Hacettepe University Graduate School Of Social Sciences

Department Of Economics

# THE IMPACTS OF ENERGY PRICE SHOCKS ON FINANCIAL STABILITY

Onur POLAT

Ph. D. Dissertation

Ankara, 2017

# THE IMPACTS OF ENERGY PRICE SHOCKS ON FINANCIAL STABILITY

Onur POLAT

Hacettepe University Graduate School Of Social Sciences

Department Of Economics

Ph. D. Dissertation

Ankara, 2017

**ACCEPTANCE AND APPROVAL**

The jury finds that Onur POLAT has on the date of 19.10.2017 successfully passed the defense examination and approves his Ph. D. Dissertation titled "The Impacts of Energy Price Shocks on Financial Stability".

Prof. Dr. Burak GÜNALP (Jury President)

Prof. Dr. İbrahim ÖZKAN (Main Adviser)

Prof. Dr. Lütfi ERDEN

Prof. Dr. Mustafa Necat COŞKUN

Prof. Dr. Armağan TARIM

I agree that the signatures above belong to the faculty members listed.

Prof. Dr. Musa Yaşar SAĞLAM

Graduate School Director

## DECLARATION

I promise that my thesis/report is completely my own work and that I have provided a source for every quotation and citation. I give permission for paper and digital copies of my thesis/report to be kept in Hacettepe University's Graduate School of Social Sciences' archives under the conditions indicated below:

- ☐ My thesis/Report can be accessed in full from any location.
- ☐ My thesis/Report can only be accessed from Hacettepe University premises.
- ☐ I do not want my thesis/report to be accessed until ..... year(s) later. After this amount of time if I have not applied to an extension of time, my thesis/report can be accessed in full from any location.

19.10.2017

_____

Onur POLAT

# YAYIMLAMA VE FİKRİ MÜLKİYET HAKLARI BEYANI

Enstitü tarafından onaylanan lisansüstü tezimin/raporumun tamamını veya herhangi bir kısmını, basılı (kâğıt) ve elektronik formatta arşivleme ve aşağıda verilen koşullarla kullanıma açma iznini Hacettepe Üniversitesine verdiğimi bildiririm. Bu izinle Üniversiteye verilen kullanım hakları dışındaki tüm fikri mülkiyet haklarım bende kalacak, tezimin tamamının ya da bir bölümünün gelecekteki çalışmalarda (makale, kitap, lisans ve patent vb.) kullanım hakları bana ait olacaktır.

Tezin kendi orijinal çalışmam olduğunu, başkalarının haklarını ihlal etmediğimi ve tezimin tek yetkili sahibi olduğumu beyan ve taahhüt ederim. Tezimde yer alan telif hakkı bulunan ve sahiplerinden yazılı izin alınarak kullanılması zorunlu metinlerin yazılı izin alınarak kullandığımı ve istenildiğinde suretlerini Üniversiteye teslim etmeyi taahhüt ederim.

O **Tezimin/Raporumun tamamı dünya çapında erişime açılabilir ve bir kısmı veya tamamının fotokopisi alınabilir.**
(Bu seçenekle teziniz arama motorlarında indekslenebilecek, daha sonra tezinizin erişim statüsünün değiştirilmesini talep etseniz ve kütüphane bu talebinizi yerine getirse bile, teziniz arama motorlarının önbelleklerinde kalmaya devam edebilecektir)

O **Tezimin/Raporumun …….. tarihine kadar erişime açılmasını ve fotokopi alınmasını (İç Kapak, Özet, İçindekiler ve Kaynakça hariç) istemiyorum.**
(Bu sürenin sonunda uzatma için başvuruda bulunmadığım takdirde, tezimin/raporumun tamamı her yerden erişime açılabilir, kaynak gösterilmek şartıyla bir kısmı veya tamamının fotokopisi alınabilir)

O **Tezimin/Raporumun……..tarihine kadar erişime açılmasını istemiyorum ancak kaynak gösterilmek şartıyla bir kısmı veya tamamının fotokopisinin alınmasını onaylıyorum.**

O **Serbest Seçenek/Yazarın Seçimi**

…… /……/……

***Onur POLAT***

# ETİK BEYAN

Bu çalışmadaki bütün bilgi ve belgeleri akademik kurallar çerçevesinde elde ettiğimi, görsel, işitsel ve yazılı tüm bilgi ve sonuçları bilimsel ahlak kurallarına uygun olarak sunduğumu, kullandığım verilerde herhangi bir tahrifat yapmadığımı, yararlandığım kaynaklara bilimsel normlara uygun olarak atıfta bulunduğumu, tezimin kaynak gösterilen durumlar dışında özgün olduğunu, Prof. Dr. İbrahim ÖZKAN danışmanlığında tarafımdan üretildiğini ve Hacettepe Üniversitesi Sosyal Bilimler Enstitüsü Tez Yazım Yönergesine göre yazıldığını beyan ederim.

***Onur POLAT***

# ACKNOWLEDGEMENTS

Firstly, I would like to express my deepest appreciation to my lovely wife Gözde EŞ POLAT for her love and support during this study.

Secondly, I would like to express my gratitude to my advisor Prof. Dr. İbrahim ÖZKAN for the support of my Ph.D study and related research, for his patience, motivation, and knowledge.

I would also like to express my thanks to my Ph. D. Dissertation Committee Members: Prof. Dr. Burak GÜNALP and Prof. Dr. M. Necat COŞKUN for their encouragements and academic supports for this study.

Finally, I would like to thank to my family: my mother and father and to my brother and sister for supporting me spiritually throughout writing this dissertation.

## ABSTRACT

POLAT, Onur. *The Impacts of Energy Price Shocks on Financial Stability,* Ph. D. Dissertation, Ankara, 2017.

Stability of financial system has become very important not only for practitioners and policy makers but also for researchers, since lack of it can trigger to turmoil and bursts in global financial system. Besides, hazardous effects of financial instability states can quickly spread out globally thanks to financial connectedness and the last global financial crisis sets an example of this. Hence, there exist increasing number of studies in the literature which determine early warning indicators of financial instability states in order to avoid from their catastrophic effects into economy. In the light of this, empirical studies in the related literature constructed financial stress indexes in low frequency (weekly, monthly, quarterly or annually) or in high frequency (daily) in order to measure risks and fragilities of financial system.

On the other hand, energy price shocks have detrimental effects into economies by different transmission channels due to energy dependency of emerging and developed countries. 1973 and 1979 oil price shocks set example of these effects since they harmfully affected both developed and emerging economies. Along with that, since oil usage consist of the greatest amount in total energy consumption, researchers investigated the impacts of oil price shocks on macro economies or financial systems of countries.

In this study; in the first step, we identify systemic stress of financial systems of 9 countries (G-7, Norway and Turkey) with high frequency (daily) financial stress indexes which consists of daily financial market indicators. Graphical illustrations of financial stress indexes show that all indexes response effectively to well-known financial stress events. In the second step, the impacts of oil price shocks on financial stability are discussed for 9 net oil importer/exporter countries with an application of SVAR model. Finally, similarities/dissimilarities of impacts of oil price shocks on 9 net oil importer/exporter countries' financial stabilities are analyzed.

**Key Words**

Financial Stability, Financial Stress Indexes, Systemic Stress, Dynamic Conditional Correlations, Oil Price Shocks, Structural VAR.

# ÖZET

POLAT, Onur. *Enerji Fiyat Şoklarının Finansal İstikrara Olan Etkileri*, Doktora Tezi, Ankara, 2017.

Finansal sistemin istikrarı yalnızca uygulayıcılar ve politika yapıcılar için değil, araştırmacılar için de önemlidir çünkü eksikliği, küresel finans sistemde kargaşa ve patlamaları tetikleyebilir. Ayrıca, finansal bağlantılılık sayesinde finansal istikrarsızlık durumlarının tehlikeli etkileri hızlı bir şekilde yayılabilir ve son küresel kriz buna örnek teşkil eder. Dolayısıyla, literatürde, ekonomiye olan yıkıcı etkilerini engellemek için finansal istikrarsızlık durumlarının erken uyarı göstergelerini belirleyen artan sayıda çalışma bulunmaktadır. Bu bağlamda, ilgili literatürdeki ampirik çalışmalar finansal sistemin risk ve kırılganlıklarını ölçmek için düşük sıklıkta (haftalık, aylık, çeyreklik veya yıllık) veya yüksek sıklıkta (günlük) finansal stres endeksleri oluşturmuştur.

Öte yandan, enerji fiyat şoklarının, gelişmekte olan ve gelişmiş ülkelerin ekonomilerine ülkelerin enerji bağımlılıkları nedeniyle farklı iletim kanalları vasıtasıyla zararlı etkileri bulunmaktadır. Gelişmiş ve gelişmekte olan ekonomileri zararlı etkilediği için 1973 ve 1979 petrol krizleri bu etkilerin örneğini oluşturmaktadır. Bununla birlikte, petrol kullanımı enerji tüketimi içindeki en büyük miktarı oluşturduğundan dolayı, araştırmacılar petrol fiyat şoklarının ülkelerin makro ekonomilerine veya finansal sistemlerine olan etkilerini araştırmıştır.

Bu çalışmada; birinci adımda, 9 ülkenin (G-7, Norveç ve Türkiye) finansal sistemlarinin sistemik riskini ölçmek için günlük piyasa göstergelerinden oluşan yüksek frekanslı (günlük) finansal stress endekslerini oluşturuyoruz. Finansal stres indekslerinin grafiksel gösterimi indekslerin bilinen finansal stress olaylarına etkili bir şekilde tepki verdiklerini göstermektedir. İkinci adımda, petrol fiyat şoklarının 9 net petrol ithalatçısı/ihracatçısı ülkenin finansal istikrarlarına olan etkileri SVAR modeliyle incelenmektedir. Son olarak, petrol fiyat şoklarının 9 net petrol ithalatçısı/ihracatçısı ülkenin finansal istikrarlarına olan etkilerinin benzerlikleri/farklılıkları araştırılmaktadır.

**Anahtar Sözcükler**

Finansal İstikrar, Finansal Stres İndeksleri, Sistemik Stres, Dinamik Koşullu Korelasyonlar, Petrol Fiyat Şokları, Yapısal VAR.

# TABLE OF CONTENTS

**ACCEPTANCE AND APPROVAL ..... i**

**DECLARATION ..... ii**

**YAYIMLAMA VE FİKRİ MÜLKİYET HAKLARI BEYANI ..... iii**

**ETİK BEYAN ..... iv**

**ACKNOWLEDGEMENTS ..... v**

**ABSTRACT ..... vi**

**ÖZET ..... viii**

**TABLE OF CONTENTS ..... x**

**ABBREVIATIONS ..... xiv**

**LIST OF TABLES ..... xvi**

**LIST OF FIGURES ..... xix**

**INTRODUCTION ..... 1**

**CHAPTER 1 ..... 5**

**FINANCIAL STABILITY AND ENERGY PRICE SHOCKS ..... 5**

**1.1. DEFINITION OF FINANCIAL STABILITY ..... 5**

**1.2. STYLIZED FACTS OF FINANCIAL STABILITY/INSTABILITY ..... 10**

**1.3. EMPIRICAL STUDIES ..... 12**

1.3.1. High Frequency (Daily) Financial Stability Indexes ..... 12

1.3.2. Low Frequency (Weekly, Monthly, Quarterly, Yearly) Financial Stress Indexes ..... 16

**1.4. IMPACTS OF ENERGY PRICE SHOCKS ON FINANCIAL AND MACROECONOMIC INDICATORS ..... 21**

**CHAPTER 2 ..... 38**

**HIGH FREQUENCY FINANCIAL STRESS INDEXES ..... 38**

**2.1. METHODOLOGY AND DEVELOPING FINANCIAL STRESS INDEXES ..... 39**

**2.2. SELECTION OF INDICATORS ..... 41**

**2.3. COUNTRY SPECIFIC DATA AND CONSTRUCTION OF FINANCIAL STRESS INDEXES ..... 41**

**2.3.1. Data ..... 42**

We use following financial market indicators while developing high frequency (daily) financial stress indexes: ..... 42

2.3.1.1. Banking Sector ..... 42

2.3.1.2. Bond Market ..... 43

2.3.1.3. Equity Market ..... 44

2.3.1.4. Money Market ..... 45

2.3.1.5. Foreign Exchange Market ..... 45

**2.3.2. Net Oil Importer Countries ..... 46**

2.3.2.1. Turkey ..... 46

2.3.2.1.1. Evaluation ..... 48

2.3.2.1.2. Event Identification ..... 48

2.3.2.2. The United States ..... 51

2.3.2.2.1. Evaluation ..... 53

2.3.2.2.3. Event Identification ..... 53

2.3.2.3. Japan ..... 55

2.3.2.3.1. Evaluation ..... 57

2.3.2.3.1. Event Identification ..... 57

2.3.2.4. The United Kingdom ..... 59

2.3.2.4.1. Evaluation ..... 61

2.3.2.4.2. Event Identification ..... 61

2.3.2.5. Germany ..... 63

2.3.2.5.1. Evaluation ..... 65
2.3.2.5.2. Event Identification ..... 65
2.3.2.6. France ..... 67
2.3.2.6.1. Evaluation ..... 69
2.3.2.6.2. Event Identification ..... 70
2.3.2.7. Italy ..... 71
2.3.2.7.1. Evaluation ..... 73
2.3.2.7.2. Event Identification ..... 73
**2.3.3. Net Oil Exporting Countries ..... 75**
2.3.3.1. Canada ..... 75
2.3.3.1.1. Evaluation ..... 77
2.3.3.1.2. Event Identification ..... 77
2.3.3.2. Norway ..... 79
2.3.3.2.1. Evaluation ..... 81
2.3.3.2.2. Event Identification ..... 81
**CHAPTER 3 ..... 83**
**ENERGY PRICE SHOCKS AND FINANCIAL STABILITY ..... 83**
**3.1. METHODOLOGY ..... 83**
3.1.1. Structural VAR Model ..... 83
3.1.2. Causality in Mean Test ..... 84
**3.2. INVESTIGATION OF OIL PRICE SHOCKS ON FINANCIAL STABILITY OF OIL IMPORTER AND OIL EXPORTER COUNTRIES ..... 85**
3.2.1. Oil Importer Countries ..... 85
3.2.1.1. Turkey ..... 85
3.2.1.2. The United States ..... 90
3.2.1.3. Japan ..... 94

3.2.1.4. The United Kingdom....98
3.2.1.5. Germany....102
3.2.1.6. France....106
3.2.1.7. Italy....110
3.2.2. Oil Exporting Countries....114
3.2.2.1. Canada....114
3.2.2.2. Norway....118
**3.3. COMPARISON OF COUNTRIES TO THE IMPACTS OF OIL PRICE SHOCKS ON FINANCIAL STABILITY....122**
**CONCLUSION....125**
**BIBLIOGRAPHY....130**
**APPENDIX 1. THESIS/DISSERTATION ORIGINALITY REPORT....142**
**APPENDIX 2. ETHICS BOARD WAIVER FORM FOR THESIS WORK....143**
**AUTOBIOGRAPHY....144**

## ABBREVIATIONS

| | |
|---|---|
| ADF | Augmented Dickey Fuller |
| ASEAN-5 | Association of Southeast Asian Nations |
| CAPM | Capital Asset Pricing Model |
| CFSI | Cleveland Financial Stress Index |
| CDS | Credit Default Swap |
| CEW | Credit Equal Weight |
| CMAX | Cumulative Maximum |
| CISS | Composite Indicator of Systemic Stress |
| CPI | Consumer Price Index |
| DCC | Dynamic Conditional Correlations |
| DF-GLS | Dickey Fuller-Generalized Least Squares |
| EW | Equal Weight |
| EWMA | Exponentially Weighted Moving Average |
| FCI | Financial Conditions Index |
| FSI | Financial Stress Index |
| GARCH | Generalized AutoRegressive Conditional Heteroskedasticity |
| GCC | Gulf Cooperation Council |
| GDP | Gross Domestic Product |
| GNP | Gross National Product |
| G-7 | Group of Seven |
| GVAR | Global Vector Autoregression |
| ICAPM | Intertemporary Capital Asset Pricing Model |
| IMF | International Monetary Fund |
| IPI | Industrial Production Index |
| KCFSI | Kansas City Financial Stress Index |

| | |
|---|---|
| KPSS | Kwiatkowski Phillips Schmidt Shin |
| MSCI | Morgan Stanley Capital International |
| NYMEX | New York Mercantile Exchange |
| OECD | The Organisation for Economic Co-operation and Development |
| OLS | Ordinary Least Squares |
| PP | Phillips Perron |
| PPI | Producer Price Index |
| STLFSI | St. Louis Financial Stress Index |
| SVAR | Structural Vector Autoregression |
| VAR | Vector Autoregression |
| VECM | Vector Error Correction Model |
| VEW | Variance Equal Weight |
| VIX | Chicago Board Options Exchange Volatility Index |

## LIST OF TABLES

**Table 1. High Frequency Financial Stress Index Indicators ..... 14**

**Table 2. Weekly Financial Stress Index Indicators ..... 18**

**Table 3. Monthly Frequency Financial Stress Index Indicators ..... 20**

**Table 4. Summary of Empirical Studies that Investigate the Impact of Oil Price Shocks on Macroeconomic Variables ..... 28**

**Table 5. Summary of Empirical Studies that Analyze the Impact of Oil Price Shocks on Macro Economic Indicators and Financial Variables ..... 36**

**Table 6. Financial Market Indicators Used in the FSI for Turkey ..... 47**

**Table 7. Financial Market Indicators Used in the FSI for the U.S. ..... 52**

**Table 8. Financial Market Indicators Used in the FSI for Japan ..... 56**

**Table 9. Financial Market Indicators Used in the FSI for the UK ..... 60**

**Table 10. Financial Market Indicators Used in the FSI for Germany . 64**

**Table 11. Financial Market Indicators Used in the FSI for France ..... 68**

**Table 12. Financial Market Indicators Used in the FSI for Italy ..... 72**

**Table 13. Financial Market Indicators Used in the FSI for Canada .... 76**

**Table 14. Financial Market Indicators Used in the FSI for Norway .... 80**

**Table 15. Pearson Correlations between Financial Stress Index (FSI) of Turkey, Oil Prices and Oil Prices Volatility ..... 86**

**Table 16. Unit Root Test Results for Financial Stress Index of Turkey, Oil Prices (log) and Oil Prices Volatility ..... 87**

**Table 17. Toda-Yamamoto Test Results for Turkey ..... 88**

**Table 18. Pearson Correlations between Financial Stress Index (FSI) of the US, Oil Prices and Oil Prices Volatility ..... 91**

**Table 19. Unit Root Test Results for Financial Stress Index of the U.S., Oil Prices (log) and Oil Prices Volatility..... 91**

**Table 20. Toda-Yamamoto Test Results for the U.S. ..... 92**

**Table 21. Pearson Correlations between Financial Stress Index (FSI) of Japan, Oil Prices and Oil Prices Volatility..... 95**

**Table 22. Unit Root Test Results for Financial Stress Index of Japan, Oil Prices (log) and Oil Prices Volatility..... 96**

**Table 23. Toda-Yamamoto Test Results for Japan ..... 96**

**Table 24. Pearson Correlations between Financial Stress Index (FSI) of the UK, Oil Prices and Oil Prices Volatility..... 99**

**Table 25. Unit Root Test Results for Financial Stress Index of the U.K., Oil Prices (log) and Oil Prices Volatility..... 100**

**Table 26. Toda-Yamamoto Test Results for the U.K. ..... 100**

**Table 27. Pearson Correlations between Financial Stress Index (FSI) of Germany, Oil Prices and Oil Prices Volatility..... 103**

**Table 28. Unit Root Test Results for Financial Stress Index of Germany, Oil Prices (log) and Oil Prices Volatility ..... 104**

**Table 29. Toda-Yamamoto Test Results for Germany..... 104**

**Table 30. Pearson Correlations between Financial Stress Index (FSI) of France, Oil Prices and Oil Prices Volatility ..... 107**

**Table 31. Unit Root Test Results for Financial Stress Index of France, Oil Prices (log) and Oil Prices Volatility..... 108**

**Table 32. Toda-Yamamoto Test Results for France..... 108**

**Table 33. Pearson Correlations between Financial Stress Index (FSI) of Italy, Oil Prices and Oil Prices Volatility..... 111**

**Table 34. Unit Root Test Results for Financial Stress Index of Italy, Oil Prices (log) and Oil Prices Volatility..... 112**

**Table 35. Toda-Yamamoto Test Results for Italy ..... 112**

**Table 36. Pearson Correlations between Financial Stress Index (FSI) of Canada, Oil Prices and Oil Prices Volatility ..... 115**

**Table 37. Unit Root Test Results for Financial Stress Index of Canada, Oil Prices and Oil Prices Volatility..... 116**

**Table 38. Toda-Yamamoto Test Results for Canada..... 116**

**Table 39. Pearson Correlations between Financial Stress Index (FSI) of Norway, Oil Prices and Oil Prices Volatility ..... 119**

**Table 40. Unit Root Test Results for Financial Stress Index of Norway, Oil Prices and Oil Prices Volatility..... 120**

**Table 41. Toda-Yamamoto Test Results for Norway..... 120**

## LIST OF FIGURES

**Figure 1. Financial Stress Index for Turkey ..... 48**

**Figure 2. Financial Stress Index for Turkey, Economic Fluctuations and Major Financial Stress Events ..... 50**

**Figure 3. Financial Stress Index for the US ..... 53**

**Figure 4. Financial Stress Index for the US, Economic Fluctuations and Major Financial Stress Events ..... 55**

**Figure 5. Financial Stress Index for Japan ..... 57**

**Figure 6. Financial Stress Index for Japan, Economic Fluctuations and Major Financial Stress Events ..... 59**

**Figure 7. Financial Stress Index for the U.K. ..... 61**

**Figure 8. Financial Stress Index for the U.K, Economic Fluctuations and Major Financial Stress Events ..... 63**

**Figure 9. Financial Stress Index for Germany ..... 65**

**Figure 10. Financial Stress Index for Germany, Economic Fluctuations and Major Financial Stress Events ..... 66**

**Figure 11. Financial Stress Index for France ..... 69**

**Figure 12. Financial Stress Index for France, Economic Fluctuations and Major Financial Stress Events ..... 71**

**Figure 13. Financial Stress Index for Italy ..... 73**

**Figure 14. Financial Stress Index for Italy, Economic Fluctuations and Major Financial Stress Events ..... 74**

**Figure 15. Financial Stress Index for Canada ..... 77**

**Figure 16. Financial Stress Index, Economic Fluctuations and Major Financial Stress Events ..... 79**

**Figure 17. Financial Stress Index for Norway ..... 81**

**Figure 18. Financial Stress Index for Norway, Economic Fluctuations and Major Financial Stress Events ..... 82**

**Figure 19. Financial Stress Index (FSI) for Turkey, Oil Prices and Oil Prices Volatility ..... 86**

**Figure 20. Response of Turkey's FSI to Oil Prices Shock ..... 88**

**Figure 21. Response of Turkey's FSI to Oil Prices Volatility Shock .. 89**

**Figure 22. Historical Decomposition of FSI of Turkey ..... 89**

**Figure 23. Financial Stress Index (FSI) for the US, Oil Prices and Oil Prices Volatility ..... 90**

**Figure 24. Response of the US's FSI to Oil Prices Shock ..... 92**

**Figure 25. Response of the US's FSI to Oil Prices Volatility Shock .. 93**

**Figure 26. Historical Decomposition of FSI of the U.S. ..... 94**

**Figure 27. Financial Stress Index (FSI) for Japan, Oil Prices and Oil Prices Volatility ..... 95**

**Figure 28. Response of Japan's FSI to Oil Price Shock ..... 97**

**Figure 29. Response of Japan's FSI to Oil Prices Volatility Shock ... 97**

**Figure 30. Historical Decomposition of FSI of Japan ..... 98**

**Figure 31. Financial Stress Index (FSI) for the UK, Oil Prices and Oil Prices Volatility ..... 99**

**Figure 32. Response of the UK's FSI to Oil Prices Shock ..... 101**

**Figure 33. Response of the UK's FSI to Oil Prices Volatility Shock 101**

**Figure 34. Historical Decomposition of FSI of the U.K. ..... 102**

**Figure 35. Financial Stress Index (FSI) for Germany, Oil Prices and Oil Prices Volatility ..... 103**

**Figure 36. Response of Germany's FSI to Oil Prices Shock ..... 105**

**Figure 37. Response of Germany's FSI to Oil prices Volatility Shock ..... 105**

**Figure 38. Historical Decomposition of FSI of Germany ..... 106**

**Figure 39. Financial Stress Index (FSI) for France, Oil Prices and Oil Prices Volatility ..... 107**

**Figure 40. Response of France's FSI to Oil Price Shock ..... 109**

**Figure 41. Response of France's FSI to Oil Prices Volatility Shock. 109**

**Figure 42. Historical Decomposition of FSI of France ..... 110**

**Figure 43. Financial Stress Index (FSI) for Italy, Oil Prices and Oil Prices Volatility ..... 111**

**Figure 44. Response of Italy's FSI to Oil Price Shock ..... 113**

**Figure 45. Response of Italy's FSI to Oil Price Volatility Shock ..... 113**

**Figure 46. Historical Decomposition of FSI of Italy ..... 114**

**Figure 47. Financial Stress Index (FSI) for Canada, Oil Prices and Oil Prices Volatility ..... 115**

**Figure 48. Response of Canada's FSI to Oil Price Shock ..... 117**

**Figure 49. Response of Canada's FSI to Oil prices Volatility Shock 117**

**Figure 50. Historical Decomposition of FSI of Canada..... 118**

**Figure 51. Financial Stress Index (FSI) for Norway, Oil Prices and Oil Prices Volatility ..... 119**

**Figure 52. Response of Norway's FSI to Oil Price Shock ..... 121**

**Figure 53. Response of Norway's FSI to Oil prices Volatility Shock 121**

**Figure 54. Historical Decomposition of FSI of Norway..... 122**

## INTRODUCTION

Despite there is no widely accepted definition on it, the term “financial stability” has been discussed frequently in recent years. Along with that; since Central Banks’ main responsibilities (providing and sustaining price stability) are dependent on a stable financial system, studies that are under the guidance of Central Banks have investigated the term. Besides, the Central Banks and the International Monetary Fund (IMF) publish reports on the financial system’s possible risks and fragilities are determined on a regular basis.

On the other hand, financial instability can rapidly pass from one country to another. The recent global financial crisis was an example of this. Because of the contagious effects of financial crises or financial instability, ensuring and maintaining financial stability is not only important for countries' financial health but also for the rest of the world. For this reason, policy makers and authorities not only develop policies to ensure financial stability, but they also regularly monitor their financial stress.

There also exists a vast literature on co-movements and co-integrations between financial markets during financial instability states. The researchers investigated the interaction and transmission channels between financial markets during periods of calm and financial instability. Since strengthen co-movements and correlations are observed during financial instability states, high financial stress can rapidly spread out between financial markets during these periods. Therefore, monitoring co-movements and correlations between financial markets in regular intervals has become important in order to determine early warning indicators of financial instability states.

What is more; researchers, practitioners and policy makers try to determine early warning indicators of financial instability states and they construct “financial stress indexes” (or “financial conditions indexes”), FSI, that measure financial stability with low (weekly, monthly, quarterly or annually) or high frequency (daily) financial

market indicators. They develop FSI with application of different econometric models. Among them, Principal Component Analysis, Equal Weight Method, Variance Equal Weight Method, Credit Equal Weight Method, Logit Method, Composite Indicator of Systemic Stress Method can be mentioned. Policy makers and authorities can measure financial stress levels by monitoring these indexes and they can develop policies in order to inhibit hazardous effects of high level financial stress into economy.

Because of the importance of energy use and energy dependence of the real sector of the economy[1], energy price shocks can affect the economy detrimentally through different transmission channels[2]. For example, 1973, 1979 oil crisis had not only negative impacts on developed countries' economies, but they also harmfully affected emerging countries' economies since oil usage constitutes the greatest amount of total energy consumption (BP Statistical Review of World Energy, 2016). Hence the impacts of oil price shocks on macro economy or on the financial indicators have been analyzed by researchers. However, these effects might be different for oil importer/exporter countries. Therefore, the analysis of the patterns of impacts should consider net oil importer/exporter countries. In addition, focusing on (dis)similarities of different patterns of impact provide important information for developing and implementing different policies.

The impacts of oil price shocks on macroeconomic indicators have been investigated with application of different econometric methods (DCC-GARCH, GARCH, Haar A Trous Wavelet, Granger Causality, OLS, SVAR, VAR). Short or long run bi-directional relationships between variables have been examined with implementation of these methods.

[1] Energy imports of countries is available in the following link: http://data.worldbank.org/indicator/EG.IMP.CONS.ZS

[2] Oil price shocks can have detrimental effects on economy since they result to increase in the consumer price index (CPI), inflation, unemployment, interest rates, decrease in the industry production index (IPI), gross domestic product (GDP), gross national product (GDP), stock prices.

This dissertation mainly composed of two parts. In the first part, we develop high frequency (daily) financial stress indexes for 9 net oil importer/exporter countries in order to measure risks and fragilities of their financial systems effectively. In the second part, we explore the impacts of oil price shocks on financial stress indexes of these 9 oil importer/exporter countries.

Our research questions are given as follows:

- Could it be possible to construct high frequency (daily) indexes to determine early warning symptoms of financial instability states?
- Do the financial stress indexes react to well-known financial stress events effectively?
- How do oil price shocks affect financial stability of countries in daily?
- Is the reaction of financial stability of a net oil importer country to oil price shock different than the reaction of financial stability of a net oil exporter country to oil price shock?

This dissertation consists of two phases and hence contributes to the related literature in two ways. In the first phase, as given in chapter two, high frequency financial stress indexes for G-7 countries, Turkey and Norway are constructed. In these indexes some new indicators (i.e. dynamic beta of banking sector, realized volatility of slope of the yield curve) are also added to the model in addition to common used indicators in the related literature[3]. It is observed that all indexes properly create signals for well-known financial stress events.

In the second phase, given in the chapter 3, the response of financial stress indexes to daily oil price shocks for net oil importer/exporter countries are analyzed separately. This approach not only provide valuable information to

[3] Rolling beta of the banking sector and level of yield curve's slope are used in the related literature. To the best of our knowledge this is the first study that use dynamic beta of the banking sector while developing financial stress indexes. In addition, we prefer using realized volatility of yield curve's slope.

researchers and practitioners, it also offers a different perspective on this research area to policy makers.

In chapter 3, the impacts of oil prices shocks on financial stability are discussed for 9 net oil importer/exporter countries with an application of SVAR model. In addition, dis(similarities) of impacts of oil price and oil price volatility shocks on financial stabilities are analyzed.

# CHAPTER 1

# FINANCIAL STABILITY AND ENERGY PRICE SHOCKS

This part of the thesis consists of 4 sections: *Definition of Financial Stability, Stylized Facts of Financial Stability/Instability, Empirical Studies, Impacts of Energy Price Shocks on Financial and Macroeconomic Indicators.* In the first section, definition of financial stability/instability are discussed and central banks' role in monitoring and providing financial stability is given. The stylized facts of financial stability/instability are analyzed in the followed section. In the third section, empirical studies that construct "financial stress indexes" or "financial conditions indexes" to measure risks and fragilities of financial system in high frequency (daily) or in low frequency (weekly, monthly, quarterly, annually) are given. Studies that investigate the impacts of energy price shocks on financial and macro indicators are given in the last section.

## 1.1. DEFINITION OF FINANCIAL STABILITY

Despite there is no common accepted definition on the term "financial stability", it has been discussed by many researchers and has been tried to be defined. Some of these studies prefer describing the term to its counter correspondence "financial instability".

Early studies defined financial instability by relating to some facts (Bernanke and Gertler, 1987; Wolfson, 1990). Bernanke and Gertler associated financial instability to financial fragility. They defined financial fragility as "*the existence of a significant deficit of investment in economy, deterioration of economic resources and weaknesses of balance sheets in which economy experiences substantial underinvestment"* (Bernanke and Gertler, 1987, p. 2-37).

Wolfson associated financial instability to "*episodes of financial crisis and the troubles of depository intermediaries".* The study found that financial instability

increased in the United States after second World War until 1966 due to increase in financial fragility, bank problems that didn't meet necessary borrowing demands and improper of the regulatory structure in the change of economic conditions (Wolfson, 1990).

In another study, financial instability hypothesis was defined. Minsky pointed out that as a model of capitalist economy, "*financial instability hypothesis doesn't endure to exogenous shocks which generate business cycles that combine the internal dynamics of capitalist economies and the regulations and interventions that keep the economy functioning*" (Minsky, 1992).

1990's other studies also defined financial instability. Crockett defined financial instability as "*a situation where economic performance is potentially impaired by fluctuations in the price of financial assets, or in the ability of financial intermediaries to meet their contractual obligations"* (Crockett, 1996, p. 532).

Mishkin described the factors that cause financial instability as "*increase in interest rates, increase in uncertainty, increase in asset market effect on balance sheets, and problems in the Banking Sector*" (Mishkin, 1997). Wyplosz suggested the term financial instability as a "*public bad"* and he related it to *"moral hazard and adverse selection occurred in financial markets and multiple equilibria"* (Wyplosz, 1998, p. 5-7).

According to Mishkin, financial instability is related to "*incapability of financial system's funding individuals or firms due to inverse selection or moral hazard*" (Mishkin, 1999, p. 6-9).

2000's studies analyzed financial instability state and they gave the definition. In one study, financial instability is defined as "*deviation of asset prices from their normal values, as a consequence of a rise in volatility"* (Bernanke and Gertler, 2000). Vercelli defined financial instability as a concept of dynamic instability. He proposed that in financial instability state, there exists "*a progressive divergence from optimum equilibrium and an abrupt change in the functional and parametric*

*structure of the unit which results in a change the qualitative character of its dynamic behavior*" (Vercelli, 2000).

According to Chant, "*financial instability is a situation in which there is a threat of the effective functioning of financial institutions and markets and it may be costly when it occurs"* (Chant, 2003, p. 12).

Lai described the indicators of financial instability as "*crisis initiation (self-fulfilling belief among depositors that others will withdraw their deposits in the short term (coordination failure), ineffectiveness of markets to provide liquidity to solvent but illiquid banks because of lack of information or market power among liquidity providers), crisis propagation (doubt of bank solvency triggered by the failure of other similar banks informational contagion, credit exposures among banks that cause their pay-offs to be interrelated (contagion caused by credit links), debt financing in credit markets with imperfect information and contractual problems (financial accelerator)"* (Lai, 2003, p. 55).

Some other studies also described main determinants of financial instability states. According to Ferguson, financial instability is characterized by some basic criteria "*diverging sharply from fundamentals of some important set of financial asset prices, significant distortion of market functioning and credit availability (domestically or internationally) and (significant deviation of aggregate spending from economy's production ability)*" (Ferguson, 2003, p. 209).

Allen and Wood indicated that, in financial instability state "*a great number of parties (households, companies, individuals, governments) face to financial crises which have seriously adverse effects on economy*" (Allen and Wood, 2006, p.160).

Edwards analyzed financial instability in Latin American countries. According to the study, "*control of capital inflows/outflows, devaluations (contractionary), propagation of international business cycles*" are the main determinants of financial instability in Latin American countries (Edwards, 2003).

According to a recent study, main determinants of financial instability are "*booms and boosts in asset prices, house prices and stock prices, exchange rate and price of some financial assets, household debt growth and debt accumulation*" (Iqbal et al., 2010, p. 23-37).

Some studies preferred defining financial stability more directly. According to Crockett (1997), "*financial stability is a situation where the key institutions in the financial system are stable (they can pursue their contractual obligations as a consequence of high level confidence) and the key markets are stable (there haven't been changes in fundamentals of transactions by participants confidently)"* (Crockett, 1997, p. 9).

2000's studies also investigated financial stability and defined the term. Schinasi pointed out that "*financial stability is related to financial system's ability to facilitate both an efficient allocation of economic resources—both spatially and especially intertemporally—and the effectiveness of other economic processes, (such as wealth accumulation, economic growth, and ultimately social prosperity), to assess, price, allocate, and manage financial risks, to maintain its ability to perform these key functions—even when affected by external shocks or by a buildup of imbalances—primarily through self-corrective mechanisms"* (Schinasi, 2004, p. 8).

Haldane et al. indicated that financial stability can be thought "*as a situation which enables individuals to smooth consumption across time and provide efficient financing of investment projects with saved resources"* (Haldane et al., 2005).

According to Allen and Wood, "*financial stability should be related to welfare, it should be an observable state of affairs, it should be subject to be controlled by public authorities and it should be property of a clearly defined politically substantial entity"* (Allen and Wood, 2006, p. 154).

In a recent study financial stability is defined as *"a situation where financial intermediation is well functioning (allowing funds from depositors to longer term*

*investment projects and as a result support the economy) and credit intermediation and payment services are supplied by financial system in order to provide continuous growth of real economy on its growth path"* (Rosengren, 2011).

Central banks and international institutions also define financial stability. Central banks states their mission of safeguarding and maintaining financial stability in addition to their principal mission of providing price stability and they publish financial stability reports in regular intervals in which fragilities and possible risks of financial system are given.

The World Bank defines stability in financial system as "*capable of efficiently allocating resources, assessing and managing financial risks, maintaining employment levels close to the economy's natural rate, and eliminating relative price movements of real or financial assets that will affect monetary stability or employment levels"* (The World Bank, 2016).

Bank of Canada defines financial stability as "*the resilience of the financial system in the face of adverse shocks that enables the continued smooth functioning of the financial intermediation process"* (Financial System Review-Bank of Canada, 2015, p. iii).

Norges Bank defines a stable financial system as "*a financial system that is resilient to shocks and thus capable of channeling funds, executing payments and distributing risk efficiently*" (Norges Bank, 2015, p. 5).

Bank of England considers the same term as "*public trust and confidence in financial institutions, markets, infrastructure, and the system as a whole"* (Bank of England, 2016).

Bank of Japan refers financial stability to *"a state in which the financial system functions properly, and participants, such as firms and individuals, have confidence in the system"* (Bank of Japan, 2016).

Türkiye Cumhuriyet Merkez Bankası defines financial stability as "*the existence of a sound and efficiently functioning financial system, as a vital component of its primary objective of achieving price stability*" (Türkiye Cumhuriyet Merkez Bankası, 2016).

Deutsche Bundesbank defines the same term as "*the financial system's ability to perform its key macroeconomic functions, especially in periods of stress and upheaval"* (Deutsche Bundesbank Eurosystem, 2016).

European Central Bank describes the same term as *"conditions in which the financial system – intermediaries, markets and market infrastructures – can withstand shocks without major disruption in financial intermediation and in the general supply of financial services"* (European Central Bank Eurosystem, 2016).

Swiss National Bank defines "*a stable financial system*" as "*a system whose individual components – financial intermediaries and the financial market infrastructure – fulfil their respective functions and prove resistant to potential shocks*" (Swiss National Bank, 2016).

## 1.2. STYLIZED FACTS OF FINANCIAL STABILITY/INSTABILITY

There exists a vast literature in which the stylized facts of financial stability/instability or financial crises periods are investigated.

