BUILDING A FINANCIAL CONDITIONS INDEX FOR TURKEY

BAYRAM ÇAKIR

BOĞAZİÇİ UNIVERSITY

2018

BUILDING A FINANCIAL CONDITIONS INDEX FOR TURKEY

Thesis submitted to the
Institute for Graduate Studies in Social Sciences
in partial fulfillment of the requirements for the degree of

Master of Arts
in
Economics

by
Bayram Çakır

Boğaziçi University
2018

DECLARATION OF ORIGINALITY

I, Bayram Çakır, certify that

- I am the sole author of this thesis and that I have fully acknowledged and documented in my thesis all sources of ideas and words, including digital resources, which have been produced or published by another person or institution;
- this thesis contains no material that has been submitted or accepted for a degree or diploma in any other educational institution;
- this is a true copy of the thesis approved by my advisor and thesis committee at Boğaziçi University, including final revisions required by them.

Signature.....

Date.....11/07/2018.....

ABSTRACT

Building a Financial Conditions Index for Turkey

The rapid expansion of financial markets in the last decades has increased the role of financial markets on economic activities. Given that most of macroeconomic models which only include interest rate and exchange rate have very little financial integration, there is a need to develop a comprehensive model that captures the financial conditions in Turkey. This study uses factor model to construct a financial conditions index out of wide range of financial variables from the beginning of 2007 to the end of 2017. Financial conditions index is basically weighted average of various financial variables. The weights found using factor model suggest that the exchange rate, stock market and real corporate credit interest rate mainly derive the financial conditions whereas the contribution of money supply, interest rate spread and real consumer loans to financial conditions is very little in Turkey. Moreover, the relationship between FCI and economic activity is investigated with nonlinear autoregressive distributed lags model. The results suggest that assymetric effects of FCI exist and positive shocks impact economic activity more than negative shocks. The constructed FCI in this study and its proven strong role on real economy in Turkey can improve the research which aims to capture financial conditions and improve effectiveness of financial policies implemented by Central Bank of the Republic of Turkey.

ÖZET

Türkiye için Finansal Koşullar Endeksi Oluşturma

Finansal piyasaların son yıllarda hızlı bir şekilde genişlemesi ekonomik aktiviteler üzerindekini etkisini arttırmaktadır. Çoğunlukla sadece faiz oranlarını ve kur değerlerini içeren makroekonomik modellerin finansal piyasaları yeterince içermemesi kapsamlı bir finansal koşullar modeli ihtiyacını doğurmaktadır. Bu çalışmada 2007 yılından 2017 yılına kadar birçok finansal değişken ile faktör model kullanılarak Türkiye için finansal koşullar endeksi oluşturulmuştur. Finansal koşullar endeksi bu birçok finansal değişkenin ağırlıklı ortalamasıdır. Faktör modelden çıkan ağırlık hesaplamalarına göre kur değeri, hisse fiyatları ve kurumsal kredi faiz oranları değişkenleri Türkiye'de finansal koşulları ciddi bir şekilde etkilerken para arzı, faiz oranlar alış-satış farkı ve tüketici kredilerinin ise Türkiye'de finansal koşullara etkisi görece olarak çok daha az olduğu görülmektedir. Buna ek olarak finansal koşullar endeksi ve ekonomik aktivite arasındaki ilişki NARDL model ile araştırılmıştr. Bu modelin sonuçlarına göre finansal koşullardaki iyileşme finansal koşullardaki kötüleşmeye nazaran ekonomik aktiviteyi daha fazla etkilemektedir. Oluşturulan finansal koşullar endeksi finansal koşulları kapsayan araştırmaları ve merkez bankası politikalarını geliştirmek için bir araç olarak kullanılabilir.

ACKNOWLEDGEMENTS

Foremost, I would like to express my deep gratitude to all the faculty of Bogazici University, especially the Economics Department for their patience and continous support in my undergraduate and graduate studies. I particularly thank to my thesis advisor, Prof. Gokhan Ozertan, for his friendly behavior and limitless help whenever I needed despite his time constraint. This thesis wouldn't be possible without his valuable contribution and unquivocal support.

I would also thank to my internal committee member, Prof. Burak Saltoğlu, for his contribution and being examiner of my thesis. He was always like a mentor not only of this thesis but also of how to progress my academic career with his expertise and open door all the time. I am also greatful to my external committe member, Dr. Barış Soybilgen, for letting me be research assistant in The Center for Financial Studies and building my first major stones towards software programming and data analysis. He never hesitated to help on my thesis and I am indebted for his contribution at every step of this thesis.

Lastly, I want to express my speacial graditudes to my lovely parents and other family members. Life would be much harder without their encouragement and inspiration to follow my dreams. They always supported my academic career without any doubt. I owe it all to you. Many thanks.

TABLE OF CONTENTS

CHAPTER 1

INTRODUCTION

Due to the financial crisis in 1930s, liberalization and expansion of free capital movements was questioned until 1970s. Many countries used to have strict regulations such as prevention of capital transfers to outside of the country to mitigate the downward pressure on real GDP and depreciation pressure on exchange rate due to the demand for foreign currency. However, this restrictive philosophy and strict regulation perspective started to change in 1970s. Because of the technological improvements which have been decreasing the transaction cost of financial transfers and liberalization trend in the world, there has been a huge financial markets expansion since 1970s. Following the expansion of financial markets, the linkages between financial markets and real economy have become significant. Today it is very crucial to realize importance of financial conditions while analyzing the performance of the real economies.

A concrete example of widened effects of financial conditions on real economy is 2008 financial crisis that resulted in deep recession in many countries. After the collapse of Lehman Brothers in the late 2008, increase in the spreads of bond markets put economic agents in more risky position and standards on credits tightened, which led to decrease in economic activities. Moreover, due to the decrease in equity and house prices, financial wealth of people worsened dramatically. The disruption of financial markets led to panic among households and economic institutions because of high integration of financial markets with real economy. On top of that, due to increased demand in liquid assets because of downward pressure on financial markets resulted in appreciation of U.S dollar. Both the panic in the economy and appreciation

of U.S dollar slowed down the real economic activities which led the U.S economy to be in deep recession for the following periods.

