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**BANKING SECTOR FRAGILITY, CENTRAL BANK
CREDIBILITY, MACROECONOMIC PERFORMANCE
AND INSTITUTIONS: THE CASE OF TURKEY**

PhD THESIS

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To my beloved daughter AYŞE SARE...

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LIST OF ABBREVIATIONS

ADF	: Augmented Dicky-Fuller
AIC	: Akaike Information Criterion
ARDL	: Autoregressive Distributed Lag
BAT	: Banks Association of Turkey
BIS	: Bank of International Settlement
BNL	: Banca Nazionale del Lavoro
BRSA	: Banking Regulation and Supervision Agency
BSFI	: Banking Sector Fragility Index
BVAR	: Bayesian Vector Autoregression
CAR	: Capital Adequacy Ratio
CBOE	: Chicago Board Options Exchange
CBRT	: Central Bank of the Republic of Turkey
CI	: Credibility Index
CPI	: Consumer Price Index
CRED	: Credibility Index
DNB	: De Nederlandsche Bank
ECB	: European Central bank
ECBI	: Extended Central bank Independence
ECM	: Error Correction Model
ECT	: Error Correction Term
EDHEC	: Ecole des Hautes Etudes Commerciales
EGARCH	: Exponential Generalized Auto-regressive Conditional Heteroskedacity
EMS	: European Monetary System
EMU	: European Economic and Monetary Union
EU	: European Union
FED	: Federal Reserve
GDP	: Gross Domestic Product

HICP	: Harmonized Index of Consumer Prices
IFS	: International Financial Statistics
IMF	: International Monetary Fund
ISPAT	: Investment Support and Promotion Agency of Turkey
LINEX	: Partly Linear and Partly Exponential
LVM	: Latent Variable Method
MAPRA	: Munich Personal Repec Archive
MRS	: Markov Regime Switching
NAIRU	: Non-accelerating Inflation Rate of Unemployment
NBER	: National Bureau of Economic Research
NBP	: National Bank of Poland
OECD	: Organisation for Economic Cooperation and Development
OLS	: Ordinary Least Squares
PP	: Phillips-Perron
PVAR	: Panel Vector Autoregression
S&P	: Standard & Poor's
SBS	: Schwarz Bayesian Criterion
SIC	: Schwarz Information Criterion
SPF	: Survey of Professional Forecasters
TL	: Turkish Lira
US	: United States
VAR	: Vector Autoregression
VARX	: VAR with Exogenous Variables
VIX	: Chicago Board Options Exchange Volatility Index
WDI	: World Development Indicators
WGI	: Worldwide Governance Indicators
WTI	: West Texas Intermediate

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RESUME

Cette thèse comprend trois études liées à la fragilité du secteur bancaire, à la crédibilité de la banque centrale, à la performance macroéconomique et aux indicateurs financiers et institutionnels pour l'économie turque sur la période 1996Q1-2015Q4.

La première étude examine les déterminants de la crédibilité de la banque centrale pour la Banque Centrale de la République de Turquie. Après avoir donné une définition détaillée du terme de crédibilité ainsi que des informations sur la politique de ciblage de l'inflation, la crédibilité de la banque centrale a été quantifiée. Pour cela, l'indice de crédibilité développé par Mackiewicz-Lyziak (2009) a été utilisé. Cet indice est utilisé car il unifie les principaux facteurs qui influent sur la crédibilité de la banque centrale dans la littérature connexe. Pour calculer un indice de crédibilité composite, six sous-indices ont été utilisés traitant respectivement de la réalisation des objectifs de la politique monétaire annoncée, la performance de l'inflation passée, la transparence de la politique monétaire, l'indépendance de la banque centrale, le risque national, et de la dette publique. L'indice de crédibilité a été défini en deux périodes dans le but d'observer de manière précise l'évolution dans le temps des résultats de la politique de ciblage de l'inflation. La première période correspond au régime de ciblage pré-inflationnel couvrant la période 1996Q1-2005Q4 et la seconde au cours de la période de politique monétaire du ciblage de l'inflation datant de 2006-11 à 2015Q4. En tant que déterminants, trois groupes de variables sont utilisés dans l'analyse. Les variables macroéconomiques sont au nombre de six indicateurs : le taux de croissance du PIB réel, le taux d'inflation, le taux de change réel effectif, le taux d'intérêt à court terme, le taux de chômage, et l'ouverture commerciale (total des importations et exportations au PIB). Les variables financières qui sont utilisées dans cette étude sont M2 au PIB, les prêts non performants sur les prêts totaux, les prêts au secteur privé au PIB, et les capitaux propres sur le total d'actifs. Les variables institutionnelles comprennent Government Effectiveness, Regulatory Quality, Rule of Law, et Polity. Dans cette étude, afin de définir les déterminants de l'indice de crédibilité de la banque centrale, la méthodologie Autoregressive Distributed Lag (ARDL) a été utilisée. Cette méthodologie a été développée par Pesaran et Shin (1999) et Pesaran et al. (2001).

Avec la méthode d'ARDL, l'existence de relations à long terme entre la crédibilité de la banque centrale et les autres variables (macroéconomiques, financières et institutionnelles) est analysée. Le modèle ARDL a été choisi car il fournit des résultats fiables en travaillant sur des échantillons limités et permet des analyses à long terme et à court terme simultanément. La plupart des études précédentes étudient les déterminants de la crédibilité avec moins de variables. Une contribution importante de cette étude à la littérature est que, avec plus de variables, les relations à long terme entre la crédibilité de la banque centrale et les autres variables sont examinées. Par ailleurs, dans la littérature, la crédibilité est principalement étudiée annuellement alors que dans cette étude, toutes les analyses sont menées tous les trois mois, ce qui fournit des informations plus précises sur l'évolution des relations au fil du temps. En plus de cela, la plupart des études étudient ces relations dans une courte période avec les méthodes de Panel, mais notre étude couvre une période de temps plus longue avec une méthode de séries temporelles. Les résultats des relations à long terme entre la crédibilité de la banque centrale et les autres variables sont donnés ainsi que les résultats à court terme. Les résultats économétriques sont discutés de manière détaillée dans la section des résultats empiriques.

La deuxième étude explore les relations entre la fragilité du secteur bancaire, la crédibilité de la banque centrale, la performance macroéconomique et les institutions de l'économie turque sur la période 1996Q1-2015Q4. La crédibilité de la banque centrale a déjà été calculée dans la première étude de la thèse et cet indice a été utilisé. Un indice de fragilité du secteur bancaire pour l'économie turque a été construit comme un proxy des variables financières de la première partie. Afin de construire un indice de fragilité du secteur bancaire, la méthodologie d'Arı et Cergibozan (2016) a été utilisée avec trois composantes; les variations du ratio des prêts non performants sur les prêts totaux bancaires, les dépôts bancaires étrangers sur les dépôts totaux bancaires, et les bénéfices (pertes) bancaires sur les capitaux propres de la banque. Ces ratios sont calculés pour les banques de dépôt car ils représentent environ 90 pour cent de l'ensemble du secteur bancaire dans l'économie turque. Le même groupe de variables macroéconomiques est utilisé, mais pour les variables institutionnelles, Rule of Law est utilisé dans l'analyse en tant que proxy de la qualité institutionnelle. La méthodologie de Vector Auto-regression (VAR) est utilisée dans cette étude afin d'étudier la relation entre la fragilité du secteur bancaire,

la crédibilité de la banque centrale, la performance macroéconomique et la qualité institutionnelle car ces modèles sont faciles à estimer et possèdent des capacités de prévision précises. En outre, les chercheurs n'ont pas à traiter les spécifications des variables, qu'elles soient endogènes ou exogènes, car elles sont toutes endogènes dans ces modèles. Pour examiner l'effet d'un choc d'une variable sur d'autres variables et vice versa, les chocs aléatoires sur les variables sont identifiés par la méthode de décomposition de Cholesky. L'analyse de la réponse impulsionnelle donne des informations sur la direction et la magnitude de l'effet d'une variable sur d'autres variables. L'évolution de ces effets tout au long du temps pourrait être considérée comme des indicateurs importants fournissant des données utiles aux décideurs afin de prendre des mesures précises. En plus de l'analyse de la réponse impulsionnelle, la méthode de décomposition de la variance est utilisée dans le but de définir le pourcentage de la variation d'une variable qui s'explique par le choc d'une autre. Dans cette étude, les résultats de l'analyse sont particulièrement discutés pour la fragilité du secteur bancaire (BSFI) et la crédibilité de la banque centrale (CRED) pour la complémentarité des premier et troisième articles de cette thèse. La principale contribution de cette étude est que, en l'état actuel des connaissances, c'est un document unique qui regroupe la fragilité du secteur bancaire, la crédibilité de la banque centrale et les indicateurs macroéconomiques, ainsi que l'institutionnalisation. Grâce à cette diversification, il fournit des informations très précieuses concernant leurs relations entre les unes et les autres pour une période de temps plus longue. Une constatation importante de cette étude est que les décideurs devraient principalement se concentrer sur le taux d'intérêt, le taux de change effectif et le taux de chômage afin d'accroître la crédibilité de la banque centrale et de diminuer la fragilité dans le secteur bancaire. Tous les résultats économétriques sont donnés dans la section des résultats empiriques en détail.

La troisième étude développe un modèle de changement de régime de Markov pour la crédibilité de la Banque centrale de la République de Turquie. Les modèles de changement de régime de Markov sont fréquemment utilisés en économie afin de définir les changements de régime. Même si la restriction des probabilités de transition constantes dans les modèles de changement de Markov précoces pose de sérieuses limitations aux chercheurs, après avoir étendu la base de référence du modèle aux probabilités de transition variables dans le temps, ce modèle commence à

être préféré par de nombreux chercheurs du fait de ses commodités. Dans un modèle de changement de régime de seuil, la commutation de régime est déterminée par la valeur des variables observées et des seuils prédéfinis. Cependant, dans un modèle de changement de régime de Markov, on suppose que le processus stochastique non observable est une chaîne de Markov. Le modèle de changement de régime de Markov a été choisi puisque il n'y a pas besoin de définir un seuil pour les changements de régime alors que le modèle de Markov définit ces changements de régime par lui-même. Ce modèle a été utilisé afin de fournir une interprétation économique du comportement politique de la banque centrale dans la politique de ciblage de l'inflation. Avec cette étude, il s'agit principalement d'examiner si la décision de la politique explicite de ciblage de l'inflation favorise la crédibilité de la banque centrale au fil du temps. Les modèles de changement de régime de Markov sont exécutés sur la période 1996Q1-2015Q4 pour trois groupes de variables qui sont utilisés dans la première étude de la thèse; macroéconomique, financier et institutionnel. L'indice de crédibilité de la banque centrale est utilisé avec ces groupes de variables afin de déterminer les changements de régime. Pour trois modèles, les résultats des tests de linéarité démontrent que l'utilisation d'une méthode d'estimation non linéaire est un moyen précis de réaliser ces analyses. Comme le modèle de Markov est l'une des méthodes d'estimation non linéaire, il est pratique d'utiliser un modèle de Markov pour cette étude. Deux régimes sont considérés pour la crédibilité de la banque centrale, à savoir une période faiblement crédible et une période hautement crédible, en attendant une période fortement crédible après avoir passé à la politique explicite de ciblage de l'inflation en 2006. Le modèle de changement de Markov Modifie les résultats macroéconomiques, financiers et les variables institutionnelles sont représentées séparément avec les probabilités de régime filtré. La principale contribution de cette étude à la littérature est que, sur la base des résultats économétriques, la politique de ciblage de l'inflation devient un régime de ciblage de l'inflation pour l'économie turque. En outre, les résultats du modèle économétrique fournissent des informations très précises sur le comportement de la banque centrale concernant le régime qui passe de la faible crédibilité à la haute, ou vice versa, pour chaque groupe de variables pendant une très longue période. Une autre contribution est que, avec cette étude, il est démontré que l'économie turque est assez robuste en termes de performance macroéconomique par rapport aux variables financières et institutionnelles. D'autres résultats des modèles

économétriques sont donnés et discutés dans la section des résultats empiriques avec des détails.



ABSTRACT

This dissertation consists of three essays related to the Banking sector fragility, the Central bank credibility, the macroeconomic performance, and the financial and institutional indicators for the Turkish economy over the period 1996Q1-2015Q4.

First study examines the determinants of the Central bank credibility for the Central Bank of the Republic of Turkey. Despite the fact that the measurement of the credibility of any Central bank has been difficult, with this study, after giving detailed definition of the term Credibility and information on the inflation targeting policy, the credibility of the Central bank is quantified for Turkey. For that, the credibility index developed by Mackiewicz-Łyziak (2009) is used in this study. This index is employed because it unifies the principal factors affecting the Central bank credibility in the related literature. To calculate a composite credibility index, six sub-indexes are employed; Achievement of Announced Monetary Policy Targets, Past Inflation Performance, Transparency of Monetary Policy, Central bank Independence, Country Risk and Public Debt. The credibility index is defined in two periods in the purpose of observing the results of the inflation targeting policy over the time in a precise way. The first period corresponds to the pre-inflation targeting policy covering 1996Q1-2005Q4 and the second one is during the inflation targeting monetary policy period dating from 2006Q1 to 2015Q4. As determinants, three variable groups are used in the analysis. The macroeconomic variables consist of six indicators; Real GDP Growth Rate, Inflation Rate, Real Effective Exchange Rate, Short Term Interest Rate and Unemployment Rate and Trade Openness (total export and import to GDP). The financial variables that are used in this study are M2 to GDP, Non-Performing Loans to Total Loans, Loans to Private Sector to GDP and Equity to Total Assets. The institutional variables include Government Effectiveness, Regulatory Quality, Rule of Law and Polity. In this study, in order to define the determinants of the Central bank credibility index, the Autoregressive Distributed Lag (ARDL) Bounds test methodology of Pesaran and Shin (1999) and Pesaran et al. (2001) is used. It allows dealing with the restricted integration order. With the ARDL method, the existence of long-run relationships between the Central bank credibility and the other variables (macroeconomic, financial and institutional) is analyzed. The ARDL model is chosen because it provides reliable results while working on limited

samples and allows analyses in long-run and short-run parameters simultaneously. Most of the previous studies investigate the determinants of the credibility with fewer variables. An important contribution of this study to the literature is that with more variables the long-run relationships between the Central bank credibility and the other variables are examined. However, in the literature the credibility is mostly investigated on a yearly basis, in this study all analysis is run on a quarterly basis which provides more accurate information about the developments of the relations throughout time. In addition to that, most of the studies investigate these relations in a short period with Panel data method, but this study's period covers a longer time period with a time series method. The long-run relationships results between the Central bank credibility and the other variables are given along with the short-run results. Model results are largely found as expected and all econometric outcomes are discussed in a detailed manner in the empirical result section.

The second study investigates the relationships between the Banking sector fragility, the Central bank credibility, the macroeconomic performance and the institutions in the Turkish economy over the period 1996Q1-2015Q4. The Central bank credibility is calculated in the first study of the dissertation and this index is used in this part of the study. Although, a Banking sector fragility index for the Turkish economy is built as a proxy for the financial variable, instead of using the financial variables of the first part. For that, the methodology of Arı and Cergibozan (2016) is used. In order to build a Banking sector fragility index, three components are employed; changes in the ratio of nonperforming loans over bank total loans, bank foreign deposits over bank total deposits, and bank profit (loss) over bank own equity. These ratios are calculated for the deposit banks since they represent about 90 percent of the whole banking sector in the Turkish economy. The same macroeconomic variable group is used, but for the institutional variables, only Rule of Law is employed in the analysis as a proxy of the institutional quality. The Vector Auto-regression (VAR) methodology is used in this study in order to investigate the relationship between the Banking sector fragility, the Central bank credibility, the macroeconomic performance and the institutional quality. This model is chosen because it is easy to estimate and have accurate forecasting capabilities. Moreover, researchers do not have to deal with the specifications of the variables either endogenous or exogenous since they are all endogenous in these models. To examine

the effect of a variable shock on other variables and vice versa, random shocks to variables are identified by the Cholesky decomposition method. The impulse response analysis gives information about the direction and magnitude of the effect of a variable on other variables. Developments of these effects throughout time might be considered as important indicators providing useful data for the policy-makers in order to take action in an accurate way. In addition to the impulse response analysis, the variance decomposition method is used in the purpose of defining the percentage of the variation in a variable which is explained by the shock of another one. In this study, the analysis results are particularly discussed for the Banking sector fragility (BSFI) and the Central bank credibility (CRED) for the complementary to the first and third papers of this dissertation. The main contribution of this study is that, to the best of our knowledge, it is a unique paper that brings together the Banking sector fragility, the Central bank credibility, and the macroeconomic indicators along with institutional one. Thanks to this richness in the number of variable, it provides very valuable information concerning their relations each other for a longer time period. An important finding of this study is that the policy-makers should primarily focus on the interest rate, the real effective exchange rate and the unemployment rate in order to increase the credibility of the Central bank and decrease the fragility in the banking sector. All of the econometric results are given in the empirical result section in detail.

The third study employs a Markov Regime Switching model for the credibility of the Central Bank of the Republic of Turkey. The Markov Regime Switching models are frequently used in economics in order to define regime changes. Even if the restriction of constant transition probabilities in the early Markov switching models poses serious limitations to researchers, after extending the baseline of the model to time varying transition probabilities, this model starts to be more preferred by many scholars thanks to its conveniences. In a threshold regime switching model, regime switching is determined by the value of observed variables and predefined thresholds. However, in a Markov regime switching model, it is assumed that the unobservable stochastic process is a Markov chain. It is preferred to use Markov regime switching model since it does not need to define any threshold for the regime changes while the Markov model defines these regime changes by itself. This model is used in order to provide an economic interpretation of the policy behavior of the

Central bank in the inflation targeting policy. With this study, it is mainly aimed to examine whether the decision of the explicit inflation targeting policy fosters the Central bank credibility throughout time. Markov Regime Switching Models are run over the period 1996Q1-2015Q4 for three variable groups that are used in the first study of the dissertation; macroeconomic, financial and institutional. The Central bank credibility index is used with these variable groups in order to determine regime changes. For three models, linearity test results demonstrate that using a non-linear estimation method is an accurate way to conduct these analyses. As the Markov model is one of the non-linear estimation methods, it is convenient to use a Markov model for this study. Two regimes for the Central bank credibility are considered, namely a low credible period and a high credible period, expecting to have a high credible period after passing to the explicit inflation targeting policy in 2006. Markov Regime Switching Model results of macroeconomic, financial and institutional variables are separately represented along with filtered regime probabilities. The principal contribution of this study to the literature is that based on the econometric results, it is concluded that inflation targeting policy becomes an inflation targeting regime for the Turkish economy. Moreover, the econometric model results supply very precise information about the behavior of the Central bank concerning the regime changes from low credibility to high one, or vice versa, for every variable group for a very large time period. Another contribution is that with this study it is shown that the Turkish economy is quite robust in terms of macroeconomic performance compared to financial and institutional variables. Other econometric models results are given and discussed in the empirical result section with details.

ÖZET

Bu tez çalışması Türkiye ekonomisi 1996Ç1-2015Ç4 dönemi için Bankacılık Sektörü Kırılganlığı, Merkez Bankası Kredibilitesi, Makroekonomik Performans, Finansal ve Kurumsal Göstergelerle ilgili üç çalışmadan oluşmaktadır.

Birinci çalışmada Merkez Bankası Kredibilitesinin belirleyicileri Türkiye Cumhuriyeti Merkez Bankası için incelenmektedir. Merkez bankasının kredibilitesinin ölçülmesi zor olsa da bu çalışmada, kredibilitenin ayrıntılı tanımını yaptıktan ve enflasyon hedeflemesi politikası hakkında bilgi verdikten sonra, Merkez bankası kredibilitesi hesaplanmaktadır. Bunun için Mackiewicz-Lyziak (2009) tarafından geliştirilen kredibilite endeksi kullanılmaktadır. Bu hesaplama yöntemini seçilmiştir çünkü bu yöntem ilgili literatürde Merkez bankasının kredibilitesini etkileyen başlıca faktörleri bir araya getirmektedir. Komposit bir güvenilirlik endeksi hesaplamak için altı alt endeks kullanılmaktadır; Açıklanan Para Politikası Hedeflerinin Başarılı Olması, Geçmiş Enflasyon Performansı, Para Politikasının Şeffaflığı, Merkez Bankasının Bağımsızlığı, Ülke Riski ve Kamu Borcu. Enflasyon hedeflemesi politikasının sonuçlarını zaman içinde kesin bir şekilde gözlemlemek amacıyla kredibilite endeksi iki dönemde tanımlanmaktadır. Birinci dönem 1996Ç1-2005Ç4'ü kapsayan enflasyon hedeflemesi öncesi politikaya karşılık gelmektedir ve ikincisi ise 2006Q1'den 2015Q4'e kadar olan enflasyon hedeflemesini içeren para politikası dönemidir. Kredibilite belirleyicileri olarak analizlerde üç değişken grubu kullanılmaktadır. Makroekonomik değişken grubu altı göstergeden oluşmaktadır; Reel GSYH Büyüme Hızı, Enflasyon Oranı, Reel Efektif Döviz Kuru, Kısa Vadeli Faiz Oranı, İşsizlik Oranı ve Ticari Açıklık (toplam ihracat ve ithalatın GSYİH'ye oranı). Çalışmada kullanılan finansal değişkenler ise: M2'nin GSYİH'ye oranı, Şüpheli Alacakların Toplam Kredilere oranı, Özel Sektöre Verilen Kredilerin ve GSYİH'ye oranı ve Sermayenin Toplam Aktiflere oranıdır. Government Effectiveness, Regulatory Quality, Rule of Law ve Polity ise kurumsal değişkenlerdir. Bu çalışmada Merkez bankası güvenilirlik endeksinin belirleyicilerini tanımlamak için Peseran ve Shin (1999) ve Peseran ve ark. (2001) tarafından geliştirilen Autoregressive Distributed Lag (ARDL) Bounds Test metodolojisi kullanılmaktadır ve bu yöntem kısıtlı entegrasyon seviyeleriyle baş edilebilmesine imkan vermektedir. ARDL yöntemi ile Merkez bankası kredibilitesi ile diğer

değişkenler (makroekonomik, finansal ve kurumsal) arasındaki uzun dönemli ilişkilerin varlığı analiz edilmektedir. ARDL modeli, sınırlı veri setleri üzerinde çalışırken güvenilir sonuçlar vermesi ve ayrıca uzun dönemli ve kısa dönemli parametrelerdeki analizlerin eş zamanlı yapılmasına olanak sağlaması nedeniyle özellikle seçilmiştir. Önceki çalışmaların çoğunda daha az değişkenle kredibilitenin belirleyicileri araştırılmaktadır. Bu çalışmanın literatüre önemli bir katkısı daha fazla değişken ile Merkez bankası kredibilitesi ile diğer değişkenler arasındaki uzun dönemli ilişkileri incelemesidir. Literatürde kredibilite çoğunlukla yıllık bazda araştırılsa da bu çalışmada tüm analizler çeyreklik dönemler halinde yapılmaktadır ve böylece zaman içerisinde ilişkilerin gelişimi hakkında daha fazla bilgiye ulaşılabilmektedir. Buna ek olarak, çalışmaların çoğu Panel veri yöntemini kullanmaktadır ve kısa zaman aralıkları için ilişkiler araştırılmaktadır. Fakat bu çalışma ile analiz dönemleri daha uzun tutulmakta ve yöntem olarak da zaman serisi kullanılmaktadır. Uzun dönemli ilişkiler ile birlikte Merkez Bankası güvenilirliği ile diğer değişkenler arasındaki kısa vadeli dönemli sonuçlar da verilmektedir. Model sonuçları büyük oranda beklendiği gibi sonuçlanmıştır ve tüm ekonometrik sonuçlar ampirik sonuç bölümünde detaylı bir şekilde anlatılmaktadır.

İkinci çalışma 1996Ç1-2015Ç4 dönemi için Bankacılık Sektörü Kırılganlığı, Merkez Bankası Kredibilitesi, Makroekonomik Performans, ve Kurumsal Göstergelerin birbirleriyle olan ilişkilerini Türkiye ekonomisi için incelemektedir. Merkez bankasının kredibilitesi tezin ilk çalışmasında hesaplanmıştı ve bu endeks çalışmanın bu kısmında kullanılmaktadır. Bununla birlikte, birinci bölümdeki finansal değişkenleri kullanmak yerine, Türkiye ekonomisi için finansal değişkenleri temsil edebilecek bir Bankacılık sektörü kırılganlık endeksi oluşturulmaktadır. Bunun için Arı ve Cergibozan'ın (2016) metodolojisi kullanılmaktadır. Bankacılık sektörü kırılganlık endeksini oluşturmak için üç bileşen grubu kullanılmaktadır; şüpheli alacakların toplam kredilere oranı, bankaların yabancı para cinsinden mevduatlarının toplam mevduatlara oranını ve banka karlarının (veya zarar) öz kaynağa oranı değişimleri kullanılmıştır. Bu oranlar, sadece mevduat bankaları için hesaplanmaktadır çünkü bu bankaların Türkiye ekonomisi bankacılık sektörü tamamı içerisindeki payı %90'a yakındır. Analizde aynı makroekonomik değişken grubu kullanılmaktadır ancak kurumsal değişkenler için kurumsal kaliteyi temsil etmesi için sadece Rule of Law yer almaktadır. Bu çalışmada, Bankacılık sektörü

kırılganlığı, Merkez bankasının kredibilitesi, makroekonomik performans ve kurumsal kalite arasındaki ilişkiyi araştırmak için Vector Autoregression (VAR) metodolojisi kullanılmaktadır. Analizlerimizde bu modeller kullanılmıştır çünkü tahmin edilmeleri kolaydırlar ve doğru tahmin yeteneklerine sahiptirler. Ayrıca, araştırmacılar bu modellerde tümüyle endojen olan değişkenlerin hangilerini endojen veya hangilerini de ekzojen olarak inceleyeceklerini bilmelerine gerek kalmamaktadır. Bir değişkende meydana gelen bir şokun diğer değişkenler üzerindeki etkilerini incelemek için, veya tersi durum, değişkenlere verilen rastgele şoklar Cholesky ayrıştırma yöntemi ile belirlenmiştir. Etki tepki analizleri bir değişkenin diğer değişkenler üzerindeki etkisinin yönü ve büyüklüğü hakkında bilgi vermektedirler. Bu etkilerin zaman içindeki gelişimleri politika yapıcılar için doğru bir şekilde harekete geçmek için yararlı veriler sağlayan önemli göstergeler olarak düşünülebilmektedirler. Etki tepki analizlerine ek olarak varyans ayrıştırma yöntemi de bir değişkende bir başka değişken şokunun neden olduğu değişimin yüzdesini tanımlamak amacıyla kullanılmaktadır. Bu çalışmada, analiz sonuçları özellikle bu tezin birinci ve üçüncü bölümlerini tamamlayıcı olması amacıyla Bankacılık sektörü kırılganlığı (BSFI) ve Merkez bankası kredibilitesi (CRED) için analiz edilmektedirler. Bu çalışmanın literatüre temel katkısı, Bankacılık sektörünün kırılganlığını, Merkez bankasının güvenilirliğini, makroekonomik performansı ve kurumları bir araya getiren tek çalışma olmasıdır. Değişken sayısındaki bu zenginlik sayesinde, bu çalışma değişkenlerin birbirleriyle ilişkileri hakkında uzun bir süreyi kapsayan çok değerli bilgiler sağlamaktadır. Bu çalışmanın önemli bir bulgusu da politika yapıcıların öncelikle Merkez bankasının kredibilitesini artırmak ve bankacılık sektöründeki kırılganlığı azaltmak için faiz oranı, reel efektif döviz kuru ve işsizlik oranına odaklanması gerektiğinin tespit edilmesidir. Ekonometrik model sonuçlarının tümü ampirik sonuç bölümünde ayrıntılı olarak verilmektedir.

Üçüncü çalışma ise Türkiye Cumhuriyet Merkez Bankasının Kredibilitesi için Markov Rejim Değişim modellerine yer vermektedir. Markov modelleri rejim değişikliklerini tanımlamak için ekonomide sıklıkla kullanılmaktadırlar. İlk Rejim Değişim modelleri sabit geçiş olasılıklarının kısıtlı olması nedeniyle araştırmacılara ciddi sınırlamalar getirirse de model tabanı zamanla değişen geçiş olasılıklarına kadar genişlettikten sonra bu model sağlamış olduğu kolaylıklarından dolayı birçok bilim insanı tarafından çokça tercih edilmeye başlanmıştır. Eşik rejimi geçiş modelinde

rejim deęiřimi, gözlemlenen deęiřkenlerin deęeri ve önceden tanımlanmış eřikler tarafından belirlenmektedir. Bununla birlikte, bir Markov Rejim Deęiřim modelinde, gözlemlenemeyen stokastik sürecin bir Markov zinciri olduęu varsayılmaktadır. Bu çalışmada, Markov Rejim Deęiřim modeli tercih edilmektedir çünkü Markov modeli bu rejim deęiřikliklerini tek başına tanımlarken, rejim deęiřiklikleri için herhangi bir eřik tanımlanması gerekmemektedir. Merkez bankasının enflasyon hedeflemesi politikası esnasında davranışını ekonomik olarak yorumlamak için bu modele yer verilmektedir. Bu çalışmayla temel olarak açık enflasyon hedefleme politikası kararının Merkez bankasının kredibilitesini zaman içerisinde arttırıp arttırmadığı incelenmektedir. Markov Rejim Deęiřim modelleri 1996Ç1-2015Ç4 dönemi için, tez çalışmasının ilk bölümünde yer alan üç deęiřken grubu için analiz edilmektedirler; makroekonomik, finansal ve kurumsal deęiřkenler. Rejim deęiřikliklerini belirlemek için bu deęiřken gruplarıyla birlikte Merkez bankası kredibilite endeksi kullanılmaktadır. Üç model için doğrusallık testi sonuçları doğrusal olmayan bir tahmin yönteminin kullanılmasının bu analizleri gerçekleřtirmek için daha iyi olacağı sonucunu vermektedirler. Markov modeli doğrusal olmayan tahmin yöntemlerinden biri olduęu için bu çalışma için bu tarz bir model kullanılması yerinde olmaktadır. Merkez bankasının kredibilitesi için iki rejim olduğunu göz önünde bulundurulmaktadır; bunlar düşük ve yüksek kredibiliteli dönemler. 2006 yılında açık enflasyon hedeflemesi politikasına geçildikten sonra yüksek kredibiliteli bir dönem beklenmektedir. Markov Rejimi makroekonomik, finansal ve kurumsal deęiřkenler için ve filtrelenmiş rejim olasılıkları için ayrı ayrı olarak tahmin sonuçlarını vermektedir. Bu çalışmanın literatüre katkısı, ekonometrik sonuçlar temel alınarak deęerlendirildiğinde, enflasyon hedeflemesi politikasının Türkiye ekonomisi için enflasyon hedeflemesi rejimi haline geldiğı sonucuna varılmasıdır. Ayrıca, ekonometrik model sonuçları Merkez Bankasının düşük kredibiliteden yüksek olana doğru, veya tersi, rejim deęiřim davranışları hakkında büyük bir deęiřken grubu için geniş bir zaman aralığında önemli bilgiler sağlamaktadırlar. Bu çalışmanın bir başka katkısı da Türkiye ekonomisinin makroekonomik performans açısından finansal ve kurumsal deęiřkenlere kıyasla oldukça sağlam olduğunu göstermesidir. Diğer ekonometrik model sonuçları, ampirik sonuç bölümünde ayrıntılı olarak verilip tartışılmaktadırlar.

1. INTRODUCTION

After the Oil Crises in 1970s, the world economy suffered serious financial troubles such as the Latin America sovereign debt crisis in 1982 and Stock market crash in 1987. Following them, the Tequila crisis of 1994, the Asian crisis of 1997-1998 showed up. The Global financial crisis of 2007-2008 and the European sovereign debt crisis starting in 2010 have also affected the economies all over the world in a very severe manner. The turmoil in the economies particularly caused distortions in the key macroeconomic indicators such as lower economic growth, higher unemployment, interest, and inflation rate. In the countries facing serious economic and financial problems, the fragility of the financial system was also increased sharply, in particular in the banking sector.

Turkey is one of those countries and in addition to these crises mentioned below, the Turkish economy has also experienced economic troubles particularly related to political disturbances within country; a financial crisis due to high devaluation that caused three digits inflation rates in 1994, 2000-2001 banking and financial crisis cost very expensive to the economy, and the Gezi Park protests in 2013 and 17-25 December investigations in the same year can be also added to them. The effects of the 2001 Turkish financial crisis were extremely harmful to economy that, according to some calculation, the cost of the 2001 crisis was more than TL 251 billion by 2011. This huge amount provides the evidence for the importance of the banking sector soundness for whole economy. The more the banking sector is fragile, the more the Turkish economy has a potential risk for exposure to crisis.

In order to keep the economy solid and deal with these economic and financial disturbances, the role of the monetary authorities has been considerably increased, in particular that of the Central banks. As a consequence of these facts, as a regulator the primary of objective of the Central bank is no longer just to ensure the price stability in the economy, but also to provide a robust financial system for all. In accordance with this purpose, new policies such as macro prudential are adopted. These new monetary tools allow the Central banks to use different methods apart from just printing money. The Central banks are now able to use these new methods in terms of required reserve ratios, liquidity management, policy interest rate and

interest rate corridor in order to run their monetary policies in an accurate way. In addition to these policies, several Central banks also adopted a new policy instrument called the inflation targeting policy in which a Central bank sets and then announces an inflation target rate as a point or interval.

This inflation targeting policy was firstly introduced by New Zealand in 1990 and many countries followed this country such as Canada in 1991 and the United Kingdom in 1992. This expanding interest in the inflation targeting policy might be considered usual because the inflation is accepted one of the most important leading economic indicators showing an economy's soundness. In order to control and decrease the inflation, there are more than 60 countries from different income groups implementing the inflation targeting policy in the world as of 2016. The Central Bank of the Republic of Turkey also adopted an explicit inflation target policy in 2006 in order to better fight against the high inflation rates. In order to conduct such a policy in a proper way, Central Banks should be accepted credible by economic agents whose expectations about the future are shaped by the announcements and if these announcements are not met by the realization then the credibility problem occurs for the policy authority. As a matter of fact, a Central bank is considered credible if people believe it will do what it says.

In order to better understand the facts mentioned above, this dissertation includes three essays related to the Banking sector fragility, the Central bank credibility, the macroeconomic performance, and the financial and institutional indicators for the Turkish economy over the period 1996Q1-2015Q4.

First study investigates the determinants of the Central bank credibility for the Central Bank of the Republic of Turkey. Despite the fact that the measurement of the credibility of any Central bank has been difficult, with this study, after giving detailed definition of the credibility and information on the inflation targeting policy, the credibility of the Central bank is quantified. For that, the credibility index developed by Mackiewicz-Łyziak (2009) is used. This index is employed because it unifies the principal factors affecting the Central bank credibility in the related literature. To calculate a composite credibility index, six sub-indexes are used; Achievement of Announced Monetary Policy Targets, Past Inflation Performance,

Transparency of Monetary Policy, Central bank Independence, Country Risk, and Public Debt. The credibility index is defined in two periods in the purpose of observing the results of the inflation targeting policy over the time in a precise way. The first period corresponds to the pre-inflation targeting policy covering 1996Q1-2005Q4 and the second one is during the inflation targeting monetary policy period dating from 2006Q1 to 2015Q4. As determinants, three variable groups are used in the analysis. The macroeconomic variables consist of six indicators; Real GDP Growth Rate, Inflation Rate, Real Effective Exchange Rate, Short Term Interest Rate and Unemployment Rate and Trade Openness (total export and import to GDP). The financial variables that are used in this study are M2 to GDP, Non-Performing Loans to Total Loans, Loans to Private Sector to GDP and Equity to Total Assets. The institutional variables include Government Effectiveness, Regulatory Quality, Rule of Law and Polity. In this study, in order to define the determinants of the Central bank credibility index, we use the Autoregressive Distributed Lag (ARDL) Bounds test methodology of Pesaran and Shin (1999) and Pesaran et al. (2001) that allows us to deal with the restricted integration order. With the ARDL method, the existence of long-run relationships between the Central bank credibility and the other variables (macroeconomic, financial and institutional) is analyzed. The ARDL model is chosen because it provides reliable results while working on limited samples and allows analyses in long-run and short-run parameters simultaneously. Most of the previous studies investigate the determinants of the credibility with fewer variables. An important contribution of this study to the literature is that with more variables the long-run relationships between the Central bank credibility and the other variables are examined. However, in the literature the credibility is mostly investigated on a yearly basis, in this study all analysis is run on a quarterly basis which provides more accurate information about the developments of the relations throughout time. In addition to that, most of the studies investigate these relations in a short period with Panel data methods, but this study's period covers a longer time period with a time series method. The long-run relationships results between the Central bank credibility and the other variables are given along with the short-run results. Model results are largely found as expected and all econometric outcomes are discussed in a detailed manner in the empirical result section.

The second study examines the relationships between the Banking sector fragility, the Central bank credibility, the macroeconomic performance and the institutions in the Turkish economy over the period 1996Q1-2015Q4. The Central bank credibility has been already calculated in the first study of the dissertation and this index is used. A Banking sector fragility index is constructed for the Turkish economy as a proxy for the financial variable, instead of using the financial variables of the first part. For that, the methodology of Arı and Cergibozan (2016) is employed. In order to build a Banking sector fragility index, three components are used: changes in the ratio of nonperforming loans over bank total loans, bank foreign deposits over bank total deposits, and bank profit (loss) over bank own equity. These ratios are calculated for the deposit banks since they represent about 90 percent of the whole banking sector in the Turkish economy. The same macroeconomic variable group is used, but for the institutional variables, only Rule of Law is employed in the analysis as a proxy of the institutional quality. The Vector Auto-regression (VAR) methodology is used in this study in order to investigate the relationship between the Banking sector fragility, the Central bank credibility, the macroeconomic performance and the institutional quality. This model is chosen because it is easy to estimate and have accurate forecasting capabilities. Moreover, researchers do not have to deal with the specifications of the variables either endogenous or exogenous since they are all endogenous in these models. To examine the effect of a variable shock on other variables and vice versa, random shocks to variables are identified by the Cholesky decomposition method. The impulse response analysis gives information about the direction and magnitude of the effect of a variable on other variables. Developments of these effects throughout time might be considered as important indicators providing useful data for the policy-makers in order to take action in an accurate way. In addition to the impulse response analysis, the variance decomposition method is used in the purpose of defining the percentage of the variation in a variable which is explained by the shock of another one. In this study, the analysis results are particularly discussed for the Banking sector fragility (BSFI) and the Central bank credibility (CRED) for the complementary to the first and third papers of this dissertation. The main contribution of this study is that, to the best of our knowledge, it is a unique paper that brings together the Banking sector fragility, the Central bank credibility, and the macroeconomic indicators along with institutional one. Thanks to this richness in the number of variable, it provides very

valuable information concerning their relations each other for a longer time period. An important finding of this study is that the policy-makers should primarily focus on the interest rate, the reel effective exchange rate and the unemployment rate in order to increase the credibility of the Central bank and decrease the fragility in the banking sector. All of the econometric results are given in the empirical result section in detail.