According to Spotton, the stylized facts of financial instability are related to "*episodes of an affiliated economy which is in the midst of technological change or institutional transformation, decline in asset prices by the effect of financial distress and the collapse of principal credit markets and collapse of speculative asset markets"* (Spotton, 1996, p. s204-s205).

Schinasi explained the stylized facts of financial stability as "*stability of financial institutions which operate in financial system and mechanism of controlling of systemic financial risks"* (Schinasi, 2003, p. 4).

According to Acharya et al., stylized facts of financial stability are "*prevention of having high leverage and risk by government support, the fair valuation of open government guarantees and providing funds in some circumstances, being more transparent in order to decline externality and regulate systemic risks of financial institutions*" (Acharya et al., 2009)

Stylized facts of financial crises (special cases of financial instability states) are investigated by important number of studies. Eichengreen and Portes associated the symptoms of financial crisis to "*debt defaults, exchange market disturbances and bank failures*" (Eichengreen and Portes, 1987).

According to Mishkin, the stylized facts of financial crises are "*increases in interest rates, stock market declines, increases in uncertainty, bank panics and unanticipated declines in the aggregate price level*" (Mishkin, 1992).

Chang and Velasco described the symptoms of financial crises for emerging countries are as follows: "*illiquidity problems caused by opening the capital account or rise in the country's access to international credit, financial liberalization due to maturity mismatch between assets and liabilities, huge decline in asset prices, credit depression and important decline in economic activity as a result of exogenous (trade, competition, world interest rates) change sourced small shocks, assets bubble, exchange rate collapse*" (Chang and Velasco, 1998, p.3-4). Krugman described financial crisis' symptoms as "*contagion, transfer problem and balance sheet problems"* (Krugman, 1999).

2000's studies also investigated stylized facts of financial crisis. According to Lai the symptoms of financial crises are "*an important decline in real economic output, drop in liquidity, instability in asset prices, contagion between and in markets and decline in confidence of investors"* (Lai, 2002).

Edwards stated that, stylized facts of financial crises are "*massive volume of capital lost, drop of international reserves to dangerously low levels and overvaluation of real exchange rates"* (Edwards, 2003).

Mishkin described symptoms of financial crises as "*deterioration of financial-sector balance sheets, increases in uncertainty and deterioration of nonfinancial balance sheets due to changes in asset prices*" (Mishkin, 2003).

According to Claessens and Kose, the stylized facts of financial crises are "*important change in asset prices and credit volume, severe disruption in financial supply to various agency in financial system and financial intermediaries; observation of firms, households, financial intermediaries and government institutions' balance sheets problems*" (Claessens et al., 2013, p. 3-59).

Some studies explored co-movements during financial crises and found evidence of strengthening co-movements between financial markets indicators (Masih and Masih, 1997; Ghosh et al., 1999; Meric et al., 2001; Chiang et al., 2007; Khan and Park, 2009; Huyghebaert et al., 2010; Kenourgios et al., 2011; Aloui and Hkiri, 2014).

## 1.3. EMPIRICAL STUDIES

There exist an important number of empirical studies that measured risks and fragilities of financial system by using indicators of financial markets (banking sector, bond, equity, money, foreign exchange, credit, derivative markets and financial intermediaries). The studies constructed high frequency (daily) or low frequency (weekly, monthly, quarterly, and annually) indexes by these indicators and with different econometric methods (Principal Component Analysis, Equal Weight Method, Variance Equal Weight Method, Credit Equal Weight Method, Logit Method, Composite Indicator of Systemic Stress).

### 1.3.1. High Frequency (Daily) Financial Stability Indexes

Illing and Liu developed financial stress index of Canada from 1981 through 2005 with Credit Equal Weight (CEW) method using 8 daily indicators from banking sector, equity, debt and foreign exchange markets. Credit Equal Weight method

constructs index by sorting indicators between 0 and 100 according to the credit weight of each indicator in related market (Illing and Liu, 2006).

Holmfeldt et al. developed the same index of Switzerland from 1997 through 2009 with Equal Weight (EW) method using 4 indicators from equity, credit, money and bond markets. Equal Weight method composes indicators in equal weights and in equal importance and constructs a single index (Holmfeldt et al., 2009).

Oet et al. constituted Cleveland Financial Stress Index (CFSI) for the U.S. from 1991 to 2011 with Credit Equal Weight (CEW) method using 11 indicators of credit, foreign exchange, equity and interbank markets (Oet et al., 2011).

Lousiz and Vouldis developed Financial Systemic Stress Index (FSSI) of Greece from 1987 through 2010 with an application of Composite Indicator of Systemic Stress (CISS) method. The study used 13 variables that represent the components of Greece economy (Lousiz and Vouldis, 2012).

Islami and Kurz-Kim developed financial stress index of 17 countries in Euro area from 2007 through 2013 with Variance Equal Weight (VEW) method using 6 variables of financial system (Islami and Kurz-Kim, 2014).

The indicators that are used in high frequency (daily) financial stress indexes are given in Table 1.

**Table 1.** High Frequency Financial Stress Index Indicators

| Indicators | Illing and Liu | Holmfeldt et al. | Oet et al. | Lousiz and Vouldis | Islami and Kurz–Kim |
|---|---|---|---|---|---|
| TED spread | | √ | √ | | |
| Yield curve's slope | | | √ | | |
| Corporate bond spread | √ | | √ | | |
| Corporate bond/treasury-bill spread | | √ | √ | | |
| Interbank borrowing rate | | | √ | | |
| Weighted dollar crashes | | | √ | | |
| Bid-ask spread on 3 month government treasury bill | √ | | √ | | |
| Banking sector beta | √ | | √ | √ | |
| Bank bond spread | | | √ | √ | |
| The covered interest spread | √ | | √ | | |
| BCA index | √ | | | | |
| CMAX of the exchange rate | √ | | | | |
| CMAX of the stock market index | √ | | | √ | |
| Equity risk premium | √ | | | | |
| Credit risk premium | | √ | | | |
| Stock market crashes | | | √ | | |
| 10 year Greek government bond/German bund spread | | | | √ | |
| Yield realized volatility | | | | √ | |

| | | | | | |
|---|---|---|---|---|---|
| Correlations between returns on Greek stocks and the German Bunds | | | | √ | |
| CDS spread on iTraxx non-financials | | | | | √ |
| CDS spread on iTraxx Europe crossover | | | | | √ |
| Deposit gap | | | | √ | |
| Loan gap | | | | √ | |
| Bank profitability (Interest Margin) | | | | √ | |
| Banking index | | | | √ | |
| Realized volatility of Banking index | | | | √ | |
| Realized volatility of stock market index | | √ | | √ | |
| Earnings per share | | | | √ | |
| 3 month Euribor/3 month German treasury bill spread | | | | √ | |
| Implied volatility of EUR/USD rate | | | | | √ |
| 3 month Euribor/EONIA spread | | | | | √ |
| Volatility of the oil price future | | | | | √ |
| Earnings price ratio | | | | | √ |

### 1.3.2. Low Frequency (Weekly, Monthly, Quarterly, Yearly) Financial Stress Indexes

Low frequency financial stress index studies suggested weekly indexes (Nelson and Perli, 2007; Brave and Butters, 2011; Hollo et al., 2012; Cerquera and Murcia, 2015; Kliesen and Smith, 2015), monthly indexes (Balakrishnan et al., 2009; Hakkio and Keaton, 2009; Morales and Estrada, 2010, Yiau et al., 2010; Cardarelli et al., 2011; Cevik et al., 2013), quarterly indexes (Sinenko et al., 2013; Arzamasov and Penikas, 2014; Eidenberger et al., 2014; Vermeulen et al., 2015) and yearly indexes (Bordo et al., 2002; Hatzius et al., 2010).

Some studies suggested weekly financial stress indexes. Nelson and Perli developed financial stress index of the United States from 1994 through 2002 with logit using 12 financial system indicators (Nelson and Perli, 2007).

Brave and Butters constituted financial conditions index for the United States from 1970 to 2010 with Principal Component Analysis using 100 indicators that represent stock, debt, money and banking markets (Brave and Butters, 2011).

Hollo et al. constituted an index for the financial conditions of Euro area from 1987 to 2011 with an application of Composite Indicator of Systemic Stress (CISS) method using 15 indicators taken from financial intermediaries, money, equity, bond and foreign exchange markets (Hollo et al., 2012).

Kliesen and Smith constructed FSI for the United States (St. Louis Financial Stress Index, STLFSI) from 1993 through 2015 with an application of Principal Component Analysis using 18 indicators from money, bond and equity markets (Kliesen and Smith, 2015).

Cerquera and Murcia constituted financial stress index for Spain from 1987 to 2015 with CISS method using 18 indicators from financial intermediaries, money, equity, bond, foreign exchange and derivative markets (Cerquera and Murcia, 2015).

The indicators that are used in weekly financial stress indexes are given in Table 2.

**Table 2.** Weekly Financial Stress Index Indicators

| Studies | Indicators |
|---|---|
| Nelson and Perli | "*2-year liquidity premium, 10-year liquidity premium, BBB risk spreads, AA risk spreads, high-yield risk spreads (7-year), long bond implied volatility, 3-month Eurodollar confidence interval 1-year ahead, Eurodollar implied volatility, 10-year Treasury implied volatility, SP100 implied volatility (VXO), federal funds target/2-year Treasury, 12-month ahead earnings/SP500"* (Nelson and Perli, 2007). |
| Hollo et al. | "*Realised volatility of the 3-month Euribor rate, Interest rate spread between 3-month Euribor and 3-month French T-bills, MFI emergency Lending at Eurosystem Central Banks, realised volatility of the German 10-year benchmark Government bond index, yield spread between A-rated non-financial, realised volatility of the Datastram non-financial sector stock market Index corporations and Government bonds, CMAX for the Datastream non-financial sector stock market index, stock-bond correlation, realised volatility of the idiosyncratic equity return of the Datastream bank sector stock market index over the total market index, yield spread between A-rated financial and non-financial corporations, realised volatility of the Euro exchange rate vis-à-vis the US dollar"* (Hollo et al., 2012). |
| Kliesen and Smith | "*Effective Federal funds rate, 2-year Treasury rate, 10-year Treasury Rate, 30-year Treasury, Baa-rated corporate, Merrill Lynch high-yield corporate master II Index, Merrill Lynch asset-backed master BBB-rated, corporate Baa-rated bond minus 10-year Treasury, Merrill Lynch high-yield corporate master II Index minus 10-year Treasury, 3-month London Interbank Offering Rate–Overnight Index Swap (LIBOR-OIS) spread, 3-month Treasury-Eurodollar (TED) Spread, 3-month commercial paper minus 3-month, Treasury bill, J.P. Morgan Emerging Markets Bond Index plus, Chicago Board Options Exchange Market Volatility Index (VIX), Merrill Lynch bond market volatility index (1-month), 10-year nominal Treasury yield minus 10-year Treasury inflation protected security yield, vanguard financials exchange-traded fund"* (Kliesen and Smith, 2015). |
| Cerqueira and Murcia | *"Realised volatility of the three-month Euribor rate, Interest rate spread between three-month Euribor and three-month Spanish Treasury Bills, Three-month Libor-OIS spread, Realised volatility of the Spanish ten-year benchmark government bond index, Yield spread between the Spanish ten-year government bond and German ten-year government bond, Bid-ask spread of Spanish government bonds, Volatility of Spanish non-financial corporation index, CMAX of Spanish non-financial corporation index, Ibex 35 liquidity, Realised volatility of the idiosyncratic equity return of the banking sector market index relative to Ibex 35 returns, Financial sector credit risk spread: weekly average of daily CDS of five important Spanish banks, CMAX of financial sector index combined with the inverse of its price-book ratio, Realised volatility of the euro exchange rate vis-à-vis the US dollar, Realised volatility of the euro exchange rate vis-à-vis the Japanese Yen, Realised volatility of the euro exchange rate vis-à-vis the British Pound, Realised volatility of IBEX-35 options, Realised volatility of IBEX-35 future open position, Realised volatility of commodities index*" (Cerqueira and Murcia, 2015) |

Some studies constructed monthly financial stress indexes. Balakrishnan et al. constituted financial stress index of 18 emerging countries from 1997 to 2009 with an application of Variance Equal Weight (VEW) method using 5 variables from banking, equity, bond and exchange markets (Balakrishnan et al., 2009).

Hakkio and Keaton the same index of the United States (Kansas City Financial Stress Index, KCFSI) from 1990 through 2009 with an application of Principal Component Analysis using 11 financial market indicators (Hakkio and Keaton, 2009).

Morales and Estrada developed the same index for Colombia from 1995 to 2008 with VEW method and qualitative approach using indicators of Commercial Banks, Financial Cooperatives Balance Sheets, and Mortgage Banks (Morales and Estrada, 2010).

Yiau et al. constructed financial stress index for Hong Kong from 1997 to 2008 with EW method (the equal-weighted average) using 6 variables from government debt, equity, exchange and banking markets (Yiau et al., 2010).

Cardarelli et al. constructed the same index for developed 17 countries from 1981 through 2009 with VEW method using 7 indicators from banking, bond, equity and exchange markets (Cardarelli et al., 2011).

Cevik et al. constituted FSI for Turkey from 1997 to 2010 with an application of Principal Component Analysis using 8 variables from banking, equity, exchange, bond, money and credit markets and 1 variable that represents external debt (Cevik et al., 2013).

The indicators that are used in monthly financial stress indexes are given in Table 3.

**Table 3.** Monthly Frequency Financial Stress Index Indicators

| **Indicators** | **Hakkio and Keaton** | **Caldarelli et al.** | **Yiu et al.** | **Balakrishnan et al.** | **Çevik et al.** |
|---|---|---|---|---|---|
| TED spread | √ | √ | √ | | |
| 2 year swap spread | √ | | | | |
| Off-the-run/On-the-run-reasury spread | √ | | | | |
| Aaa/Treasury spread | √ | | | | |
| Baa/Aaa spread | √ | | | | |
| High-yield bond/Baa spread | √ | | | | |
| Consumer ABS/Treasury Spread | √ | | | | |
| Corporate bond spread | | √ | √ | | |
| Stock-bond correlations | √ | | | | |
| Stock market returns | | √ | | √ | |
| Stock market volatility | √ | √ | √ | √ | √ |
| Volatility of bank stock prices | √ | | | | |
| Cross section dispertion of bank stock returns | √ | | | | |
| Slope of the yield curve | | √ | √ | √ | |
| Rolling beta of banking sector | | √ | | √ | |
| Exchange rate volatility | | √ | √ | | |
| Inverted term spread | | | √ | | |
| EMBI | | | | √ | √ |
| Bond spread | | | | | √ |
| Default probability of banking market | | | | | √ |
| Trade finance | | | | | √ |
| Growth rate of short term external debt | | | | | √ |

Some studies constructed quarterly financial stress indexes. Sinenko et al. constituted financial stress index for Lithuania from 1998 through 2013 with EW method using 7 indicators taken from credit institutes balance sheet, money, bond and equity markets (Sinenko et al., 2013).

Arzamasov and Penikas developed financial stress index for Israel from 2002 to 2013 with an application of Positive Weighting Principal Component Analysis using 16 "*financial soundness indicators*" constituted by International Monetary Fund (Arzamasov and Penikas, 2014).

Eidenberger et al. developed the same index for Australia from 2004 through 2013 with EW method using 5 variables from equity money and bond markets (Eidenberger et al., 2014).

Vermeulen et al. developed financial stress indexes of 28 OECD countries from 1980 to 2010 with EW method using 6 variables from money, capital, banking and exchange markets (Vermeulen et al., 2015).

Some other studies constituted annual financial stress indexes: Bordo et al. developed financial conditions index for the U.S. from 1870 through 1997 using standardized 4 series (Bordo et al., 2001).

Hatzius et al. developed the same index for the U.S. from 1970 to 2010 with Principal Component Analysis using 45 indicators from the U.S. financial system (Hatzius et al., 2010).

## 1.4. IMPACTS OF ENERGY PRICE SHOCKS ON FINANCIAL AND MACROECONOMIC INDICATORS

The impacts of oil price shocks on financial or macro indicators have been investigated by researchers to determine the transmission channels of shocks. Besides, transitory and permanent impacts of shocks are taken into consideration by policy makers since oil price shocks may have detrimental effects into

economy. Early studies dated to 1970's found evidence of negative effect of shocks on macroeconomic indicators of the U.S. (Pierce et al., 1974; Rasche and Tatom, 1977).

The bi-directional effects between oil price shocks and macroeconomic indicators constituted an important place in the 1980's and 1990's related studies: Though some studies couldn't find a significant relationship among shocks and macroeconomic indicators (Hamilton, 1983; Loungani, 1986), some other studies reported evidences of the effects of shocks on economic determinants. Among them, i) asymmetric relationship between shocks and macroeconomic variables (Mork, 1989; Mork et al., 1994, Lee et al., 1995), ii) negative impacts of shocks on economic indicators of the United States (Hamilton, 1986; Ferderer, 1997, Brown and Yucel, 1999), and specifically during recession (Hooker, 1996; Raymond and Rich, 1997) can be mentioned.

Asymmetric linkages between oil price shocks and macroeconomic determinants were found in some studies: Mork found asymmetry between oil price and GNP for the United States (Mork, 1989). Mork et al. analyzed the correlations among oil price increases and GDP growth of 7 oil importer/exporter OECD countries. They found negative correlations and asymmetric relationship between variables (Mork et al., 1994). Lee et al. investigated the causal relationship among normalized oil price shocks and growth of real GNP. They found asymmetric impacts of negative, positive normalized shocks (Lee et al., 1995). Hooker found evidence for impact of 1973 and 1979 oil price shocks on macroeconomy, while he found asymmetry for the late 1980's relationship between the variables (Hooker, 1996).

Some studies couldn't determine significant relationship among oil price shocks and macroeconomic variables or couldn't find common result for the relationship during different periods (Hamilton, 1983; Loungani, 1986).

Hamilton investigated correlations between oil price and output for the United States during seven of the eight recessions after World War 2 and he couldn't find a common result for all recession periods (Hamilton, 1983).

Loungani constructed the dispersion index in order to measure the labor reallocation required for each period and used the index to "*decompose the differential impact of oil price shocks across industries and across residual dispersion*". Loungani stated that "*except for oil price increases in 1950s and 1970s, the impact of oil price shocks were not main determinant of unemployment rate*" (Loungani, 1986).

The response of macro economy of the U.S. to oil price shocks during recessions, business cycle periods were examined and negative effects were found in some of the studies (Hooker, 1996; Raymond and Rich, 1997).

Raymond and Rich investigated the relationship between oil price shocks and business cycle fluctuations after second World War for the United States with an application of Markov Switching model. They proposed that oil price shocks triggered 1973-75 and 1980 recessions, while not principal determinants of 1990-92 recession (Raymond and Rich, 1997).

Some studies found adverse effects of oil price shocks into the economy for the United States (Ferderer, 1997, Brown and Yucel, 1999). Ferderer analyzed linkage between oil prices volatility and aggregate growth and determined oil price's disruptions have negative effect on macroeconomy of the United States over the period 1970-1990 (Ferderer, 1997). According to Brown and Yucel, increase in oil price resulted to decline in potantial output as a classic supply shock (Brown and Yucel, 1999).

Some studies investigated relationship between oil price shocks and macroeconomic indicators from a different perspective (Hamilton, 1996; Bernanke et al., 1997).

Hamilton investigated the relationship between growth rate and oil price rises in two periods (1948:I-1973:III and1973:IV-1994:II). The study indicated that turmoil in the Middle East would result to disruption to oil-supply and it would cause to recession in the United States (Hamilton, 1996).

Bernanke et al. explored the impacts of oil price shocks on the economy of the United States. They found that the most part of the impact of oil price shocks come because of "*tightening of monetary policy*" (Bernanke et al., 1997).

The more recent studies investigated transmission channels between oil price shocks into macro economy. Adverse and significant impacts of oil price shocks on economic indicators were found by several studies (Lee et al., 2001 (for the U.S.); Papapetrou, 2001 (for Greece); Cuñado and Gracia, 2003 (for 15 European countries); Barsky and Kilian, 2004 (for the United States); Guo and Kliesen, 2005 (for the United States); Tang et al., 2010; Wei and Guo, 2016 (for China)).

Lee et al. investigated the effect of oil price shocks on economic activity for Japan. The impact of oil price shocks was found statistically significant for the economic activities of Japan by the study (Lee et al., 2001).

Papapetrou investigated dynamic relationship among oil prices, interest rates, employment, real stock prices and economic activity for Greece. Results of the study indicated important role of oil prices in explaining economic activity and employment (Papapetrou, 2001).

Cuñado and Gracia explored macroeconomy and oil price relationship for European countries. Permanent inflationary effect and asymmetric effect on production growth rates were found (Cuñado and Gracia, 2003).

Barsky and Kilian analyzed the connections among oil price shocks and macroeconomy of the U.S. They found contribution of shocks on recessions,

whereas they couldn't find  impact of shocks in explaining stagflation in real GDP (Barsky and Kilian, 2004).

Guo and Kliesen examined the same relationship and determined significant and negative impact of shocks on main macroeconomic determinants (Guo and Kliesen, 2005).

Herrera and Pesavento investigated of the responses of the US economy to oil price shocks and monetary policies. Important contribution of oil price shocks on fluctuations and insignificant role of monetary policy of reducing oil price shocks were found (Herrera and Pesavento, 2009).

Tang et al. analyzed reaction of the Chinese macro economy to the oil price shocks. They found adverse effect of shocks on output, investment and positive effect on inflation and on interest rate (Tang et al., 2010).

Wei and Guo also examined the same relationship for China. Results of the study indicate significant impact of shocks on main Chinese macroeconomic determinants (Wei and Guo, 2016).

Some studies analyzed the impacts of oil price shocks which follows a monetary policy or explored the impacts of a monetary policy which follows oil price shocks on macro economy: Hamilton and Herrera analyzed the suggestion of "*oil price shocks could be eliminated by monetary policy"* of Bernanke et al (1997). Results of the study showed that potential of monetary policy in reducing the effect of oil price shocks is not as big as suggested by Bernanke et al. (Hamilton and Herrera, 2004). Leduc and Sill investigated the impact of oil price shock on growth which follow monetary policy specifications. The impact of shocks on growth is small if the Central Bank targets the level of price by the results of the study (Leduc and Sill, 2004).

Kormilitsina explored the role of monetary policy that follows oil price shocks on recessions. Results of the study indicated that monetary policy which follows shocks exacerbate recessions (Kormilitsina, 2011).

The impacts of oil price shocks on macro economy of oil importer/exporter countries have been investigated over the last two decades: Jimenez-Rodriguez and Sánchez analyzed the impacts of oil price shocks on GDP for a sample of oil importer/exporter countries (G-7 countries, Norway and the Euro area). The study determined significant and negative impact of oil price increase on output for oil importer countries except for Japan. Besides, positive effect of oil price increase on output of Norway and negative effect of it on output of the United Kingdom were found (Jimenez-Rodriguez and Sánchez, 2005). Lescaroux and Mignon analyzed the same research for oil importer/exporter 36 countries using Granger causality test. They found oil prices Granger causes to GDP except for some oil exporter countries (Saudi Arabia, UK and Qatar) (Lescaroux and Mignon, 2008).

Response of economic activity of Brazil and the U.S. to oil price shocks were examined by Cavalcanti and Jalles. Impacts of the shocks for the United States economy were found larger than that for Brazilian economy by the results of the study (Cavalcanti and Jalles, 2013).

Allegret et al. analyzed the effects of oil price shocks on global imbalances of 30 oil importer/exporter countries. The results of the study indicated that the impacts are dependent to the source of shocks (Allegret et al., 2015).

Some studies found limited or no effects of oil price shocks: Blanchard and Gali analyzed macroeconomic performance of some industrialized economies after 1970s oil price shocks in the last decade with an application of SVAR model. Study suggests that "*the price of oil explains only a part of the stagflation periods of the 1970s and the effects of oil price changed over time"* (Blanchard and Gali, 2007). Álvarez et al. explored inflationary impacts of oil price shocks for Spain. They found limited effects of shocks, whereas found major role of fluctuations in oil price shocks resulted by inflation variability (Álvarez et al., 2011). Basnet and

Upadhyaya examined the impacts of oil price shocks on output, inflation and exchange rate for ASEAN-5 countries. They found no evidence of long-run effect of shocks on economic growth, as well as on macroeconomic performance (Basnet and Upadhyaya, 2015).

Cuñado et al. analyzed response of macro economy to oil price shocks for some Asian countries (Japan, Korea, India and Indonesia) and found limited response (Cuñado et al., 2015).

Huang et al.compared the impacts of oil price changes and volatility on economic activity for Japan, Canada and the United States. The impacts of oil price changes were found greater than the impact of oil price volatility on economic activity (Huang et al., 2005). Structural breaks for the macroeconomic development for Japan were determined due to the oil price shocks (Jiménez-Rodriguez and Sánchez, 2012).

From a different perspective, Blanchard and Riggi developed a New-Keynesian model and found natural candidacy of oil price shocks in explaining monetary policy changes if they were easy to be identified (Blanchard and Riggi, 2013).

Herwatz and Plödt investigated reaction of macroeconomic variables to oil price shocks for the U.S., Euro area and China by distinguishing shocks demand/supply based. The impacts of oil demand shocks were found larger by the study (Herwatz and Plödt, 2016).

Table 4 summarizes the empirical studies given above:

**Table 4.** Summary of Empirical Studies that Investigate the Impact of Oil Price Shocks on Macroeconomic Variables

| **Authors** | **Methodology** | **Variables** | **Period** |
|---|---|---|---|
| Pierce and Enzler (1974) | MIT-Penn-SSRC | Oil prices, GNP plus imports | 1958-1973 |
| Rasche and Tatom (1977) | Ordinary least squares (OLS) | Oil prices, GNP | 1949-1975 |
| Hamilton (1983) | OLS, Granger causality test | Oil prices, GNP, unemployment rate, price deflator compensation per worker, import prices, M1 | 1947-1975 |
| Burbidge and Harrison (1984) | VAR | Oil prices, IPI, short term interest rate, currency and demand deposit, average early earnings in manufacturing, CPI | 1961:1-1982:6 |
| Loungani (1986) | OLS | Quarterly employment data for 28 industries, oil prices | 1947-1982 |
| Mork (1989) | VAR | GNP, unemployment rate, 90-day Treasury bill rate, wage inflation, import price inflation, inflation, oil prices | 1949:1-1988:2 |
| Mork et al. (1994) | OLS, Granger causality test | Oil prices, GDP | 1967:3 - 1992:4 |
| Lee et. al (1995) | VAR | GNP, unemployment rate, 90-day Treasury-bill rate, wage inflation, import price inflation, inflation, oil prices | 1949:1-1986:1 |
| Hooker (1996) | VAR | Oil prices, GNP | 1949:1-1992:3 |
| Raymond and Rich (1997) | Markov Switching Model | Oil prices, GDP | l951:I-l995:III |

| | | | |
|---|---|---|---|
| Brown and Yucel (1999) | VAR | Oil prices, GDP, personal consumption expenditures, IPI, total non-agricultural, employment, 90 day Treasury-bill, 10 year T-bill | 1965:1-1997:12 |
| Lee et al. (2001) | VAR | Oil price, CPI | 1960:1-1996:5 |
| Papapetrou (2001) | VAR | Oil prices, IPI, 12 month interest rate, CPI | 1989:1-1999:6 |
| Cuñado and Gracia (2003) | Granger causality test, co-integration test | Oil prices, IPI, inflation rate | 1960-1999 |
| Hamilton and Herrera (2004) | VAR | GDP, GDP deflator, commodity price index, oil prices, FED funds rate, 90 day Treasury-bill rate, 10 year. Treasury-bill rate | 1965:1-1995:12 |
| Huang et al. (2005) | Multivariate Threshold Model | Oil prices, 90 days Treasury-bill rate, real stock returns, IPI | 1970-2012 |
| Jimenez-Rodriguez and Sánchez (2005) | VAR | GDP, effective exchange rate, oil price, wage, inflation, 3 month Treasury-bill rate, government bond yield | 1972:III-2001-IV |
| Guo and Kliesen (2005) | Granger causality test, Wald test | Oil futures, stock returns, GDP | 1984-2004 |
| Blanchard and Gali (2007) | Structural VAR | GDP, CPI, unemployment data, wages, oil prices | 1970:1-2005:4 |
| Lescaroux and Mignon (2008) | VAR, Granger causality test, co-integration tests | GDP, CPI, household consumption, unemployment rate, share prices | 1960-2005 |
| Cologni and Manera (2009) | Markov-Switching Method | Oil prices, CPI, GDP | 1970Q1-2005Q1 |
| Tang et al. (2010) | Structural VAR | Oil prices, CPI, PPI, rate of return for industrial companies, one year loan rate, industrial added value | 1998:6-2008:8 |
| Herrera et al. (2011) | VAR, OLS | GDP, IPI | 1947:1:2009:9 |

| | | | |
|---|---|---|---|
| Jiménez-Rodriguez and Sánchez (2012) | VAR | Oil prices, CPI, PPI, wage data, effective exchange rate, short and long term interest rates | 1976:Q1-2008:Q2 |
| Cavalcanti and Jalles (2013) | SVAR | Oil prices, GDP, CPI | 1980-2007 |
| Allegret et al. (2015) | Global VAR (GVAR) | GDP, equity prices, current account, exchange rate, oil prices, oil production | 1980-2011 |
| Cuñado et al. (2015) | VAR | GDP, CPI, PPI, effective exchange rate, discount rate series, oil production, oil prices | 1997Q2–2014Q3 |
| Basnet and Upadhyaya (2015) | SVAR | GDP, effective exchange rate, inflation | 1970Q1-2010Q2 |
| Herwatz and Plödt (2016) | SVAR | Oil production, IPI, GDP, oil prices, CPI | 1973:1:2014:12 |
| Wei and Guo, 2016 | VAR | Oil prices, GDP, fixed investment, total return sales of consumer goods, total value of exports, M2, 7 days weighted average interest rate on interbank lending | 1996Q1-2014Q4 |

An important number of studies investigated the impacts of oil price shocks on financial indicators. Some of these studies analyzed the impacts of the shocks on stock market indicators with different econometric methods (Capital Asset Pricing Model (CAPM), Granger Causality, GARCH, Haar A Trous Wavelet, SVAR, OLS, VAR).

Some studies investigated the relation between oil price betas (obtained by CAPM) and stock price returns or stock betas: Chen et al. examined impact of some macroeconomic indicators and oil prices on stock price returns with an application of CAPM model for the United States. The study found no significant oil betas (Chen et al., 1986). Basher and Sadorsky investigated relationships between oil prices and stock returns of 21 emerging economies with an application of CAPM. Non-linear, conditional and negative; significant unconditional relationships between variables were found (Basher and Sadorsky, 2006).

Some studies determined non-linear linkages among oil price dynamics and stock returns: Ciner analyzed dynamic relationships among stock market of the U.S. and oil prices and found non-linear relationship between them (Ciner, 2001). As explained in the paragraph given above, Basher and Sadorsky (2006) found non-linear relationships between variables. Wang et al. examined the same relationship of 9 oil importer countries (the United States, Japan, Germany, France, the United Kingdom, Italy, China, Korea and India) and 7 oil exporter countries (Saudi Arabia, Kuwait, Mexico, Norway, Russia, Venezuela and Canada). Little evidence of linearity that captures the relationship and strong explanatory power of oil price shocks on stock returns for oil exporter countries were found (Wang et al., 2013).

Some other studies investigated correlations between oil prices and stock returns: Huang et al. analyzed correlations among oil futures returns and stock returns during 1980s and found no correlations (Huang et al., 1996). Filis et al.

investigated time-varying correlations for a sample of oil importer/exporter countries. They found no difference in correlations (Filis et al., 2011).

Negative effects of oil price shocks on stock returns were found by some of the studies: Jones and Kaul analyzed responses of real stock returns to oil price shocks for the U.S., Canada, Japan and the U.K. during post World War II period. Results of the study stated that the impacts of oil price shock on stock markets of the U.S. and Canada can be accounted for their effects on cash flows, though there are not such cases for Japan and the United Kingdom (Jones and Kaul, 1992). Sadorsky analyzed the impacts of oil price and oil price volatility shocks on stock returns for the US. The results of the study found shocks running from oil prices which deteriorate real stock returns (Sadorsky, 1999). Kang et al. analyzed the impacts of oil price and oil price volatility shocks on the covariance of stock returns for the US. The study found negative impact of oil specific shocks on covariance of stock return and stock market volatility (Kang et al., 2015).

Some studies investigated long-run relationships between oil price shocks and stock returns: The impacts of oil price shocks on stock returns for the U.S. and 13 European countries (Germany, Belgium, Spain, Greece, Sweden, the U.K., Finland, Italy, Denmark, Norway, Netherlands, Austria and Sweden) were examined by Park and Ratti. Significant impacts of shocks in the same within one or two month were found (Park and Ratti, 2008). Another study investigated long run relationships between stock markets of 6 OECD countries (Canada, France, Germany, Italy, the U.S., the U.K.) and oil prices. Significant long-run relationships between variables were found (Miller and Ratti, 2009).

Another strand of studies investigated relationship between stock markets and oil prices for a set of oil importer/exporter countries: Filis et al. explored time varying correlations between oil prices and stock returns for oil importer countries (the U.S., Germany, Netherlands) and oil exporter countries (Canada, Mexico, Brazil). By the results of the study, time varying correlations have same characteristics for oil importer/exporter countries, the correlations rise positively (negatively) due to demand side oil price shocks. Supply side shocks don’t affect the relationship

between two markets and the lagged correlations indicate that oil price negatively affect stock markets except for 2008 crisis (Filis et al., 2011). As explained before, Wang et al. (2013) analyzed the relationship for 9 oil importer and 7 oil exporter countries. Jammazi analyzed the impacts of oil price shocks on stock returns for five oil importer/exporter countries (the U.S., the U.K., Japan, Germany and Canada) with an application of the Haar A Trous Wavelet decomposition and the tri-variate BEKK Markov Switching GARCH models. Close link between "*equity and crude oil high volatility state"* were found. "*Apart from the U.K. and Japan, the impacts of oil price shocks on stock returns found to be connected to geographic area for the main source of supply*" (Jammazi, 2012).

Some 1990s studies found positive and significant relationships: Kaneko and Lee found significant and positive relationship between oil prices and stock returns of Japan (Kaneko and Lee, 1995). Faff and Brailsford analyzed the sensitivity of stock market returns of Australia to oil price factor and found positive sensitivities for oil, gas and diversified resource industries (Faff and Brailsford, 1999).

2000s studies also determined significant and positive relationship between variables: Hammoudeh and Aleisa analyzed the relationships between stock market data of GCC countries and NYMEX oil futures. The found significant bi-directional relationship between Saudi stock indices and NYMEX oil future prices, though they couldn't find direct relationship for other member countries (Hammoudeh and Aleisa, 2004). Another study analyzed the same relationship for the United Kingdom. The study found positive, significant relationship between variables (Sharif et al., 2005).

Some studies analyzed oil price supply shocks and demand shocks separately: Apergis and Miller analyzed the response of stock markets of 8 countries (Australia, Canada, France, Germany, Italy, Japan, the U.K., and the U.S.) to structural oil price shocks (oil supply shocks, global aggregate-demand shocks, and idiosyncratic demand shocks). Results of the study indicate significance of structural oil price shocks in explaining movements of stock returns (Apergis and Miller, 2009). Cuñado and Gracia analyzed the impact of oil price shocks on stock

returns for 12 oil importing European countries (Austria, Belgium, Denmark, Finland, France, Germany, Italy, Luxembourg, Netherlands, Spain, Portugal and the U.K.). By the results of the study, oil price changes have a significant and negative effect on stock returns for the most of the countries. In addition, "*oil supply shocks have greater negative effect on stock returns than oil demand shocks and oil price increase"* (Cuñado and Gracia, 2014).

Asymmetry between oil prices and stock market indicators was found in some studies: Cong et al. analyzed relationship between oil prices and stock market indices of China and asymmetry between variables were found (Cong et al., 2009). Arouri and Nguyen analyzed relationships between oil and stock prices for Euro area. The study found strong transmissions between variables, though they change across the sectors. Besides, evidence for asymmetric relationship between variables was found (Arouri and Nguyen, 2010). Herrera et al. found asymmetry and non-linearity between oil prices and real output (Herrera et al., 2011). Another study analyzed the same relationship for developing countries. The results of the study found oil price risks as important determinants of stock returns and found asymmetry in oil sensitivity of stock returns (Aloui et al., 2012).

Some studies analyzed causality between oil prices and stock market indices: Soytas and Oran examined volatility and return transmissions among daily oil prices, Istanbul Stock Exchange 100 and electricity indexes. The results of the study indicated that there exist bi-directional Granger causality from oil prices to electricity index in variance, though there doesn't exist a Granger causality from oil prices to stock returns (Soytas and Oran, 2011).

Some recent studies directly investigated spillovers between oil price shocks and financial stress indexes: Chen et al. analyzed spillovers with an application of SVAR model which consists of "*an oil supply shock, an aggregate demand shock, an oil-specific demand shock, and a financial shock*". The study used Kansas City Financial Stress Index (KCFSI) as an indicator of global financial conditions and found that a financial shock results to a significant decline in oil prices. Besides,

the financial shock has a relatively high explanatory power for oil price fluctuations (Chen et al., 2014). Nazlioglu et al. investigated the transmission between volatility of oil prices and financial stress during pre-crisis, crisis and post-crisis (2008 as crisis). The study used Cleveland Financial Stress Index (CFSI) as a determinant of financial stress and proposed that, "*oil prices and the financial stress index are dominated by the long-run volatility, there exists a causality running from oil prices to financial stress after the crises and there exists a causality from financial stress to oil prices in the crises"* (Nazlioglu et al., 2015).