Given that most of macroeconomic models analyzing of real economic conditions have very little financial integration, there is a need to extend the research on real economy considering the serious effects of financial conditions. Most of the literature only includes interest rate which is clearly not adequate to capture the financial conditions and its effects on real economy. Monetary Condition Index (MCI) is the first attempt to widen the integration of financial conditions with real economy where the exchange rate is considered along with the interest rate. Although its a broader perspective to capture the effects of financial conditions on real economy, it is not also adequate because growth and real economic conditions is seriously affected by other financial variables such as credit volumes, volatility of prices, supply of loans, liquidity of the markets and various financial variables.

On the light of the information above, there is a need of broader index to capture effect of financial markets on real economy. Financial Condition Index (FCI) is a natural extension of Monetary Condition Index (Angelopoulou et al., 2014). Hatzius et al. (2014) defines financial conditions as "the current state of financial variables that influence economic behavior and (thereby) the future state of the economy". FCI literature focuses on various variables such as spread of interest rates, prices, credit volumes and lending standards to capture and summarize future state of the economy better.

Many researchers from financial firms, central banks and universities have been developing FCIs using different methodologies and variables. Almost all IFCs constructed in the literature include the variables, interest rate and exchange rates, following the idea of Freedman (1995) that these two variables stand for capturing the

effects of monetary policies on real economy. On top of that, the asset bubbles and sharp decreases after bubbles in the period of 1995-2000s and their serious effects on real economy resulted in inclusion of financial asset prices to decide policies and forecast the future state of the economy. Moreover, Bernanke and Gertler (1995) and Zeldes (1989) talk about importance of liquidity constraints and credit volumes that seriously affect consumption and state of the economic activity.

Following the ideas stated above, Hatzius et al. (2014) and Swiston (2008) constructed the FCIs which include asset prices and credit variables. As variables included in FCIs have been expanding, there are many different perspectives regarding which variables should be included in the FCI. Lack (2002) includes real property prices as an indicator of financial conditions, J.P Morgan for Canada (2002) includes Yield Curve and Macroeconomic Advisors (1998) includes dividend price ratio to incorporate household equity wealth. Briefly, the literature differs on the equity market variables on top of interest rates and exchange rates.

Hatzius et al. (2014) states that methodology on how to construct FCI can be divided into two categories: a weighted-sum approach and principal-components approach. First one is based on the relative effects of variables on real GDP to assign weights on variables where VAR methods are common for this approach. The second approach which this paper will follow to construct an FCI for Turkey focuses on constructing several factors out of the whole range of variables to capture the best common changes of the variables and their effects on the real economy.

In 2010, Central Bank of the Republic of Turkey started to follow new policy considering the liquity, credit and interest rate dynamics. This new policy adoption created a need to analyze financial conditions using comprehensive set of variables. Kara et al. (2012) constructed two financial indexes for Turkey using VAR model.

Moreover, Akdeniz and Catik (2017) constructed alternative FCIs using the Reduced form demand functions, VAR generalized impulse-response functions, dynamic factor model and factor-augmented VAR models. However, it is clear that there is a lack of study of FCIs for Turkey as there are a few papers analyzing it. This paper aims to fill the gap of FCI studies for Turkey including wide range of variables using the second methodolody stated above, which is principal component analysis. After the adoption of new policy strategy by Central Bank of the Republic of Turkey, the effect of various financial variables on Turkish real economy has undoubtedly increased. Therefore, this paper aims to help to determine leading financial variables which are main driving factors in Turkish economy. Moreover, analyzing the effects of different financial variables on real economy helps to create new policies for a better performance of Turkish economy in the future.

This paper mainly consists of two parts. First, we use wide range of variables to construct a financial conditions index for Turkey using factor model between the years 2007-2017. By using weights resulting from factor model, we investigate the effects of each financial variables on overall financial conditions. Secondly, we employ nonlinear autoregressive model to investigate the relationship between financial conditions and economic activity as literature suggests that there is significant relationship between FCI and economic activity. The NARDL model allows us to relax the assumption of symmetric effects of FCI where the effects of positive shocks and negative shocks in FCI are equal. With this model, we seperately investigate the effects easing financial conditions and tightening financial conditions on economic activity.

CHAPTER 2

THE DATA

As a result of expanding financial markets and increased number of variables affecting the real economy, this paper uses a comprehensive set of variables to construct an FCI for Turkey. All of the indicators in this paper consists of monthly data from January 2007 to November 2017. Moreover, all series are exposed to suitable transformations if necessary.

The first category of variables included in this paper is credit volumes. As Turkish banks have important role in real economic activities, credit volume is an important sign to state the current and future situation of the Turkish economy. Guichard and Turner (2009), Lown and Morgan (2006) conclude that the real economic activity is negatively affected when lending standards in banking sector tightens. Following the literature to capture the effect of credit volumes on financial conditions, real consumer loans is included to construct FCI.

On top of that, real monetary level has strong explanatory power in the real economy. A cut in the interest rate and higher monetary levels are signs of stronger financial conditions because central banks usually increase the monetary level to recover the economy from recession. To capture monetary side of financial conditions, M1, M3, 2 years benchmark interest rates and corporate credit interest rates are included on construction of FCI.

Angelopoulou et al. (2014) explains that movements in interest rate spreads between long term and short term occurs as a sign of risk in financial markets. An increase in risk premia is associated with loosening financial conditions and negatively affects the real economic conditions. On the light of this statement, this

paper includes the difference between 1 year Libor rate for Turkey and overnight interest rate.

Exchange rates are also driving factor of economies and they should be considered in constructing financial conditions index because of their strong predictive power on explaining the real economy. Osorio et. al. (2011) found that the exchange rate depreciation affected to FCIs negatively, in Australia, Korea, and Taiwan. An increase in the exchange rates means depreciation of money due to the relatively increase in the demand for foreign currencies. Relatively less demand in local currency is a sign of loosening financial conditions. In this paper, USD/TRY ratio is used to construct FCI as an indicator of value of local currency to capture its effect on financial conditions and real economy.

