MULTIVARIATE TIME SERIES MODELING OF THE NUMBER OF APPLICANTS AND BENEFICIARY HOUSEHOLDS FOR CONDITIONAL CASH TRANSFER PROGRAM IN TURKEY

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MULTIVARIATE TIME SERIES MODELING OF THE NUMBER OF APPLICANTS AND BENEFICIARY HOUSEHOLDS FOR CONDITIONAL CASH TRANSFER PROGRAM IN TURKEY

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ABSTRACT

MULTIVARIATE TIME SERIES MODELING FOR THE NUMBER OF APPLICANTS AND BENEFICIARY HOUSEHOLDS FOR CONDITIONAL CASH TRANSFER PROGRAM IN TURKEY

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Conditional Cash Transfer (CCT) is a social assistance program which aims for investing in human capital by enabling families under risk of poverty to send their children to school and to benefit from health services regularly. CCT aims for decreasing poverty by means of cash transfers in the short run and aims for investing in children's human capital by providing basic preventative health care, regular school attendance and nutrition in the long run. Under the state of these aims, beginning from 1990s, more than 20 countries in the world started their own CCT program by the mediation or leadership of World Bank. CCT program in Turkey started so as to decrease the adverse effects of economic crisis in 2001 within the Social Risk Mitigation Project which was financially supported by the World Bank loan and constituted under the Social Assistance and Solidarity Foundation.

CCT program in Turkey has been adopted by poor families in recent years, and demands and overall payments within the program have been increased significantly in a consideration of years. The need for examining and predicting the increase in these demands scientifically; and considering the fact that CCT is being applied over 20 countries, and such a study being never done before made this study necessary. In this thesis study, the change of CCT applications and number of beneficiary household over time were modeled using multivariate time series models according to geographical regions. Using the vector autoregressive models with exogenous variables (VARX), the forecasts were obtained for the number of CCT applications and beneficiary households in the future.

Keywords: Conditional Cash Transfer (CCT), Proxy Means Testing (PMT), Systems of Dynamic Simultaneous Equations (SEM), Multivariate Time Series Analysis, VARX models.

ÖZ

TÜRKIYE'DEKI ŞARTLI NAKİT TRANSFERİ PROGRAMI BAŞVURULARI VE HAK SAHİBİ HANE SAYILARI İÇİN ÇOK DEĞİŞKENLİ ZAMAN SERİSİ MODELLEMESİ

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Temel olarak Şartlı Nakit Transferi (ŞNT), beşeri sermayeye yatırım yapmak amacıyla yoksulluk riski altındaki ailelerin eğitim çağındaki çocuklarını düzenli okula göndermelerini ve temel sağlık hizmetlerinden düzenli olarak faydalanmalarını hedefleyen nakit bir sosyal yardım programıdır. ŞNT ile kısa vadede nakit desteği yoluyla yoksulluğun hızlı bir şekilde azaltılması, uzun vadede ise yoksul ailelerin temel sağlık, eğitim ve gıda gereksinimlerinin karşılanması yoluyla insani sermayelerine yatırım yapılması amaçlanmıştır. Bu amaçlar doğrultusunda ŞNT programları 1990'lı yıllardan başlamak suretiyle dünya üzerinde 20 den fazla ülkede Dünya Bankası aracılığı ya da öncülüğü ile uygulanmaya başlanmıştır. ŞNT uygulaması Türkiye'de ise 2001 krizi sonrası yaşanılan olumsuz etkileri azaltmak amacıyla, Dünya Bankası kredisiyle Sosyal Yardımlaşma ve Dayanışmayı Teşvik Fonu bünyesinde oluşturulan Sosyal Riski Azaltma Projesi kapsamında başlatılmıştır.

Ülkemizde uygulanan Şartlı Nakit Transferi programı kısa zamanda ihtiyaç sahibi vatandaşlar tarafından benimsenmiş, bu yardımlar için gelen talepler ve verilen destekler yıllar itibariyle fark edilir düzeyde artmıştır. Söz konusu yardım taleplerindeki artışın değişiminin bilimsel olarak incelenmesi ihtiyacı ile ŞNT' nin dünya üzerinde 20 den fazla ülkede uygulanmasına karşın böyle bir çalışmanın yapılmamış olması, bu çalışmayı gerekli kılmıştır. Bu çalışmada çok değişkenli zaman serisi modelleri kullanılarak coğrafi bölgelere göre ŞNT uygulaması için yapılan başvurular (talepler) ile söz konusu uygulamadan faydalanan hanelerin zamana göre değişimi modellenmiştir. ŞNT programı başvuru sayısı ve hak sahibi hane sayısı için bağımsız değişkenli Vektör Otoregresif Zaman Serileri kullanılarak geleceğe dönük öngörüler oluşturulmuştur.

Anahtar Kelimeler: Şartlı Nakit Transferi (ŞNT), Temsili Ortalamalar Değerlendirmesi (TOD), Dinamik Eşanlı Denklemler Sistemi, Çok Boyutlu Zaman Serileri Analizi, VARX Modelleri.

To My Parents

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Ahmet Fatih ORTAKAYA

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LIST OF ABBREVIATIONS

abast	:	Applicant series from Mediterranean Region
AD	:	Anderson-Darling
ADF	:	Augmented Dickey-Fuller
AIC	:	Akaike Information Criteria
ahakt	:	Beneficiary Household series from Mediterranean Region
ahaknuft	:	Beneficiary Household Size Series from Mediterranean Region
anuft	:	Applicant Household Size Series from Mediterranean Region
ANOVA	:	Analysis of Variance
AR	:	Autoregressive
ARCH	:	Autoregressive Conditional Heteroscedastic
CCT	:	Conditional Cash Transfer
dbast	:	Applicant Series from Eastern Anatolia Region
dnuft	:	Applicant Household Size Series from Eastern Anatolia Region
dhakt	:	Beneficiary Household Series from Eastern Anatolia Region
dhaknuft	:	Beneficiary Household Size Series from Eastern Anatolia Region
DW	:	Durbin Watson
ebast	:	Applicant Series from Aegean Region
EGLS	:	Estimated Generalized Least Squares Estimator
ehakt	:	Beneficiary Household Series from Aegean Region
enuft	:	Applicant Household Size Series from Aegean Region
ehaknuft	:	Beneficiary Household Size Series from Aegean Region
gbast	:	Applicant Series from Southeastern Anatolia Region
GDSAS	:	General Directorate of Social Assistance and Solidarity
GDSSCP	:	General Directorate of Social Services and Child Protection
ghakt	:	Beneficiary Household Series from Southeastern Anatolia Region
ghaknuft	:	Beneficiary household size series from S.eastern Anatolia Region
GLS	:	Generalized Least Squares Estimator

gnuft	:	Applicant Household Size Series from S.eastern Anatolia Region
IFPRI	:	International Food Policy Research Institute
ibast	:	Applicant Series from Central Anatolia Region
ihakt	:	Beneficiary Household Series from Central Anatolia Region
ihaknuft	:	Beneficiary Household Size Series from Central Anatolia Region
inuft	:	Applicant household size series from Central Anatolia Region
kbast	:	Applicant series from Blacksea Region
khakt	:	Beneficiary Household Series from Blacksea Region
khaknuft	:	Beneficiary Household Size Series from Blacksea Region
knuft	:	Applicant household size series from Blacksea Region
LAC	:	Latin American Countries
LSE	:	Least Squares Estimation
MARCH	:	Multivariate Autoregressive Conditional Heteroscedastic
mbast	:	Applicant Series from Marmara Region
MGARCH	:	Multivariate General Autoregressive Conditional Heteroscedastic
mhakt	:	Beneficiary Household Series from Marmara Region
mhaknuft	:	Beneficiary Household Size Series from Marmara Region
mnuft	:	Applicant Household Size Series from Marmara Region
MSE	:	Mean Squared Error
NGO	:	Non-governmental Organization
ODTÜ	:	Orta Doğu Teknik Üniversitesi
PMT	:	Proxy Means Testing
SASF	:	Social Assistance and Solidarity Foundation
SBC	:	Schwartz Information Criteria
SEM	:	Simultaneous Equations Models
SRMP	:	Social Risk Mitigation Project
TSI	:	Turkish Statistical Institute
UMT	:	Unverified Means Testing
VAR	:	Vector Autoregressive
VARMA	:	Vector Autregressive Moving Average
VARMAX	:	Vector Autoregressive Moving Average Model with Exogenous

Variables

VARX : Vector Autoregressive Model with Exogenous Variables

VEC : Vectorizing

VMT : Verified Means Testing

WN : White Noise

CHAPTER 1

INTRODUCTION

Conditional Cash Transfer (CCT) is a social assistance program, which aims for investing in human capital by enabling families under risk of poverty to send their children to school and to benefit from health services regularly. CCT aims for decreasing poverty by means of cash transfers in the short run and aims for investing in children's human capital by providing basic preventative health care, regular school attendance and nutrition in the long run. Under the state of these aims, starting from 1990s more than 20 countries in world started their own CCT program by the mediation or leadership of World Bank. CCT program in Turkey started so as to decrease the adverse effects of economic crisis in 2001 within the Social Risk Mitigation Project, which was financially supported by the World Bank, and it was constituted under the Social Assistance and Solidarity Foundation (SASF).