The third study employs a Markov Regime Switching model for the credibility of the Central Bank of the Republic of Turkey. The Markov Regime Switching models are frequently used in economics in order to define regime changes. Even if the restriction of constant transition probabilities in the early Markov switching models poses serious limitations to researchers, after extending the baseline of the model to time varying transition probabilities, this model starts to be more preferred by many scholars thanks to its conveniences. In a threshold regime switching model, regime switching is determined by the value of observed variables and predefined thresholds. However, in a Markov regime switching model, it is assumed that the unobservable stochastic process is a Markov chain. It is preferred to use Markov regime switching model since we do not need to define any threshold for the regime changes while the Markov model defines these regime changes by itself. We employ this model in order to provide an economic interpretation of the policy behavior of the Central bank in the inflation targeting policy. With this study, it is mainly aimed to examine whether the decision of the explicit inflation targeting policy fosters the Central bank credibility throughout time. Markov Regime Switching Models are run over the period 1996Q1-2015Q4 for three variable groups that are used in the first study of the dissertation; macroeconomic, financial and institutional. The Central bank credibility index is used with these variable groups in order to determine regime changes. For three models, linearity test results demonstrate that using a non-linear estimation method is an accurate way to conduct these analyses. As the Markov model is one of the non-linear estimation methods, it is convenient to use a Markov model for this study. Two regimes are considered for the Central bank credibility, namely, a low credible period and a high credible period, expecting to have a high credible period after passing to the explicit inflation targeting policy in 2006. Markov Regime Switching Model results of macroeconomic, financial and institutional variables are separately represented along with filtered regime probabilities. The principal contribution of this

study to the literature is that based on the econometric results, it is concluded that inflation targeting policy becomes an inflation targeting regime for the Turkish economy. Moreover, the econometric model results supply very precise information about the behavior of the Central bank concerning the regime changes from low credibility to high one, or vice versa, for every variable group for a very large time period. Another contribution is that with this study it is shown that the Turkish economy is quite robust in terms of macroeconomic performance compared to financial and institutional variables. Other econometric models results are given and discussed in the empirical result section with details.



2. THE DETERMINANTS OF THE CENTRAL BANK CREDIBILITY

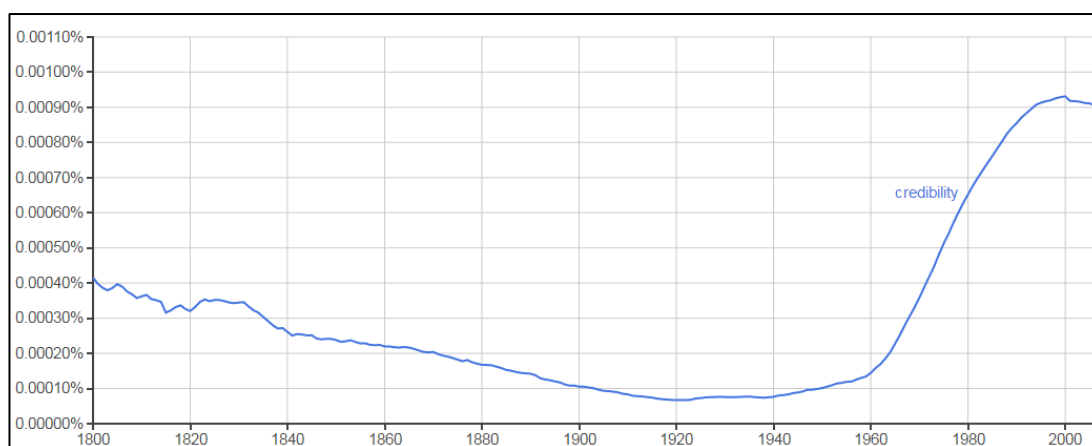
2.1 Definition of the Credibility

This term's origin goes back to the middle of 16th century. Merriam-Webster defines this term as “*The quality of being believed or accepted as true, real, or honest.*” Oxford explains it as “*The quality of being convincing or believable.*”

The term “credibility” has been quite widespread in the economic literature especially since 1980s. After searching economic journals in JSTOR archive, Blinder (1999) reaches 140 articles having the word “credibility” connected to monetary policies or Central banks over the period 1983-1992. When he did the same search for previous 10-year period, just 40 studies could be found and 23 among them were in the 1980s. Blinder (1999) partly attributes this interest in credibility to the rational expectation revolution since he argues that Central bank credibility is convenient while expectations are less than fully rational. Fischer (2015) also emphasizes the development of the modern academic literature on Central bank independence in the late 1980s and the first half of the 1990s.

When someone searches the credibility relevant to the Central bank and monetary policies in the JSTOR journals and books in 2016, more than 100,000 studies come out. It is a major indicator showing how credibility became an important economic concept throughout the history.

Figure 2.1 Frequency of the Use of the Word “Credibility” in Books



Source: Google Books Ngram Viewer

Figure 2.1 provides us with information about this process in order to investigate the historical development of this concept. This figure shows the Google¹ Books Ngram Viewer program results² about the use of the word "Credibility" from 1800 to 2008 in the books. It can be seen in the Figure 2.1 that the usage of the phrase "Credibility" started to rise at a gallop in the late of 1950s then it peaked in 2000 and has been falling steadily since that time. It may be partly because of the new publishing technology easing producing books especially in the form of electronic book (from sheets of Papyrus to e-book). Although there are more books referring to the credibility, the increase in the total book number has been far more than the use of this concept.

When the economic literature on the institutional credibility is examined, financial authorities' credibility is more obvious as they run monetary policies. Cukierman and Meltzer (1986) define the credibility as *"the absolute value of the difference between the policymaker's plans and the public's beliefs about those plans. The smaller this difference is, the higher the credibility of planned monetary policy."*

Fellner (1979) introduces the credibility hypothesis as follows: *"The hypothesis of the credibility effect maintains that market expectations, and thus the effect of past money wage and price increases and of any currently observed slack on current money-wage and price increases, are significantly influenced by the expected future behavior of policymaker."* Barro and Gordon (1983) evaluate the two concepts; *reputation* and *credibility* in the same way. They argue that economic agents' expectations are shaped by the authority announcements and if these announcements are not met by the realization then the credibility problem occurs for the policy authority.

Cukierman (1986) defines the credibility as the deviation between the current announcement and the people's expectation. He also emphasizes the importance of the credibility of the monetary policymakers in order to attain their future goals. And the ability of these future objectives is largely dependent on the people inflation

¹ According to Google, there are nearly 130 million books in 2010.

² Search is made in English corpus. For more information visit <https://books.google.com/ngrams/info>

expectations. At this point credibility plays a crucial role since these inflation expectations depend on the people's evaluation of the credibility of the authorities.

Blinder (2000) mentions that in the academic literature the Central bank credibility is specified by one of them: powerful aversion to inflation, incentive compatibility and precommitment. He agrees on this definition "*A Central bank is credible if people believe it will do what it says.*" Mackiewicz-Łyziak (2009) defines it as "*the ability of the monetary authorities to manage inflation expectations of economic agents.*" Dogan and Bozdemir (2014) consider the credibility as an important instrument for policy makers in order to manage the inflation expectation in inflation targeting regimes. They conclude that high credibility leads to the lower disinflation costs.

There are other researchers who define the credibility almost as previous descriptions. But as for the measurement of the Central bank credibility researchers differ from each other and try to define it in a various perspective. For instance, Bordo and Siklos (2015a) evaluate the credibility by calculating the difference between observed inflation and estimation of the inflation rates while Dogan and Bozdemir (2014) analyze the variation of interest rates.

2.2 Inflation Targeting

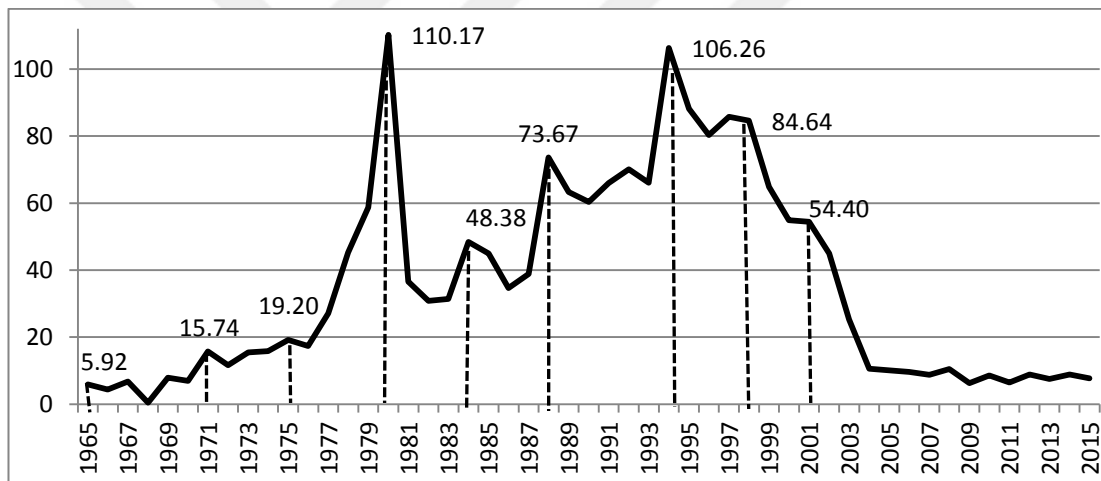
Inflation is one of the most important issues of the economics as it is a prominent indicator showing an economy's soundness. In order to better understand to what extent that inflation causes negative consequences over an economy, the following example may be given: two percent rate of inflation³ might be considered "low" for many economies, however, with this yearly constant pace prices will be doubled in 35 years. This shows why it is so important for an economy especially in a developing economy where high inflation rates are frequently seen.

As a developing economy, Turkey has been also a sufferer from the high inflation, particularly in the years of 1976-2004. Figure 2.2 provides information

³ Geraats (2008) states that the European Central bank (ECB) defines price stability as "a year-on-year increase in the Harmonized Index of Consumer Prices (HICP) for the euro area of below 2%".

about changes in yearly inflation rate over the period 1965-2015. In 1965, inflation rate was about 6% and continued to fluctuate around this rate until 1969. Due to the Oil Crisis in 1970s and the Cyprus Peace Operation in 1974, consumer price index increased at a gallop and this rise brought about a record in the Turkish economic history in 1980 by reaching more than 110%. After the 12 September 1980 Turkish coup d'état, this rate rapidly dropped to about 30%, and then it kept climbing even if there were some declines related to political disturbances. In 1994, inflation rate attained 106% due to the currency crisis, and after this rate, inflation cooled down and it has never been that high. Apart from a few decreases during the crisis periods 1997-1998 and 2001, inflation was tamed to such an extent that in 2004 it was again single digit after about 35 years.

Figure 2.2 Turkish Economy Inflation Rates: 1965-2015 Period



Source: The World Bank, World Development Indicators (WDI).

The control of the inflation becomes a *sine qua non* for economies struggling with the high persistent inflation like Turkey. At this point, it is important to remember Heymann's (1986) statement that says economic activities are seriously disturbed in situations of high inflation. Central banks play a crucial role in controlling inflation since they rule the monetary policies such as inflation targeting policy.

Inflation targeting is defined by Green (1996) as "*a monetary policy framework under which policy decisions are guided by expected future inflation relative to an announced inflation target.*" Roger (2010) states that inflation

targeting countries fix the consumer price index (CPI) as their monetary policy goal. Some countries could determine a point target while others define an interval. From one country to another setting the target rate may vary along with the tolerance interval⁴. For example, for the year of 2016, the Central bank of the Republic of Turkey (hereafter the CBRT) sets a target rate of 5% floating between +/- 2 points meanwhile Canada 2% and +/-1.

Unlike monetary aggregates or regimes aimed at foreign exchange, the inflation targeting regime targets itself directly without using any intermediate targets (Kara and Orak, 2008). For the candidate country, before adopting the inflation targeting regime Batini and Laxton (2006) introduce four “preconditions”; *institutional independence* (Central bank must have a complete autonomy and be free from external pressure such as political), *well-developed technical infrastructure* (Central bank should have adequate forecasting and modeling capabilities along with necessary data), *sound economic structure* (minimal dollarization, solid economy to commodity prices and exchange rates and fully-regulated prices) and *healthy financial system* (well-developed capital markets, sound banking system and financial stabilization to minimize potential problems). In addition to that, Roger and Stone (2005) put forward three principal components for the inflation targeting framework; governance structure, specification of the inflation target and arrangements for policy transparency and accountability.

Inflation targeting regime is first seen in New Zealand in 1990 (Hammond, 2012). With the Reserve Bank of New Zealand Act 1989⁵, the inflation targeting policy was announced and applied as of the beginning of 1990. Just after New Zealand, Canada adopted this policy in 1991 and in the Europe the United Kingdom was the first country accepting it in 1992. Australia and Finland both followed these countries in 1993. Finland, Spain and Slovak Republic abandoned inflation targeting after joining the European Monetary Union (Roger 2010).

⁴ See Appendix A1 for details about targets and tolerance intervals (upper and lower) for the year of 2016.

⁵ See “Monetary Policy” section, Reserve Bank of New Zealand Act 1989. Date of assent is 20 December 1989.

The literature on inflation targeting is vast and in his paper Siklos (2008) notes that a search on Econ Lit results that almost 300 articles or books are written on the topic of inflation targeting over the past 2.5 years alone. In the literature, advantages and disadvantages of inflation targeting have been being discussed by researchers since the first practice of the inflation targeting in New Zealand.

Bernanke et al. (2001) argue that the simplicity and openness of inflation targeting make it far easier for the public to understand the intent and effects of monetary policy. Batini and Laxon (2006) argue that inflation targeting policy ensures more flexibility and could help building credibility with anchoring inflation expectations more quickly and sustainably. They also claim that inflation targeting causes a lower economic cost in case of failure of the monetary policy. Mehrotra and Yetman (2014) believe that adequately anchored inflation expectation could largely contribute to taming actual inflation rates in lots of New Keynesian models. Quinonez (2015) concludes that countries that implement inflation targeting have higher GDP than non-inflation targeting countries over the period 2000-2013. Schmidt-Hebbel (2009) attributes inflation targeting potential effects to inflation levels, output and inflation stability and monetary policy efficiency.

Critics about the inflation targeting state that there are excessive constraints on Central banks. Inflation targeting causes high exchange rate volatility and cannot anchor inflation expectations. Many inflationist measures restrict needlessly the economic growth (Batini and Laxon, 2006). Mishkin (2000) underlines that inflation targeting should not be considered as a panacea for many emerging markets, however, it could be accepted as an appropriate monetary policy strategy for some countries.

It is not surprising to observe many countries shifting to such a monetary policy. Mishkin (2000) states that Latin American and East Asian countries with pegged exchange rate regimes found themselves in massive financial crises in 1990s. This caused emerging market economies to search for nominal anchors and inflation targeting was used by some industrial countries. Quantitative inflation targets serve as the nominal anchor and make possible a high degree of monetary policy accountability (Roger and Stone, 2005).

Mishkin and Schmidt-Hebbel (2007) inform that in 2005 there were eight industrial countries and thirteen emerging economies having full-fledged inflation targeting. According to Odhiambo (2011), this number reached 28 countries in 2010. Dissemination of the inflation targeting was very influential to the extent that as a major Central bank in the world, the Federal Reserve also set an inflation target rate of 2 percent for the US economy under the presidency of Bernanke in 2012. However, Thornton (2012) claims that there was an implicit inflation target before this policy action.

The inflation targeting is considered as a successful monetary policy strategy, as a result of that, regardless of their economic size, a growing number of countries continue to adopt it (e.g. a low income country Uganda in 2011 and a high income country Japan in 2013⁶). According to the Central bank News data, there are more than 60 countries implementing the inflation targeting regime in the world as of 2016.

2.2.1 Inflation Targeting and the Central bank of Republic of Turkey

Turkey adopted an implicit inflation target⁷ in 2002 and switched to an explicit one in the beginning of 2006. Kara (2006) argues that a transition period was necessary for Turkish economy because of the difficulty of the switching to a full-fledged inflation targeting. Economic environment did not seem to be suitable for this kind of policy since especially high actual and previous inflation rates took it more difficult to manage the expectations of the future inflation. Drastic depreciation of the Turkish Lira, costly restructuring of the banking system, fiscal dominance and high debt played also an important role in order to have a transition period (Kara 2006). The deepest economic crisis in Turkish history in February 2001 made it almost impossible to pass through full-fledged inflation targeting. Success stories of other countries on the inflation targeting and scarce of other probable options made

⁶ See Appendix A2 for adaptation dates of other countries for the inflation target regime.

⁷ Kara (2006) defines the implicit inflation targeting as “a period under which inflation targets are announced to the public, but not the regime and its details as such. It involves country acting as if inflation targeting were in place without a formal adoption of the regime.”

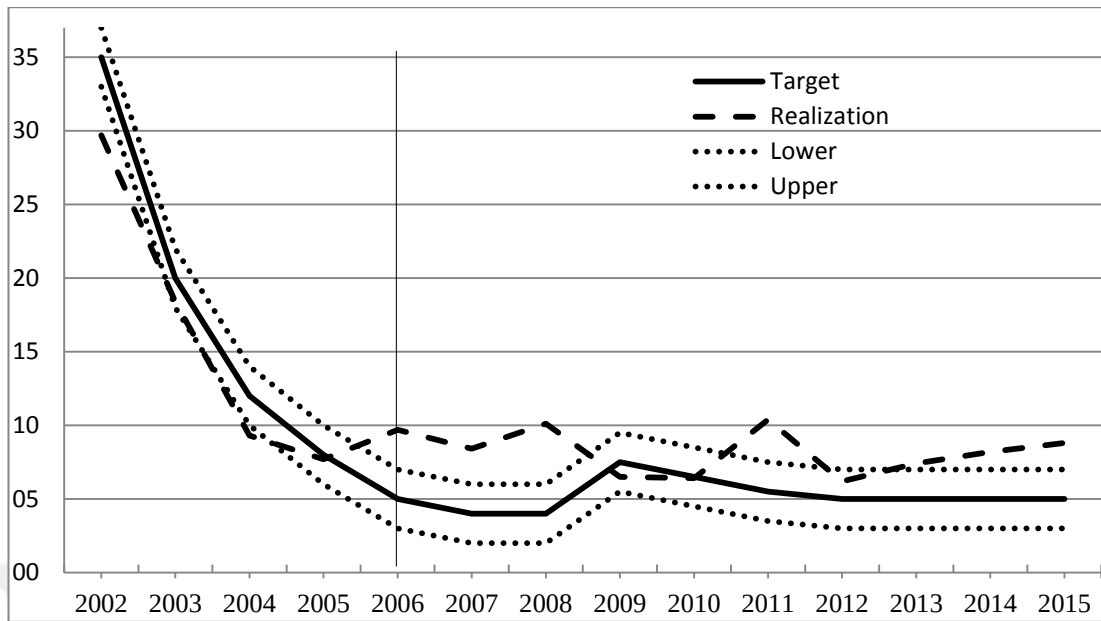
attractive the inflation targeting for the Turkey's monetary policy framework (Kara and Ogunc, 2008).

The CBRT was able to switch to the full-fledged inflation targeting, thanks to improvements in the Turkish economy at the beginning of 2006. During the explicit inflation targeting period, all of the inflation targets were reached, reliability increased and inflation expectations converged to targets. Concern of the sustainability of the public debt stock lost its importance compared to the past. Fear about the sustainability of fiscal discipline greatly diminished. As the depth of financial markets increased, the fragility of the financial sector decreased. These economic recoveries made easier for the Central bank to change from implicit to explicit inflation targeting framework. For the institutional side, the Central bank activated its institutional framework, clarified its communication policy, broadened its information set and improved inflation forecasting methods (CBRT, 2005).

The transition from implicit to explicit inflation targeting brought new liabilities to the Central bank because if the announced target rates cannot be achieved the Central bank is obliged to explain to the public the reason of this failure (CBRT, 2005).

As an inflation targeting country, Turkey has adopted point targets within symmetric ranges for inflation rates. Ranges are usually close to 4 percentage points wide. This is shown in the Figure 2.3. Ranges might be considered as a tolerance interval for the achievement of the target. In order to calculate one part of the Central bank credibility these intervals are used as a criterion of the success of the committed targets.

Figure 2.3 provides information about the target and actual inflation rates. Between 2002 and 2006, decline in the inflation rates was dramatic (35% in 2002 against 5% in 2006). During the implicit inflation targeting period, target rates stay above the current inflation rates until the year of 2005 in which decrease in the current inflation is slower than that of target rate.

Figure 2.3 The CBRT Inflation Target Rates and Inflation Realizations

Source: The CBRT, Upper and Lower curves represent the target rate plus or minus 2 percentage points, respectively.

As it might be clearly seen on the Figure 2.3, with the year of 2005 current inflation rate surpasses the target rate and this situation keeps going until the 2008-2009 Global crisis period in which actual inflation rates stay again under the targets. After that period, inflation target rates always move above the target inflation rates except from tolerance interval. To summarize, during the implicit period, the CBRT has some success in keeping current inflation rates equal or below the target inflation rates thanks to the tendency of quick decline in current inflation rates. After 2005 target rates are set under the actual rates throughout the explicit inflation targeting period apart from Global financial crisis years.

2.3 Literature on the Credibility

Cukierman and Meltzer (1986) develop a positive theory of credibility based on objective function. They explore the implications of this informational advantage for inflation and the credibility of the policymaker when the policymaker maximizes his own objective function and investigates the relationship between the structure of the policymaker's objectives and his credibility. They also characterize the credibility as the speed with which the public is convinced that new policies have been adopted

when this is the case. Their main result is that policymakers with relatively unstable objectives tend to be more ambiguous and less credible.

Giavazzi and Pagona (1988) work on the Central bank credibility in the European Monetary System⁸ (EMS). They conclude that the EMS membership brings potentially large credibility gains to policy makers in inflation prone countries.

Sibert and Weiner (1988) argue that the credibility problem occurs if the public is skeptical about the Central bank's intention to pursue non-inflation monetary policies. As a result of that, the credibility of a Central bank's commitment to price stability can be undermined by the public perceptions that keeping unemployment at an unrealistically low level is an overriding goal of monetary policy.

Marlow (1991) claims that the credibility is related to the predictability, however, it is difficult to be defined. He tries to examine the hypothesis that the predictive ability of money is affected by Central bank policy for the American economy. As a test of this hypothesis, he analyzes the predictive ability of money in the 1960s, 1970s, and 1980s. He concludes that differences in money growth variability and predictability reflect differences in credibility; the 1970s was a period of relatively high Central bank credibility, in contrast, the 1960s and 1980s appear to be periods characterized by relatively low credibility.

Cottarelli and Giannini (1997) investigate the credibility of monetary policy in the Post-Bretton Woods era. They point out four strategies in order to achieve credibility; (1) delegation of monetary policy to an independent Central bank, (2) increased transparency of the monetary policy process and inflation targeting, (3) greater reliance on an outside source of credibility, and (4) a heavy front-loaded investment in anti-inflationary reputation on the part of monetary authorities.

Ferderer (1998) examines the impact of several different factors on the credibility of the Federal Reserve's (FED) monetary targets. He reached to two

⁸ A former European monetary cooperation.

factors that explain why the targets became less credible during the 1980s; the Fed's shift from M1 to M2 targets reduced credibility because the latter aggregate is less controllable, and velocity instability caused the Fed to widen the target ranges and this action signaled that they were placing less weight on monetary targets in the conduct of monetary policy.

Blinder (2000), in his seminal work, conducts a survey⁹ among Central bankers and economists in order to determine their attitudes on two important subjects; why credibility matters and how credibility can be built. This survey contains 17 questions and each respondent answers by selecting a number on the five-point scale. He sends this questionnaire to the heads of 127 Central banks being member of the Bank of International Settlement (BIS), and 84 of the 127 banks respond. He also sends a substantially identical questionnaire to a similarly sized sample of academic economists¹⁰ who specialize in monetary economics or macroeconomics and 55 out of 115 respond. When Central bankers and economists evaluate methods of building or creating credibility their views get closer. With this study, he finds that greater credibility makes disinflation less costly and helps hold down inflation.

The linkage between the credibility, expectations, and disinflation is accurately explained by Huh and Lansing (2000)¹¹. They state that credibility has an important effect on expectations and the dynamics of disinflation. When the Central bank benefits from a high degree of prior credibility, agents who are rational lower their inflation expectations in response to the declared change in the inflation target. This change in expectations helps to lower current inflation and hence contributes to a faster and less costly disinflation period. However, when prior credibility is low, agents' expectations respond only gradually as they become convinced of the Central bank's commitment to reducing inflation.

⁹ This survey's questionnaire is given in the Appendix A8.

¹⁰ The sampling frame was all members of two National Bureau of Economic Research (NBER) programs: Economic Fluctuations and Growth and Monetary Economics. Program members are chosen by the NBER based on the recommendations of other program members.

¹¹ They use a version of the Fuhrer-Moore model in order to study the effects of expectations and Central bank credibility on the economy's dynamic transition path during a disinflation with the data running from 1965:1 to 1996:4.

Faust and Svensson (2001) examine the credibility, transparency and reputation in a model. Their conclusions about the credibility are as follows; a low-credibility bank, everything else equal, should conduct a less expansionary policy than a high-credibility bank, a low-credibility bank has less flexibility to respond to shocks in order to avoid further erosion of credibility, and increased transparency increases credibility and improves policy outcomes.

Cecchetti and Krause (2002) construct an index (CI) based on the difference between the expected inflation $E(\pi)$ and target inflation π_t in order to quantify the Central bank credibility. The index values run from 0 (no-credibility) to 1 (complete credibility).

$$CI = \begin{cases} 1 & \text{if } E(\pi) \leq \pi_t \\ 1 - \frac{1}{0.20 - \pi_t} (E(\pi) - \pi_t) & \text{if } \pi_t < E(\pi) < 0.20 \\ 0 & \text{if } E(\pi) \geq 0.20 \end{cases}$$

where $E(\pi)$ is expected inflation, π_t means target inflation and 0.20 is a threshold. If the expected inflation exceeds this threshold then CI becomes zero. When the expected inflation is equal or lower than the target inflation, in this case CI gets 1 point. And finally, if the expected inflation stays between the threshold value and the target inflation CI has values in a linear way as it is marked in the formula.

Stella (2005) emphasizes the importance of the credibility of policy in theory and practice. He notes that there are three key issues about the credibility; adopting the right objective function, enabling the attainment of the objective, and being transparent.

Geraats (2008) studies the credibility of the European Central bank (ECB) over the period 1999 to 2007. She calculates the credibility according to the ECB's criterion of 2% inflation rate over the medium term. She points out that to achieve price stability the credibility of ECB is decreased, and the inflation experience of the euro area has a negative effect on medium and long term inflation expectations. In

her paper, it is also stated that with the high transparency about the ECB's objectives and decision-making this credibility problem can be overcome. The credibility of the ECB is also studied by Eijffinger (1997) for 12 member countries with the Latent Variable Method (LVM). He finds that there is a gain in terms of independence while lowering conservativeness of the ECB.

An alternative credibility index generated by De Mendonça (2007) is based on the earlier credibility index formed by Cecchetti and Krause (2002). The novelty of this index is that it includes the target inflation with the tolerance intervals together. The index values range from 0 (no-credibility) to 1 (full credibility). This index is formulated as follows:

$$CI = \begin{cases} 1 & \text{if } E(\pi) = \pi_t \\ 1 - \frac{1}{\pi_t^* - \pi_t} (E(\pi) - \pi_t) & \text{if } \pi_{t \text{ Min}}^* < E(\pi) < \pi_{t \text{ Max}}^* \\ 0 & \text{if } E(\pi) \geq \pi_{t \text{ Max}}^* \text{ or } E(\pi) \leq \pi_{t \text{ Min}}^* \end{cases}$$

where $E(\pi)$ is expected inflation, π_t means target inflation, and $\pi_{t \text{ Max}}^*$ and $\pi_{t \text{ Min}}^*$ represent maximum and minimum values for the target rates. According to this formula, the credibility index has a value equal to 1 when the annual expected inflation $E(\pi)$ is equal to the inflation target π_t and decreases in a linear way while inflationary expectation deviates from the announced target.

Taking into consideration the tolerance interval in order to better show the Central bank success, De Mendonça and Souza (2009) develop another credibility index and with the help of this index formula they also calculate a reputation index¹². They note that the empirical evidence of their study confirms the hypothesis that higher credibility implies lower variations in the interest rate for controlling inflation. Their index is given in the following formula:

¹² De Mendonça and Souza (2009) claim that the credibility indices based on reputation represent an alternative in the cases where the series of inflation expectation are not available.

$$CI = \begin{cases} 1 & \text{if } \pi_{t \text{ Min}}^* \leq E(\pi) \leq \pi_{t \text{ Max}}^* \\ 1 - \frac{1}{0.20 - \pi_{t \text{ Max}}^*} (E(\pi) - \pi_{t \text{ Max}}^*) & \text{if } \pi_{t \text{ Max}}^* < E(\pi) < 0.20 \\ 1 - \frac{1}{-\pi_{t \text{ Min}}^*} (E(\pi) - \pi_{t \text{ Min}}^*) & \text{if } 0 < E(\pi) < \pi_{t \text{ Min}}^* \\ 0 & \text{if } E(\pi) \geq 0.20 \text{ or } E(\pi) \leq 0 \end{cases}$$

The value of 20% used in *CI* as a limit for the loss in credibility is provided from the threshold value of Cecchetti and Krause (2002). De Mendonça and Souza (2009) attribute the value of 0% to Svensson (2000) by considering critical value for a loss in credibility is based on the argument that a null or negative inflation implies the risk of reducing output or increasing unemployment. They also argue that the combination of fixed critical values with flexible provides an asymmetrical framework which is useful in the measurement of credibility.

Mackiewicz-Łyziak (2009) proposes a new measure of Central bank credibility. She calculates a credibility index on the basis of key determinants of the literature related to the Central bank credibility. The components of the credibility consist of “Achievement of Announced Monetary Policy Targets”, “Past Inflation Performance”, “Transparency of Monetary Policy”, “Central bank Independence”, “Central bank Accountability”, “Country Risk”, and “Public Debt”. This index is quantified for the years from 1999 to 2007 for nine countries: Czech Republic, Hungary, Slovakia, Poland, Chile, Brazil, Turkey, United Kingdom and Sweden. With this study, Mackiewicz-Łyziak (2009) concludes that the credibility index may be considered a relevant and consistent credibility measure and it offers advantage of being fully comparable between countries. This methodology is explained in detail in the Construction of the Central bank Credibility Index section.

Before this study, Łyziak et al. (2007) analyze transparency and credibility of the National Bank of Poland's (NBP) monetary policy under the inflation-targeting regime in the period 1998–2004. They reached a conclusion that Central bank transparency and credibility are closely related. As it is suggested in the literature, higher transparency should lead to higher credibility; it is confirmed by this empirical study. They measure credibility of the monetary policy as the deviation of

inflation expectations from the Central bank inflation target or forecast. This study is studied again by Łyziak (2013) for a longer period (1998-2012) and with this update he confirms that inflation expectations of enterprises and especially of financial sector analysts show a high degree of anchoring at the NBP inflation target.

Another credibility index is proposed by Browne and Kelly (2010) for the monetary union the period 1984Q1 to 2009Q4. This index is based on the ECB's performance in maintaining price stability relative to the respective member states' inflation experiences from the legacy monetary inflation regimes of the past. Their credibility index is formed as follows:

$$CI = \frac{P_{t+i}}{P_{t+i-60}} * 100$$

According to the equation, credibility is the ratio of the price level at any point in time in monetary union relative to what it was 60 quarters previously. For a Central bank that is perceived as credible in its declared objective of price stability, this index would fall systematically since the start of the new monetary regime which was also the start of monetary union. With this study Browne and Kelly (2010) argue that the credibility has a highly important and sizeable effect on income velocity in member states. They also conclude that if inflation fighting credibility is lost temporarily, it is hugely important to re-establish it as soon as possible.

Dogan and Bozdemir (2014) investigate the relationship between the credibility and the interest rates in Turkey over the period 2004-2012. They employ nine credibility indices in their paper in order to get empirical evidence supporting the claim that higher credibility leads to lower variations in interest rates of both monetary policy and the market. They also conclude that the credibility index proposed by Cecchetti and Krause (2002) is the most reliable measure for explaining the variations in both monetary policy interest rate and market interest rate.

Levieuge et al. (2015) propose a new Central bank credibility index for 18 emerging economies¹³ including Turkey in the period 1990-2007. This index is a time-varying measure of Central bank credibility based on the gap between inflation expectations and the official inflation target. They also investigate the existence of a negative effect of credibility on the volatility of the short-term interest rate with the Exponential Generalized Auto-regressive Conditional Heteroskedacity (EGARCH) model, and this existence is proved in their study. Taking into consideration the expectations channel of monetary policy, they conclude that the higher the credibility of the Central bank, the lower the need to move its instruments to efficiently fulfill its objective. For their study, they define this new credibility index in terms of inverse quasi LINEX¹⁴ function for different cases and their calculation equations change according to the target feature (point target or range). In equations, $\bar{\pi}$ means the target rate, π^e stands for expected inflation, and $\bar{\pi}^e$ is the deviation between π^e and $\bar{\pi}^e$. Two cases are given as follows:

$$CI_1 = \begin{cases} 1 & \text{for } \pi^e < \bar{\pi} \\ \frac{1}{\exp(\bar{\pi}^e) - \bar{\pi}^e} & \text{for } \pi^e \geq \bar{\pi} \end{cases}$$

In the first case, the inflation rate is a point target and it is considered that $\pi^e < \bar{\pi}$ does not lead to a loss in the credibility. The above formula gives the results between 0 and 1; non-credibility and full-credibility, respectively.

$$CI_2 = \begin{cases} \frac{1}{\exp(\pi^e - \bar{\pi}^{\min}) - (\pi^e - \bar{\pi}^{\min})} & \text{for } \pi^e < \bar{\pi}^{\min} \\ 1 & \text{for } \pi^e \in [\bar{\pi}^{\min}, \bar{\pi}^{\max}] \\ \frac{1}{\exp(\pi^e - \bar{\pi}^{\max}) - (\pi^e - \bar{\pi}^{\max})} & \text{for } \pi^e > \bar{\pi}^{\max} \end{cases}$$

¹³ Those countries are Brazil, Chile, Colombia, the Czech Republic, Guatemala, Hungary, Indonesia, Israel, Mexico, Peru, the Philippines, Poland, Romania, Slovakia, South Africa, South Korea, Thailand, and Turkey.

¹⁴ The asymmetrical LINEX loss function (partly LINear, partly EXPonential). See Zellner (1986).

In the second case, the target inflation rate is in a range and it is considered that $\pi^e < \bar{\pi}$ leads to a loss in the credibility. It also produces the values between 0 and 1.

Papadamou et al. (2014) try to define determinants of the Central bank credibility with the help of the vector autoregressive approach on panel data (PVAR). For that, they employ the credibility index proposed by Mackiewicz-Łyziak (2009). Their sample period runs from 1997 to 2007 for six emerging economies: Brazil, Chile, the Czech Republic, Hungary, Poland, and Slovakia. With this study, they find that the favorable effects of credibility could be connected mostly to achieved targets and past inflation. It is also stated that a higher level of credibility is related to a positive influence on economic activities.

Tablo 2.1 Selected Articles on the Credibility

Author	Measurement	Sample and Period	Method	Result
Kunter and Janssen (2002)	The credibility of Central banks and inflation targeting.	Inflation targeting countries and EU members. Whole period: October 1960 to December 1997.	Panel Data	They conclude that perception of the people about the Central bank's previous performance and its willingness for fighting against inflation are important indicators for Central bank credibility.
Calderón et al. (2004)	The cyclical properties of macroeconomic policies and the credibility.	Eleven emerging market economies and Chile. 1996-2002 and 1991-2003 for Chile	Panel Data and Time Series	Higher credibility allows conducting countercyclical fiscal and monetary policies; however, less credible policies cause greater cyclical surges.
Cowan and Do (2003)	The determinants of foreign currency liabilities and Central bank credibility.	Latin America, East Asia, and Eastern Europe countries. 1990-1997 and 1993-2001	Signaling Model	Less credible Central banks can have high levels of dollarization. In this situation, it makes difficult to keep monetary policy stable and makes costly to restore credibility.
Waller and Haan (2004)	The determinants of credibility and transparency of Central banks.	Participants in Ifo's World Economic Survey for seven Central banks. December 2003.	Survey	Credibility is important to have price stability at low cost. Gaining credibility depends on history of honesty and a high level of Central bank independence. FED is the most credible, transparent and independent among seven Central banks.
Tanuwidjaja and Choy (2006)	The Central bank credibility and inflation targeting.	Indonesia. 1983Q1 to 200Q4.	Time Series	For the Indonesian Central bank, it is important to foster its credibility in order to get lower inflation rates.

Table 2.1 Selected Articles on the Credibility (Continued)

Author	Measurement	Sample and Period	Method	Result
Demir and Yigit (2008)	The credibility performance and inflation targeting.	The United Kingdom and New Zealand. 1993 for the United Kingdom and 1990 for the New Zealand; to 2005.	State Space Estimation and Kalman Filter Method	Credibility depends on how much attention the public pays to target announcements. Accuracy and frequency of inflation announcements have a positive impact on people's perception.
Demertzis et al. (2008)	The sensitivity of inflation expectations and credibility.	The United States. 1963 to 2007.	Vector Autoregressive (VAR) Model	The credibility is regained in 1980s and inflation expectations are unanchored in 1970s.
Davis (2012)	Past observations of inflation and the public's perception of the Central bank inflation target.	The United States, the United Kingdom, Canada, Norway, Switzerland and Sweden. Different time periods from 1965 to 2007.	Structural VAR	Past observations of inflation could affect the public's perception of the Central bank inflation targets with future expectations. In limited credibility model, the volatility of long-run inflation expectations can be matched.
Moreira (2012)	Central bank credibility, shocks and inflation targeting.	-	Stochastic Autoregressive Dynamic Model and Small Numeric Simulation	The greater the credibility level is, the lower its sensibilities to the observed deviations are.