Macroeconomic Advisers (1998) used market capitalization variable which is assumed have positive impact on financial conditions. Increase in market capitalization is a sign of increase in wealth. Therefore, increase in wealth leads to more consumption which end up with higher growth rates of GDP. To capture wealth effect, this paper includes BIST100 market capitalization constructing FCI. Furthermore, Gauthier and Li (2004) suggests that stock returns follow closely the movements in total output and they are important sign of potential output in the economies. Therefore, BIST100 index is included to construct FCI in this paper to capture this effect.

Lastly, Table 1 shows the neccessary transformations to construct meaningful FCI. The transformations of the variables make sure that the increase in the value of variable leads to easing financial conditions whereas the decrease in the value of variable leads to tightening financial conditions.

Table 1. Transformation of Financial Variables

Variable	Transformation
Real Consumer Loans	Growth Rate
Real M1	Growth Rate
Real M3	Growth Rate
Real Corporate Credit Interest Rate	Negative Difference
2 years benchmark interest rates	Negative Difference
Spread between 1 Year Libor Rate and O/N	Negative Level
USD/TRY	Negative Growth Rate
BIST 100	Growth Rate
BIST100 market capitalization	Growth Rate

CHAPTER 3

METHOLODOGY

The aim of the model is to create a latent index representing the financial conditions. In other words, the model is expected to summarize the financial variables which are important leading economic indicators. To construct an index out of many different variables requires determination of weights which represent the contribution of each variable to overall financial conditions. As there are large number of observations and large number of indicators in our data set and there exists high covariability among the variables due to the nature of macroeconomic variables, there is a need to simplify the data set and reduction of dimension to solve high dimensional problem.
Therefore, this paper uses the factor analysis model to explain our data set in a few number of unobserved factors which are orthogonal (independent) to each other. The factors are assumed to explain the common variation in the observed set of variables.

Let Y_t is standardized N monthly series $Y_t = (Y_{1,t}, Y_{2,t}, ..., Y_{N,t})'$. The factor representation of our observed variables Y_t is as follows:

$$Y_t = \Lambda F_t + \epsilon_t$$

where Λ is NxR matrix and represents factor loadings which are coefficients of each factor on each series, $F_t = (F_{1,t}, ..., F_{R,t})'$ is the vector of unobserved common factors of R dimension which satisfies $R < N$ and ϵ_t is an Nx1 vector of idiosyncratic disturbances.

The main question here is how to estimate common factors so that we can have consistent estimators of true latent factors under the assumption that idiosyncratic components are serially and cross-sectionally correlated which is our case due to the

nature of our financial variables data set. Stock and Watson (2002) proves that principal components are consistent estimators of true latent factors where N (number of series) and T (number of observations) $\rightarrow \infty$ allowing the idiosyncratic components are serially and cross-sectionally correlated.

We follow the procedure of McCracken and Ng (2016) which use the expectation-maximization (EM) algorithm Stock and Watson (2002) proposes. Firstly, the data is demeaned and standardized.Then missing values are replaced by mean of the nonmissing observations. Then, factors and factor loadings are calculated by principal component analysis (PCA). The fitted values of factor model $\tilde{\Lambda}_t \tilde{F}_t$ is used to update the missing values. The updated data is demeaned and standardized to estimate new factors and factor loadings. This procedure is repeated until the estimates of principal components do not change.

CHAPTER 4

RESULTS OF PRINCIPAL COMPONENT ANALYSIS

The principal components that are found out of EM algorithm are calculated using eigenvalue decomposition of the matrix of our data set. Each principal component is associated with an eigenvalue and principal components associated with bigger eigenvalues accounts for more variation on the observed data. The principal components are ranked according to their explanatory power on the observed data set. In other words, principal component i has more explanatory power than principal component j for our data set where $i > j$. Moreover, principal components are uncorrelated with each other.

We considered the total variance explained by the principal components on deciding the number factors in our analysis. As it can be seen from the Table 2, total variance explained by three principal components is 77 %, which means these three components are able to summarize most of our data set. Moreover, the literature mostly uses three principal components when the number of series is close to our number of series. Therefore, number of principal components is set to three in the analysis.

Furthermore, the data is transformed, whenever is needed, to make sure an increase in each series reflect a better financial conditions. In other words, if an increase in the series is expected to tighten financial conditions, the transformation takes the opposite sign of the series. For example, the interest rate spread is multiplied by -1 so that an increase in the last version leads to easy financial conditions because an increase in interest rate spread is expected to negatively affect financial conditions.

In the Table 2, the factor loadings of each variable on three principal components can be observed on columns 2-4. The factor loadings reflect the effect of

each series on each principal component. A detailed look on the value of factor loadings can help to explain the movements of principal components. Firstly, the most contribution to PC1 comes from USD/TRY and BIST100 market capitalization. Moreover, most of the series has significant contribution on PC1 except real consumer loans, real M1, real M3 and interest rate spread as the size of factor loadings of other six variables is significantly big and close to each other. Secondly, PC2 movements mostly come from the effect of series M3, M1 and interest rate spread where M3 has significantly large contribution on PC2. Thirdly, real M1 is the main driver series of PC3. On top of real M1, real consumer loans and BIST100 have significant contribution on movements PC3. In the Figure 1, principal components are plotted. Variation in movements of principal components comes from the weighted effects of each series on principal components as explained above.