Table 5 summarizes empirical studies given above:

**Table 5.** Summary of Empirical Studies that Analyze the Impact of Oil Price Shocks on Macro Economic Indicators and Financial Variables

| Authors | Methodology | Variables | Period |
|---|---|---|---|
| Chen et al. (1986) | CAPM, OLS | Inflation, 1 month Treasury-bill, long term government bonds, IPI, Baa rated bonds, equally weighted equities, value weight. equities, consumption, oil price | 1958-1984 |
| Jones and Kaul (1996) | OLS, Granger Causality Test | IPI growth rate of cash flows, oil prices | 1947-1991 |
| Huang et al. (1996) | VAR | Oil future contracts on NYMEX, S&P 500, 12 stock price indices, 3 oil company stock price series | 10.09.1979-03.16.1990 |
| Faff and Brailsford (1999) | CAPM, OLS | 24 Australian industry portfolios, oil prices | 1983:7-1996:3 |
| Sadorsky (1999) | VAR | IPI, 3 month Treasury-bill rate, oil prices | 1947:1-1996:4 |
| Ciner (2001) | VAR | Oil future contracts on NYMEX, S&P 500 | 10.09.1979-03.02.2000 |
| Hammoudeh and Aleisa (2005) | VAR | Oil spot prices, oil futures prices on NYMEX, GCC countries' stock returns | 02.15.1994-12.25.2001 |
| Basher and Sadorsky (2006) | CAPM, OLS | 21 emerging markets stocks, MSCI World Index, oil futures prices on NYMEX | 12.31.1992-10.31.2005 |
| Park and Ratti (2008) | VAR | IPI, oil prices, CPI, 3 month Treasury-bill rates, PPI, share prices | 1986:1-2005:12 |
| Apergis and Miller (2009) | VAR | Global index of dry cargo single voyage freight rates, goods prices proxies by CPI, oil prices, oil production | 1981-2007 |
| Cong et al. (2009) | VAR | Oil prices, 1 year loan rate, stock prices traded on Shanghai stock market and Shenzhen stock market, IPI, CPI, PPI | 1996:1-2007:12 |
| Miller and Ratti (2009) | VECM, Structural Break Tests | Stock market prices, oil prices, 3 month Treasury-bill rate | 1971:1-2008:3 |
| Arouri and Nguyen (2010) | Asymmetric Asset Pricing Model, Granger | Dow Jones Stoxx 600, 12 European sector indices, oil prices | 01.01.1998-11.13.2008 |

| | Causality Test | | |
|---|---|---|---|
| Filis et al. (2011) | DCC-GARCH-GJR | Stock market indices, oil prices | 1987:1-2009:9 |
| Jammazi (2012) | Trous Haar Wavelet Transform, GARCH-BEKK | Stock market indices, oil prices | 1989:1-2007:12 |
| Aloui et al. (2012) | OLS | Stock market indices, oil future contracts, 90 days Treasury-bill, Trade Weighted Exchange Index | 09.29.1997-11.02.2007 |
| Wang et al. (2013) | SVAR | Stock market indices, oil prices, CPI | 1999:01-2011:12 |
| Cuñado and Gracia (2014) | VAR | Stock market indices, IPI, oil prices, oil production, short term interest rates, CPI, exchange rates | 1973:2-2011:12 |
| Kang et al. (2015) | SVAR | Stock market indices, VIX, oil production, oil prices, global index of dry cargo single voyage freight rates | 1973:1-2013:12 |
| Chen et. al (2014) | SVAR | KCFSI, global index of dry cargo single voyage freight rates, CPI, oil prices, oil production | 1991:1-2012:12 |
| Nazlioglu et al. (2015) | VAR | CFSI, oil prices | 09.25.1991-01.02.2014 |

# CHAPTER 2

## HIGH FREQUENCY FINANCIAL STRESS INDEXES

In this chapter, we develop high frequency (daily) financial stress indexes for a sample of net oil importer/exporter countries with application of Composite Indicator of Systemic Stress (CISS) method using variables that represent bond, equity, money, foreign exchange markets and banking sector. We select indicators of financial markets in this study as suggested by the related literature. Different than Hollo et al. (2012), we prefer using Dynamic Conditional Correlations[4] between sub-indexes while aggregating them. Our methodology consists of two parts: Firstly, following Hollo et al. (2012), sub-financial market indexes are obtained by equally weighted average of indicators in each sub-financial market (bank, bond, equity, money and foreign exchange) segment. Secondly, sub-financial market indexes are aggregated with an application of CISS which based on dynamic conditional correlations among the sub-financial indexes. Different than Hollo et al., we select the weights of sub-financial indexes in the CISS equally similar to the related studies (for example: Holmfeldt et al., 2009; Yiau et al.,2010, Sinenko et al., 2013; Eidenberger et al., 2014; Vermeulen et al., 2015).

We use standardized indicators[5] and DCC-GARCH methodology (Engle, 2002) while evaluating financial stress indexes.

---

[4] Hollo et al. (2012) use Exponentiallly-Weighted Moving Average (EWMA) method in their original methodology. EWMA is a special case of $GARCH(1,1)$ model, while it lacks a mean reversion. EWMA uses different decay factors for different frequency data (e.g., 0.94 for daily, 0.97 for monthly data). Practically, variance rates tend to be mean reverting, therefore $GARCH(1,1)$ models are more accurate than EWMA in forecasting volatility.

[5] The indicators are first standardized to normalize their effects in each methodology. This is a conventional standardization using the following formula:

$$\tilde{x}_t = \frac{x_t - \bar{x}}{\sigma}$$

where, $\tilde{x}_t$ is the standardized series, $\sigma$ is the stand. dev. of the series and $\bar{x}$ is the mean of the series.

## 2.1. METHODOLOGY AND DEVELOPING FINANCIAL STRESS INDEXES

The methodology of developing financial stress index is largely based on the two-steps portfolio aggregation method which is called as CISS (Hollo et al., 2012). Hollo et al. (2012) define CISS in sub open interval $[0,1)$ as below:

$$CISS_t = (w^{\circ}s_t)C_t(w^{\circ}s_t)' \tag{2.1}$$

Where, $w = (w_1, w_2, w_3, w_4, w_5)$ is sub index weight vector, $s_t = (s_1, s_2, s_3, s_4, s_5)$ is sub-markets index vector, $w^{\circ}s_t$ is Hadamart product, $C_t$ is the estimated correlation coefficients matrix ($\rho_{ij,t}$) across sub-market indexes $i$ ($i = 1,2,3,4,5$) and $j$ ($j = 1,2,3,4,5$) given as follow:

$$C_t = \begin{pmatrix} 1 & \rho_{12,t} & \rho_{13,t} & \rho_{14,t} & \rho_{15,t} \\ \rho_{12,t} & 1 & \rho_{23,t} & \rho_{24,t} & \rho_{25,t} \\ \rho_{13,t} & \rho_{23,t} & 1 & \rho_{34,t} & \rho_{35,t} \\ \rho_{14,t} & \rho_{24,t} & \rho_{34,t} & 1 & \rho_{45,t} \\ \rho_{15,t} & \rho_{25,t} & \rho_{35,t} & \rho_{45,t} & 1 \end{pmatrix} \tag{2.2}$$

In their original methodology, the cross correlations $(\rho_{ij,t})$ that have $\sigma_{ij,t}$ covariance and $\sigma_{i,t}^2$ variance are estimated by Exponentially-Weighted Moving Average (EWMA) method given as below:

$$\sigma_{ij,t} = \lambda\sigma_{ij,t-1} + (1-\lambda)\tilde{s}_{i,t}\tilde{s}_{j,t} \tag{2.3a}$$

$$\sigma_{i,t}^2 = \lambda\sigma_{i,t-1}^2 + (1-\lambda)\tilde{s}_{i,t}^2 \tag{2.3b}$$

$$\rho_{ij,t} = \sigma_{ij,t}/\sigma_{i,t}\sigma_{j,t} \tag{2.3c}$$

$i = 1, \dots, 5$ , $j = 1, \dots, 5$, $t = 1, \dots, T$ and $\tilde{s}_{i,t} = (s_{i,t} - 0.5)$.

Hollo et al. used transformed indicators based on cumulative distribution function (CDF) and Exponentially Weighted Moving Average (EWMA) methodology in

order to obtain the financial stress index[6]. However, we use standardized indicators and DCC-GARCH methodology (Engle, 2002) to develop financial stress indexes[7]. Engle proposed "*a new class of multivariate $GARCH$ estimators that can be viewed as a generalization of constant correlation estimators*" that are developed by Bollerslev (1990) (Engle, 2002). In this model, multivariate series $r_t$ can be given as follows:

$r_t|\varphi_{t-1} \sim N(0, H_t)$ where,

$$H_t = D_t R_t D_t \tag{2.4a}$$

$$D_t = diag(\sqrt{\mu_{i,t}}) \tag{2.4b}$$

$$\mu_{i,t} = \omega_i + \sum_{k=1}^{K_i} \tau_{ik} r_{it-k}^2 + \sum_{j=1}^{J_i} \rho_{ij} \mu_{it-j} \tag{2.4c}$$

where $R_t$ represents the time varying correlation matrix that contains the conditional correlations and it is defined with a positive matrix $Q_t$ as follows:

$$R_t = diag\{Q_t\}^{-1/2} Q_t diag\{Q_t\}^{-1/2} \tag{2.5}$$

Engle showed that *"the parameters of the model can be maximized by the following log likelihood function"*:

$$L = -\frac{1}{2}\sum_{t=1}^{T}(nlog(2\pi) + 2log|D_t| + r_t' D_t^{-1} D_t^{-1} r_t - \varepsilon_t'\varepsilon_t + log|R_t| + \varepsilon_t' R_t^{-1} \varepsilon_t) \tag{2.6}$$

[6] "*Hollo et al. determined portfolio weights of sub-indices on the basis of their relative impact on industrial production growth measured by the cumulated impulse responses from different specifications of standard linear VAR models*" Hollo et al. (2012). We replicated the same methodology and determined portfolio weights of sub-indices in each sub-market level. We also developed financial stress indexes with an application of Principal Component Analysis applied to equal-weighted sub-market indices. However; the financial stress indexes developed by DCC-GARCH based CISS methodology response to well-known financial stress events the best efficiently.

[7] In the first step, we determine sub-market indexes by equal weighting average of indicators in each sub-financial market segment. In the second step, financial stress index is constructed with an application of DCC-GARCH based CISS methodology applied to equal-weighted sub-market indices.

where $\varepsilon_t \sim N(O, R_t)$.

Once the conditional correlations are estimated for each pair of sub-market indexes, the dynamic correlation coefficient matrix, $C_t$ is constructed.

Finally, daily financial stress index (CISS) is obtained by the following equation:

$$CISS_t = \sqrt{(w \circ s_t) C_t (w \circ s_t)'} \quad (2.7)$$

We compute CISS as "volatility-equivalent terms" which was suggested by Hollo et al. (2012) by square root of equation 2.1.

## 2.2. SELECTION OF INDICATORS

We select indicators of financial markets similar to the related literature. Therefore, we use banking sector, bond, equity, money and foreign exchange markets *indicators* to construct financial stress indexes. Besides, time periods of the financial stress indexes vary due to availability of country specific financial market indicators.

## 2.3. COUNTRY SPECIFIC DATA AND CONSTRUCTION OF FINANCIAL STRESS INDEXES

In this section, we construct high frequency (daily) financial stress index for 9 net oil importer/exporter countries with an application of CISS and DCC-GARCH methodologies. We use daily indicators of financial system of each country while developing financial stress indexes. The data has been downloaded from three sources: Bloomberg[8] , Quandl[9], FRED[10] databases.

[8] The data has been downloaded from Bloomberg database on 07/02/2017.
[9] The data has been downloaded from Quandl database on 07/02/2017.
[10] The data has downloaded from FRED database on 07/02/2017.

### 2.3.1. Data

We use following financial market indicators while developing high frequency (daily) financial stress indexes:

#### 2.3.1.1. Banking Sector

We use banking sector indexes of Turkey (BIST Banks Index-XBANK), the U.S. (Dow Jones US banks index-DJUSBK), Japan (Tokyo Stock Exchange TOPIX Banks Index-TPNBNK), Germany (DAXsector All Banks Index), Italy (FTSE All-Share Banks Index) and Canada (S&P/TSX Composite Index Banks-STBANKX). The indexes of Barclays (BARC- Barclays BARC BARCLAYS PLC ORD 25P), BNP Paribas SA and DNB Bank (OSE4010) are used as proxies for the U.K., France and Norway respectively.

***The Realized Volatility of Banking Sector Index Returns:*** This measure is calculated with $GARCH(1,1)$.

***CMAX for the Banking Sector Index:*** Following Hollo et al. (2012), we use daily bank index with 2 years window to determine large losses in financial system with an application of CMAX. Patel and Sarkar proposes CMAX and *it measures maximum cumulated loss over a specific time span* $(T)$ *for stock market index* $(x)$ ***as follows:"*** (Patel and Sarkar, 1998)

$$CMAX_t = \frac{x_t}{max\{x \in \{x_{t-i} | i = 0, 1, \dots, T\}\}} \tag{2.8}$$

***Dynamic Beta of the Banking Sector:*** Similar to the related studies (Illing and Liu, 2006; Oet et al., 2013; Lousiz and Vouldis, 2012), we use time varying beta of the banking sector. Time varying beta of the banking sector is calculated with an application of DCC-GARCH methodology within the scope of the Merton's (1973) ICAPM. They are evaluated as follows:

$$Bank\beta_t = \frac{cov(r_t, m_t)}{var(m_t)} \quad (2.9)$$

where, $Bank\beta_t$ represent time varying beta of the banking sector, $r_t$ corresponds to bank index returns and $m_t$ represents stock market returns.

2.3.1.2. Bond Market

***The Realized Volatility of Yield Curve Slope:*** Yield curve at any time $t$, is modeled by Nelson and Siegel (1987) as follows:

$$y(\tau) = \beta_1 + \beta_2 \left(\frac{1-e^{\mu\tau}}{\mu\tau}\right) + \beta_3 \left(\frac{1-e^{\mu\tau}}{\mu\tau} - e^{\mu\tau}\right) \quad (2.10)$$

where $\beta_1$, $\beta_2$ and $\beta_3$ represent *level*, *slope* and *curvature* respectively and $\tau$ denotes maturity. The dynamic interaction between these latent yield factors and macroeconomic indicators are examined by several studies (for example, Diebold et al., 2006; Afonso and Martins, 2012; Lange, 2013; Chauvet and Senyuz, 2016; Laurini and Caldeira, 2016; Levant and Ma, 2016; Paccagnini, 2016). Realized volatility of yield curve slope, $\beta_2$, is used to determine bond market risk level. $GARCH\ (1,1)$ is used to obtain this measure.

***The Realized Volatility of the Credit Default Swap (CDS) for Turkey, Germany, France and Italy:*** Credit Default Swaps have been used since 1994 in financial markets. The realized volatility of the CDS obtained with $GARCH\ (1,1)$ is used to evaluate sovereign risk of countries. This measure is used to calculate one of the risk component in the bond market.

***The Realized Volatility of Government 10 Year Generic Bond Yield for Turkey, U.S., Japan, U.K., Germany, France, Italy and Norway:*** Similar to the previous studies in the literature (Hollo et al., 2012; Huatori, 2015; Wen, 2015), the real. vol. of 10 yr. Gov. bond yield is used as another risk component in the bond market. It is evaluated with $GARCH\ (1,1)$.

***The Realized Volatility of the 3-month Government Bond Yield for Canada:*** Similar to the study of Illing and Liu (2006), we use the realized volatility of the 3 month Government bond yield to measure systemic stress in the bond market. It is evaluated with $GARCH(1,1)$.

***The Realized Volatility of Covered Treasury Bond Spread for Canada***: Following Illing and Liu (2006), the realized volatility of the cov. Canada-U.S. 3 month T. bill spr. is used as another risk component in the bond market. The spread is calculated as follows:

$$Covered\ Treasury\ Bill\ Spread_t = TBCAN3M_t - TBUS3M_t \qquad (2.11)$$

where $TBCAN3M_t$ represents Canada 3 m. T. bill and $TBUS3M_t$ represents the U.S. 3 m. T. bill.

***The Realized Volatility of the Spread between UK Government 10-year and US Government 10-year Bond Yields:*** Following Corbet and Twomey (2014), we use the real. vol. of the spr. between 10-yr. UK Gov. bond yield and 10-yr. US Gov. bond yield. The spread is calculated as follows:

$$10\ Year\ Government\ Bond\ Spread_t = UK10Y_t - US10Y_t \qquad (2.12)$$

where $UK10Y_t$ represents UK 10-yr. gov. bond yield and $US10Y_t$ represents the US 10 yr. gov. bond yield. This measure is calculated with $GARCH(1,1)$.

2.3.1.3. Equity Market

***The Realized Volatility of the Stock Market Returns:*** Following Hollo et al. (2012), we use the realized volatility of stock market index to find equity market stress level. $GARCH\ (1,1)$ is used to determine this measure.

***CMAX of Stock Market Index:*** The cumulative maximum loss is calculated for the stock market index to determine risk in equity market. This measure is evaluated same as methodology given for the bank market.

***Difference between CMAX of Turkey, Japan, U.K., Germany, France, Italy, Canada, Norway and CMAX of S&P 500*:** As pointed out in the vast literature, 2008 global financial crisis originated at the U.S. and spread to the rest of the world. Besides, S&P 500 represents one of the most important stock index in the world due to its impacts on other countries' stock indexes. Therefore, we use the difference between CMAX of these indexes.

2.3.1.4. Money Market

***The Realized Volatility of 3 Month Interbank Rate:*** 3 month interbank rate of is related to the interest rate of short term unsecured interbank lending. High volatility of this rate reflects "*flight to quality and flight to liquidity as a result of rise in uncertainty in interbank market*" (Hollo et al., 2012). We use the realized volatility of 3-month interbank rate as a risk measure in money market. The realized volatility is calculated with $GARCH\ (1,1)$.

***The Realized Volatility of the Spread between 3 Month Interbank Rate and 3 month Government Bond Yield:*** Spread between 3 m. interbank rate and 3 m. gov. bond yield (equivalent to TED spread for the U.S.) is used to measure "*liquidity and counterparty risk in the interbank loan market"* in various studies (Holmfeldt et al., 2009, Oet et al., 2011; Hollo et al., 2012; Huotari, 2015; Wen, 2015). Similar to these studies, we use the realized volatility of the spread This measure is calculated with $GARCH\ (1,1)$.

2.3.1.5. Foreign Exchange Market

***The Realized Volatility of the Exchange Rate:*** A great amount of stress level in the foreign exchange market is originated through currency markets. Hence,

the realized volatility of exchange rate is used to determine one of the risk factors in the foreign exchange market. This measure is calculated with $GARCH\ (1,1)$.

### 2.3.2. Net Oil Importer Countries

In this section, we construct high frequency (daily) financial stress indexes for 7 net oil importer countries (Turkey, U.S., Japan, U.K., Germany, France, Italy).

#### 2.3.2.1. Turkey

Daily financial stress index of Turkey is constructed by 13 daily indicators that represent banking sector, bond market, equity market, money market and foreign exchange market of Turkey.

Table 6 summarizes indicators used in the calculation of financial stress index for Turkey.

**Table 6.** Financial Market Indicators Used in the FSI for Turkey

| Financial Market | Indicator | Impact of Indicator into Financial Stress | Available Date |
|---|---|---|---|
| Banking sector | Realized volatility of return of XBANK | Uncertainty about fundamentals, flight to quality, flight to liquidity | 2001/11/28 2016/11/17 |
| Banking sector | CMAX for XBANK | Flight to quality flight to liquidity | 2001/11/28 2016/11/17 |
| Banking sector | Dynamic beta of the banking sector | Uncertainty about fundamentals, flight to quality, flight to liquidity | 2005/01/11 2016/11/17 |
| Bond market | Realized volatility of slope of the yield curve | Flight to quality, flight to liquidity | 2005/01/11 2016/11/17 |
| Bond market | Realized volatility of the CDS | Flight to quality, flight to liquidity | 2000/10/12 2016/11/17 |
| Bond market | Realized volatility of the Turkey 10 year government bond yield | Flight to quality, flight to liquidity | 2003/03/26 2016/11/17 |
| Equity market | CMAX for market equity index for Turkey | Flight to quality, flight to liquidity | 1989/06/06 2016/11/17 |
| Equity market | Difference between CMAX for market equity index for Turkey and CMAX for market equity index for US | Flight to quality, flight to liquidity | 1989/06/06 2016/06/13 |
| Equity market | Realized volatility of XU100 | Flight to quality, flight to liquidity | 1989/06/06 2016/11/17 |
| Money market | Realized volatility of TR3LIBOR | Flight to quality, flight to liquidity | 2002/08/01 2016/11/17 |
| Money market | Realized volatility of spread between TR3LIBOR and 3 month government bond yield | Flight to quality, flight to liquidity | 2005/01/10 2016/11/17 |
| FX market | Realized volatility of USD/TRY | Uncertainty about fundamentals, flight to quality, flight to liquidity | 2000/01/13 2016/11/17 |
| FX market | Realized volatility of EUR/TRY | Uncertainty about fundamentals, flight to quality, flight to liquidity | 2000/01/13 2016/11/17 |

2.3.2.1.1. Evaluation

Daily financial stability for Turkey is measured by a financial stress index which is developed with an application of dynamic conditional correlation based CISS method. Figure 1 illustrates financial stress index for Turkey from 01/11/2005 to 11/17/2016.

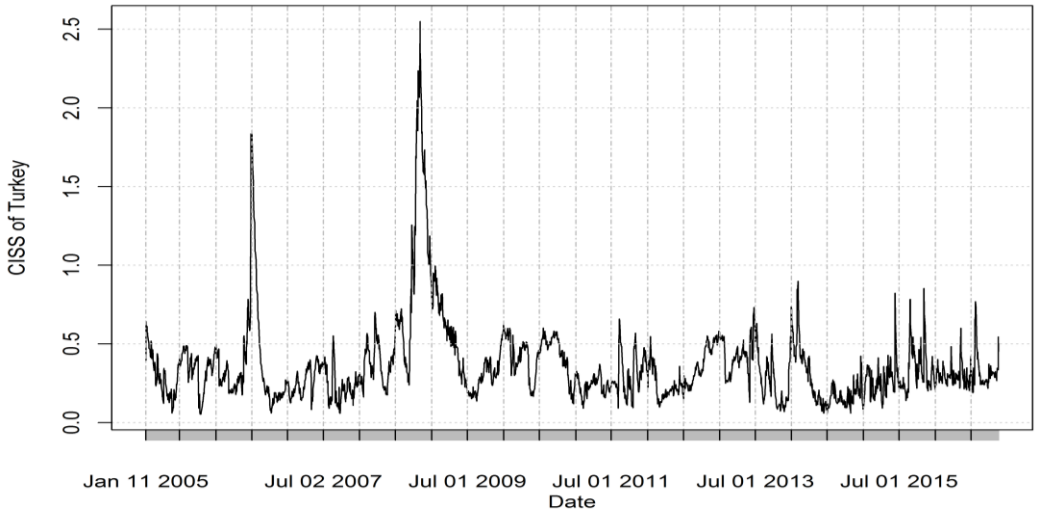



**Figure 1.** Financial Stress Index for Turkey

The index is oscillating between 0.053 and 0.899 most of the time over the period between 2005 and 2016. The mean value is 0.361 and the value of standard deviation of the index is 0.260. The first peak (1.806) appears at 2006-07-04. It reached its maximum value (3.549) on 2008-11-03 which belongs to the period of recent global financial crisis. It takes relatively high values at around 2014-02 as can be seen by the figure. Hence the event identification seems to be an important step to analyze the performance of the index qualitatively.

2.3.2.1.2. Event Identification

The response of financial stress index to a past financial disruption event (financial downturn, economic fluctuations or financial crises) were used to evaluate performance of index (Hakkio and Keaton, 2009; Hollo et al., 2012).

Similarly, we analyzed the response of our financial stress index to the well-known financial turmoil or economic fluctuation. The well-known stress event in the financial system are chosen as follows: BNP Paribas Press Release in August 2007 (on August 09, BNP Paribas, France's largest bank suspended redemptions on three investment funds); Lehman Brother's file for Chapter 11 bankruptcy protection on September 15, 2008; the U.S. Treasury announcement of the Troubled Asset Relief Program (TARP) release on November 12, 2008; Freddie Mac's loss release on May 12, 2009 (Federal Reserve Bank of St. Louis, 2016); Greece bailout on May 02, 2010 (Lane, 2012); European Financial Stability Facility (EFSF) on May 10, 2010 (Closa and Maatsch, 2014); Portugal bailout on November 20, 2010 (Lane, 2012); high tension on the Euro market on November 09, 2011 due to the impacts of European sovereign debt crisis (Stracca, 2013). The U.S. Federal Reserve's (Fed) first considered of a reduce the pace of asset purchases ("*tapering*") and since the Fed's quantitative easing program was accompanied by funds into emerging economies, this date was chosen another financial stress event in the timeline. On December 18, 2013, Fed announced a cut in its monthly bond purchases, therefore this date is taken another stress event date (Rai and Suchanek, 2014). On October 29, 2014, Federal Open Market Committee (FOMC) decided to conclude its asset purchase ("*quantitative easing*") program and this date is selected the next financial stress event (Board of Governors of the Federal Reserve System, 2014). On December 16, 2015, FOMC decided to increase target funds rate from 0.25 to 0.5 firstly since 2006 (Board of Governors of the Federal Reserve System, 2015). Therefore, we select December 16, 2015 as a financial stress event date. Brexit referendum of UK on June 23, 2016 is chosen another financial stress event since global financial markets were negatively affected. The United States presidential election was held on November 08, 2016 and Turkey's stock market index fell -158.82 base point in the following day similar to most of the global stock markets. Likewise, the exchange rate USD/TRY increased by % 0.64 on November 09, 2016. Besides, FED's chair stated on November 17, 2016 that the FED could raise interest rate "relatively soon". Following this statement, exchange rate USD/TRY

has reached its highest values. As a consequence, November 08, 2016 is chosen another financial stress event date in the timeline.

In May 2006, Turkey's country risk increased from 171 base score to 273 base score due to unfavorable developments in the international markets (Central Bank of the Republic of Turkey, 2006). As a consequence, May-Jun, 2006 was selected first fluctuation period. The crisis in subprime mortgage market tend to be worsening in August, 2007 and in December 2009, the U.S. Treasury Department announced the removal of caps on the amount of preferred stock (Federal Reserve Bank of St. Louis, 2016). Therefore, 08/2007-12/2009 period is chosen global financial crisis period. Uncertainties over the Fed's monetary policies resulted to fluctuations in financial market during the periods 2013-06/2014-03 and 2014-12/2015-04 (Central Bank of the Republic of Turkey, 2015). This period is chosen the last fluctuation period in our timeline. Financial stress index evaluated with CISS responses efficiently to the well-known financial events in the timeline as can be seen in Figure 2.

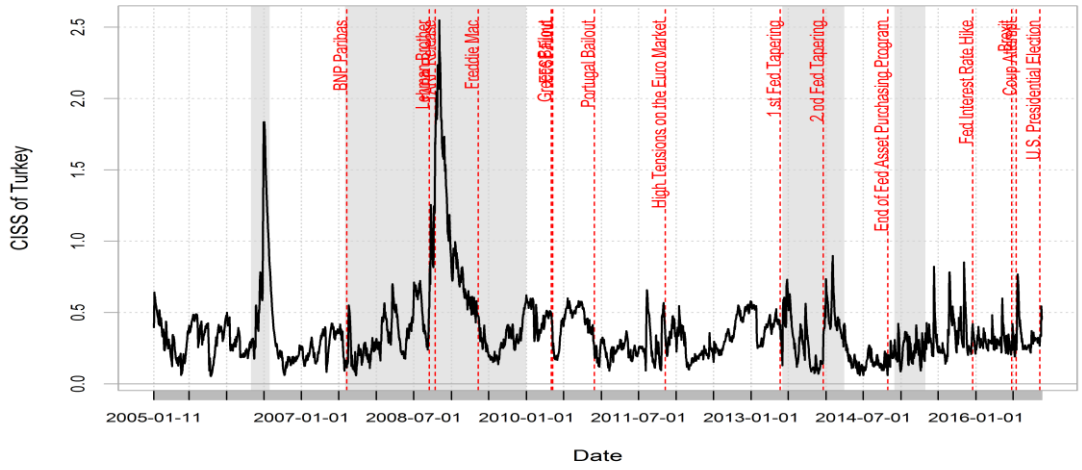



**Figure 2.** Financial Stress Index for Turkey, Economic Fluctuations and Major Financial Stress Events

#### 2.3.2.2. The United States

High frequency financial stress index of the United States is developed by 12 daily indicators that represent banking sector, bond, equity, money and foreign exchange markets.

Table 7 summarizes indicators used in the calculation of financial stress index for the United States.

**Table 7.** Financial Market Indicators Used in the FSI for the U.S.

| Financial Market | Indicator | Impact of Indicator into Financial Stress | Available Date |
|---|---|---|---|
| Banking sector | Realized volatility of return of DJUSBK | Uncertainty about fundamentals, flight to quality, flight to liquidity | 1989/09/11 - 2016/11/29 |
| Banking sector | CMAX for DJUSBK | Flight to quality, flight to liquidity | 1989/09/11 - 2016/11/29 |
| Banking sector | Dynamic beta of the banking sector | Uncertainty about fundamentals, flight to quality, flight to liquidity | 1989/09/11 - 2016/11/29 |
| Bond market | Realized volatility of slope of the yield curve | Flight to quality, flight to liquidity | 1993/10/01 - 2016/11/29 |
| Bond market | Realized volatility of the US 10 year government bond yield | Flight to quality, flight to liquidity | 1980/01/02 - 2016/11/29 |
| Bond market | Realized volatility of the US 10 year corporate bond. spread | Flight to quality, flight to liquidity | 1980/01/02 - 2016/11/29 |
| Equity market | CMAX for stock market index for US | Flight to quality, flight to liquidity | 1980/01/02 - 2016/11/29 |
| Equity market | Realized volatility of S&P 500 | Flight to quality, flight to liquidity | 1980/01/02 - 2016/11/29 |
| Money market | Realized volatility of 3 month USD LIBOR | Uncertainty about fundamentals, flight to quality, flight to liquidity | 1984/12/06 - 2016/11/29 |
| Money market | Realized volatility of TED spread | Uncertainty about fundamentals, flight to quality, flight to liquidity | 1993/10/01 - 2016/11/29 |
| FX market | Realized volatility of GBP/USD | Flight to quality, flight to liquidity | 1980/01/02 - 2016/11/29 |
| FX market | Realized volatility of JPY/USD | Uncertainty about fundamentals, flight to quality, flight to liquidity | 1980/01/02 - 2016/11/29 |

2.3.2.2.1. Evaluation

Daily financial stability for the US is measured by a financial stress index which is developed with an application of dynamic conditional correlation based CISS method on equally weighted market indicators. Figure 3 illustrates financial stress index for the US from 01/10/1993 to 11/18/2016.

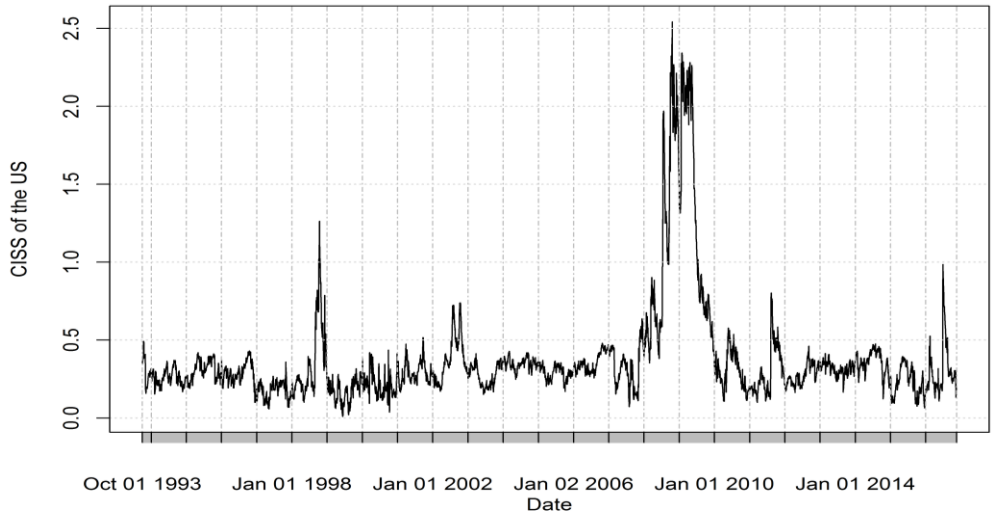



**Figure 3.** Financial Stress Index for the US

The index is oscillating between 0.058 and +0.633 most of the time over the period between 1993 and 2016. The mean value is 0.327 and the value of standard deviation of the index is 0.274. The first peak (1.502) appears at 1998-10-14. It reached its maximum value (2.985) on 2008-10-20 which belongs to the period of recent financial crisis. There are two more peaks can be seen on the figure at 1999-9 and 2016-6. As a consequence, the event identification seems to be an important step to analyze the performance of the index qualitatively.

2.3.2.2.3. Event Identification

In this section, the response of the US financial stress index to past financial disruption events (financial downturn, economic fluctuations or financial crises) are analyzed. The first well known stress event in the US' financial system is the

Mexican Peso devaluation in December 1994. "*On December 12, the government of Mexico announced the devaluation of Peso which followed rise in Mexican current account deficit about $29 billion*" (Truman, 1996). This date corresponds to first financial stress event in our timeline. Thai Baht's peg collapsed on July 2, 1997 and the East and South Asian financial markets followed downward direction as a result of contagion effects (Baig and Goldfajn, 1999). Therefore, the second financial stress event is represented by this date. On 17 August 1998, the Russian Government faced to payments crisis and as a result the ruble was devaluated and "*moratorium on payment by Russian commercial banks to foreign creditors was declared"* (Desai, 2000). This date represents the third financial stress event. Following to Russian debt moratorium, as a result of 'flight to quality' heavy losses in many hedge funds including Long Term Capital Management occurred on September 23, 1998 (Humayun and Hassan, 2005). This date corresponds to another financial stress event in our timeline. The NASDAQ index peaked in March 10, 2000 and followed by huge sell orders of high-tech companies' stocks and the stock market lost 10% of its value within a few weeks (Invostepedia, 2016). As a consequence this date represents the fourth financial stress event in our timeline. The terrorist attacks on September 11, 2001 corresponds to another financial stress event for the US. The Iraq war's start date March 20, 2003 is chosen another financial stress event in our timeline. The followed financial stress events are: BNP Paribas Press Release on August 09, 2007; Lehman Brother's bankruptcy protection on September 15, 2008; the U.S. Treasury announcement of the TARP release on November 12, 2008; Freddie Mac's loss release on May 12, 2009 (Federal Reserve Bank of St. Louis, 2016); high tension on the Euro market on November 09, 2011 due to the impacts of European sovereign debt crisis (Stracca, 2013); FOMC's decision to conclude its asset purchase program on October 29, 2014 (Board of Governors of the Federal Reserve System, 2014); FOMC's decision to increase its target funds rate from 0.25 to 0.5 on December 16, 2015 (Board of Governors of the Federal Reserve System, 2015) and Brexit referendum of UK on June 23, 2016 are chosen financial stress event dates for the US respectively. The President Election date November 08, 2016 is chosen the final financial stress event date in the timeline.

2001-03/2001-11 and 2007-12/2009-07 represent business cycle periods for the US by the NBER (The National Bureau of Economic Research, 2016). Therefore, these periods are taken as business cycle periods for the US). Financial stress index of the U.S. evaluated by CISS responses efficiently to the well-known financial events in the timeline as can be seen by Figure 4.

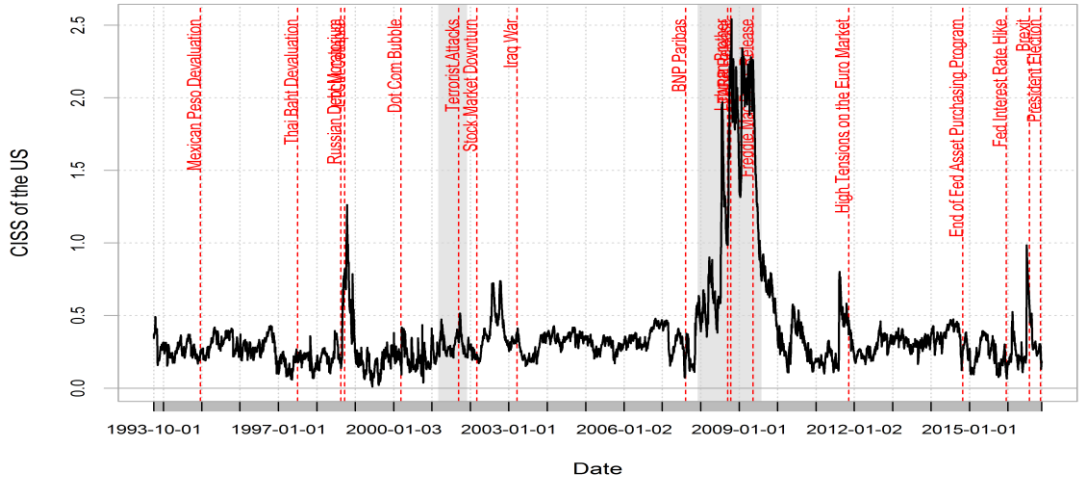



**Figure 4.** Financial Stress Index for the US, Economic Fluctuations and Major Financial Stress Events

2.3.2.3. Japan

High frequency financial stress index of Japan is constructed by 13 daily indicators that represent banking sector, bond, equity, money and foreign exchange markets.

Table 8 summarizes indicators used in the calculation of financial stress index for Japan.

**Table 8.** Financial Market Indicators Used in the FSI for Japan

| Financial Market | Indicator | Impact of Indicator into Financial Stress | Available Date |
|---|---|---|---|
| Banking sector | Realized volatility of return of TPNBNK | Uncertainty about fundamentals, flight to quality, flight to liquidity | 1988/04/04 - 2016/11/29 |
| Banking sector | CMAX for TPNBNK | Flight to quality, flight to liquidity | 1988/04/04 - 2016/11/29 |
| Banking sector | Dynamic beta of the banking sector | Uncertainty about fundamentals, flight to quality, flight to liquidity | 1988/04/04 - 2016/11/29 |
| Bond market | Real volatility of slope of the yield curve | Flight to quality, flight to liquidity | 1995/10/05 - 2016/11/29 |
| Bond market | Real volatility of Japan government 10 year bond yield | Flight to quality, flight to liquidity | 1995/10/05 - 2016/11/29 |
| Bond market | Realized volatility of the covered Japan-U.S. 3 month Treasury bill spread | Flight to quality, flight to liquidity | 1995/10/05 - 2016/11/29 |
| Equity market | CMAX for Nikkei 225 | Flight to quality, flight to liquidity | 1980/01/02 - 2016/11/29 |
| Equity market | Realized volatility of Nikkei 225 | Flight to quality, flight to liquidity | 1980/01/02 - 2016/11/29 |
| Equity market | Difference between CMAX of Nikkei 225 and S&P 250 | Uncertainty about fundamentals, flight to quality, flight to liquidity | 1980/01/02 - 2016/11/29 |
| Money market | Realized volatility of 3 month JPY LIBOR | Uncertainty about fundamentals, flight to quality, flight to liquidity | 1986/01/02 - 2016/11/29 |
| Money market | Realized volatility of spread between 3 month JPY LIBOR and 3 month government bond yield | Flight to quality, flight to liquidity | 1993/10/01 - 2016/11/29 |
| FX market | Realized volatility of USD/JPY | Uncertainty about fundamentals, flight to quality, flight to liquidity | 1980/01/02 - 2016/11/29 |
| FX market | Realized volatility of KRW | Uncertainty about fundamentals, flight to quality, flight to liquidity | 1980/01/02 - 2016/11/29 |

2.3.2.3.1. Evaluation

Daily financial stability for Japan is measured by a financial stress index developed with an application DCC-GARCH based CISS method on equally weighted market indicators. Financial stress index for Japan from 10/05/1995 to 11/29/2016 in Figure 5.