Table 2.1 Selected Articles on the Credibility (Continued)

Author	Measurement	Sample and Period	Method	Result
Gerlach-Kristen and Moessner (2014)	The credibility, the global financial crisis, the European debt crisis and monetary policies.	The Euro Area, the United Kingdom and the United States. July 2004 to September 2013.	VAR Model	For those economies, the Central bank credibility stays intact even if there are large rises in their balance sheets, stemming from unconventional monetary policy measures.
Mammadov (2014)	The Central bank credibility and dynamics of inflation persistence.	20 countries. Quarterly data for the period 1980-1998.	Panel Time Series Methods	The Central bank autonomy and Central bank interventions play a role in level of inflation persistence.
Kupfer (2015)	Svensson's (1993) test of inflation target credibility by applying it to the European Central bank (ECB)'s credibility.	Seven European bond pairs (Nominal and Inflation-linked). French debt agency and German debt agency. Maturity from 2016 to 2040.	Bai-Perron Multiple Breakpoint Test	The ECB's credibility can be confirmed during calm financial times. Svensson's (1993) test is applicable during relatively calm times but does not work properly during the recent financial and sovereign debt crisis.
Kril et al. (2016)	Credibility in the economic predictions of the Bank of Israel.	Israel. Data collection: May 16-July 14, 2011.	Factor Analysis	Public perception of the Central bank provides three principal factors; professionalism (including freedom from political involvement), transparency, and social awareness and Innovation. Between them, only professionalism predicts the credibility while others do not.

Siklos and Bordo (2015b) calculate the credibility for a large group of both advanced and emerging countries from 1980 to 2014 with the Panel estimations. They conclude that financial crises decrease the Central bank credibility and sound institutions lead to increase credibility while economics shocks such as 2007-2008 financial crisis. As a determinant, the volatility index (VIX¹⁵), adopting an inflation target and the Central bank transparency are found to be very important. For their study, they construct a new measure of credibility as a function of the differential between observed inflation and some estimate of the inflation rate that the Central bank targets. Their preferred definition of Central bank credibility is given in the following functions:

$$\begin{aligned} CRED_t &= (\pi_{t+1}^f - \pi_t^*), \text{ if } \pi_t^* - 1 \leq \pi_{t+1}^e \leq \pi_t^* + 1 \\ CRED_t &= (\pi_{t+1}^f - \pi_t^*)^2, \text{ if } \pi_t^* - 1 > \pi_{t+1}^e > \pi_t^* + 1 \end{aligned}$$

where π_{t+1}^e is expected inflation for the year ahead which is proxied by π_{t+1}^f , and π_t^* is the proxy for the time-varying inflation objective or target. These equations calculate the credibility with a forward-looking measure and as it can be seen in the formula¹⁶ that if the deviations are small then the credibility is improved. They also quantify the credibility with a backward-looking measure as follows:

$$\begin{aligned} CRED_t &= (\pi_t - \pi_t^*), \text{ if } \pi_t^* - 1 \leq \bar{\pi}_t \leq \pi_t^* + 1 \\ CRED_t &= (\pi_t - \pi_t^*)^2, \text{ if } \pi_t^* - 1 > \bar{\pi}_t > \pi_t^* + 1 \end{aligned}$$

where $\bar{\pi}_t$ is a moving average of past inflation (2-5 years). With this equation, the credibility is calculated by how far inflation outturns are from what the Central bank, in principle, believes is the medium-term inflation objective.

¹⁵ Wikipedia explains VIX as the ticker symbol for the Chicago Board Options Exchange (CBOE) Volatility Index, a popular measure of the implied volatility of S&P 500 index options, calculated and published by the CBOE.

¹⁶ The penalty for missing the target is greater when expectations are exceeded the $\pm 1\%$ interval than when forecasts miss the target inside the target range. A smaller penalty is reached when the gap between the inflation target and expectations produces small deviations from an inflation target to have trivial effect on the credibility.

When Bordo and Siklos (2015b) use either π_{t+1}^f or $\bar{\pi}_t$, their result does not change. They also define determinants of the credibility in terms of macroeconomic, financial, and institutional indicators. Macroeconomic indicators include real GDP growth and real exchange rate; financial variables consist of the term spread, the rate of change in housing prices, the growth of private sector credit, equity returns, and indicators of non-performing loans, credit risk, capital adequacy, risk premium on loans, and VIX; and institutional indicators cover the rule of law, voice and accountability, political stability, adopting inflation targets and the level of Central bank transparency. Their final model is as follows:

$$CRED_{it} = f(ECON_{it}, FIN_{it}, INST_{it}) + \varepsilon_{it}$$

In this study, with more variables related to macroeconomic, financial and institutional variables, the same model that tries to determine the Central bank credibility for the CBRT is used, after calculating the credibility index based on the paper of Mackiewicz-Lyziak (2009).

2.4 Construction of the Central bank Credibility Index

Despite the fact that the measurement of the credibility of any Central bank has been difficult, some researchers have tried to quantify it in a different aspect such as Cukierman and Meltz (1986), Blinder (2000), Cecchetti and Krause (2002), de Mendonça (2007), de Mendonça and Souza (2009), Mackiewicz-Lyziak (2009), Levieuge et al. (2015), Bordo and Siklos (2014, 2015a, and 2015b). A detailed study on the Central bank credibility is given under the section titled “Literature Review”.

In this study, the credibility index developed by Mackiewicz-Lyziak (2009) is referred as a Central bank credibility index for the CBRT. This index is chosen since it is formed by the principal factors of the Central bank credibility proposed in the related literature and it largely captures the Central bank credibility for the Turkish economy over the years 1996-2015. It has also been a sound indicator showing off the effects of the Central bank inflation targeting policy.

Mackiewicz-Łyziak (2009) uses Blinder's study (2000) as a starting point in order to put together principal characteristics which are likely to contribute to the Central bank credibility. Mackiewicz-Łyziak (2009)¹⁷ measures the credibility index for nine countries¹⁸ over the 1999 to 2007 period. In order to calculate the Central bank credibility index, she employs seven sub-indexes; *Achievement of Announced Monetary Policy Targets*, *Past Inflation Performance*, *Transparency of Monetary Policy*, *Central bank Independence*, *Central bank Accountability*, *Country Risk* and *Public Debt*. Number of these credibility sub-indexes may vary from one study to another, for instance Papadamou et al. (2014) make use of six of them for their study by eliminating the Central bank Accountability sub-index.

Due to limited availability of data¹⁹, in this study only six sub-indexes are used dropping the Central bank Accountability sub-index, in order to calculate the Central bank credibility index for the CBRT over two periods with quarterly data²⁰. In consideration of the application of the explicit inflation targeting policy in 2006, numbers of sub-index used in this study are 5 and 6 for the 1996-2005 and 2006-2015 period, respectively. The latter period includes the Achievement of Announced Monetary Policy Targets sub-index. The credibility index is separately investigated in order to better observe the results of the inflation targeting policy over the time. The credibility index values range from 0 to 100. While 0 means no credibility, 100 denote the complete credibility.

¹⁷ For *Transparency of Monetary Policy*, *Central bank Independence* and *Central bank Accountability*, Mackiewicz-Łyziak (2009) uses the methods of the measurement developed by Fry et al. (2000). See Appendix A3, A4 and A5 for the questionnaires of the measurement.

¹⁸ Czech Republic, Hungary, Slovakia, Poland, Chile, Brazil, Turkey, United Kingdom and Sweden.

¹⁹ To the best of our knowledge, there are no data covering the Central bank Accountability for the CBRT over the period 1996-2015.

²⁰ All of the data are obtained from the CBRT, International Monetary Fund - International Financial Statistics (IMF-IFS) database and Oxford Economics. Quarterly data are used, and if necessary, yearly data are converted into quarterly.

2.4.1 Components of the Central bank Credibility Index

In this section, previously mentioned six sub-indexes are explained in detail beginning with the Achievement of Announced Monetary Policy Targets to construct the Central bank credibility index. CI_n defines the n^{th} Credibility Sub-Index calculated according to the related sub-index formula.

2.4.1.1 Achievement of Announced Monetary Policy Targets

A Central bank can set an inflation target with a point target or a range. How much the actual inflation rate varies from the targeted level is an important indicator for the performance measures. It is obvious that the larger the variation is, the larger the effects are on the credibility.

Blinder (2000) claims that the most important way to establish credibility stems from *the history of honesty*. By saying “*have a history of doing what it says it will do*” he emphasizes the importance of being consistent with the announced targets for a Central bank. Being consistent -or at least trying to be- with the declared targets is the first part of the Central bank credibility index that is given in the following function:

$$CI_1 = \frac{1}{2}(\text{percent of time in target}) + \frac{1}{2} \left[\frac{100}{e^{0.5|\text{actual}-\text{target}|}} \right]$$

where *actual* refers to the actual inflation rate, *target* means the targeted inflation rate in the tolerance interval for the corresponding period. CI_1 ²¹ consists of two equally weighted parts. First part of the function represents the percentage of time in which the target achieves to stay in the tolerance interval. To give an example, for the year of 2015, the CBRT set the target inflation rate at 5% within the range +/-2 points. It indicates if the actual inflation exceeds 7% then the *percent of the time in*

²¹ In this study, CI_1 is constructed over only 2006-2015 period in which explicit inflation targeting policy is used. Data about the inflation target rates are gathered from the CBRT. Inflation data based on quarters of the year are provided by IMF for Turkey and the developed countries.

target value²² will be zero and it cannot contribute to the CI_1 . The same is true for the rates under the 3%.

Second part measures the deviation from the target level. We calculate the quarterly observations²³ of the absolute value of the deviation of the actual inflation minus the targeted inflation rate. In this non-linear form, it indicates that the more *actual inflation rate* is close to target the more *the Central bank performance* increases. Kia and Patron (2004) use this kind of non-linear form in order to construct the market based monetary policy transparency.

Kynland and Prescott (1977) define the concept of the time inconsistency as the deviations from the previously announced policy. These deviations play a significant role in the credibility problem since economic players make their future decisions based on these announced policies. If there is a persistent difference between the announcement and the realization, it is no longer sustainable for a policy. Like Kynland and Prescott (1977), Calvo (1978) also studies the time inconsistency problem and he stresses that under perfect foresight optimal monetary policy is bound to be time inconsistent. He also argues that if the positive government consumption enters into the government's objective function, and income affects the demand for money, time inconsistency could arise even when money supply is constrained to be constant over time.

Barro and Gordon (1983) mention the repeated interaction between policymakers and private agents and argue that if a policymaker set a higher inflation than people's expectation, somehow people increase their expectations about the future inflation. That situation makes it difficult for the Central banks to handle with the previously announced inflation rates.

²² For this study, quarterly data are used and to calculate this part of the credibility index monthly CPI is employed. If in a quarter period actual inflation rate stays in the tolerance interval; for 3 months it gives 100 points, 2 months 66.6 points, 1 month 33.3 points and if it does not stay within the range during 3 months, it generates 0 point.

²³ The CBRT announces the yearly inflation targets and in the study these targets are used as quarterly targets for a given year.

Ammer and Freeman (1995) state that having information about the policy could help firms and consumers make their future choices appropriately and thus there would be better economic outcomes. Papadamou et al. (2014) call attention to the effectiveness of monetary policies such as disinflation policy since the Central bank credibility is a prominent factor to run this kind of policy in an effective way. In addition to that, setting targets at applicable levels and accordingly minimizing the variation become very crucial in order to keep credible a Central bank.

2.4.1.2 Past Inflation Performance

Mackiewicz-Łyziak (2009) argues that past inflation performance is one of the most important factors influencing the Central bank credibility. If a Central bank is successful at fighting inflation then it has a superior credibility among the economic agents.

Cecchetti and Krause (2002) construct a policy credibility index based on Svensson (2000) credibility index. They take into account the deviations of expected inflation from the Central bank target level and assume that there is no credibility in the case of inflation expectation higher than 20%. Mackiewicz-Łyziak (2009) employs this index by changing *target inflation level* to *developed countries inflation rates* and *expected inflation rates* to *average inflation in a given country*. She also defends that inflation cannot be determined by only the internal factors; there are external factors that play a part in the inflation process. She takes foreign inflation into consideration and includes developed countries average inflation rates in the equation. The developed countries average inflation rates are chosen since they are low and stable compared to other country groups and it is also assumed that if these rates are high then their impact on the credibility will be stronger due to excessive variation.

To calculate the CBRT past inflation performance in consideration with the developed countries inflation rates the following formula is used:

$$CI_2 = \begin{cases} 0 & \text{for } \bar{\pi}_t \geq 20 \\ 100 - \left(\frac{100}{20 - \bar{\pi}_t^{dev}} \right) \cdot (\bar{\pi}_t - \bar{\pi}_t^{dev}) & \text{for } \bar{\pi}_t^{dev} < \bar{\pi}_t < 20 \\ 100 & \text{for } \bar{\pi}_t \leq \bar{\pi}_t^{dev} \end{cases}$$

where $\bar{\pi}_t$ presents the average inflation rate in Turkey over the past three years, $\bar{\pi}_t^{dev}$ means the average inflation rate in the developed countries over the previous three year and the value of 20 expresses an inflation at the rate of 20 percent as a threshold value.

According to the this formula, if the average rate of inflation in Turkey during the past three years passes beyond 20% then CI_2 takes 0. If the average inflation in Turkish economy remains between 20% and the average inflation rate in the developed countries, CI_2 gets value depending on the variation. It implies that the higher the gap is the lower the credibility index. When the average inflation rate in Turkey stays below that of the developed countries, CI_2 becomes 100.

2.4.1.3 Transparency of Monetary Policy

Eijffinger and Greaats (2006) define the transparency as "*the extent to which Central banks disclose information that is related to the policymaking process.*" Greaats (2002) distinguishes five aspects of the transparency; *political transparency* (openness about policy objectives, like explicit inflation targets), *economic transparency* (disclosure of economic data, models and Central bank forecasts), *procedural transparency* (information about the monetary policy strategy and internal policy deliberations, for instance through the release of minutes and voting records), *policy transparency* (communication of policy decisions, like changes in the interest rate, and statements about likely future actions), *operational transparency or market transparency* (openness about the implementation of policy decisions, market interventions and control errors).

Łyziak et al. (2007) point out that high transparency of the monetary policy with the improvement of communication ways conducts to better predictability of policy implementations. The transparency of the monetary policy is considered as an important element influencing the Central bank credibility.

Fry et al. (2000)²⁴ try to quantify the Central bank transparency with a survey about the information issued by Central banks that improves the public comprehension concerning the Central bank future policy. Chortareas et al. (2002), Eijffinger and Geraats (2006)²⁵ and Crowe and Meade (2008)²⁶ also construct a transparency index based on a survey.

In her study Mackiewicz-Łyziak (2009) quantifies the transparency with the use of the index suggested by Fry et al. (2000) since thanks to 94 respondent Central banks participating in their study it is a comprehensive index covering major perspectives of the credibility. This seminal work of Fry et al. (2000) on the measurement of the transparency is used by many researchers.

In this study, the transparency index developed by Dincer and Eichengreen (2007 and 2014²⁷) is used. In September 2015²⁸, their data period is expanded to 2014²⁹ with 120 Central banks including the CBRT. They observe an increase in the transparency of the Central banks throughout the analysis period. This index is chosen because of the data time range and its comprehensive aspects about the transparency. The index takes values from 0 to 100 points. The third credibility sub-index is thus formed as follows:

²⁴ See Appendix A3 for the Questionnaire of the Transparency Measure prepared by Fry et al. (2000).

²⁵ Eijffinger and Geraats (2006) construct an index for nine major Central banks by providing a Central bank transparency index over the years 1998-2002. See Appendix A6 for the survey of the Transparency Measurement constructed by Eijffinger and Geraats (2006).

²⁶ Crowe and Meade (2008) construct their index on the studies of Fry et al. (2000) and Eijffinger and Geraats (2006). Their measure of transparency covers 37 Central banks.

²⁷ For their index, they use a survey which is similar to the index of Crowe and Meade (2008) and Eijffinger and Geraats (2006). In 2014, they extend their study to more than 100 Central banks by constructing an index for the period 1998-2010 compared to shorter periods in their early work.

²⁸ http://eml.berkeley.edu/~eichengr/Dincer-Eichengreen_figures&tables_2014_9-4-15.pdf

²⁹ Data covers 1998 to 2014 and as this study analyzes two periods 1996-2005 and 2006-2015, for the missing year values, necessary data are generated by Cubic Spline method in EViews. These yearly data are analyzed on a quarterly basis, assuming the index value does not change in a given year. The overall index runs from 0 to 15 and they are converted to the hundred systems for the sake of simplicity to calculate overall credibility score.

$$CI_3 = \text{Transparency Index}$$

2.4.1.4 Central bank Independence

Another major factor that contributes to the Central bank credibility is the Central bank independence. Chang (1998) argues that the practice of Central banking around the world is profoundly affected by two trends and one of them is to provide Central bank with greater independence compared to other branches of their governments.

Mackiewicz-Łyziak (2009) states that the independence index measures the independence *de jure*, while there might be some more significant changes in the independence *de facto*. She argues that because of the difficulty of the measurement of the independence *de facto*, the most known and widely used independence index measure is the independence *de jure*. Acemoglu et al. (2008) explain both of them as; *de jure* measures, which capture how much independence the Central bank has in law, and *de facto* measures, which correspond to how much independence the Central bank has in practice. And Garriga (2016) introduces the most comprehensive dataset on *de jure* Central bank independence, including yearly data from 182 countries between 1970 and 2012.

Mackiewicz-Łyziak (2009) sees the independence of a Central bank as one of the most important conditions for being credible. At this point, the pioneer might be Rogoff (1985) since he stresses that the assignment of an independent and conservative Central banker is convenient for the disinflation.

The monetary authorities must prove their abilities to govern independently and Backus and Driffill (1985) underline the importance of the autonomous Central banks in order to make non-inflationary policies more credible by minimizing the costs associated to uncertainty about policy. In their studies, Alesina and Summers (1993), De Haan and Kooi (1997) and Eijffinger et al. (1998), they find an advantageous relation between the Central bank independence and credibility. However, Debelle and Fischer (1994) claim that when a Central bank is more

independent disinflation policy is more costly and argues that credibility does not generate any benefit in the process of disinflation.

Crowe and Meade (2008) construct an index based on Cukierman et al. (1992) in order to calculate the Central bank independence. They combine four aspects for being more independent; head of the Central bank is appointed by the board of the Central bank, policy decisions are made without direct government involvement, price stability is the primary goal of monetary policy, and limits on the ability of the government to borrow from the Central bank.

According to Mackiewicz-Łyziak (2009), the most prominent independence measures are developed by Grilli et al. (1991), Cukierman et al. (1992), Alesina and Summers (1993) and Cukierman and Webb (1995). For her study, she uses the method of the measurement of the independence proposed by Fry et al. (2000)³⁰.

Arnone and Romelli (2013), Romelli (2014), and Masciandaro and Romelli (2015) also study on the Central bank credibility. In this study, we use the independence index calculated by Romelli³¹. He constructs the Extended Central bank Independence (ECBI) index covering the CBRT over the period 1970-2014³². This new index provides information about 42 criteria of Central bank institutional design. This independence index is chosen since the data time range and its comprehensive aspects about the independence of the Central bank. The index values range from 0 to 1 point³³. This credibility sub-index is given in the following form:

$$CI_4 = \text{Independence Index}$$

³⁰ See Appendix A4 for the Questionnaire of the Independence Measure prepared by Fry et al. (2000).

³¹ We would like to present our deepest gratitude to Prof. Davide Romelli for his contribution to this study with his independence index before publishing it.

³² As this study investigates the Central bank credibility over two periods (1996-2005 and 2006-2015), for the missing value in 2015, necessary data are generated by Cubic Spline method in EViews. These yearly data are analyzed on a quarterly basis, assuming the index value does not change in a given year.

³³ The overall index runs from 0 to 1 and they are converted to the hundred systems for the sake of simplicity to calculate overall credibility score.

2.4.1.5 Country Risk

Mackiewicz-Łyziak (2009) claims that the perception of a Central bank has an important effect on its credibility. Quality of the institution plays an additional role in assessment of this perception. In other words, if the institutions in a given country are qualified then the people of this country are more likely to expect that the Central bank is also of good quality and they increase their belief about the effectiveness in its policy actions.

Calderón et al. (2004) use the country risk measure as a proxy for the credibility of the macroeconomic policies. There are also other studies investigating this subject in different aspects. For example, Fouejieu-Azangue and Roger (2013) find that country risk premia³⁴ for the inflation targeting countries are lower than other countries. They argue that it stems from the greater policy predictability and more stable long term inflation in these countries. Ciro and de Mendonça (2015) conclude that credibility is an important improvement in the institutional framework in order to reduce the sovereign risk premium³⁵.

Mackiewicz-Łyziak (2009) gives place to the country risk rating data provided by Euromoney to analyze this sub-index value. In this study, due to accessibility to these data, we use the political stability risk rating data prepared by the Oxford Economics Global Data Workstation as a proxy for the Central bank credibility. The index values change from 0 to 7 point³⁶. This credibility sub-index is formed as follows.

$$CI_5 = \text{Country Risk Rating}$$

³⁴ Fouejieu-Azangue and Roger (2013) define this concept as the spread between yields on a country's internationally traded securities (usually long-term bonds) and those on a comparable security issued by one of the large advanced economies - typically the United States.

³⁵ The sovereign risk premium is the price of financial resources which is available to governments in the form of credit Ciro and de Mendonça (2015).

³⁶ Yearly data are analyzed on a quarterly basis, assuming the index value does not change in a given year. This index runs from 0 to 7 (higher value means lower risk) and these values are converted to the hundred systems for the sake of simplicity to calculate overall credibility score.

2.4.1.6 Public Debt

In this study, the last component of the Central bank credibility index is dedicated to the public debt. Mackiewicz-Łyziak (2009) stresses that there would be other indirect elements which might affect the credibility and they would not be fully under the Central bank control. At this point, the relation between the public debt and the inflation steps forward since the more the public debt is, the less the Central bank power is over the disinflation. High public debt decreases the people's perception of the ability of a Central bank to fulfill its future policy such as the belief in the success in the disinflation process. Reinhart and Sack (2000) argue that lower nominal debt loads should help trim inflation expectations and they base their claim on Barro and Gordon (1983)³⁷.

Sargent and Wallace (1981) conclude that because of the fiscal dominance and high public debt, the monetary authorities lose control over the inflation. In addition to that, Reinhart and Sack (2000) point out that the lower public debt makes it easier to keep inflation expectations low. And Blinder (2000) claims that outsized fiscal deficits and/or large accumulations of public debt (relative to GDP) put upward pressure on interest rates, which may induce a more accommodative policy from the Central bank. In spite of the fact that, Acemoglu et al. (2008) suggest that in countries where Central bank reforms reduce inflation, government expenditure tends to increase. Cabral and Ozkan (2008) also show that inflation targeting regime may lead to higher public debt.

High public debt leads to the inflation pressure and thus it weakens the Central bank credibility or vice versa. This mechanism is shown in the following equation:

³⁷ Agents' knowledge that the return to unexpected inflation is high should lead them to expect a bit more inflation on average.

$$CI_6 = \begin{cases} 0 & \text{for } \left(\frac{debt}{GDP}\right) \cdot 100 > 100 \\ 100 \cdot \left(1 - \frac{debt}{GDP}\right) \cdot \left(\frac{10}{7}\right) & \text{for } 30 \leq \left(\frac{debt}{GDP}\right) \cdot 100 \leq 100 \\ 100 & \text{for } \left(\frac{debt}{GDP}\right) \cdot 100 < 30 \end{cases}$$

where *debt* means the gross government debt and *GDP* refers to gross domestic product. The index values fluctuate between 0 and 100. The formula states that if the debt to GDP ratio overpasses 100 percent and is less than 30 percent then the value of CI_6 becomes zero and 100, respectively. If the ratio stays between 30 and 100 percent, CI_6 gets value according to its debt performance. Thirty percent is chosen as a threshold by Mackiewicz-Łyziak (2009) since she claims that this rate does not cause damage to the Central bank credibility.

According to the Maastricht criteria, the reference values referred to in Article 104c (2) of the Treaty are 60% for the ratio of government debt to gross domestic product at market prices (Treaty on European Union, 1992). Compared to Mackiewicz-Łyziak (2009) ratio, the Treaty's rate is seen more moderate. However, Reinhart and Rogoff (2010 and 2012) argue that there is a threshold for the debt above 90 percent of GDP which causes worse growth outcomes. For this study, the threshold value of 30 percent is applied to the analysis.

2.4.2 Weighting of the Credibility Index

The central credibility index is quantified in six subcomponents. In order to put together these six sub-indexes in a single one, the equally weighted methodology is used by assuming each subcomponent of the credibility index has the same level of importance. This equally weighted methodology is also used by Blinder (2000),

Eijffinger and Geraats (2006)³⁸, Mackiewicz-Łyziak (2009), Dincer and Eichengreen (2014)³⁹ and Papadamou et al. (2014) for their analyses.

However, Mackiewicz-Łyziak (2009) argues that these indexes might have a different effect on the credibility⁴⁰. For instance, the monetary policy results would be more important than other factors for the Central bank credibility. In consideration with this assumption, the weights will change as the monetary variables become higher as shown in the following weighted equation:

$$CI = 0.25CI_1 + 0.25CI_2 + 0.125CI_3 + 0.125CI_4 + 0.125CI_5 + 0.125CI_6$$

Or the institutional factors such as the transparency of monetary policy and Central bank independence could be relatively more significant for the credibility. At this context, the weighted equation becomes such as the following one:

$$CI = 0.13CI_1 + 0.13CI_2 + 0.24CI_3 + 0.24CI_4 + 0.13CI_5 + 0.13CI_6$$

In their study of "*A Comparison of Index-Weighting Schemes*", Amenc et al. (2011) explain that equally weighted indexes simply attribute the same weight to each of their components. And they defend that these indexes might provide a fair representation since it is a straightforward way to construct. Blinder (2000) also uses the average scores of the respondents for his survey analysis. Papadamou et al. (2014) argue that the equal weights make further investigations about the importance of each subcomponent easier. They also conclude that while implementing policies, authorities could easily pay attention to the particular components according to their impact on the credibility.

In this study, each sub-credibility index is assumed to be of the same importance as others. This approach is chosen since it properly covers the changes in

³⁸ In their formulation of the Central bank transparency index, Eijffinger and Geraats (2006) use fifteen questions and the index is the sum of the scores for the answers to these fifteen questions in five dimensions. Each question in the index is of the same level of importance (equally weighted) and they can contribute to the overall index score only up to 1 point. Overall index score runs 0 to 15.

³⁹ Dincer and Eichengreen (2014) follow the methodology of Eijffinger and Geraats (2006) for their transparency index.

⁴⁰ Different weights are used for this study and it is proven that these different weights did not significantly change the main course of the credibility index. See Appendix A7 for the example given.

the course of the credibility index throughout two time periods. Equal-weighted indices are respectively presented for both data periods as in the following equations:

$$CI_{1996-2005} = 0.2CI_2 + 0.2CI_3 + 0.2CI_4 + 0.2CI_5 + 0.2CI_6$$

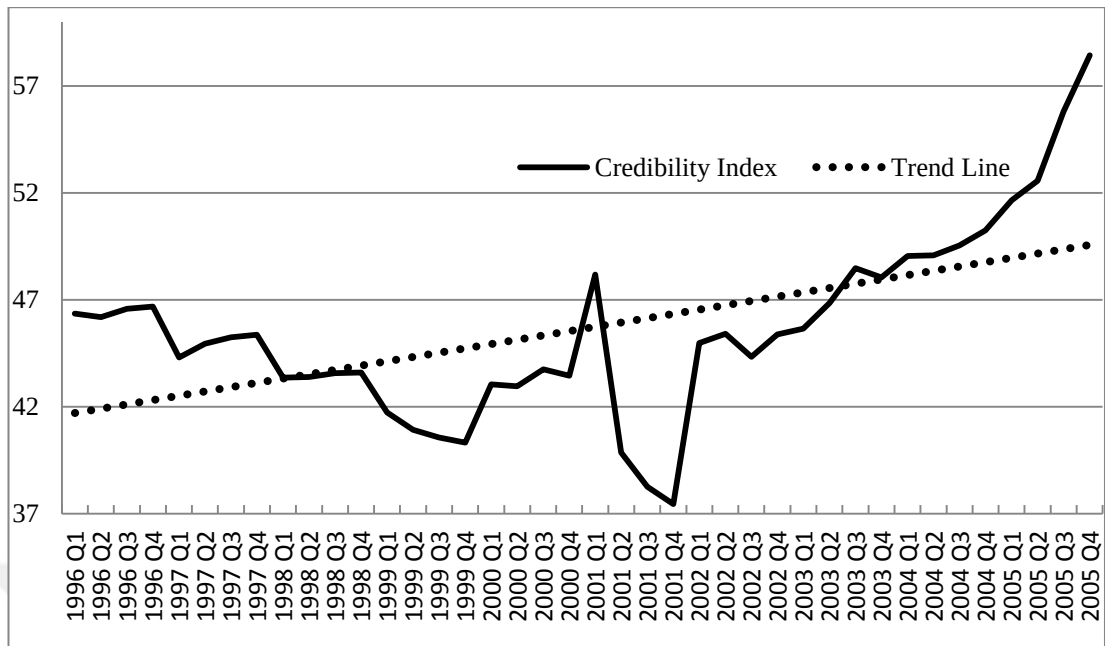
$$CI_{2006-2015} = 0.166CI_1 + 0.166CI_2 + 0.166CI_3 + 0.166CI_4 + 0.166CI_5 + 0.166CI_6$$

2.4.3 Central bank Credibility Index for the Central bank of the Republic of Turkey

Based on these two credibility index equations above, Figure 2.4 and Figure 2.5 present the tendencies of the credibility index over the 1996-2005 and 2006-2015 period, respectively. The only difference between these two equations is that the former one does not contain the first sub-index of the Achievement of Announced Monetary Policy Targets since the CBRT started implementing the explicit inflation policy in 2006.

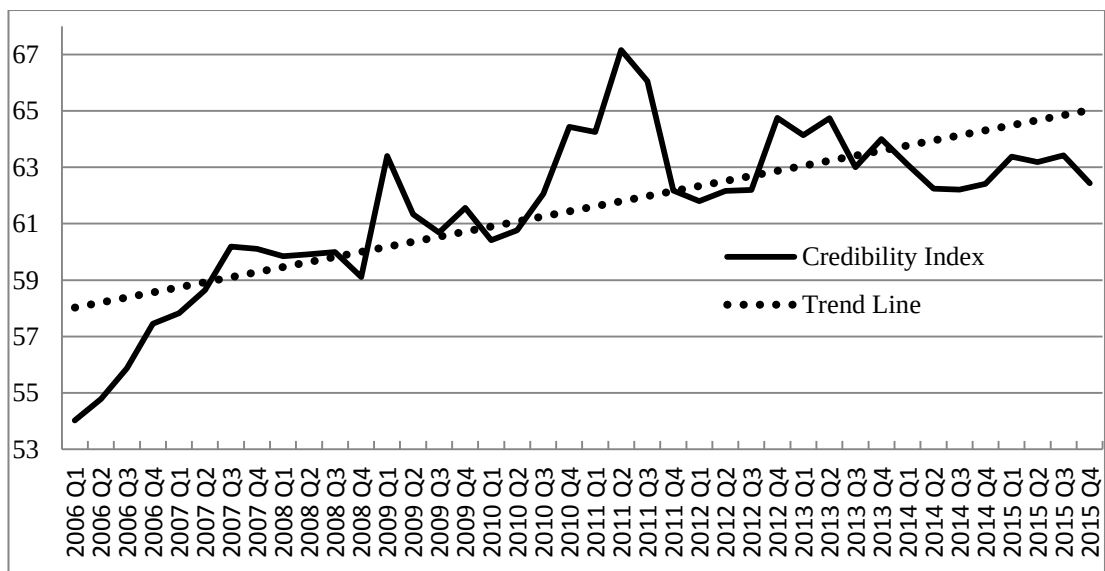
Two serious declines can be seen on the Figure 2.4 for 1997-1998 Asian and Russian financial crisis and 2001 Turkish financial crisis periods. It can be observed that the second crisis period is more influential and the credibility is reduced very much. With the year of 2004, Turkish economy experienced the single digit inflation rate⁴¹. This strong decrease in inflation is believed by Ari et al. (2013) as a result of the establishment of the independent Central bank focusing mainly on fighting inflation and of tight fiscal policies implemented in 2001. This downward change in inflation ameliorates the credibility index and makes slope more upright.

⁴¹ According to the CBRT, increase in the CPI was 9.32% in 2004 against 18.36% in 2003.

Figure 2.4 The Credibility Index: 1996-2005 Period

Source: The author's own calculations.

Figure 2.5 provides information about the credibility index over the 1996-2015 period. Compared to the Graph 5.1, in this graph there are more substantial changes; the following breakdown of the Global financial crisis of 2007–2008 beginning in USA. The European sovereign debt crisis is started in Greece in 2010. In the following years, with the spread of the effects of the crisis, more European countries are affected such as Ireland and Portugal.

Figure 2.5 The Credibility Index: 2006-2015 Period

Source: The author's own calculations.

For Turkish economy, it can be said that internal or external economic and political issues play an important role in determining the course of the economic tendency. There are some political disturbances like Gezi Park protests in 2013 and 17-25 December investigations. Their downward effects on the credibility could be seen on the Figure 2.5 They significantly influenced the Turkish economy, as a result, the CBRT credibility is also affected negatively and during these unfavorable periods it is decreased.

When these two periods are compared each other, in the second period the slope of the trend line is steeper compared to that of first period in which the trend line is following a more horizontal course. It clearly shows that between 2006 and 2015 the CBRT's credibility is increased faster.

This improvement of credibility may be explained largely by the success in the disinflationary policies with the help of the explicit inflation targeting policy starting in 2006. Yılmaz and Arı (2013) support our suggestion and they claim that behind this achievement of the disinflation lies the success of the monetary policy and inflation targeting strategy that the autonomous Central bank has been implementing for years. Kirbitcioglu (2005) considers the issue in terms of banking and state that after 2001 financial crisis, the government initiated a comprehensive Banking Sector Restructuring and Rehabilitation Program. In order to recover the economy, this kind of economic regulatory implementation functioned properly and effects of the economic and financial turmoil could be felt lesser.

When the changes in inclination of the line of credibility index are examined in the two graphs, these changes are moving along with the changes in the Turkish economy. It thus proves us the soundness of this credibility index while capturing these major changes in an adequate way.

2.5 Data and Methodology

2.5.1 Data

This section specifies which data are used in the analyses of the study. The credibility index for the CBRT (*CRED*) is calculated in the previous section and in order to determine the components of the Central bank credibility index, three indicator groups are used as follows: *Macroeconomic*, *Financial* and *Institutional Variables*. For analyses, necessary data are gathered from different institutions such as the CBRT, the World Bank, and the Oxford Economics Global Data Workstation. All data names, notations, sources and expected signs are given in the Table 2.2.

Table 2.2 Data Information

Category / Variable	Notation	Source	Expected Sign
Macroeconomic			
Real GDP Growth Rate	GDP	Oxford Economics	Positive
Inflation Rate	INF	Oxford Economics	Negative
Real Effective Exchange Rate	REER	Oxford Economics	Positive
Short Term Interest Rate	STINT	Oxford Economics	Negative
Unemployment Rate	UNEMP	Oxford Economics	Negative
Trade Openness	TRADEOP	Oxford Economics	Positive
Financial			
M2/GDP	M2GDP	IMF-IFS and Oxford Economics	Positive
Non-Performing Loans/Total Loans	NPLTOTL	CBRT	Negative
Loans to Private Sector/GDP	PRVTGDP	CBRT and Oxford Economics	Negative
Equity/Total Assets	EQTOAST	CBRT	Positive
Institutional			
Government Effectiveness	GOVEF	World Bank	Positive
Regulatory Quality	REGQUA	World Bank	Positive
Rule of Law	RUOLAW	World Bank	Positive
Polity	POLITY	Systemic Peace	Positive

2.5.1.1 Macroeconomic Variables

Macroeconomic Variables consist of six indicators: Real GDP Growth Rate, Inflation Rate, Real Effective Exchange Rate, Short Term Interest Rate and Unemployment Rate and Trade Openness (total export and import to GDP). These indicators are provided by the Oxford Economics Global Data Workstation for the quarterly basis. Data cover the 1996Q1-2015Q4 period. For each variable the expected sign of the relation with the Central bank credibility is given in the Table 2.2.

2.5.1.2 Financial Variables

The Investment Support and Promotion Agency of Turkey⁴² (ISPAT) informs that the Banking sector dominates the Turkish financial sector, accounting for over 70 percent of overall financial services. As banks are highly important for the Turkish economy, in terms of financial indicators banking sector data are mainly used in this study such as the ratio of the nonperforming loans to total gross loans and total loans to private sector to GDP.

In the Turkish banking system, four types of the bank operate; the Central bank, Deposit Money Banks, Investment and Development Banks and Participation Banks. According to the Banking Regulation and Supervision Agency⁴³ (BRSA), as of September 2016, 34 Deposit Money and 13 Investment and Development and 5 Participation Banks serve in the Turkish banking sector. The asset size of the Turkish Banking Sector was increased by 2.3% to TL 2.5 trillion in September 2016 compared to the previous quarter. In the same period, the total amount of loans was

⁴² It is “T.C. Başbakanlık Türkiye Yatırım Destek ve Tanıtım Ajansı (TYDTA) in Turkish. The ISPAT is the official organization for promoting Turkey’s investment opportunities to the global business community and for providing assistance to investors before, during, and after their entry into Turkey.