Table 2. Results of Principal Component Analysis

	PC1	PC2	PC3	Weighted Loadings
1.Real Consumer Loans	-0.175	1.772	-1.013	0.147
2.Real M1	-0.352	0.870	2.104	0.371
3.Real M3	-0.943	1.409	0.776	0.043
4.Spread between 1 Year Libor Rate and O/N	-0.206	1.069	-0.461	0.072
5.2 years benchmark interest rates	1.213	-0.607	0.378	0.412
6.Real Corporate Credit Interest Rate	1.189	0.146	0.737	0.617
7.USD/TRY	1.320	0.540	0.863	0.772
8.BIST 100	1.153	0.878	-1.137	0.466
9.BIST100 market capitalization	1.396	0.718	0.026	0.710
Share of Total Variance Explained	40%	21%	16%	77%

In the last row of Table 2, the exact total variances explained by each principal component is given. PC1, PC2 and PC2 explain 40%, 21% and 16% respectively. Totally 77% of variation in our observed data, which is quite adequate, can be explained by three principal components. The overall effect of each series in our data set is shown by weighted loadings, which is our main goal to construct an index out of our financial variables. Weighted loadings are calculated by summing the factor loadings multiplied by share of total variance explained by corresponding principal component. By definition, weighted loadings indicate the contribution of each series on overall financial conditions. According to results in the Table 2, USD/TRY,

BIST100 market capitalization and real corporate credit interest rate are potentially main drivers of financial conditions of Turkey whereas the effects of M3 and interest rate spread are almost negligible.

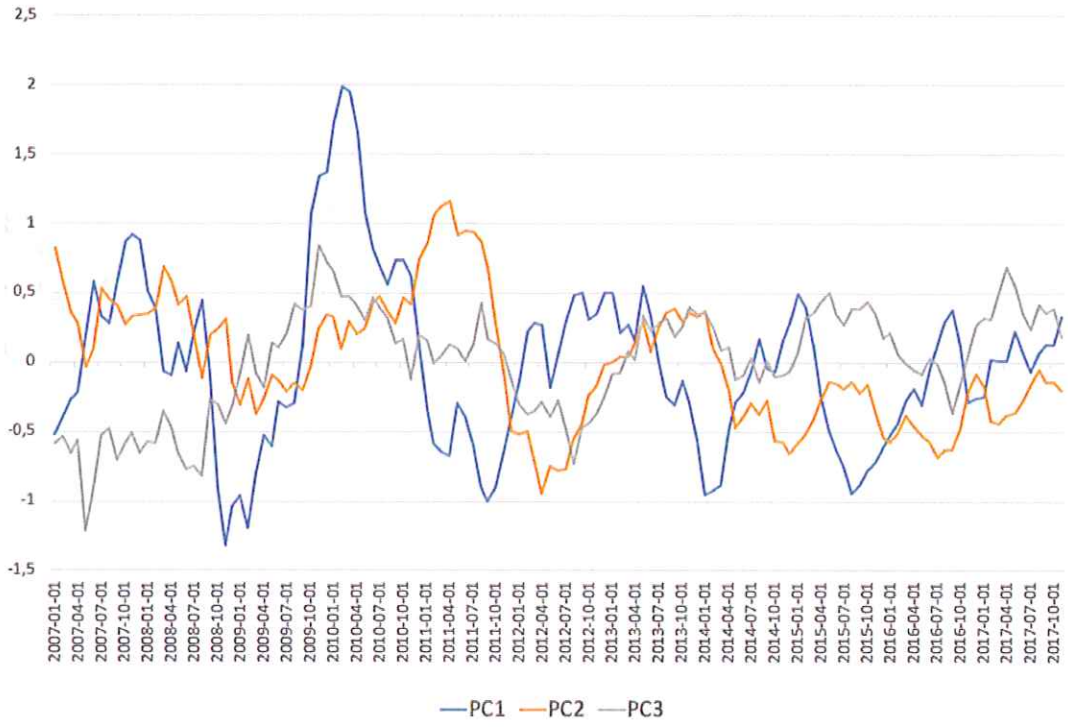

Figure 1. Principal Components

CHAPTER 5

FINANCIAL CONDITIONS INDEX FOR TURKEY

In the figure 2 and 3, FCI for Turkey, which is weighted sum of the series along the weighted loadings, can be observed from the beginning of 2007 to the end of 2017. An increase in the value of FCI reflect a better financial conditions whereas a decline in the value of index means tightening financial conditions. To evaluate the performance of FCI constructed in this paper, figures also include leading indicator of Turkey. A leading indicator basically is constructed to show the level of economic activity and turning points in the short term. Both FCI and leading indicator can be evaluated qualitatively rather than quantitatively.

As depicted in both figures, FCI movements follow the leading indicator movements very closely. After 2008 crisis and lack of availability of loans globally resulted in tight financial conditions. This loosening financial conditions in 2008 is successfully captured by FCI with a significant continuous decline until the beginning of 2009 as it can be seen from leading indicator as well. Following the cut in interest rates, fiscal policies and financial regulations, Turkey had a novel recovery after the 2008 crisis. This recovery is also captured by FCI index with a significant increase starting at the beginning of 2009 following closely the leading indicator. Second turning point in Turkish economy realized in 2010 due to new policy adoption, worsening EU relations and depreciation of Turkish Lira, which negatively affected the conditions of Turkish economy is very well captured by FCI. Finally, Gezi Park protests and its worsening effects on Turkish economy at second half of 2013 together with political crisis and huge deprecation of Turkish Lira in 2015 which resulted in decrease in economic activities are also successfully captured by FCI. Briefly, looking at the ups and downs of Turkish economy and comparing FCI constructed in this

paper with leading indicator is adequate to conclude the successful performance of FCI and its predictive power for the state of Turkish economy.