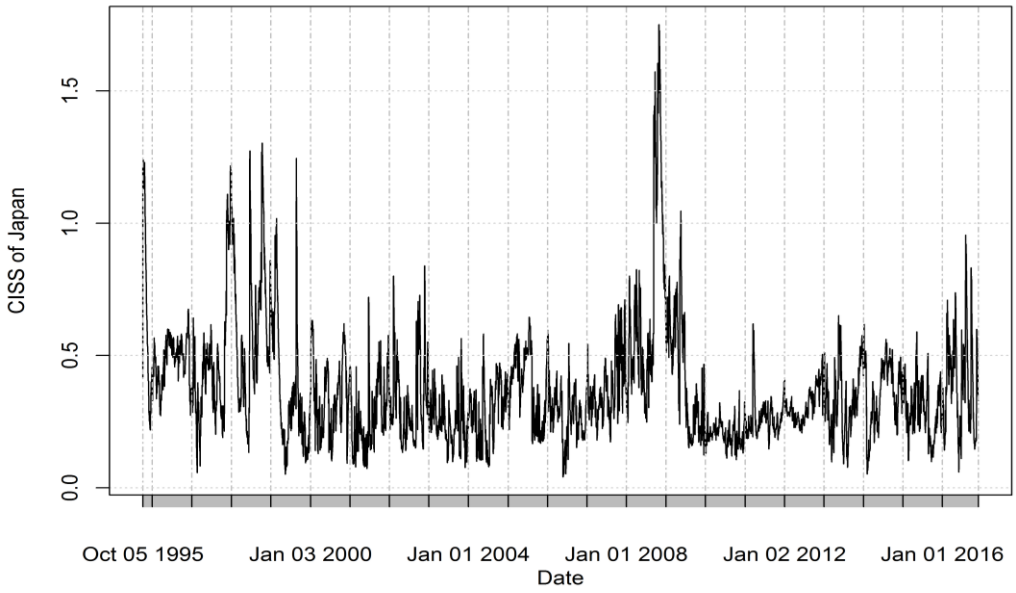



**Figure 5.** Financial Stress Index for Japan

The index is oscillating between 0.040 and 1.751 most of the time over the period between 1995 and 2016. The mean value is 0.370 and the value of standard deviation of the index is 0.211. The first peak (1.239) appears at 1995-10-09. It reached its maximum value (1.751) on 2008-10-28 which belongs to the period of recent financial crisis. There are three more peaks can be seen on the figure at 1998-10, 2009-05 and 2016-8. Event identification seems to be an important step to analyze the performance of the index qualitatively.

2.3.2.3.1. Event Identification

The response of the Japan financial stress index to past financial disruption events (financial downturn, economic fluctuations or financial crises) are

analyzed in this section. The past financial stress events are taken chronically as follows: Thai Baht's peg collapse on July 2, 1997 (Baig and Goldfajn, 1999); Russian debt moratorium on 17 August 1998 (Desai, 2000); LTCM collapse on September 23, 1998 (Humayun and Hassan, 2005); the Dotcom Bubble on March 10, 2000 (Dotcom Bubble, 2016); the terrorist attacks on September 11, 2001; Iraq war's start date on March 20, 2003; BNP Paribas Press Release on August 09, 2007; Lehman Brother's bankruptcy protection on September 15, 2008; the U.S. Treasury announcement of the TARP on November 12, 2008; Freddie Mac's loss release on May 12, 2009 (Federal Reserve Bank of St. Louis, 2016); European sovereign debt crisis on November 09, 2011 (Stracca, 2013); Fed's first consideration of a reduce the pace of asset purchases ("*tapering*") on May 22, 2013 and Fed's second tapering on December 18, 2013 (Rai and Suchanek, 2014); FOMC decision to conclude its quantitative easing program on October 29, 2014 (Board of Governors of the Federal Reserve System, 2014); FOMC's decision to increase target funds rate from 0.25 to 0.5 on December 16, 2015 (Board of Governors of the Federal Reserve System, 2015); Brexit referendum of UK on June 23, 2016 and the US' President Election on November 08, 2016.

Business cycle periods are selected as 1997-09/1999-03, 2001-03/2002-03 and 2007-12/2009-07 (Wall, 2006). During 1995, thirteen Japanese financial institutions went bankrupt (Scheade, 1995).Therefore, we choose 1995-10/1995-12 as a fluctuation period. Financial stress index of Japan obtained with CISS responses efficiently to the well-known financial events in the timeline as can be seen by Figure 6.

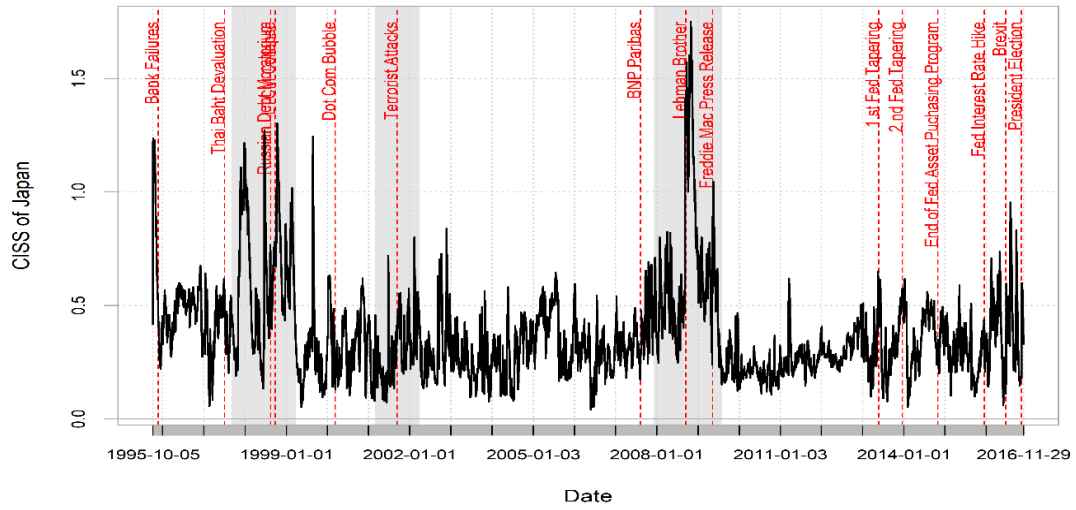



**Figure 6.** Financial Stress Index for Japan, Economic Fluctuations and Major Financial Stress Events

2.3.2.4. The United Kingdom

High frequency financial stress index for the U.K. is constructed by 13 daily indicators that are taken from banking sector, bond, equity, money and foreign exchange markets.

Table 9 summarizes indicators used in the calculation of financial stress index for the United Kingdom.

**Table 9.** Financial Market Indicators Used in the FSI for the UK

| Financial Market | Indicator | Impact of Indicator into Financial Stress | Available Date |
|---|---|---|---|
| Banking sector | Realized volatility of returns of BARC | Uncertainty about fundamentals, flight to quality, flight to liquidity | 1994/01/04 2016/11/29 |
| Banking sector | CMAX for BARC | Fight to quality, flight to liquidity | 1994/01/04 2016/11/29 |
| Banking sector | Dynamic beta of the banking sector | Uncertainty about fundamentals, flight to quality, flight to liquidity | 1994/01/04 2016/11/29 |
| Bond market | Realized volatility of slope of the yield curve | Fight to quality, flight to liquidity | 1996/02/28 2016/11/29 |
| Bond market | Realized volatility of the UK 10 year bond yield | Fight to quality, flight to liquidity | 1980/01/02 2016/11/29 |
| Bond market | Realized volatility of the spread between 10-year UK-US bond yields | Uncertainty about fundamentals, flight to quality, flight to liquidity | 1980/01/02 2016/11/29 |
| Equity market | CMAX for FTSE100 | Fight to quality, flight to liquidity | 1983/12/30 2016/11/29 |
| Equity market | Realized volatility of FTSE 100 | Uncertainty about fundamentals, flight to quality, flight to liquidity | 1983/12/30 2016/11/29 |
| Equity market | Difference between CMAX for FTSE100 and S&P 500 | Fight to quality, flight to liquidity | 1983/12/30 2016/11/29 |
| Money market | Realized volatility of 3 month GBP LIBOR | Uncertainty about fundamentals, flight to quality, flight to liquidity | 1987/01/02 2016/11/29 |
| Money market | Realized volatility of spread between 3 month GBP LIBOR and 3 month Sterling mean interbank lending rate | Fight to quality, flight to liquidity | 1987/01/01 2016/11/29 |
| FX market | Realized volatility of USD/GBP | Uncertainty about fundamentals, flight to quality, flight to liquidity | 1980/01/02 2016/11/29 |
| FX market | Realized volatility of CAD/GBP | Uncertainty about fundamentals, flight to quality, flight to liquidity | 1980/01/02 2016/11/29 |

2.3.2.4.1. Evaluation

Daily financial stability for the U.K. is measured by a financial stress index developed with an application DCC-GARCH based CISS method on equally weighted market indicators. Financial stress index for the UK from 02/28/1996 to 11/29/2016 in Figure 7.

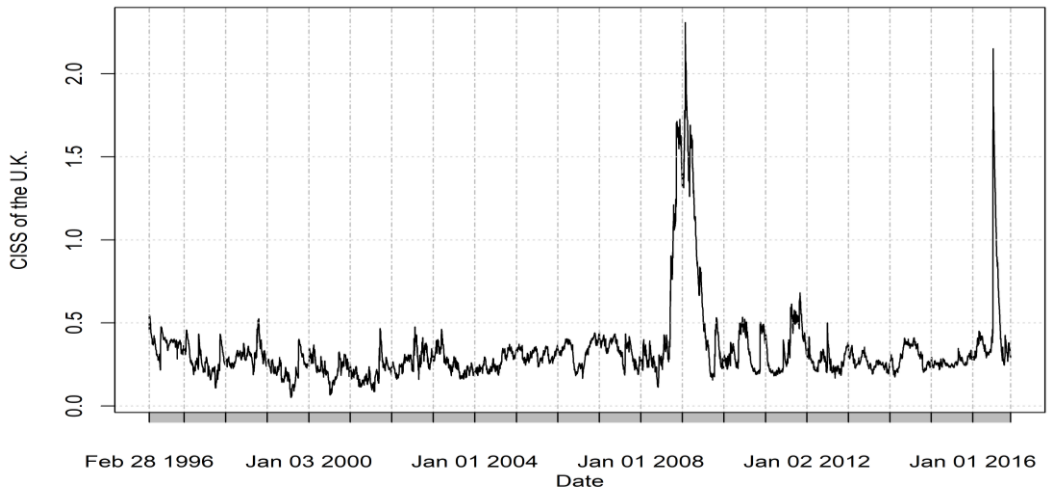



**Figure 7.** Financial Stress Index for the U.K.

The index is oscillating between -0.225 and +0.177 most of the time over the period between 1996 and 2016. The mean value is 0.000022 and the value of standard deviation of the index is 0.17. The first peak (0.251) appears at 1998-10-02. It reached its maximum value (1.691) on 2009-01-27 which belongs to the period of recent financial crisis. There are two more peaks can be seen on the figure at 2011-10 and 2016-6. As a consequence, the event identification seems to be an important step to analyze the performance of the index qualitatively.

2.3.2.4.2. Event Identification

The response of the UK financial stress index to past financial disruption events (financial downturn, economic fluctuations or financial crises) are investigated in this section. The past financial stress events are taken chronically as follows: Thai

Baht's peg collapse on July 2, 1997 (Baig and Goldfajn, 1999); Russian debt moratorium on 17 August 1998 (Desai, 2000); LTCM collapse on September 23, 1998 (Humayun and Hassan, 2005); the Dotcom Bubble on March 10, 2000 (Investopedia, 2016), the terrorist attacks on September 11, 2001; Iraq war's start date on 20 March 2003; BNP Paribas Press Release on August 09, 2007; Lehman Brother's bankruptcy protection on September 15, 2008; the U.S. Treasury announcement of the TARP on November 12, 2008 (Federal Reserve Bank of St. Louis, 2016); Freddie Mac's loss release on May 12, 2009 (Federal Reserve Bank of St. Louis, 2016); Greece bailout on May 02, 2010 (Lane, 2014); European Financial Stability Facility (EFSF) on May 10, 2010 (Closa and Maatsch, 2014); Portugal bailout on November 20, 2010 (Lane, 2014); high tension on the Euro market on November 09, 2011 (Stracca, 2013), Fed's first consideration of a reduce the pace of asset purchases on May 22, 2013 and Fed's second tapering on December 18, 2013 (Rai and Suchanek, 2014). FOMC's decision to conclude its asset purchase (quantitative easing) program on October 29, 2014 (Board of Governors of the Federal Reserve System, 2014), FOMC's decision to increase its target funds rate from 0.25 to 0.5 on December 16, 2015 (Board of Governors of the Federal Reserve System, 2015), the Brexit referendum of UK on June 23, 2016 and the US' President Election on November 08, 2016 are chosen financial stress event dates for the UK respectively.

Business cycle period is chosen as 2008-05/2010-01 (International Business Cycle Dates, 2016). Financial stress index obtained by CISS responses efficiently to the well-known financial events in the timeline as can be seen by Figure 8.

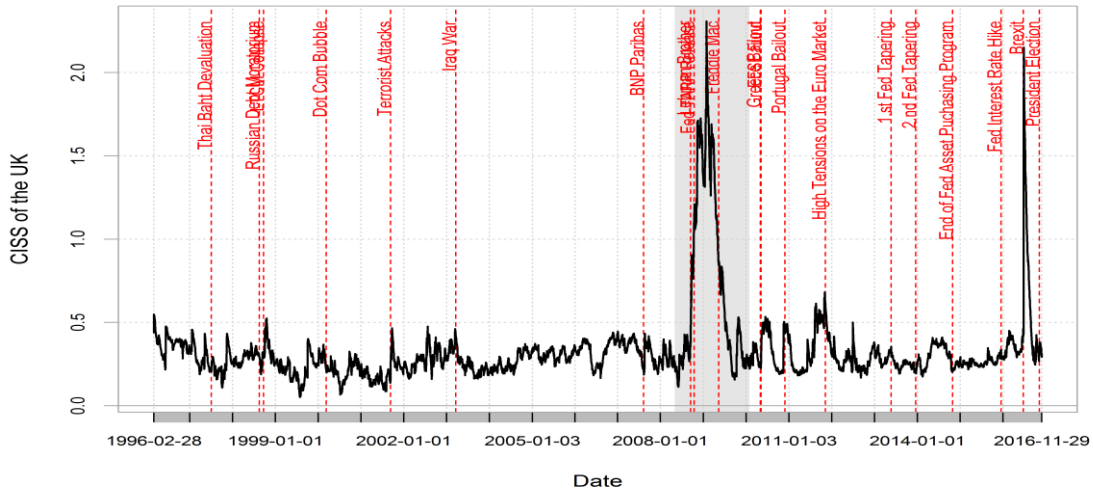



**Figure 8.** Financial Stress Index for the U.K, Economic Fluctuations and Major Financial Stress Events

2.3.2.5. Germany

High frequency financial stress index for Germany is constructed by 13 daily indicators that are taken from banking sector, bond, equity, money and foreign exchange markets.

Table 10 summarizes indicators used in the calculation of financial stress index for Germany.

**Table 10.** Financial Market Indicators Used in the FSI for Germany

| Financial Market | Indicator | Impact of Indicator into Financial Stress | Available Date |
|---|---|---|---|
| Banking sector | Realized volatility of returns of bank index (Daxsector all banks) | Uncertainty about fundamentals, flight to quality, flight to liquidity | 1989/10/23 2016/11/29 |
| Banking sector | CMAX for bank index (Daxsector all banks) | Flight to quality, flight to liquidity | 1989/10/23 2016/11/29 |
| Banking sector | Dynamic beta of the banking sector | Uncertainty about fundamentals, flight to quality, flight to liquidity | 1989/10/23 2016/11/29 |
| Bond market | Realized volatility of slope of the yield curve | Flight to quality, flight to liquidity | 1995/01/10 2016/11/29 |
| Bond market | Realized volatility of Germany 10 year bond yield | Flight to quality, flight to liquidity | 1995/01/10 2016/11/29 |
| Bond market | Realized volatility of German CDS | Uncertainty about fundamentals, flight to quality, flight to liquidity | 2003/03/03 2016/11/29 |
| Equity market | CMAX for DAX | Flight to quality, flight to liquidity | 1989/10/23 2016/11/29 |
| Equity market | Realized volatility of DAX | Uncertainty about fundamentals, flight to quality, flight to liquidity | 1989/10/23 2016/11/29 |
| Equity market | Difference between CMAX for DAX and S&P 500 | Flight to quality, flight to liquidity | 1989/10/23 2016/11/29 |
| Money market | Realized volatility 3 month EURIBOR | Uncertainty about fundamentals, flight to quality, flight to liquidity | 1998/12/30 2016/11/29 |
| Money market | Realized volatility of spread between 3 month EURIBOR and 3 month Euro area government bond yield | Flight to quality, flight to liquidity | 1998/12/30 2016/11/29 |
| FX market | Realized volatility of USD/EURO | Uncertainty about fundamentals, flight to quality, flight to liquidity | 1999/01/04 2016/11/29 |
| FX market | Realized volatility of GBP/EURO | Uncertainty about fundamentals, flight to quality, flight to liquidity | 1999/01/04 2016/11/29 |

2.3.2.5.1. Evaluation

Daily financial stability for Germany is measured by a financial stress index developed with an application DCC-GARCH based CISS method on equally weighted market indicators. Financial stress index for Germany from 09/06/2004 to 11/29/2016 in Figure 9.

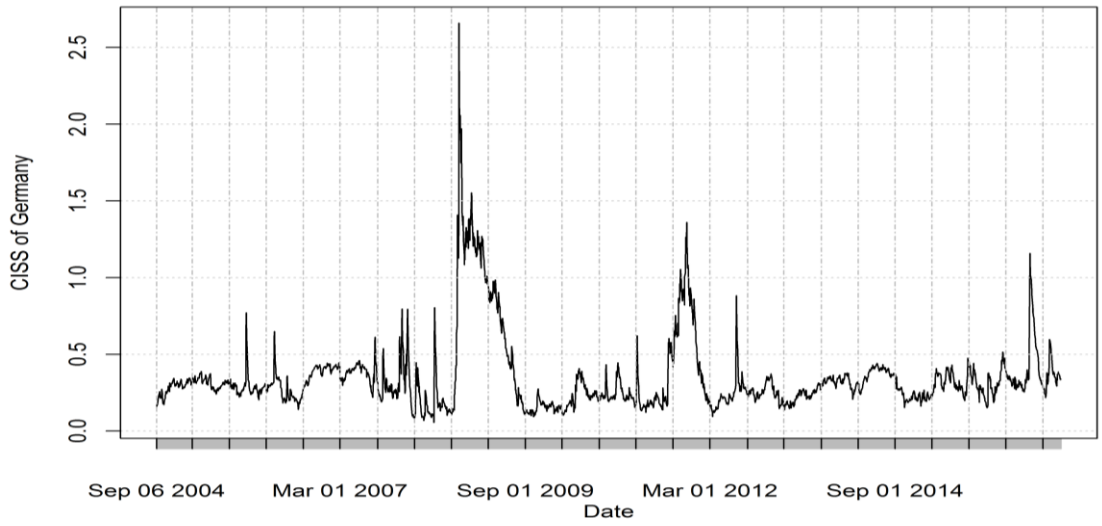



**Figure 9.** Financial Stress Index for Germany

The index is oscillating between 0.140 and 0.771 most of the time over the period between 1999 and 2016. The mean value is 0.348 and the value of standard deviation of the index is 0.245. The first peak (0.795) appears at 2008-01-01. It reached its maximum value (2.659) on 2008-10-08 which belongs to the period of recent financial crisis. There are three more peaks can be seen on the figure on 2011-11, 2012-7 and 2016-6. Therefore, the event identification seems to be an important step to analyze the performance of the index qualitatively.

2.3.2.5.2. Event Identification

The response of the Germany's FSI to past financial disruption events (financial downturn, economic fluctuations or financial crises) are analyzed in this section. The past financial stress events are chosen chronically as follows: BNP Paribas

Press Release on August 09, 2007; Lehman Brother's bankruptcy protection on September 15, 2008; the U.S. Treasury announcement of the TARP on November 12, 2008; Freddie Mac's loss release on May 12, 2009 (Federal Reserve Bank of St. Louis, 2016); Greece bailout on May 02, 2010 (Lane, 2012); European Financial Stability Facility (EFSF) on May 10, 2010 (Closa and Maatsch, 2014); Portugal bailout on November 20, 2010 (Lane, 2014); high tensions on the Euro market on November 09, 2011 (Stracca, 2013); Fed's first consideration of a reduce the pace of asset purchases on May 22, 2013 (Rai and Suchanek, 2014); Fed's second tapering on December 18, 2013 (Rai and Suchanek, 2014); FOMC's decision to conclude its asset purchase (quantitative easing) program on October 29, 2014 (Board of Governors of the Federal Reserve System, 2014); FOMC's decision to increase target funds rate from 0.25 to 0.5 on December 16, 2015 (Board of Governors of the Federal Reserve System, 2015); the Brexit referendum of UK on June 23, 2016 and the US' President Election on November 08, 2016.

2008-04 / 2009-01 is chosen business cycle period for Germany (The National Bureau of Economic Research, 2016). Financial stress index of Germany obtained by CISS responses efficiently to the well-known financial events in the timeline as can be seen by Figure 10.

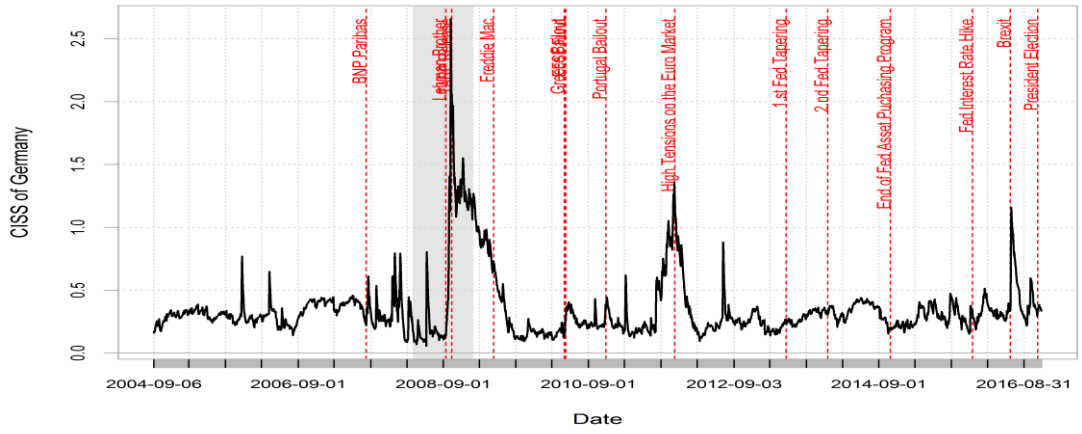



**Figure 10.** Financial Stress Index for Germany, Economic Fluctuations and Major Financial Stress Events

2.3.2.6. France

High frequency financial stress index for France is constructed by 13 daily indicators that are taken from banking sector, bond, equity, money and foreign exchange markets.

Table 11 summarizes indicators used in the calculation of financial stress index for France.

**Table 11.** Financial Market Indicators Used in the FSI for France

| Financial Market | Indicator | Impact of Indicator into Financial Stress | Available Date |
|---|---|---|---|
| Banking sector | Realized volatility of returns of bank index (BNP Paribas SA) | Uncertainty about fundamentals, flight to quality, flight to liquidity | 1993/10/18<br>2016/11/29 |
| Banking sector | CMAX for bank index (BNP Paribas SA) | Flight to quality, flight to liquidity | 1993/10/18<br>2016/11/29 |
| Banking sector | Dynamic beta of the banking sector | Uncertainty about fundamentals, flight to quality, flight to liquidity | 1993/10/18<br>2016/11/29 |
| Bond market | Realized volatility of slope of the yield curve | Flight to quality, flight to liquidity | 1990/08/08<br>2016/11/29 |
| Bond market | Realized volatility of France 10 year bond yield | Flight to quality, flight to liquidity | 1990/08/08<br>2016/11/29 |
| Bond market | Realized volatility of France CDS | Uncertainty about fundamentals, flight to quality, flight to liquidity | 2003/03/31<br>2016/11/29 |
| Equity market | CMAX for CAC | Flight to quality, flight to liquidity | 1987/07/09<br>2016/11/29 |
| Equity market | Realized volatility of CAC | Uncertainty about fundamentals, flight to quality, flight to liquidity | 1987/07/09<br>2016/11/29 |
| Equity market | Difference between CMAX for CAC and S&P 500 | Flight to quality, flight to liquidity | 1987/07/09<br>2016/11/29 |
| Money market | Realized volatility of 3 month EURIBOR | Uncertainty about fundamentals, flight to quality, flight to liquidity | 1998/12/30<br>2016/11/29 |
| Money market | Realized volatility of spread between EURIBOR and 3 month Euro area government bond yield | Flight to quality, flight to liquidity | 1998/12/30<br>2016/11/29 |
| FX market | Realized volatility of USD/EURO | Uncertainty about fundamentals, flight to quality, flight to liquidity | 1999/01/04<br>2016/11/29 |
| FX market | Realized volatility of GBP/EURO | Uncertainty about fundamentals, flight to quality, flight to liquidity | 1999/01/04<br>2016/11/29 |

2.3.2.6.1. Evaluation

Daily financial stability for France is measured by a financial stress index developed with an application DCC-GARCH based CISS method on equally weighted market indicators. Financial stress index for France from 09/06/2004 to 11/29/2016 in Figure 11.

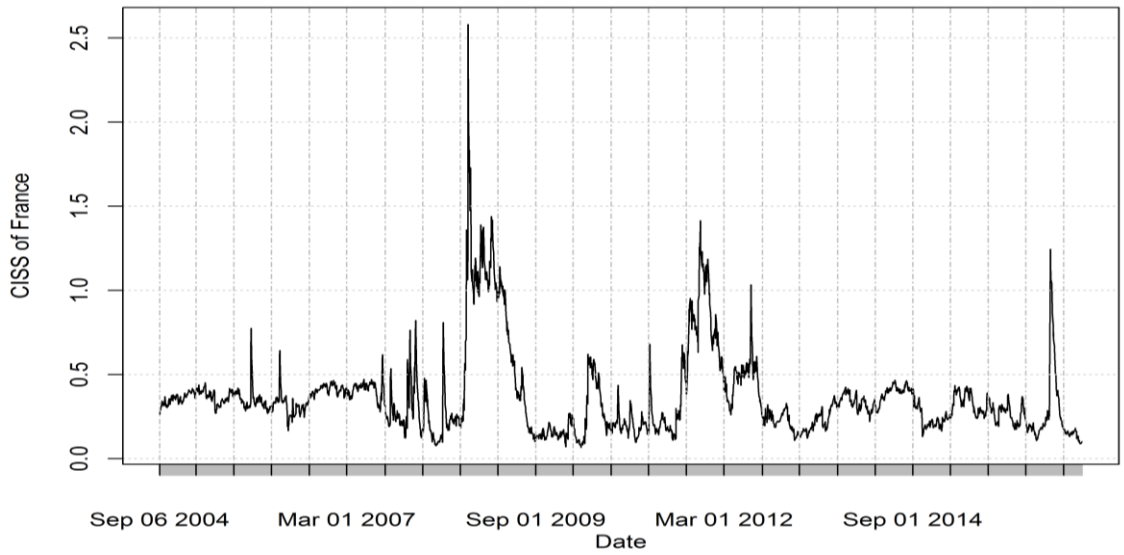



**Figure 11.** Financial Stress Index for France

The index is oscillating between 0.122 and 0.774 most of the time over the period between 1999 and 2016. The mean value is 0.366 and the value of standard deviation of the index is 0.246. The first peak (0.409) appears at 2005-01-25. It reached its maximum value (2.58) on 2008-10-08 which belongs to the period of recent financial crisis. There are three more peaks can be seen on the figure at 2010-05, 2011-11 and 2016-06. Therefore, the event identification seems to be an important step to analyze the performance of the index qualitatively.

2.3.2.6.2. Event Identification

The response of the France's FSI to past financial disruption events (financial downturn, economic fluctuations or financial crises) are analyzed in this section. The past financial stress events are same as for France and Germany: BNP Paribas Press Release on August 09, 2007; Lehman Brother's bankruptcy protection on September 15, 2008; the U.S. Treasury announcement of the TARP on November 12, 2008; Freddie Mac's loss release on May 12, 2009 (Federal Reserve Bank of St. Louis, 2016); Greece bailout on May 02, 2010 (Lane, 2012); European Financial Stability Facility (EFSF) on May 10, 2010 (Closa and Maatsch, 2014); Portugal bailout on November 20, 2010 (Lane, 2012); high tensions on the Euro market on November 09, 2011 (Stracca, 2013); Fed's first consideration of a reduce the pace of asset purchases on May 22, 2013 and Fed's second tapering on December 18, 2013 (Rai and Suchanek, 2014); FOMC's decision to conclude its asset purchase (quantitative easing) program on October 29, 2014 (Board of Governors of the Federal Reserve System, 2014); FOMC's decision to increase its target funds rate from 0.25 to 0.5 on December 16, 2015 (Board of Governors of the Federal Reserve System, 2015); the Brexit referendum of UK on June 23, 2016 and the US' President Election on November 08, 2016.

2008-03/2009-06 and 2011-11/2012-11 are chosen business cycle periods for France (The National Bureau of Economic Research, 2016). Financial stress index of France obtained by CISS responses efficiently to the well-known financial events in the timeline as can be seen by Figure 12.

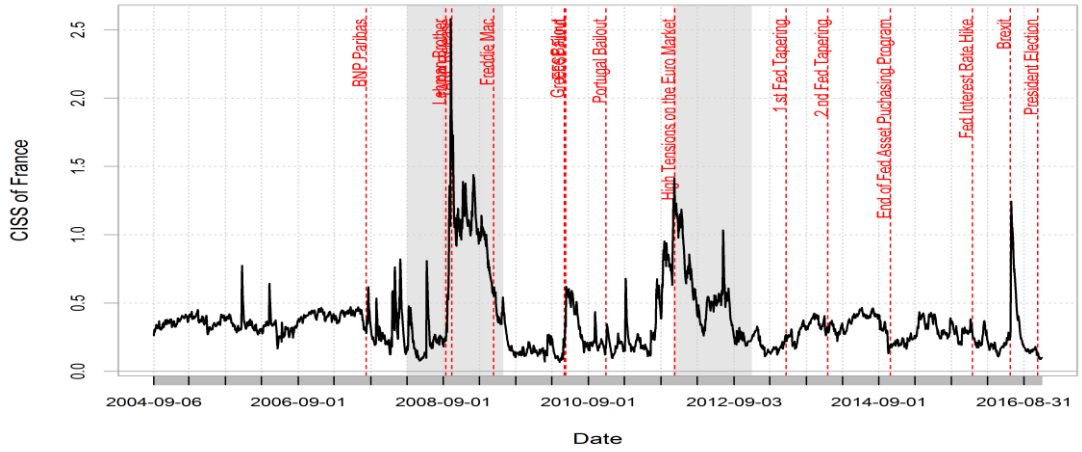



**Figure 12.** Financial Stress Index for France, Economic Fluctuations and Major Financial Stress Events

2.3.2.7. Italy

High frequency financial stress index for Italy is constructed by 13 daily indicators that are taken from banking sector, bond, equity, money and foreign exchange markets.

Table 12 summarizes indicators used in the calculation of financial stress index for Italy.

**Table 12.** Financial Market Indicators Used in the FSI for Italy

| Financial Market | Indicator | Impact of Indicator into Financial Stress | Available Date |
|---|---|---|---|
| Banking sector | Realized volatility of bank index (FTSE All-Share Banks Index) returns | Uncertainty about fundamentals, flight to quality, flight to liquidity | 1997/12/31 2016/11/29 |
| Banking sector | CMAX for bank index (FTSE All-Share Banks Index) | Flight to quality, flight to liquidity | 1997/12/31 2016/11/29 |
| Banking sector | Dynamic beta of the banking sector | Uncertainty about fundamentals, flight to quality, flight to liquidity | 1997/12/31 2016/11/29 |
| Bond market | Realized volatility of slope of the yield curve | Flight to quality, flight to liquidity | 1994/09/05 2016/11/29 |
| Bond market | Realized volatility of the Italy 10 year bond yield | Flight to quality, flight to liquidity | 1994/09/05 2016/11/29 |
| Bond market | Realized volatility of the Italy CDS | Uncertainty about fundamentals, flight to quality, flight to liquidity | 1994/09/05 2016/11/29 |
| Equity market | CMAX for FTSE MIB | Flight to quality, flight to liquidity | 1998/01/01 2016/11/29 |
| Equity market | Realized volatility of the FTSE MIB | Uncertainty about fundamentals, flight to quality, flight to liquidity | 1994/09/05 2016/11/29 |
| Equity market | Difference between CMAX of FTSE MIB and S&P 500 | Flight to quality, flight to liquidity | 1994/09/05 2016/11/29 |
| Money market | Realized volatility of the 3 month EURIBOR | Uncertainty about fundamentals, flight to quality, flight to liquidity | 1998/12/30 2016/11/29 |
| Money market | Realized volatility of spread between 3 month EURIBOR and 3 month Euro area government bond yield | Flight to quality, flight to liquidity | 1998/12/30 2016/11/29 |
| FX market | Realized volatility of USD/EURO | Uncertainty about fundamentals, flight to quality, flight to liquidity | 1999/01/04 2016/11/29 |
| FX market | Realized volatility of GBP/EURO | Uncertainty about fundamentals, flight to quality, flight to liquidity | 1999/01/04 2016/11/29 |

2.3.2.7.1. Evaluation

Daily financial stability for Italy is measured by a financial stress index developed with an application DCC-GARCH based CISS method on equally weighted market indicators. Financial stress index for Italy from 09/06/2004 to 11/29/2016 in Figure 13.

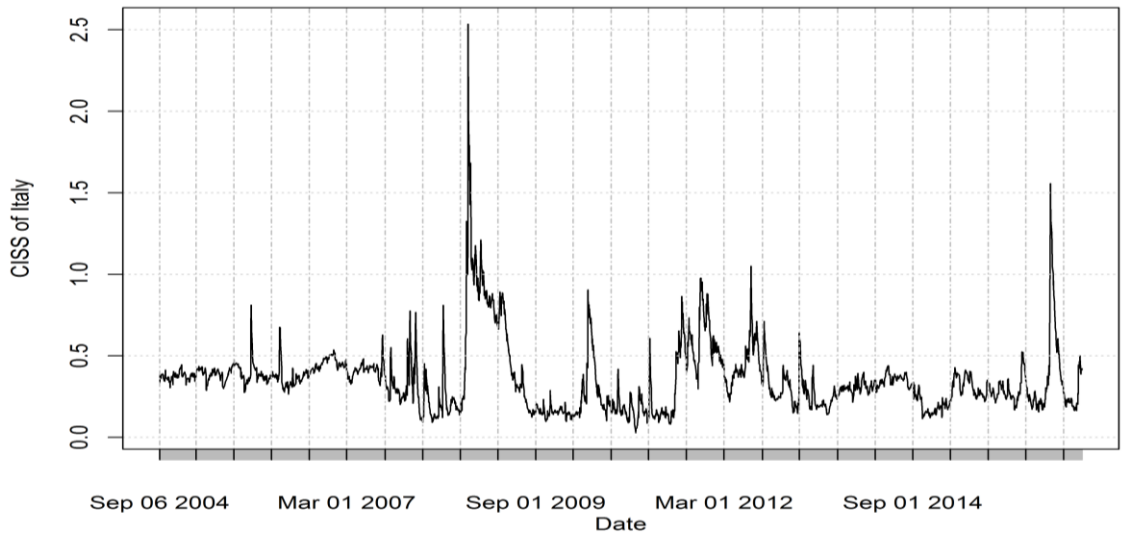



**Figure 13.** Financial Stress Index for Italy

The index is oscillating between 0.265 and 0.812 most of the time over the period between 1999 and 2016. The mean value is 0.358 and the value of standard deviation of the index is 0.208. The first peak (0.812) appears at 2006-04-12. It reached its maximum value (2.534) on 2008-10-08.There are two more peaks can be seen on the figure at 2012-7 and 2016-6.

2.3.2.7.2. Event Identification

The response of the Italy's FSI to past financial disruption events (financial downturn, economic fluctuations or financial crises) are analyzed in this section. The past financial stress events are same as for Germany and France: BNP Paribas Press Release on August 09, 2007; Lehman Brother's bankruptcy

protection on September 15, 2008; the U.S. Treasury announcement of the TARP on November 12, 2008; Freddie Mac's loss release on May 12, 2009 (Federal Reserve Bank of St. Louis, 2016); high tensions on the Euro market on November 09, 2011 (Stracca, 2013); Fed's first consideration of a reduce the pace of asset purchases on May 22, 2013 and Fed's second tapering on December 18, 2013 (Rai and Suchanek, 2014); FOMC's decision to conclude its asset purchase (quantitative easing) program on October 29, 2014 (Board of Governors of the Federal Reserve System, 2014); FOMC's decision to increase its target funds rate from 0.25 to 0.5 on December 16, 2015 (Board of Governors of the Federal Reserve System, 2015); the Brexit referendum of UK on June 23, 2016 and the US' President Election on November 08, 2016.

2007-08/2009-03 and 2011-04/2014-10 are chosen business cycle periods for Italy (The National Bureau of Economic Research, 2016). Financial stress index of Italy obtained with CISS responses efficiently to the well-known financial events in the timeline as can be seen by Figure 14.

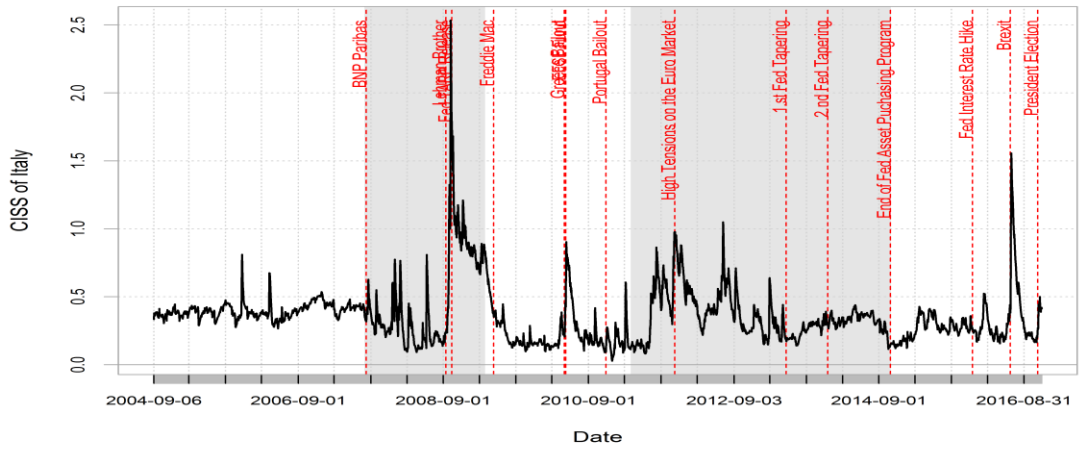



**Figure 14.** Financial Stress Index for Italy, Economic Fluctuations and Major Financial Stress Events

### 2.3.3. Net Oil Exporting Countries

#### 2.3.3.1. Canada

High frequency financial stress index for Canada is constructed by 13 daily indicators that are taken from banking sector, bond, equity, money and foreign exchange markets.