CCT program was/is implemented in many countries all over the world. It was started as a pilot social assistance program in the countries facing global crises such as Kenya and Pakistan. On the other hand, in countries such as, Colombia, Argentina, Brazil and Mexico, it is implemented as a large-scale social assistance program. Early experience of CCT program is in Latin American Countries (LAC) where the risk of poverty is quite high. With the experience gathered from the implication of CCT in those countries, it is introduced in Africa and Asia as well. During the implementation period, as the programs approach a certain stage (i.e. whenever the goals of the program are achieved) they are terminated, and impact assessments are done to evaluate the certain effects of the programs by the mediation or leadership of International Food Policy Research Institute (IFPRI). Although, these impact assessments provide information about the effects of the CCT on people or households covered in the program, they still do not reveal information about when to reach the desired number of people to benefit from the program.

In our knowledge, almost in all CCT programs in the world, number of people or households to be covered in the program is determined (or guessed) before the program starts. However, during the implementation step of the CCT, this number is mostly exceeded and the number of people (or households) to be covered in the program even in the following weeks or months is mainly unknown. Besides, total number of people (or households) to apply for the CCT program, in the following weeks or months in any country where it is implemented, is unknown, as well.

A unique study for determining the total number of applications and beneficiary households for the CCT program in Turkey was done as an expertise thesis (Ortakaya, 2009). In thesis study, Autoregressive Conditional Heteroscedastic (ARCH) and Generalized Autoregressive Conditional Heteroscedastic Models (GARCH) were used to predict and to forecast the total number of applicants and beneficiary households for CCT program all over Turkey. This was a univariate case study and time varying applications and beneficiary households according to geographical differences was not taken into account. Besides, the geographical relations for the applicants (whether the application in one region has an increasing or decreasing affect on the applications of other regions) were not of interest (Ortakaya, 2009). Hence, in this updated study, it is aimed to examine the unpredictable demands and total number of beneficiary households for the CCT program in Turkey according to geographical regions. It is also aimed to show that the number of applicants and beneficiary households for the CCT program in Turkey can be modeled by using multivariate time series analysis. By using this study, resources to be allocated for the CCT program in Turkey according to geographical regions and the number of people who are responsible for the implementation of the CCT can be re-planned. By using the required data, this study can also be extended for the CCT programs in other countries as well.

In order to predict the future values of CCT applications, the multivariate time series analysis considering all geographic regions in Turkey is used. The change in CCT applications and number of beneficiary households are modeled by vector autoregressive model with exogenous variable (VARX) given as the household size. In almost all poverty studies, as the household size increases the risk of poverty increases. Due to this importance, the change of household size can provide information for determining the time varying behavior of applications and beneficiary households for the CCT program in Turkey. Hence, household size is included as an exogenous variable in both models. It is also considered to include other variables in the models for providing additional information in determining the total number of applicants and beneficiary households. Variables like income, expenditure, and goods in house are thought to be correlated with the poverty level and should be included in both models. However, due to problems in CCT database those variables are mostly incorrect and they are not useful in modeling. Hence only household size of the applicants and beneficiary households are used as exogenous variable in modeling.

In the second chapter of this study, basic information about CCT program and the implementation stage in Turkey is given. Within the context of this chapter; conditionality principle, target group, targeting mechanisms varying according to countries' structural dynamics, monitoring systems of CCT, beginning of the program in Turkey, implementation stages, workflow of the process, current situation of total applicants, and beneficiary households are explained.

In the third chapter of this study, detailed information about systems of dynamic simultaneous equations is given. The estimation of those models, as well as conditional and unconditional forecast methods is explained. Also, to determine the effects of CCT applicant series in one geographical region on another, Wald Test for Granger Causality is discussed.

In the final chapter of this study; data taken from CCT database are analyzed. Under the scope of data analysis, the change of applications and number of beneficiary households over time for the CCT program in Turkey according to geographical regions are modeled by using suitable Systems of Dynamic Simultaneous Equations (SEM). Moreover, the possible number of applicants and beneficiaries are predicted by using the fitted models controlling the exogenous variables.

In the conclusions chapter; general evaluations and conclusions were drawn with the help of data analysis and forecasted values obtained by using fitted models. The relational geographical regions for the applications of the CCT program were outlined in a view of migration issue. Also, in a technical view; the problems in fitting the multivariate time series models and as well as outlier detection in statistical software packages were discussed.

CHAPTER 2

BACKGROUND

2.1. Description of the Conditional Cash Transfer Program

CCT is a social assistance program which provides cash to people who are under risk of financial deficiency to enable them to send their children to school, to decrease the mortality rate of their children between ages 0-6 by making them to bring their children to health centers, and to have preventive healthcare for the pregnant mothers in hospitals on regular basis. With the help of this program most vulnerable women and children are targeted and investments are made in their human capital by meeting their basic needs such as education health and nutrition so that the long term intergenerational poverty between them could be prevented and social inclusion could be encouraged.

Different from traditional social assistance program, CCT is not only an active social assistance program for meeting the short-term requirements by direct cash transfers but is also helpful in meeting long-term requirements by promoting accession to education and health services. Being a cash program and having effects on reaching the poor enabled CCT to be used all over the world as a poverty alleviation tool.

CCT is accepted as a social assistance program which makes it possible to create different kinds of social policies. By targeting directly the poor and the way of its implementation, CCT has changed the social responsibility principles between governments and citizens (De la Brière and Rawlings, 2006). Within the direction of this change, a probable descent in the poor community is to be prevented by using CCT programs, and the income distribution becomes more homogenous.

In today's world there is a certain relationship between poverty and income distribution. In the countries that income distribution is not fair, the elasticity of poverty rate to growth rate is smaller. Especially in the countries, where income inequality exists, children are enabled to integrate into society with the contributions of long-run investments of CCT programs. The resources in the poor family that will probably be used for education, health and nutrition needs would also be spent on other family needs so that the welfare of family would be in a better stage.

CCT program has two main aims. The short-term aim of CCT is to provide cash directly to the poor so as to decrease poverty in a short period, and the long-term aim is to invest in human capital of those poor families and to break intergenerational poverty chain by providing accession to basic needs such as education, health and nutrition services. To achieve these aims, countries use different methods depending on their local and regional needs.

CCT has been applied in more than 20 countries in the world. In these countries the program has been started for the poorest community. Then, its target group is widened. With the widening procedure; in education supports of the program, school payments and the opportunity loss of children in going to school instead of working, are covered. Besides paying CCT directly to mothers empowers the women's statute in the community (De la Brière and Rawlings, 2006).

2.1.1. Conditionality principle

Conditionality principle in CCT program becomes outshined due to the global and regional economic crises, limited resources and within the context of spreading liberal ideas. These crises and shocks primarily affected the poor and forced countries to take precautions. As a result, countries could be able to increase their social protection networks; thus, new social assistance programs were generated. These generated programs have limitations within their implementation time, partial scope and target group that will be covered. Within the context of these limitations, the conditionality principles of CCT program are constituted and its aims for investing in human capital by means of providing support for education, health and nutrition services are come into prominence.

According to restrictions in CCT, certain conditions are created to take advantage of the program. Restrictions to be fulfilled are stated differently for the type of each sub CCT program. These terms can be considered as children's attending schools and having regular health examinations and vaccinations carried out in the health clinics where they have their basic health education, and mothers' continuing regular checks in hospitals and have their births in them. In order to meet these conditions, institution that implements the program is responsible for the organization in general, in addition, the institutions that provide basic health and education services are responsible to work in coordination with the owner institute of the program.

Being a conditional social assistance program, CCT, is also participatory program. To ensure the above mentioned conditions, the active participation of the education and health institutions is necessary to check the families' participation to the program. Other than these institutions, there are many stakeholders working actively in the program. In some countries, these stakeholders are local governments, civil societies, and non-governmental organizations (NGO's) as well. By satisfying the mentioned conditions and tracking of stakeholders within the program, beneficiary families tend to develop positive behavior for getting better education and health services so that the transfer of poverty to the next generation can be prevented.

2.1.2. Target group

The target group of CCT is constituted by poor families who cannot send their children to school or who cannot have regular health controls due to insufficient financial conditions. Differing from other social assistance program, CCT serves as an integrated social assistance support by directly targeting the women.

Between different cultures and civilizations throughout history, the various economic, sociological, and anthropological studies show that women make more investment in their children than men (Hadded et al.,1997). Thinking the role of women in families and the role of women in society, the CCT program focuses on women to strengthen their socio-economic status by directly transferring cash to them. By empowering the women's role in society, women's participation in social and economic life is also encouraged especially in developing countries. A great experience in the implementation of CCT program in Mexico shows that through long-term women participation in production processes in non-agricultural and agricultural sectors have emerged and increased (Gertler et al., 2006). In some countries, CCT payments are formed to vary according to gender and girls are paid more than boys so as to increase girls' enrollment rates in schools (Khandker et al., 2003). Other target group in CCT program is the children. Starting in the early ages of children of the poor households, CCT reduces the potential health problems after the birth.

Moreover, in the workshop report of Impact Assessment of Social Assistance and Project Supports, it was mentioned that pre-school education programs should be included in CCT system and payments in that stage should be higher. This result shows the importance in starting to invest in human capital of children in early ages (SYDGM, 2008).