⁴³ It is “Bankacılık Düzenleme ve Denetleme Kurumu” (BDDK) in Turkish. Banking Regulation and Supervision Agency (BRSA) was established in June 1999 according to Banks Act Nr. 4389 and began to operate in August 2000. The BRSA is public legal entity with administrative and financial autonomy. There are also two more associations that work for the banks; the “Banks Association of Turkey” (BAT) (Türkiye Bankalar Birliği, TBB in Turkish) and the Participation Banks Association of Turkey (PBAT) (Türkiye Katılım Bankaları Birliği, TKBB in Turkish).

TL 1.610 trillion; TL 1.089 trillion in TL and TL 521 billion in foreign currencies (BRSA, 2016).

For the financial indicators, variables that are related to the Turkish banking sector are calculated for the Deposit Money Banks. It is done in this way because deposit banks dominate the banking sector by representing about 90 percent of the total loans and it is almost the same amount for the total assets. This domination can be seen in the Table 2.3 over the period 2005-2015. Another reason to choose the deposit banks is the lack of the data. Accessible banking sector data do not cover all analysis period. The BRSA data can back to only the year of 2002 and other data sources such as the CBRT and the Banks Association of Turkey (BAT) do not provide enough information about the whole banking sector. As a result, for the proxy of the entire Turkish banking sector Deposit Money Banks are chosen in the analyses since data are properly provided by the CBRT and it covers all analysis data period.

Table 2.3 Shares of the Banks in the Total Loans

Years	Deposit Banks	Investment and Development Banks	Participation Banks
2005	89.69	5.56	4.72
2006	90.10	5.03	4.84
2007	89.38	4.48	6.12
2008	89.43	4.69	5.86
2009	87.99	4.72	7.28
2010	89.74	3.82	6.44
2011	89.72	4.23	6.05
2012	88.96	4.62	6.41
2013	88.85	5.04	6.11
2014	89.48	5.16	5.36
2015	89.52	5.48	4.99
2005-2015 Average	89.35	4.80	5.84

Source: The CBRT and the author's own calculation.

The financial variables that are used in this study are *M2 to GDP*⁴⁴, *Non-Performing Loans to Total Loans*, *Loans to Private Sector to GDP*⁴⁵ and *Equity to Total Assets*⁴⁶.

2.5.1.3 Institutional Variables

In this study, the institutional data are provided by the World Bank Worldwide Governance Indicators⁴⁷ (WGI) and the Center for Systemic Peace. It is expected to have a positive relation between the Central bank credibility and each relevant institutional variable since the institutional quality empowers the Central bank credibility.

The WGI reports aggregate and individual governance indicators for 215 countries and territories over the period 1996–2015, for six dimensions of governance⁴⁸: Voice and Accountability, Political Stability and Absence of Violence, Government Effectiveness, Regulatory Quality, Rule of Law, and Control of Corruption (Kaufmann et al., 2010). For the analyses, three institutional variables of the WGI are employed; *Government Effectiveness*, *Regulatory Quality* and *Rule of Law* from 1996Q1 to 2015Q4⁴⁹. For these three dimensions, the values range from approximately -2.5 (weak) to +2.5 (strong) governance performance.

⁴⁴ Quarterly data are obtained from the Oxford Economics and the IMF IFS for GDP and M2, respectively.

⁴⁵ Data of the loans given to private sector by the deposit banks are taken from the CBRT while GDP from the IMF IFS on a quarterly basis.

⁴⁶ These data are taken from the Deposit Money Banks Balance Sheet given in the Central bank of the Republic of Turkey - Electronic Data Delivery System (CBRT-EDDS). For the Capital value, Owner's Equity (Capital Accounts) is used. It includes Paid-up Capital, Inflation Adjustment for Paid-up Capital, Capital Reserves, Profits Reserves, Profit (Loss) and Profit (Loss) for the Previous Year.

⁴⁷ These aggregate indicators combine the views of a large number of enterprise, citizen and expert survey respondents in industrial and developing countries. They are based on over 30 individual data sources produced by a variety of survey institutes, think tanks, non-governmental organizations, international organizations, and private sector firms.

⁴⁸ See Appendix A9 for detailed information about these dimensions.

⁴⁹ Data start with the year of 1996 but it is published every two years until 2002 in which data become continuous form. Missing data for the years of 1997, 1999 and 2001 are interpolated by the Cubic Spline method in EViews. These yearly data are analyzed on a quarterly basis, assuming the value does not change in a given year.

Another important institutional indicator is *Polity*⁵⁰. The Polity data are prepared by the Center for Systemic Peace. Center's Polity IV Project continues to study of coding authority characteristics of states in the world system for purposes of comparative, quantitative analysis. Their dataset covers all major, independent states in the global system over the period 1800-2015 including Turkey (Marshall et al. 2016). Combined Polity Score is computed by subtracting the Autocracy score from the Democracy⁵¹ score; the resulting unified polity scale ranges from +10 (strongly democratic) to -10 (strongly autocratic). These yearly data are analyzed on a quarterly basis, assuming the value does not change in a given year.

2.5.2 Methodology

2.5.2.1 ARDL Bound Test

Atkins and Coe (2002) emphasize the growing academic interest in the empirical testing of long-run neutrality predictions since the late 1980s. This huge interest stems from largely advances in the development of the time series methodologies for studying non-stationary data. At this point, researchers use some co-integration techniques such as Engle and Granger (1987) and Johansen (1988) in order to test for the existence of a stationary long-run relation between series being individually non-stationary. An important weakness of these techniques is that they require the underlying time series to be non-stationary. And this weakness restricts the researchers to doing their analysis with I(1) series.

In this study, in order to define the determinants of the Central bank credibility index, the Autoregressive Distributed Lag (ARDL) Bounds Test methodology is employed. This methodology is introduced by Pesaran and Shin (1999) and Pesaran et al. (2001), and it allows dealing with the restricted integration order. With the ARDL method, the existence of a long-run relationship between the Central bank

⁵⁰ The Polity scheme consists of six component measures that record key qualities of executive recruitment, constraints on executive authority and political competition. It also records changes in the institutionalized qualities of governing authority. The Polity data include information only on the institutions of the central government and on political groups acting, or reacting, within the scope of that authority. It does not include consideration of groups and territories that are actively removed from that authority.

⁵¹ See Appendix A10 for detailed information about Democracy and Autocracy.

credibility and the other variables (macroeconomic, financial and institutional) is broadly tested as this method does not need to have time series only $I(1)$.

The ARDL regression gives a test statistic that involves two asymptotic critical value bounds depending on whether the variables are $I(0)$ or $I(1)$ or a mixture of both. If the test statistic exceeds the upper critical value, the null hypothesis of no long-run relationship could be rejected regardless of orders of integration. And finally, if the sample test statistic stays between these two bounds -in the indecisive region-, then the result may be inconclusive.

Moreover, if the order of integration is bigger than 1, namely $I(2)$, then critical bounds values calculated by Pesaran et al. (2001) cannot be used in that case since they compute these values for variables of $I(0)$ and $I(1)$. All variables thus need firstly to be checked by Unit Root tests if they are $I(0)$, $I(1)$ and $I(2)$.

As it is emphasized by Pesaran and Shin (1999) and Panopoulou and Pittis (2004), this method may also provide reliable results while working on limited samples and can analyze short and long term parameters simultaneously. Thanks to this convenience, more time series variables can be added in the models regardless of whether these series are $I(1)$ or $I(0)$. As a result, these analyses can include many descriptive variables while being more comprehensive.

2.5.2.2 ARDL Models

In this section, all models are given for the econometrics analyses of the ARDL method and equations are written in the same form for both periods along with different variables groups.

ARDL Model 1. Macroeconomics Variables: 1996-2005 and 2006-2015 Periods

$$\begin{aligned}
\Delta CRED_t = & \alpha_0 + \sum_{i=1}^p \alpha_1 \Delta CRED_{t-i} + \sum_{i=0}^p \alpha_2 \Delta GDP_{t-i} + \sum_{i=0}^p \alpha_3 \Delta INF_{t-i} + \sum_{i=0}^p \alpha_4 \Delta REER_{t-i} \\
& + \sum_{i=0}^p \alpha_5 \Delta STINT_{t-i} + \sum_{i=0}^p \alpha_6 \Delta UNEMP_{t-i} + \sum_{i=0}^p \alpha_7 \Delta TRADEOP_{t-i} \\
& + \lambda_1 CRED_{t-1} + \lambda_2 GDP_{t-1} + \lambda_3 INF_{t-1} + \lambda_4 REER_{t-1} + \lambda_5 STINT_{t-1} \\
& + \lambda_6 UNEMP_{t-1} + \lambda_7 TRADEOP_{t-1} + \varepsilon_t
\end{aligned}$$

ARDL Model 2. Financial Variables: 1996-2005 and 2006-2015 Periods

$$\begin{aligned}
\Delta CRED_t = & \alpha_0 + \sum_{i=1}^p \alpha_1 \Delta CRED_{t-i} + \sum_{i=0}^p \alpha_2 \Delta M2GDP_{t-i} + \sum_{i=0}^p \alpha_3 \Delta NPLTOTL_{t-i} + \sum_{i=0}^p \alpha_4 \Delta PRVTGDP_{t-i} \\
& + \sum_{i=0}^p \alpha_5 \Delta EQTOAST_{t-i} + \lambda_1 CRED_{t-1} + \lambda_2 M2GDP_{t-1} + \lambda_3 NPLTOTL_{t-1} \\
& + \lambda_4 PRVTGDP_{t-1} + \lambda_5 TLTOTD_{t-1} + \varepsilon_t
\end{aligned}$$

ARDL Model 3. Institutional Variables: 1996-2005 and 2006-2015 Periods

$$\begin{aligned}
\Delta CRED_t = & \alpha_0 + \sum_{i=1}^p \alpha_1 \Delta CRED_{t-i} + \sum_{i=0}^p \alpha_2 \Delta GOVEF_{t-i} + \sum_{i=0}^p \alpha_3 \Delta REGQUA_{t-i} + \sum_{i=0}^p \alpha_4 \Delta RUOLAW_{t-i} \\
& + \sum_{i=0}^p \alpha_5 \Delta POLITY_{t-i} + \lambda_1 CRED_{t-1} + \lambda_2 GOVEF_{t-1} + \lambda_3 REGQUA_{t-1} \\
& + \lambda_4 RUOLAW_{t-1} + \lambda_5 POLITY_{t-1} + \varepsilon_t
\end{aligned}$$

For all models, α_0 signifies constant term, ε represents the error term, Δ is the first difference operator, p is the optimal lag length, α (from α_1 to α_n) indicates short-run dynamics and the symbol of λ (from λ_1 to λ_n) defines the long-run relationship between the time series variables. Other notations represent variable names such as GDP and INF (Gross Domestic Product Growth and Inflation Rates).

In order to analyze long and short-run relationships between variables by using the ARDL method, Model 1, 2 and 3 need to be estimated through Ordinary Least Squares (OLS) method with an appropriate lag selection criterion based Akaike Information criterion (AIC) or the Schwarz Bayesian criterion (SBC). The F-test is employed to test the long-term relationship between variables. The null hypothesis of

no-cointegration ($H_0 : \lambda_1 = \lambda_2 = \lambda_3 = \dots = \lambda_n = 0$) is tested against the alternative hypothesis of cointegration ($H_1 : \lambda_1 \neq \lambda_2 \neq \lambda_3 \neq \dots \neq \lambda_n \neq 0$).

F-statistic values are compared with upper and lower critical values in Pesaran et al. (2001). To be able to get a long-run relationship between the variables, calculated F-statistic values should be greater than the upper critical values. If not, there is no long-run relationship between the variables.

After having a long-run relationship between the variables, the Error Correction Model (ECM) is estimated in order to have the short-run dynamic parameters. For the equations of Model 1, 2 and 3, ECM estimations are as follows for both periods:

ECM Model 1. Macroeconomics Variables: 1996-2005 and 2006-2015 Periods

$$\begin{aligned} \Delta CRED_t = & \theta_0 + \sum_{i=1}^p \mu_1 \Delta CRED_{t-i} + \sum_{i=0}^p \mu_2 \Delta GDP_{t-i} + \sum_{i=0}^p \mu_3 \Delta INF_{t-i} + \sum_{i=0}^p \mu_4 \Delta REER_{t-i} \\ & + \sum_{i=0}^p \mu_5 \Delta STINT_{t-i} + \sum_{i=0}^p \mu_6 \Delta UNEMP_{t-i} + \sum_{i=0}^p \mu_7 \Delta TRADEOP_{t-i} + \phi ECT_{t-1} + u_t \end{aligned}$$

ECM Model 2. Financial Variables: 1996-2005 and 2006-2015 Periods

$$\begin{aligned} \Delta CRED_t = & \theta_0 + \sum_{i=1}^p \mu_1 \Delta CRED_{t-i} + \sum_{i=0}^p \mu_2 \Delta M2GDP_{t-i} + \sum_{i=0}^p \mu_3 \Delta NPLTOTL_{t-i} + \sum_{i=0}^p \mu_4 \Delta PRVTGDP_{t-i} \\ & + \sum_{i=0}^p \mu_5 \Delta EQTOAST_{t-i} + \phi ECT_{t-1} + u_t \end{aligned}$$

ECM Model 3. Institutional Variables: 1996-2005 and 2006-2015 Periods

$$\begin{aligned} \Delta CRED_t = & \theta_0 + \sum_{i=1}^p \mu_1 \Delta CRED_{t-i} + \sum_{i=0}^p \mu_2 \Delta GOVEF_{t-i} + \sum_{i=0}^p \mu_3 \Delta REGQUA_{t-i} + \sum_{i=0}^p \mu_4 \Delta RUOLAW_{t-i} \\ & + \sum_{i=0}^p \mu_5 \Delta POLITY_{t-i} + \phi ECT_{t-1} + u_t \end{aligned}$$

For all models, θ signifies constant term, u represents the residual terms that are assumed to be identically, independently, and normally distributed. Δ is the first difference operator, μ (from μ_1 to μ_n) is the short-run dynamic coefficient, ECT is the error correction term and ϕ the coefficient of speed of adjustment which is expected to have negative sign.

2.6 Empirical Results

2.6.1 Unit Root Test Results

The stationarity is very important for econometric estimation because applying least square regressions on non-stationary variables could give misleading parameter estimates of the relationship between variables. At this point, to check statistical stationarity becomes crucial since it shows what kind processes should be used in the models in order to make accurate predictions (Diebold and Kilian, 2000). Before them, this problem is also studied by Granger and Newbold (1974) and by many others such as Hamilton (1994) in their econometrics text books on time series.

Mahadeva and Robinson (2004) argue that when economists work on macroeconomic time series, an important difficulty might be faced if these series are trended or affected by persistent changes in the processing. In order to overpass this problem, it is common to test whether series are stationary. These tests are often called unit root tests.

In this study, in order to detect whether the Central bank credibility index (CRED), macroeconomic, financial and institutional variables have a unit root, two of the most popular unit root tests are run; Augmented Dicky-Fuller (ADF, 1979) and Phillips-Perron (PP, 1988). Unit root test results⁵² are given in the following tables in accordance with the analysis periods starting from the Central bank credibility index.

⁵² All tests are run in the Eviews. After testing the series in *Level* and *1st Difference* (if necessary *2nd Difference*) including *Intercept*, *Trend* and *intercept* in test equations, results are accurately given according to their statistical significances.

Table 2.4 Unit Root Test Result of the Credibility Index: 1996-2005

Variable	ADF Unit Root Test		PP Unit Root Test	
	τ -statistic (Level)	τ -statistic (First Difference)	τ -statistic (Level)	τ -statistic (First Difference)
CRED	0.816204	-6.117422***	1.030282	-6.495674***

Note: ***, **, and * indicate statistical significance at 1%, 5% and 10% levels, respectively.

Table 2.5 Unit Root Test Result of the Credibility Index: 2006-2015

Variable	ADF Unit Root Test		PP Unit Root Test	
	τ -statistic (Level)	τ -statistic (First Difference)	τ -statistic (Level)	τ -statistic (First Difference)
CRED	-2.902902*	-6.776921***	-2.926676*	-6.780816***

Note: ***, **, and * indicate statistical significance at 1%, 5% and 10% levels, respectively.

Based on ADF and PP tests results, Table 2.4 and Table 2.5 show the statistical outcomes for the Central bank credibility index in the periods 1996-2005 and 2006-2015, respectively. In the period 1996-2005, CRED series is not stationary at level but when first difference is applied, this series becomes stationary at a significance level less than 1%.

For the period 2006-2015, CRED is stationary at level, at a significance level less than 10%. As the general acceptance of the statistical significance level is equal to or less than 5%, the same threshold value is applied to this study and it is accepted that CRED series is not stationary at level. When first difference is taken, it turns out to be stationary at a significance level less than 1%. For both periods, CRED series are I(1), integrated of order one, since they become stationary at first difference.

Table 2.6 provides information about the unit root test results for the macroeconomic variables over the period 1996-2005. ADF test output states that GDP, INF, and REER are stationary at a significance level less than 10% and they begin to be stationary at first difference. However, STINT, UNEMP, and TRADEOP are stationary at level, at a significance level more than 10%. At first differences, all variables become stationary. For PP test results, at level, UNEMP and TRADEOP

are stationary at a significance level less than 5% while INF, REER and STINT are not stationary at a significance level more than 10%.

Table 2.6 Unit Root Test Results of the Macroeconomic Variables: 1996-2005

Variable	ADF Unit Root Test		PP Unit Root Test	
	τ -statistic (Level)	τ -statistic (First Difference)	τ -statistic (Level)	τ -statistic (First Difference)
GDP	-1.832784*	-5.224932***	-1.935452*	-6.332179***
INF	-3.497878*	-5.602323***	-2.578447	-3.510547***
REER	-3.262404*	-5.446350***	-2.481175	-5.549934***
STINT	-3.060679	-6.681298***	-3.060679	-6.857312***
UNEMP	-3.131472	-2.015643**	-4.130058**	-9.149607***
TRADEOP	0.754022	-7.651980***	-4.277122***	-13.23809***

Note: ***, **, and * indicate statistical significance at 1%, 5% and 10% levels, respectively.

Table 2.7 Unit Root Test Results of the Macroeconomic Variables: 2006-2015

Variable	ADF Unit Root Test		PP Unit Root Test	
	τ -statistic (Level)	τ -statistic (First Difference)	τ -statistic (Level)	τ -statistic (First Difference)
GDP	-2.681171***	-4.760596***	-2.000774**	-4.728170***
INF	-2.288165	-9.018092***	-2.797932*	-8.187375***
REER	-4.787341***	-4.788167***	-2.426286	-6.217349***
STINT	-0.701285	-6.801377***	-0.713544	-6.801377***
UNEMP	-3.585525**	-2.621143**	-3.193527**	-15.33601***
TRADEOP	-2.517333	-10.43924***	-3.254589*	-10.43924***

Note: ***, **, and * indicate statistical significance at 1%, 5% and 10% levels, respectively.

Table 2.7 represents unit root test outcomes for the macroeconomic variable for the period 2006-2015. According to the ADF test results, GDP, REER, and UNEMP are stationary in two cases at a significance level less than 5%. STINT is non-stationary for both tests at level and it becomes stationary at first difference. Two tests provide slightly different results at level; however, at first difference they give almost same outcomes.

Table 2.8 Unit Root Test Results of the Institutional Variables: 1996-2005

Variable	ADF Unit Root Test		PP Unit Root Test	
	τ -statistic (Level)	τ -statistic (First Difference)	τ -statistic (Level)	τ -statistic (First Difference)
GOVEF	-7.179146 ***	-4.633006***	-2.179684	-6.022543***
REGQUA	-2.491071	-3.145121***	-0.520199	-3.149841***
RUOLAW	-0.905856	-5.844808***	-0.926954	-5.844808***
POLITY	-1.194016	-6.030047***	-3.939883***	-6.030047***

Note: ***, **, and * indicate statistical significance at 1%, 5% and 10% levels, respectively.

Table 2.9 Unit Root Test Results of the Institutional Variables: 2006-2015

Variable	ADF Unit Root Test		PP Unit Root Test	
	τ -statistic (Level)	τ -statistic (First Difference)	τ -statistic (Level)	τ -statistic (First Difference)
GOVEF	-0.191199	-5.867295***	-0.191199	-5.867295***
REGQUA	0.023077	-6.085437***	0.023077	-6.085437***
RUOLAW	-0.893048	-5.965506***	-0.916305	-5.965506***
POLITY	-0.861637	-6.083644***	-0.861637	-6.083644***

Note: ***, **, and * indicate statistical significance at 1%, 5% and 10% levels, respectively.

Table 2.8 represents unit root test outputs for the institutional variables in the period 1996-2005. GOVEF in ADF test and POLITY in PP test are stationary in both cases at a significance level less than 1%. Taking first differences makes all the

institutional variables stationary. Table 2.9 gives unit root test results for same variables over the period 2006-2015. For both tests, all variables are non-stationary at level but they are stationary at a significance level less than 1% at first differences.

Table 2.10 Unit Root Test Results of the Financial Variables: 1996-2005

Variable	ADF Unit Root Test		PP Unit Root Test	
	τ -statistic (Level)	τ -statistic (First Difference)	τ -statistic (Level)	τ -statistic (First Difference)
M2GDP	-2.585638	-5.523002***	-2.585638	-4.869331***
NPLTOTL	-0.552889	-4.907833***	-0.659436	-4.923006***
PRVTGDP	-0.098497	-2.536664**	-2.413156	-7.782645***
EQTOAST	-0.205114	-8.386115***	0.085401	-8.977321***

Note: ***, **, and * indicate statistical significance at 1%, 5% and 10% levels, respectively.

Table 2.11 Unit Root Test Results of the Financial Variables: 2006-2015

Variable	ADF Unit Root Test		PP Unit Root Test	
	τ -statistic (Level)	τ -statistic (First Difference)	τ -statistic (Level)	τ -statistic (First Difference)
M2GDP	-2.639121	-15.98765***	-4.093959**	-6.246252***
NPLTOTL	-3.354607*	-3.640377***	-1.090686	-3.767796***
PRVTGDP	-2.156726	-2.180223**	-3.071798	-5.266083***
EQTOAST	-2.740538*	-8.472941***	-2.815553*	-8.108165***

Note: ***, **, and * indicate statistical significance at 1%, 5% and 10% levels, respectively.

In the Table 2.10 unit root test results are given for the financial variable in the period 1996-2005. All variables are non-stationary at level and they become stationary at their first difference. As for the Table 2.11, it also represents test outcomes for the same variable over the period 2006-2015. In both tests, before taking their first difference, there are some stationary variables such as NPLTOTL and EQTOAST at 10% significance.

After testing all variables in ADF and PP tests with the different time ranges, it is concluded that all these variable are not $I(2)$ and all of them are either integrated of zero or one ($I(0)$ or $I(1)$). This conclusion is crucial since it allows using the Auto-Regressive Distributed Lag (ARDL) method. This method results are given and discussed in the following section.

2.6.2 ARDL Model Results

The ARDL models are run for the three variable groups for both periods 1996-2005 and 2006-2015. The results of the ARDL bounds testing approach for these periods are given in the tables with the optimal leg lengths, F-statistics and calculated Critical values by Pesaran and et al. (2001) for $I(0)$ and $I(1)$ at significance levels of %5 and %10. As the lag length is very important for the ARDL approach of cointegration, in order to define lag lengths calculated values of Schwarz Information Criterion (SIC) are used. Optimal lag lengths are provided in parentheses for variables.

In the Table 2.12, $F(\text{CRED} \mid \text{GDP, INF, REER, STINT, UNEMP, TRADEOP})$ represents the model of the macroeconomic variable group. The calculated F-statistic for this model surpasses the upper critical values in both significance levels; %5 and %10, respectively. This conclusion indicates that there exists a long-run relationship at a significance level of 5% between the Central bank credibility, Growth Rates, Inflation, Reel Effective Exchange Rates, Short-term Interest Rates, Unemployment Rates and Trade Openness over the period 1996-2005.

Second model in the Table 2.12 is dedicated to the financial variables. The computed F-statistic of the model $F(\text{CRED} \mid \text{M2GDP, NPLTOTL, PRVTGDP, EQTOAST})$ exceeds the upper critical values at a significance level of %10. It means that there is a long-run relationship between the Central bank credibility, M2 over GDP, Non-performing Loans to Total Loans, Loans to Private Sector over GDP, and Equity to Assets over the same period.

Third model of the Table 2.12 is run for the institutional variables. The estimated F-statistic of the model $F(\text{CRED} \mid \text{GOVEF}, \text{REGQUA}, \text{RUOLAW}, \text{POLITY})$ is superior to the upper critical values at a significance level of %10. As a result of that, it can be clearly said that there is also a long-run relationship between the Central bank credibility, Government Effectiveness, Regulatory Quality and Rule of Law and Polity in the same period.

Table 2.12 Results of the ARDL Cointegration Test: 1996-2005

Bounds Testing to Cointegration			Critical values %5		Critical values %10	
Estimated Models	Optimal lag	F-statistics	I(0)	I(1)	I(0)	I(1)
$F(\text{CRED} \mid \text{GDP}, \text{INF}, \text{REER}, \text{STINT}, \text{UNEMP}, \text{TRADEOP})$	(4, 3, 4, 4, 4, 4, 4)	3.43	2.27	3.28	1.99	2.94
$F(\text{CRED} \mid \text{M2GDP}, \text{NPLTOTL}, \text{PRVTGDP}, \text{EQTOAST})$	(1, 1, 0, 0, 0)	3.22	2.56	3.49	2.20	3.09
$F(\text{CRED} \mid \text{GOVEF}, \text{REGQUA}, \text{RUOLAW}, \text{POLITY})$	(1, 0, 0, 4, 0)	3.12	2.56	3.49	2.20	3.09

Note: The critical values are obtained from Pesaran et al. (2001).

Table 2.13 provides information about the models of the same variable groups but different time period; 2006-2015. The estimated F-statistic value of the model $F(\text{CRED} \mid \text{GDP}, \text{INF}, \text{REER}, \text{STINT}, \text{UNEMP}, \text{TRADEOP})$ is greater than the upper critical value at a significance level of %5, stating that there is a long-run relationship between the Central bank credibility and the macroeconomic variables. The calculated F-statistic of the model $F(\text{CRED} \mid \text{M2GDP}, \text{NPLTOTL}, \text{PRVTGDP}, \text{EQTOAST})$ exceeds the upper critical value at a significance level of %5, indicating a long-run relationship between these variables. As for the model $F(\text{CRED} \mid \text{GOVEF}, \text{REGQUA}, \text{RUOLAW}, \text{POLITY})$, the computed F-statistic value is larger than the

upper critical value at a significance level of %5. This result also states a long-run relationship between the Central bank credibility and the institutional variables.

Tablo 2.13 Results of the ARDL Cointegration Test: 2006-2015

Bounds Testing to Cointegration			Critical values %5		Critical values %10	
Estimated Models	Optimal lag	F-statistics	I(0)	I(1)	I(0)	I(1)
F(CRED GDP, INF, REER, STINT, UNEMP, TRADEOP)	(1, 2, 1, 2, 2, 2, 2)	8.68	2.27	3.28	1.99	2.94
F(CRED M2GDP, NPLTOTL, PRVTGDP, EQTOAST)	(4, 3, 4, 3, 4)	6.26	2.56	3.49	2.20	3.09
F(CRED GOVEF, REGQUA, RUOLAW, POLITY)	(4, 2, 4, 2, 0)	3.55	2.56	3.49	2.20	3.09

Note: The critical values are obtained from Pesaran et al. (2001).

After providing information about the existence of the long-run relationships between the Central bank credibility and the variables groups, it is analyzed how these long-run relations occur between these variables in terms of coefficients obtained from the ARDL models. In addition to long-run relations, short-run relations are also investigated with this study for three variable groups over the periods 1996-2005 and 2006-2015.

The macroeconomic variables estimations model results are represented in the Table 2.14. Before discussing the coefficients of the model, it should be firstly stated that these results are statistically robust according to the diagnostic tests in terms of the accuracy of the whole model since in this model there does not exist normality, serial correlations and heteroskedasticity problems in both periods. In the table, there

is also Cusum test estimation outcomes that support the robustness and fitness of the model, stating estimated coefficients are stable over the periods.

In accordance with the long-run analysis results in the Table 2.14, GPD, INF, REER, STINT and UNEMP are statistically significant at different levels in both periods, but only TRADEOP is statistically significant in the period 2006-2015 at a significance level of %1. Additionally, the short-run analysis outcomes are also given in the same table. As it is expected, Error Correction Terms (ECT) are negative and statistically significant at the level of 1% for both periods. This finding supports the long-run relationships between variables because these coefficients indicate that the short-run deviations from the long-run equilibrium are corrected by %16.6 in the first period and %61.2 in the second one towards long-run equilibrium path for each quarter.

According to the results, any change in GDP leads to augmentations in the Central bank credibility, all other things being equal. These econometric outcomes are statistically significant at a significance level of %1 in 1996-2005, and %5 in 2006-2015. Having a positive relation between them is quite normal because when the macroeconomic and monetary policies are applied correctly by the government then it thus stimulates the economic growth. With the economic and financial soundness, the Central bank credibility gets stronger as it is an important part of the economic system in the Turkish economy.

Econometric estimation results indicate that the coefficient of INF is negative in both periods. It means that when the INF increases, the credibility decreases. The principal duty of the Central bank is to ensure price stability, in other words dealing with the inflation. This responsibility is given by the Law to the CBRT. Because of the negative relationship, if the inflation goes up, it makes harder for the Central bank to manage to handle with this raise. At the end, the Central bank becomes unsuccessful if it loses control over the reduction in the rate of inflation. There is also another important point in the struggle with the inflation for the CBRT; it defines the target inflation rates and based on the achievement of these rates, it is considered either successful or unsuccessful. If the CBRT fails to fulfill the inflation targets then it loses its persuasiveness, in turn its credibility.

Tablo 2.14 Long-run and Short-run Results: Macroeconomic Variables

Dependent Variable = CRED				
	1996-2005		2006-2015	
Variables	Coefficient	T-statistic	Coefficient	T-statistic
Long-run Analysis				
Constant	3.2451**	6.5151	1.8693***	3.1048
GDP	0.0846***	14.8512	0.0117**	2.5920
INF	-0.1428**	-8.3348	-0.1107***	-4.7159
REER	0.2521*	2.9934	0.2880***	3.6218
STINT	-0.1344**	4.9085	-0.0366***	-3.6787
UNEMP	-0.3810**	-6.9697	-0.0849**	-2.7813
TRADEOP	0.0283	0.4699	0.3241***	5.0079
Short-run Analysis				
CRED (-1)	-1.1511*	-2.9510	-	-
CRED (-2)	-0.1200	-0.4615	-	-
CRED (-3)	-0.0352	-0.1441	-	-
GDP	0.0272	2.6829	-0.0150***	-3.9262
GDP (-1)	0.0232	2.4570	0.0490	0.9435
GDP (-2)	0.3167	1.8505	-	-
GDP (-3)	0.2468	2.0555	-	-
INF	0.0552	1.1878	-0.0439***	-3.7383
INF (-1)	0.5375*	3.2457	-0.0567***	-3.5070
INF (-2)	0.6257	2.7536	-	-
REER	0.2800	1.6497	-0.1626***	-3.2117
REER (-1)	0.0483	0.4024	0.0360	0.5634
REER (-2)	0.1078*	4.0312	-	-
REER (-3)	0.0945	1.5955	-	-
STINT	0.0050	0.1439	0.0002	0.0720
STINT (-1)	0.0080	0.2425	-	-
STINT (-2)	-0.0107	-1.1944	-	-
STINT (-3)	0.0385*	3.2554	-	-
UNEMP	-0.1213	-1.3955	0.0099	0.5339
UNEMP (-1)	-0.1214	-1.5869	-0.8710***	-9.0820
UNEMP (-2)	0.7047*	3.3622	-	-
TRADEOP	0.2472	2.1087	-0.1316*	-2.0492
TRADEOP (-1)	0.2499	1.9095	0.0359*	1.9576
TRADEOP (-2)	0.0522	0.6869	-	-
TRADEOP (-3)	-0.1759	-1.6425	-	-
ECT (-1)	-0.1664***	-7.0722	-0.6121***	-5.2975
Diagnostic Tests	Prob. Value		Prob. Value	
<i>NORMAL</i>	0,3550		0.5498	
<i>SERIAL</i>	0,3421		0.1597	
<i>WHITE</i>	0.3875		0.5329	
<i>CUSUM</i>	Stable		Stable	
<i>CUSUM OF SQUARES</i>	Stable		Stable	

Note: The superscripts ***, ** and * denote the significance at 1%, 5% and 10% level, respectively.

Any increase in REER indicates that TL appreciates against the foreign currencies in real terms. Based on the results, changes in REER affect positively the Central bank credibility over the two periods. When the TL is more valuable the CBRT can strengthen its power over the monetary policy. As a result of that, it makes the CBRT more credible while achieving its financial goals. Furthermore, the intervention in the exchange rates through monetary policy instruments such as buying or selling foreign currencies is one of the important responsibilities of the Central bank in order to keep TL stable. When the national currency is either exceptionally depreciated or appreciated, the Central bank intervenes in the money market to balance the value of the TL, in particular while depreciating. The more the volatility is high in exchange rates, the less the ability of the Central bank to stabilize them is. Because the protection of the reputation of the TL is much more important, increases in REER leads to the improvement in the Central bank credibility.

Interest rates are very important for the whole economy since the investment decisions directly depend on it. As an influential actor, the CBRT partially tries to determine the interest rates over the money market and its success stems from the effectiveness of the interest rate policy. If it is good at reducing the interest rates then the Central bank is considered successful and it hereby boosts its credibility. In accordance with this relation, the following conclusion can be drawn; increase in STINT diminishes the credibility of the CBRT. This conclusion is endorsed by the econometric results of the model, showing negative relation between the credibility and short-term interest rates in the Table 2.14.

The rate of unemployment is another important factor that affects the Central bank credibility since this rate provides information about the functioning of the labor market in the Turkish economy. Taking into account econometric model results, in the long-run UNEMP is negatively related to the Central bank credibility and this relationship is statistically significant at a significance level of %5 for both periods. These findings are important since between economic growth and unemployment there is a tight relationship. If the economy needs to grow, production may provide this growth. As the factors of production include land, labor, capital and entrepreneurship, it makes employees an important input for the production of goods or services. If the number of people in work augments, it is beneficial for the

economy because they improve the national wealth. When the economy is getting bigger and stronger thanks to these new employees, the Central bank can maintain its monetary policies in a healthier economic environment while increasing its credibility.

The ratio of the total export and import to GDP shows the degree of openness in terms of international trade. When this ratio grows up, monetary volume also expands and it leads to a bigger financial size for the Turkish economy. This financial increase provides more financial sources and it is not only advantageous for the economy but also for the Central bank because its efficiency depends on the favorable economic conditions. Augmentations in TRADEOP consequently increase the degree of the Central bank credibility. This relation is supported by the econometric results of the model for the second period at a significance level of %1. For the first period, this relationship is not statistically significant. It is because of the volume of the foreign trade in terms of merchandise; from 1996 to 2005 the total volume of the foreign trade is about 1 trillion US dollars and as for 2006-2015 it is 3.3 trillion US dollars. In the second period, it becomes more important for the Turkish economy and therefore for the Central bank.

The financial variables model results are given in the Table 2.15. Based on the diagnostic tests in terms of the accuracy of the whole model, this model is statistically robust because there is not normality, serial correlations and heteroskedasticity problems for both periods. Robustness and fitness of the model is also supported by Cusum test estimation results, indicating estimated coefficients are stable over the two periods.

According to the long-run analysis results in the Table 2.15, M2GDP is the only one being statistically significant in the both periods; at a significance level of %10 and %1, in 1996-2005 and 2006-2015, respectively. NPLTOTL, PRVTGDP and EQTOAST are statistically significant in the second period. ECTs are negative and statistically significant in both periods. This result also supports the long-run relationships between the Central bank credibility and the financial variables.

In the International Monetary Fund's (IMF) International Financial Statistics (IFS), the definition of money supply is frequently called M2 and it corresponds to money and quasi money comprise the sum of currency outside banks, demand deposits other than those of the central government, and the time, savings, and foreign currency deposits of resident sectors other than the central government. The ratio of M2 to GDP is thus a very good indicator to represent the financial sector growth in terms of size. The more the growth in the financial system exists, the more Central bank has resources. This positive relation provides the Central bank with an accurate atmosphere to run its monetary policies in an effective way and its credibility consequently augments. This relationship in the long-run is confirmed by the econometric results of the model in both periods.

In consideration of the repayment of the loan, banks can substantially reduce their credit risk by lending less to their customers but this causes inefficiency problems. Ratio of bank nonperforming loans to total gross loans is defined by the IMF as the value of nonperforming loans divided by the total value of the loan portfolio. The ratio of bank nonperforming loans to total gross loans, which is a measure of bank health and efficiency, helps identify problems with asset quality in the loan portfolio. This is one of the most important ratios for an economy because a high ratio might signal deterioration of the credit portfolio (World Bank WDI, 2011). When this ratio increases, the level of financial trouble in the banking system rises up. As a consequence of this, the Central bank credibility is adversely affected by this deterioration. This is proven by the econometric result of the model in the second period. This result states that the Central bank credibility responds to increases in the NPLTOTL by degrading its credibility.

A bank collects deposit from investors and then it gives them to borrowers in terms of credit for the purpose of having profit. Credit provided by the banking sector to private sector as a share of GDP is a measure of the banking sector depth and financial sector development in terms of size. However, it is also a measure of the pressure on banks since the more credit is provided the more risk-taking in the banking sector increases. In the long-run the relationship between the Central bank credibility and the ratio of loans to private sector over GDP is expected to be negative since when this ratio goes up; risks in the banking sector also rise up. As a

result of this risk increase, as an important player and regulator in the financial system, the Central bank is negatively touched and its credibility thus degrades. This conclusion is approved by the econometric outcome of the model which gives a statistically significant negative coefficient for the second period.

The ratio of bank capital to total assets is considered as a measure of bank solvency and resiliency. It is another important ratio for banks in order to operate efficiently on the financial market. It shows the extent to which banks could deal with unexpected losses (World Bank WGI, 2011). It is calculated as a ratio of capital and reserves to total assets. It is predicted to have a positive relation between the Central bank credibility and EQTOAST in the long-run. It is occurred in this way because when this ratio increases, it means that the capital structure of the banking sector gets stronger. The soundness of the banking sector supports the Central bank's ability to run its monetary policies accurately. In accordance with the econometric results of the model in the Table 2.15, the effect of EQTOAST on the Credibility is positive in the period 2006-2015.