Table 13 summarizes indicators used in the calculation of financial stress index for Canada.

**Table 13.** Financial Market Indicators Used in the FSI for Canada

| Financial Market | Indicator | Impact of Indicator into Financial Stress | Available Date |
|---|---|---|---|
| Banking sector | Realized volatility of STBANKX returns | Uncertainty about fundamentals, flight to quality, flight to liquidity | 1989/06/21 2016/11/29 |
| Banking sector | CMAX for STBANKX | Flight to quality, flight to liquidity | 1989/06/21 2016/11/29 |
| Banking sector | Dynamic beta of the banking sector | Uncertainty about fundamentals, flight to quality, flight to liquidity | 1989/06/21 2016/11/29 |
| Bond market | Realized volatility of slope of the yield curve | Flight to quality, flight to liquidity | 1997/07/07 2016/11/29 |
| Bond market | Realized volatility of Canada 3-month government bond yield | Flight to quality, flight to liquidity | 1997/07/07 2016/11/29 |
| Bond market | Realized volatility of the covered Canada-U.S. 3 month Treasury bill spread | Uncertainty about fundamentals, flight to quality, flight to liquidity | 1997/07/07 2016/11/29 |
| Equity market | CMAX for S&P/TSX composite index | Flight to quality, flight to liquidity | 1980/01/02 2016/11/29 |
| Equity market | Realized volatility of the S&P/TSX | Uncertainty about fundamentals, flight to quality, flight to liquidity | 1980/01/02 2016/11/29 |
| Equity market | Difference between CMAX S&P/TSX and CMAX for S&P 500 | Flight to quality, flight to liquidity | 1980/01/02 2016/11/29 |
| Money market | Realized volatility of the 3 month CIDOR | Uncertainty about fundamentals, flight to quality, flight to liquidity | 1995/01/06 2016/11/29 |
| Money market | Realized volatility of spread between 3 month CIDOR and 3 month government bond yield | Flight to quality, flight to liquidity | 1995/01/06 2016/11/29 |
| FX market | Realized volatility of USD/CAD | Uncertainty about fundamentals, flight to quality, flight to liquidity | 1980/01/02 2016/11/29 |
| FX market | Realized volatility of GBP/CAD | Uncertainty about fundamentals, flight to quality, flight to liquidity | 1980/01/02 2016/11/29 |

2.3.3.1.1. Evaluation

Daily financial stability for Canada is measured by a financial stress index developed with an application of dynamic conditional correlation based CISS method on equally weighted market indicators. Financial stress index for Canada from 07/07/1997 to 11/29/2016 in Figure 15.

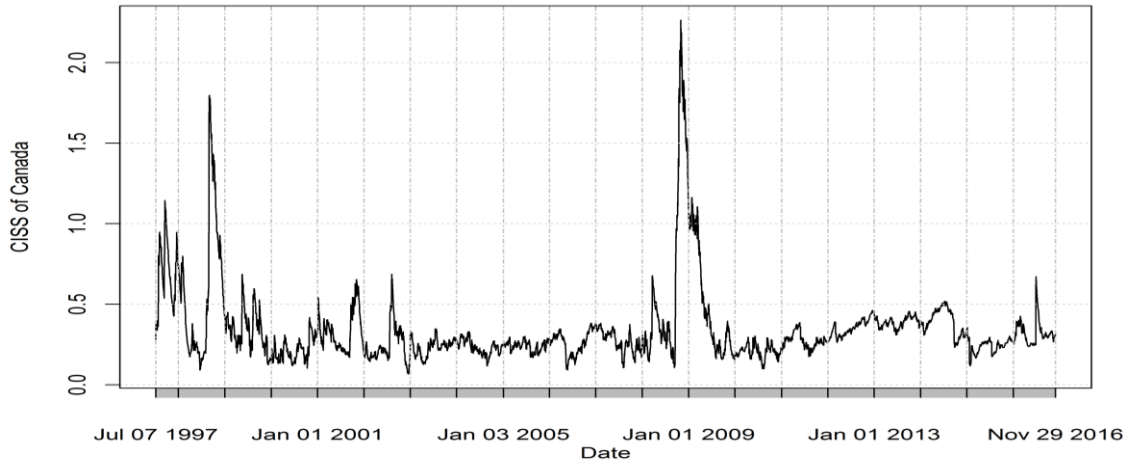



**Figure 15.** Financial Stress Index for Canada

The index is oscillating between 0.066 and 0.52 most of the time over the period between 1997 and 2016. The mean value is 0.34 and the value of standard deviation of the index is 0.241. The first peak (1.797) appears at 1998-09-02. It reached its maximum value (2.264) on 2008-10-30 which belongs to the period of recent financial crisis. There are two more peaks can be seen on the figure at 1997-9 and 2016-6.

2.3.3.1.2. Event Identification

The response of the Canada financial stress index to past financial disruption events (financial downturn, economic fluctuations or financial crises) are analyzed in this section. Due to strong spillovers between the US and Canada financial systems, the past financial disruption events are chosen mostly same

as for the US. Russian debt moratorium on 17 August 1998 (Desai, 2000); LTCM collapse on September 23, 1998 (Humayun and Hassan, 2005); the Dotcom Bubble on March 10, 2000 (Dotcom Bubble, 2016); the terrorist attacks on September 11, 2001; Iraq war's start date on March 20, 2003; BNP Paribas Press Release on August 09, 2007; Lehman Brother's bankruptcy protection on September 15, 2008; the U.S. Treasury announcement of the TARP on November 12, 2008; Freddie Mac's loss release on May 12, 2009 (Federal Reserve Bank of St. Louis, 2016); high tensions on the Euro market on November 09, 2011 (Stracca, 2013); Fed's first consideration of a reduce the pace of asset purchases on May 22, 2013 and Fed's second tapering on December 18, 2013 (Rai and Suchanek, 2014); FOMC's decision to conclude its asset purchase (quantitative easing) program on October 29, 2014 (Board of Governors of the Federal Reserve System, 2014); FOMC's decision to increase its target funds rate from 0.25 to 0.5 on December 16, 2015 (Board of Governors of the Federal Reserve System, 2015) and the Brexit referendum of UK on June 23, 2016. The President Election date November 08, 2016 represents the final financial stress event date in the timeline.

Fluctuation period is chosen as 2007-12/2009-07 which represent the global crisis period (Federal Reserve Bank of St. Louis, 2016). Financial stress index obtained by CISS responses efficiently to the well-known financial events in the timeline as can be seen by Figure 16.

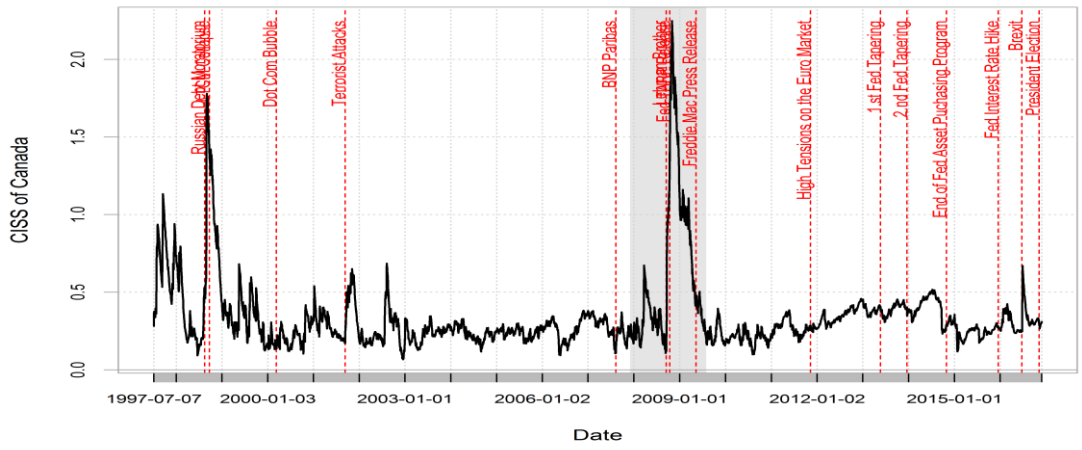



**Figure 16.** Financial Stress Index, Economic Fluctuations and Major Financial Stress Events

2.3.3.2. Norway

High frequency financial stress index for Norway is constructed by 13 daily indicators that are taken from banking sector, bond, equity, money and foreign exchange markets.

Table 14 summarizes indicators used in the calculation of financial stress index for Norway.

**Table 14.** Financial Market Indicators Used in the FSI for Norway

| Financial Market | Indicator | Impact of Indicator into Financial Stress | Available Date |
|---|---|---|---|
| Banking sector | Realized volatility of OSE4010 returns | Uncertainty about fundamentals, flight to quality, flight to liquidity | 1996/01/01 2016/12/06 |
| Banking sector | CMAX for OSE4010 | Flight to quality, flight to liquidity | 1996/01/01 2016/12/06 |
| Banking sector | Dynamic beta of the banking sector | Uncertainty about fundamentals, flight to quality, flight to liquidity | 1996/01/01 2016/12/06 |
| Bond market | Realized volatility of slope of the yield curve | Flight to quality, flight to liquidity | 2007/03/02 2016/12/06 |
| Bond market | Realized volatility of Norway 10 year government bond yield | Flight to quality, flight to liquidity | 2007/03/02 2016/12/06 |
| Equity market | CMAX for OSEBX | Flight to quality, flight to liquidity | 1987/01/05 2016/12/06 |
| Equity market | Realized volatility of the OSEBX | Uncertainty about fundamentals, flight to quality, flight to liquidity | 1987/01/05 2016/12/06 |
| Money market | Realized volatility of the 3 month NIBOR | Uncertainty about fundamentals, flight to quality, flight to liquidity | 1991/01/07 2016/12/06 |
| Money market | Realized volatility of spread of 3 month NIBOR and 3 month government bond yield | Flight to quality, flight to liquidity | 2007/03/02 2016/12/06 |
| FX market | Realized volatility of the USD/NOK | Uncertainty about fundamentals, flight to quality, flight to liquidity | 1980/01/02 2016/12/06 |
| FX market | Realized volatility of the EURO/NOK | Uncertainty about fundamentals, flight to quality, flight to liquidity | 1980/01/02 2016/12/06 |

2.3.3.2.1. Evaluation

Daily financial stability for Norway is measured by a financial stress index developed with an application of dynamic conditional correlation based CISS method on equally weighted market indicators. Financial stress index for Norway from 03/02/2007 to 12/06/2016 in Figure 17.

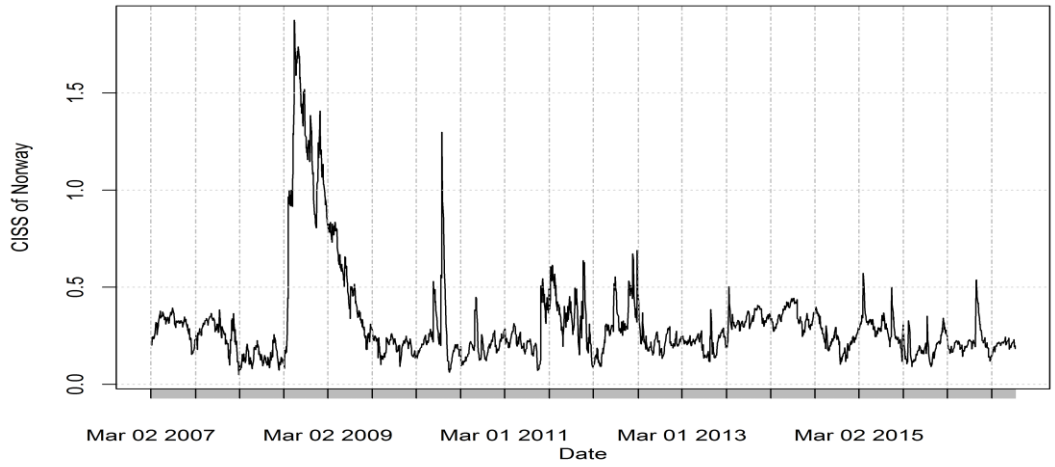



**Figure 17.** Financial Stress Index for Norway

The index is oscillating between 0.153 and 0.689 most of the time over the period between 1997 and 2016. The mean value is 0.312 and the value of standard deviation of the index is 0.242. The first peak (1.875) appears at 2008-10-14 and it belongs to the period of recent financial crisis (It is also maximum value of the index). There are two more peaks can be seen on the figure at 2010-6 and 2012-8.

2.3.3.2.2. Event Identification

The response of the Norway financial stress index to past financial disruption events (financial downturn, economic fluctuations or financial crises) are investigated in this section. BNP Paribas Press Release on August 09, 2007; Lehman Brother’s bankruptcy protection on September 15, 2008; the U.S.

Treasury announcement of the TARP on November 12, 2008; Freddie Mac's loss release on May 12, 2009 (Federal Reserve Bank of St. Louis, 2016); Greece bailout on May 02, 2010 (Lane, 2012); European Financial Stability Facility (EFSF) on May 10, 2010 (Closa and Maatsch, 2014); Portugal bailout on November 20, 2010 (Lane, 2014); high tensions on the Euro market on November 09, 2011 (Stracca, 2013); Fed's first consideration of a reduce the pace of asset purchases on May 22, 2013 and Fed's second tapering on December 18, 2013 (Rai and Suchanek, 2014); FOMC's decision to conclude its asset purchase (quantitative easing) program on October 29, 2014 (Board of Governors of the Federal Reserve System, 2014); FOMC's decision to increase its target funds rate from 0.25 to 0.5 on December 16, 2015 (Board of Governors of the Federal Reserve System, 2015) and the Brexit referendum of UK on June 23, 2016 and the President Election on November 08.

2007-12/2009-09 is selected business cycle period for Norway (Aastveit, 2016). Financial stress index obtained by CISS responses efficiently to the well-known financial events in the timeline as can be seen by Figure 18.

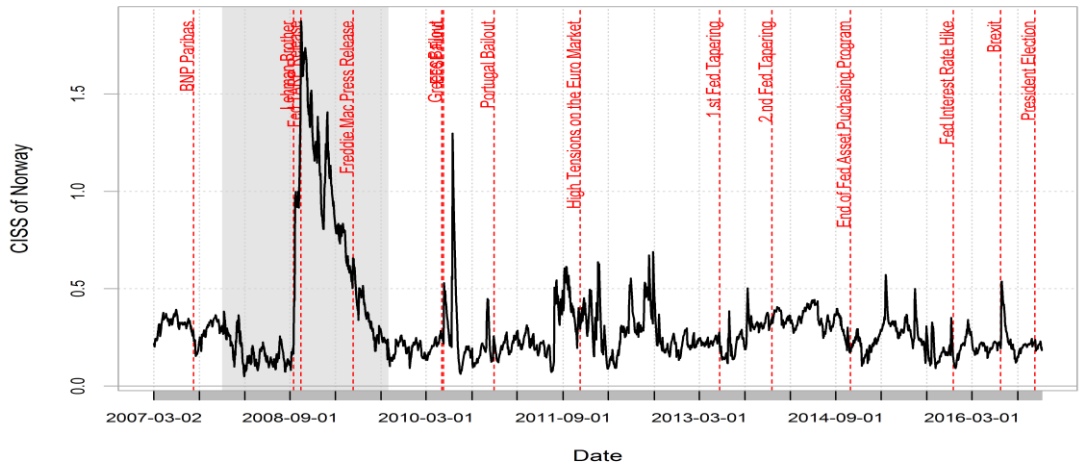



**Figure 18.** Financial Stress Index for Norway, Economic Fluctuations and Major Financial Stress Events

# CHAPTER 3

# ENERGY PRICE SHOCKS AND FINANCIAL STABILITY

In this chapter, we analyze short and long run impacts of energy price shocks on financial stability of G-7 countries, Turkey and Norway[11]. The impacts are determined by focusing on transmission channels between daily oil price dynamics and financial stress indexes which are developed in chapter 2. We identify and estimate impacts of shocks on financial stability with an application of Structural Vector Auto Regression (SVAR) method. Besides, Toda and Yamomoto (1995) causality tests are employed to determine mean spillovers between the series. Similar to the related literature (Apergis and Miller, 2009; Kilian and Park, 2009; Miller and Ratti, 2009; Chen et al., 2014; Nazlioglu et al., 2015) we use daily oil prices (West Texas Intermediate (WTI)).

## 3.1. METHODOLOGY

SVAR model is employed to estimate short/long run effects of shocks on financial stress index. Toda and Yamomoto (1995) causality test is implemented in order to determine mean spillover between series. In this section, these methodologies are given.

### 3.1.1. Structural VAR Model

The structural shocks are defined to capture oil price changes, oil prices volatility changes and changes in financial stability/instability states with VAR model. As a consequence, we identify structural oil price shocks (oil price changes and oil

[11] We estimate SVAR model using 30 lags of each variable in order to capture potential long run impacts of shocks on financial stability. Similar to the related literature (Chen et al., 2014; Nazlioglu et al., 2015), the short run impacts are observed within the first 10 days for the most of series and the long run impacts are observed in the rest of the month.

prices volatility changes) and structural financial shocks. Therefore, the representation of SVAR model is given as follows:

$$B_0 y_t = \beta + \sum_{i=1}^{p} B_i y_{t-i} + \varepsilon_t \quad (3.1)$$

where $y_t$ is $(3 \times 1)$ vector that includes financial stress index, daily oil price returns (logarithmic difference of oil prices) and daily oil prices volatility (obtained with $GARCH(1,1)$), $B_0$ is contemporaneous coefficient matrix, $\beta$ is vector of constant terms and $\varepsilon_t$ represents vector of serially and mutually uncorrelated error terms (structural shocks).

Therefore, structural shocks can be estimated by the following reduced form errors:

$$e_t = B_0^{-1} \varepsilon_t \quad (3.2)$$

The reduced-form VAR can be obtained as follows:

$$\begin{pmatrix} u_{1t} \\ u_{2t} \\ u_{3t} \end{pmatrix} = \begin{pmatrix} 1 & 0 & 0 \\ b_{21} & 1 & 0 \\ b_{31} & b_{32} & 1 \end{pmatrix} \times \begin{pmatrix} \varepsilon_{financial\ shock} \\ \varepsilon_{oil\ price\ shock} \\ \varepsilon_{oil\ price\ volatility\ shock} \end{pmatrix} \quad (3.3)$$

SVAR is estimated by using 30 lags of each variable to determine potential long run impacts of oil price shocks on financial stability.

### 3.1.2. Causality in Mean Test

Toda and Yamamoto (1995) proposed that the levels of VAR can be estimated and the general restrictions on the parameters can be tested "*even if the processes may be integrated or co-integrated of an arbitrary order. The lag selection procedure is done for a possibly integrated or co-integrated VAR in the first place. In addition to the selection of lag length* $k$, $(k + d_{max})$ *th-order VAR is*

*estimated in which $d_{max}$ the maximal order of integration that might occur in the process is. The coefficient matrices of the last $d_{max}$ in the model are ignored and the linear or non-linear restrictions on the first $k$ coefficient matrices are tested"* (Toda and Yamamoto, 1995).

## 3.2. INVESTIGATION OF OIL PRICE SHOCKS ON FINANCIAL STABILITY OF OIL IMPORTER AND OIL EXPORTER COUNTRIES

In this section, the structural shocks are estimated using SVAR models for 9 net oil importer/exporter countries (G-7 countries, Turkey and Norway). In addition, impulse responses of structural shocks are obtained in order to capture short and long run relationships between variables.

### 3.2.1. Oil Importer Countries

In this section, the response of financial stability to oil price shocks for 7 net oil importing countries (Turkey, United States, Japan, United Kingdom, Germany, France, Italy) are investigated using SVAR models.

#### 3.2.1.1. Turkey

Before empirical analysis, financial stress index of Turkey, log of oil prices and volatility of oil prices with $GARCH(1,1)$ from 01/11/2005 to 11/17/2016 are graphically illustrated in Figure 19:

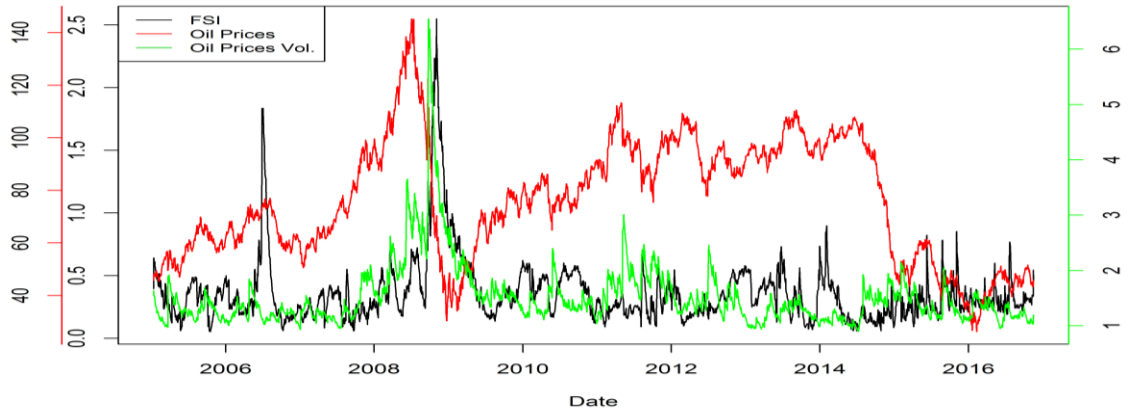



**Figure 19.** Financial Stress Index (FSI) for Turkey, Oil Prices and Oil Prices Volatility

It appears from Figure 19 that there exists a decline in oil prices while there exist an upward trend in financial stress index and volatility of oil prices during 2008 financial crisis. This situation is very similar to the US during the same period (Nazlioglu et al., 2015). Co-movements and correlations strengthen during financial instability periods as can be seen from Figure 19. Correlation structure of the series are given following table:

**Table 15.** Pearson Correlations between Financial Stress Index (FSI) of Turkey, Oil Prices and Oil Prices Volatility


Table 15 show that financial stress index and oil prices are negatively and weakly correlated. In addition, there exist a moderate, positive correlation between

financial stress index and volatility of oil prices. Therefore, SVAR model is estimated in order to capture transmissions between financial stress index and oil price dynamics.

Before setting up structural VAR model, we employ unit root tests (Dickey and Fuller (1979) (ADF), Phillips and Perron (1988) (PP), Elliott et al. (1996) (DF-GLS), and Kwiatkowski et al. (1992) (KPSS)) to financial stress index of Turkey, oil price and oil price volatility. Results of unit root tests are given in following table:

**Table 16.** Unit Root Test Results for Financial Stress Index of Turkey, Oil Prices (log) and Oil Prices Volatility

| Unit Root Test | Financial Stress Index | Oil Prices | Oil Prices Volatility |
|---|---|---|---|
| **ADF** | -5.3596 *** | -2.0042 | -4.5862 *** |
| **KPSS** | 1.1587 *** | 2.7402 *** | 1.9001 *** |
| **DF-GLS** | -6.1402 *** | -1.3896 ** | -5.2129 *** |
| **PP** | -5.7781 *** | -2.0759 | -5.0914 *** |

*Notes*: *, ** and *** show significance level at 10, 5 and 1 percent.

By the results of ADF, DF-GLS and PP unit root test, daily financial stress index of Turkey is stationary at 1%, 5% and 10% significance levels, though KPSS unit root test rejects stationarity. ADF, KPSS, DF-GLS and PP tests both confirm non-stationarity of daily oil prices. By the results of ADF, DF-GLS, PP tests oil prices volatility is found to be stationary. As a consequence, we estimate SVAR model that contains financial stress index, oil price returns and oil prices volatility.

In the next step, we employ Toda-Yamamoto approach in order to determine mean spillovers between the series. Toda-Yamamoto causality test results are given in the following table:

**Table 17.** Toda-Yamamoto Test Results for Turkey

| | |
|---|---|
| **Causality of Oil Prices to Financial Stress (p value)** | 0.39 |
| **Causality of Oil Prices Volatility to Financial Stress (p value)** | $1.6 \times 10^{-11}$ |

Toda-Yamamoto causality test indicates that, the null hypothesis "oil prices does not Granger cause financial stress" could not be rejected. In addition, the null hypothesis "oil prices volatility does not Granger cause financial stress" could be rejected at 1%, 5% and 10% significance levels. Therefore, there exist mean and volatility transmissions between Turkey's financial stress index and daily oil price dynamics.

The impulse responses of financial stress index to 1 standard deviation shock (oil price and volatility shock) are illustrated in the following figures:

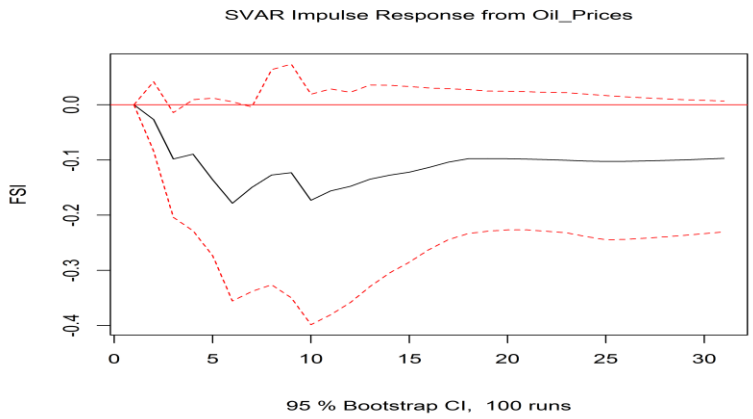



**Figure 20.** Response of Turkey's FSI to Oil Prices Shock

Figure 20 shows that financial stress index fall as a result of positive oil price shock. Approximately 18 days later, the financial stress index stabilizes. In the long run, the effect of oil prices on financial stress index is negative.

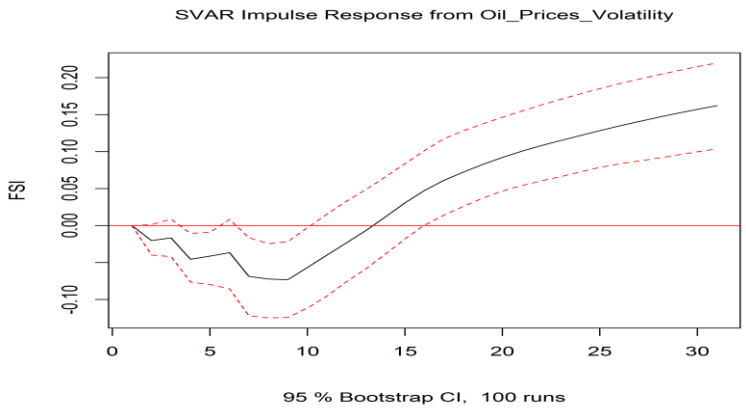



**Figure 21.** Response of Turkey's FSI to Oil Prices Volatility Shock

Figure 21 illustrates Turkey's financial stress index's response to positive oil prices volatility shock. Financial stress index of Turkey initially declines as a consequence of positive oil prices volatility shock. It reaches its initial value approximately 13 days later. The impact of oil price volatility shock on financial stress index of Turkey is positive, in the long run.

The effects of different structural shocks to the fluctuations in the VAR are determined by estimating the forecast error variance decomposition. Figure 22 illustrates the historical decomposition of financial stress index of Turkey.

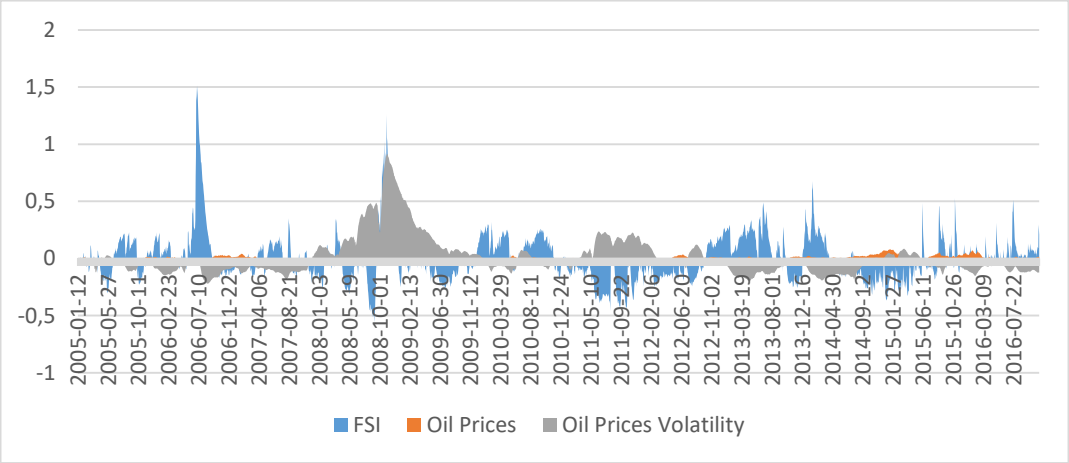



**Figure 22.** Historical Decomposition of FSI of Turkey

It appears from Figure 22 that, the proportion of oil prices volatility in historical decomposition of financial stress index reaches its highest value during last

global financial crisis. Little evidence shows strong transmissions between oil price returns and financial stress index in the whole period. The greatest proportion of decomposition of the financial stress index consists of itself.

3.2.1.2. The United States

Before empirical analysis, financial stress index of the United States, log of oil prices and volatility of oil prices with $GARCH(1,1)$ from 01/10/1993 through 11/18/2016 are graphically illustrated in Figure 23:

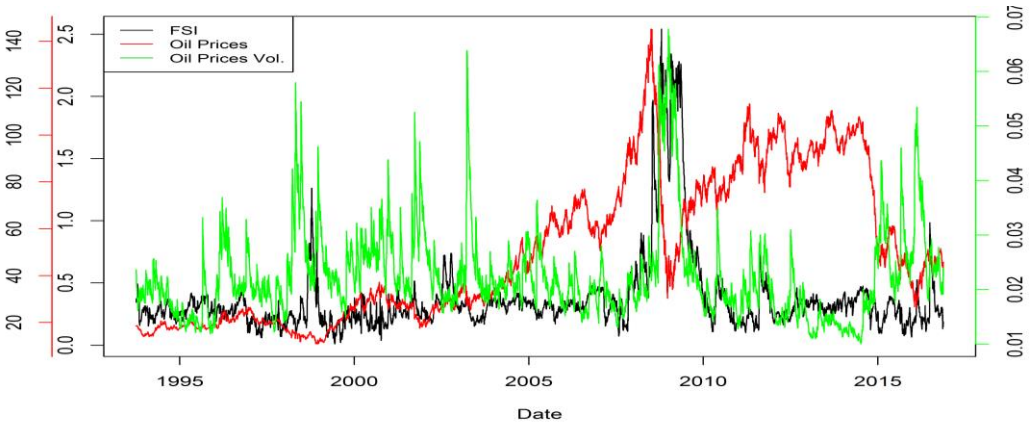



**Figure 23.** Financial Stress Index (FSI) for the US, Oil Prices and Oil Prices Volatility

During 2008 financial crisis, there exist upward trends in financial stress index and volatility of oil prices, though oil prices declines. This situation is similar to the results found in (Nazlioglu et al., 2015). Co-movements and correlations between series strengthen during 2008 financial crisis. Correlation structure of the series are given in Table18:

**Table 18.** Pearson Correlations between Financial Stress Index (FSI) of the US, Oil Prices and Oil Prices Volatility

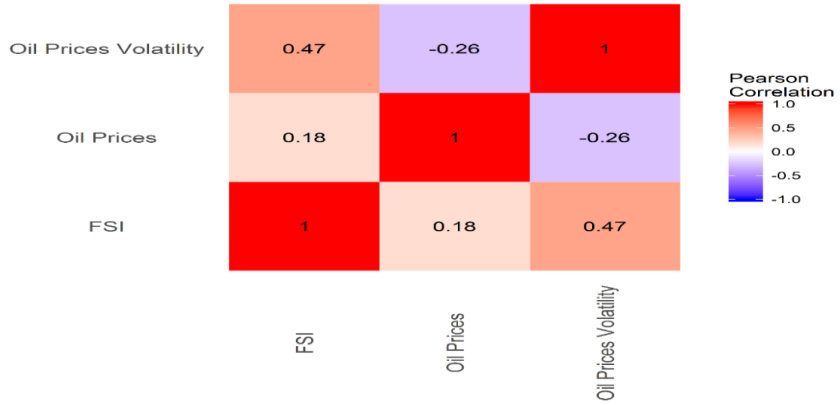



Table 18 shows that, financial stress index and oil prices are positively and weakly correlated. Besides, financial stress index and oil prices volatility are positively and moderately correlated. As a consequence, we estimate SVAR in order to capture linkages between FSI and oil price dynamics.

Before SVAR analysis, ADF, PP, DF-GLS and KPSS unit root tests are employed to financial stress index of the U.S., oil prices and oil prices volatility. The results of unit root tests are given in the following table:

**Table 19.** Unit Root Test Results for Financial Stress Index of the U.S., Oil Prices (log) and Oil Prices Volatility

| Unit Root Test | Financial Stress Index | Oil Prices | Oil Prices Volatility |
|---|---|---|---|
| **ADF** | -3.8921 ** | -1.7867 | -5.7832 *** |
| **KPSS** | 2.5348 *** | 26.519 *** | 0.57376 ** |
| **DF-GLS** | -4.2485 *** | -2.0797 *** | -7.0452 *** |
| **PP** | -4.342 *** | -1.8062 | -6.854 *** |

*Notes*: *, ** and *** show sign. level at 10, 5 and 1 percent.

ADF, DF-GLS and PP unit root tests indicate that, daily financial stress index for the U.S. is stationary, while the results of KPSS test rejects stationarity. ADF, KPSS, DF-GLS and PP test results both confirm that oil prices has a unit root. ADF, DF-GLS and PP unit test results indicate that oil prices volatility is

stationary, though KPSS test results show that it has a unit root. Therefore, we estimate SVAR that contains financial stress index of the U.S., the first difference of log oil prices and oil prices volatility.

Toda-Yamamoto approach is employed in the next step to determine mean spillovers between the series. The results of Toda-Yamamoto causality analysis is given the next table:

**Table 20.** Toda-Yamamoto Test Results for the U.S.

| | |
|---|---|
| **Causality of Oil Prices to Financial Stress (p value)** | 0.013 |
| **Causality of Oil Prices Volatility to Financial Stress (p value)** | 0.00014 |

By the results of Toda-Yamamoto causality tests, the null hypothesis “oil prices does not Granger cause financial stress” could be rejected at 5% and 10% significance levels. In addition, the null hypothesis “oil prices volatility does not Granger cause financial stress” could be rejected at 1%, 5% and 10% significance levels.

The impulse responses of financial stress index to 1 standard deviation shock (oil price and volatility shock) are illustrated in the following figures:

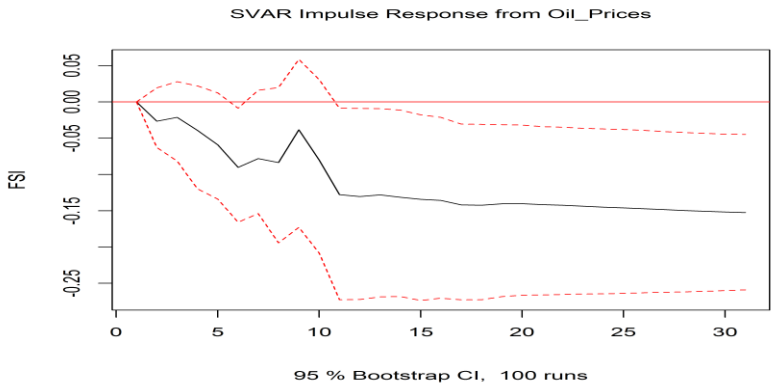



**Figure 24.** Response of the US’s FSI to Oil Prices Shock

Figure 24 shows that positive oil price shock lead to initial decline in financial stress. FSI starts to fall sharply after 10th day and it stabilizes approximately on 13th day. In the long run, the effect of oil prices on financial stress index is negative. This situation is alike to results found in related studies (Chen et al., 2014; Nazlioglu et al., 2014).

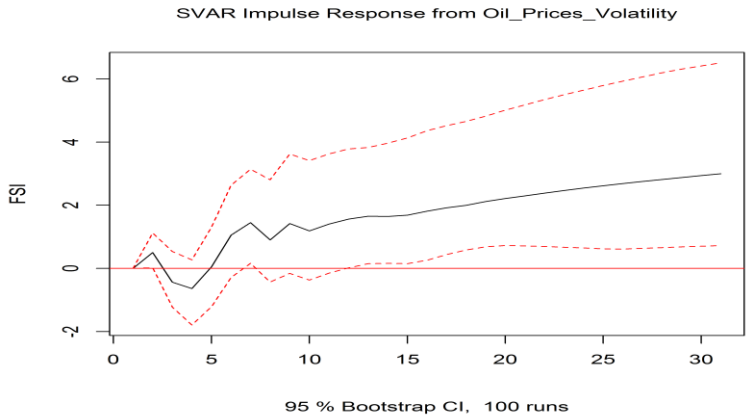



**Figure 25.** Response of the US's FSI to Oil Prices Volatility Shock

Figure 25 shows response of financial stress index of the U.S. to positive oil prices volatility shock. Index slightly rises as a consequence of positive oil prices volatility shock approximately 2 days later. Almost 5 days later, it returns to its initial level. The long-run effect of oil price volatility shock on financial stress index of the U.S. is positive.

The effects of different structural shocks to the fluctuations in the VAR are determined by estimating the forecast error variance decomposition. Figure 26 shows the historical decomposition of financial stress index of the United States.

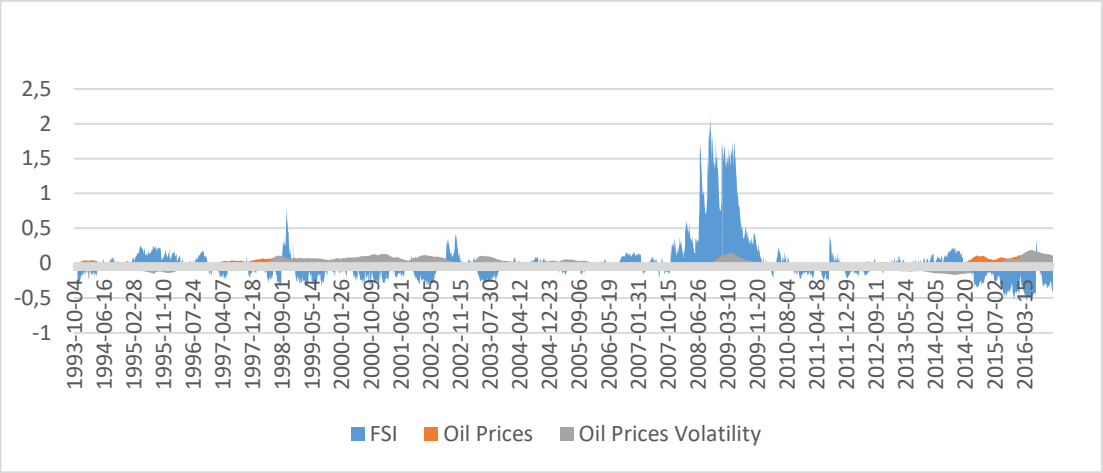



**Figure 26.** Historical Decomposition of FSI of the U.S.

Figure 26 indicates that, the greatest amount of decomposition of financial stress index during 2008 financial crisis originated by itself. The proportion of oil price volatility in the decomposition of financial stress index during pre-crisis period (2003/05-2007/05) are mostly positive, while it becomes mostly negative during post-crisis period (2009/11-2015/05).