The aim of education sub program of CCT is to prevent child labor and to make children continue their education instead of working. However, in Mexico, as occurred in the PROGRESA program, when the beneficiary household head has a sudden illness or unemployment situation, the education beneficiary children in that house have to work in different jobs and have to go to school at the same time (De Janvry et al., 2005).

There are criticisms on CCT that it targets only women and children but not elderly, disabled, and people who cannot work. It is another debate issue that, CCT is not having compliance conditions for these groups included within the goals of social inclusion. For these excluded groups, countries develop different social assistance and social support programs to fight against poverty.

2.1.3. Targeting mechanism

The main purpose of targeting mechanisms used in CCT is to reach the poorest community who faces with the social exclusion risk and who have problems in achieving education and health services provided by the state. In this way, with the limited amount of resources of the program, the ones experiencing the poverty as the most intensive manner are founded and a contribution to the social welfare of those people is assured.

Generally, different targeting mechanisms are available in the social assistance programs. By using these mechanisms, poor households or individuals in poor households are targeted. There are other methods which are used for targeting the poor geographically. Sometimes combinations of these methods are applied. Three different approaches are used for targeting the poor households or individuals in poor households. These approaches are: Verified Means Testing (VMT), Unverified Means Testing (UMT) and Proxy Means Testing (PMT).

Although there are differences in the implementation of these methods between developed and developing countries, basic steps are generally as follows:

1. Depending on a variety of methods used in data collection (surveys, home visits or face-to-face meeting or office visits) data are sampled from individuals or from households. At this stage, different sample selection methods are used according to the current status of the countries. In one method, households no matter they have a chance of being beneficiary or not, are selected so as to reveal socio-economic status of different individuals or households in the country. In another method, only the households that are potential beneficiaries are selected.
2. After the collected information is controlled using various mechanism (or without being controlled), it is transferred to digital media under the name of household information systems. (At this stage, a unique registration number is assigned to individuals or households.)

3. According to the information transferred to household information system, socio-economic levels of households (depending on the method used) are determined.
4. After analysis is completed, the households' applicants are checked to ensure that they provide the conditions of the social assistance programs and their socio-economic statuses are under the designated level to benefit from the program.
5. Finally, the households or individuals that satisfy the necessary conditions become eligible for the CCT program.

VMT is used in OECD countries where the households or the individual's income and expenditure can be measured, can be held in sophisticated databases and can be verified by using cross-checks from other national databases. VMT is accepted to be the most effective targeting mechanism in identifying the poor due to countries' minimum level of informal economy, integrated database of assets, social insurance, banking and taxing mechanisms (Castañeda and Lindert, 2005). However, this method is not widely used in developing countries. The main reason is that administration, infrastructure and implementation costs as well as level of informal economy are considerably high in those countries.

In the assessment of VMT method, after special conditions for benefiting from social assistance program is determined, the applicants' information is verified and the ones meeting the necessary requirements are considered to be eligible for the program. On the other hand, in the assessment of UMT method, the applicant household's or individuals' income is received according to their statements and these statements are not verified or only a limited number of them are verified at all. To measure the level of welfare of households in local level, surveys are conducted and data are collected and registered to central databases whenever possible. Different kinds of analysis are made using this unverified information, and the applicants are determined as beneficiary if they satisfy the conditions of social assistance program. Compared to the VMT method, UMT method is more economical and easy to apply. However, this method has disadvantages such as being inaccurate in measuring income and social welfare, becoming far from transparency and accountability, and letting some households or individuals to benefit from social assistance programs longer than they do.

Due to the difficulty in measuring the income in an effective way, in some LAC countries and in Turkey, PMT method is used for identifying the poor. In this method, poverty is taken into account as a multidimensional phenomenon. To use this method, first, households are selected by using various sampling techniques all over the country. After the selection is done, questions are asked to determine the socio-economic status of these households. Using the data gathered, regression models are fitted by using explanatory variables obtained from the questions. When there are correlated variables, principle component analysis is applied and smaller numbers of independent and uncorrelated variables are obtained.

Variables like the development status of the residence area where the applicant's house is settled, the number of people living in the house, education level, the number of children continuing in education in the house, working status and income of the family, the quality and quantity of goods in the house, etc. are included in the regression models so as to create a scoring formula for determining the household's socio-economic status. According to the result of analysis made, households or individuals who have a smaller score than the desired threshold point become eligible for the social assistance program.

PMT is considered as an effective targeting method for detection of extreme poor households and letting them benefit from social assistance programs in the long-term. (Castañeda and Lindert, 2005). However, this method has the following disadvantages:

- Sudden changes due to crisis in households are not recognized by PMT, so that those households cannot be included in social assistance programs.
- The application runs centrally and it is not well-known in local and rural areas.

- Due to the risk of manipulation of local practitioners or inconsistent information obtained from applicants, the weights of the variables in developed model by PMT are kept confidential, and this results in confusion between applicants in the sense of being beneficiary.
- It results in discrimination between applicants for being beneficiary or not (Adato, 2000a; Adato et al., 2000b).

It is expressed that if methods used for targeting poor individuals or households are combined with geographical targeting on a certain amount, they become more effective in determining the poor (Castañeda and Lindert, 2005).

Using geographical targeting methods, statistical models are developed according to VMT, UMT and PMT by using the data obtained from various regions where the poverty is highly concentrated. With the help of these constructed models, socio-economic status of households living in these regions is determined. If the applicant household's or individual's score is less than predetermined threshold value and also if that household or individual satisfy the necessary conditions to benefit from the social assistance program, they become beneficiary.

Targeting mechanism for identifying households that will benefit from social assistance program should be well-planned and tested for a long time. However, in most cases, the governments in which the social assistance program will be implemented want to start these programs immediately. Due to this quick implementation, time for planning and pilot phase for the program become relatively short, and this results in inefficiency in the implementation of social assistance programs. In addition, not conducting a study for checking the adequacy of education and health services both in quality and quantity before the program, the demands for those services are not able to be met after the program has started. As a result, social assistance programs are not well-designed, cannot reach the poorest efficiently, and cause countries to provide lower quality of health and education services to its citizens. In order to get rid of these possible drawbacks, following precautions can be taken:

- Social assistance programs should be examined with a large-scale pilot studies. The planned targeting mechanism, implementation cost, effect of the program and transparency issues should be evaluated (Coady et al., 2004). In some cases, pilot phase should be applied between 12 to 18 months long.
- Data collection techniques for establishment of targeting mechanism should be rigorous depending on the countries' dynamics. It should be decided whether the data should be taken from the households of different socio-economic status or it should only be collected from the poor households. Moreover, data collection technique should be selected in accordance with the country's administration type. The possible experimental errors should be kept in minimum in the surveys, face to face conversations and home or office visits.
- The data collected should be verified (from different databases-in case there exists any) as much as possible within the country. This controlled data should be installed in a single database with a unique registration number and they should be periodically controlled and updated.
- Depending on countries' conditions (existence of informal economy, economic and social welfare, existence of information systems and national databases) and based on the targeting method used more than one statistical model should be developed, and the statistically most valid and reliable one should be selected. In some cases the targeting mechanism used should be combined with the geographical targeting methods.
- There should be strong communication and co-ordination between the institution that is responsible for the implementation of social assistance programs and the public institutions that are responsible for providing education and health services. Besides, the quantity and functional competence of units that provide education and health services should be re-planned with respect to the total resource planned to be used and total beneficiaries planned to be reached in social assistance program. In case of necessity, units which provide education and health services should be reinforced.

2.1.4. Monitoring mechanism

Important steps have been taken in the implementation of CCT program due to recent technological developments. The use of central databases and software programs has become widespread in receiving applications, determining beneficiaries, verifying the conditionality principles and making the scheduled payments. By the use of central databases, duplicate records and duplicate beneficiaries are prevented. More efficient monitoring mechanisms enabled to see the changes in socio-economic status of beneficiaries, and thus, resources are used in more efficient way.

Monitoring mechanisms vary across the countries. For example, In Mexico, Chili, Brazil and Costa Rica, national databases are used and detailed information of all beneficiaries are stored in them. By the use of those databases, each beneficiary's socio-economic status change can be monitored and reported in schedule. Differing in Brazil, only the beneficiaries who do not satisfy the conditions are reported. Since there is no central database in Colombia, the time for benefiting from social assistance programs are limited. However, beneficiaries move from one district to another and continue to benefit from the program with a new beneficiary ID. Thus, this resulted in duplicate records all over the country and the same households could benefit from social assistance for a long time.

By using data verification operation, it is checked whether the conditions for social assistance program are satisfied or not. This operation is done by using software programs that are used by education and health service providers instantly if they have a central database, or it is done by forms that proves beneficiaries' regular attendance to schools or to health centers. These forms can be filled and registered to system by municipalities or states according to countries' administration system (De la Brière and Rawlings, 2006).

In monitoring the program conditions in Colombia, records of beneficiaries which are randomly selected from schools and health centers are used. In Argentina, tracking studies are made in the macro level by using household surveys. In the U.S., monitoring is done by using an integrated social security system and sophisticated software programs.