Tablo 2.15 Long-run and Short-run Results: Financial Variables

Dependent Variable = CRED				
	1996-2005		2006-2015	
Variables	Coefficient	T-statistic	Coefficient	T-statistic
Long-run Analysis				
Constant	42.0811***	2.8441	1.8034***	7.6431
M2GDP	0.3559*	1.8447	0.5080***	3.5651
NPLTOTL	-0.4704	-1.3182	-0.1769***	-4.2245
PRVTGDP	-0.3832	-1.2870	-0.1986**	-2.6377
EQTOAST	0.6762	1.1356	0.3616***	4.1575
Short-run Analysis				
CRED (-1)	-	-	0.4433***	3.3207
CRED (-2)	-	-	0.1101	1.0672
CRED (-3)	-	-	0.1449	1.6803
M2GDP	0.0668**	2.1268	0.2093	1.3805
M2GDP (-1)	-	-	0.4547**	2.8886
M2GDP (-2)	-	-	0.5005**	2.6208
M2GDP (-3)	-	-	0.4631***	3.0278
NPLTOTL	-0.1339	-1.2456	-0.0881	-1.5092
NPLTOTL (-1)	-	-	-0.0133	-0.2386
NPLTOTL (-2)	-	-	-0.2981***	-4.9881
PRVTGDP	-0.0532	-1.1437	-0.1469	-1.0389
PRVTGDP (-1)	-	-	-0.6730***	-5.0039
PRVTGDP (-2)	-	-	-0.6712***	-3.8022
PRVTGDP (-3)	-	-	-0.3802**	-2.6503
EQTOAST	-0.4388**	-2.5847	-0.0654	-1.0332
EQTOAST (-1)	-	-	-0.3278***	-3.6000
EQTOAST (-2)	-	-	-0.1593	-1.6951
ECT (-1)	-0.2227**	-2.4502	-0.3629***	-7.2118
Diagnostic Tests	Prob. Value		Prob. Value	
<i>NORMAL</i>	0.5601		0.7214	
<i>SERIAL</i>	0.4525		0.2152	
<i>WHITE</i>	0.7643		0.2425	
<i>CUSUM</i>	Stable		Stable	
<i>CUSUM OF SQUARES</i>	Stable		Stable	

Note: The superscripts ***, ** and * denote the significance at 1%, 5% and 10% level, respectively.

The model results of the institutional variables are represented in the Table 2.16. According to the diagnostic tests outcomes, this model is statistically robust because it does not include normality, serial correlations or heteroskedasticity problems for both periods. Cusum test results also confirm the accuracy of the model by proving the stability of the estimated coefficients in the two periods.

In this model, indicators of Government Effectiveness, Regulatory Quality, Rule of Law and Polity are considered to be potential institutional determinants of central bank credibility. Based on the long-run analysis results in the Table 2.16, POLITY is statistically significant in the both periods at a significance level of %1. GOVEF and RUOLAW are statistically significant in the second period at a significance level of %5 and %1, respectively. Among these four institutional variables, only REGQUA is found statistically insignificant for both periods. In the short-run results of the model, the values of ECT are also negative and statistically significant in both periods. This result also indicates the long-run relationships between the Central bank credibility and the institutional variables, showing the speed of adjustment to the long-run equilibrium.

The coefficients of GOVEF and RUOLAW are positive in the period 2006-2015. It suggests that when these variables increase, the credibility augments. This relation is quite reasonable as GOVEF includes the credibility of the government's commitment to policies while RUOLAW contains perceptions of the extent to which agents have confidence in the rules of society. As for Polity, in the first period its coefficient is positive and confirms earlier relationship; however, it becomes negative in the second period.

Table 2.16 Long-run and Short-run Results: Institutional Variables

Dependent Variable = CRED				
	1996-2005		2006-2015	
Variables	Coefficient	T-statistic	Coefficient	T-statistic
Long-run Analysis				
Constant	3.5396	0.3999	4.6634***	43.7789
GOVEF	0.0175	0.4203	0.2197**	2.5458
REGQUA	-0.1231	-2.4931	0.0199	0.3466
RUOLAW	-0.1409	-1.0766	0.0274***	4.8080
POLITY	1.7235***	11.3728	-0.0999***	-3.3363
Short-run Analysis				
CRED (-1)	-	-	0.4335**	2.6857
CRED (-2)	-	-	0.4026**	2.7187
CRED (-3)	-	-	0.4063***	2.8687
GOVEF	0.0297	1.4965	0.2071***	4.4183
GOVEF (-1)	-	-	-0.0879**	-2.5338
REGQUA	-0.0390	-1.5512	0.1404*	1.7710
REGQUA (-1)	0.0640**	2.5431	0.1498**	2.1420
REGQUA (-2)	0.0692**	2.6243	-	-
REGQUA (-3)	0.0722**	2.6163	-	-
RUOLAW	-0.0732	-1.6295	0.0414***	3.0463
POLITY	1.2554	1.9698	-0.0433*	-1.9969
POLITY (-1)	-	-	0.1120***	4.9117
POLITY (-2)	-	-	0.1312***	5.0004
POLITY (-3)	-	-	0.1145***	4.3759
ECT (-1)	-0.3367***	-3.1977	-0.4097***	-6.1048
Diagnostic Tests	Prob. Value		Prob. Value	
<i>NORMAL</i>	0.2051		0.1243	
<i>SERIAL</i>	0.9817		0.9059	
<i>WHITE</i>	0.9724		0.5282	
<i>CUSUM</i>	Stable		Stable	
<i>CUSUM OF SQUARES</i>	Stable		Stable	

Note: The superscripts ***, ** and * denote the significance at 1%, 5% and 10% level, respectively.

2.7 Summary and Comments

With this study, the determinants of the Central bank credibility for the Central Bank of the Republic of Turkey are investigated. For that, three variable groups are employed; macroeconomic, financial and institutional. Macroeconomic Variables consist of six indicators: Real GDP Growth Rates, Inflation Rates, Real Effective Exchange Rates, Short Term Interest Rates, Unemployment Rates and Trade Openness (total export and import to GDP). Financial variables include M2 to GDP, Non-Performing Loans to Total Loans, Loans to Private Sector to GDP and Equity to Total Assets. Institutional variables contain Government Effectiveness, Regulatory Quality, Rule of Law and Polity.

In this study, the Central bank credibility is calculated as an index based on the methodology developed by Mackiewicz-Łyziak (2009) for the CBRT over the period 1996-2015. This index is employed because it unifies the principal factors affecting the Central bank credibility in the related literature. As a composite index, it comprises sub-indexes: Achievement of Announced Monetary Policy Targets, Past Inflation Performance, Transparency of Monetary Policy, Central bank Independence, Country Risk and Public Debt. Taking into consideration the implementation of the explicit inflation targeting policy in 2006, numbers of sub-index used in forming the credibility index are 5 and 6 for the 1996-2005 and 2006-2015 periods, respectively. The credibility index is analyzed in two periods in the purpose of observing the results of the inflation targeting policy over the time in a precise way.

In order to define the determinants of the Central bank credibility, these variables groups are examined in two periods with the ARDL bounds test approach. The first period corresponds to the pre-inflation targeting regime covering 1996Q1-2005Q4 and the second one is during the inflation targeting monetary policy period dating from 2006Q1 to 2015Q4. The ARDL model is chosen because it provides reliable results while working on limited samples and allows analyses in long-run and short-run parameters simultaneously. There is another important point to use this model; it gives us the ability to deal with the restricted integration order, in other

words it is possible to investigate models with time series regardless of whether these series are $I(0)$ or $I(1)$.

The empirical results are given for three models. In terms of the accuracy of the whole models, these results are statistically robust since in these models do not include normality, serial correlations and heteroskedasticity problems in both periods.

The first model is dedicated to the macroeconomic variables; $F(\text{CRED} \mid \text{GDP}, \text{INF}, \text{REER}, \text{STINT}, \text{UNEMP}, \text{TRADEOP})$. The calculated F-statistic of the model exceeds the upper critical values, indicating there is a long-run relationship at a significance level of 5% between the Central bank credibility, Growth Rates, Inflation, Real Effective Exchange Rates, Short-term Interest Rates, Unemployment Rates and Trade Openness over the period 1996Q1-2005Q4. These results are same for the period 2006Q1-2015Q4. According to the long-run analysis results, GDP, INF, REER, STINT and UNEMP are statistically significant at different levels in both periods, but only TRADEOP is statistically significant in the period 2006Q1-2015Q4 at a significance level of 1%. Model results give also information about the short-run analyses. As it is expected, Error Correction Terms (ECT) that indicate the speed of adjustment to the long-run equilibrium are negative and statistically significant at the level of 1% in both periods. This result also supports the long-run relationships between the Central bank credibility and the macroeconomic variables.

Second model is run for the financial variables; $F(\text{CRED} \mid \text{M2GDP}, \text{NPLTOTL}, \text{PRVTGDP}, \text{EQTOAST})$. For the period 1996Q1-2005Q4, the estimated F-statistic value of the model is greater than the upper critical value at a significance level of 10%, confirming the existence of the long-run relations between the Central bank credibility, M2 over GDP, Non-performing Loans to Total Loans, Loans to Private Sector over GDP and Equity to Assets. The same results are obtained from the model for the period 2006Q1-2015Q4 but at a more significant level; namely 5%. This difference indicates that in the second period, the long-run relations between the Central bank credibility and financial variables become more robust. Based on the long-run estimation outcomes, M2GDP is only statistically significant in the both periods; at a significance level of 10% and 1%, in 1996Q1-2005Q4 and 2006Q1-

2015Q4, respectively. NPLTOTL, PRVTGDP and EQTOAST are statistically significant in the second period. ECTs are negative and statistically significant in both periods.

Third model is devoted to the institutional variables; $F(\text{CRED} \mid \text{GOVEF}, \text{REGQUA}, \text{RUOLAW}, \text{POLITY})$. The calculated F-statistic value of the model surpasses the upper critical values at a significance level of %10, confirming the presence of the long-run relations between the Central bank credibility, Government Effectiveness, Regulatory Quality, Rule of Law and Polity in the period 1996Q1-2005Q4. Same results are found for the period 2006Q1-2015Q4 but at a significance level of %5. It means that in the second period, the long-run relations between the Central bank credibility and institutional variables are found stronger. According to the long-run analysis results, POLITY is statistically significant in the both periods at a significance level of %1. GOVEF and RUOLAW are statistically significant in the second period at a significance level of %5 and %1, respectively. Among them, only REGQUA is found statistically insignificant for both periods. As for ECTs, they are negative and statistically significant for in both periods.

In addition to these model results, there is also an important point extracted from the model estimations; M2GDP is more significant in the second period and its coefficient is also bigger compared to that of the first period. It means that with the growth in the financial sector, this variable becomes more substantial in order to be defined as one of the determinants of the Central bank credibility. This is the case for the other variables; NPLTOTL, PRVTGDP and EQTOAST. They are statistically insignificant in the first period and all turn out to be significant in the second period.

3. THE RELATIONSHIP BETWEEN BANKING SECTOR FRAGILITY, CENTRAL BANK CREDIBILITY, MACROECONOMIC PERFORMANCE, AND INSTITUTIONS

After defining the determinants of the Central bank credibility in the previous section, this section investigates the relationships between Banking sector fragility, Central bank credibility, macroeconomic performance and institutions in the Turkish economy over the period 1996Q1-2015Q4.

In this study, in order to examine the effect of a variable shock on other variables, and vice versa (e.g. a credibility shock on banking sector fragility, macroeconomic performance and institutional variables), VAR methodology is employed. In the analyses, random shocks to variables are identified by the Cholesky decomposition method. The impulse response analysis gives information about the direction and magnitude of the effect of a variable on other variables. Developments of these effects throughout time might be considered as important indicators providing useful data for the policy-makers in order to take action in an accurate way. For instance, if a positive shock to the Central bank credibility has a negative effect on the short-term interest rates it may mean that the Central bank should focus on other objectives such as disinflation process, rather than arranging interest rates like the policy interest rate. In addition to the impulse response analysis, the variance decomposition method is used in the purpose of defining the percentage of the variation in a variable which is explained by the shock of another one.

Abbreviations indicate the following information; BSFI (Banking sector fragility index), CRED (Central bank credibility index), ECON (macroeconomic performance indicators: GDP, INF, REER, STINT, UNEMP and TRADEOP), and INST (institutional variable: RUOLAW). Macroeconomic and institutional variables are explained in the previous section (see the section titled *2.5 Data and Methodology*). The Central bank credibility (CRED) index based on the method developed by of Mackiewicz-Łyziak (2009) is calculated in the section *2.4 Construction of the Central bank Credibility Index*. As for the banking sector fragility index (BSFI), based on the methodology of Arı and Cergibozan (2016) an indice is constructed.

This study starts with the concept of the banking sector fragility. In the same section, some constructions of indices concerning banking or financial sector fragility are explained. In the following section, a banking sector fragility index is built in order to investigate its relation with other variables. After construction of the fragility index, selected papers are represented in the literature review section. Following that, the methodology of analysis is briefly described. Econometric model outcomes are given in the empirical results part. With a summary section, this paper completes itself.

3.1 Banking Sector Fragility

Since 1990s, the world economy has been suffering from major financial turbulences (e.g. 1994-1995 Latin America, 1997-1998 Asian, 1998 Russian, 2008-2009 Global financial crises). These financial turmoils lead to profound damages in economies such as deficiency in growth or increase in unemployment. In order to give an example, Reinhart and Rogoff (2009) demonstrate that the unemployment rate can increase an average of 7 percentage points and output may decrease an average of over 9 percent due to a financial crisis,. Those numbers show to what extent a crisis can cost to an economy.

For the financial robustness, the banking sector is an important indicator as it is a mediator located in the heart of the economic system. It also covers up to 90 percent of the financial sector in Turkey (according to the BRSA, the employment distribution in financial sector is dominated by banking sector at a rate of 89% in 2012). It is obvious that whenever there is a problem concerning banking sector (e.g. signs of financial distress like liquidity problem or increase in non-performing loans), whole economy will be affected sooner or later and the Turkish economy has experienced it several times throughout history. Leaven and Valencia (2012) count 147 banking crises all over the world between 1970 and 2011. And for Turkey, they mention two crises periods based on their banking crises episode conditions; 1982-1984 and 2000-2001. This study covers the 2000-2001 period which is considered as the biggest financial distress for the economic history of Turkey. In 2011, Minister of Economy declared that the cost of the 2001 crisis was more than TL 251 billion by

2011. This amount shows the deepness of this financial turbulence stemmed from banking sector for the Turkish economy.

An economy can be also faced with currency or sovereign debt problem along with banking sector problems. A bank failure is defined by Kibritçioğlu (2003) as a situation in which the excessively rising liquidity, credit, interest-rate, or exchange-rate risk drive banks to suspend the internal convertibility of its liabilities. At this point, if the bank failure problem worsens all banking system, then banking sector fragility rises up. As for the difficulty of the prediction of a banking sector crisis (or fragility), in their paper, Cihak and Schaeck (2010), it is argued that some indicators such as rapid credit growth (or credit boom) are likely to define possibility of a crisis. Upon on this kind of indicator (e.g. ratio of nonperforming loans to total loans), it makes possible for researchers to build a banking sector fragility index.

As banking sector is highly important for Turkish economy and some Central bank policies are closely related to the banking sector such as policy interest rates and required reserve ratios, in this study, it is aimed to examine the relationship between the Central bank credibility and the banking sector fragility along with macroeconomic and intuitional variables.

For this purpose, in the following section, a banking sector fragility index is calculated on a quarterly basis for the Turkish economy in the period 1996-2015. To build an index, the methodology of Arı and Cergibozan (2016) is applied. This methodology is chosen since it captures better banking sector disturbances compared to other indexes for the Turkish economy. But before that, we want to introduce some articles on the construction of the banking sector (or financial sector) fragility index.

The fragility of the banking sector to exposure to a crisis is studied by many researchers such as Laeven and Valencia (2008, 2012). They introduce some conditions in order to define a problem in the banking sector; significant bank runs, losses in the banking system, and/or bank liquidations, and interventions after significant losses in the banking system (e.g. bank nationalizations and deposit

freezes or bank holidays). They also prepare a database including all systemic banking, currency, and sovereign debt crises dates during the period 1970–2011.

Kibritçioğlu (2003) constructs an index for the banking sector fragility index (BSF). For that, he employs three components; bank deposits (*DEP*), bank claims on (or credits to) the domestic private sector (*CPS*), and foreign liabilities of banks (*FL*). He analyzes 22 countries including Turkey with monthly data starting from different date to December 2002. He designs his index formula in the following form:

$$BSF_t = \frac{\left(\frac{CPS_t - \mu_{CPS}}{\sigma_{CPS}} \right) + \left(\frac{FL_t - \mu_{FL}}{\sigma_{FL}} \right) + \left(\frac{DEP_t - \mu_{DEP}}{\sigma_{DEP}} \right)}{3}$$

where μ and σ represent the arithmetic average and standard deviation of these three variables, respectively. The BSF index is defined as an average of standardized values of *CPS*, *FL* and *DEP*.

$$CPS_t = \frac{LCPS_t - LCPS_{t-12}}{LCPS_{t-12}}$$

$$FL_t = \frac{LFL_t - LFL_{t-12}}{LFL_{t-12}}$$

$$DEP_t = \frac{LDEP_t - LDEP_{t-12}}{LDEP_{t-12}}$$

In addition, Kibritçioğlu (2003) defines *LCPS*, *LFL* and *LDEP* as the banking system's total real claims on the private sector, the banks' real foreign liabilities, and the total real deposits on banks, respectively. As it is seen in the previous equations, 12-month percent changes are used instead of monthly changes in order to avoid seasonality problem.

Von Hagen and Ho (2003, 2007) calculate an index of money market pressure (IMP). As an index method, they define the Central bank loans to bank deposits ratio as

loans from the monetary authorities to deposit money banks divided by total deposits in deposit money banks. Their data sample includes 49 countries including Turkey quarterly data ranging from 1980 to 2001. Their index is formulated as follows:

$$IMP = \frac{\Delta\gamma}{\sigma_{\Delta\gamma}} + \frac{\Delta r}{\sigma_{\Delta r}}$$

where γ stands for the Central bank loans to bank deposits ratio, r represents the money market rate in real terms; Δ is the difference operator, $\sigma_{\Delta\gamma}$ and $\sigma_{\Delta r}$ define the standard deviations of the two elements, respectively. This index is formed as a weighted average of changes in Central bank loans to bank deposits ratio and changes in money market rate.

Another index of financial fragility is used by Corsetti et al. (2001) and Bunda and Ca'Zorzi (2010) based on the lending boom in a domestic economy which reflects banks taking high risk. Their index of financial fragility (IFF) is defined as the growth of commercial bank loans to the private sector (*CPS*) as percentage of gross domestic product (*GDP*). The index is calculated in the following form:

$$IFF_t = \Delta \left(\frac{CPS}{GDP} \right)_t$$

This index provides information about the financial fragility if its value exceeds the specified threshold; 1.5 and 3 standard deviations plus the index mean for a given country.

Some studies on the banking/financial sector fragility are represented in order to give an idea how this kind of indices are constructed. In addition to that, in the next section, the construction of the banking sector fragility index is discussed.

3.2 Building the Banking Sector Fragility Index

For the compatibility of the study, an index for the banking sector fragility is calculated with three components for the period 2006-2015. This index is introduced into literature by Ari and Cergibozan (2016). In their study, they analyze the link between banking and currency crises. They also investigate the principal

determinants of these twin crises by developing a multivariate logit model for the period 1990–2013 with the monthly data.

In order to construct a banking sector fragility index (BSFI), three components are used: changes in the ratio of nonperforming loans over bank total loans NPL/TL , bank foreign deposits over bank total deposits FD/TD , and bank profit (loss) over bank own equity PL/OE . These ratios are calculated for the deposit banks since they represent about 90 percent of the whole banking sector in Turkish economy⁵³.

NPL/TL ratio is a good indicator of the financial fragility because it shows the difficulty of the repayment of loans when it is increased. At this point, debtors cannot pay back their loans to financial institutions, and in turn, when depositors want their money bank these institutions cannot afford to give back all of money. This situation drives financial institutions to high risk. When investors see this disturbance in the banking sector, they lose their trust in national currency and they convert their money into foreign currencies. As a result of that, the ratio of FD/TD increase, and so do the fragility in the banking sector. After all, changes in the balance sheet may result in losses for banks.

For the index, quarterly data gathered from the CBRT are used. These index parts are weighted by the inverse of their respective standard deviations; $\sigma_{NPL/TL}$, $\sigma_{FD/TD}$ and $\sigma_{PL/OE}$. Index values can take any values depending on the calculation formula (positive or negative). Rises in the index values mean the risk for the banking sector is greater and vice versa. The index is calculated as follows:

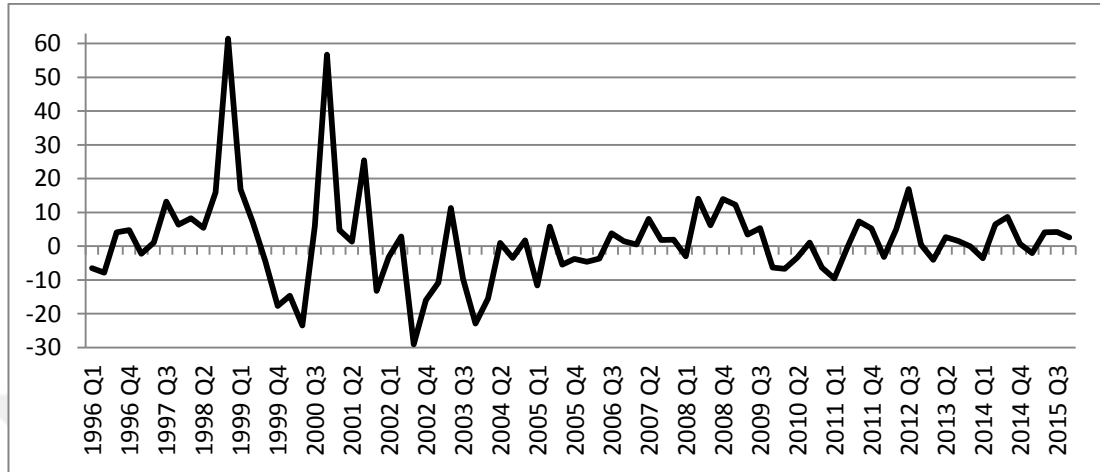
$$BSFI_t = \frac{1}{\sigma_{NPL/TL}} \left(\frac{(NPL/TL)_t - (NPL/TL)_{t-1}}{(NPL/TL)_{t-1}} \right) + \frac{1}{\sigma_{FD/TD}} \left(\frac{(FD/TD)_t - (FD/TD)_{t-1}}{(FD/TD)_{t-1}} \right) + \frac{1}{\sigma_{PL/OE}} \left(\frac{(PL/OE)_t - (PL/OE)_{t-1}}{(PL/OE)_{t-1}} \right)$$

For this study, this index is chosen for the fact that it shows the most important financial turmoils over the Turkish economy such as 1997-1998, 2001 and 2008-

⁵³ According to the BRSA, as for December 2015 the deposit banks cover more than 91% of the total asset of the Turkish banking sector (TL 1454 billion against TL 1324 billion).

2009 financial crises, and European sovereign debt crisis starting in 2010. This accuracy can be seen in the Table 3.1.

Figure 3.1 Banking Sector Fragility Index: 1996-2015



Source: The author's own calculation.

3.3 Literature Review

The relationship between banking/financial sector fragility, Central bank credibility (independence or transparency), macroeconomic performance and institutions is studied by many scholars in the economic literature with different aspects. Selected examples are given below.

Parkin (1986) examines relationship between the central bank independence and the government deficits over the period 1955-1983 for 12 countries, and concludes that there is a negative relationship between them. Masciandaro and Tabellini (1988) study the relationship between the central bank independence and the fiscal deficits for Australia, Canada, Japan, New Zealand and the United States during the period 1970-1985. They arrive at this conclusion that New Zealand as a country having the highest fiscal deficit has the lowest level of central bank independence. Besides, the United States with the highest level of Central bank independence has a deficit similar to other countries.

Grilli et al. (1991) finds no evidence showing effect of Central bank independence on the growth rate of real output even if the Central bank

independence helps an economy in low inflation process. They also state that there is a negative correlation between the degree of central bank independence and the deficit ratio.

Alesina and Summers (1993) investigate a correlation between Central bank independence and economic variables such as growth, unemployment, and real interest rates. Their study consists of 16 countries covering the entire 1955-1988 period. They conclude that while Central bank independence supports price stability, it has no measurable impact on economic performance.

The principal finding of the study of Cukierman et al. (1993) is that the Central bank independence has a positive effect on growth in the less developed countries but for industrial countries they cannot arrive at same result.

Pollard (1993) arrives at a conclusion that the independency of a Central bank can raise up policy conflicts with the government when their aims are different, and at this point it may worsen the economic performance of a this country. He also argues that the Central bank independence can foster the credibility and in this way overall effectiveness of a policy program can be assured.

Lybek (1999) investigates the relationship between Central bank autonomy, inflation, and output performance in the Baltic States, Russia and other countries of the former Soviet Union over the period 1995-1997. He finds that there is a positive correlation between higher degree of Central bank autonomy/independence and high real growths.

Hein (2001) examines the effects of Central bank independence and labor market institutions on macroeconomic performance. He emphasizes that Central bank independence is in favor of the price stability and does not allow the rate of unemployment to fall below the Non-accelerating Inflation Rate of Unemployment (NAIRU).

After studying on 18 developing countries over the period 1990s, Atchariyachanvanich (2003) claims that in the short-run, increased Central bank

independence can produce tradeoffs on growth and unemployment rates. He explains this result as increasing the Central bank independence means that policy makers devote their responsibility more on price stability than other objectives and this policy takes long time horizon to be achieved. In this case, it can affect the performances of the economy negatively in short-run.

Calderon and Schmidt-Hebbel (2003) analyze the credibility and macroeconomic policies in Latin America and the Caribbean. They perform this research with the annual data over the period 1970-2002, using OLS and Panel Data analysis methods. They find that the adoption of counter-cyclical macroeconomic policies is eased by the credibility and the Central bank independence is important at meeting inflation targets.

Rochon and Rossi (2006) investigate the connection between inflation targeting and economic performance. For 23 countries, the sample starts at various dates depending on the starting time of the inflation targeting regime and ends in 2005. They focus on the impact of targeted inflation on the distribution of income (wage share) and conclude that for the countries adopting an inflation targeting policy there is a decline in the wage share.

Clare and Courtenay (2001) examine the impact of Central bank transparency focusing on financial assets is examined for the Bank of England. They find that increasing the Central bank transparency helps the efficiency of the financial market. Geraats et al. (2006) try to get an answer to this question: whether the Central bank transparency decreases interest rates. And their answer is yes. They reach a conclusion that increase in transparency has a significant effect on interest rates. In addition to that, Van der Cruysen and Demertzis (2006) suggest that transparency helps fixing inflation expectations for the private sector. De Mendonça and Filho (2008) evaluate the effect of the Central bank transparency on macroeconomic variables for the Central bank of Brazil over the period 2002-2006. They conclude that the Central bank transparency reduces the inflation expectations and long term interest rates.

Browne and Kelly (2010) focus on the Central bank credibility and income velocity in a Monetary Union over the period 1999Q1 to 2009Q4. Their result shows that the credibility has a highly significant impact on income velocity in member states. To be more specific, according to their measurement one per cent increase in credibility gain leads to half per cent decrease in income velocity.

Aleem and Lahiani (2014) study the relation between the monetary policy credibility and exchange rate. They investigate this relationship for Brazil, Mexico, Philippines, South Korea and Thailand with monthly data depending on the data availability by using VAR with Exogenous Variables (VARX) model. Their main conclusion is that a credible monetary policy which wants to control inflation is related to a lower exchange rate pass-through. They also conclude that after implementing inflation targeting policy, exchange rate pass-through is shrunk.

Heimonen and Maslowska-Jokinen (2014) shed light on the relationship between the Central bank independence and debts for 14 countries of the European Economic and Monetary Union (EMU) for the 1980-2000 period with the Panel data estimations. Their main conclusion is that greater increase in Central bank independence is connected to greater increase in debt for both public and private.

Doğan and Bozdemir (2014) work on the credibility and its relation with the interest rates for Turkey in the 2004–2012 period. Their conclusion is that greater credibility leads to lesser volatility in interest rates for the monetary policy and market. Their result supports the empirical evidence of De Mendonça and Souza (2009) that suggests that higher credibility implies lower variations in the interest rates.

Dincer and Eichengreen (2014) calculate the transparency and independence for more than 100 Central banks from 1998 to 2000. After that, they analyze the relationship between transparency, independence and inflation rates. In their paper, it is argued that Central bank transparency and independence significantly affect the variability of inflation rates.

Papadamou et al. (2014) define determinants of Central bank credibility for 6 emerging economies with annual data from 1999 to 2007 by using the Panel Vector Autoregressive (PVAR) model. In their study, it is found that the greater the credibility is the lower interest rates are while higher effective exchange rates. It is also shown that there is a positive impact on economic activity.

Akıncı et al. (2015) investigate the relationship between Central bank independence, financial freedom, and economic growth for the European Union (EU) countries. For their study, they use Panel ARDL Bounds Testing Approach for the period from 1995 to 2011. They find that for the long and short term, there is a positive relation between Central bank independence, financial freedom, and economic growth.

Bodea and Hicks (2015) examine the issue of credibility in an institutional way for 78 countries from 1973 to 2008. They argue that if institutional mechanisms can limit political interference in Central banks' activities in a country, then its Central bank can have greater effects on price stability. And they also conclude that if the public is convinced that this Central bank is free from any interference, then they reduce their inflation expectations. It is more effective in price stability compared to the control of the money supply.

Romdhane and Mensi (2015) study the impact of inflation targeting on inflation and output for 30 Organization for Economic Cooperation and Development (OECD) countries over the period 1980-2012 with Panel Data analysis. They suggest that inflation targeting assist in improving macroeconomic performance of targeted OECD countries. Furthermore, Kumo (2015) investigates the relationship inflation targeting and the economic growth in South Africa for two periods: 1960Q1-1998Q4 and 2000Q1-2013Q3, respectively. He concludes that in the first period (without inflation targeting regime), there is a negative impact on economic growth while there is a positive one in the second period (with inflation targeting regime).

Bordo and Siklos (2015) analyze the Central bank credibility and financial crisis and economic growth for advanced and emerging countries over the period

1980-2014. They mention that financial crises decrease the degree of Central bank credibility and economic growth has a significant impact on Central bank credibility. They emphasize the importance of the quality of the institutions for Central banks in order to be strong against the crises.

After measuring the Central bank credibility deriving from the difference between inflation targets and expectations for 18 emerging economies, Levieuge et al. (2015) investigate the connection between credibility and interest rates. Their finding highlights that there is a negative influence of credibility on the volatility of the short term interest rates.

Moreira et al. (2015) work on the connection between the credibility of the monetary policy and macroeconomic indicators such as output and exchange rate for the Brazilian economy from 2005 to 2012. This study is carried out using the Bayesian Vector Autoregression (BVAR) model. With this study, it is shown that the credibility gains or losses are affected by inflation rate and is negatively touched by undervaluated domestic money.

Papadamou et al. (2016) measure the effectiveness of the Central bank independence on economic performance. For this purpose, they examine the independence of the Central bank of 22 countries from 1992 to 2000, applying Dynamic Panel Data analysis. They claim that Central bank independence has a significant impact on deficit, GDP growth and public debt.

Galati et al. (2016) work on inflation expectations in the Euro Area in terms of credibility of the ECB. They use a survey data from the ECB's Survey of Professional Forecasters (SPF) spanning from January 2010 to December 2015. Based on Granger Causality tests, they find that if long-term inflation expectations are not anchored then there is a loss in the Central bank credibility for achieving its price stability.

Horvath and Vasko (2016) focus on the relationship between the degree of transparency and the financial stability. For 110 countries from 2000 to 2011 with Panel regressions, they find that if a country has a greater transparency, it is not

beneficial for its financial stability. They also conclude that more developed countries have a high degree of transparency.

As it is seen below, the relationship between banking/financial sector fragility, Central bank credibility (independence or transparency), macroeconomic performance and institutions are studied by many scholars in different perspectives. It obviously shows the importance of these subjects in the economic literature. After giving some related articles, the VAR model is shortly introduced in the next part.

3.4 Methodology and Model

The Vector Auto-regression (VAR) methodology is used in this study in order to investigate the relationship between Banking sector fragility, Central bank credibility, macroeconomic performance and institutions.

The VAR methodology is firstly introduced into empirical economics by Sims⁵⁴ (1980) with his seminal work “Macroeconomics and Reality”. Following Sims (1980), VAR models are preferred by many researchers because it provides a flexible and tractable framework while analyzing economic time series. After VAR, with a series of studies the co-integration method is introduced by Granger (1983), Granger and Weiss (1983), and Engle and Granger (1987). These studies construct a very useful probability structure in order to analyze long and short run economic relations (Watson, 1994).

VAR models are used for multivariate time series. The structure is that each variable is a linear function of past lags of itself and past lags of the other variables (Pfaff, 2008). For a bivariate VAR (1) model, the equations are given as follow:

$$\begin{aligned} y_{1t} &= \alpha_1 + \phi_{11}y_{1t-1} + \phi_{12}y_{2t-1} + u_{1t} \\ y_{2t} &= \alpha_2 + \phi_{21}y_{1t-1} + \phi_{22}y_{2t-1} + u_{2t} \end{aligned}$$

⁵⁴ In 2011, Christopher A. Sims shared the Sveriges Riksbank Prize in Economic Sciences in Memory of Alfred Nobel with Thomas J. Sargent for their works on Statistical Modeling of Monetary Policy and its Effects.

Or these equation systems can be also written in the following matrix form:

$$\begin{bmatrix} y_{1t} \\ y_{2t} \end{bmatrix} = \begin{bmatrix} \alpha_1 \\ \alpha_2 \end{bmatrix} + \begin{bmatrix} \phi_{11} & \phi_{12} \\ \phi_{21} & \phi_{22} \end{bmatrix} \begin{bmatrix} y_{1t-1} \\ y_{2t-1} \end{bmatrix} + \begin{bmatrix} u_{1t} \\ u_{2t} \end{bmatrix}$$

In the model of VAR(2), two lagged values are added to the right sides of the equations for all variables. A Vector Autoregressive model of order p , defined as VAR(p), is written in the following form:

$$y_t = \alpha + \phi_1 y_{t-1} + \dots + \phi_p y_{t-p} + u_t$$

In its basic form, a VAR model consists of a set of K endogenous variables $y_t = (y_{1t}, \dots, y_{kt}, \dots, y_{Kt})$ for $k = 1, \dots, K$ and ϕ_i are $(K \times K)$ coefficient matrices for $i = 1, \dots, p$ (p is a positive integer). α ($\alpha = \alpha_1, \dots, \alpha_K$) is a vector of intercept terms ($K \times 1$) and u_t ($u_t = u_{1t}, \dots, u_{Kt}$) represents a K dimensional white noise with covariance matrix $\sum_u$ assuming non-singular.

For the analysis, the VAR model is employed because these models are easy to estimate and have accurate forecasting capabilities. Moreover, researchers do not have to deal with the specifications of the variables either endogenous or exogenous since they are all endogenous in these models. The form of the VAR model is described as follows:

$$\Omega_t = \theta + \beta_i \Omega_{t-i} + \varepsilon_t$$

where Ω is a vector of (*BSFI*, *CRED*, *ECON*, *INST*) or more precisely it is a nine-variable vector (*BSFI*, *CRED*, *GDP*, *INF*, *REER*, *STINT*, *UNEMP*, *TRADEOP*, *RUOLAW*). θ stands for a vector of intercept terms, β represents coefficient matrices, and ε is the error term. Model results are examined in the following section.

3.5 Empirical Results

With this study, it is focused on the effect of BSFI, CRED, ECON and INST on each other over the 10-quarter horizon. The VAR model results are represented in the figures. The impulse responses to one standard error shock are identified by the methodology of Cholesky decomposition as it is noted in the figure (one standard innovation). These errors shock, innovation or impulse are considered positive since a sudden shock to a variable of size is defined as $\varepsilon_t = +1\sigma$. In the figures, the shape and the size of the impulse responses are quite different, depending on the variable shock. In addition to the impulse responses, this study also covers the Variance decomposition results in order to define the percentage of the variation in a variable which is explained by the shock of another one. In this part, the analysis results are particularly discussed for CRED and BSFI for the complementary to the first and third papers of this dissertation.

The Figure 3.2 shows the impulse response functions of all variables to a variable shock, including BSFI, CRED, GDP, INF, REER, STINT, UNEMP, TRADEOP and RUOLAW. The impulse responses are given in a combined way in the Figure 3.2; however, the Figure 3.3 displays these responses for every single variable with the shock variable. It can be easily observed in the Figure 3.3 that the curves of the impulse response of all variables follow a fluctuating course instead of moving smoothly. As a consequence of this fluctuation, from one quarter to another an effect can be reversed and it hereby makes us difficult to fully interpret these tendencies in a precise way. However, interpretations are made by referring to the first quarters.

In the first paper, with the ARDL model it is shown that in the long-run relations GDP, REER, TRADEOP and RUOLAW have a positive impact on the Central bank credibility while INF, STINT and UEMP have a negative one. As it is expected, the Figure 3.3 demonstrates that the response of CRED to GDP, RUOLAW and REER shocks is zero in the first quarter but starting from the second quarter positive shocks of GDP, RUOLAW and REER have a positive effect on

CRED. Although there is no relation between them in the first period, positive shocks of INF and STINT have a negative impact on CRED in the second period. For these variables, these long-run relations are thus confirmed by the VAR model for the first quarters. As for UNEMP and TRADEOP, the empirical results are not satisfactory in the first two quarters in order to construct a reasonable relationship between the credibility, unemployment rate and trade openness. Only starting with the third quarter, these relations can be provided by the model results. A positive shock to UNEMP has a negative effect on CRED and the response of the CRED to a positive TRADEOP shock is positive. Moreover, results reveal that a positive CRED shock causes a positive impact on itself. For CRED, some of these impulse response function results are discussed in the following lines.