3.2.1.3. Japan

Before empirical analysis, financial stress index of Japan, log of oil prices and volatility of oil prices with $GARCH(1,1)$ are illustared from 06/10/1995 through 11/29/2016 in Figure 27:

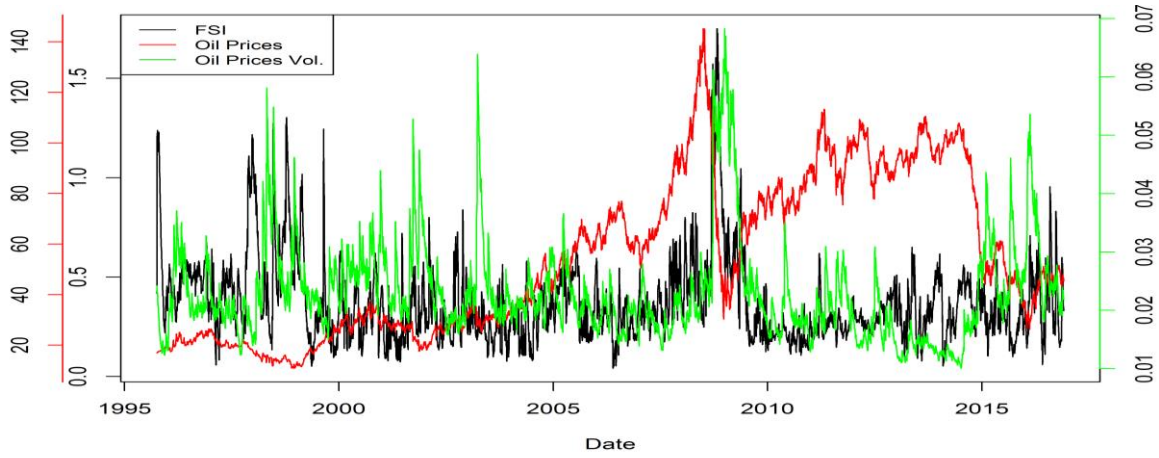


**Figure 27.** Financial Stress Index (FSI) for Japan, Oil Prices and Oil Prices Volatility

Similar to the US and Turkey cases, financial stress index of Japan and volatility of oil prices rise during 2008 financial crisis. Correlation structure of the series are given in the following table.

**Table 21.** Pearson Correlations between Financial Stress Index (FSI) of Japan, Oil Prices and Oil Prices Volatility

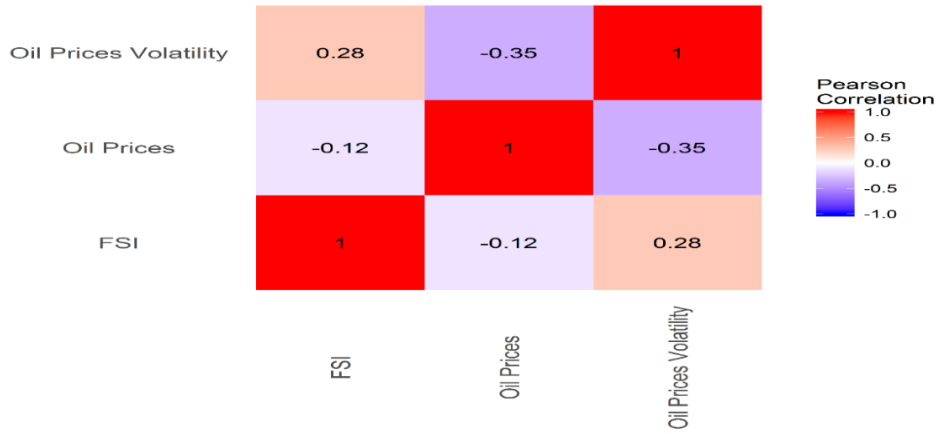



Table 21 indicates that, there exists a negative and weak correlation between oil prices and FSI of Japan. In addition, volatility of oil prices and index are positively and weakly correlated. As a consequence, we estimate SVAR in order to capture transmissions between financial stress index and oil price dynamics.

Before SVAR analysis, ADF, PP, DF-GLS and KPSS unit root tests are employed to financial stress index of Japan, oil prices and oil prices volatility. The results of unit root tests are given in Table 22:

**Table 22.** Unit Root Test Results for Financial Stress Index of Japan, Oil Prices (log) and Oil Prices Volatility

| Unit Root Test | Financial Stress Index | Oil Prices | Oil Prices Volatility |
|---|---|---|---|
| **ADF** | -8.018 *** | -1.593 | -5.7264 *** |
| **KPSS** | 1.4479 *** | 22.67 *** | 0.81593 *** |
| **DF-GLS** | -10.106 *** | -1.8408 ** | -6.802 *** |
| **PP** | -10.009 *** | -1.6618 | -6.6427 *** |

*Notes*: *, ** and *** show significance level at 10, 5 and 1 percent levels

ADF, DF-GLS and PP unit root tests show that daily FSI of Japan is stationary. Log of daily oil prices is found to be non-stationary and oil prices volatility series is found to be stationary by ADF, KPSS, DF-GLS and PP tests. Therefore, we estimate SVAR model that includes financial stress index, oil price returns and oil prices volatility.

We employ Toda-Yamamoto causality tests to determine spillovers between series. The results are given in the following table:

**Table 23.** Toda-Yamamoto Test Results for Japan

| | |
|---|---|
| **Causality of Oil Prices to Financial Stress (p value)** | 0,025 |
| **Causality of Oil Prices Volatility to Financial Stress (p value)** | 0.09 |

By the results of Table 23, the null hypothesis “oil prices does not Granger cause financial stress” could be rejected at 1%, 5% and 10% significance levels. Besides, the null hypothesis “oil prices’ volatility does not Granger cause financial stress” could be rejected at 10% significance level.

The impulse responses of financial stress index to 1 standard deviation shock (oil price and volatility shock) are illustrated in the following figures:

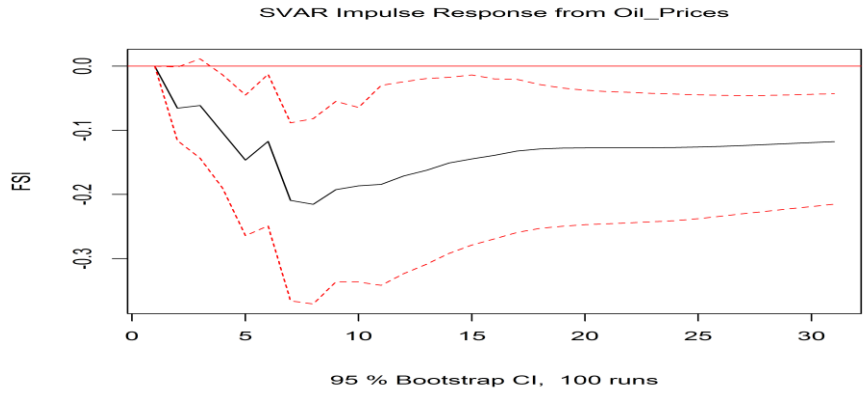



**Figure 28.** Response of Japan's FSI to Oil Price Shock

Figure 28 indicates that FSI of Japan sharply falls as a result of positive oil price shock approximately 2 days later. After 8th day financial stress index starts to increase and stabilizes approximately on 18th day. The long-run effect of oil prices on FSI of Japan is negative.

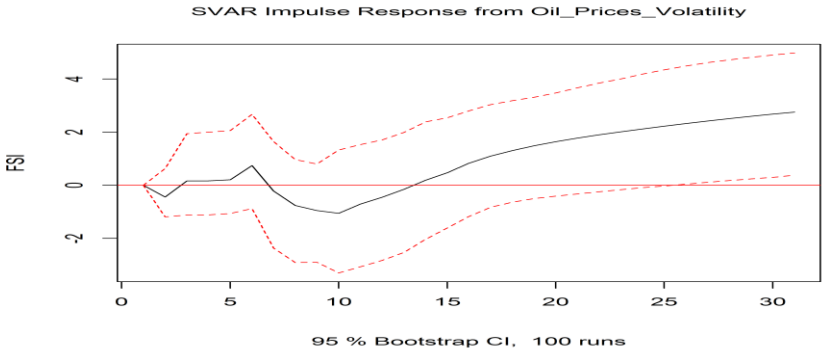



**Figure 29.** Response of Japan's FSI to Oil Prices Volatility Shock

Figure 29 illustrates response of financial stress index of Japan to positive oil prices volatility shock. Index slightly decreases as a result of positive shock approximately 2 days later. Almost on 8th day, it reaches its initial value and 2 days later it starts to rise. The long-run effect of oil prices volatility on FSI of Japan is positive.

The effects of different structural shocks to the fluctuations in the VAR are determined by estimating the forecast error variance decomposition. Figure 30 shows the historical decomposition of financial stress index of Japan.

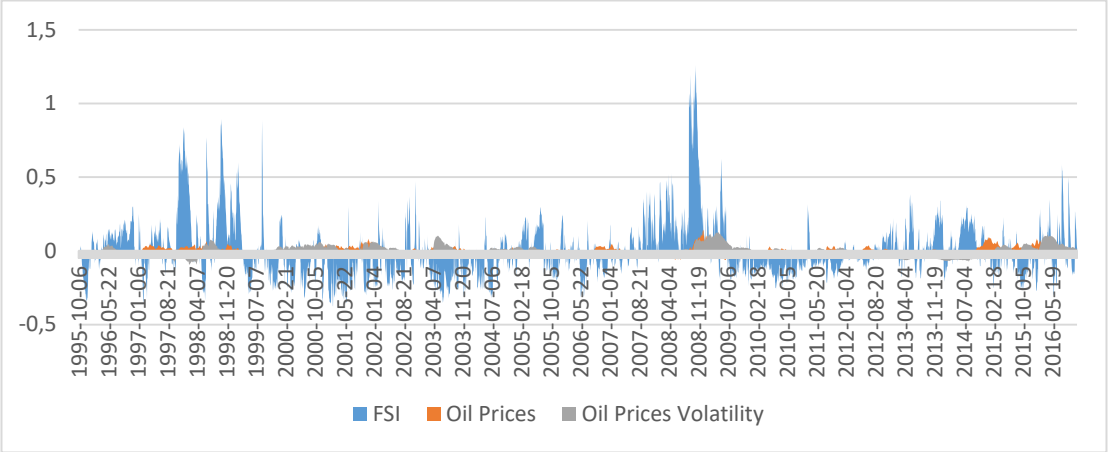



**Figure 30.** Historical Decomposition of FSI of Japan

It can be seen from Figure 30 that, the greatest amount of decomposition of financial stress index is composed of itself during 2008 financial crisis similar to the US. Proportion of oil price volatility in the historical decomposition of FSI during 2008 crisis is mostly positive. Similarly, proportion of oil price in the historical decomposition of financial stress index is positive during 1997 Asian and 2008 crises.

3.2.1.4. The United Kingdom

FSI of the United Kingdom, log of oil prices and volatility of oil prices with $GARCH(1,1)$ from 02/28/1996 to 11/19/2016 are given in Figure 31:

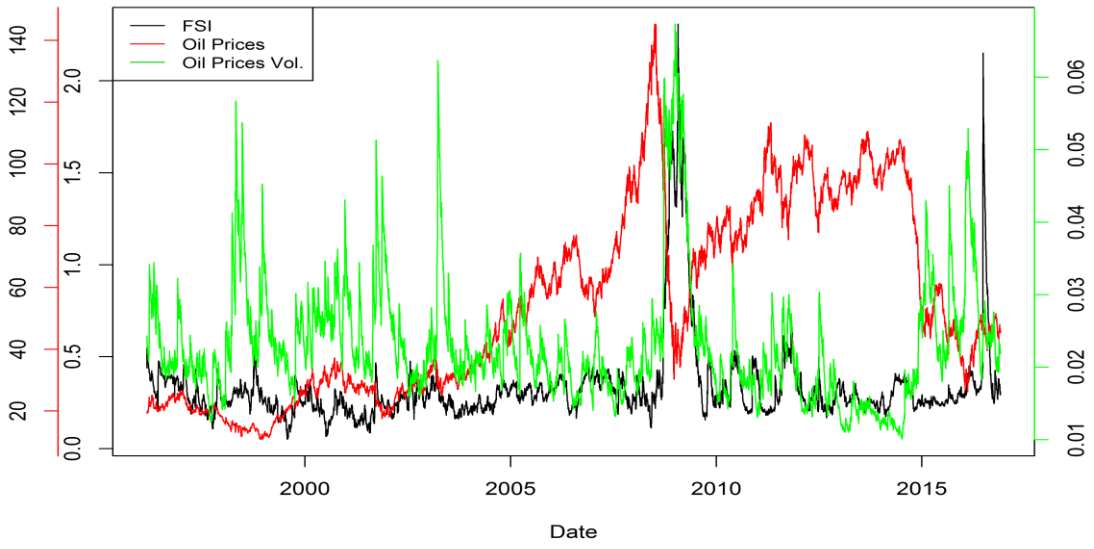
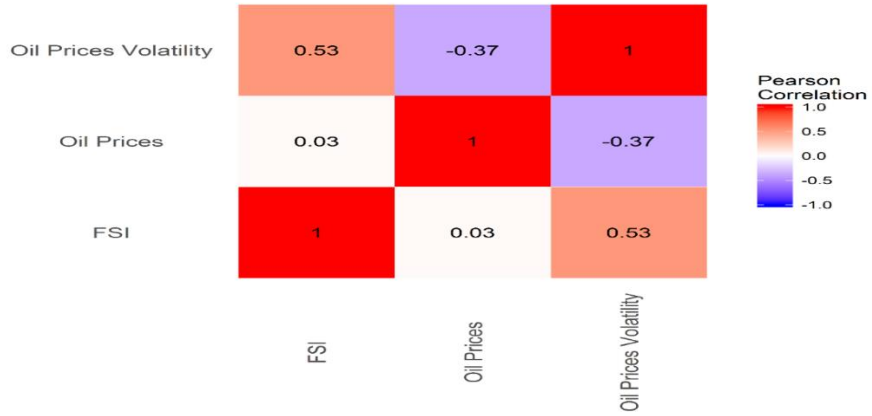



**Figure 31.** Financial Stress Index (FSI) for the UK, Oil Prices and Oil Prices Volatility

Similar to the other countries in the sample, financial stress index of the U.K. and oil price volatility increase, while oil prices decline during 2008 financial crisis. Correlation structure of the series are given in Table 24:

**Table 24.** Pearson Correlations between Financial Stress Index (FSI) of the UK, Oil Prices and Oil Prices Volatility




By the correlation structure, we can conclude that FSI of the U.K. and oil price volatility are positively and strongly correlated. In addition, there exists positive and weak correlation between oil prices and index.

Before SVAR analysis, ADF, PP, DF-GLS and KPSS unit root tests are employed to financial stress index of the U.K., oil prices and oil prices volatility. The results of unit root tests are given in Table 25.

**Table 25.** Unit Root Test Results for Financial Stress Index of the U.K., Oil Prices (log) and Oil Prices Volatility

| Unit Root Test | Financial Stress Index | Oil Prices | Oil Prices Volatility |
|---|---|---|---|
| **ADF** | -4.8449 *** | -1.5879 | -5.5226 *** |
| **KPSS** | 1.8233 *** | 23.127 *** | 1.0113 *** |
| **DF-GLS** | -5.0541 *** | -1.8738 ** | -6.4887 *** |
| **PP** | -5.2524 *** | -1.6226 | -6.336 *** |

*Notes*: *, ** and *** show significance level at 10, 5 and 1 percent levels.

ADF, DF-GLS and PP unit root tests confirm that daily financial stress index of the U.K. is stationary at 1%, 5% and 10% significance levels. Log of oil prices is found to be non-stationary and oil prices volatility series is found to be stationary by the ADF, KPSS, DF-GLS and PP tests. Therefore, we estimate SVAR model that contains the financial stress index, oil price returns and oil prices volatility.

Toda-Yamamoto causality tests are employed in the next step to capture linkages between series. Table 26 shows Toda Yamamoto test results for the series:

**Table 26.** Toda-Yamamoto Test Results for the U.K.

| | |
|---|---|
| **Causality of Oil Prices to Financial Stress (p value)** | 0.0085 |
| **Causality of Oil Prices Volatility to Financial Stress (p value)** | 0.00029 |

By the results of Table 26, the null hypothesis “oil prices does not Granger cause financial stress” and the null hypothesis “oil prices’ volatility does not Granger cause financial stress” could be rejected at 1%, 5% and 10% significance levels.

The impulse responses of financial stress index of the U.K. to 1 standard deviation shock (oil price and volatility shock) are illustrated in the following figures:

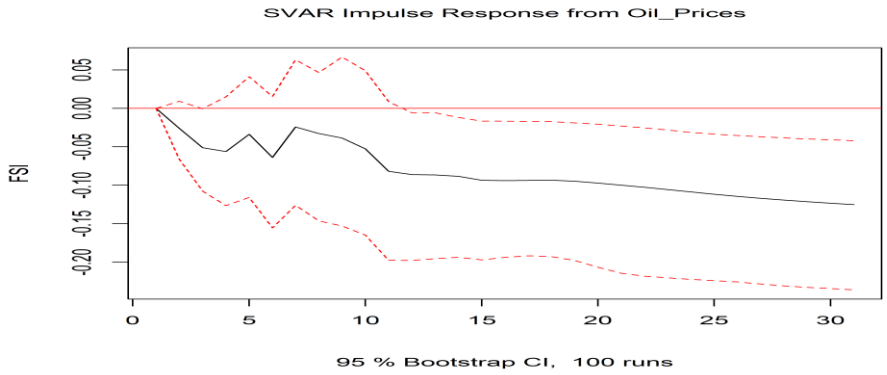



**Figure 32.** Response of the UK's FSI to Oil Prices Shock

Figure 32 shows that financial stress index of the U.K. declines as a consequence of positive oil price shock approximately 2 days later. Almost on 11$^{th}$ day the index stabilizes. The long-run effect of oil price shocks on financial stress index is negative.

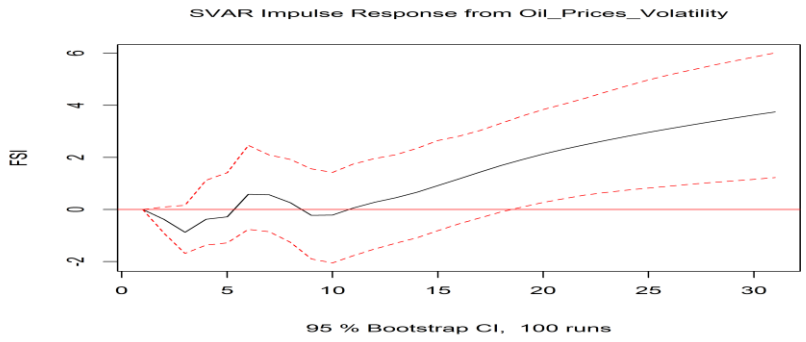



**Figure 33.** Response of the UK's FSI to Oil Prices Volatility Shock

FSI of the U.K. declines approximately 2 days later as a result of positive oil price shock. It reaches its initial value at lag 5. Almost on 10$^{th}$ day, the index starts to increase. The long run effect of oil prices volatility shock on financial stress index is positive.

The effects of different structural shocks to the fluctuations in the VAR are determined by estimating the forecast error variance decomposition. Figure 34 shows the historical decomposition of financial stress index of the UK.

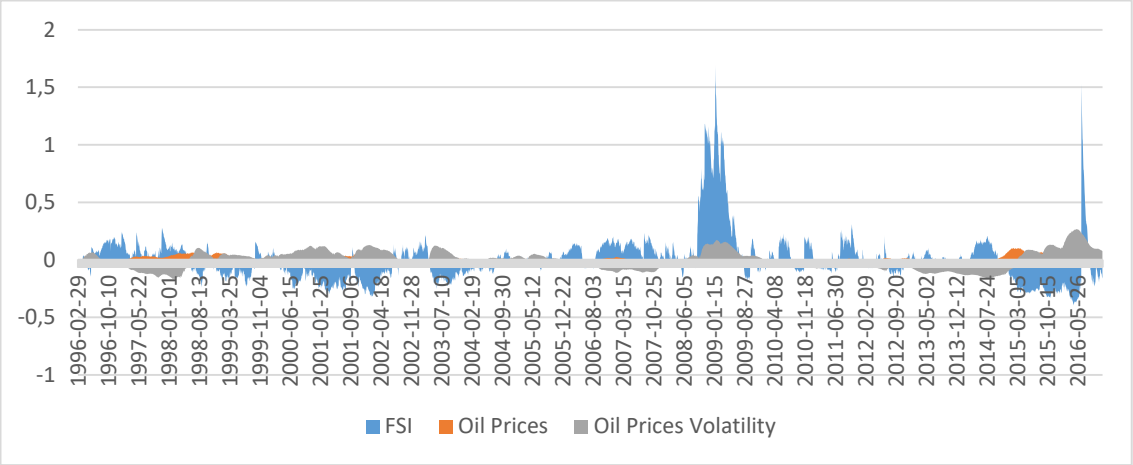



**Figure 34.** Historical Decomposition of FSI of the U.K.

Figure 34 shows that, the highest proportion of the decomposition of financial stress index during 2008 financial crisis consist of itself and a small proportion of its decomposition consists of oil price volatility. The proportion of oil prices in the decomposition of financial stress index is considerably small.

### 3.2.1.5. Germany

Before empirical analysis, financial stress index of Germany, log of oil prices and volatility of oil prices with $GARCH(1,1)$ are illustared from 09/07/2004 through 11/29/2016 in Figure 35:

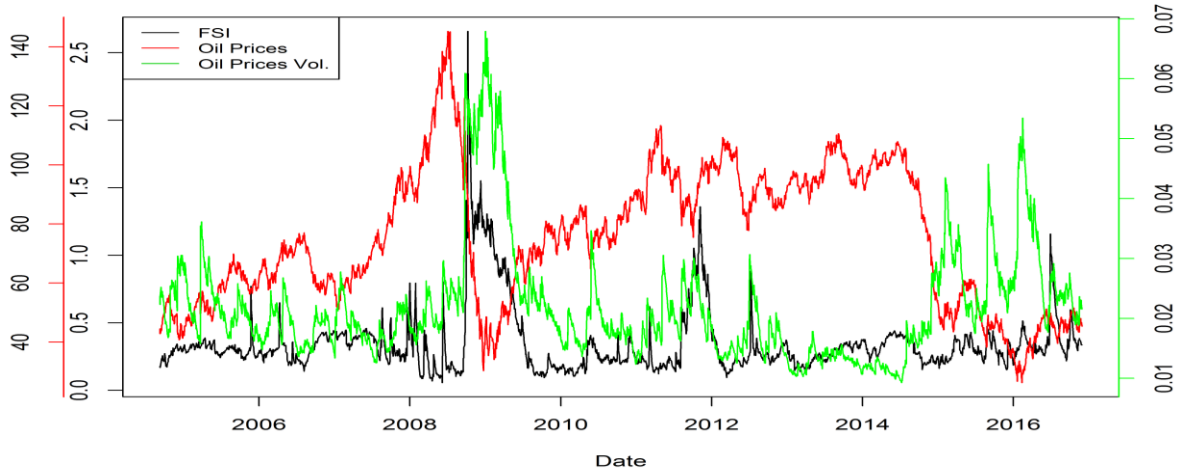
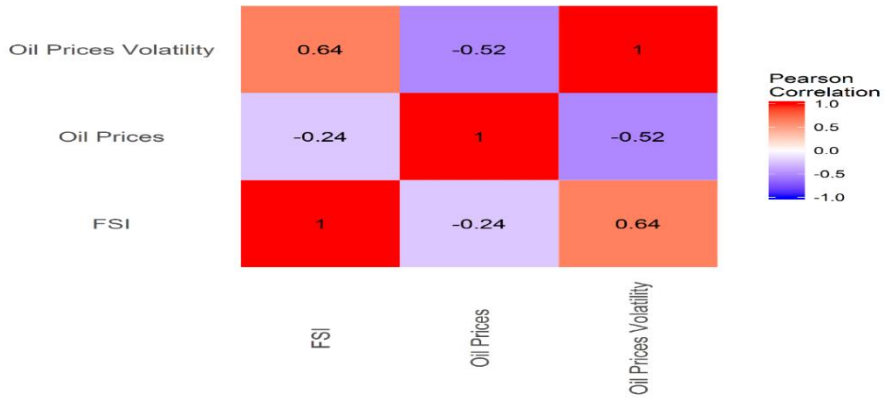



**Figure 35.** Financial Stress Index (FSI) for Germany, Oil Prices and Oil Prices Volatility

It appears from Figure 35 that, co-movements and correlations between series strengten during 2008 financial and European Sovereign debt crises. Correlation structure of the series are given in Table 27:

**Table 27.** Pearson Correlations between Financial Stress Index (FSI) of Germany, Oil Prices and Oil Prices Volatility




By the results of correlation structure, oil prices volatility and financial stress index of Germany are positively and strongly correlated. In addition, FSI of Germany and oil price volatility are negatively and moderately correlated. Consequently, we estimate SVAR model that captures linkages among the index and oil price dynamics.

Before SVAR analysis, ADF, PP, DF-GLS and KPSS unit root tests are employed to financial stress index of Germany, oil prices and oil prices volatility. The results of unit root tests are given in Table 28.

**Table 28.** Unit Root Test Results for Financial Stress Index of Germany, Oil Prices (log) and Oil Prices Volatility

| Unit Root Test | Financial Stress Index | Oil Prices | Oil Prices Volatility |
|---|---|---|---|
| **ADF** | -4.7408 *** | -1.9147 | -3.7724 ** |
| **KPSS** | 0.45532 * | 2.6827 *** | 0.93521 *** |
| **DF-GLS** | -4.6416 *** | -1.3826 *** | -3.9862 *** |
| **PP** | -5.4958 *** | -2.037 | -3.9537 ** |

*Notes*: *, ** and *** show significance level at 10, 5 and 1 percent levels.

All tests except KPSS confirm that financial stress index of Germany is stationary. Oil prices is found non-stationary and oil prices volatility is found stationary by the results of ADF, DF-GLS and PP unit root tests. As a consequence, we estimate SVAR model that contains FSI, oil prices returns and oil prices volatility.

Toda-Yamamoto tests are implemented in the next step and table 29 shows causality tests results:

**Table 29.** Toda-Yamamoto Test Results for Germany

| | |
|---|---|
| **Causality of Oil Prices to Financial Stress (p value)** | $7.7 \times 10^{-5}$ |
| **Causality of Oil Prices Volatility to Financial Stress (p value)** | $2.7 \times 10^{-14}$ |

By the results of Table 29, the null hypothesis “oil prices does not Granger cause financial stress” could be rejected at 1%, 5% and 10% significance levels. Similarly, the null hypothesis “oil prices’ volatility does not Granger cause financial stress” could be rejected at 1%, 5% and 10% significance levels.

The impulse responses of financial stress index of Germany to 1 standard deviation shock (oil price and volatility shock) are illustrated in the following figures:

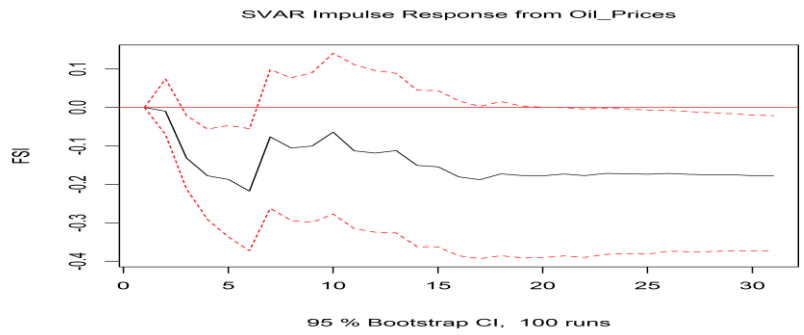



**Figure 36.** Response of Germany's FSI to Oil Prices Shock

FSI of Germany decreases approximately 2 days later as a result of positive oil price shock. Approximately on 17$^{th}$ day, the index stabilizes. The long run effect of oil price shock on financial stress index of Germany is negative.

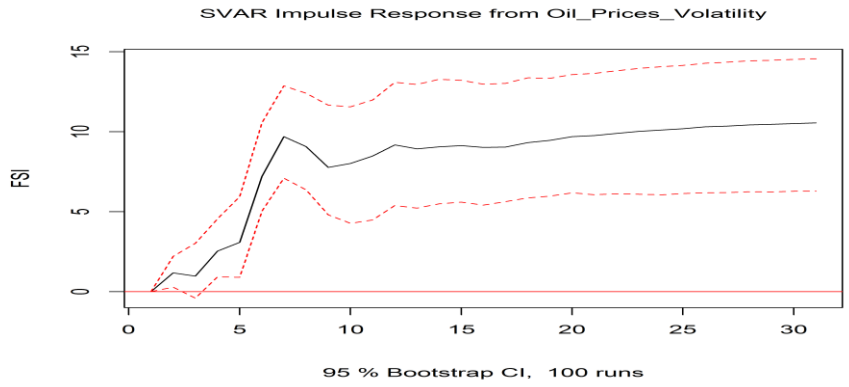



**Figure 37.** Response of Germany's FSI to Oil prices Volatility Shock

FSI of Germany goes up approximately 2 days later as a result of positive oil price volatility shock. It stabilizes almost on 12$^{th}$ day. The long run effect of oil price volatility shock on financial stress index is positive.

The effects of different structural shocks to the fluctuations in the VAR are determined by estimating the forecast error variance decomposition. Figure 38 shows the historical decomposition of financial stress index of Germany.

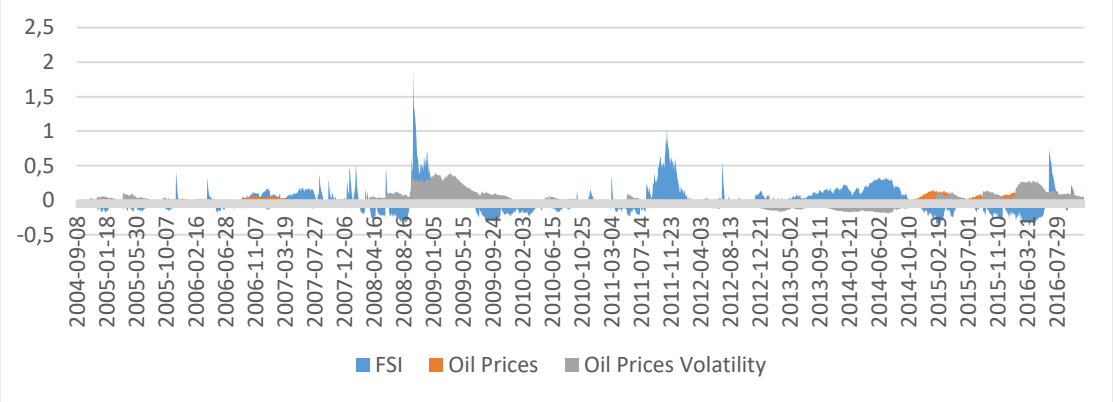



**Figure 38.** Historical Decomposition of FSI of Germany

It appears from Figure that, a great amount of decomposition of financial stress index is originated by oil price volatility during 2008 financial crisis. On the other hand, the decomposition of index is composed of itself during European Sovereign debt crisis. Recently, a small and positive amount of decomposition of financial stress index is composed of oil prices.

### 3.2.1.6. France

Financial stress index of France, log of oil prices and volatility of oil prices with $GARCH(1,1)$ are illustared from 09/07/2004 through 11/29/2016 in Figure 39:

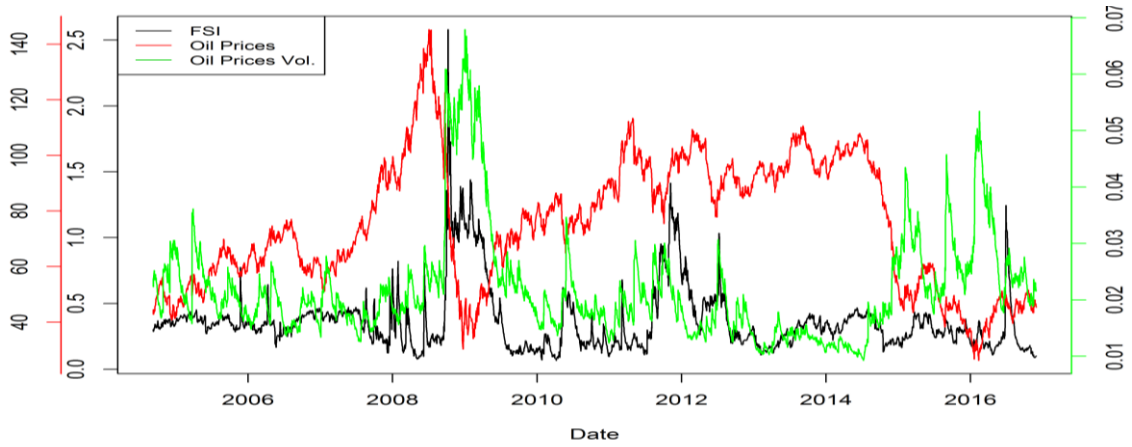
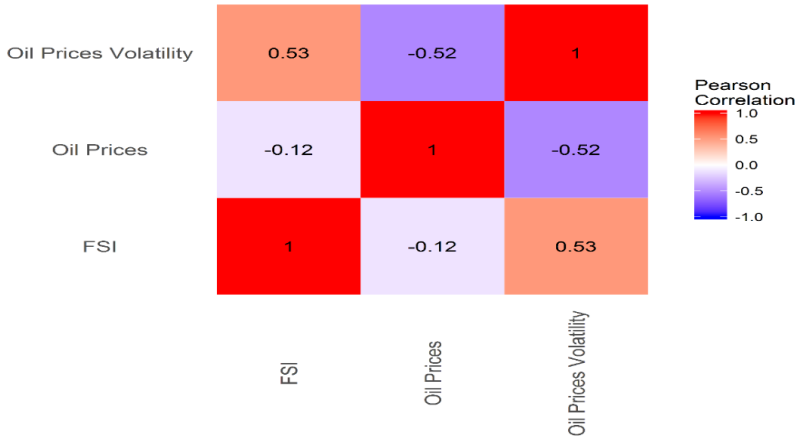



**Figure 39.** Financial Stress Index (FSI) for France, Oil Prices and Oil Prices Volatility

Similar to Germany, co-movements and correlations between FSI of France and oil prices dynamics strengten during 2008 financial and European Sovereign debt crises. Correlation structure of the series are given in Table 30:

**Table 30.** Pearson Correlations between Financial Stress Index (FSI) of France, Oil Prices and Oil Prices Volatility




There exists a strong and positive correlation between volatility of oil prices and the FSI of France. In addition, oil prices and FSI of France negatively and weakly correlated.

Before SVAR analysis, ADF, PP, DF-GLS and KPSS unit root tests are employed to financial stress index of France, oil prices and oil prices volatility. The results of unit root tests are given in Table 31.

**Table 31.** Unit Root Test Results for Financial Stress Index of France, Oil Prices (log) and Oil Prices Volatility

| Unit Root Test | Financial Stress Index | Oil Prices | Oil Prices Volatility |
|---|---|---|---|
| **ADF** | -4.6866 *** | -1.9147 | -3.7724 ** |
| **KPSS** | 0.86484 *** | 2.6827 *** | 0.93521 *** |
| **DF-GLS** | -4.9153 *** | -1.3826 *** | -3.9862 *** |
| **PP** | -5.5943 *** | -2.037 | -3.9537 ** |

*Notes*: *, ** and *** show significance level at 10, 5 and 1 percent levels.

ADF, DF-GLS and PP unit root tests confirm that, the daily financial stress index of France is stationary, though KPSS test rejects stationarity. Log of daily oil prices series is non-stationary by ADF, DF-GLS and PP tests. Oil prices volatility series is stationary by ADF, DF-GLS and PP unit root tests. Consequently, we estimate SVAR model that includes financial stress index of France, oil prices returns and oil prices volatility.

In the next step, we implement Toda-Yamamoto tests to the series. Results are given in the following table:

**Table 32.** Toda-Yamamoto Test Results for France

| | |
|---|---|
| **Causality of Oil Prices to Financial Stress (p value)** | $1.3 \times 10^{-5}$ |
| **Causality of Oil Prices Volatility to Financial Stress (p value)** | $4.4 \times 10^{-8}$ |

Results of Table 32 indicate that the null hypothesis “oil prices does not Granger cause financial stress” could be rejected at 1%, 5% and 10% significance levels. Besides, the null hypothesis “oil prices’ volatility does not Granger cause financial stress” could be rejected at 1%, 5% and 10% significance levels.

The impulse responses of financial stress index of France to 1 standard deviation shock (oil price and volatility shock) are illustrated in the following figures:

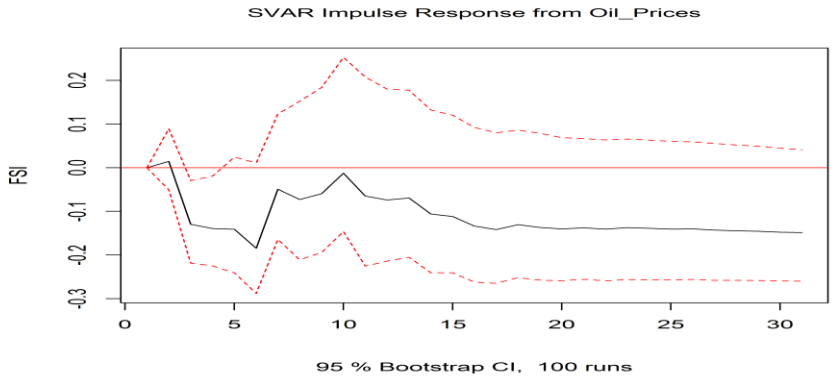



**Figure 40.** Response of France's FSI to Oil Price Shock

Financial stress index of France falls almost 2 days later then positive oil prices shock. Approximately on 10$^{th}$ day, it reaches its initial value and stabilizes at lag 12. The effect of oil price shock on FSI of France is negative in the long run.