Not only the socio-economic status change of beneficiaries should be monitored but also addresses and basic information of them should be updated within a certain time period. Additionally, by using software programs it must be monitored whether the objectives of the program are satisfied and the beneficiaries tend to create a positive behavior on sending their children to school and having a regular health check.

Status of the beneficiaries, who were taken into program for a long time, should be examined carefully. It is necessary to include new poor families to program instead of families who do not adopt the conditions of the program and who have a substantial increase in their economic status (like the head of family finding a job or having a better paid job than he/she used to have, etc). This change must be declared by the beneficiaries to local authorities who are responsible for running the program. If it is not declared, some certain punishment mechanisms must be used for those beneficiaries.

In the U.S., individuals except being extremely old or having chronic diseases, are automatically monitored each month and according to the change in their status changes, it is decided whether the family will continue to benefit from social assistance or not. In the implementation of CCT programs in LAC and Caribbean countries, data verification is done within two or three months and criminal sanctions are not effectively used (Castañeda and Lindert, 2005).

For monitoring process, data are recorded to database in two different ways. In the first way, all the information of eligible households is recorded and their status changes are examined in specific time periods due to social assistance that they receive. In the second way, only the individuals' information who are eligible for the program are recorded and their status change is monitored.

Due to the ease of implementation in the second case, it is more preferable across countries. But in that case, it will be impossible to monitor the change of household-based poverty. Although the first case is difficult to implement, it enables monitoring the change of household-based poverty.

2.2. Conditional Cash Transfer Program in Turkey

CCT program has been started within the context of Social Risk Mitigation Project (SRMP) in Turkey. It was signed between Government of the Republic of Turkey and World Bank on 14th of September, 2001 and became operational on 28th of November, 2001. SRMP has started after the economic crises in November, 2000 and February, 2001 so as to fight against poverty more efficiently. 500 million $ World Bank credit and 134 million $ Turkish Government contribution were allocated to Social SASF for the use of SRMP. The aims of this project were:

- To reduce the adverse effects of economic crises faced in 2000 and 2001 on the most vulnerable people (the poorest) of the community,
- To prevent the intergenerational poverty in the long run and to create new social assistance programs for increasing the resistance of the citizens against negative factors such as economic crises,
- To increase the institutional capacity of public institutions that provide social assistance and services to citizens,
- To increase the accessibility of poor to education and health services,
- To contribute to the improvement of quality and quantity of the services for disabled people,
- To apply different programs for the poor to achieve sustainable income and participate in the labor market.

SRMP consists of two main portions named as: adjustment portion-rapid response and investment portion. Under the scope of investment portion, there are three sub-portions named as: institutional development component, local initiatives and CCT.

Under the scope of Adjustment Portion - Rapid Response, financial support was given to SASF. In this portion, education and health supports were provided and these activities were completed in 2002. Under the institutional development component of investment portion, financial and technical support was provided to General Directorate of Social Assistance and Solidarity's (GDSAS's), SASF's, General Directorate of Social Services and Child Protection's (GDSSCP's) and Turkish Statistical Institute's (TSI's) management information systems and information technologies, staff trainings, monitoring and evaluation studies and public information mechanisms. Under the local initiatives component of investment portion, project supports are given to attain a sustainable income and to improve employability skills of poor people and to improve the quality of social services offered to disabled people as well. The projects supported under the local initiatives are as follows:

- Income-Generating Micro-Scale Sub-Projects
- Employability Training Projects For Poor Youngsters and Young Women
- Social Infrastructure and Services Projects
- Temporary Employment Projects
- Community Development Projects

Under the CCT component of the investment portion, a social assistance program has been applied in order to invest in human capital of poor people and break intergenerational poverty chain by providing education and health supports (SYDGM, 2007).

By the termination of SRMP on 31th of March 2007, applications under CCT and local initiatives components were delivered to GDSAS. The projects under local initiatives were renamed as Income-Generating Projects, Employability Training Projects, Social Services Projects, Temporary Employment Projects and Community Development Projects, and their total amounts in quantity and their support limits were increased.

2.2.1. The aim of CCT program in Turkey

Declared among the recent social assistances programs, CCT is aimed for transferring cash directly to poor who cannot access to education and health services provided by the state. In a more explicit way, CCT is a social assistance program to provide cash support for poor families who are under the scope of Social Assistance and Solidarity Foundation Law and who cannot send their children to school or who have to take their children from schools, and who cannot have or afford regular health checks for their pre-school children or who cannot give a birth in a health institution.

The aim of CCT program is to make children of poor to let them continue on their education and to make poor families have their children aged between 0 - 6 health checked regularly. In addition, it is aimed for pregnant in poor families to give a birth in a health centers. The main aim of the CCT program is to create a positive behavior on accessing education and health services by providing direct cash transfer to bank accounts created for mothers in poor families so that the intergenerational poverty will be prevented.

2.2.2. Target group, goals and components of the program

Target group of the program is constituted by the families who cannot send their children to school or who cannot have their children's health to be checked regularly, who do not subject to any social security institution, who do not have a regular income and who belong to the poorest 6%[1]of the community. The goals of the program are as follows:

- To enable children of poor to continue their education by meeting the costs like text books, school clothing, school fees that prevent them from going to schools,

[1] According to the analysis of the results of Household Income and Expenditure Survey done in 1994, 6% of the Turkish population were found to be extremely poor and they were accepted as the target group for the CCT program of Turkey (SYDGM, 2006)

- To enable poor families to benefit from health and nutrition services such as immunization, growth monitoring and troubleshooting in malnutrition disorder after the birth,
- To prevent from the risks during pregnancy by regular follow-ups before giving the birth, to have a fully scheduled vaccination after the birth, to avoid possible risk of anemia during pregnancy and to give a birth in hospitals or in health institutions (SYDTF, 2005).

In order to achieve the goals of the CCT program by meeting the specific conditions for each sub-program, education, health and pregnancy supports are provided. Under the scope of education component, families who belong to poorest 6% of the population should register their children to schools and should make them continue their education at 80% attendance rate. Under the scope of health component, families who belong to the poorest 6% of the population should visit the clinics or health centers regularly to have their children aged between 0-6 checked and have them vaccinated in schedule. They should also attend the health seminars in those clinics and health centers regularly. Under the scope of pregnancy support, pregnant women in families having the same socio-economic status as stated above should have regular health checks during their pregnancy period, and give birth in a health center.

2.2.3. Targeting Mechanism of CCT Program

As stated in details in section 2.1.3, due to the difficulty in measuring households' income in an effective way and having a high level informal economy rate in Turkey, PMT was used for determining the beneficiary household for the CCT program. In this method, a scoring formula was used to evaluate household's expenditure and welfare of the household instead of income by using various kinds of indicators.

In order to use PMT, some indicators showing socio-economic status of the family had to be determined. To obtain these indicators, updated data were needed. Since the latest Household Income and Expenditure survey conducted by the Turkish

Statistical Institute in 1994, this requirement was met by “Beneficiary Assessment Research” (Özcan and Ayata, 2000).

Consumption per capita household was calculated by the findings of this research and the relation between this amount and variables concerning household’s demographic, socio-economic, life quality and his/her ownership were examined. According to this study, the weights of those variables were estimated and a scoring formula was developed. By using this formula, the households were sorted according to their poverty scores and a threshold point was determined. The households who had smaller poverty scores than this threshold value become eligible for the CCT program (SYDGM, 2007).

The information that constitutes a basis for the formula was added to application form created for CCT program, and these forms were filled by the families who applied for CCT. After the pilot studies, the variables and the weight of the variables in the scoring formula were updated in February, May and September, 2003, and finally it was revised in May 2004. New threshold value was determined after the update process was completed.

2.2.4. Roll - out of the CCT program

Pilot phase of CCT program has launched in six districts which are; central district of Çankırı, Keçiören district of Ankara, Göksun district of Kahramanmaraş, Ereğli district of Zonguldak, Yavuzeli district of Gaziantep and Durağan district of Sinop in February 2002. According to the results of the pilot phase study, scope of the program was widened. After May 2004, it was started to be used all over the country.

2.2.5. The process of application and becoming beneficiary in CCT

To be able to benefit from CCT program, people have to fill in the CCT application form and provide the necessary documents that will be given to SAS Foundations. In some cases like ageing, disabled or having serious health problems, the application forms are filled by social workers of SAS Foundations in their houses.

The applications of the program are mainly done by mothers. In the case where mother is not alive, the application to the program is done by fathers or any member of the family who is older than 18 years old. In the case where both parents are not alive, the application to the program is done by legal guardian of the children. Such conditions like having children aged between 0-6, or having children who are currently enrolled in primary or secondary education, being pregnant, not belonging to any social security institution, not having proper goods or so are desired to benefit from the CCT program. Applicants are responsible for answering the questions provided by the SAS Foundations, and then, the forms filled by the applicants are entered to the CCT software program.

After the information is entered to the system, a scoring mechanism is run by using the CCT software and the poverty point of the applicant is determined according to the answer given in the application form. If the poverty value of the applicant is smaller than the desired threshold value that household become temporary beneficiary for the CCT program. Then, social workers in SAS Foundations make home visits to those temporary beneficiaries. They check whether the information that temporary beneficiaries has provided during the application is correct or not. If what they said is not verified with the recent conditions of the household in the visits, then social workers write a report about them and they are put out of the program. If the applicants' information is verified by the social workers, then those households become beneficiary in the CCT program (SYDTF, 2005).

