and other countries.

REFERENCES

- Adler, b. **In Reports On Failures, Regulators Also Fail.**
American Banker,174(71), 1-3. (2009).
- Ahearne, Alan G. **Monetary Policy and House Prices: A Cross-Country Study .**
& FRB International Finance Discussion Paper No. 841.
Ammer, John (September 2005).
Matthew &
Doyle, Brian M.
& Kole, Linda &
Martin, Robert F.
- Amadeo, K. **2008 Financial Crisis Timeline**, Retrieved from
[https://www.thebalance.com/2008-financial-crisis-timeline](https://www.thebalance.com/2008-financial-crisis-timeline-3305540)
[3305540](https://www.thebalance.com/2008-financial-crisis-timeline-3305540). (2009).
- Antila, H. J. **Behaviors in Markets Conditions Before Stock Market Crash.**
University Of Applied Sciences, Vaasan Ammattikorkeakoulu. (2011).
- Baker, D. **The housing bubble and the financial crisis.** Real-world economics
review, 46(20), (2008), pp.73-81.
- Becchetti, L., & **STOCK MARKET REACTION TO THE GLOBAL FINANCIAL**
Ciciretti, R. **CRISIS: Testing For The Lehman Brothers'event.** Giornale degli
Economisti e Annali di Economia, 3-58. (2011).
- Brooks, C. **Introductory Econometrics for Finance.** Second Edition (2008).

- Burnham, K. P & Anderson, D. R . **Understanding AIC and BIC in Model Selection**, Colorado State University. (2004).
- Cameron, cooper. **6 Economists Who Predicted The Global Financial Crisis**.
Retrieved from:
<https://www.intheblack.com/articles/2015/07/07/6-economists-who-predicted-the-global-financial-crisis-and-why-we-should-listen-to-them-from-now-on> (2015)
- Carolina, N. **Order Approving the Acquisition of a Bank Holding Company by Bank of America**, Federal Reserve System. (Vol. 4). (2008).
- Ferguson, C. **Inside Job, documentary**. USA: Sony Pictures. (2010).
- John Griffith, **7 Things You Need to Know About Fannie Mae and Freddie Mac**. Center for American progress. (2014).
- Act, A. **One Hundred Eleventh Congress of the United States of America**. Federal Sentencing Reporter, 23(3). (2011).
- CFI, **Credit Default Swap**. Retrieved from:
<https://corporatefinanceinstitute.com/resources/knowledge/finance/credit-default-swap-cds/>. (2015).
- Fleming, M. J., & Sarkar, A **The failure resolution of Lehman Brothers**. Economic Policy, ReviewForthcoming. (2014).
- Fahad Balubaid. **S&P 500 Index Analysis: The effects of the 2008 financial crisis**. Saint Mary's University. Copyright Fahad Balubaid 2014. Written for MFIN 6692.0 (2015).

- Davig, T., & Leeper, E. M. **Monetary–fiscal policy interactions and fiscal stimulus.** European Economic Review, 55(2), 211-227. (2011).
- Federal Reserve Bank **Default Rates on Prime and Subprime Mortgages: Differences and Similarities,** Federal Reserve Bank of Chicago. (2010)
- Gebhard Kirchgässner, Jürgen Wolters & Uwe Hassler **Introduction to Modern Time Series Analysis** Second Edition, Springer-Verlag Berlin Heidelberg, (2008) pp. 27–87.
- Goldstein, I., & Urevick-Ackelsberg, D. **Subprime lending, mortgage foreclosures and race: how far have we come and how far have we to go. *Philadelphia: The Reinvestment Fund.***
- Joint Center of Harvard Studies **The State of the Nation’s Housing,**1–44. Harvard JCHS.(2018). Retrieved from, www.jchs.harvard.edu
- Healey, J. F. **The Essentials Of Statistics: A Tool For Social Research.**(2012) Nelson Education.
- Healey, J. F. **Dow, First Time in a Year, Breaks Through 10,000.** (2009). Retrieved from: <https://www.nytimes.com/2009/10/15/business/15markets.html>
- Herbert, C. E., & Apgar, W. C. **Report to Congress on the Root Causes of the Foreclosure Crisis.** (2012). *SSRN Electronic Journal.*
- Ivashina, V., & Scharfstein, D. **Bank lending during the financial crisis of 2008.** Journal of Financial economics, (2010), 97(3), 319-338.

- Jan, P. **Median and Average Sales Prices of New Homes Sold in United States, 1963–2011.**
- Kim, J. **What went wrong at AIG?**
Fierce Finance IT, 1. (2014). Retrieved from:
<https://insight.kellogg.northwestern.edu/article/what-went-wrong-at-aig>
- Kimberly Amadeo. **2007 Financial Crisis Explanation, Causes, and Timeline.** (2019).
Retrieved from: <https://www.thebalance.com/2007-financial-crisis-overview-3306138>
- Larry Elliott. ***Global financial crisis: five key stages 2007-2011.*** (2011).
Retrieved from:
<https://www.theguardian.com/business/2011/aug/07/global-financial-crisis-key-stages>
- Lifland, B. R. **U.S. Bankruptcy Court Denies Failed HedgeFunds’ Request for Chapter 15 Recognitio,** (2007) Jones Day, New York.
- Mauro F. Guillén. **The Global Economic & Financial Crisis: A Timeline.**
Wharton. Art & Science, (University of Pennsylvania), 1–96. (2007).
- Mayer, C., Pence, K., & Sherlund, S. M. **The Rise in Mortgage Defaults.** *Journal of Economic Perspectives*, 23(1), 27–50. (2009).

- Murphy, D. C. **Calculation of Gini and Theil Inequality Coefficients for Irish Household Incomes in 1973 and 1980.** *The Economic and Social Review*, 16(3), 225–249. (1985).
- Reinhart, C. M., **The aftermath of financial crises.** *American Economic Review*, 99(2),
& Rogoff, K. S. 466-72. (2009).
- Rastogi, S. **The Financial Crisis Of 2008 And Stock Market Volatility-Analysis And Impact On Emerging Economies Pre And Post Crisis.**
Afro-Asian Journal of Finance and Accounting, 4(4), 443-459. (2014).
- Thaden, E. **Stable Home Ownership In A Turbulent Economy:** Delinquencies and foreclosures remain low in community land trusts.
Lincoln Institute of Land Policy working paper. WP11ET1. (2011).
- Rugh, J. S., & **Racial segregation and the American foreclosure crisis.**
Massey, D. S. *American Sociological Review*, 75(5), 629–651. (2010).
- Swedberg, R. **The structure of confidence and the collapse of Lehman Brothers.**
Research in the Sociology of Organizations (Vol. 30). Elsevier. (2010).
- Lucca, D. O., & **Measuring central bank communication: an automated approach**
Trebbi, F. **with application to FOMC statements** National Bureau of
Economic Research. (No. w15367). (2009).
- Shah, A. **Emergency Economic Stabilization Act Of 2008.**
Harv. J. on Legis . 46,569. (2009).

Weaver, K. **The Sub-Prime Mortgage Crisis: A Synopsis.**
Global Securitisation and Finance, 22–31. (2008).

Another Window: The Term Auction Facility.
Wheelock, D. C. *Economic Synopses*, (2008). Retrieved from:
<https://doi.org/10.20955/es.2008.6>

Bianco, K. M. **The subprime lending crisis: causes and effects of the mortgage
meltdown.**
CCH Mortgage Compliance Guide and Bank Digest. (2008).