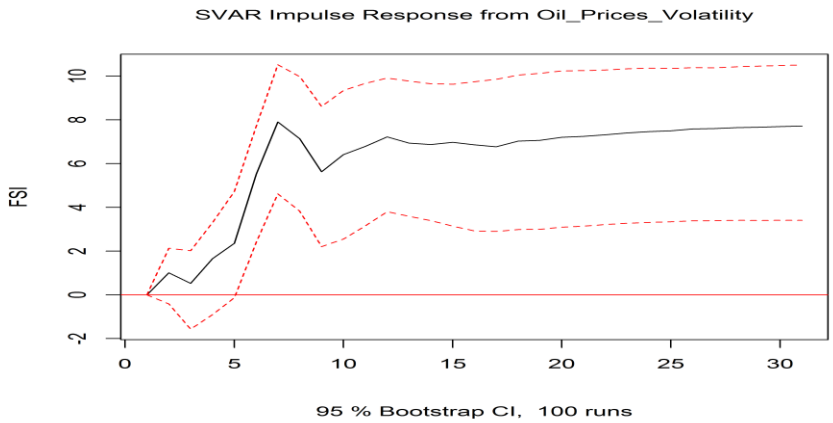



**Figure 41.** Response of France's FSI to Oil Prices Volatility Shock.

Similar to Germany, FSI of France tends to increases approximately 2 days later than positive oil price volatility shock. It stabilizes almost at lag 12. The effect of oil price volatility shock on FSI of France is positive in the long run.

The effects of different structural shocks to the fluctuations in the VAR are determined by estimating the forecast error variance decomposition. Figure 42 shows the historical decomposition of financial stress index of France.

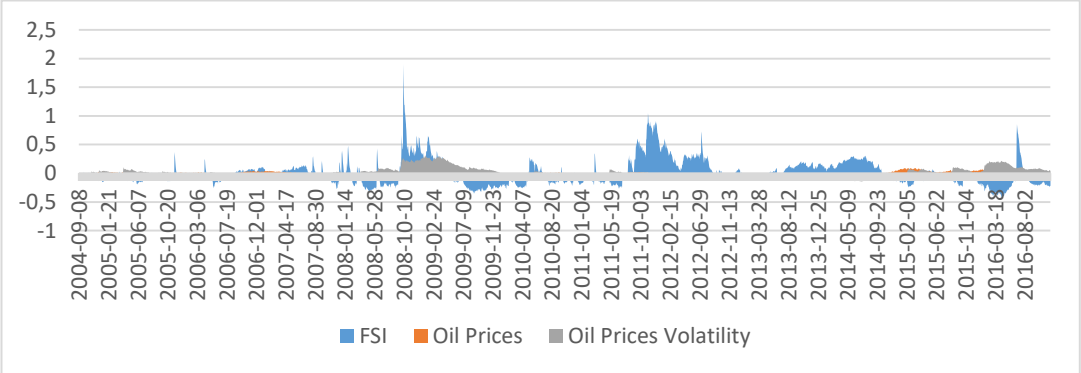



**Figure 42.** Historical Decomposition of FSI of France

Similar to Germany, an important amount of decomposition of financial stress index is composed of oil prices volatility during 2008 crisis. Besides, the decomposition of index is originated by itself during European Sovereign debt crisis. Proportions of oil prices and oil prices volatility in the decomposition of financial stress index tend to be positive recently.

3.2.1.7. Italy

Before empirical analysis, financial stress index of Italy, log of oil prices and volatility of oil prices with $GARCH(1,1)$ are illustared from 09/07/2004 through 11/29/2016 in Figure 43:

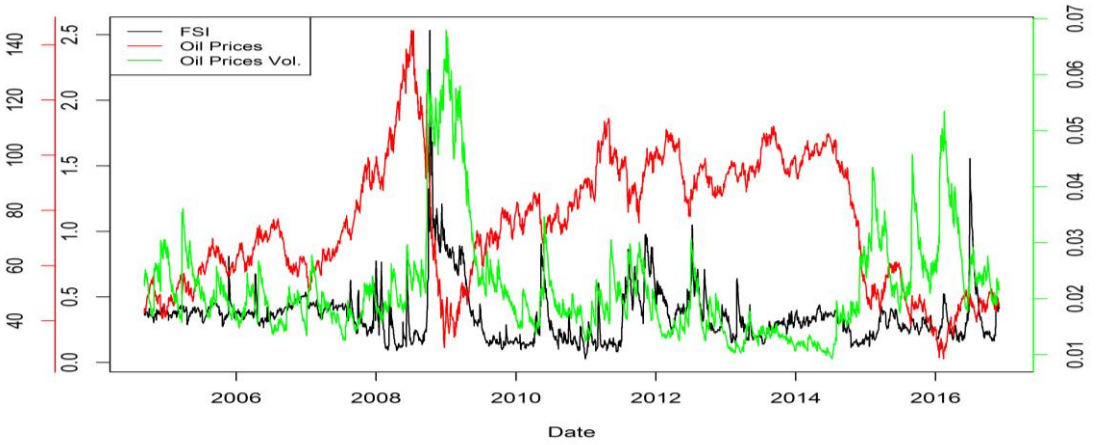
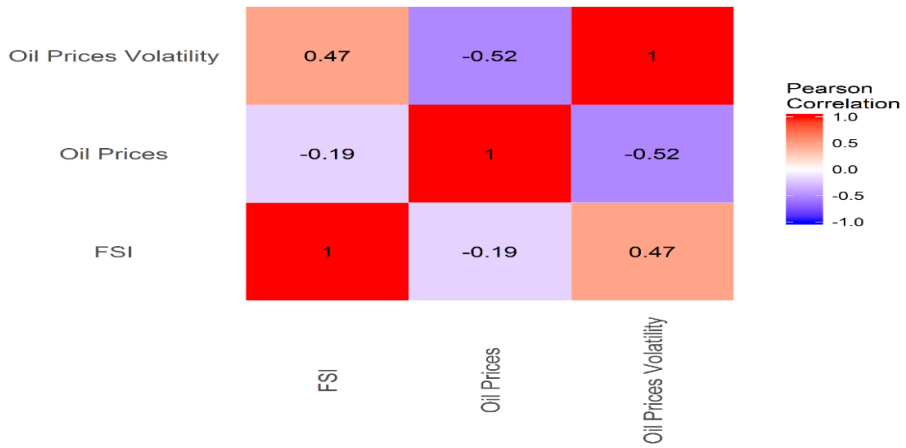



**Figure 43.** Financial Stress Index (FSI) for Italy, Oil Prices and Oil Prices Volatility

Co-movements and correlations between series strengthen during 2008 financial and European Sovereign debt crises. Correlation structure of the series are given in Table 33:

**Table 33.** Pearson Correlations between Financial Stress Index (FSI) of Italy, Oil Prices and Oil Prices Volatility




By the results of Table 33, oil prices volatility and FSI of Italy positively and moderately correlated. What is more, oil prices and FSI of Italy are negatively and weakly correlated.

Before SVAR analysis, ADF, PP, DF-GLS and KPSS unit root tests are employed to financial stress index of Italy, oil prices and oil prices volatility. Unit root tests results are given in the following table:

**Table 34.** Unit Root Test Results for Financial Stress Index of Italy, Oil Prices (log) and Oil Prices Volatility

| Unit Root Test | Financial Stress Index | Oil Prices | Oil Prices Volatility |
|---|---|---|---|
| **ADF** | -5.9582 *** | -1.9147 | -3.7724 ** |
| **KPSS** | 0.9295*** | 2.6827 *** | 0.93521 *** |
| **DF-GLS** | -6.473 *** | -1.3826 *** | -3.9862 *** |
| **PP** | -7.0798 *** | -2.037 | -3.9537 ** |

*Notes*: *, ** and *** show significance level at 10, 5 and 1 percent levels.

With an exception of KPSS test, all other unit root tests show that financial stress index of Italy is stationary. Log of daily oil prices series is non-stationary by ADF, DF-GLS and PP unit root tests. Oil prices volatility series is stationary by ADF, DF-GLS and PP tests. As a consequence, we estimate SVAR model that includes Italy's financial stress index, oil prices returns and oil prices volatility.

Toda-Yamamoto tests are implemented to the series. Test results are given in the following table:

**Table 35.** Toda-Yamamoto Test Results for Italy

| | |
|---|---|
| **Causality of Oil Prices to Financial Stress Index (p value)** | 0.0026 |
| **Causality of Oil Prices Volatility to Financial Stress (p value)** | $8.6 \times 10^{-8}$ |

Results of Table 35 indicate that the null hypothesis "oil prices does not Granger cause financial stress" could be rejected at 1%, 5% and 10% significance levels. In addition, the null hypothesis "oil prices' volatility does not Granger cause financial stress" could be rejected at 1%, 5% and 10% significance levels.

The impulse responses of FSI of Italy to 1 standard deviation shock (oil price and volatility shock) are illustrated in the following figures:

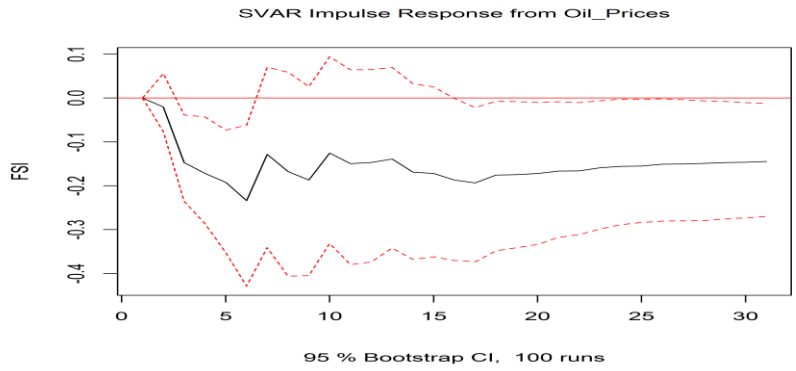



**Figure 44.** Response of Italy's FSI to Oil Price Shock

Approximately 2 days later, FSI of Italy declines as a result of positive oil price shock. It stabilizes almost at lag 17. The long run effect of oil price shock on financial stress index is negative.

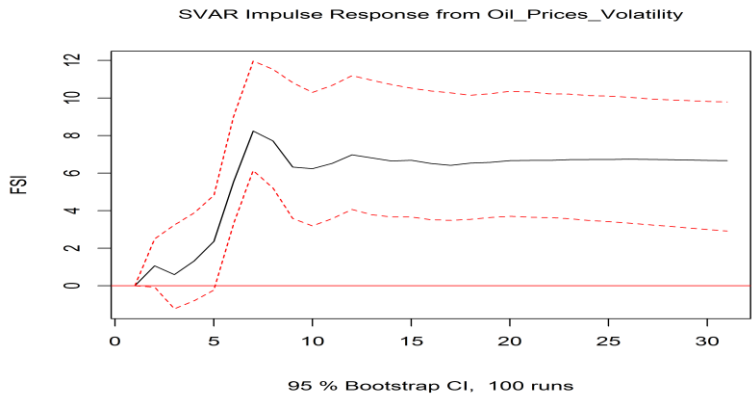



**Figure 45.** Response of Italy's FSI to Oil Price Volatility Shock

FSI of Italy increases as a result of positive oil price volatility shock approximately 2 days later. It stabilizes almost on 13$^{th}$ day. The effect of oil price volatility shock on financial stress index is positive in the long run.

The effects of different structural shocks to the fluctuations in the VAR are determined by estimating the forecast error variance decomposition. Figure 46 shows the historical decomposition of financial stress index of Italy.

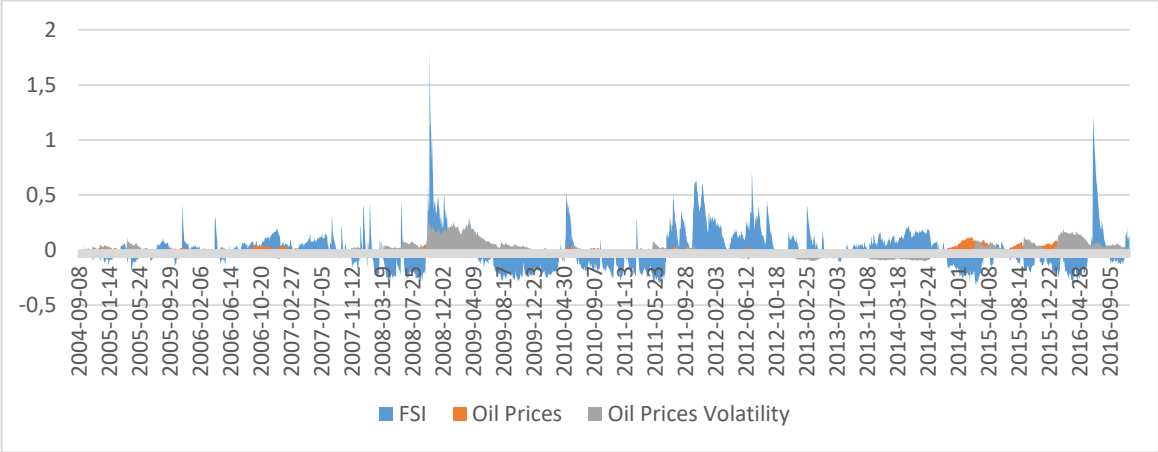



**Figure 46.** Historical Decomposition of FSI of Italy

It appears from Figure 46 that, a great amount of decomposition of financial stress index of Italy is composed of oil prices volatility in 2008 financial crisis. Similar to France and Germany, the decomposition of index is originated mostly by itself during European debt crisis. In the recent period, proportions of oil prices and oil prices volatility in the decomposition of financial stress index tend to be positive.

### 3.2.2. Oil Exporting Countries

#### 3.2.2.1. Canada

Financial stress index of Canada, log of oil prices and volatility of oil prices with $GARCH(1,1)$ are illustared from 07/07/1996 through 11/29/2016 in Figure 47:

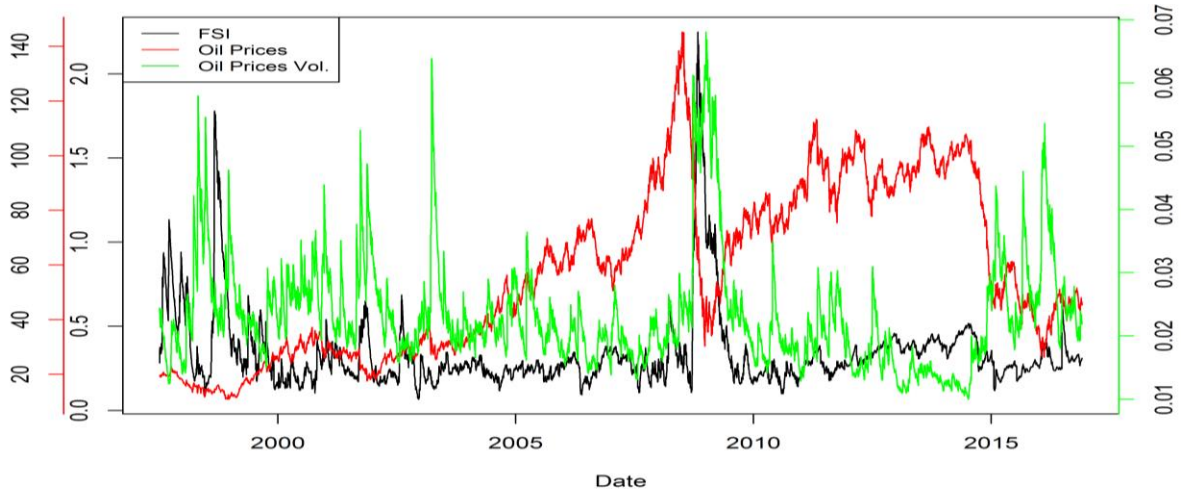
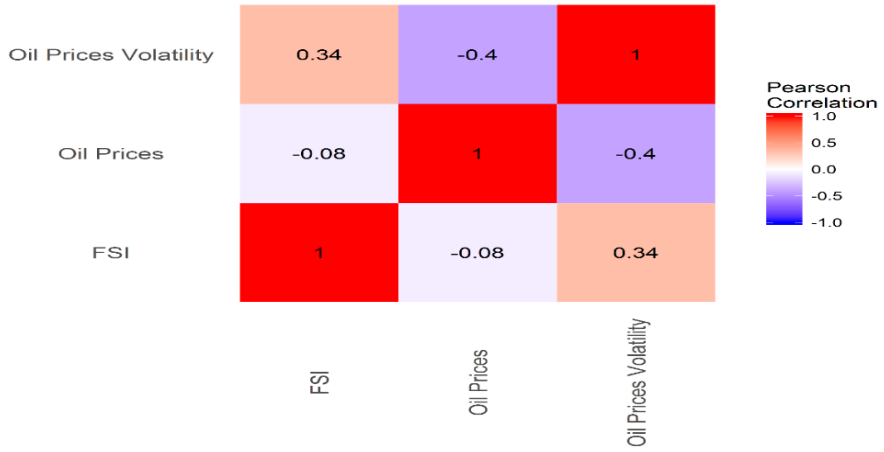



**Figure 47.** Financial Stress Index (FSI) for Canada, Oil Prices and Oil Prices Volatility

It appears from Figure 47 that, the co-movements and correlations among series strengthen during 1990s and 2008 financial crises. Correlation structure of the series are given in Table 36:

**Table 36.** Pearson Correlations between Financial Stress Index (FSI) of Canada, Oil Prices and Oil Prices Volatility




By the correlation structure, oil prices and FSI of Canada are negatively and weakly correlated. Besides, oil prices and FSI of Canada are positively and moderately correlated.

Before SVAR analysis, ADF, PP, DF-GLS and KPSS unit root tests are employed to financial stress index of Canada, oil prices and oil prices volatility. Unit root tests results are given in the following table:

**Table 37.** Unit Root Test Results for Financial Stress Index of Canada, Oil Prices and Oil Prices Volatility

| Unit Root Test | Financial Stress Index | Oil Prices | Oil Prices Volatility |
|---|---|---|---|
| **ADF** | -6.2764 *** | -1.4855 | -5.4668 *** |
| **KPSS** | 0.58087 ** | 20.358 *** | 1.1675 *** |
| **DF-GLS** | -5.245 *** | -1.6996 *** | -6.4285 *** |
| **PP** | -5.3079 *** | -1.4954 | -6.2972 ** |

*Notes*: *, ** and *** show significance level at 10, 5 and 1 percent levels.

With an exception of KPSS, all unit tests results indicate that financial stress index is stationary. All unit tests both confirm that log of daily oil prices has unit root. In addition, ADF, DF-GLS and PP unit root tests confirm stationarity of oil prices volatility. Consequently, we estimate SVAR model that contains financial stress index, the return of oil prices and oil prices volatility.

Toda-Yamamoto tests are implemented to the series. Results are given in the following table:

**Table 38.** Toda-Yamamoto Test Results for Canada

| | |
|---|---|
| **Causality of Oil Prices to Financial Stress Index (p value)** | 0.0035 |
| **Causality of Oil Prices Volatility to Financial Stress (p value)** | 0.1 |

Results of Table 38 shows that the null hypothesis “oil prices does not Granger cause financial stress” could be rejected at 1%, 5% and 10% significance levels. Besides, the null hypothesis “oil prices’ volatility does not Granger cause financial stress” couldn’t be rejected at 10% significance level.

The impulse responses of financial stress index of Canada to 1 standard deviation shock (oil price and volatility shock) are illustrated in the following figures:

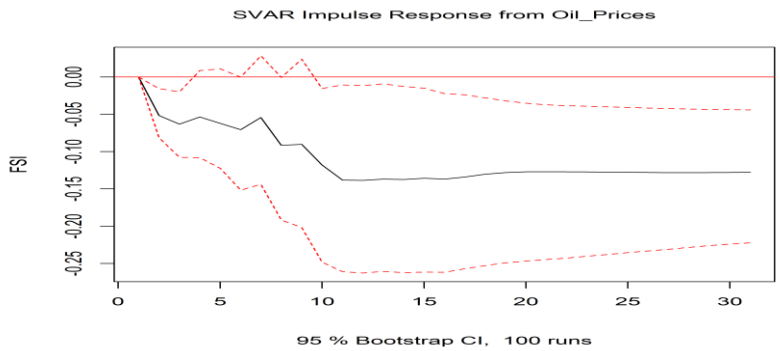



**Figure 48.** Response of Canada's FSI to Oil Price Shock

Financial stress index of Canada declines consequent to positive oil prices shock after approximately 2 days later. It stabilizes almost at lag 11. The long run effect of oil prices on FSI of Canada is negative.

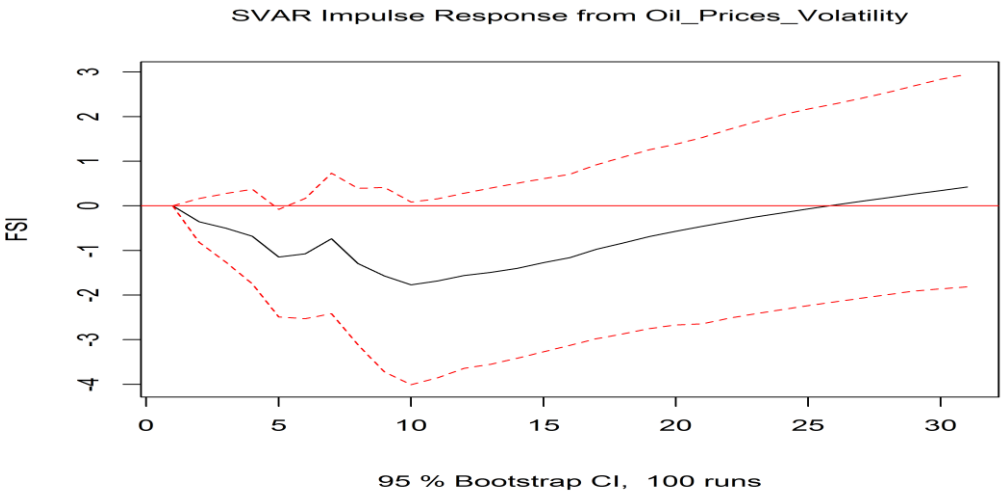



**Figure 49.** Response of Canada's FSI to Oil prices Volatility Shock

Financial stress index falls consequent to oil prices volatility shock approximately 2 days later. It reaches its initial value almost at lag 26. The long run effect of oil price volatility shock on FSI of Canada is positive.

The effects of different structural shocks to the fluctuations in the VAR are determined by estimating the forecast error variance decomposition. Figure 50 shows the historical decomposition of financial stress index of Canada.

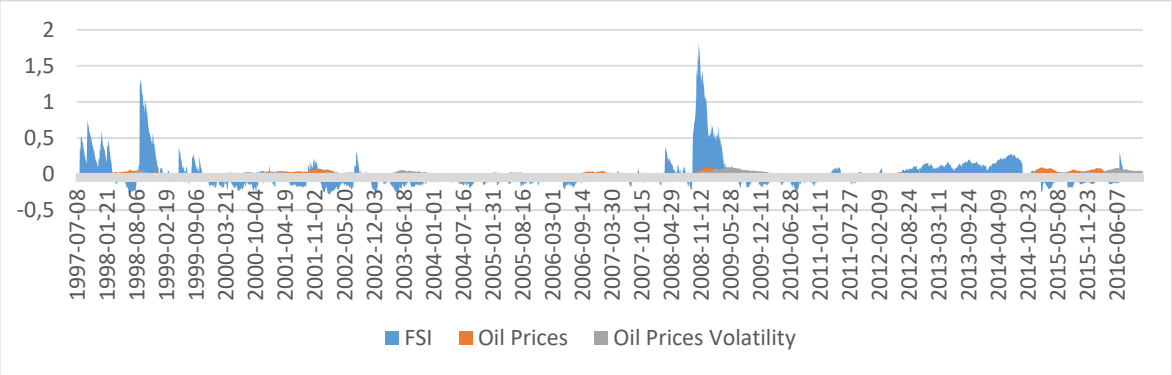



**Figure 50.** Historical Decomposition of FSI of Canada

Figure 50 shows that, a small amount proportion of oil prices volatility in the decomposition of financial stress index exists during 2008 financial crisis. The decompositions of financial stress index during 1998's and during 2008 financial crises are mostly originated by itself. The proportion of oil prices in the decomposition of oil prices tends to be positive recently.

### 3.2.2.2. Norway

Financial stress index of Norway, log of oil prices and volatility of oil prices with $GARCH(1,1)$ are illustared from 03/20/1997 through 12/06/2016 in Figure 51:

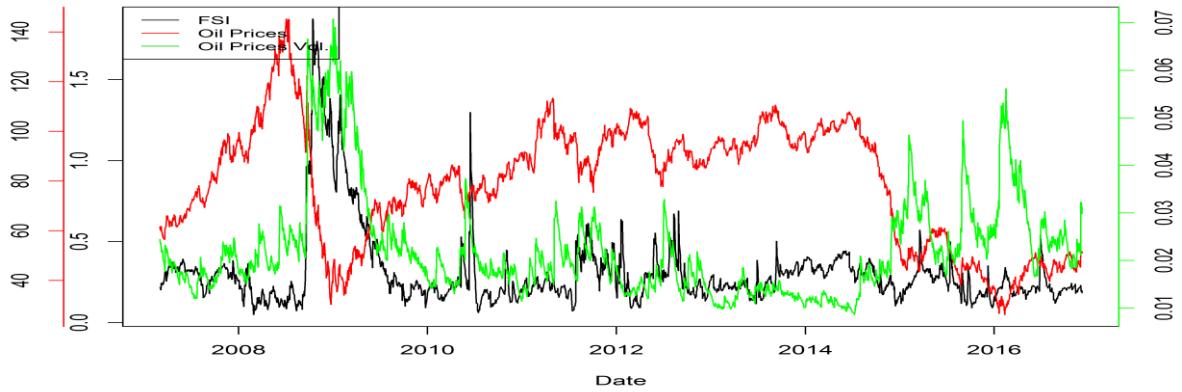
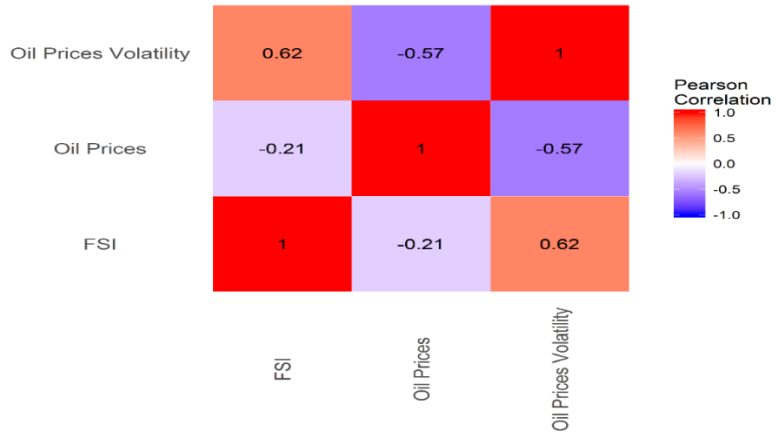



**Figure 51.** Financial Stress Index (FSI) for Norway, Oil Prices and Oil Prices Volatility

Similar to other European member countries in the sample, co-movements and correlations among series strengthen during 2008 financial and European Sovereign debt crises. Correlation structure of the series are given in Table 39:

**Table 39.** Pearson Correlations between Financial Stress Index (FSI) of Norway, Oil Prices and Oil Prices Volatility




By the correlation structure, oil prices volatility and FSI of Norway are positively and strongly correlated. In addition, oil prices and FSI of Norway are negatively and weakly correlated.

Before SVAR analysis, ADF, PP, DF-GLS and KPSS unit root tests are employed to financial stress index of Norway, oil prices and oil prices volatility. Unit root tests results are given in the following table:

**Table 40.** Unit Root Test Results for Financial Stress Index of Norway, Oil Prices and Oil Prices Volatility

| Unit Root Test | Financial Stress Index | Oil Prices | Oil Prices Volatility |
|---|---|---|---|
| **ADF** | -3.8504 ** | -2.1567 | -3.2812 * |
| **KPSS** | 1.7176 ** | 4.4395 *** | 1.5935 *** |
| **DF-GLS** | -1.6251 *** | -1.6996 ** | -3.7464 *** |
| **PP** | -4.5791 *** | -2.0971 | -3.7041 ** |

*Notes*: *, ** and *** show significance level at 10, 5 and 1 percent levels.

With an exception of KPSS, all unit root tests results confirm that the daily financial stress index for Norway is stationary. All unit root tests shows that log of daily oil prices has unit root. With an exception of KPSS, all unit root tests reject non-stationarity of oil prices volatility. Therefore, we estimate SVAR model that includes financial stress index return of oil prices and oil prices volatility.

We employ Toda-Yamamoto tests to the series. The results are given in the following table:

**Table 41.** Toda-Yamamoto Test Results for Norway

| | |
|---|---|
| **Causality of Oil Prices to Financial Stress Index (p value)** | 0.0062 |
| **Causality of Oil Prices Volatility to Financial Stress (p value)** | 0.025 |

Results of Table 41 show that the null hypothesis “oil prices does not Granger cause financial stress” could be rejected at 1%, 5% and 10% significance levels. Similarly, the null hypothesis “oil prices’ volatility does not Granger cause financial stress” could be rejected at 1%, 5% and 10% significance levels.

The impulse responses of financial stress index of Norway to 1 standard deviation shock (oil price and volatility shock) are illustrated in the following figures:

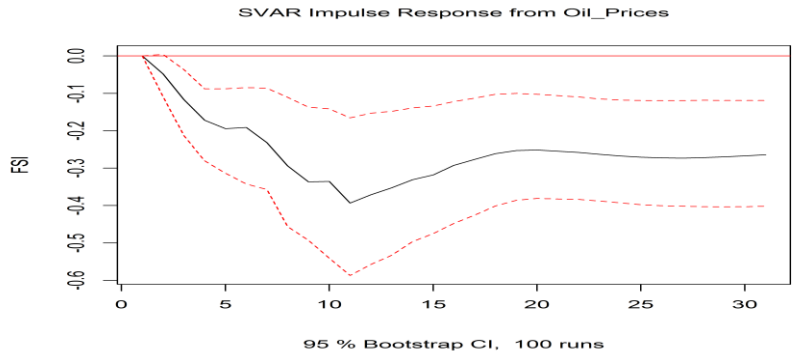



**Figure 52.** Response of Norway's FSI to Oil Price Shock

Financial stress index of Norway declines in respond to positive oil price shock approximately 2 days later. After lag 11, it starts to increase and it stabilizes almost 18 days later. The long run effect of oil price shock on FSI of Norway is negative.

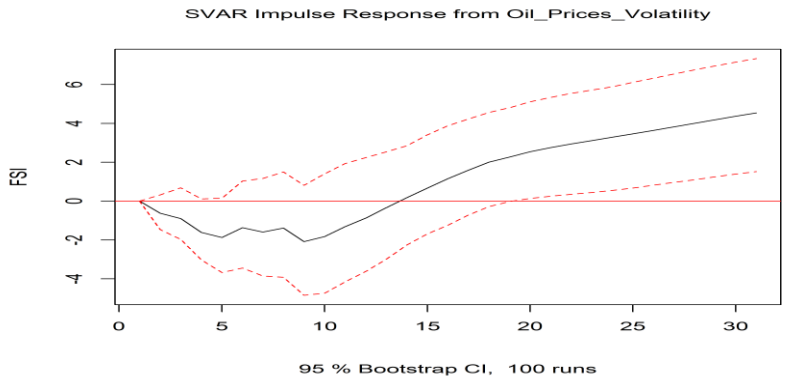



**Figure 53.** Response of Norway's FSI to Oil prices Volatility Shock

Financial stress index of Norway goes down in respond to positive oil prices volatility shock approximately 2 days later. It starts to increase almost 9 days later and reaches its initial value at lag 18. The long run effect of oil price volatility shock on FSI of Norway is positive.

The effects of different structural shocks to the fluctuations in the VAR are determined by estimating the forecast error variance decomposition. Figure 54 shows the historical decomposition of financial stress index of Norway.

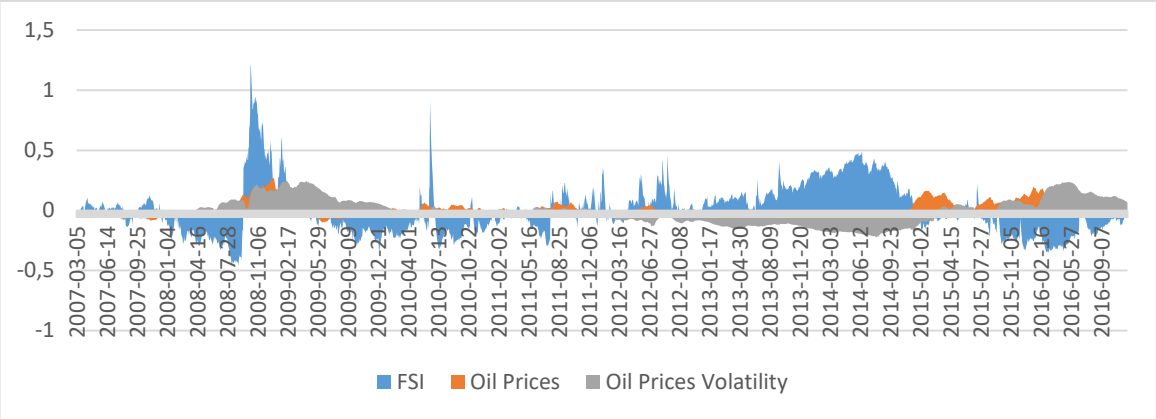



**Figure 54.** Historical Decomposition of FSI of Norway

It appears from Figure 54 that, a large amount of proportion of the decomposition of financial stress index is composed of oil prices volatility and a small amount of proportion of the decomposition is composed of oil prices during 2008 financial crisis. During 2013-2014 period, the proportion of oil prices volatility in the decomposition of index is negative, though it is positive in the recent period.

## 3.3. COMPARISON OF COUNTRIES TO THE IMPACTS OF OIL PRICE SHOCKS ON FINANCIAL STABILITY

In this section, 9 net oil importer/exporter countries are compared based on response of their financial stress indexes to oil price shocks. Besides, similarities/dissimilarities of impacts of shocks on financial stability of countries are discussed.

Financial stress indexes of 9 oil importer/exporter country response negatively to positive oil prices shocks in the short run[12]. Financial stress indexes of the U.S., the U.K. and Canada stabilize approximately 10 days after positive oil prices shock. Along with that, financial stress indexes of Turkey, Japan, Germany, France, Italy and Norway stabilize almost 18 days after positive oil price shocks.

[12] Short run effects are mostly observed within the first 10 days for the most of the countries.

Financial stress index of 9 oil importer/exporter countries response positively to positive oil prices volatility shocks in the long run[13]. Responses of financial stress indexes of Germany, France and Italy to positive oil prices volatility shock are very similar. This situation is related to have common financial market indicators in the FSIs of these countries since they are member of Economic and Monetary Union. Response of financial stress indexes of Japan and the U.K. to positive oil prices volatility shock have similar patterns. In the short run, financial stress index of Canada responses to positive oil prices volatility shock negatively and this behavior seperates Canada from other countries.

Financial stress indexes of all countries and oil prices volatility are positively correlated. There exist moderate positive linear relationship between financial stress index and oil prices volatility for Turkey (0.5), United States (0.47), United Kingdom (0.53), France (0.53) and Italy (0.47). There exist weak positive linear relationships between FSI and oil prices volatility for Japan (0.28) and Canada (0.34). There exist strong positive linear relationship among FSI and oil prices volatility for Germany (0.64) and Norway (0.62).

Financial stress indexes and oil prices are negatively correlated for the most of countries (Turkey, Japan, Germany, France, Italy, Canada and Norway). There exist weak, negative linear relationships between financial stress index and oil prices for Turkey (-0.09), Japan (-0.12), Germany (-0.24), France (-0.12), Italy (-0.18) Canada (-0.08) and Norway (-0.21). There exist weak and positive relationship between financial stress index and oil prices for United States (0.18) and United Kingdom (0.03).

Oil prices Granger causes financial stress indexes except for Turkey. Besides, oil prices volatility Granger causes financial stress indexes for 9 oil importer/exporter countries.

[13] Long run effects of shocks are observed after 10 or 18 days within a month mostly.

Historical decompositions of financial stress indexes of Germany, France and Italy have very similar patterns. These behaviors are most probably due to similarity of their financial stress indexes. Besides, decomposition of these three European countries' financial stress indexes reached high levels during European Sovereign debt crisis. Financial stress indexes of all countries have high decompositions during 2008 financial crisis. Decompositions of financial stress indexes of the United States and Canada are composed of themselves for the most of period. The proportion of oil prices and oil prices volatility in the decompositions of financial stress index are considerably higher for Turkey and Norway.

# CONCLUSION

The term “financial stability” has become a very important subject for researchers, practitioners and policy makers due to hazardaous and contagious effects of financial instability states. Therefore, researchers have tried to analyze stylized facts of “financial stability” or “financial instability”. Along with that, central banks points out their missions of safeguarding financial stability in addition to their principle mission of providing price stability. In this respect, central banks publish financial stability reports in which fragilities and risks of financial system are evaluated.

Despite there is no common accepted definition on financial stabiliy, there exist some facts that represent the term directly or its counter correspondence “financial instability”. Among them, Increase in uncertainity; deviation of assets from their normal values; increase in volatility; divergence from optimum equilibrium; illiquidity problems; credit problems; balance sheet problems can be counted for describing financial instability. On the other hand, stability of key institutions in the financial system; smooth consumption of individuals across time; efficient functioning of financial investment projects; efficient allocation of economic resources; efficient allocation of resources; management of financial risks; public trust in financial institutions and efficient functioning of financial system reflect financial stability.

As a special case of financial instability state, financial crisis can be represented by some stylized facts. Bank failures, debt defaults, increase in interest rates, decline in stock markets, rise in uncertainity, illiquidity problems, big declines in asset prices, huge decline in economic activity, contagion, bubble in asset prices, balance sheet problems, overvalued exchange rates, important deviation of asset prices from their normal values, strengthening co-movements between financial markets can be considered as stylized facts of financial crisis.

In addition to studies that tried to determine stylized facts of financial (in)stability, emprical studies developed financial stress indexes with low frequency (weekly,

monthly, quarterly, yearly) or high frequency (daily) financial market indicators with application of different econometric methods (Credit Equal Weight (CEW), Composite Indicator of Systemic Stress (CISS), Equal Weight (EW), Logit Model, Principal Component Analysis, Variance Equal Weight (VEW)). Early warning symptoms of financial instability states were tried to be determined with these financial stress indexes.

On the other hand, the response of macroeconomic or financial indicators to energy price shocks have been investigated by researchers in order to determine transmission channels of shocks into macroeconomy or financial markets. Since the greatest amount of energy usage consists of oil, researchers have investigated the effects of oil price shocks on financial or macroeconomic indicators with application of different econometric models. Despite some of these studies found limited or no effects of shocks into macroeconomic indicators, some of them determined common facts that reflect the impacts of shocks. Among them; asymmetric or non-linear relationships between oil price shocks and macroeconomic indicators, adverse effects of oil price shocks into economic activity, positive effects of shocks on economic activity for some oil exporting countries can be mentioned.

In addition to the studies that investigated the effects of oil price shocks on macroeconomic indicators, some other empirical studies analyzed the impacts of oil price shocks on financial market indicators with different econometric models (Granger Causality Test, GARCH, GVAR, Markov Switching Model, MIT-Penn-SSRC, Multivariate Threshold Model, OLS, SVAR, VAR, Wald Test).

In addition to the studies that found significant lead/lag impacts of oil price shocks on stock returns, some studies found asymmetric or non-linear relationships between variables.