2.2.6. Monitoring system of CCT

In order to check whether the aims of the CCT program are satisfied, there should be a strong co-ordination and co-operation between the state institution that runs the CCT program, and health and education services that the state provides. The conditions that the beneficiaries should satisfy during the program are monitored by the help of these state services. In Turkey, to monitor and track the beneficiaries' status, protocols were signed between GDSAS and Ministry of National Education as well as Ministry of Health. In that way, the active participation of those ministries to CCT were achieved for the continuation of beneficiaries to the program.

Payments in CCT program are maintained depending on the beneficiaries' permanence in the program. In order households to continue benefiting from the CCT program, they should bring their children aged between 0-6 to clinics for their health checks and vaccinations where it was scheduled by the ministry of health. They should also make their children continue their education. Tracking of these processes are held by feedbacks from health centers and schools to SAS Foundations.

Under the scope of education support sub-program of CCT, the children of beneficiary household should attend the school with 80% of attendance rate and s/he should not repeat the same term more than once. The tracking of education beneficiaries' is done by the tracking form for education support. In this form, information such as Turkish identity number, class, GPA of the beneficiary student, the name of the school where the beneficiary student is currently enrolled, and the district name where the school is settled are included.

Under the scope of health support sub-program of CCT, the beneficiary household should bring their children aged between 0-6 to clinics for health checks regularly. The schedule of the health visits are;

- Children between 0-6 months old should be brought to clinics monthly for health checks,
- Children between 7-18 months old should be brought to clinics within every two months for health checks,
- Children between 19-72 months old should be brought to clinics within every six months for health checks.

The tracking of health beneficiaries' is done by the tracking form for health support. In this form, name of the clinic that the health check is done, Turkish identity number, name and surname of the health beneficiary are included.

To benefit from pregnancy support of CCT program, the pregnant mother within the program should keep visiting the health clinics for health check on schedule where the visiting times are determined by the ministry of health. The tracking of pregnancy support program is held by tracking form for health. In this form, name of the health center, Turkish identity number, name, surname and the pregnancy period (in months) of pregnant mother are included. In order to benefit from this program pregnant mother should visit the health centers or clinics every month till birth and 2 months after the birth.

2.2.7. Current status of beneficiary and applicant households

From the beginning of CCT program in Turkey to June 17, 2009, 1,844,169 households applied for this program. According to the scoring mechanism and within the scope of the data verification process, 1,088,249 (59% of the applicants) households became beneficiary and 755,920 (41% of the applicants) were unable to become beneficiary. Considering the beneficiary rates among the seven geographical regions in Turkey, Southeastern Anatolia and Eastern Anatolia have higher rates for becoming beneficiary when compared to the other regions. In other words, 77 applicants in Southeastern Anatolia and 78 applicants in Eastern Anatolia Regions became beneficiary out of every 100 applicants whereas only 29 applicants in Marmara Region out of every 100 applicants became beneficiary.

Table 1. Distribution of Total Applicants, Beneficiary Households and Beneficiary Rates with respect to Geographical Regions for the CCT Program (2003-2009 May)

GEOGRAPHICAL REGIONS	APPLICANT HOUSEHOLDS		BENEFICIARY HOUSEHOLDS		BENEF. HH. / APPL. HH. (%)
	# of APPL.	(%)	# of BENEF.	(%)	
S. EASTERN ANATOLIA	480.258	26.04	368,252	33.84	76.68
EASTERN ANATOLIA	395.814	21.46	306,878	28.20	77.53
MEDITERRANEAN	261.001	14.15	126,307	11.61	48.39
BLACKSEA	209.956	11.38	89,909	8.26	42.82
CENTRAL ANATOLIA	194.890	10.57	100,128	9.20	51.38
MARMARA	173.761	9.42	49,191	4.52	28.31
AEGEAN	128.489	6.97	47,584	4.37	37.03
TOTAL	**1.844.169**	**100**	**1,088,249**	**100**	**59**

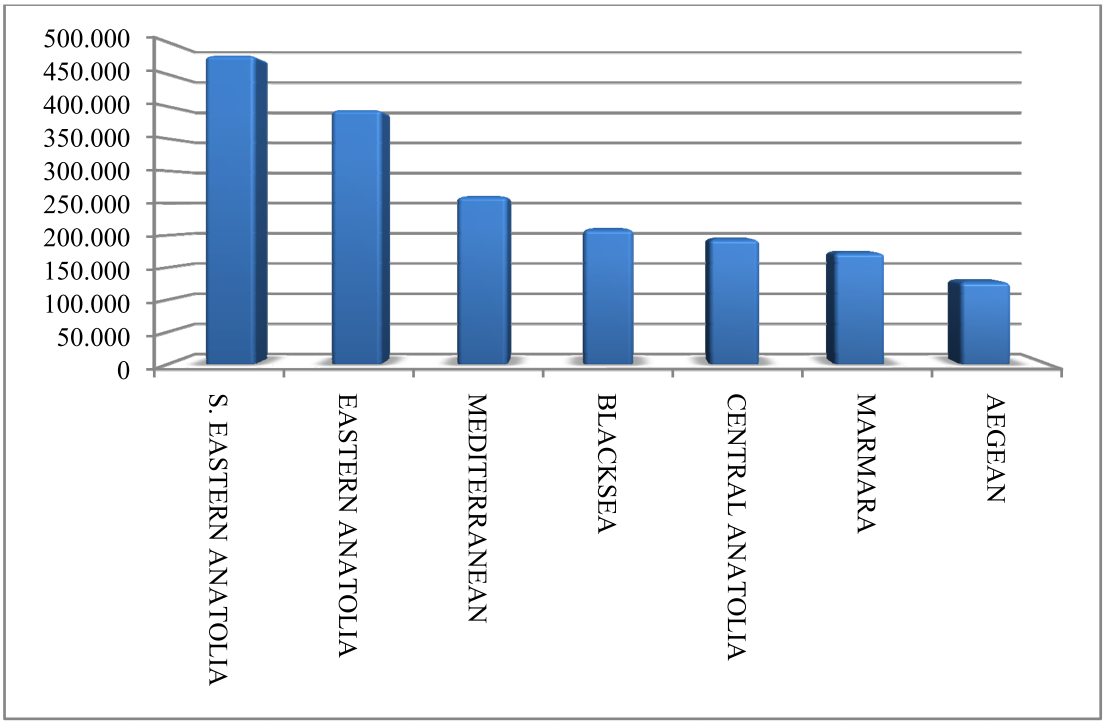


Figure 1. Distribution of Total Applicants for the CCT Program with respect to Geographical Regions (2003-2009 May)

According to distribution of total applicants for CCT, 47.5% of them were done from Southeastern and Eastern Anatolia Regions. When the settlements of the applicants are considered, 55% of them are from city/town centers and 45% of them are from rural areas. When the settlements of beneficiary households are considered, 49% of them are from city/town centers and 51% of them are from rural areas.

Table 2. Distribution of Education, Health and Pregnancy Support Beneficiaries with respect to Geographical Regions for the CCT Program

GEOGRAPHICAL REGIONS	HEALTH BENEFICIARY		EDUCATION BENEFICIARY		PREGNANT MOTHER	
	# of BENEF.	(%)	# of BENEF.	(%)	# of BENEF.	(%)
S. EASTERN ANATOLIA	433,057	40.67	771,227	37.23	16,560	35.71
EASTERN ANATOLIA	368,733	34.63	568,172	27.43	18,704	40.34
MEDITERRANEAN	93,459	8.78	228,761	11.04	4,153	8.96
CENTRAL ANATOLIA	61,676	5.79	173,773	8.39	2,679	5.78
BLACKSEA	57,793	5.43	152,704	7.37	2,382	5.14
MARMARA	26,917	2.53	95,500	4.61	1,184	2.55
AEGEAN	23,181	2.18	81,163	3.92	708	1.53
TOTAL	**1,064,816**	**100**	**2,071,300**	**100**	**46,370**	**100**