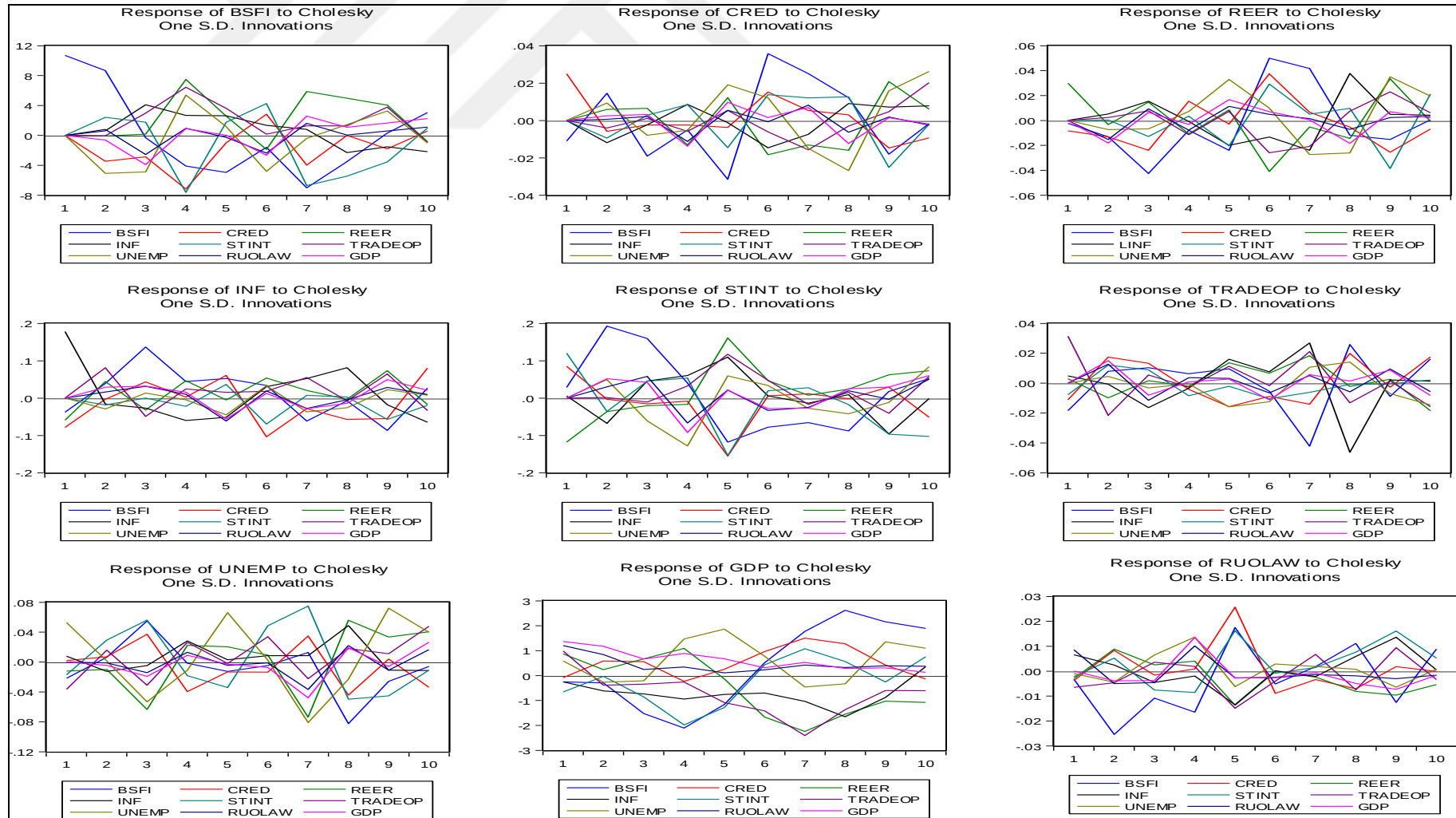
According to the impulse response analysis results, a positive CRED shock has a negative effect on INF. This empirical result is very remarkable since the first objective of the Central bank is fighting against the inflation (ensuring price stability in the economy), and in doing so, any increase in its credibility helps to decrease the inflation rates. The truth behind this relationship is that with the increase in credibility, the Central bank can conduct its disinflation policy in terms of inflation expectations among economic agents in a more convinced way. It holds for the positive relation between REER and CRED since the CBRT also intervenes in the foreign exchange rates in order to regulate them in case of extreme depreciation and appreciation. As REER indicates appreciations in TL against the foreign currencies in real terms, powerful national currency leads to increase in the credibility because the protection of the value of the TL has also a priority for the CBRT.

Increase in institutional quality leads to the improvement in the Central bank credibility. With the governmental quality, the Central bank can generate better outcome in terms of economic activities. For instance, if a government that has institutional quality can define economic goals more accurately and share the responsibility between related institutions as it is supposed to be. This favorable relation is proven between RUOLAW and CRED since a positive shock of RUOLAW has a positive impact on CRED. It is partly because of the lesser pressure from the politicians on the Central bank even if it is considered an independent organization, and partly because of the perception of the people about the quality of

the Central bank. The Central bank is one of the most important institutions of the country such as the Treasury and if other institutions are perceived as a reliable institution then the Central bank is also accepted as one of them. It is a very good example of the positive externality subject and the positive spillover effect.

In this study, a banking sector fragility index is calculated for the Turkish economy. As BSFI is used only in this part of the dissertation, it is not included in the analyses of the ARDL and Markov Regime Switching models. Because of that, it is highly important to investigate relationships between BSFI, CRED, GDP, INF, REER, STINT, UNEMP, TRADEOP and RUOLAW in order to enrich the study. For that, every single variable is separately examined with BSFI. It should be noted that, in general, there is neither positive nor negative effects on BSFI from the shock variables in the first quarters. A positive shock to GDP has a negative effect on BSFI. It is acceptable since the more the economy gets stronger the more the banking sector is robust. It is a process that feeds each other. To foster the economy, financial sources are needed and the banks can mostly provide these sources in terms of loans. With the financial improvement feeding from economic wealth, risks in the banking sector decline. As it is displayed in the Figure 3.3, a positive BSFI shock causes a negative effect on REER for six quarters. In the same figure, there is also the response of BSFI to a positive REER shock. It also shows the same result, indicating a negative impact on BSFI. This negative relationship stems from the loss of confidence in the TL. When the fragility increases in the banking sector, the national currency is adversely affected as the investors are more likely to invest in foreign currency instead of TL. As REER indicates appreciations in TL against the foreign currencies such as US dollar and Euro in real terms, due to foreign currency demand, TL depreciates and REER therefore declines. As a result of that, the level of the dollarization in the economy raises along with the high risk in the banks' balance sheet in terms of foreign exchange.

Figure 3.2 Impulse Response Analysis: Combined



The response of BSFI to a positive INF shock is positive. This positive relation is logical because when the level of price in economy goes up it means that expenditure of the economic agent increases. At this point, assuming their revenue stays constant, in proportion to their needs they have to find financial sources. Banking sector partly provides these necessary sources by experiencing deterioration on the balance sheet. As a result of that action, the fragility in the banking sector augments since decrease in deposits and providing loans to clients cause troubles without replacing these losses in source with new ones.

Interest rate is a very important indicator for the decision making process of investors, either borrowers or lenders. Since banks play a mediator role between borrowers and lenders, it is also very crucial for the whole banking sector. Increase in rates makes it harder for the borrowers to receive an amount of money from a lender. In this case, lenders cannot allow others to use their financial sources via banks. As the financial transactions decrease, the size of the banking sector declines and it puts the banks in a riskier environment. In the model, it is shown that a positive innovation to STINT has a positive effect on BSFI. This econometric conclusion confirms the reasoning behind this interaction.

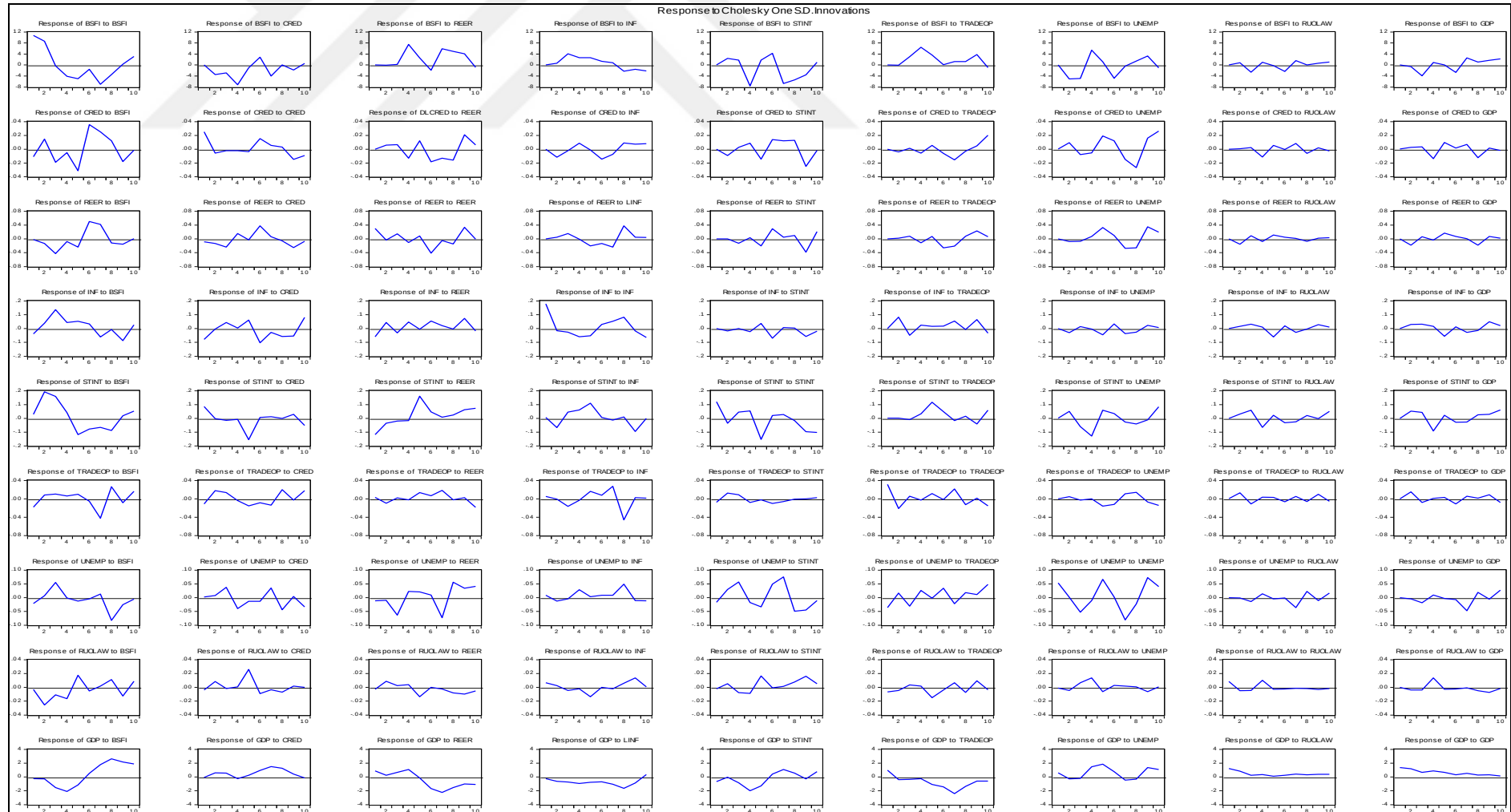
The response of the BSFI to a positive shock on UNEMP is expected to be positive. However, in the model, this positive interaction is provided starting from the fourth quarter. After a negative response period in 6th quarter, it becomes positive again until to the end of the period. Having a positive response of BSFI after a positive shock to UNEMP is usual because when the unemployment rate rises up, it means that there are some people who do not work anymore and search new jobs. Before they leave work, they earn money and they can invest their money by putting them in the bank. But after becoming jobless, they cannot bring money to banks anymore. Instead of that, the unemployment pushes them to use their invested financial sources in the banks. The more they withdraw their money, the more the banking sector is exposure to risk of the degradation in their balance sheet (e.g. increase in the maturity mismatch). This loss in the resources leads to increment in the fragility of the banking system.

The Figure 3.3 indicates that a positive innovation to BSFI has a negative effect on TRADEOP. This negative relation is quite normal between them because when the fragility or risk in banking sector augments, the banks may restrict the loans to exporter or importer. As a consequence of that, foreign traders can end up with being limited to find sufficient sources in order to finance their foreign trades. Difficulty in finding necessary funds thus decreases the volume of the international trade.

Institutional quality plays an important role in reducing the risk in financial organizations such as the banks. With this study, it is also shown that institutional quality leads to the improvement in the Central bank credibility. It should be stated that quality in the government is more important. This importance comes from the power of decisions on the economic and financial goals such as having a sustainable growth rate and lower inflation rate. For instance, if the government seeks to improve the capital structure in the banking sector by increasing the capital adequacy ratio (CAR), the BRSA can execute this duty as a regulator in the banking system. The more the institutional quality exists in the whole system, the more these governmental tasks are fulfilled in an accurate way. According to the results provided in the Figure 3.3, a positive shock on BSFI significantly decreases RUOLAW since the deterioration in the banks makes it difficult to run financial policies related to banking sector for the policy-makers and monetary authorities.

A positive BSFI shock produces a negative impact on CRED at the first quarter. After second quarter, this effect persists until 6th quarter. This econometric finding is reasonable because when the risk in the banking sector augments it consequently degrades the Central bank credibility as being an important player in the financial system. In the opposite case, namely a positive CRED shock to BSFI, in the first quarter the effect is found zero but starting from the second quarter, this negative relationship is also confirmed between them. The response of BSFI mostly negative in each quarter apart from the sixth quarter in which its response becomes positive. The value of the negative response of BSFI to a positive CRED shock is getting bigger in absolute value and in the fourth quarter it has the highest value. It means that in a one-year period, their negative relationship reach its edge. After a positive response in the sixth quarter, it continues to go down but not below that.

Figure 3.3 Impulse Response Analysis: Uncombined



The Figure 3.4 represents the variance decomposition results of all variables⁵⁵, including BSFI, CRED, GDP, INF, REER, STINT, UNEMP, TRADEOP and RUOLAW. Decomposition information is very important to understand which variables are more prominent in order to define the variability in BSFI and CRED. And more importantly, these results might provide to policy-makers with adequate information about the variables that should be taken into consideration while deciding policies. For example, if the interest rate explains the variation in CRED more than the unemployment does, and then in order to increase the Central bank credibility, authorities should focus on the interest rate rather than concentrating on the unemployment.

Although the decomposition results are given in a combined way in the Figure 3.4, the Figure 3.5 demonstrates each variable individually in order to be better observed. For this study, as the analysis results are given over the 10-quarter horizon, a three-quarter, six-quarter and ten-quarter period can be respectively considered as short, middle and long runs.

According to the results provided by the variance decomposition for BSFI, in the second quarter, a shock to BSFI covers 80.8% of the total variation in BSFI. In the same period, shocks to CRED, STINT, and UNEMP explain about 5%, 2.5% and 11% of the total variation in BSFI, respectively. As the total variation has to be hundred, the rest of the total variation is explained by other variables, depending on their importance in the model.

In the 6th quarter, an innovation to BSFI accounts for 33.1% of the total variation in BSFI, while 11.4%, 9.4%, 4.7%, 12.5%, 9.0%, 14.6% and 1.9% by shocks to CRED, REER, INF, STINT, TRADEOP, UNEMP, RUOLAW and GDP, respectively. In the last period, namely the 10th quarter, the capacity of BSFI to explain the variation in BSFI continues to decrease from one quarter to another and becomes 29.6%. CRED also loses its potential to contribute to the explanation of the variation in BSFI and have a value of 9.8%.

⁵⁵ See Appendix A11 and A12 for detailed information about the variations in BSFI and CRED.

Figure 3.4 Variance Decomposition Results: Combined

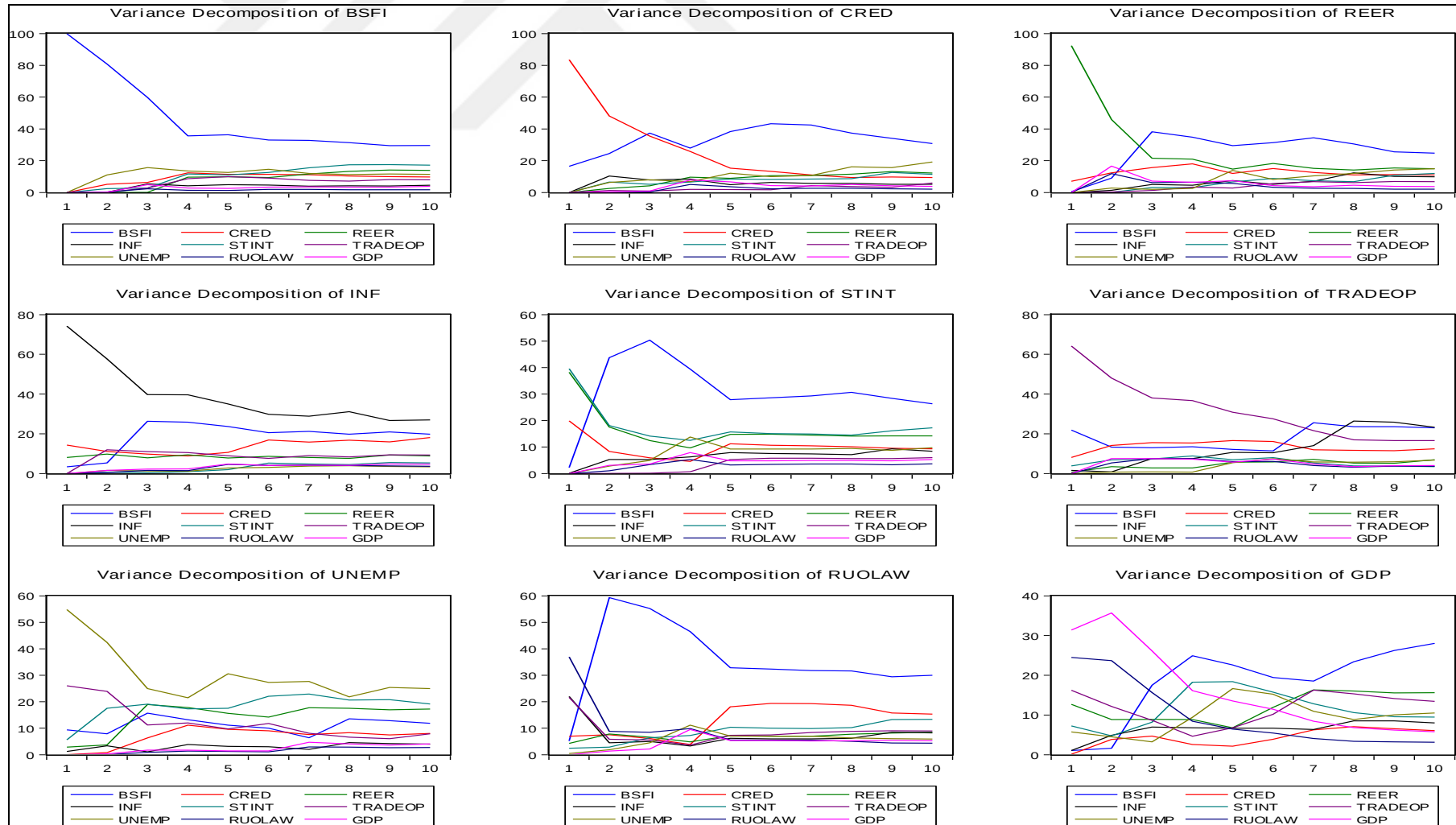
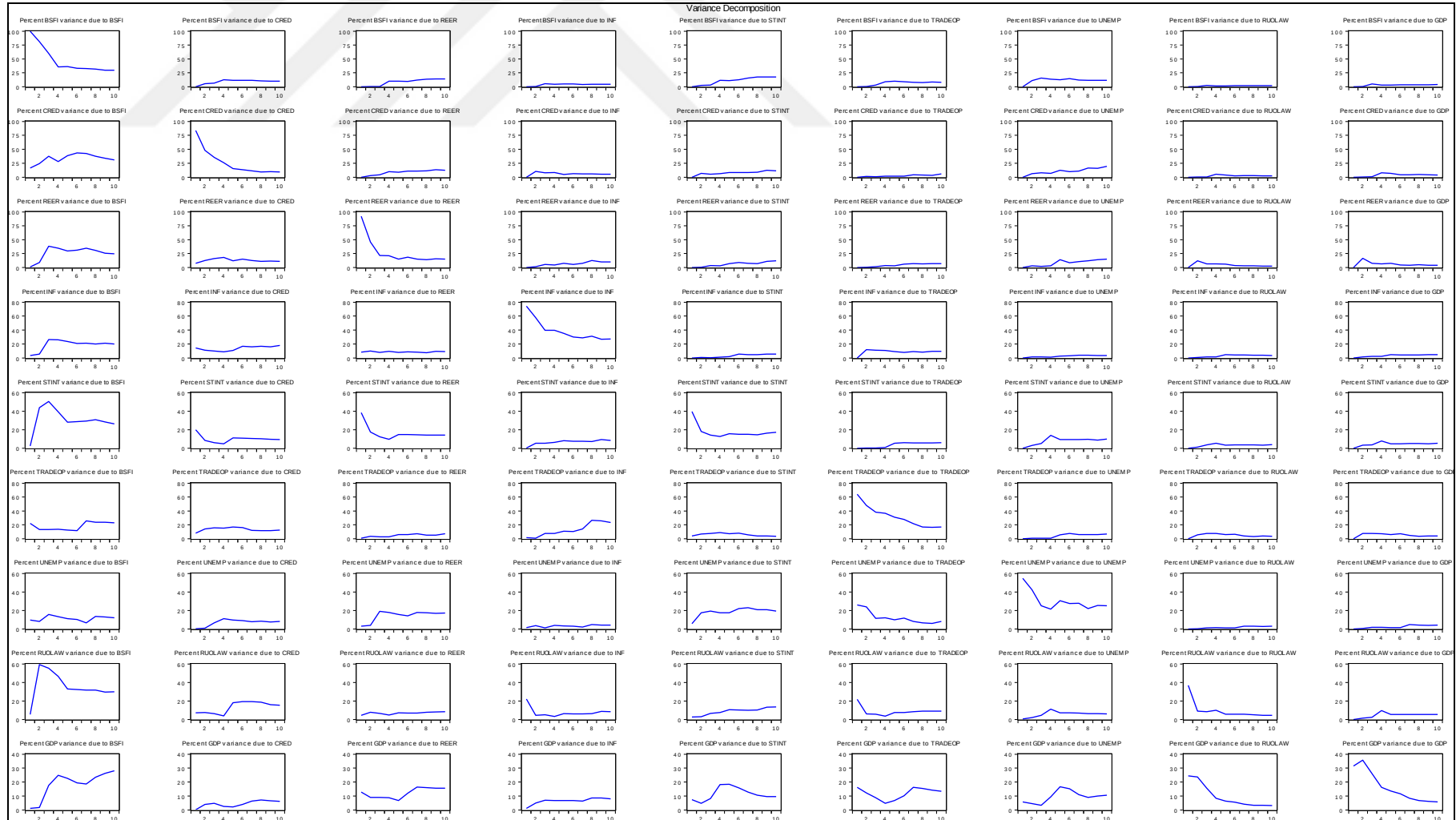


Figure 3.5 Variance Decomposition Results: Uncombined



However, there are some variables that increase their power over the clarification of the variation in BSFI. REER, STINT and GDP are respectively these variables with 13.9%, 17.2%, and 3.8% of the explanation of the total variation in BSFI. INF, TRADEOP, UNEMP and RUOLAW are the variables that decrease explanation power over the variation in BSFI.

When all variables are compared each other for three quarters, in terms of being important to explain the total variation in BSFI, apart from BSFI, in the second quarter the first three are UNEMP, CRED and STINT according to their explanation power. In the 6th quarter, they are UNEMP, STINT and CRED. For the last quarter, they are ordered as follows STINT, REER and UNEMP.

When the variance decomposition analysis for CRED is investigated, different conclusions show up. In the second quarter, a shock to CRED represents 48.1% of the total variation in CRED. In the same period, innovations to BSFI, INF, and STINT can cover 24.5%, 10.3% and 6.5% of the total variation in CRED, respectively. Only with the shocks to these three variables, more than 40% of the variation can be explained. The power of impulse to CRED is declined very dramatically to clarify the variation in CRED. When it comes to the 6th quarter, to a shock to CRED explains only 13.2% of the total variation in CRED.

In the same quarter, contributions to clarification of the total variation in CRED are 43.3%, 10.6%, 6.3%, 8.2%, 1.7%, 9.9%, 2.3% and 4.3% for BSFI, REER, INF, STINT, TRADEOP, UNEMP, RUOLAW and GDP, respectively. In the 10th quarter, the ability of CRED to describe the variation in CRED keeps to the decline and becomes just 9.4%. However, the capacity of BSFI to explain the variation in CRED is more than 40% in the sixth quarter; it shrinks from one quarter to another and finally drops to 30.7% in the tenth quarter. The same holds for GDP, RUOLAW and INF, they all decline in terms of their potential to contribute to the explanation of the variation in CRED. There are also some variables that increase their power of the explication of the variation in CRED; they are REER, STINT and UNEMP with 12.2%, 11.4% and 19.2%, respectively. For the last quarter, according to their explanation power, the first three variables are BSFI, UNEMP and REER.

3.6 Summary and Comments

Since the first introduction of empirical application of the VAR model in macroeconomics by the seminal work of Sims (1980), a great amount of paper has been focusing on this model in order to explain especially relations between economic concepts. In this paper, after constructing a banking sector fragility index for Turkey based on the methodology of Ari and Cergibozan (2016), the VAR model analysis is used to investigate the relationships between banking sector fragility, Central bank credibility, macroeconomic performance and institutions over the period 1996Q1-2015Q4.

In order to show the direction and magnitude of the effect of a variable on other variables, the impulse response analysis is employed. The ability of this analysis in tracing out the developments of these effects throughout time can provide useful data for the policy-makers to better determine their policies. To give an example, if there is no effect from CRED to UNEMP then the authority should not intervene in the labor market in the purpose of increasing the Central bank credibility. In addition to the impulse response analysis, the variance decomposition method is applied in the purpose of identifying the percentage of the variation in a variable which is explained by the shock of another one. Information obtained from this decomposition analysis is also very helpful for the policy-makers since they can know which variables are more important in the total variation of a variable. Supposing that the policy-makers seeks to decrease fragility in the banking sector (reducing risk in banks) and if the total variation in BSFI is largely explained by the short term interest rates (STINT), then the policy-makers should give a great attention to regulate the interest rates instead of dealing with an insignificant variable.

According to the impulse response analysis results, starting from the second quarter positive shocks to GDP, RUOLAW and REER have a positive effect on CRED. However, shocks to INF and STINT have a negative impact on CRED in the same period. The empirical result of the shock to UNEMP is not satisfactory in the first two quarters in order to construct a reasonable negative relationship between the credibility and unemployment rates. Starting from the third quarter, however, this

negative relation can be provided by the model results. As for the response of CRED to a shock on TRADEOP, it is also not adequate in the first two quarters for a reasonable positive relationship between the credibility and the trade openness. In the third quarter, this relation turns out to be positive as it is expected. Model results also indicate that a positive CRED shock causes a positive impact on itself. As the primary objective of the CBRT is to ensure price stability, a positive CRED shock has a negative effect on INF. Because of the protection of the value of the TL is one of the primary objectives of the CBRT, the same holds for REER. A one standard deviation shock to REER increases CRED, indicating powerful national currency leads to increase in the credibility. Institutional quality is considered as an important determinant of the Central bank credibility and this is proven by the model results; a one standard deviation positive shock to RUOLAW causes a positive effect on CRED.

As BSFI is calculated and used only in this part of the dissertation, it is not included in the analyses of the ARDL and Markov Regime Switching models. Actually, financial variables are used in these models instead of BSFI. Because of that, relationships between BSFI, CRED, GDP, INF, REER, STINT, UNEMP, TRADEOP and RUOLAW are separately investigated.

Any augmentation in BSFI means that risk or fragility in the banking system augments. As it is expected, increase in GDP, or in other words a positive shock to GDP, causes a positive impact on BSFI. It implies the more the economy gets stronger the more the banking sector is robust. A one standard deviation shock to BSFI leads to a negative effect on REER, indicating the loss of confidence in the TL because when the fragility increases in the banking sector, the national currency is adversely affected as the investors are more likely to invest in foreign currency instead of TL.

The response of BSFI to a one positive standard deviation shock to INF occurs positively. Due to rise in INF, when the level of price in the economy augments it means that expenditure of the economic agent increases. They have to find a financial source in order to meet their needs. At this point, the banking sector can

partly provide these necessary sources by decreasing its deposits and providing loans to clients, implying deteriorations on their balance sheet.

A positive impulse to STINT has a positive effect on BSFI. The banks play a mediator role between borrowers and lenders. These interactions heavily depend on interest rates. If interest rates increase, it makes harder for the borrowers to receive an amount of money from a lender. As the financial transactions decrease, the size of the banking sector declines and it may put the banks in a riskier environment, indicating the inefficiency of the banking sector. The response of the BSFI to a positive shock on UNEMP is expected to be positive. This positive interaction is provided starting from the fourth quarter. Increase in the unemployment rates implies the degradation of the economy; in turn it leads to an augmentation in the fragility of the banking system. A positive innovation to BSFI has a negative impact on TRADEOP. Increase in the fragility of banking sector causes some restrictions for exporters or importers in terms of loans. As result of that, exporters and importers end up with being restricted to find enough sources in order to finance their foreign trades.

A one positive standard deviation shock on BSFI significantly decreases RUOLAW. It suggests that institutional quality leads to the improvement in the economy since the more the government or state is robust the more the economy is sound, by implication it holds for the banking sector. The CBRT can be also defined as an important institution in the financial system and the response of the BSFI to a positive shock on CRED is thus negative.

The variance decomposition results indicate that in the second quarter, a shock to BSFI covers 80.8% of the total variation in BSFI. In the same period, shocks to CRED, STINT, and UNEMP explain about 5%, 2.5% and 11% of the total variation in BSFI, respectively. In the sixth quarter, an innovation to BSFI accounts for 33.1% of the total variation in BSFI, while 11.4%, 9.4%, 4.7%, 12.5%, 9.0%, 14.6% and 1.9% by shocks to CRED, REER, INF, STINT, TRADEOP, UNEMP, RUOLAW and GDP, respectively. For the last quarter, namely 10th, the capacity of BSFI to explain the variation in BSFI continues to decrease from one quarter to another and

becomes 29.6%. CRED also loses its potential to contribute to the explanation of the variation in BSFI and has a value of 9.8%.

In the second quarter, a shock to CRED represents 48.1% of the total variation in CRED. Impulses to BSFI, INF, and STINT can cover 24.5%, 10.3% and 6.5% of the total variation in CRED, respectively. In the sixth quarter, to a shock to CRED explains only 13.2% of the total variation in CRED. Contributions to clarification of the total variation in CRED are 43.3%, 10.6%, 6.3%, 8.2%, 1.7%, 9.9%, 2.3% and 4.3% for BSFI, REER, INF, STINT, TRADEOP, UNEMP, RUOLAW and GDP, respectively. In the tenth quarter, the variation in CRED is explained by REER, STINT and UNEMP with 12.2%, 11.4% and 19.2%, respectively.

In brief, in terms of being important to explain the total variation in BSFI, apart from BSFI, CRED, STINT, REER and UNEMP are prominent among all variables. For the explanation of the total variation in CRED, apart from CRED, BSFI, INF, STINT, REER, UNEMP are the most important explanatory variables. The common variables in both are STINT, REER and UNEMP. This result indicates that the policy-makers should primarily focus on the interest rate, the reel effective exchange rate and the unemployment rate in order to increase the credibility of the Central bank and decrease the fragility in the banking sector.

4. A REGIME SWITCHING MODEL FOR THE CREDIBILITY OF THE CENTRAL BANK OF THE REPUBLIC OF TURKEY

In the previous chapter, the relationship between Central bank credibility, macroeconomic performance, banking sector fragility and institutions are investigated. In this chapter, Markov Regime Switching models are run in order to provide an economic interpretation of the policy behavior of the Central bank in the inflation targeting policy. With this study, it is mainly aimed to examine whether the decision of the explicit inflation targeting policy fosters the Central bank credibility. In this study, the Markov Regime Switching model is firstly explained and after that some studies in literature are given. In the following part, data and models are represented. After providing the empirical results, a summary part ends this paper.

4.1 Markov Regime Switching Model

Ye (2012) defines a regime switching model as a time series model in which parameters change values according to the regime at present time. The changing of regimes is governed by a finite state stochastic process, which is often unobservable. Nikolay (2012) argues that the regime switching models are introduced in macroeconomics by Quandt (1972), Goldfeld and Quandt (1973). In his work, Krolzig (2002) emphasizes four types of regime switching models; structural change and switching regression models, threshold models, smooth transition autoregressive models and finally Markov switching vector auto-regressions.

In a threshold regime switching model, regime switching is determined by the value of observed variables and predefined thresholds. However, in a Markov regime switching model, it is assumed that the unobservable stochastic process is a Markov chain (Ye, 2012). In the study, it is preferred to use Markov regime switching model since it does not need to define any threshold for the regime changes while the Markov model defines these regime changes by itself. In addition to that, other advantages of this model are discussed in the following paragraph.

Nikolay (2012) argues that the Markov Regime Switching (MRS) model is widely used since it allows researchers to define discrete changes of regimes which

do not depend on any specific transition variable. He also puts forward the advantages of this model under four explanations: (i) MRS models assume an abrupt discrete switch that takes place between some unobservable states rather than considering a gradual transition between regimes, (ii) MRS model features much greater flexibility in dealing with nonlinearities since it estimates the regime switches using all available data, (iii) MRS model is a more general framework to detect regime shifts without defining a priori any transition variable that drives the switch between regimes, (iv) MRS model assumes that the regime shift occurs instantaneously as one would expect in a period of economic turmoil for instance.

Hamilton (1994)⁵⁶ explains the Markov model as follow: Let s_t be a random variable taking only integer values $(1, 2, \dots, N)$ and supposing that the probability that s_t is equal to particular value j depends on the past only through the most recent value, it means s_{t-1} .

$$P\{s_t = j \mid s_{t-1} = i, s_{t-2} = k, \dots\} = P\{s_t = j \mid s_{t-1} = i\} = p_{ij} \quad (4.1)$$

This kind of process is defined as an N-state Markov chain with transition probabilities $\{p_{ij}\}_{i,j=1,2,\dots,N}$. The transition probability p_{ij} provides the probability that state i will be followed by state j . The sum of probabilities equals 1.

$$p_{i1} + p_{i2} + \dots + p_{iN} = 1 \quad (4.2)$$

It is appropriate to gather the transition probabilities in an $(N \times N)$ transition matrix P . The row j , column i element of P is the transition probability p_{ij} .

$$P = \begin{bmatrix} p_{11} & p_{12} & \cdots & p_{1N} \\ p_{21} & p_{22} & \cdots & p_{2N} \\ \vdots & \vdots & \cdots & \vdots \\ p_{N1} & p_{N2} & \cdots & p_{NN} \end{bmatrix} \quad (4.3)$$

⁵⁶ For detailed information about this subject, refer to “Time Series Analysis” under the section “Modeling Time Series with Changes in Regime” by Hamilton (1994). This subject is also studied by Hamilton in 1996, 2005, 2010.

As the result of a regime shift variable, autoregressive process in which the parameters of the auto-regression can change. The regime itself will be defined as the outcome of an unobserved Markov chain. It is useful to consider a special case of these processes known as i.i.d.⁵⁷ mixture distributions before analyzing such process.

Let the regime that a given process is in at date t be indexed by an unobserved random variable s_t , where there are N possible regimes ($s_t = 1, 2, \dots, N$). When the process is in regime 1, the observed variable y_t is presumed to have been drawn from a $N(\mu_1, \sigma_1^2)$ distribution. If the process is in regime 2, then y_t is drawn from a $N(\mu_2, \sigma_2^2)$ distribution and it continues like that. Consequently, the density of y_t conditional on the random variable s_t taking on the value j is for $j = 1, 2, \dots, N$ as follows:

$$f(y_t | s_t = j; \theta) = \frac{1}{\sqrt{2\pi}\sigma_j} \exp\left\{-\frac{(y_t - \mu_j)^2}{2\sigma_j^2}\right\} \quad (4.4)$$

where θ is a vector of population parameters that includes $\mu_1, \dots, \mu_N$ and $\sigma_1^2, \dots, \sigma_N^2$. The unobserved regime $\{s_t\}$ is presumed to have been generated by some probability distribution, for which

the unconditional probability that s_t takes on the value j is denoted π_j :

$$P\{s_t = j; \theta\} = \pi_j \text{ for } j = 1, 2, \dots, N. \quad (4.5)$$

The probabilities $\pi_1, \dots, \pi_N$ are also included in θ :

$$\theta = (\pi_1, \dots, \pi_N, \sigma_1^2, \dots, \sigma_N^2, \pi_1, \dots, \pi_N)'. \quad (4.6)$$

For example, if it is important in the probability of the joint event that $s_t = j$ and that y_t falls within interval $[c, d]$, this can be found by integrating over all values of y_t between c and d :

$$p(y_t, s_t = j; \theta) = f(y_t | s_t = j; \theta) \cdot P\{s_t = j; \theta\} \quad (4.7)$$

⁵⁷Independent and identically distributed random variables.