In this dissertation; in the first part, we develop high frequency (daily) financial stress indexes for 9 net oil importer/exporter countries with an application of CISS method using indicators from banking sector, bond, equity, money and foreign

exchange markets. In addition to common used indicators in the literature, we use some new indicators (dynamic beta of the banking sector, realized volatility of the slope of the yield curve) while developing financial stress indexes. We prefer using DCC-GARCH while aggregating sub-financial market indices since it superiors to EWMA model in estimating volatility in the most cases.

We contribute to the literature with two ways: Firstly; we developed high frequency (daily) financial stress indexes of G-7, Turkey and Norway and all financial stress indexes create proper signs to well-known financial stress events. We use some new indicators in addition to the common used indicators, and to the best of our knowledge this is the first study that uses dynamic beta of the banking sector while developing daily financial stress index. Besides, we construct daily financial stress indexes for Turkey, Germany, France and Italy that lack of (or not widely accepted) high frequency financial stress indexes to the best of our knowledge. Secondly; we investigate the impacts of oil price shocks on financial stability in high frequency by using financial stress indexes developed in Section 2. Even though there exist studies that investigated the impacts of oil price shocks on financial stress indexes developed by Federal Reserve Banks (Chen et al., 2014 (KCFSI), Nazlioglu et al., 2015 (CFSI)), this is the first study that analyze the impacts of oil price shocks on financial stress indexes developed by the study itself to the best of our knowledge.

Findings of this study can be summarized as follows: There exist an increasing trend in all financial stress indexes during 2008 financial crisis (08/2007-12/2009). And, all financial stress indexes reach their peak values during 2008 financial crisis.

Significant increase in financial stress indexes of 9 countries are observed on Brexit referendum (June 23, 2016), while the highest increase is observed for the United Kingdom. In addition, financial stress indexes of Germany, France, Italy and Norway rise considerably higher than other countries' financial stress indexes.

There exist an important increase in Turkey's financial stress index between May-June 2006 different than other countries. This behavior may related to be higher fragility of Turkey's financial system to unfavorable developments in the international markets than other countries' financial systems.

There exist vast amount of increases in financial stress indexes of European Union member countries (Germany, France, Italy), Norway and the United Kingdom during European Sovereign debt crisis period. These countries' financial stress indexes create proper signs to well-known financial stress events (Greece bailout on May 02, 2010, European Financial Stability Facility (EFSF) on May 10, 2010 and Portugal bailout on November 20, 2010) in this period.

Japan's financial stress index reach high levels during 1997 Asian crisis as expected. It efficiently responses to financial stress events observed in Asian financial crisis (Thai Baht's peg collapse on July 2, 1997) and during following period (Russian debt moratorium on 17 August 1998, LTCM collapse on September 23, 1998). There exist an increasing trend in financial stress index of Japan after the President election held in the United States (November 08, 2016).

Financial stress indexes of Canada and the United States follows similar patterns. This behavior may be resulted by being geographically close to each other or having similar financial markets. Both of indexes reach high levels on Russian debt moratorium (August 17, 1998) and on LTCM collapse (September 23, 1998). Similarly, both of the indexes response effectively to Brexit referendum on June 23, 2016.

Financial stress indexes of European Union members in our sample (Germany, France and Italy) have very similar patterns since their financial stress indexes have some common indicators.

On the other hand, the impacts of oil price shocks on financial stability for G-7, Turkey and Norway can be summarized as follows: Financial stress indexes of all countries response to positive oil prices shocks negatively in the short run.

Therefore, the response of financial stability of 9 countries to positive oil price shocks behave similarly in the short run.

Financial stress indexes of the U.S., the U.K. and Canada stabilize approximately 10 days after positive oil price shocks. Financial stress indexes of Turkey, Japan, Germany, France, Italy and Norway stabilize approximately 18 days after positive oil price shocks.

Financial stress indexes of all countries response positively to positive oil prices volatility shocks in the long run. Therefore, the response of financial stability of 9 countries to positive oil price volatility shocks behave similarly in the long run.

The response of FSIs of Germany, France and Italy to positive oil price and volatility shocks behave very similarly in the short/long run. This situation is mostly related to have financial stress indexes that follow similar patterns.

Financial stress index of Canada responses negatively to positive oil prices volatility shock in the short-run. Therefore; financial conditions recover as a result of shock in the short run. This behavior seperates Canada from other countries.

In the light of the findings of this study we can point out following results: Though, the research area of measuring systemic stress of financial system with high or low frequency indexes is quite new, it provides important information to researchers, practitioners and policy makers in order to avoid from detrimental effects of financial instability states. Therefore; we not only contribute to the related literature by developing daily financial stress indexes that create proper signs to well-known financial stress events, we provide valuable information to practitioners and policy makers for monitoring systemic stress level of financial systems in daily frequency. Since the response of financial stress indexes to positive oil price volatility shock is negative in the long run, the authorities should develop policies in order to diminish negative effects of shocks into financial systems of both net oil importer/exporter countries.

## BIBLIOGRAPHY


Aastveit, K. A., Jore, A. S., & Ravazzolo, F. (2016). Identification and real-time forecasting of Norwegian business cycles. *International Journal of Forecasting, 32*(2), 283-292.

Acharya, V. V.; Philippen, T.; Richardson, M.; Roubini, R. (2009). Restoring financial stability: how to repair a failed system. In V. V. Acharya, & M. P. Richardson (Eds.). Hoboken: John Wiley & Sons.

Afonso, A., & Martins, M. M. (2012). Level, slope, curvature of the sovereign yield curve, and fiscal behaviour. *Journal of Banking & Finance, 36*(6), 1789-1807.

Allegret, J. P., Mignon, V., & Sallenave, A. (2015). Oil price shocks and global imbalances: Lessons from a model with trade and financial interdependencies. *Economic Modelling, 49*, 232-247.

Allen, W. A., & Wood, G. (2006). Defining and achieving financial stability. *Journal of Financial Stability, 2*(2), 152-172.

Aloui, C., & Hkiri, B. (2014). Co-movements of GCC emerging stock markets: New evidence from wavelet coherence analysis. *Economic Modelling, 36*, 421-431.

Aloui, C., Nguyen, D. K., & Njeh, H. (2012). Assessing the impacts of oil price fluctuations on stock returns in emerging markets. *Economic Modelling, 29*(6), 2686-2695.

Álvarez, L. J., Hurtado, S., Sánchez, I., & Thomas, C. (2011). The impact of oil price changes on Spanish and euro area consumer price inflation. *Economic modelling, 28*(1), 422-431.

Apergis, N., & Miller, S. M. (2009). Do structural oil-market shocks affect stock prices? *Energy Economics, 31*(4), 569-575.

Arouri, M. E. H., & Nguyen, D. K. (2010). Oil prices, stock markets and portfolio investment: evidence from sector analysis in Europe over the last decade. *Energy Policy, 38*(8), 4528-4539.

Arzamasov, V., & Penikas, H. (2014). A Financial Stability Index for Israel. *Procedia Computer Science, 31*, 985-994.

Baig, T., & Goldfajn, I. (1999). Financial market contagion in the Asian crisis. *IMF staff papers, 46*(2), 167-195.

Balakrishnan, R. D. (2011). The transmission of financial stress from advanced to emerging economies. *Emerging Markets Finance and Trade, 47*(sup2), 40-68.

*Bank of England*. (2016, 02 13). Retrieved from Financial Stability: http://www.bankofengland.co.uk/financialstability/Pages/default.aspx

*Bank of Japan*. (2016, 02 14). Retrieved from Financial System: http://www.boj.or.jp/en/finsys/outline/index.htm/

Barsky, R. B., & Kilian, L. (2004). Oil and the Macroeconomy since the 1970s. *The Journal of Economic Perspectives, 18*(4), 115-134.

Basher, S. A., & Sadorsky, P. (2006). Oil price risk and emerging stock markets. *Global finance journal, 17*(2), 224-251.

Basnet, H. C., & Upadhyaya, K. P. (2015). Impact of oil price shocks on output, inflation and the real exchange rate: evidence from selected ASEAN countries. *Applied Economics, 47*(29), 3078-3091.

Bernanke, B. S., Gertler, M., Watson, M., Sims, C. A., & Friedman, B. M. (1997). Systematic monetary policy and the effects of oil price shocks. *Brookings papers on economic activity, 1997*(1), 91-157.

Bernanke, B., & Gertler, M. (1987). *Financial fragility and economic performance.* Cambridge, MA: National Bureau of Economic Research.

Bernanke, B., & Gertler, M. (2000). *Monetary policy and asset price volatility.* Cambridge, MA: National Bureau of Economic Research.

Blanchard, O. J., & Gali, J. (2007). *The Macroeconomic Effects of Oil Shocks: Why are the 2000s so different from the 1970s?* Cambridge, MA: National Bureau of Economic Research.

Blanchard, O. J., & Riggi, M. (2013). Why are the 2000s so different from the 1970s? A structural interpretation of changes in the macroeconomic effects of oil prices. *Journal of the European Economic Association,, 11*(5), 1032-1052.

*Board of Governors of the Federal Reserve System*. (2014, 10 29). Retrieved 05 13, 2016, from Press Release: https://www.federalreserve.gov/newsevents/pressreleases/monetary20141029a.htm

*Board of Governors of the Federal Reserve System*. (2015, 12 15). Retrieved 05 14, 2016, from Press Release: https://www.federalreserve.gov/newsevents/pressreleases/monetary20151216a.htm

Bollerslev, T. (1990). Modelling the coherence in short-run nominal exchange rates: a multivariate generalized ARCH model. *The review of economics and statistics*, 498-505.

Bordo, M. D., Dueker, M. J., & Wheelock, D. C. (2002). Aggregate price shocks and financial instability: A historical analysis. *Economic Inquiry, 40*(4), 521-538.

(2016). *BP Statistical Review of World Energy .* BP P.L.C.

Brave, S. A., & Butters, R. A. (2011). Monitoring financial stability: A financial conditions index approach. *Economic Perspectives, 35*(1), 1-22.

Brown, S. P., & Yucel, M. K. (1999). Oil prices and US aggregate economic activity: a question of neutrality. *Economic & Financial Review*, 16-23.

Burbidge, J., & Harrison, A. (1984). Testing for the effects of oil-price rises using vector autoregressions. *International Economic Review,*, 459-484.

Cardarelli, R., Elekdag, S., & Lall, S. (2011). Financial stress and economic contractions. *Journal of Financial Stability, 7*(2), 78-97.

Cavalcanti, T., & Jalles, J. T. (2013). Macroeconomic effects of oil price shocks in Brazil and in the United States. *Applied Energy, 104*, 475-486.

*Central Bank of the Republic of Turkey*. (2006, 06). Retrieved 05 13, 2016, from Financial Stability Report: http://www.tcmb.gov.tr/wps/wcm/connect/f1f1b4b3-5ae4-4d17-83c3-d1b82779ef16/fulltext2.pdf?MOD=AJPERES&CACHEID=ROOTWORKSPACE-f1f1b4b3-5ae4-4d17-83c3-d1b82779ef16-krn7qLY

*Central Bank of the Republic of Turkey*. (2015, 05). Retrieved 05 13, 2016, from Financial Stability Report: http://www.tcmb.gov.tr/wps/wcm/connect/3675016f-bd3d-4fba-8a48-630d1b1d6915/fulltext20.pdf?MOD=AJPERES&CACHEID=ROOTWORKSPACE-3675016f-bd3d-4fba-8a48-630d1b1d6915-l16iPls

Cerqueira, E., L.; Murcia, C., I. (2015). *A Spanish Financial Market Stress Index (FMSI).* Madrid: CNMV.

Cevik, E. I., Dibooglu, S., & Kenc, T. (2013). Measuring financial stress in Turkey. *Journal of Policy Modeling, 35*(2), 370-383.

Chang, R., & Velasco, A. (1998). *Financial crises in emerging markets.* Cambridge, MA: National Bureau of Economic Research.

Chant, J. F. (2003). Essays on Financial Stability. In A. L. John Chant, *Essays on Financial Stability* (pp. 1-28). Ottawa, ON: Bank of Canada.

Chauvet, M., & Senyuz, Z. (2016). A dynamic factor model of the yield curve components as a predictor of the economy. *International Journal of Forecasting, 32*(2), 324-343.

Chen, N. F., Roll, R., & Ross, S. A. (1986). Economic forces and the stock market. *Journal of business*, 383-403.

Chen, W., Hamori, S., & Kinkyo, T. (2014). Macroeconomic impacts of oil prices and underlying financial shocks. *Journal of International Financial Markets, Institutions and Money, 29*, 1-12.

Chiang, T. C., Jeon, B. N., & Li, H. (2007). Dynamic correlation analysis of financial contagion: Evidence from Asian markets. *Journal of International Money and finance, 26*(7), 1206-1228.

Ciner, C. (2001). Energy shocks and financial markets: nonlinear linkages. *Studies in Nonlinear Dynamics & Econometrics, 5*(3), 203-212.

Claessens, S., & Kose, M. M. A. (2003). Financial crises explanations, types, and implications. In M. A. Stijn Claessens, *Financial Crises: Causes, Consequences and Policy Responses* (pp. 3-59). Washington, DC: International Monetary Fund.

Closa, C., & Maatsch, A. (2014). In a spirit of solidarity? Justifying the European financial stability facility (EFSF) in national parliamentary debates. *JCMS: Journal of Common Market Studies, 52*(4), 826-842.

Cologni, A., & Manera, M. (2009). The asymmetric effects of oil shocks on output growth: A Markov–Switching analysis for the G-7 countries. *Economic Modelling, 26*(1), 1-29.

Cong, R. G., Wei, Y. M., Jiao, J. L., & Fan, Y. (2008). Relationships between oil price shocks and stock market: An empirical analysis from China. *Energy Policy, 36*(9), 3544-3553.

Corbet, S., & Twomey, C. (2014). An index of financial market stress for the United Kingdom. *Economics and Business Letters, 3*(2), 127-133.

Crockett, A. (1996). The theory and practice of financial stability. *De Economist, 144*(4), 531-568.

Crockett, A. (1997). Why is financial stability a goal of public policy? *Economic Review-Federal Reserve Bank of Kansas City, 82*(4), 7-35.

Cuñado, J., & de Gracia, F. P. (2003). Do oil price shocks matter? Evidence for some European countries. *Energy Economics, 25*(2), 137-154.

Cunado, J., & de Gracia, F. P. (2014). Oil price shocks and stock market returns: Evidence for some European countries. *Energy Economics, 42*, 365-377.

Cunado, J., Jo, S., & de Gracia, F. P. (2015). Macroeconomic impacts of oil price shocks in Asian economies. *Energy Policy, 86*, 867-879.

Desai, P. (2000). Why did the Ruble collapse in August 1998? *The American economic review, 90*(2), 48-52.

*Deutche Bundesbank Eurosystem*. (2016, 05 15). Retrieved from Financial and Monetary Stability:

https://www.bundesbank.de/Navigation/EN/Tasks/Financial_and_monetary_system/Stability/financial_and_monetary_stability.html

Dickey, D. A., & Fuller, W. A. (1979). Distribution of the estimators for autoregressive time series with a unit root. *Journal of the American statistical association, 74*(366a), 427-431.

Diebold, F. X., Rudebusch, G. D., & Aruoba, S. B. (2006). The macroeconomy and the yield curve: a dynamic latent factor approach. *Journal of econometrics, 131*(1), 309-338.

Edwards, S. (2003). Financial Instability in Latin America. *Journal of International Money and Finance, 22*(7), 1095-1106.

Eichengreen, B., & Portes, R. (1987). *The anatomy of financial crises.* Cambridge, MA: National Bureau of Economic Research.

Eidenberger, J., Neudorfer, B., Sigmund, M., & Stein, I. (2014). *What predicts financial (in) stability? A Bayesian approach.* Frankfurt am Main: Deutsche Bundesbank.

Elliott, G., Rothenberg, T. J., & Stock, J. H. (1996). Efficient tests for an autoregressive unit root. *Econometrica, 64*(4), 813-836.

El-Sharif, I., Brown, D., Burton, B., Nixon, B., & Russell, A. (2005). Evidence on the nature and extent of the relationship between oil prices and equity values in the UK. *Energy Economics, 27*(6), 819-830.

Engle, R. (2002). Dynamic conditional correlation: A simple class of multivariate generalized autoregressive conditional heteroskedasticity models. *Journal of Business & Economic Statistics, 20*(3), 339-350.

*European Central Bank Eurosystem*. (2016, 06 03). Retrieved from Financial stability and macroprudential policy: https://www.ecb.europa.eu/ecb/tasks/stability/html/index.en.html

Faff, R. W., & Brailsford, T. J. (1999). Oil price risk and the Australian stock market. *Journal of Energy Finance & Development, 4*(1), 69-87.

*Federal Reserve Bank of St. Louis*. (2016, 05 13). Retrieved 05 13, 2016, from The Financial Crisis Full Timeline: https://www.stlouisfed.org/financial-crisis/full-timeline

Ferderer, J. P. (1997). Oil price volatility and the macroeconomy. *Journal of macroeconomics, 18*(1), 1-26.

Ferguson, R. W. (2003). Should financial stability be an explicit central bank objective. In *Challenges to Central Banking from Globalized Financial Systems* (pp. 208-223). Washington DC: International Monetary Fund.

Filis, G. D. (2011). Dynamic correlation between stock market and oil prices: The case of oil-importing and oil-exporting countries. *International Review of Financial Analysis, 20*(3), 152-164.

*Financial System Review-Bank of Canada.* (2015, 12 01). Retrieved from http://www.bankofcanada.ca/wp-content/uploads/2015/12/fsr-december2015.pdf

Frederic, M. (2003). Financial policies and the prevention of financial crises in emerging market countries. In M. Feldstein (Ed.), *Economic and Financial Crises in Emerging Market Economies* (pp. 93-130). Chicago: University of Chicago Press.

Ghosh, A., Saidi, R., & Johnson, K. H. (1999). Who Moves the Asia-Pacific Stock Markets—US or Japan? Empirical Evidence Based on the Theory of Cointegration. *Financial review, 34*(1), 159-169.

Guo, H., & Kliesen, K. L. (2005). Oil price volatility and US macroeconomic activity. *Review-Federal Reserve Bank of Saint Louis, 87*(6), 669-684.

Hakkio, C. S., & Keeton, W. R. (2009). Financial stress: what is it, how can it be measured, and why does it matter? *Economic Review-Federal Reserve Bank of Kansas City, 94*(2), 5-50.

Haldane, A. G., Hoggarth, G., Saporta, V., & Sinclair, P. (2005). Financial stability and bank solvency. In D. D. Evanoff, & G. G. Kaufman (Eds.), *Systemic Financial Crises: Resolving Large Bank Insolvencies* (pp. 83-114). Singapore: World Scientific Publishing Co. Pte. Ltd.

Hamilton, J. D. (1983). Oil and the macroeconomy since World War II. *Journal of political economy, 91*(2), 228-248.

Hamilton, J. D. (1996). This is what happened to the oil price-macroeconomy relationship. *Journal of Monetary Economics, 38*(2), 215-220.

Hamilton, J. D., & Herrera, A. M. (2004). Oil shocks and aggregate macroeconomic behavior: the role of monetary policy: a comment. *Journal of Money, Credit, and Banking, 36*(2), 265-286.

Hammoudeh, S., & Aleisa, E. (2004). Dynamic relationships among GCC stock markets and NYMEX oil futures. *Contemporary Economic Policy, 22*(2), Contemporary Economic Policy.

Hatzius, J., Hooper, P., Mishkin, F. S., Schoenholtz, K. L., & Watson, M. W. (2010). *Financial conditions indexes: A fresh look after the financial crisis.* Cambridge, MA: National Bureau of Economic Research.

Herrera, A. M., & Pesavento, E. (2009). Oil price shocks, systematic monetary policy, and the “Great Moderation. *Macroeconomic Dynamics, 13*(1), 107-137.

Herrera, A. M., Lagalo, L. G., & Wada, T. (2011). Oil price shocks and industrial production: Is the relationship linear?. Macroeconomic Dynamics. *Macroeconomic Dynamics, 15*(S3), 472-497.

Herwartz, H., & Plödt, M. (2016). The macroeconomic effects of oil price shocks: Evidence from a statistical identification approach. *Journal of International Money and Finance, 61*, 30-44.

Holmfeldt, M., Rydén, A., Strömberg, L., & Strömqvist, M. (2009). *How has the stress on the financial markets developed?–An index-based discussion.* Stockholm: Sveriges Riskbank.

Hooker, M. A. (1996). What happened to the oil price-macroeconomy relationship? *Journal of monetary Economics, 38*(2), 195-213.

Huang, B. N., Hwang, M. J., & Peng, H. P. (2005). The asymmetry of the impact of oil price shocks on economic activities: an application of the multivariate threshold model. *Energy Economics, 27*(3), 455-476.

Huang, R. D., Masulis, R. W., & Stoll, H. R. (1996). Energy shocks and financial markets. *The Journal of Futures Markets, 16*(1), 1-27.

Huyghebaert, N., & Wang, L. (2010). The co-movement of stock markets in East Asia: Did the 1997–1998 Asian financial crisis really strengthen stock market integration? *China Economic Review, 21*(1), 98-112.

Illing, M., & Liu, Y. (2006). Measuring financial stress in a developed country: An application to Canada. *Journal of Financial Stability, 2*(3), 243-265.

*Investopedia*. (2016, 04 01). Retrieved from Dotcom Bubble: http://www.investopedia.com/terms/d/dotcom-bubble.asp?lgl=no-infinite

Iqbal, Z., Mirakhor, A., Krichenne, N., & Askari, H. (2010). *The stability of Islamic finance: Creating a resilient financial environment for a secure future.* Singapore: John Wiley & Sons.

Islami, M., & Kurz-Kim, J. R. (2014). A single composite financial stress indicator and its real impact in the euro area. *International Journal of Finance & Economics, 19*(3), 204-211.

Jammazi, R. (2012). Oil shock transmission to stock market returns: Wavelet-multivariate Markov switching GARCH approach. *Energy, 37*(1), 430-454.

Jiménez-Rodríguez*, R., & Sánchez, M. (2005). Oil price shocks and real GDP growth: empirical evidence for some OECD countries. *Applied economics, 37*(2), 201-228.

Jiménez-Rodríguez, R., & Sánchez, M. (2012). Oil price shocks and Japanese macroeconomic developments. *Asian-Pacific Economic Literature, 26*(1), 69-83.

Jones, C. M., & Kaul, G. (1996). Oil and the stock markets. *The Journal of Finance, 51*(2), 463-491.

Kabir, M. H., & Hassan, M. K. (2005). The near-collapse of LTCM, US financial stock returns, and the fed. *Journal of Banking & Finance, 29*(2), 441-460.

Kaneko, T., & Lee, B. S. (1995). Relative importance of economic factors in the US and Japanese stock markets. *Journal of the Japanese and International Economies, 9*(3), 290-307.

Kang, W., Ratti, R. A., & Yoon, K. H. (2015). The impact of oil price shocks on the stock market return and volatility relationship. *Journal of International Financial Markets, Institutions and Money, 34*, 41-54.

Kenourgios, D. S. (2011). Financial crises and stock market contagion in a multivariate time-varying asymmetric framework. *Journal of International Financial Markets, Institutions and Money, 21*(1), 92-106.

Khan, S., & Park, K. W. K. (2009). Contagion in the stock markets: The Asian financial crisis revisited. *Journal of Asian Economics, 20*(5), 561-569.

Kilian, L. (2008). Exogenous oil supply shocks: how big are they and how much do they matter for the US economy? *The Review of Economics and Statistics, 90*(2), 216-240.

Kilian, L., & Park, C. (2009). The impact of oil price shocks on the US stock market. *International Economic Review, 50*(4), 1267-1287.

Kliesen, K. L. (2010). Measuring financial market stress. *Economic Synopses*.

Kormilitsina, A. (2011). Oil price shocks and the optimality of monetary policy. *Review of Economic Dynamics, 14*(1), 199-223.

Kremer, M., Lo Duca, M., & Holló, D. (2012). *CISS-a composite indicator of systemic stress in the financial system.* Frankfurt am Main: European Central Bank.

Krugman, P. (1999). Balance sheets, the transfer problem, and financial crises. *International finance and financial crises,, 6*(4), 459-472.

Kwiatkowski, D., Phillips, P. C., Schmidt, P., & Shin, Y. (1992). Testing the null hypothesis of stationarity against the alternative of a unit root: How sure are we that economic time series have a unit root? *Journal of econometrics, 54*(1-3), 159-178.

Lai, A. (2002). *Modelling financial instability: a survey of the literature.* Ottowa: Bank of Canada.

Lai, A. (2003). Financial Fragility:. In A. S. Literature, *Essays on Financial Stability* (pp. 29-59). Ottowa, ON: Bank of Canada.

Lane, P. R. (2012). The European sovereign debt crisis. *The Journal of Economic Perspectives, 26*(3), 49-67.

Lange, R. H. (2013). The Canadian macroeconomy and the yield curve: A dynamic latent factor approach. *International Review of Economics & Finance, 27*, 261-274.

Laurini, M. P., & Caldeira, J. F. (2016). A macro-finance term structure model with multivariate stochastic volatility. *International Review of Economics & Finance, 44*, 68-90.

Leduc, S., & Sill, K. (2004). A quantitative analysis of oil-price shocks, systematic monetary policy, and economic downturns. *Journal of Monetary Economics, 51*(4), 781-808.

Lee, B. R., Lee, K., & Ratti, R. A. (2001). Monetary policy, oil price shocks, and the Japanese economy. *Japan and the World Economy, 13*(3), 321-349.

Lee, K., Ni, S., & Ratti, R. A. . (1995). Oil shocks and the macroeconomy: the role of price variability. *The Energy Journal*, 39-56.

Lescaroux, F., & Mignon, V. (2008). On the influence of oil prices on economic activity and other macroeconomic and financial variables. *OPEC Energy Review, 32*(4), 343-380.

Levant, J., & Ma, J. (2016). Investigating United Kingdom's monetary policy with Macro-Factor Augmented Dynamic Nelson–Siegel models. *Journal of Empirical Finance, 37*, 117-127.

Loungani, P. (1986). Oil price shocks and the dispersion hypothesis. *Review of Economics and Statistics*, 536-539.

Louzis, D. P., & Vouldis, A. T. (2012). A methodology for constructing a financial systemic stress index: An application to Greece. *Economic Modelling, 29*(4), 1228-1241.

Masih, A. M., & Masih, R. (1997). Dynamic linkages and the propagation mechanism driving major international stock markets: an analysis of the pre-and post-crash eras. *The Quarterly Review of Economics and Finance, 37*(4), 859-885.

Meric, G., Leal, R. P., Ratner, M., & Meric, I. (2001). Co-movements of US and Latin American equity markets before and after the 1987 crash. *International Review of Financial Analysis, 10*(3), 219-235.

Miller, J. I., & Ratti, R. A. (2009). Crude oil and stock markets: Stability, instability, and bubbles. *Energy Economics, 31*(4), 559-568.

Minsky, H. P. (1992). *The financial instability hypothesis.* Annandale-on-Hudson: Levy Economics Institute of Bard College.

Mishkin, F. S. (1992). Anatomy of a financial crisis. *Journal of evolutionary Economics, 2*(2), 115-130.

Mishkin, F. S. (1997). The causes and propagation of financial instability: Lessons for policymakers. *Maintaining financial stability in a global economy* (pp. 55-96). Kansas City: Federal Reserve Bank of Kansas City.

Mishkin, F. S. (1999). Global financial instability: framework, events, issues. *The Journal of Economic Perspectives, 13*(4), 3-20.

Morales, M. A. (2010). A financial stability index for Colombia. *Annals of Finance, 6*(4), 555-581.

Mork, K. A. (1989). Oil and the macroeconomy when prices go up and down: an extension of Hamilton's results. *Journal of political Economy, 97*(3), 740-744.

Mork, K. A., Olsen, Ø., & Mysen, H. T. . (1994). Macroeconomic responses to oil price increases and decreases in seven OECD countries. *The Energy Journal*, 19-35.

Nazlioglu, S., Soytas, U., & Gupta, R. (2015). Oil prices and financial stress: A volatility spillover analysis. *Energy Policy, 82*, 278-288.

Nelson, W. R. (2007). Selected indicators of financial stability. *Risk measurement and systemic risk, 4*, 343-372.

*Norges Bank.* (2015, 11 12). Retrieved 06 15, 2016, from Financial Stability Report: http://www.norges-bank.no/en/Published/Publications/Financial-Stability-report/2015-Financial-stability/

Oet, M. V., Dooley, J. M., & Ong, S. J. (2011). *Oet, M. V., Dooley, J. M., & Ong, S. J.* Cleveland, OH: Federal Reserve Bank of Cleveland.

Paccagnini, A. (2016). The macroeconomic determinants of the US term structure during the Great Moderation. *Economic Modelling, 52*, 216-225.

Papapetrou, E. (2001). Oil price shocks, stock market, economic activity and employment in Greece. *Energy economics, 23*(5), 511-532.

Park, J., & Ratti, R. A. (2008). Oil price shocks and stock markets in the US and 13 European countries. *Energy economics, 30*(5), 2587-2608.

Patel, S. A., & Sarkar, A. (1998). Crises in developed and emerging stock markets. *Financial Analysts Journal, 54*(6), 50-61.

Phillips, P. C., & Perron, P. (1988). Testing for a unit root in time series regression. *Biometrika, 75*(2), 335-346.

Pierce, J. L., Enzler, J. J., Fand, D. I., & Gordon, R. J. (1974). The effects of external inflationary shocks. *Brookings Papers on Economic Activity, 1*, 13-61.

Rai, V., & Suchanek, L. (2014). *The effect of the federal reserve's tapering announcements on emerging markets.* Ottowa: Bank of Canada.

Rasche, R. H., & Tatom, J. A. (1977, 6). Energy resources and potential GNP. *Federal Reserve Bank of St. Louis Review*, 10-24.

Raymond, J. E., & Rich, R. W. . (1997). Oil and the macroeconomy: A Markov state-switching approach. *Journal of Money, Credit, and Banking*, 193-213.

Rosengren, E. S. (2011). Defining financial stability, and some policy implications of applying the definition. *Keynote Remarks by President of Federal Reserve Bank of Boston at Stanfort Finance Forum. 3*, pp. 1-15. Stanford: Stanfort University.

Sadorsky, P. (1999). Oil price shocks and stock market activity. *Energy economics, 21*(5), 449-469.

(1996). *Schaede, U.* San Diego: Berkeley Roundtable on the International Economy.

Schinasi, J. G. (2004). *Defining financial stability.* Washington, DC: International Monetary Fund.

Schinasi, M. G. (2003). *Responsibility of central banks for stability in financial markets.* Wahington, DC: International Monetary Fund.

Siņenko, N., Titarenko, D., & Āriņš, M. (2013). The Latvian financial stress index as an important element of the financial system stability monitoring framework. *Baltic Journal of Economics, 13*(2), 87-112.

Soytas, U., & Oran, A. (2011). Volatility spillover from world oil spot markets to aggregate and electricity stock index returns in Turkey. *Applied energy, 88*(1), 354-360.

Spotton, B. L. (1996). Financial instability: some stylized facts. *The Canadian Journal of Economics/Revue canadienne d'Economique, 29*, S202-S206.

Stracca, L. (2013). *The global effects of the euro debt crisis.* Frankfurt am Main: European Central Bank.

*Swiss National Bank*. (2016, 10 02). Retrieved from Financial Stability: https://www.snb.ch/en/iabout/finstab

Tang, W., Wu, L., & Zhang, Z. (2010). Oil price shocks and their short-and long-term effects on the Chinese economy. *Energy Economics, 32*, S3-S14.

*The National Bureau of Economic Research*. (2016, 06 01). Retrieved from US Business Cycle Expansions and Contractions: http://www.nber.org/cycles.html

*The World Bank*. (2016, 06 15). Retrieved 01 15, 2016, from The World Bank: http://www.worldbank.org/en/publication/gfdr/background/financial-stability

Toda, H. Y., & Yamamoto, T. (1995). Statistical inference in vector autoregressions with possibly integrated processes. *Journal of econometrics, 66*(1), 225-250.

Truman, E. M. (1996). The Mexican Peso Crisis: Implications for International Finance. *Federal Reserve Bulletin, 82*, 199-299.

*Türkiye Cumhuriyet Merkez Bankası*. (2016). Retrieved 03 01, 2016, from Financial Stability: http://www.tcmb.gov.tr/wps/wcm/connect/TCMB+EN/TCMB+EN/Main+Menu/MONETARY+POLICY/FINANCIAL+STABILITY

Vercelli, A. (2000). Structural financial instability and cyclical fluctuations. *Structural Change and Economic Dynamics,, 11*(1), 139-156.

Vermeulen, R., Hoeberichts, M., Vašíček, B., Žigraiová, D., Šmídková, K., & de Haan, J. (2015). Financial stress indices and financial crises. *Open Economies Review, 26*(3), 383-406.

Wall, H. J. (2006). Regional business cycle phases in Japan. *Federal Reserve Bank of St. Louis Review, 89*(1), 61-76.

Wang, Y., Wu, C., & Yang, L. (2013). Oil price shocks and stock market activities: Evidence from oil-importing and oil-exporting countries. *Journal of Comparative Economics,, 41*(4), 1220-1239.

Wei, Y., & Guo, X. (2016). An empirical analysis of the relationship between oil prices and the Chinese macro-economy. *Energy Economics, 56*, 88-100.

Wolfson, M. H. (1990). The causes of financial instability. *Journal of Post Keynesian Economics,, 12*(3), 333-355.

Wyplosz, C. (1998). Globalized financial markets and financial crises. *Regulatory and supervisory challenges in a new era of global finance*, 70-87.

Yiu, M. S., Ho, W. Y. A., & Jin, L. (2010). *A measure of financial stress in Hong Kong financial market–the financial stress index.* Hong Kong: Hong Kong Monetary Autherity.

# APPENDIX 1

**HACETTEPE UNIVERSITY**
**GRADUATE SCHOOL OF SOCIAL SCIENCES**
**THESIS/DISSERTATION ORIGINALITY REPORT**

**HACETTEPE UNIVERSITY**
**GRADUATE SCHOOL OF SOCIAL SCIENCES**
**TO THE DEPARTMENT OF ECONOMICS**

Date: 26/10/2017

Thesis Title / Topic: The Impacts Of Energy Price Shocks On Financial Stability

According to the originality report obtained by myself/my thesis advisor by using the Tumitin plagiarism detection software and by applying the filtering options stated below on 26/10/2017 for the total of 130 pages including the a) Title Page, b) Introduction, c) Main Chapters, and d) Conclusion sections of my thesis entitled as above, the similarity index of my thesis is 17%.

Filtering options applied:

1. Approval and Decleration sections excluded
2. Bibliography/Works Cited excluded
3. Quotes included
4. Match size up to 5 words excluded

I declare that I have carefully read Hacettepe University Graduate School of Social Sciences Guidelines for Obtaining and Using Thesis Originality Reports; that according to the maximum similarity index values specified in the Guidelines, my thesis does not include any form of plagiarism; that in any future detection of possible infringement of the regulations I accept all legal responsibility; and that all the information I have provided is correct to the best of my knowledge.

I respectfully submit this for approval.

26.10.2017

| | |
|---|---|
| **Name Surname:** | Onur POLAT |
| **Student No:** | N11246689 |
| **Department:** | Economics |
| **Program:** | Ph. D. |
| **Status:** | ☐ Masters ☒ Ph.D. ☐ Integrated Ph.D. |

**ADVISOR APPROVAL**

APPROVED.

Prof. Dr. İbrahim ÖZKAN

# APPENDIX 2

## ETHICS BOARD WAIVER FORM FOR THESIS WORK

**HACETTEPE UNIVERSITY**
**GRADUATE SCHOOL OF SOCIAL SCIENCES**
**ECONOMICS TO THE DEPARTMENT PRESIDENCY**

Date: 26/10/2017

Thesis Title / Topic: The Impacts of Energy Price Shocks on Financial Stability

My thesis work related to the title/topic above:

1. Does not perform experimentation on animals or people.
2. Does not necessitate the use of biological material (blood, urine, biological fluids and samples, etc.).
3. Does not involve any interference of the body's integrity.
4. Is not based on observational and descriptive research (survey, measures/scales, data scanning, system-model development).

I declare, I have carefully read Hacettepe University's Ethics Regulations and the Commission's Guidelines, and in order to proceed with my thesis according to these regulations I do not have to get permission from the Ethics Board for anything; in any infringement of the regulations I accept all legal responsibility and I declare that all the information I have provided is true.

I respectfully submit this for approval.

26.10.2017

| | |
|---|---|
| **Name Surname:** | Onur POLAT |
| **Student No:** | N11246689 |
| **Department:** | Economics |
| **Program:** | Doctor of Philosophy in Economics-Ph.D. |
| **Status:** | ☐ Masters ☒ Ph.D. ☐ Integrated Ph.D. |

**ADVISER COMMENTS AND APPROVAL**

Prof. Dr. İbrahim ÖZKAN

# AUTOBIOGRAPHY

**Personal Information**

Name/Surname : Onur POLAT

Date of Birth and Place : 13.10.1983, Tunceli

**Education**

Bachelor Degree : Hacettepe University, Mathematics

Master : Middle East Technical University, Financial Mathematics

Foreign Language : English

Scientific activities : **Publications**

Polat, O., Ozkan, I. (2017), “Financial Stress Connectedness and Network Analysis”, *International Journal of Finance and Economics, (S.S.C.I), (Publication process cont.)*

Polat, O., Ozkan, I. (2017), “Measuring Financial Stability in Turkey with a High Frequency Index”, *Journal of Policy Modelling, (S.S.C.I), (Publication process cont.)*

Polat, O., Polat, Es, Gozde. (2016), “Volatility Transmission between Oil Prices and Financial Stress”, *The Empirical Economics Letters 15(6), (Econlit), ISSN 1681-8997*

Polat, O. (2010), “Complication and Optimization in Additive Markets: Dynamic Complex Hedging and Potfolio Optimization in Additive Markets”, *LAP LAMBERT Academic Publishing*.

**Presentations**

Polat O., Ozkan I. (2017), “Composite Indicator of Systemic Stress for Turkey”, *presented at Eastern Economics Association, New York, 23-26 February 2017*.

Polat O., Es Polat G., (2016), “Volatility Spillover Analysis between Oil Prices and Financial Stress”, *presented at EconWorld, Barcelona, 1-3 February 2016*.

Polat O., (2015), “The Growth Curve Analysis of $CO_2$ Emission Per Capita in OECD Countries”, *presented at Hopa Graduate Student’s Workshop, Artvin, 15-16 October 2015.*

Polat O., (2014), “Relationship between Electricity Consumption, Economic Growth and $CO_2$ Emission in Developing Countries: A Panel Co-integration Analysis”, *presented at EconHarran, Urfa, 23-24 October 2014.*

Polat O., (2014), “Relationship between Energy Consumption and GDP in developing OECD Countries: A Panel Co-integration Analysis”, *presented at METU 2. Workshop of Ph. D. Students, Ankara, 17-18 April 2014.*

**Job Experiences**

Institutions : Ministry of Customs and Trade, System Analyst

**Connections**

E-Mail Address : opolat62@yahoo.com

**Date** : 19.10.2017