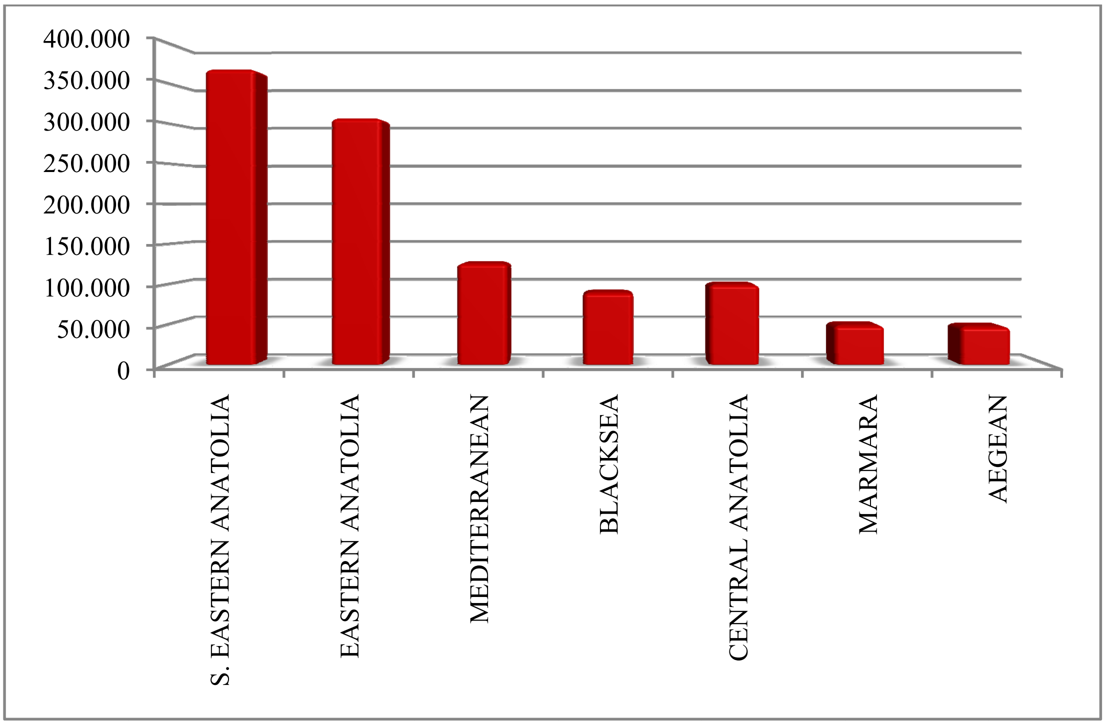


Figure 2. Distribution of Total Beneficiary Households for the CCT Program with respect to Geographical Regions (2003-2009 May)

When the beneficiary households are compared with respect to geographical regions, Southeastern Anatolia region has the highest rate of beneficiary households (34% of all beneficiary households) whereas Aegean region has the smallest rate of beneficiary households (only 4.4% of all beneficiary households).

Table 3. Distribution of Beneficiary Households and Average Number of Beneficiaries within a Household with respect to Geographical Regions for the CCT Program (2003-2009 May)

GEOGRAPHICAL REGIONS	BENEFICIARY HOUSEHOLDS		TOTAL BENEFICIARIES (EDUCATION+HEALTH +PREGNANCY)		AVERAGE #OF BENEFICIARY PEOPLE WITHIN A HOUSEHOLD
	# of BENEF.	(%)	# of BENEF.	(%)	
S. EASTERN ANATOLIA	368,252	33.84	1,220,844	38.36	**3.32**
EASTERN ANATOLIA	306,878	28.20	955,609	30.03	**3.11**
MEDITERRANEAN	126,307	11.61	326,373	10.26	**2.58**
CENTRAL ANATOLIA	100,128	9.20	238,128	7.48	**2.38**
BLACKSEA	89,909	8.26	212,879	6.69	**2.37**
MARMARA	49,191	4.52	123,601	3.88	**2.51**
AEGEAN	47,584	4.37	105,052	3.30	**2.21**
TOTAL	**1,088,249**	**100**	**3,182,486**	**100**	**2.92**

When the beneficiary households and total beneficiaries (for education, health and pregnancy support) in the households for the CCT program are examined, three people on the average in the family members benefit from the program. When the average beneficiaries within households with respect to geographical regions are compared, Southeastern Anatolia Region has the highest number by 3.32 whereas Aegean Region has the smallest number by 2.21. According to this information, in the CCT program, the total number of beneficiary households as well as number of beneficiary people within households increases from west to east of Turkey.

CHAPTER 3

METHODOLOGY AND ANALYTICAL FRAMEWORK

In time series analysis, decision makers are often need predictions of a variable of interest. If the observations of a variable are available, and if they contain information about the future development of that variable, it is meaningful to use as forecast some function of the data collected in the past. In dealing with data having more than one variable, often the value of one variable is not only related with its past values, but also it depends on past values of others. While forecasting one variable, it makes sense to use the possible additional information which comes from other variables (Lütkepohl, 2005). Hence, multiple time series analysis is used to learn about the relations of different variables, their change with respect to time, and predictions and forecasts of them.

There are a couple of models used in multivariate time series analysis. Vector autoregressive processes (VAR), vector autoregressive moving average models (VARMA), vector autoregressive moving average model with exogenous variables (VARMAX), vector error correction models, multivariate autoregressive conditional heteroscedastic (MARCH) and multivariate generalized autoregressive conditional heteroscedastic (MGARCH) models, periodic VAR processes and intervention models, state space models and systems of dynamic simultaneous equation models (SEM) are the widely used ones.

In this study, the change in CCT applications and number of beneficiary households in Turkey according to seven geographical regions are of interest. In time series modeling of applicants and beneficiary households, household size is thought to provide additional information about the past and future observations of them, respectively. Hence, they are modeled by VARX given as the household size. Moreover, dynamic relationships between applicants according to geographical regions and beneficiary household according to geographical regions are of interest. Therefore, SEM model given above is used in this study.

3.1. Systems of Dynamic Simultaneous Equations

In practice, the generation processes are not affected only by the variables in the system. In fact, they are affected by the variables both within the system and as well as outside of the system. The variables within the system are called as endogenous and the ones outside the system are called as exogenous or unmodelled (Lütkepohl, 2005). A model with exogenous variables can have the structural form:

$$\mathbf{A}y_t = A_1^* y_{t-1} + \ldots + A_p^* y_{t-p} + B_0^* x_t + B_1^* x_{t-1} + \ldots + B_s^* x_{t-s} + w_t \qquad (3.1.1)$$

where $y_t = (y_{1t}, \ldots, y_{Kt})'$ is a K-dimensional vector of endogenous variables and $x_t = (x_{1t}, \ldots, x_{Mt})'$ is an M-dimensional vector of exogenous variables. A is a (KxK) matrix and shows the relations between the endogenous variables, B_i^* ‘s are (KxK) and B_i^* ‘s are (KxM) coefficient matrices, respectively and w_t is a K-dimensional error vector. When the error term is white noise, the model described in (3.1.1) is named as Vector Autoregressive Model with Exogenous Variables VARX(p,s), where p is the order of Autoregressive (AR) term and s is the order of exogenous variable. Generally, these models are called as *dynamic simultaneous equations* (SEM) and we will use the VARX in modeling.

In equation (3.1.1), the components of y_t consists of endogenous variables and the components of x_t consist of exogenous variables. Here, x_t is called exogenous if $x_t, x_{t-1}, \ldots, x_{t-s}$ are independent of the error term w_t. x_t is also called strictly exogenous, if all lags and leads are independent from all lags and leads of the error term w_t. However, in practice these assumptions may not be met. Therefore, some restrictions are made to ascertain on the independence of x_t and w_t. Consider the following simple model:

$$
\begin{aligned}
y_{1t} &= v_1^* + \alpha_{11,1}^* y_{1,t-1} + \alpha_{12,1}^* y_{2,t-1} + \beta_{12,1}^* x_{1,t-1} + w_{1t}, \\
y_{2t} &= v_2^* + \alpha_{22,1}^* y_{2,t-1} + a_{21,0} y_{1t} + \alpha_{21,1}^* y_{1,t-1} + w_{2t}.
\end{aligned}
\tag{3.1.2}
$$

The model above can be written as in the form (3.1.1) as follows:

$$
\begin{bmatrix} 1 & 0 \\ -\mathbf{a}_{21,0} & 1 \end{bmatrix}
\begin{bmatrix} y_{1t} \\ y_{2t} \end{bmatrix}
=
\begin{bmatrix} \alpha_{11,1}^* & \alpha_{12,1}^* \\ \alpha_{22,1}^* & \alpha_{21,1}^* \end{bmatrix}
\begin{bmatrix} y_{1,t-1} \\ y_{2,t-1} \end{bmatrix}
+
\begin{bmatrix} v_1^* & \beta_{12,1}^* \\ v_2^* & 0 \end{bmatrix}
\begin{bmatrix} 1 \\ x_{1,t-1} \end{bmatrix}
+
\begin{bmatrix} w_{1t} \\ w_{2t} \end{bmatrix}.
\tag{3.1.3}
$$

Hence, $y_t = (y_{1t}, y_{2t})'$ and $x_t = (1, x_{1t})'$ are both two-dimensional. The instantaneous effects of endogenous variables are reflected in the elements of *A*, so by multiplying with a nonsingular (*K*x*K*) matrix results in an equivalent form for the process generating y_t, which is called as reduced form. In order to obtain the reduced form it is necessary to premultiply the system in (3.1.1) by A^{-1} where exists.