Expression (4.7) is called the joint density distribution function of y_t and s_t . From equations (4.4) and (4.5), this function is given by

$$p(y_t, s_t = j; \theta) = \frac{\pi_j}{\sqrt{2\pi}\sigma_j} \exp\left\{-\frac{(y_t - \mu_j)^2}{2\sigma_j^2}\right\} \quad (4.8)$$

The unconditional density of y_t can be found by summing equation (4.8) over all possible values for j :

$$\begin{aligned} f(y_t; \theta) &= \sum_{j=1}^N p(y_t, s_t = j; \theta) \\ &= \frac{\pi_1}{\sqrt{2\pi}\sigma_1} \exp\left\{-\frac{(y_t - \mu_1)^2}{2\sigma_1^2}\right\} \\ &\quad + \frac{\pi_2}{\sqrt{2\pi}\sigma_2} \exp\left\{-\frac{(y_t - \mu_2)^2}{2\sigma_2^2}\right\} + \dots \\ &\quad + \frac{\pi_N}{\sqrt{2\pi}\sigma_N} \exp\left\{-\frac{(y_t - \mu_N)^2}{2\sigma_N^2}\right\} \end{aligned} \quad (4.9)$$

Expression (4.9) is the relevant density describing the actual observed data y_t since the regime s_t is unobserved. If the regime variable s_t is distributed i.i.d. across different dates t , then the log likelihood for the observed data can be calculated from the equation (4.9) as:

$$\ell(\theta) = \sum_{t=1}^T \log f(y_t; \theta) \quad (4.10)$$

The maximum likelihood of θ is obtained by maximizing expression (4.10) subject to the constraints that $\pi_1 + \pi_2 + \dots + \pi_N = 1$ and $\pi_j \geq 0$ for $j = 1, 2, \dots, N$. This can be done using numerical methods.

4.2 Markov Regime Switching Models in Economic Literature

The Markov Regime Switching models are frequently used in economics in order to define regime changes. Even if the restriction of constant transition

probabilities in the early Markov switching models poses serious limitations to scholars, after extending the baseline of the model to time varying transition probabilities this model starts to be more preferred by many researchers thanks to its conveniences. Abiad (2003) links this growing interest in Markov models to the new technological development in terms of high computing power. He also mentions that after the first use of Markov Regime Switching model by Quandt (1972), these model are applied to many different economic subjects such as interest rates (Hamilton, 1988), behavior of GNP (Hamilton, 1989), stock returns (Cecchetti et al., 1990), floating exchange rates (Engel and Hamilton, 1990), and business cycle phases (Filardo, 1994). Relationship between monetary policy regimes and beliefs are even studied by Andolfatto and Gomme (2003). Some selected articles related to Markov regime switching models are given below.

Quandt (1972) develops a new approach to estimate switching regressions, assuming nature chooses between regimes 1 and 2 with probabilities λ and $1-\lambda$ where λ is unknown to researchers. With this new approach, he proposes the new “ λ -model” for estimating different regimes when the switching point is unknown and he argues that it is possible for computations. He also finds this model satisfactory for the limited set of sampling experiments and economic problems. Goldfeld and Quandt (1973) explain the Markov switching model and use an economic example of Fair and Jaffee (1972) based on a housing market.

Cai (1994) studies the permanent volatility in returns. For that, he proposes a Markov-ARCH model for the US economy including three-month T-bill monthly excess returns from August 1964 to November 1991. With this model, he finds two regime shifts; January 1974 – July 1974 period related to oil shock and September 1979 – July 1982 connected to Federal Reserve’s policy change⁵⁸. The latter regime period is also defined by Hamilton (1988)⁵⁹ who investigates yields on three month Treasury bills and ten-year Treasury bonds during 1962 to 1987.

⁵⁸ Federal Reserve adopted a policy of targeting non-borrowed reserves, allowing interest rates to fluctuate across a broad range (Hamilton, 1988).

⁵⁹ As a time of dramatically higher and more volatile short term interest rates than that seen before.

Engel (1994) argues that behavior of the dollar against certain currencies might be forecasted. In order to prove this argument, he investigates 18 exchange rates in the post-Bretton Woods period, including 11 non-U.S. dollar exchange rates over the period 1973-1986 and post sample forecast period 1986-1991. However, he concludes that the Markov switching models do not provide accurate forecasts of exchange rates.

Ricketts and Rose (1995) use two and three state Markov switching models which are applied to inflations in the G-7 countries; Canada, France, Germany, Italy, Japan, the United Kingdom and the United States for the period 1954-1993. The probability estimates for the Markov model reveals that the random walk state is generally connected to periods of high and rising inflation. Especially in the 1970s and early 1980s these economies suffered from significant oil price shocks.

Bollen et al. (2000) investigate the ability of regime switching models to determine the dynamics of foreign exchange rates. Their sample period spans January 1973 to December 1996 including weekly spot exchange rates for the British Pound, Japanese Yen, and Deutsche Mark all in terms of US Dollars. Their main finding indicates that regime switching models might help investors and these models are capable to define the dynamics of exchange rates better than other time series models.

Simone (2000) studies Chile economy in terms of inflation for the period 1991-1999 in order to indicate whether regime changes are justified. He concludes that after adding Markov switching models to estimations, it does not help to improve the fit of the models.

Dahlquist and Gray (2000) employ a Markov regime-switching model in order to provide a description of the effect of exchange rate on the dynamics of short term interest rates in the European Monetary System (EMS). They find two regimes; in the non-credible regime there are extremely high and volatile interest rates while in the low volatility regime the target rates are credible.

Peria (2002) uses a Regime Switching model in the purpose of investigating speculative attacks. She works with the monthly data for Belgium, Denmark, France, Ireland, Italy, Spain and the United Kingdom over the period 1979-1993. It is inferred from her study that in both regime change models, budget deficits have the most important role in transitioning from the static regime to the crisis regime.

Alvarez-Plata and Schrooten (2006) study Argentina economy in terms of crisis between January 1994 and December 2001 with a Markov model. After defining a crisis definition based on the changes in exchange rates, US interest rates and international reserves, they show that there are two different regimes for Argentine. They have also reached to another conclusion stating changes in anticipations plays an important role in the crisis.

Moore and Wang (2007) examine the volatility in stock markets for the new European Union (EU) member states of the Czech Republic, Hungary, Poland, Slovenia and Slovakia. They use the Markov regime switching model. They provide two or three volatility states for the emerging stock markets, assuming in the earlier period of transition into the EU there is high volatility while after entering the union volatility of stock market is lower.

Brunetti et al. (2008) analyze exchange rate troubles with a Markov switching GARCH model for Thailand, Singapore, Philippines and Malaysia for the period 1989-2001. They conclude two regimes; one of them is the ordinary regime and the other one is the turbulent regime. The ordinary regime indicates low exchange rates changes and low volatility and the turbulent regime identifies high exchange rate devaluations.

Bhar and Malliaris (2011) study oil prices. They find two regimes with the help of the Markov model. In the first regime, devaluation of US dollar and gold prices play an important role in increasing oil prices during 2004–2006 while in the second regime, between 2007 and 2009, it is not true. Zhang and Zhang (2015) also investigate crude oil price movements for both Brent and West Texas Intermediate (WTI) crude oils with the Markov regime switching model with dynamic

autoregressive coefficients. They find three main regimes in both Brent and WTI crude oil price returns; sharply downward, slightly downward and sharply upward.

After giving briefly some selected articles concerning the regime switching model particularly the Markov models, in the following section, in the intention of examining regime changes, the data and the specific models employed in this study are outlined.

4.3 Data and Models

4.3.1 Data

In this study, Markov Regime Switching Models are run for three variable groups over the period 1996Q1-2015Q4. The Central bank credibility index is used with these variable groups in order to determine regime changes.

Macroeconomic variables consist of GDP, INF, REER, STINT, UNEMP and TRADEOP. Financial indicators include M2GDP, NPLTOTL, PRVTGDP, and EQTOAST. And institutional variables comprise GOVEF, REQUA, RUOLAW, and POLITY. The Central bank credibility index and other variables are earlier explained in the sections 2.4 and 2.5.

4.3.2 Models

In this paper, the effects of the inflation targeting policy on the Central bank credibility are investigated. Two regimes for the Central bank credibility, namely, a low credible period and a high credible period are expected, claiming to have a high credible period after passing to the explicit inflation targeting policy in 2006.

A simple mean variance Markov regime switching model for three variable groups is run. On the basis that, there are two potential states (i.e. $S_t=1$ corresponding to the low credibility and $S_t=2$ to the high credibility). The basic regime switching models can be written as follow:

$$CRED_t = \alpha_{S_t} + \beta_{S_t} MACRO_t + \varepsilon_t, \quad t=1, \dots, T, \quad \varepsilon_t \sim N(0, \sigma_{S_t}^2)$$

$$CRED_t = \alpha_{S_t} + \beta_{S_t} FIN_t + \varepsilon_t, \quad t=1, \dots, T, \quad \varepsilon_t \sim N(0, \sigma_{S_t}^2)$$

$$CRED_t = \alpha_{S_t} + \beta_{S_t} INST_t + \varepsilon_t, \quad t=1, \dots, T, \quad \varepsilon_t \sim N(0, \sigma_{S_t}^2)$$

$$\alpha_{S_t} = \alpha_1(1 - S_t) + \alpha_2, \quad \beta_1 < \beta_2$$

$$\beta_{S_t} = \beta_1(1 - S_t) + \beta_2 S_t$$

$$\sigma_{S_t}^2 = \sigma_1^2(1 - S_t) + \sigma_2^2 S_t$$

where *MACRO* defines macroeconomic variables, *FIN* stands for financial variables and *INST* corresponds to institutional variables. For all models, it is assumed that α , β and σ depend on unobservable state variable. ε_t of each regime (i.e. 1 or 2) follows normal distribution with zero mean and variance equal to σ^2 . Models results are specified in the following section.

4.4 Empirical Results

Table 4.1 Markov Regime Switching Model Results: Macroeconomic Variables

Variables	Regime 1		Regime 2	
	Coefficient	T-Statistic	Coefficient	T-Statistic
CONSTANT	32.011**	2.338	35.099***	4.670
GDP	-0.033	-0.373	0.430***	4.133
INF	-0.127***	-4.240	-0.210***	-6.810
REER	4.484***	9.480	0.024	0.454
STINT	0.010	0.467	-0.183***	-3.592
UNEMP	0.313	1.360	0.027	0.135
TRADEOP	0.522***	3.060	0.313**	2.570
Diagnostic Tests				
<i>Log-Likelihood</i>	-157.705	<i>Sigma 1</i>	-0.141	
<i>Linearity Test</i> χ^2	133.650 [0.000]	<i>Sigma 2</i>	0.993	
<i>Normality Test</i> χ^2	0.815 [0.665]	p_{11}	0.974	
<i>Portmanteau Test</i> χ^2	19.350 [0.080]	p_{22}	0.975	
<i>Davies P-value</i>	[0.000]			

Note: ***, **, and * indicate statistical significance at 1%, 5% and 10% levels, respectively. Brackets represent P-values.

Markov Regime Switching Model results of macroeconomic, financial and institutional variables are separately represented along with filtered regime probabilities. The first model results are dedicated to macroeconomic variables.

According to the model estimations results, which are shown in the Table 4.1, there are two different regimes. One of them is the low credible regime, and the other one is the high credible regime. Distinction between regimes depends on the value of the constant terms. Two constant terms are statistically significant at 5% level and the value of constant term in the Regime 1 is lower than that of the Regime 2. The Regime 1 signifies the low Central bank credibility while Regime 2 indicates high credibility.

Table 4.1 also provides information about the whole model in terms of diagnostic tests. The accuracy of this model is justified by these results. Linearity test suggests that non-linear estimation methods are more appropriate to employ than the linear estimation method. As the Markov Regime Switching Model is a non-linear estimation method, according to this result, it is convenient to use Markov model for this study. This result also supports the fitness of the methodology of the econometric analysis.

Normality and autocorrelation test confirm that, for this model, autocorrelation and normality problems do not exist. Based on the regime probabilities results (p_{11} and p_{22}), two regimes are quite persistent. As for Davies p-value, it gives information about the accuracy of the number of regimes. According to this result, two regimes are accurate for this model.

As it is shown in the Table 4.1, INF, REER and TRADEOP are statistically significant in the Regime 1 in order to explain the Central bank credibility. GDP, INF, STINT and TRADEOP are also statistically significant in the Regime 2. Among these variables, only UNEMP is insignificant in both regimes. It implies that for the Markov model estimates, the rate of unemployment is not a good indicator describing the relationship between the Central bank credibility and itself even if it is a very important indicator between macroeconomic variables.

Coefficient values in Table 4.1 indicate that any increase in GDP, in the regime 2, namely high credible period, fosters the Central bank credibility. In another words, when the growth rates are positive, their impacts on the credibility are also positive. This relationship is usual because when the current government came to power in 2002; its primary objective was to improve the prosperity of the country. To achieve this aim, the prime priority is to boost the economic growth. The government encouraged investors to produce more and took measures in order to ease economic activities such as giving incentives and lightening regulations. Due to suitable environment, Turkish economy has received a lot of benefit from this economic approach. As a result, it made easy to achieve its low inflation policy for the CBRT thanks to Turkey's robust economy in terms of growth. Although, there are some fluctuations in economic growth, this favorable growth rates strengthened the Central bank credibility. This conclusion is confirmed by these econometric model estimations.

As the primary objective⁶⁰ of the CBRT is to fight against the inflation and assure price stability, having negative coefficients for INF in both regimes is quite normal. In addition, this objective is universal and it does not change around the world for Central banks such as the Bank of England founded in 1694 whose primary mission is to promote the good of the people of the United Kingdom by maintaining monetary and financial stability. These negative values state that when the inflation rates increase the Central bank credibility is negatively affected by these changes in low and high credible environment. Under the inflation pressure, the Central bank cannot easily run its policies and it thus causes the fact of losing its credibility. At this point, setting inflation target rates at achievable levels becomes crucial for the Central bank since economic agents estimate their own inflation expectations by observing historical rates (realized inflation), and if they see that the gap between target and realization is getting bigger, for them it is more likely to lose their trust in the CBRT's future targets. This distrust damages the Central bank credibility since it tries to anchor inflation and if it cannot tame the inflation people start to believe that the CBRT are not capable of lowering inflation. Moreover, the more the inflation is persisting, the more the credibility is degrading.

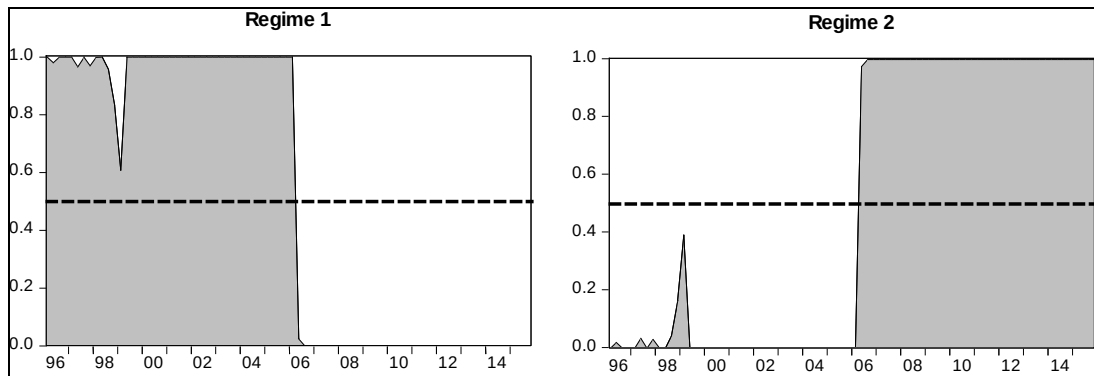
⁶⁰ It is given by the Law No. 1211. In the Article 4, it is noticed that "The primary objective of the Bank shall be to maintain price stability".

In the low credible period or Regime 1, positive changes in REER have favorable impacts on the Central bank credibility. Rises in REER mean that TL appreciates against the foreign currencies such as US dollar and Euro in real terms. When the TL gets more valuable, as a unique authority to print money in Turkey, the CBRT reinforces its power over the monetary policy and it makes the CBRT stronger while achieving its goals. It should also be stated that in the low credible environment, the value of the national currency is more important than in the high one because in the low credibility period, the CBRT needs to improve its political strength (or its credibility) and strong domestic currency might provide that help easily as an important instrument for the monetary policy. This suggestion is confirmed by this Markov model. When the currency is either extremely depreciated or appreciated, the Central bank may intervene in the exchange rates through monetary policy instruments such as buying or selling foreign currencies in order to normalize exchange rates. These kinds of monetary operations are fine as long as they work. However, when these interventions are useless in the purpose of stabilizing exchange rates (for instance because of the lack of the enough reserve) then it harms on the credibility of the Central bank since its efficiency will be questioned along with its credibility. Moreover, the imbalance in the foreign trade and uncontrolled huge cash inflows and outflows also make it hard for the CBRT to run a floating exchange rate regime without trouble.

STINT is another important factor that affects the Central bank credibility since interest rates are partly determined by the Central bank. It comes forward as a good indicator showing the success of the Central bank because interest rates are quite influential over the whole economy. In consideration of the potential financial sources, reasonable interest rates play an important role between the lender and the borrower in order to invest. Keeping interest rates affordable for both sides is a major responsibility of the Central banks. When the interest rates are so high, it makes difficult to run a proper monetary policy for the Central bank. As a result of that, increases in interest rates prevent the Central bank from having high credibility. In the model, in the high credible period (in Regime 2), STINT is statistically significant and its coefficient has a negative value. As it is mentioned, this fact reduces the credibility of the CBRT.

International trade is crucial for an open economy such as Turkey. And Turkey's economic development policy has depended on largely foreign trade volume especially since 1980. The Central bank is located in the center of monetary operations such as setting interest rates or intervening in exchange rates. Among them, exchange rates are particularly significant because international trade transactions are mainly made in foreign currencies. With the growth in international trade volume, trade in value raises. As result of this increment, monetary volume also increases and it leads to a bigger financial size for the Turkish economy. Financial depth or size provides more financial sources and it is not only good for the economy but also for the Central bank credibility whose efficiency comes from its sources. For example, if an export firm augments its trade, in turns, it will increase its revenues and can put more money into the bank account. This bank will place more required reserve in the Central bank in proportion to its deposit and it thus rises up the Central bank's sources. With more sources, the Central bank's efficiency gets stronger and its credibility benefits from this favorable environment. Markov model results support this fact for low and high credible regime; when the ratio of the total export and import to GDP is growing then these rises foster the Central bank credibility.

Figure 4.1 Markov Switching Filtered Regime Probabilities: Macroeconomic Variables



Note: In order to define regime changes, Hamilton's (1989) 0.5 threshold value is used.

These regime transitions are shown in the Figure 4.1 in which filtered regime probabilities are given for the macroeconomic variables. As Hamilton (1989) sets 0.5 point threshold value for the transition, this threshold value is also applied to this study. Shaded/gray areas in Regime 1 and 2 complete each other. In the Regime 1,

shaded/gray area represents the low credible period and this continues to exist until 2005. Since two regime figures integrate themselves, in the Regime 2 shaded/gray areas indicate high credible period. These filtered regime probability results demonstrate regime changes in a precise way. In particular, it is evident to see the transition from low credible regime to high credible regime at the beginning of 2006. This result points out that this inflation targeting policy leads to a regime change for the Central bank. This turning point coincides with the implementation of the explicit inflation targeting policy in 2006. Based on these results, it is concluded that inflation targeting policy becomes an inflation targeting regime for the Turkish economy.

Tablo 4.2 Markov Regime Switching Model Results: Financial Variables

Variables	Regime 1		Regime 2	
	Coefficient	T-Statistic	Coefficient	T-Statistic
CONSTANT	32.969***	8.500	33.846***	22.500
M2GDP	0.149***	6.420	0.287***	24.200
NPLTOTL	-0.562***	-4.450	-0.241***	-6.580
PRVTGDP	0.007	0.222	-0.125***	-11.300
EQTOAST	0.777***	3.070	0.350**	2.250
Diagnostic Tests				
<i>Log-Likelihood</i>	-178.428	<i>Sigma 1</i>	2.052	
<i>Linearity Test χ^2</i>	48.137 [0.000]	<i>Sigma 2</i>	1.650	
<i>Normality Test χ^2</i>	1.260 [0.533]	<i>p₁₁</i>	0.827	
<i>Portmanteau Test χ^2</i>	14.228 [0.286]	<i>p₂₂</i>	0.893	
<i>Davies P-value</i>	[0.000]			

Note: ***, **, and * indicate statistical significance at 1%, 5% and 10% levels, respectively. Brackets represent P-values.

Markov model results of the financial variables are represented in the Table 4.2. Taking consideration these econometric outcomes into account, it is concluded that there are two different regimes. One of them is the low credible regime, and the other one is the high credible regime as it is mentioned in the first model results. Distinction between regimes depends on the value of the constant terms. Two constant terms are statistically significant at 1% level and the value of constant term

in the Regime 1 is lower than that of the Regime 2. The Regime 1 describes the low Central bank credibility while Regime 2 specifies high credibility for the CBRT.

In addition to the relationships between regimes and variables, Table 4.2 also supplies information about the whole model with the diagnostic test results related to the accuracy of the model. Instead of the linear estimation methods, as it is stated by the linearity test result non-linear estimation methods are found suitable to employ in this study. Markov Regime Switching Model is one of the non-linear estimation methods; it is therefore used for this part of the study and this methodology makes these econometric models more coherent. Normality and autocorrelation tests stress that in this model there is not any autocorrelation and normality problem. Regime probabilities results (p_{11} and p_{22}) indicate that two regimes are quite persistent and Davies p-value supports this identification with the accuracy of the number of regimes, stating two regimes are accurate for this model.

M2GDP, NPLTOTL and EQTOAST are statistically significant in the Regime 1 and 2 in order to explain the Central bank credibility. As for PRVTGDP, it is only statistically significant in the Regime 2 at 1% level. Based on these results, it can be said that all four variables are appropriate in defining relationship between the Central bank credibility and financial indicators in the model for the low and high credible environment.

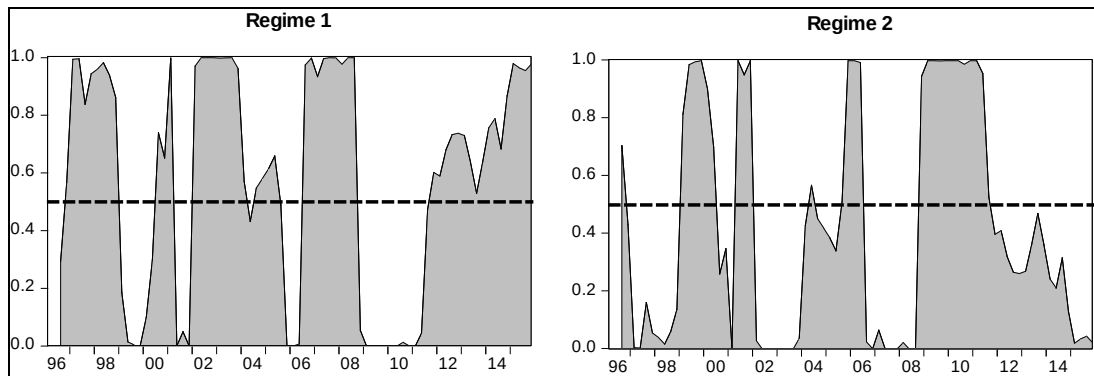
The ratio of M2 to GDP is a very good indicator to represent the financial sector growth in terms of size. In Table 4.2, model results emphasize that positive changes in M2GDP contribute to improve the Central bank credibility in low and high credible regime. This conclusion is reasonable for the CBRT since the more the depth in financial markets exists the more the Central bank has resources. This relation allows the Central bank to run its monetary policies in an effective way. With this effectiveness, the Central bank gains credibility among economic agents.

By definition the non-performing loans are not desired in the financial sector since they disrupt the market's functioning. The ratio of bank nonperforming loans to total gross loans can be considered as a measure of bank health and efficiency. It is also one of the most important ratios for financial markets because increases in ratio

can signal deterioration of the markets and it hereby causes loss in the Central bank credibility. Results from the model underline this relationship; when NPLTOTL augments it trims off the Central bank credibility in low and high credible environment. This conclusion is very obvious since when there is a significant problem in the banking sector (i.e. persistent high rate of NPLTOTL, it may block entire credit system), it will not stay longer there and with contagious effects the whole economy will be affected soon or later.

Loans provided by the banking sector to private sector as a share of GDP is a financial sector development indicator. The more credit is provided, the more risk-taking in the banking sector increases. Compared to public sector, private sector is more riskier for the banks and increases in this ratio can lead to financial turmoil for the markets and it thus brings about losses in the Central bank credibility. This inverse relationship between the credibility and PRVTGDP is provided by the model result, indicating that in the high credible period (in the Regime 2) when the PRVTGDP increases its impact on the Central bank credibility is negative.

As for EQTOAST, the ratio of bank capital to assets provides information about the bank solvency and resiliency. It is another important ratio for banks in order to operate efficiently in the economy. This ratio is useful to understand to what extent banks can deal with unexpected losses. EQTOAST also shows how the banking sector is healthy and the soundness of the banking sector backs up the Central bank's ability to run its monetary policies. There is also the implication of the capital adequacy ratio for banks in the intention of strengthening bank balance sheets. It is calculated as a bank's capital to its risk weighted assets. With the Basel 3, the minimum capital adequacy ratio is set at 8%. For the Turkish Banking system this ratio was about 15% in 2016. This is higher than the Bank of International Settlement's (BIS) requirement since regulators want banks to be more solid in terms of capital in case of financial trouble. Based on econometric results in the Table 4.2, increases in EQTOAST augment the Central bank credibility in both regimes.

Figure 4.2 Markov Switching Filtered Regime Probabilities: Financial Variables

Note: In order to define regime changes, Hamilton's (1989) 0.5 threshold value is used.

Markov Switching Filtered Regime Probabilities of the financial variables are given in the Figure 4.2. As a threshold value, Hamilton's (1989) 0.5 point rule is also applied to this analysis in order to catch the transitions of regime. In the figure, shaded/gray areas in Regime 1 and 2 complete each other. In the Regime 1, shaded/gray area represents the low credible period. Since two regime figures integrate themselves, in the Regime 2 shaded/gray areas indicate high credible period. These filtered regime probability results display regime changes in an accurate way throughout the time period.

In the low credible regime, financial disturbances have negative impacts on the Central bank credibility. According to the filtered regime probabilities, for 1997-1998 Asian and Russian financial crisis and 2001 Turkish financial crisis, there is a low credible regime. This low credibility regime can also be seen during the Global financial crisis of 2007–2008 and the European sovereign debt crisis starting from 2010. Other political disturbances such as Gezi Park protests in 2013 and 17-25 December investigations and their downward effects on the credibility could be seen. In the figure, there is also 2002-2005 period in which the new government put into practice some new institutions such as the Banking Regulation and Supervision Agency (BRSA) trying to regulate the banking sector effectively but since the effects of the 2001 Turkish financial crisis were extremely harmful to economy, as a result of that, it took some time to get rid of these detrimental outcomes for the Turkish economy. There was also a new monetary implementation concerning the national currency by removing six zeros from the Turkish lira at the beginning of 2005.

Tablo 4.3 Markov Regime Switching Model Results: Institutional Variables

Variables	Regime 1		Regime 2	
	Coefficient	T-Statistic	Coefficient	T-Statistic
CONSTANT	57.048***	5.750	57.542***	45.400
GOVEF	0.332***	3.340	0.508***	32.100
REGQUA	0.302***	3.540	0.359***	18.100
RUOLAW	0.363***	6.280	0.171***	5.220
POLITY	-0.329***	-3.380	-0.217***	-12.200
Diagnostic Tests				
<i>Log-Likelihood</i>	-172.255	<i>Sigma 1</i>	0.883	
<i>Linearity Test χ^2</i>	128.140 [0.000]	<i>Sigma 2</i>	1.792	
<i>Normality Test χ^2</i>	2.261 [0.323]	<i>p₁₁</i>	0.769	
<i>Portmanteau Test χ^2</i>	16.858 [0.155]	<i>p₂₂</i>	0.935	
<i>Davies P-value</i>	[0.000]			

Note: ***, **, and * indicate statistical significance at 1%, 5% and 10% levels, respectively. Brackets represent P-values.

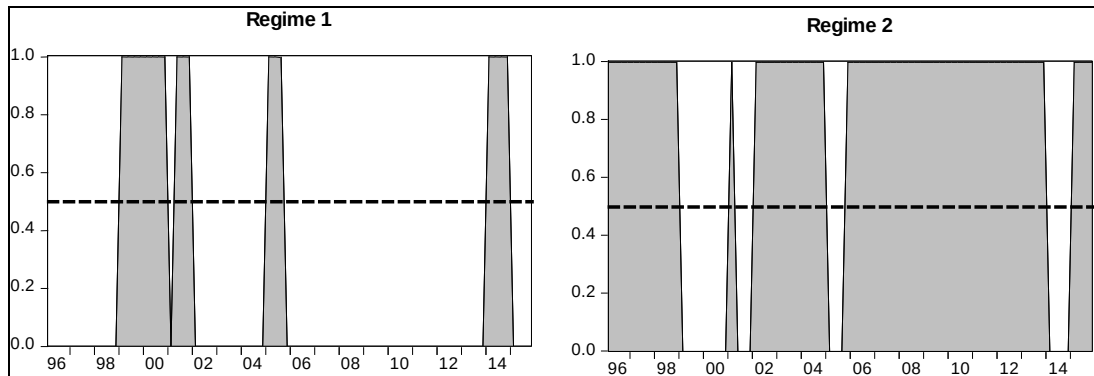
Table 4.3 provides information about the Markov model results of the institutional variables. These results indicate that there are two different regimes. One of them is the low credible regime, and the other one is the high credible regime as it is mentioned in the earlier models. Distinction between regimes depends on the value of the constant terms which are statistically significant at 1% level. The Regime 1 signifies the low credibility while Regime 2 denotes high credibility for the CBRT.

According to the diagnostic test results measuring the accuracy of the model, linearity test result indicates that non-linear estimation methods are more suitable to apply to this study. Markov Regime Switching Model is therefore used for this part of the study and this methodology strengthens these econometric estimation results as it is an important model in terms of non-linear models. Normality and autocorrelation tests state that autocorrelation and normality are not statistical problems for this model. Regime probabilities results (p_{11} and p_{22}) indicate that two regimes are quite persistent and Davies p-value backs up this finding with the accuracy of the number of regimes, stating two regimes are accurate for this model.

GOVEF, REGQUA, RUOLAW and POLITY are statistically significant at 1% level in the Regime 1 and 2 in order to explain briefly the Central bank credibility. According to this model's econometric outcomes, it can be said that all four variables are suitable in determining relationship between the Central bank credibility and institutional indicators for the low and high credible environment. Among them, only POLITY has negative effects on the Central bank credibility in both regimes.

POLITY consists of information about the institutions of the central government and on political groups acting or reacting. It is calculated by subtracting the Autocracy score from the Democracy. Based on the estimation results in the Table 4.3, POLITY's coefficients are negative in two regimes and it means that raises in POLITY affects the credibility negatively. On the other hand, GOVEF, REGQUA, RUOLAW and POLITY have positive relation with the Central bank credibility in low and high credible environment. As the CBRT is also one of the most important institutions, increases in institutional quality boost the Central bank credibility.

Figure 4.3 Markov Switching Filtered Regime Probabilities: Institutional Variables



Note: In order to define regime changes, Hamilton's (1989) 0.5 threshold value is used.

Markov Switching Filtered Regime Probabilities of the institutional variables are represented in the Figure 4.3 in which shaded/gray areas in Regime 1 and 2 complete each other. In the Regime 1, shaded/gray area represents the low credible period. Since two regime figures integrate themselves, in the Regime 2 shaded/gray areas indicate high credible period. These filtered regime probability results give regime changes in an appropriate way over the analysis period.

In the low credible regime, political and economic disturbances play negative role in determining the Central bank credibility. Between 1999 and 2000, Turkey was in need of stability in terms of government. In 1998, the government step down and in 1999 new government came to power but in the same year because of the Marmara earthquakes whose impacts were very severe for the economy this new government also had difficulties dealing with the economic issues. These economic and political problems continued to exist and especially the malpractice in the banking sector in 2000 made things very inconvenient. As a result of this inappropriate atmosphere, in 2001 due to a conflict between the President and the Prime Minister, a very devastating crisis emerged. Its cost was immense and for many it was the biggest turmoil in the history of Turkish economy. In 2004, many laws, such as Private Law Convention Against Corruption, European Convention about the Judgment Process in the European Court of Human Rights and New Press Law, were introduced and it needed to take some time to get results from them. Another political trouble occurred in 2014, just after Gezi Park protests and 17-25 December investigations in 2013. These political distresses reduced the Central bank credibility and put it in the low credible regime.

4.5 Summary and Comments

With this study, Markov Regime Switching Models are run for three variable groups over the period 1996Q1-2015Q4: macroeconomic, financial and institutional. The Central bank credibility index is used with these variable groups in the purpose of determining regime changes. For three models, linearity test results demonstrate that using a non-linear estimation method is an accurate way to conduct these analyses. As the Markov model is one of the non-linear estimation methods, it is convenient to use a Markov model for this study.

According to models results, two regimes are found for each model, identifying a low credible (Regime 1) and a high credible (Regime 2). These results are supported by Davies p-values, emphasizing the precision of the number of regimes. The accuracies of the models are justified by diagnostic tests result such as normality

and autocorrelation tests. In addition, the regime probabilities results confirm that two regimes are quite persistent for these three models.

Markov model results of the macroeconomic variables indicate that INF, REER and TRADEOP are statistically significant in the Regime 1 in order to explain the Central bank credibility. GDP, INF, STINT and TRADEOP are significant in the Regime 2. Although it is one of the most important macroeconomic variables, only UNEMP is found insignificant in both regimes among all macroeconomic variables. Filtered regime probability results, which provide information about the regime changes in figures, point out that there is only one transition from the low credible regime to the high credible one at the beginning of 2006. This date is very important and model results coincide with that. This date is the implementation of the explicit inflation targeting policy by the CBRT. Looking at these results, it is concluded that inflation targeting policy becomes an inflation targeting regime for the Turkish economy and this conclusion is successfully confirmed by the econometric analyses of this study.

Markov model results of the financial variables stress that M2GDP, NPLTOTL and EQTOAST are statistically significant in the Regime 1 and 2 in order to define the Central bank credibility. As for PRVTGDP, it is only statistically significant in the Regime 2. All four variables are found appropriate in determining relationship between the Central bank credibility and financial indicators. Filtered Regime Probabilities of the financial variables state that in the low credible regime, financial disturbances have negative impacts on the Central bank credibility. These effects can be seen for 1997-1998 Asian and Russian financial crisis, 2001 Turkish financial crisis, Global financial crisis of 2007–2008, the European sovereign debt crisis starting from 2010 and Gezi Park protests in 2013 and 17-25 December investigations. During these periods, the credibility of the CBRT was degraded and was obliged to fall from high credible environment to the low credible regime.

Markov model results of the institutional variables suggest that GOVEF, REGQUA, RUOLAW and POLITY are statistically significant in both the Regime 1 and 2. Based on the econometric estimates, increases in institutional quality boost the Central bank credibility. However, among them, only POLITY has negative effects

on the Central bank credibility in both regimes. Filtered Regime Probabilities of the institutional variables state that in the low credible regime, political and economic disturbances play a negative role in explaining the Central bank credibility. Between 1999 and 2001, and unfavorable effects of the instability of governments, natural disasters (Marmara region earthquakes) and political conflicts between authorities caused devastating outcomes for the economy. In addition to that, in 2013 Gezi Park protests and 17-25 December investigations occurred. As a result of these unsuitable conditions, the credibility of the CBRT was negatively touched and during these periods it stayed in the low credible regime.

After comparing the macroeconomic with financial variable results, it can be concluded that the Central bank credibility is more sensitive to the economic or financial turbulences and the credibility immediately falls in the low credible regime in case of economic distress. It can also be inferred from these results that the Central bank credibility is more solid in terms of macroeconomic shocks rather than financial shocks. In the latter one, volatility is influential and it causes regime transitions frequently as it is seen in the Figure 4.2.

When institutional model with the macroeconomic model are compared each other, it can be inferred from the results that the Central bank credibility is more responsive to the economic or political turbulences and especially the credibility can easily decrease in case of political distress. This conclusion is verified by these econometric estimations. If this comparison is made between financial and institutional models, in terms of number of the transition between regimes, financial variables come into prominence. Among all Markov models, the macroeconomic variables model is the most stable one since it changes only one time from low regime to high regime in the beginning of 2006.

5. CONCLUSION

This dissertation covers three essays related to the Banking sector fragility, the Central bank credibility, the macroeconomic performance, and the financial and institutional indicators for the Turkish economy over the period 1996Q1-2015Q4.

In the first study, the determinants of the Central bank credibility for the Central Bank of the Republic of Turkey are defined. In order to determine which variables are more important to the Central bank credibility, three variable groups are employed; macroeconomic, financial and institutional. After providing a detailed definition of the Credibility and information on the inflation targeting policy, the Central bank credibility index for the CBRT based on the methodology developed by Mackiewicz-Łyziak (2009) is calculated. The credibility index is examined for two periods in order to observe the results of the inflation targeting policy over the time in a proper way. The first period corresponds to the pre-inflation targeting policy covering 1996Q1-2005Q4 and the second one is during the inflation targeting monetary policy period dating from 2006Q1 to 2015Q4. When these two periods are compared each other in terms of the slope of the trend lines, in the second period it is steeper compared to that of first period in which the trend line is following a more horizontal course. It clearly shows that between 2006 and 2015 the Central bank credibility increased more rapidly with the implementation of the inflation targeting policy.

As an analysis method, in the first study, the Autoregressive Distributed Lag (ARDL) Bounds test methodology of Pesaran and Shin (1999) and Pesaran et al. (2001) is used in order to estimate the long-run and short-run relationships between variables along with the diagnostic tests results of the models. The ARDL model is chosen because it provides reliable results while working on limited samples and allows analyses in long-run and short-run parameters simultaneously. There is another important point to use this model; it gives us the ability to deal with the restricted integration order, in other words it is possible to investigate models with time series regardless of whether these series are $I(0)$ or $I(1)$. Based on the ADF and the PP Unit root test results, there is no variable of $I(2)$, the ARDL model can thus be used.

For three models, to control whether the long-run relationships exist, calculated F-statistics and Critical values of Pesaran and et al. (2001) for $I(0)$ and $I(1)$ are compared each other, and all models are found statically significant at different significance levels. In terms of the accuracy of the whole models, these results are statistically robust since these models do not include normality, serial correlations and heteroskedasticity problems in both periods. Cusum test estimation outcomes also support the robustness and fitness of the model, stating estimated long-run relationship coefficients are stable over the periods. Model results give also information about the short-run analyses. As it is expected, Error Correction Terms that indicate the speed of adjustment to the long-run equilibrium are negative and statistically significant at the level of 1% in both periods. This result also supports the long-run relationships between the Central bank credibility and the variables.