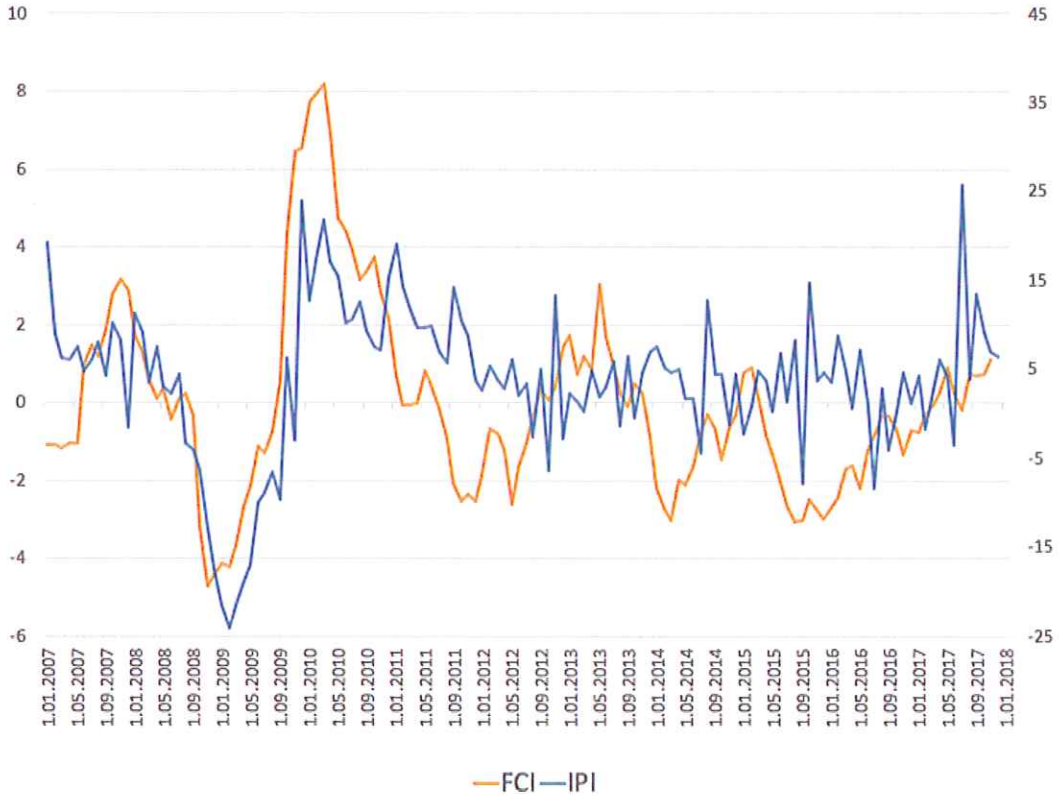

Figure 2. FCI and Industrial Production Index

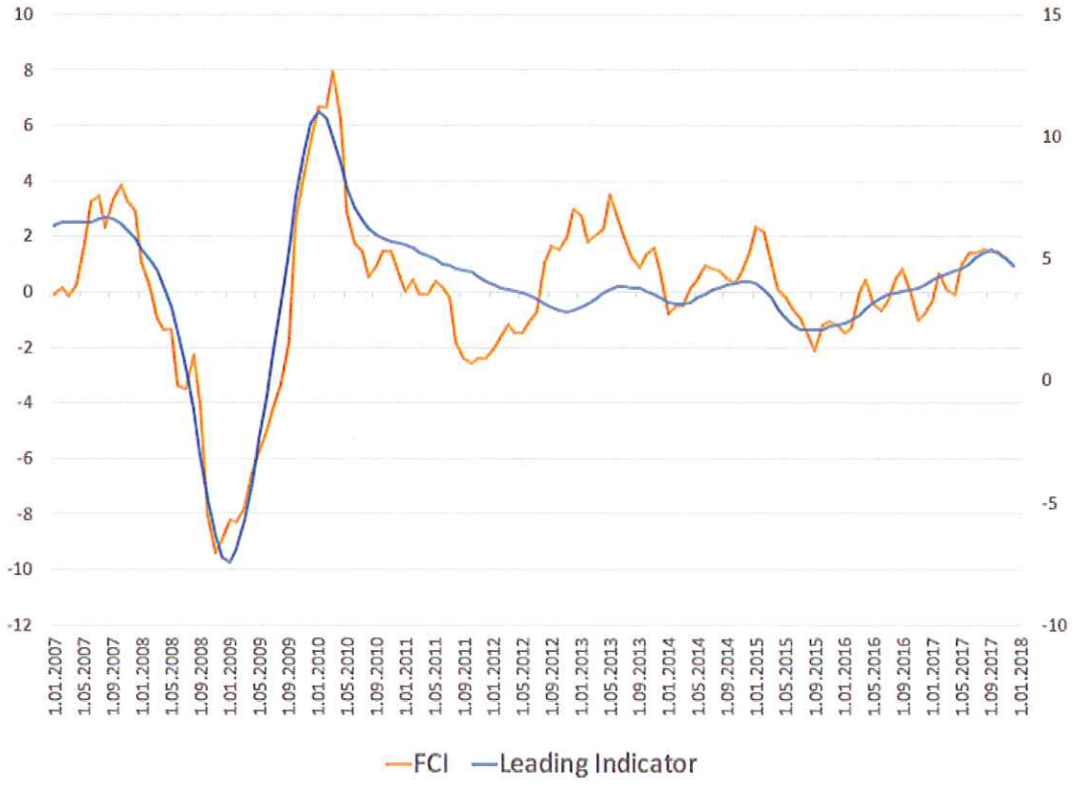

Figure 3. FCI and Leading Indicator

CHAPTER 6

CONTRIBUTION TO FCI

In this section, the financial variables are categorized into three types which are money supply, interest rate and financial markets indicators. Money supply indicator contains real consumer loans, real M1 and real M3 where interest rate indicator includes interest rate spread, 2 years benchmark interest rate and real corporate credit interest rate. Financial markets indicator consists of BIST100, BIST100 market capitalization and USD/TRY variables. The analysis out of this categorization helps to analyze the particular contribution of different group of variables with similar characteristics to FCI.

In the Figure 4, weighted indexes of different categories is depicted to observe the contribution of each category on the FCI in a particular time. The blue, orange and gray areas show the contributions of financial markets, interest rate and money supply indicators respectively.

A first glance on the Figure 4 clears that financial markets indicator has the largest contribution on financial conditions of Turkey whereas the effect of money supply indicator is almost mostly neutral. This analysis is also helpful to notice the underlying reason of crisis. For example, the worsening effect of 2008 crisis on FCI is driven by rapid decline in financial markets indicator as it can be seen from movement of blue area. Right after the crisis, there is a strong contribution of interest rate indicator on the recovery of FCI because Central Bank of the Republic of Turkey had an active role through an interest rate cut to recover the financial conditions. As it can be seen from the Figure 4, the decline of the FCI after 2010 is driven both by interest rate and financial markets indicators where strong positive effect of money supply was not enough to prevent FCI from declining. The third large decline in FCI

in 2013 is mostly driven by financial markets indicator. The reason behind 2013 FCI drop is the depreciation of exchange rate as capital flew out from Turkish economy due to political crisis. To sum up, the contribution of different categories can be changed over time as a result of policies and global financial conditions, which is closely analyzed in this section.