$$
y_t = A_1 y_{t-1} + \ldots + A_p y_{t-p} + B_0 x_t + B_1 x_{t-1} + \ldots + B_s x_{t-s} + u_t \tag{3.1.4}
$$

where $A_i := \mathbf{A}^{-1} A_i^*$ (i=1,...p), $B_j := \mathbf{A}^{-1} B_i^*$ (j=1,…p) and $u_t := \mathbf{A}^{-1} w_t$, the model in (3.1.3) can be written in the reduced form as below:

$$\begin{bmatrix} y_{1t} \\ y_{2t} \end{bmatrix} = A_1 \begin{bmatrix} y_{1,t-1} \\ y_{2,t-1} \end{bmatrix} + B_1 \begin{bmatrix} 1 \\ x_{1,t-1} \end{bmatrix} + \begin{bmatrix} u_{1t} \\ u_{2t} \end{bmatrix}, \tag{3.1.5}$$

where

$$A_1 = \begin{bmatrix} \alpha_{11,1} & \alpha_{12,1} \\ \alpha_{22,1} & \alpha_{21,1} \end{bmatrix} = \begin{bmatrix} \alpha_{11,1}^* & \alpha_{12,1}^* \\ \mathbf{a}_{21,0}\alpha_{11,1}^* + \alpha_{21,1}^* & \mathbf{a}_{21,0}\alpha_{12,1}^* + \alpha_{22,1}^* \end{bmatrix}, \tag{3.1.6}$$

and

$$B_1 = \begin{bmatrix} \beta_{11,1} & \beta_{12,1} \\ \beta_{22,1} & \beta_{21,1} \end{bmatrix} = \begin{bmatrix} v_1^* & \beta_{12,1}^* \\ \mathbf{a}_{21,0}v_1^* + v_2^* & \mathbf{a}_{21,0}\beta_{12,1}^* \end{bmatrix} \text{ and } \begin{bmatrix} u_{1t} \\ u_{2t} \end{bmatrix} = \begin{bmatrix} w_{1t} \\ \mathbf{a}_{21,0}w_{1t} + w_{2t} \end{bmatrix} \tag{3.1.7}$$

3.2. Estimation in Systems of Dynamic Simultaneous Equations

Let $(y_t', x_t')'$ be generated from a stationary process and the parameters of the reduced form in (3.1.4) are to be estimated. For simplicity let us take p=1 and s=0. Then,

$$y_t = A_1 Y_{t-1} + BX_{t-1} + B_0 x_t + u_t, \tag{3.2.1}$$

where $A := [A_1, ... A_p], B = [B_1, ... B_s]$,

$$Y_t := \begin{bmatrix} y_1 \\ . \\ . \\ . \\ y_{t-p+1} \end{bmatrix}, \quad X_t := \begin{bmatrix} x_1 \\ . \\ . \\ . \\ x_{t-s+1} \end{bmatrix}.$$

In addition, u_t is assumed to be a white noise process with nonsingular covariance matrix $\sum_u$. Let us assume that a matrix *R* and a vector γ exist such that

$$\beta := vec\left[A, B, B_0\right] = R\gamma. \tag{3.2.2}$$

For a sample having a size of *T*, the system can be written compactly as

$$Y = \left[A, B, B_0\right] Z + U, \tag{3.2.3}$$

$$\text{where } Y := \left[y_1, ..., y_T\right],\ \ Z := \begin{bmatrix} Y_0, ..., Y_{T-1} \\ X_0, ..., X_{T-1} \\ x_1, ..., x_T \end{bmatrix} \text{ and } U := \left[u_1, ..., u_T\right]. \tag{3.2.4}$$

We can write the equation in (3.2.3) in a vector form as

$$\mathbf{y} = (Z' \otimes I_K)R\gamma + \mathbf{u}, \tag{3.2.5}$$

where $\mathbf{y} := vec(Y)$ and $\mathbf{u} := vec(U)$. Generalized Least Squares (GLS) estimator is known to be

$$\hat{\gamma} = \left[R'(ZZ' \otimes \textstyle\sum_u^{-1})R\right]^{-1} R'(Z \otimes \textstyle\sum_u^{-1})\mathbf{y}, \tag{3.2.6}$$

and this estimator is not operational since $\sum_u$ is not known (Lütkepohl, 2005). But it can be estimated by using Least Squares (LS) estimator.

$\breve{\gamma} = \left[R'(ZZ'\otimes I_K)R\right]^{-1} R'(Z\otimes I_K)\mathbf{y}$ which gives residuals $\breve{\mathbf{u}} = \mathbf{y} - (Z'\otimes I_K)R\breve{\gamma}$

and the estimator;

$$\breve{\Sigma}_u = \breve{U}\breve{U}'/T \tag{3.2.7}$$

of Σ_u ,where $\breve{U}$ is such that $vec(\breve{U}) = \breve{\mathbf{u}}$, and T is sample size. By using the estimator of the White Noise (WN) covariance matrix results in the Estimated Generalized Least Square Estimator (EGLS).

$$\hat{\hat{\gamma}} = \left[R'(ZZ'\otimes \breve{\Sigma}_u^{-1})R\right]^{-1} R'(Z\otimes \breve{\Sigma}_u^{-1})\mathbf{y}. \tag{3.2.8}$$

Under the standard assumptions, this estimator is consistent and asymptotically normal,

$$\sqrt{T}\left(\hat{\hat{\gamma}} - \gamma\right) \xrightarrow{d} N\left(0, \Sigma_{\hat{\hat{\gamma}}}\right), \tag{3.2.9}$$

where

$$\Sigma_{\hat{\hat{\gamma}}} = \left(R'\left[p\lim(T^{-1}ZZ')\otimes \Sigma_u^{-1}\right]R\right)^{-1}. \tag{3.2.10}$$

where p is AR order. In order to have this result, both $p\lim(T^{-1}ZZ')$ and the inverse of the matrix in (3.2.10) should exist. Besides, to be able to guarantee the asymptotic normality of EGLS estimator, u_t should be white noise and VAR part should be stable which is

$$|A(z)|=|I_K - A_1 z - .... - A_p z^p| \neq 0 \text{ for } |z|<1, \tag{3.2.11}$$

and x_t should be generated by a stationary and stable VAR process and should be independent of u_t (Hannan and Desiter, 1988). All exogenous variables should also be stochastic. It can be modified so that we have nonstochastic variables as well. In that way, *plim* in (3.2.10) becomes a nonstochastic limit in some or all components (Anderson, 1971 ; Harvey, 1981). An estimator for $\beta = R\gamma$ can be obtained as $\hat{\hat{\beta}} = R\hat{\hat{\gamma}}$. If (4.2.7) holds this estimator has an asymptotic normal distribution,

$$\sqrt{T}\left(\hat{\hat{\beta}} - \beta\right) \xrightarrow{d} N\left(0, \Sigma_{\hat{\hat{\beta}}} = R\Sigma_{\hat{\hat{\gamma}}} R'\right), \tag{3.2.12}$$

Additionally, by satisfying the general conditions, the corresponding estimator $\hat{\hat{\Sigma}}_u$ of white noise covariance matrix is asymptotically independent of $\hat{\hat{\beta}}$, and it has the same asymptotic distribution as the estimator UU'/T based on the unobserved true residuals.

The above procedure was explained for a simple case with white noise error terms. In practice, there can be restrictions on the structural form coefficients $A_i^*, i = 1,..., p,$ and $B_j^*, j = 1,..., s.$ This can result in nonlinear constraints in the reduced coefficients. Estimation of the structural form rather than reduced form can be of interest. One major problem with estimation of the structural form is that it may not be unique. Also, for a proper estimation, there must be conditions on structural form coefficients so as to achieve uniqueness.

3.3. Unconditional and Conditional Forecasts

To predict future values of the endogenous variables in dynamic SEM, corresponding values of exogenous variables should be known. In practice, however, those unmodelled variables are generally unknown. If the endogenous variables are generated by the reduced form as in (3.1.4) where u_t is white noise and independent of x_t process, the optimal *h*-step forecast can be obtained as given below:

$$y_t(h) = A_1 y_t(h-1) + ... + A_p y_t(h-p) + B_0 x_t(h) + ... + B_s x_t(h-s), \qquad (3.3.1)$$

where $y_t(j) := y_{t+j}$ and $x_t(j) := x_{t+j}$ for $j \leq 0$, and the *unconditional forecasts* for *h*=1,2,… can be obtained in that manner since the forecasts are based on the forecasts of the exogenous variables for the forecast period. In this type of forecast, future values of exogenous variable should be estimated and they should be included in the forecasts of endogenous variable. Hence, the forecast error caused by the exogenous variable effects the forecasts of endogenous variable. (i.e. forecast errors of exogenous variable increases the forecast errors of endogenous variable.)