After proving the existence of the long-run relationships between the Central bank credibility and the variables, it is analyzed how these long-run relations occur between these variables in terms of coefficients obtained from the ARDL models. According to the long-run analysis results, GPD, INF, REER, STINT and UNEMP are statistically significant at different levels in both periods, but only TRADEOP is statistically significant in the period 2006Q1-2015Q4 at a significance level of %1. In accordance with the long-run analysis results, M2GDP is the only one being statistically significant in the both periods; at a significance level of %10 and %1, in 1996Q1-2005Q4 and 2006Q1-2015Q4, respectively. NPLTOTL, PRVTGDP and EQTOAST are statistically significant in the second period. Indicators of Government Effectiveness, Regulatory Quality, Rule of Law and Polity are considered to be potential institutional determinants of central bank credibility. Based on the long-run analysis results, POLITY is statistically significant in the both periods at a significance level of %1. GOVEF and RUOLAW are statistically significant in the second period at a significance level of %5 and %1, respectively. Among these four institutional variables, only REGQUA is found statistically insignificant for both periods. In addition to these model results, there is also an important point extracted from the model estimations; M2GDP is more significant in the second period and its coefficient is also bigger compared to that of the first period. It means that with the growth in the financial sector, this variable becomes

more substantial in order to be defined as one of the determinants of the Central bank credibility. This is the case for the other variables; NPLTOTL, PRVTGDP and EQTOAST. They are statistically insignificant in the first period and all turn out to be significant in the second period with the depth in the financial sector.

In the second study, the relationships between the Banking sector fragility, the Central bank credibility, the macroeconomic performance and the institutions are examined in the Turkish economy over the period 1996Q1-2015Q4. The Central bank credibility is calculated in the first section and this index is used in this part of the dissertation. But a Banking sector fragility index for the Turkish economy is constructed as a proxy for the financial variable, instead of using the financial variables of the first part. For that, the methodology of Arı and Cergiboza (2016) is used. The same macroeconomic variable group is used, but for the institutional variables, only Rule of Law is employed in the analysis as a proxy of the institutional quality. The Vector Auto-regression (VAR) methodology is used in this study in order to investigate the relationships. To examine the effect of a variable shock on other variables and vice versa, random shocks to variables are identified by the Cholesky decomposition method. The impulse response analysis gives information about the direction and magnitude of the effect of a variable on other variables. According to the impulse response analysis results, starting from the second quarter positive shocks to GDP, RUOLAW and REER have a positive effect on CRED. However, shocks to INF and STINT have a negative impact on CRED in the same period. The empirical result of the shock to UNEMP is not satisfactory in the first two quarters in order to construct a reasonable negative relationship between the credibility and unemployment rates. But starting from the third quarter, this negative relation can be provided by the model results. As for the response of CRED to a shock on TRADEOP, it is also not adequate in the first two quarters for a reasonable positive relationship between the credibility and the trade openness. In the third quarter, this relation turns out to be positive as it is expected. Model results also indicate that a positive CRED shock causes a positive impact on itself. As the primary objective of the CBRT is to ensure price stability, a positive CRED shock has a negative effect on INF. A one standard deviation shock to REER increases CRED, indicating powerful national currency leads to increase in the credibility. Institutional quality is considered as an important determinant of the Central bank

credibility and this is proven by the model results; a one standard deviation positive shock to RUOLAW causes a positive effect on CRED. Any augmentation in BSFI means that risk or fragility in the banking system augments. As it is expected, increase in GDP, or in other words a positive shock to GDP, causes a positive impact on BSFI. A one standard deviation shock to BSFI leads to a negative effect on REER, indicating the loss of confidence in the TL because when the fragility increases in the banking sector, the national currency is adversely affected as the investors are more likely to invest in foreign currency instead of TL. The response of BSFI to a one positive standard deviation shock to INF occurs positively. A positive impulse to STINT has a positive effect on BSFI. The response of the BSFI to a positive shock on UNEMP is expected to be positive. A positive innovation to BSFI has a negative impact on TRADEOP. Increase in the fragility of banking sector causes some restrictions for exporters or importers in terms of loans. As result of that, exporters and importers end up with being restricted to find enough sources in order to finance their foreign trades. A one positive standard deviation shock on BSFI significantly decreases RUOLAW. The response of the BSFI to a positive shock on CRED is thus negative.

In addition to the impulse response analysis, the variance decomposition method is used in the purpose of defining the percentage of the variation in a variable which is explained by the shock of another one. According to the results, in the second quarter, a shock to BSFI covers 80.8% of the total variation in BSFI. In the same period, shocks to CRED, STINT, and UNEMP explain about 5%, 2.5% and 11% of the total variation in BSFI, respectively. In the sixth quarter, an innovation to BSFI accounts for 33.1% of the total variation in BSFI, while 11.4%, 9.4%, 4.7%, 12.5%, 9.0%, 14.6% and 1.9% by shocks to CRED, REER, INF, STINT, TRADEOP, UNEMP, RUOLAW and GDP, respectively. For the last quarter, namely 10th, the capacity of BSFI to explain the variation in BSFI continues to decrease from one quarter to another and becomes 29.6%. CRED also loses its potential to contribute to the explanation of the variation in BSFI and has a value of 9.8%. In the second quarter, a shock to CRED represents 48.1% of the total variation in CRED. Impulses to BSFI, INF, and STINT can cover 24.5%, 10.3% and 6.5% of the total variation in CRED, respectively. In the sixth quarter, to a shock to CRED explains only 13.2% of the total variation in CRED. Contributions to clarification of

the total variation in CRED are 43.3%, 10.6%, 6.3%, 8.2%, 1.7%, 9.9%, 2.3% and 4.3% for BSFI, REER, INF, STINT, TRADEOP, UNEMP, RUOLAW and GDP, respectively. In the tenth quarter, the variation in CRED is explained by REER, STINT and UNEMP with 12.2%, 11.4% and 19.2%, respectively. In terms of being important to explain the total variation in BSFI, apart from BSFI, CRED, STINT, REER and UNEMP are prominent among all variables. For the explanation of the total variation in CRED, apart from CRED, BSFI, INF, STINT, REER, UNEMP are the most important explanatory variables. The common variables in both are STINT, REER and UNEMP. This result indicates that the policy-makers should primarily focus on the interest rate, the reel effective exchange rate and the unemployment rate in order to increase the credibility of the Central bank and decrease the fragility in the banking sector.

In the third study, Markov Regime Switching Models are run for three variable groups over the period 1996Q1-2015Q4: macroeconomic, financial and institutional. The Central bank credibility index is used with these variable groups in the purpose of determining regime changes. For three models, linearity test results demonstrate that using a non-linear estimation method is an accurate way to conduct these analyses. As the Markov model is one of the non-linear estimation methods, it is convenient to use a Markov model for this study. According to models results, two regimes are found for each model, identifying a low credible (Regime 1) and a high credible (Regime 2). These results are supported by Davies p-values, emphasizing the precision of the number of regimes. The accuracies of the models are justified by diagnostic tests result such as normality and autocorrelation tests. In addition, the regime probabilities results confirm that two regimes are quite persistent for these three models

According to the model results, INF, REER and TRADEOP are statistically significant in the Regime 1 in order to explain the Central bank credibility. GDP, INF, STINT and TRADEOP are significant in the Regime 2. Although it is one of the most important macroeconomic variables, only UNEMP is found insignificant in both regimes among all macroeconomic variables. Filtered regime probability results, which provide information about the regime changes in figures, point out that there is only one transition from the low credible regime to the high credible one at

the beginning of 2006. This date is very important and model results coincide with that. This date is the implementation of the explicit inflation targeting policy by the CBRT. Looking at these results, it is concluded that inflation targeting policy becomes an inflation targeting regime for the Turkish economy and this conclusion is successfully confirmed by the econometric analyses of this study. Markov model results of the financial variables stress that M2GDP, NPLTOTL and EQTOAST are statistically significant in the Regime 1 and 2 in order to define the Central bank credibility. As for PRVTGDP, it is only statistically significant in the Regime 2. All four variables are found appropriate in determining relationship between the Central bank credibility and financial indicators. Filtered Regime Probabilities of the financial variables state that in the low credible regime, financial disturbances have negative impacts on the Central bank credibility. These effects can be seen for 1997-1998 Asian and Russian financial crisis, 2001 Turkish financial crisis, Global financial crisis of 2007–2008, the European sovereign debt crisis starting from 2010 and Gezi Park protests in 2013 and 17-25 December investigations. During these periods, the credibility of the CBRT was degraded and was obliged to fall from high credible environment to the low credible regime

GOVEF, REGQUA, RUOLAW and POLITY are statistically significant in both the Regime 1 and 2. Based on the econometric estimates, increases in institutional quality boost the Central bank credibility. However, among them, only POLITY has negative effects on the Central bank credibility in both regimes. Filtered Regime Probabilities of the institutional variables state that in the low credible regime, political and economic disturbances play a negative role in explaining the Central bank credibility. Between 1999 and 2001, and unfavorable effects of the instability of governments, natural disasters (Marmara region earthquakes) and political conflicts between authorities caused devastating outcomes for the economy. In addition to that, in 2013 Gezi Park protests and 17-25 December investigations occurred. As a result of these unsuitable conditions, the credibility of the CBRT was negatively touched and during these periods it stayed in the low credible regime

It can be concluded that that the Central bank credibility is more sensitive to the economic or financial turbulences and the credibility immediately falls in the low credible regime in case of economic distress. It can also be inferred from these

results that the Central bank credibility is more solid in terms of macroeconomic shocks rather than financial shocks. In the latter one, volatility is influential and it causes regime transitions frequently. When institutional model with the macroeconomic model are compared each other, it can be inferred from the results that the Central bank credibility is more responsive to the economic or political turbulences and especially the credibility can easily decrease in case of political distress. This conclusion is verified by these econometric estimations. If this comparison is made between financial and institutional models, in terms of number of the transition between regimes, financial variables come into prominence. Among all Markov models, the macroeconomic variables model is the most stable one since it changes only one time from low regime to high regime in the beginning of 2006.



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Central Bank News, <http://www.centralbanknews.info/>

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APPENDIX

Appendix A1: Inflation Targeting Countries in 2016.

Data in this section is provided by the Central bank News (for more information visit: <http://www.centralbanknews.info/p/inflation-targets.html>).

	Country	Central bank	Target and Tolerance Interval
1	Albania	Bank of Albania	3.00% +/-1%
2	Argentina	Central bank of Argentina	12%-17%
3	Armenia	Central bank of Armenia	4.00% +/-1.5%
4	Australia	Reserve Bank of Australia	2.00% - 3.00%
5	Azerbaijan	Central bank of the Rep. of Azerbaijan	5.00% - 6.00%
6	Bangladesh	Bangladesh Bank	6.20%
7	Belarus	National Bank of the Rep. of Belarus	12.00%
8	Botswana	Bank of Botswana	3.00% - 6.00%
9	Brazil	Central bank of Brazil	4.50% +/-2.0%
10	Canada	Bank of Canada	2.00% +/-1.0%
11	Chile	Central bank of Chile	3.00% +/-1.0%
12	China	People's Bank of China	4.00%
13	Colombia	Central bank of Colombia	3.00% +/-1.0%
14	Costa Rica	Central bank of Costa Rica	4.00% +/-1.0%
15	Czech Republic	Czech National Bank	2.00% +/-1.0%
16	Dominican Republic	Central bank of the Dominican Repl.	4.00% +/-1%
17	Euro Area	European Central bank	<2.00%
18	Georgia	National Bank of Georgia	5%
19	Ghana	Bank of Ghana	8.00% +/-2.0%
20	Guatemala	Bank of Guatemala	4.00% +/-1.0%
21	Hungary	Central bank of Hungary	3.00% +/-1.0%

22	Iceland	Central bank of Iceland	2.50%
23	India	Reserve Bank of India	8.00%
24	Indonesia	Bank Indonesia	4.00% +/-1.0%
25	Israel	Bank of Israel	1.00% - 3.00%
26	Jamaica	Bank of Jamaica	4.5% - 6.5%
27	Japan	Bank of Japan	2.00%
28	Kazakhstan	National Bank of Kazakhstan	6.00%-8.00%
29	Kenya	Central bank of Kenya	5.00% +/-2.50%
30	Kyrgyzstan	National Bank of the Kyrgyz Republic	7.00%
31	Malawi	Reserve Bank of Malawi	14.20%
32	Mexico	Bank of Mexico	3.00% +/-1.0%
33	Moldova	National Bank of Moldova	5.00% +/-1.5%
34	Mongolia	Bank of Mongolia	7.00%
35	Mozambique	Bank of Mozambique	5.60%
36	New Zealand	Reserve Bank of New Zealand	2.00% +/-1.0%
37	Nigeria	Central bank of Nigeria	6.00% - 9.00%
38	Norway	Norges Bank	2.50%
39	Pakistan	State Bank of Pakistan	6%
40	Paraguay	Central bank of Paraguay	4.5% +/-2.0%
41	Peru	Central Reserve Bank of Peru	2.00% +/-1%
42	Philippines	Bangko Sentral ng Pilipinas	3.00% +/- 1.0
43	Poland	National Bank of Poland	2.50% +/-1.0%
44	Romania	National Bank of Romania	2.5% +/-1.0%
45	Russia	Bank of Russia	4%
46	Samoa	Central bank of Samoa	3.00%
47	Serbia	National Bank of Serbia	4.00% +/-1.5%
48	South Africa	South African Reserve Bank	3.00% - 6.0%
49	South Korea	Bank of Korea	2%
50	Sri Lanka	Central bank of Sri Lanka	3.00% - 5.0%
51	Sweden	The Riksbank	2.00%
52	Switzerland	Swiss National Bank	<2.00%
53	Thailand	Bank of Thailand	2.50% +/-1.5%

54	Turkey	Central bank of Republic of Turkey	5.00% +/-2%
55	Uganda	Bank of Uganda	5.00% +/-2.0%
56	Ukraine	National Bank of Ukraine	12.00%
57	United Kingdom	Bank of England	2.00%
58	Uruguay	Central bank of Uruguay	3.00% - 7.00%
59	USA	Federal Reserve	2.00%
60	Vietnam	State Bank of Vietnam	7.00%
61	West African States	Central bank of West African States	2.00% +/-1%
62	Zambia	Bank of Zambia	7.00%

Appendix A2: Adoption Year of Inflation Targeting Countries and Income Group

The country list below is basically prepared by Quinonez (2015) and has some additions done by the author of this study. Year of application may change compared to other studies because of the time difference between the approval and the effective date of the policy. For example, in 1989 New Zealand announced the inflation targeting policy in the *Reserve Bank of New Zealand Act* and started implementing it in 1990. In some articles both dates (1989 and 1990) might be seen as a starting date for the inflation targeting year. In the table, income groups are classified according to GNI per capita calculated by the World Bank Atlas Method in 2015:

Low Income Economies $\leq$ \$1,025

$\$1,026 \leq$ *Lower Middle Income Economies* $\leq$ \$4,035

$\$4,036 \leq$ *Upper Middle Income Economies* $\leq$ \$12,475

$\$12,476 \leq$ *High Income Economies*

Country	Income Group	Year When Inflation Targeting Adopted
New Zealand	High income: OECD	1990
Canada	High income: OECD	1991
United Kingdom	High income: OECD	1992
Australia	High income: OECD	1993
Finland	High income: OECD	1993
Spain	High income: OECD	1995
Sweden	High income: OECD	1995
Israel	High income: OECD	1997
Korea, Republic	High income: OECD	1998
Poland	High income: OECD	1998
Colombia	Upper middle income	1999
Brazil	Upper middle income	1999
Chile	High income: OECD	1999
Mexico	Upper middle income	2000
South Africa	Upper middle income	2000
Switzerland	High income: OECD	2000

Thailand	Upper middle income	2000
Hungary	High income: OECD	2001
Iceland	High income: OECD	2001
Norway	High income: OECD	2001
Peru	Lower middle income	2001
Philippines	Lower middle income	2002
Bangladesh	Lower middle income	2003
Guatemala	Lower middle income	2005
Indonesia	Lower middle income	2005
Romania	Upper middle income	2005
Armenia	Lower middle income	2006
Botswana	Upper middle income	2006
Turkey	Upper middle income	2006
Ghana	Lower middle income	2007
Uruguay	High income: OECD	2007
Albania	Upper middle income	2009
Georgia	Lower middle income	2009
Serbia	Upper middle income	2009
Moldova	Lower middle income	2010
Costa Rica	Upper middle income	2011
Uganda	Low income	2011
United States	High income: OECD	2012
Dominican Republic	Upper middle income	2012
Malawi	Low income	2012
Mongolia	Upper middle income	2012
Belarus	Upper middle income	2013
Japan	High income: OECD	2013
Azerbaijan	Upper middle income	2014
Kenya	Lower middle income	2014
Kazakhstan	Upper middle income	2015
Ukraine	Lower middle income	2015

Appendix A3: The Questionnaire of the Transparency Measurement

This questionnaire is prepared by Fry et al. (2000). They circulated this questionnaire around 114 Central banks during one year in order to be able to construct the Transparency Index. In total 94 institutions completed this questionnaire.

Questions	Question Weight	Scores	Categories of Answers
Explanation of Policy Decisions			
1. Central bank provides explanations on day policy changed?	1.5	100 0	Yes No
2. Explanations provided when policy-makers meet and do not change policy?	0.3	100 50 0	Yes Sometimes No
3. Policy decisions discussed in standard bulletins and reports?	2	100 50 0	At least twice a year At least annually No
4. Minutes of policy meetings published	1	100 50 0	Within a month of meeting More than a month after No
5. Voting patterns published	0.5	100 0	Yes No
Published Forward-looking Analysis			
6. Forward-looking analysis in standard bulletins and reports	2	100 50 25 0	More than annually At least annually Unspecified Otherwise
7. Form of publication	1.5	100 50 25 0	Words, one of numbers or graphs One of words, numbers or graphs Unspecified None
8. Risk to forecast published	1	100 50 0	Words and one of number or graphs One of words, numbers or

			graphs None
9. Discussion of past forecast errors	1	100 50 0	Yes Sometimes No
Assessment and Analysis			
10. Analysis in standard bulletins and reports	2	100 50 0	More than annually At least annually Otherwise
11. Frequency of speeches	1.5	100 66 33 0	At least monthly At least quarterly Less than quarterly/occasional Never, almost never
12. Working papers and other research publications	1	100 66 33 0	More than 10 each year More than 5 each year More than 2 /occasional Never

Appendix A4: The Questionnaire of the Independence Measurement

This questionnaire is prepared by Fry et al. (2000). They circulated this questionnaire around 114 Central banks during one year in order to be able to construct the Independence Index. In total 94 institutions completed this questionnaire.

Questions	Question Weight	Scores	Categories of Answers
1. To what extent do statutory objectives provide the Central bank with a clear focus on price stability?	1	100 75 50 25 0	Only goal is price, monetary or currency stability Price stability + financial stability objectives and non-conflicting monetary stability objectives Price stability + conflicting objectives No statutory objectives Only goals other than price stability
2. To what extent does the Central bank determine the setting of policy targets?	1	100 50 0	Only Central bank sets an explicit target (for either inflation, money or the exchange rate) or there are no explicit targets Both Central bank and government have a role in setting an explicit target (for either inflation, money or the exchange rate). Only government sets a target (for either inflation, money or the exchange rate)
3. To what extent does the Central bank determine the adjustment of monetary policy instruments?	2	100 65 33 0	Central bank decides on changes in instruments and no representative of government attends the meeting of monetary policy makers, other than as an observer Central bank decides on changes to instruments and a representative of government attends the meeting of monetary policy makers Central bank and government have a role in setting instruments

			Central bank role in setting instruments is limited
4. To what extent are there limits on Central bank financing of the fiscal deficit?	2	100 75 50 25 0	Prohibited, never used, or amounts so small and for short periods independence in no way affected Narrow, well enforced limits exist Limits exist that are usually enforced Wide limits exist and some procedures exist when limits are missed No limits or little enforcement
5. How long is the term of office of the Governor?	0.5	100 86 71 57 43 29 14	8 years or above 7 years 6 years 5 years 4 years 3 years Term can exceed 3 years

Appendix A5: The Questionnaire of the Accountability Measurement

This questionnaire is prepared by Fry et al. (2000). They circulated this questionnaire around 114 Central banks during one year in order to be able to construct the Accountability Index. In total 94 institutions completed this questionnaire.

Questions	Question Weight	Scores	Categories of Answers
Accountability to A Specific Target			
1. Is there a specific published target?	1.5	100 0	Yes No
2. Do procedures exist for when the target is missed?	1.5	100 50 0	Recognized formal procedures exist Informal procedures exist, or if Central bank reports instruments set in conjunction with government No
Accountability to Government or In General			
1. Central bank subject to monitoring by legislature?	3	100 50 0	Yes Irreg

Appendix A6: The Questionnaire of the Central bank Transparency Index

This appendix contains the exact formulation of the Central bank transparency index constructed by Eijffinger and Geraats (2006). The index is the sum of the scores for the answers to the fifteen questions below (min = 0, max = 15).

1. Political Transparency

Political transparency refers to openness about policy objectives. This comprises a formal statement of objectives, including an explicit prioritization in case of multiple goals, a quantification of the primary objective(s), and explicit institutional arrangements.

(a) Is there a formal statement of the objective(s) of monetary policy, with an explicit prioritization in case of multiple objectives?

No formal objective(s) = 0.

Multiple objectives without prioritization = 1/2.

One primary objective, or multiple objectives with explicit priority = 1.

(b) Is there a quantification of the primary objective(s)?

No = 0.

Yes = 1.

(c) Are there explicit institutional arrangements or contracts between the monetary authorities and the government?

No Central bank, contracts or other institutional arrangements = 0.

Central bank without explicit instrument independence or contract = 1/2.

Central bank with explicit instrument independence or Central bank contract (although possibly subject to an explicit override procedure) = 1.

2. Economic Transparency

Economic transparency focuses on the economic information that is used for monetary policy. This includes economic data, the model of the economy that the Central bank employs to construct forecasts or evaluate the impact of its decisions, and the internal forecasts (model based or judgmental) that the Central bank relies on.

(a) Is the basic economic data relevant for the conduct of monetary policy publicly available?

The focus is on the following five variables: money supply, inflation, GDP, unemployment rate and capacity utilization.

Quarterly time series for at most two out of the five variables = 0.

Quarterly time series for three or four out of the five variables = 1/2.

Quarterly time series for all five variables = 1.

(b) Does the Central bank disclose the formal macroeconomic model(s) it uses for policy analysis?

No = 0.

Yes = 1.

(c) Does the Central bank regularly publish its own macroeconomic forecasts?

No numerical Central bank forecasts for inflation and output = 0.

Numerical Central bank forecasts for inflation and/or output published at less than quarterly frequency = 1/2.

Quarterly numerical Central bank forecasts for inflation and output for the medium term (one to two years ahead), specifying the assumptions about the policy instrument (conditional or unconditional forecasts) = 1.

3. Procedural Transparency

Procedural transparency is about the way monetary policy decisions are taken. It involves an explicit monetary policy rule or strategy that describes the monetary policy framework, an account of policy deliberations and how the policy decision was reached.

(a) Does the Central bank provide an explicit policy rule or strategy that describes its monetary policy framework?

No = 0.

Yes = 1.

(b) Does the Central bank give a comprehensive account of policy deliberations (or explanations in case of a single Central banker) within a reasonable amount of time?

No, or only after a substantial lag (more than eight weeks) = 0.

Yes, comprehensive minutes (although not necessarily verbatim or attributed) or explanations (in case of a single Central banker), including a discussion of backward and forward-looking arguments = 1.

(c) Does the Central bank disclose how each decision on the level of its main operating instrument or target was reached?

No voting records, or only after substantial lag (more than eight weeks) = 0.

Non-attributed voting records = 1/2.

Individual voting records, or decision by single Central banker = 1.

4. Policy Transparency

Policy transparency means prompt disclosure of policy decisions. In addition, it includes an explanation of the decision, and an explicit policy inclination or indication of likely future policy actions.

(a) Are decisions about adjustments to the main operating instrument or target promptly announced?

No, or after a significant lag = 0.

Yes, at the latest on the day of implementation = 1.

(b) Does the Central bank provide an explanation when it announces policy decisions?

No = 0.

Yes, when policy decisions change, or only superficially = 1/2.

Yes, always and including forwarding-looking assessments = 1.

(c) Does the Central bank disclose an explicit policy inclination after every policy meeting or an explicit indication of likely future policy actions (at least quarterly)?

No = 0.

Yes = 1.

5. Operational Transparency

Operational transparency concerns the implementation of the Central bank's policy actions. It involves a discussion of control errors in achieving operating targets and (unanticipated) macroeconomic disturbances that affect the transmission of monetary policy. Furthermore, the evaluation of the macroeconomic outcomes of monetary policy in light of its objectives is included here as well.

(a) Does the Central bank regularly evaluate to what extent its main policy operating targets (if any) have been achieved?

No, or not very often (at less than annual frequency) = 0.

Yes, but without providing explanations for significant deviations = 1/2.

Yes, accounting for significant deviations from target (if any); or, (nearly) perfect control over main operating instrument/target = 1.

(b) Does the Central bank regularly provide information on (unanticipated) macroeconomic disturbances that affect the policy transmission process?

No, or not very often = 0.

Yes, but only through short-term forecasts or analysis of current macroeconomic developments (at least quarterly) = 1/2.

Yes, including a discussion of past forecast errors (at least annually) = 1.

(c) Does the Central bank regularly provide an evaluation of the policy outcome in light of its macroeconomic objectives?

No, or not very often (at less than annual frequency) = 0.

Yes, but superficially = 1/2.

Yes, with an explicit account of the contribution of monetary policy in meeting the objectives = 1.

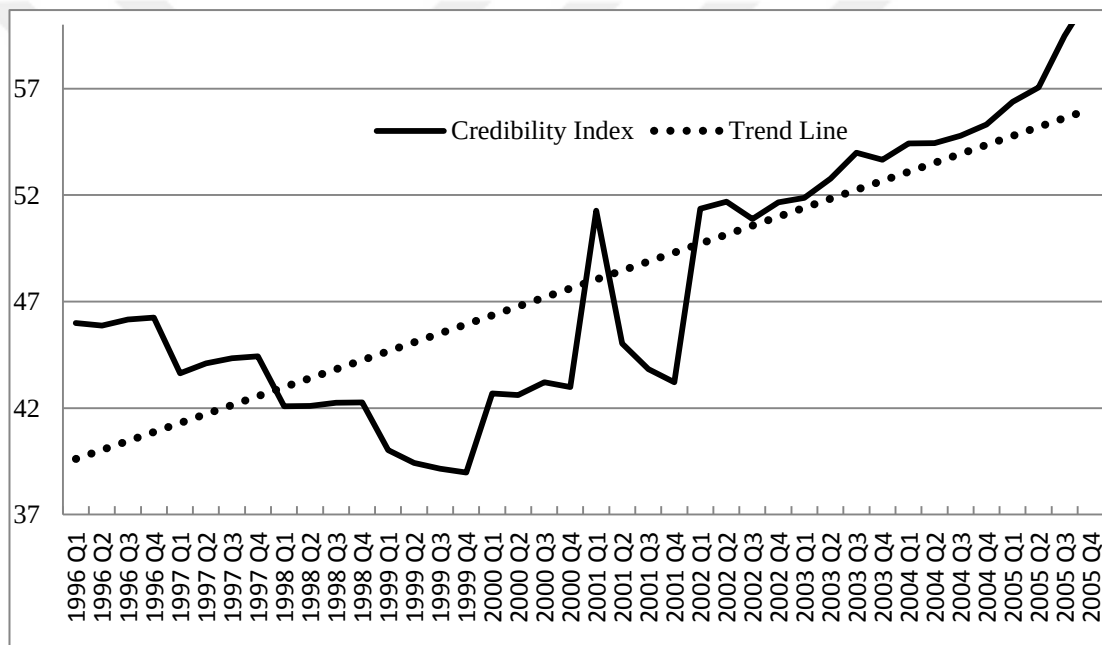
Appendix A7: Differently Weighted Central bank Credibility Indexes

In this section, we assume that institutional factors such as the transparency of monetary policy and Central bank independence are relatively more significant for the credibility. Taking into consideration the different importance of these factors, the weighted equations are given for two periods as follows:

$$CI_{1996-2005} = 0.15CI_2 + 0.275CI_3 + 0.275CI_4 + 0.15CI_5 + 0.15CI_6$$

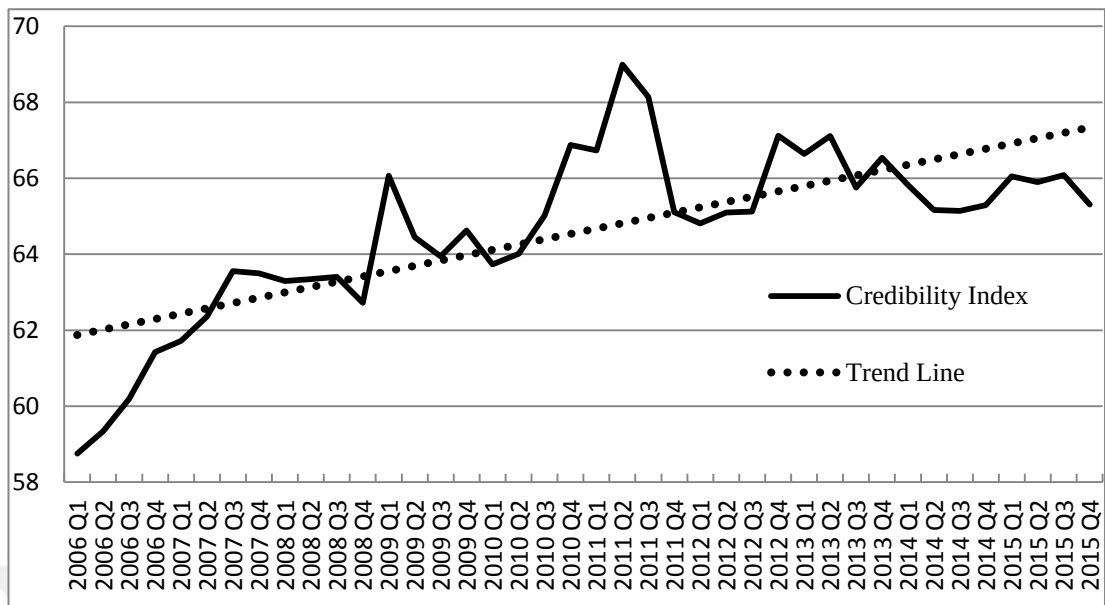
$$CI_{2006-2015} = 0.13CI_1 + 0.13CI_2 + 0.24CI_3 + 0.24CI_4 + 0.13CI_5 + 0.13CI_6$$

The Differently Weighted Credibility Index: 1996-2005 Period



Source: The author's own calculations.

The Differently Weighted Credibility Index: 2006-2015 Period



Source: The author's own calculations.

Appendix A8: Blinder's Questionnaire

This questionnaire is prepared by Blinder in 1998 and sent to the head of 127 Central banks and 115 economists. This questionnaire consists of 17 questions as follows:

Q1. How important is credibility to a Central bank?

Respondents answer by selecting a number on the following five-point scale:

- 1 = unimportant
- 2 = of minor importance
- 3 = moderately important
- 4 = quite important
- 5 = of the utmost importance

Q2. How closely related are the following two concepts:

- (a) a Central bank's credibility
- (b) a Central bank's dedication to price stability?

On the following five-point scale:

- 1 = unrelated
- 2 = slightly related
- 3 = moderately related
- 4 = quite closely related
- 5 = virtually the same

Immediately following the two preliminary questions already mentioned, the survey instrument offered respondents seven reasons why credibility might be important to a Central bank

Reasons why credibility is important

Respondents were asked to express their agreement or disagreement on the following five-point scale:

- 1 = strongly disagree
- 2 = disagree
- 3 = neutral
- 4 = agree
- 5 = strongly agree

Q3. Reducing the costs of disinflation

Q4. Helping to keep low inflation

Q5. Flexibility to change tactics

Q6. Serving as a lender of last resort

Q7. Defending the exchange rate

Q8. A duty to be open and truthful

Q9. Credibility is important as a way to justify public support for an independent Central bank

Q10. On the survey instrument which asked respondents to rank from Q3 to Q9 (1 to 7).

Q11. To establish or maintain credibility, how important is it that a Central bank be independent?

Respondents were asked to rate each attribute on the same one-to-five scale used for the survey's first question:

1 = unimportant

2 = of minor importance

3 = moderately important

4 = quite important

5 = of the utmost importance

Q12. Openness and transparency

Q13. A History of Living Up to Its Word

Q14. A history of fighting inflation

Q15. To establish or maintain credibility, how important is it that a Central bank's governor(s) be bound (whether by law or by custom) to follow a prescribed rule that constrains their decision-making?

Q16. To establish or maintain credibility, how important is it that a Central bank's governor(s) suffer some personal loss (e.g., a lower salary or loss of job) when inflation is too high?

Q17. Fiscal discipline by the government.

Appendix A9: The Six Dimensions of the Worldwide Governance Indicators

The WGI are produced by Daniel Kaufmann: Natural Resource Governance Institute (NRGI) and Brookings Institution and Aart Kraay, World Bank Development Research Group.

Voice and Accountability

Reflects perceptions of the extent to which a country's citizens are able to participate in selecting their government, as well as freedom of expression, freedom of association, and a free media.

Political Stability and Absence of Violence

Political Stability and Absence of Violence/Terrorism measures perceptions of the likelihood of political instability and/or politically-motivated violence, including terrorism.

Government Effectiveness

Reflects perceptions of the quality of public services, the quality of the civil service and the degree of its independence from political pressures, the quality of policy formulation and implementation, and the credibility of the government's commitment to such policies.

Regulatory Quality

Reflects perceptions of the ability of the government to formulate and implement sound policies and regulations that permit and promote private sector development.

Rule of Law

Reflects perceptions of the extent to which agents have confidence in and abide by the rules of society, and in particular the quality of contract enforcement, property rights, the police, and the courts, as well as the likelihood of crime and violence.

Control of Corruption

Reflects perceptions of the extent to which public power is exercised for private gain, including both petty and grand forms of corruption, as well as "capture" of the state by elites and private interests.

Appendix A10: Democracy and Autocracy

In this section, information about Democracy and Autocracy is provided by the Center for Systemic Peace.

Democracy

Democracy is conceived as three essential, interdependent elements. One is the presence of institutions and procedures through which citizens can express effective preferences about alternative policies and leaders. Second is the existence of institutionalized constraints on the exercise of power by the executive. Third is the guarantee of civil liberties to all citizens in their daily lives and in acts of political participation.

Autocracy

Marshall et al. (2016) define it operationally in terms of the presence of a distinctive set of political characteristics. In mature form, autocracies sharply restrict or suppress competitive political participation. Their chief executives are chosen in a regularized process of selection within the political elite, and once in office they exercise power with few institutional constraints.

Appendix A11: Variance Decompositions Results of CRED

Period	S.E.	BSFI	CRED	REER	INF	STINT	TRADEOP	UNEMP	RUOLAW	GDP
1	0.027335	16.43984	83.56016	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
2	0.037008	24.50014	48.07520	2.561695	10.28201	6.543751	1.191565	6.371942	0.028311	0.445387
3	0.043307	37.42380	35.42113	4.135859	7.795541	5.185246	0.932552	7.968069	0.272593	0.865214
4	0.051019	27.94869	25.74021	9.640117	8.452495	6.499475	1.964003	6.810015	5.043353	7.901641
5	0.066990	38.33557	15.24601	8.918034	4.931774	8.466617	1.771240	12.07147	3.587185	6.672095
6	0.083203	43.29963	13.22809	10.62312	6.306360	8.227074	1.696302	9.925283	2.332056	4.362083
7	0.092421	42.47471	11.05642	10.63664	5.765715	8.390963	4.265002	10.63977	2.669782	4.100997
8	0.100585	37.33102	9.421623	11.48864	5.675949	8.669686	3.687544	16.11439	2.644709	4.966443
9	0.109807	34.01415	9.710660	13.22196	5.191617	12.54244	3.275106	15.61031	2.248789	4.184977
10	0.115570	30.72610	9.420567	12.20758	5.150098	11.35260	6.015846	19.24311	2.078760	3.805344

Appendix A12: Variance Decompositions Results of BSFI

Period	S.E.	BSFI	CRED	REER	INF	STINT	TRADEOP	UNEMP	RUOLAW	GDP
1	10.71090	100.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
2	15.32393	80.83131	5.079364	0.002786	0.165194	2.464613	0.000904	11.00990	0.282591	0.163342
3	17.82842	59.74703	6.360958	0.010880	5.409338	2.822182	2.821696	15.62417	2.283973	4.919773
4	24.08862	35.61226	12.37643	9.659253	4.203310	11.61078	8.721707	13.57683	1.407688	2.831742
5	25.24120	36.28218	11.42876	9.849959	4.921437	11.04999	10.01042	12.58581	1.292395	2.579055
6	26.58880	33.05014	11.44354	9.368019	4.689989	12.51673	9.024850	14.62437	1.964356	3.318006
7	29.38173	32.75223	11.21550	11.66562	3.916896	15.46842	7.581625	11.99474	1.912827	3.492148
8	30.66196	31.37655	10.29849	13.33979	4.156637	17.36651	7.133742	11.23878	1.756554	3.332948
9	31.67011	29.42015	9.978357	14.13237	4.123245	17.54093	8.125544	11.59948	1.682404	3.397508
10	32.05498	29.63179	9.773746	13.86803	4.487402	17.21803	8.021118	11.42320	1.764095	3.812600

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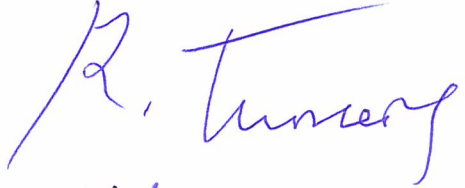
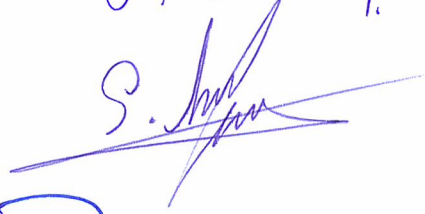
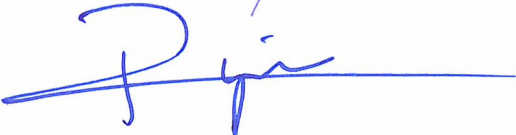
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