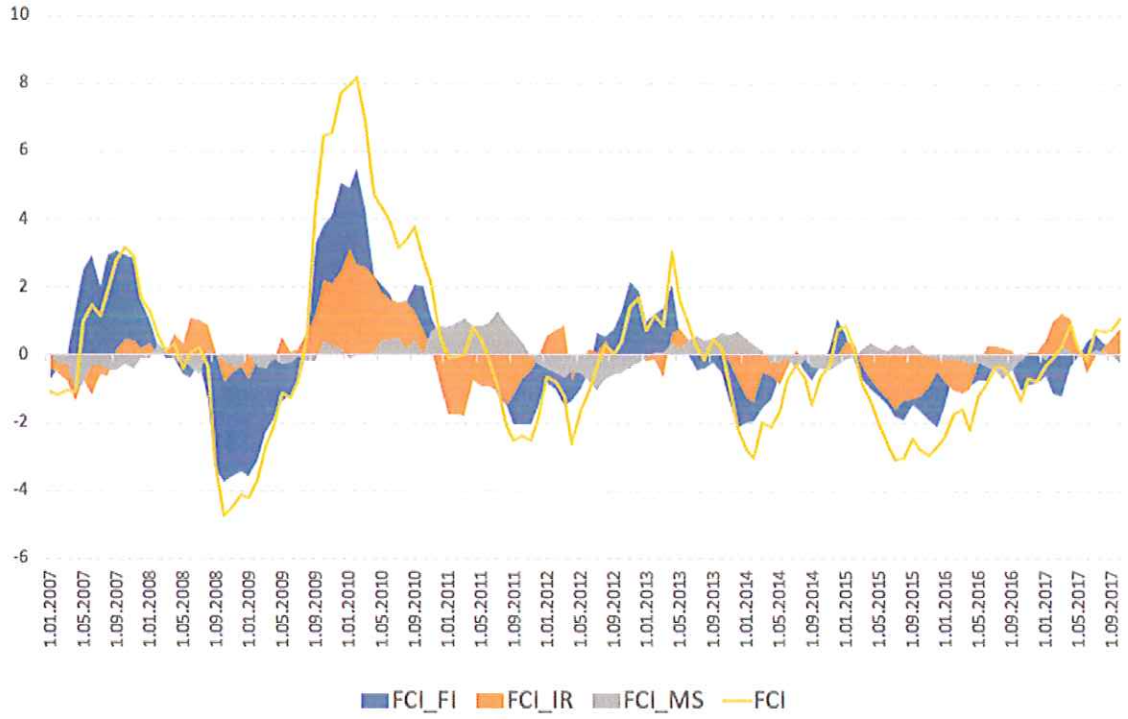

Figure 4. Contribution to FCI

CHAPTER 7

GRANGER CAUSALITY

Many findings in the literature suggest that financial variables affect the real economic activity. Friedman and Kuttner (1992) suggests that interest rate spread Granger causes economic activities. Moreover, Fama and French (1989) successfully predicts the economic output using the stock prices. Rodrik (2008) finds that a high real exchange rate increases economic growth. Following these findings in the literature, it is expected that financial conditions index created out of financial variables has explanatory power of economic activities.

To test the causal relationship between FCI and economic activities, Granger (1969) proposes a model based on the idea that the variable x Granger causes the variable y if y can be more successfully predicted using the historical information of x along with y compared to using historical information of y alone. Following the idea of Granger causation, the regression which is used to test causality is as follows:

$$Y_t = \sum_{k=1}^{4} \alpha_k Y_{t-k} + \sum_{l=1}^{4} \beta_l X_{l-k} + \epsilon_t$$

where ϵ is random error term, α_k is the coefficient of lagged dependent variable Y and β_l is the coefficient of lagged independent variable X . If the hyphothesis that each $\beta_l = 0$ fails, it can be concluded X Granger causes Y. F test is used to decide if each $\beta_l = 0$.

Industrial Production Index and Real Sector Confidence Index are used to see directional relation between economic activity and financial condition index. To smooth the data, yearly growth rates are taken which is essential for Granger causality test. The results are shown in the Table 3 where RCCI and IPI stand for Real

Consumer Price Index and Industrial Production Index respectively. As it can be seen from the results in the Table 3 , FCI Granger causes Industrial Production and Real Consumer Confidence as results are significant in 1% whereas Industrial Production and Real Consumer Confidence do not Granger cause FCI. This analysis shows that financial conditions causes the level of economic activity whereas the level of economic activity does not cause financial conditions in Turkey. Therefore, easing financial conditions is helpful to recover the economic output in case of recession periods in Turkey. However, worsening financial conditions can not be recovered by policies stimulating economic growth.

Table 3. Granger Causality Test Results

Direction of Granger Causality	F-statistics
FCI $\rightarrow$ IPI	5.908***
FCI $\rightarrow$ RCCI	6.037***
IPI $\rightarrow$ FCI	1.249
RCCI $\rightarrow$ FCI	1.4959

CHAPTER 8

NONLINEAR AUTOREGRESSIVE DISTRIBUTED LAGS MODEL

Following the results of Granger Causality test that shows FCI Granger causes Industrial Production and findings in the literature, in this secion, our goal is to analyze the effect of FCI on industrial production of Turkey to find out the relationship between financial markets and economic activity. In order to investigate this relationship, we use nonlinear autoregressive distributed lags (NARDL) model proposed by Shin et. al. (2014), which allows to analyze assymetric effects of FCI with short-run and long-run dynamics.

To analyze the assymetric effects of FCI, we decompose the ΔFCI_t into two parts to seperate positive changes from negative changes. The following equations show the calculation how we decompose ΔFCI_t as it is proposed in Shin et. al. (2014) :

$FCI_t^{POS} = \sum_{j=1}^{t} max(\Delta FCI_j, 0)$ and $FCI_t^{NEG} = \sum_{j=1}^{t} min(\Delta FCI_j, 0)$

where FCI_t^{POS} and FCI_t^{NEG} are the partial sums of positive shocks and negative shocks in FCI. Then, we move to the following model proposed by Shin et. al. (2014) where positive and negative shocks in FCI are behaved as seperate independent variables with different coefficients :

$$\Delta IPI_t = \beta_1 + \beta_2 IPI_{t-1} + \beta_3 FCI_{t-1}^{POS} + \beta_4 FCI_{t-1}^{NEG} + \sum_{i=1}^{12} \alpha_{1,i} \Delta IPI_{t-i} + \sum_{i=0}^{12} \alpha_{2,i} \Delta FCI_{t-i}^{POS} + \sum_{i=0}^{12} \alpha_{3,i} \Delta FCI_{t-i}^{NEG} + \epsilon_t$$

where assymetric effects is included by decomposition of FCI as explained above. According to the unit root tests, both FCI and IPI series are not I(2) which is one of the main assumptions of this NARDL model. This model is a modified version of Pesaran et. al. (2001) and Shin et. al. (2014) shows that the bound test approach proposed by Pesaran et. al. (2001) is applicable in this nonlinear modification.

Another advantage of the model is to analyze both short-run and long-run dynamics. The short-run effects are demostrated by α coefficients whereas the long-run effects are demostrated by β coefficients. The model is estimated by OLS method.

In order to test the long-run relationship, Pesaran et. al. (2001) proposes a nonstandard F test. In this test, the null hypthotesis $\beta_2 = \beta_3 = \beta_4 = 0$ which means that there is no cointagration between variables is tested. The F-statistic out of this test is compared to the critical values that is proposed by Pesaran et. al. (2001). If the F-statistics is more than upper bound, the null hypthotesis of no cointegration is rejected and we conclude that there is long-run relationship between our variables. In this case of long-run relationship, $-\frac{\beta_3}{\beta_2}$ reflects the exact long-run coefficient of positive shocks of FCI and $-\frac{\beta_4}{\beta_2}$ reflects the exact long-run coefficient of negative shocks of FCI. The exact short-run coefficients is equal to the values of $\alpha's$. Moreover, to check if there is an asymmetric effects of FCI on industrial production, the hyphotesis $-\frac{\beta_3}{\beta_2} = -\frac{\beta_4}{\beta_2}$ which tests the equivalence of long-run impact of positive and negative shocks in FCI can be tested by the Wald test. A rejection of this test means that the long-run effects of positive and negative shocks in FCI significantly differ from each other. Furthermore, short-run asymmetry can be checked by testing the null hypothesis that total short-run impacts of positive shocks on FCI are equal to the total short run impacts of negative shocks on FCI.

To select the appropriate model specification, we adopt a general-to-specific approach where insignificant lags are excluded from the general model to reach final model specification. Results of coefficients, cointegration test and asymmetry tests can be seen in the Table 4. Following the results, $-\frac{\beta_3}{\beta_2} = 10.823$ and $-\frac{\beta_4}{\beta_2} = 8.274$ are exact long-run coefficients of positive shocks in FCI and negative shocks in FCI respectively. The long-run coefficients are clearly positive as in line with

expectations. 1% increase in FCI leads to 10.823% increase in industrial production and 1% point decrease in FCI leads to 8.274% decrease in industrial production. As it can be seen, positive shocks have higher effect on industrial production compared to negative shocks.

As it can be observed in panel C, the result of F statistic is significant and we reject the null hypothesis $\beta_2 = \beta_3 = \beta_4 = 0$ which means cointegration exists between variables in the model and long-run conclusions are valid. Moreover, in Panel D and Panel E, the results of long-run and short-run asymmetry tests can be observed. According to the results, we reject the long-run symmetry at 1% level and conclude that positive and negative shocks in FCI have different effects on industrial production in the long-run. In the short-run, we can only reject the short-run asymmetry at 10% level.

Briefly, results show us that the effect of FCI on industrial production is significant in the long-run. Moreover, positive shocks in FCI have significantly higher impact on industrial production compared to negative shocks in FCI in the long-run. The asymmetry tests indicate that the nonlinear modelling in order to investigate this relationship between FCI and industrial production is better because assuming the effect of FCI is symmetric may lead to wrong interpretation.

Table 4. NARDL Model Estimation and Assymetry Test Results

Variable	Coefficient
Panel A: Long-run Estimation Results	
$Constant$	2.141
IPI_{t-1}	-0.051
FCI_{t-1}^{POS}	0.552 ***
FCI_{t-1}^{NEG}	0.422 ***
Panel B: Short-run Estimation Results	
ΔIPI_{t-1}	-0.416***
ΔIPI_{t-7}	-0.365***
ΔIPI_{t-8}	-0.354 ***
ΔFCI_{t-11}^{POS}	-0.488*
ΔFCI_{t-3}^{POS}	-0.720 **
ΔFCI_{t-5}^{NEG}	-0.561 *
ΔFCI_{t-6}^{POS}	-0.637 **
ΔFCI_{t-2}^{NEG}	0.555 *
ΔFCI_{t-2}^{POS}	-0.541 *
ΔFCI_{t-7}^{NEG}	-0.579 *
Panel C: Bounds Test of No Cointegration $\beta_2 = \beta_3 = \beta_4 = 0$	
Test Statistic	Value
F-statistic	14.764***
Panel D: Long-run Assymetry Test	
Test Statistic	Value
F-statistic	6.891***
Panel E: Short-run Assymetry Test	
Test Statistic	Value
F-statistic	2.829*

CHAPTER 9

CONCLUSION

Given that most of the macroeconomic models only include interest rate and exchange rate which are insuffient to capture financial conditions, this paper contructs a Financial Conditions Index for Turkey including a wide range of financial variables and proves that financial conditions help to forecast the future economic activity. The Financial Conditions Index built in this paper stands for the summary of financial markets and provides insights regarding the financial stress of Turkey.

The indicators used to construct the FCI are exchange rates, stock prices, credit variables, money supply variables and interest rates. The reason behind using such a wide range of variables is that market imperfections exist and prices are inadequate to capture financial conditions alone. The factor model with principal components analysis is applied to extract the weights of each financial variable to construct the resulting FCI. Factor analysis shows that the main indicators leading Turkish financial conditions are exchange rates, stock market capitalization and real corporate credit interest rate. The weights of money supply variables in financial conditions are almost negligible. This factor analysis and resulting weights can be used as a policy tool to decide what indicators should Central Bank of the Rebuplic of Turkey should target to easy financial conditions effectively whenever needed.

The FCI for Turkey is constructed between the years 2007 and 2017. The outstanding performance of FCI is evaluated by comparing it to leading indicators of Turkish economy. The leading indicators are closely followed by FCI over the period 2007-2017. There are three turning points of Turkish Economy in 2008, 2010 and 2013, which are successfully captured by the constructed FCI in this paper. Moreover, the main driving indicators of financial dumpening for these three different periods is

analyzed to figure out fundemantel causes of each crisis. The analysis shows that stock markets are the main driver of 2008 crisis whereas 2010 financial dumpening is caused by also interest rate variables. The policitical crisis, capital outflow and depreciation of exchange rate resulted in 2013 financial dumpening, which is also successfuly observed by the factor analysis as the contribution of exchange rate on FCI is high in 2013.

Lastly, Granger causaility test is employed to see if FCI affects the economic activity which is proxied by industrial production. The results suggest that FCI Granger causes industrial production. Moreover, on the light of Granger causality test, we use nonlinear autoregression distributed lags model proposed by Shin et. al. (2014) to investigate the relationship between FCI and industrial production. The results show that an increase in FCI positively affects the industrial production whereas a decrease in FCI negatively affects the industrial production. Furthermore, the results of the asymmetry tests suggest that the positive shocks in FCI have more impact on industrial production compared to negative shocks. The existence of asymmetric effects of FCI indicates that easing financial conditions increases economic activity more compared to dumpening effect of tightening financial conditions on production.

REFERENCES

Angelopoulou, E., Balfoussia, H., & Gibson, H. D. (2014). Building a financial conditions index for the Euro area and selected Euro area countries: What does it tell us about the crisis?. *Economic Modelling*, 38, 392-403.

Akdeniz, C., & Çatık, A.N. (2017). Türkiye için finansal koşulların bir analizi: Faktör ve VAR modellerinden bulgular. *Eskişehir Osmangazi Üniversitesi İktisadi ve İdari Bilimler Dergisi*, 12(1), 99-120.

Bernanke B. S., & Gertler, M. (1989). Agency costs, net worth, and business fluctuations. *The American Economic Review*, 79(1), 14-31.

Bernanke B. S., & Gertler, M. (1995). Inside the black box: The credit channel of monetary policy transmission. *Journal of Economic Perspectives*, 9(4), 27-48.

Carmichael, T. (2002). *Canada's financial conditions point to recovery.* Toronto: J.P. Morgan Canada

Fama, E.F., & French K. (1989). Business conditions and expected returns on stocks and bonds. *Journal of Financial Economics*, 25(1), 23-49.

Freedman, C. (1995). *The role of monetary conditions and the monetary conditions index in the conduct of policy.* Ottawa, Ontario: Bank of Canada Review.

Friedman, C.M., & Kuttner K. (1992). Money, income, prices, and interest rates. *American Economic Review*, 82(3), 472-492.

Gauthier, C., Graham C., & Liu, Y. (2004) . *Financial conditions indexes for Canada.* (Report No. 2004-22), Ottawa, Ontario: Bank of Canada

Granger, C. W. J. (1969). Investigating causal relations by econometric models and cross-spectral methods. *Econometrica*, 37(3), 424-438.

Hatzius, J., Hooper, P., Mishkin, F., Schoenholtz, K., & Watson, M. (2010). *Financial condition indexes: A fresh look after the financial crisis.* (Report No. 16150). New York: National Bureau of Economic Research

Hatzius, J., Stehn, S. J., & Ursua, J. (2014). *Some long-term evidence on short-term rates.* New York: Goldman Sachs

Kara, A.H., Özlü, P., & Ünalmış, D. (2012). *Financial conditions indices for the Turkish economy.* (Report No. 16150). Ankara: Research and Monetary Policy Department, Central Bank of the Republic of Turkey.

Lack, C.. (2002). *A financial conditions index for Switzerland.* (Report No. 19). Basel: Bank for International Settlements

Lown, C., & Morgan, D. (2006). The credit cycle and the business cycle: New findings using the loan officer opinion survey. *Journal of Money, Credit and Banking*, 38(6), 1575-1597.

Macroeconomic Advisers. (1998). *From the U.S. economic outlook.* Saint Louis, MO: Macroeconomic Advisers

McCracken, M.W., & Ng, S. (2016). Fred-md: A monthly database for macroeconomic research. *Journal of Business and Economic Statistics* , 34(4), 574-589.

Osario, C., Ünsal, D.F., & Pongsaparn, R. (2011). *A quantitative assessment of financial conditions in Asia.* (Report No. 11-170) Washington, D.C.: International Monetary Fund

Rodrik, D. (2008). The real exchange rate and economic growth. *Brookings Papers on Economic Activity*, 39(2), 365-439.

Shin, Y., Yu, B., & Greenwood-Nimmo, M. (2014). Modelling Asymmetric Cointegration and Dynamic Multipliers in a Nonlinear ARDL Framework. In W. Horrace, & R. Sickles (Eds.), *The Festschrift in Honor of Peter Schmidt.: Econometric Methods and Applications*. New York: Springer.

Stock, J. H., & Watson, M.W. (2002). Forecasting using principal components from a large number of predictors. *Journal of the American Statistical Association*, 97(460), 1167-1179.

Swiston, A. J. (2008). *A U.S. financial conditions index; putting credit where credit is due.* (Report No. 08-161) Washington, D.C.: International Monetary Fund

Zeldes, S. P. (1989). Optimal consumption with stochastic income: Deviations from certainty equivalence. *The Quarterly Journal of Economics*, 104(2), 275-298.