In some cases the future values of exogenous variables are known or can be controlled and the forecast of y_t is of interest. This type of forecast is called as *conditional forecasts*. Let us consider the reduced model in (3.1.4) to be VARX(1,0) as

$$Y_t = \mathbf{A} Y_{t-1} + \mathbf{B} x_t + U_t, \qquad (3.3.2)$$

$$Y_t := \begin{bmatrix} y_t \\ . \\ . \\ y_{t-p+1} \\ x_t \\ . \\ . \\ x_{t-s+1} \end{bmatrix}, \qquad U_{t:=} \begin{bmatrix} u_t \\ 0 \\ . \\ . \\ . \\ 0 \end{bmatrix} \qquad ((Kp+Ms)\times 1),$$

A matrix is a $((Kp+Ms)\times(Kp+Ms))$ partitioned matrix, where $\mathbf{A} := \left[\begin{array}{c|c} A_{11} & A_{12} \\ \hline A_{21} & A_{22} \end{array}\right]$,

where

$$A_{11} := \begin{bmatrix} A_1 & .... & A_{p-1} & A_p \\ I_K & & 0 & 0 \\ \vdots & . & \vdots & \vdots \\ 0 & .... & I_K & 0 \end{bmatrix}, \; A_{12} := \begin{bmatrix} B_1 & .... & B_{s-1} & B_s \\ 0 & .... & 0 & 0 \\ \vdots & . & \vdots & \vdots \\ 0 & .... & 0 & 0 \end{bmatrix}, \; A_{21} : 0 \text{ and}$$

$$A_{22} := \begin{bmatrix} 0 & .... & 0 & 0 \\ I_M & .... & 0 & 0 \\ \vdots & . & \vdots & \vdots \\ 0 & .... & I_M & 0 \end{bmatrix}$$

B is also $((Kp+Ms)\times M)$ partitioned matrix, where $\mathbf{B} := \left[\frac{B_{11}}{B_{21}}\right]$, $B_{11} := \begin{bmatrix} B_0 \\ 0 \\ . \\ . \\ . \\ 0 \\ \hline I_M \\ 0 \\ . \\ . \\ . \\ 0 \end{bmatrix}$

where B_{11} is a $(Kp \times M)$ dimensional matrix and B_{21} is an $(Ms \times M)$ dimensional matrix. By successive substitution for lagged Y_t 's

$$Y_t = \mathbf{A}^h Y_{t-h} + \sum_{i=0}^{h-1} \mathbf{A}^i \mathbf{B} x_{t-i} + \sum_{i=0}^{h-1} \mathbf{A}^i U_{t-i}. \tag{3.3.3}$$

By premultiplying Y_t with a $(K \times (Kp + Ms))$ matrix $J := [I_K : 0 : \ldots : 0]$:

$$y_{t+h} = J\mathbf{A}^h Y_t + \sum_{i=0}^{h-1} J\mathbf{A}^i \mathbf{B} x_{t+h-i} + \sum_{i=0}^{h-1} J\mathbf{A}^i J' u_{t+h-i}, \tag{3.3.4}$$

where the optimal *h*-step forecast for y_t at *t*, given $x_{t+1}, \ldots, x_{t+h}$, is

$$y_t(h \mid x) = J\mathbf{A}^h Y_t + \sum_{i=0}^{h-1} J\mathbf{A}^i \mathbf{B} x_{t+h-i}. \tag{3.3.5}$$

The corresponding forecast error can be written as

$$y_{t+h} - y_t(h \mid x) = \sum_{i=0}^{h-1} J\mathbf{A}^i J' u_{t+h-i}, \tag{3.3.6}$$

Hence, the MSE of the conditional forecast is

$$\Sigma_y(h \mid x) := MSE\left[y_t(h \mid x)\right] = \sum_{i=0}^{h-1} J\mathbf{A}^i J' \Sigma_u J(\mathbf{A}^i)' J'. \tag{3.3.7}$$

(Lütkepohl, 2005). In the data analysis part, the future values of exogenous variables will be controlled and the conditional forecast technique will used. (For a detailed discussion about the unconditional and conditional forecasts with autocorrelated error process, see Yamamoto, 1980 and Baillie, 1981).

3.4. Wald Test for Granger Causality

A former definition of causality can be expressed shortly as a cause cannot come after the effect (Granger, 1969). In other words, if a variable x affects a variable z, then x should contribute improving the predictions of z. Let Ω_t be the information set containing all relevant information up to and including period t. Let $z_t(h \mid \Omega_t)$ be the optimal h-step predictor of the process z_t at origin t on the basis of the information in Ω_t. The forecast MSE can be denoted by $\Sigma_u(h \mid \Omega_t)$. The process x_t is set to cause z_t in Granger's sense if

$$\Sigma_z(h \mid \Omega_t) < \Sigma_z(h \mid \Omega_t \setminus \{x_s \mid s \le t\}) \text{ for at least one } h=1,2,\ldots \tag{3.4.1}$$

If (3.4.1) holds, then x_t is Granger-causes or simply causes z_t. Moreover z_t can be predicted more efficiently if the information in x_t process taken into account in addition to all other information in the universe, then x_t is causal for z_t (Lütkepohl, 2005). The definition can be extended to multivariate case by z_t being M-dimensional and x_t being N-dimensional as follows:

$$\sum_z (h \mid \Omega_t) \neq \sum_z (h \mid \Omega_t \setminus \{x_s \mid s \leq t\}) \quad (3.4.2)$$

for some *t* and *h*. This requires that two MSEs should be different and

$$\sum_z (h \mid \Omega_t) < \sum_z (h \mid \Omega_t \setminus \{x_s \mid s \leq t\}) \quad (3.4.3)$$

should hold. Let y_t be a stable VAR(*p*) process with nonsingular white noise covariance matrix $\sum_u$ as in the following form:

$$y_t = \begin{bmatrix} z_t \\ x_t \end{bmatrix} = \begin{bmatrix} v_1 \\ v_2 \end{bmatrix} + \begin{bmatrix} A_{11,1} & A_{12,1} \\ A_{21,1} & A_{22,1} \end{bmatrix} \begin{bmatrix} z_{t-1} \\ x_{t-1} \end{bmatrix} + ... + \begin{bmatrix} A_{11,p} & A_{12,p} \\ A_{21,p} & A_{22,p} \end{bmatrix} \begin{bmatrix} z_{t-p} \\ x_{t-p} \end{bmatrix} + \begin{bmatrix} u_{1t} \\ u_{2t} \end{bmatrix} \quad (3.4.4)$$

Then,

$$z_t(h \mid \{\mathrm{y}_s \mid s \leq t\}) = z_t(h \mid \{z_s \mid s \leq t\}), \quad h=1,2,\ldots \quad (3.4.5)$$
$$\Leftrightarrow A_{12,i} = 0 \quad \text{for } i=1,..,p.$$

Alternatively,

$$x_t(h \mid \{\mathrm{y}_s \mid s \leq t\}) = x_t(h \mid \{\mathrm{x}_s \mid s \leq t\}), \quad h=1,2,\ldots \quad (3.4.6)$$
$$\Leftrightarrow A_{21,i} = 0 \quad \text{for } i=1,...,p.$$

This implies that noncausalities can be determined by looking at the VAR representation (Lütkepohl, 2005). This type of causality can be characterized by zero constraints on the VAR coefficients. In order to test for Granger-causality, zero constraints for the coefficients should be tested. More generally;

$$H_0 : C\beta = c \text{ against } H_1 : C\beta \neq c \ , \tag{3.4.7}$$

where C is an $(N \times (K^2 p + K))$ matrix of rank N and c is an (Nx1) vector. Assuming that

$$\sqrt{T}\left(\hat{\beta} - \beta\right) \xrightarrow{d} N\left(0, \Gamma^{-1} \otimes \Sigma_u\right) \tag{3.4.8}$$

Than, Least Square or Maximum Likelihood Estimation leads to

$$\sqrt{T}\left(C\hat{\beta} - C\beta\right) \xrightarrow{d} N\left(0, C\left(\Gamma^{-1} \otimes \Sigma_u\right)C'\right) \tag{3.4.9}$$

Hence, the Wald Statistic can be obtained as follows:

$$T\left(C\hat{\beta} - c\right)' \left(C\left(\Gamma^{-1} \otimes \Sigma_u\right)C'\right)^{-1} \left(C\hat{\beta} - c\right) \xrightarrow{d} \chi^2(N) . \tag{3.4.10}$$

By replacing Γ and Σ_u with their estimators $\hat{\Gamma} = ZZ'/T$ and $\hat{\Sigma}_u$, respectively the resulting statistics can be written as given below:

$$\lambda_W = \left(C\hat{\beta} - c\right)' \left(C\left((ZZ')^{-1} \otimes \hat{\Sigma}_u\right)C'\right)^{-1} \left(C\hat{\beta} - c\right) \xrightarrow{d} \chi^2(N) \ . \tag{3.4.11}$$

provided that y_t satisfies the asymptotic properties of the white noise covariance matrix estimator (for a detailed discussion see Lütkepohl, 2005 and Granger, 1982).

CHAPTER 4

DATA COLLECTION AND DATA ANALYSIS

4.1. Data Collection

Data for modeling the total number of applicants (demands) and total number of beneficiary households changing over time were taken from CCT Program's database. By using this data, time-varying demands and the number of beneficiary households were examined and modeled with respect to geographical regions. For modeling the number of the applicants, data from May 2003 to June 2009 were used. Total number of CCT program applicants and the total household size of those applicants were grouped weekly according to geographical regions. Here the endogenous variable is the total number of applicants and the exogenous variable is the total number of people living in the house.

In a similar manner, for modeling the number of beneficiary households, data from May 2003 to May 2009 were used. Total number of CCT program beneficiaries and the total household size of those beneficiaries were grouped weekly according to geographical regions. Here, the endogenous variable is the total number of beneficiaries and the exogenous variable is the total number of people in the house. Data during the pilot stage of the CCT program were not included in the analysis step.

For modeling the number of applicants, a total of 317 weekly data obtained between May 24, 2003 and June 20, 2009 and for modeling the number of beneficiary households total of 311 weekly data obtained between May 24, 2003 and May 2, 2009 were used. Each data set was grouped with respect to seven geographical regions. In the analysis, SEM was used, and the possible number of applicants and possible number of beneficiary households for the future observations were forecasted.

4.2. Data Analysis

4.2.1. Modeling of applicants according to geographical regions

In this part, weekly total number of applicants in CCT program according to geographical regions is modeled.

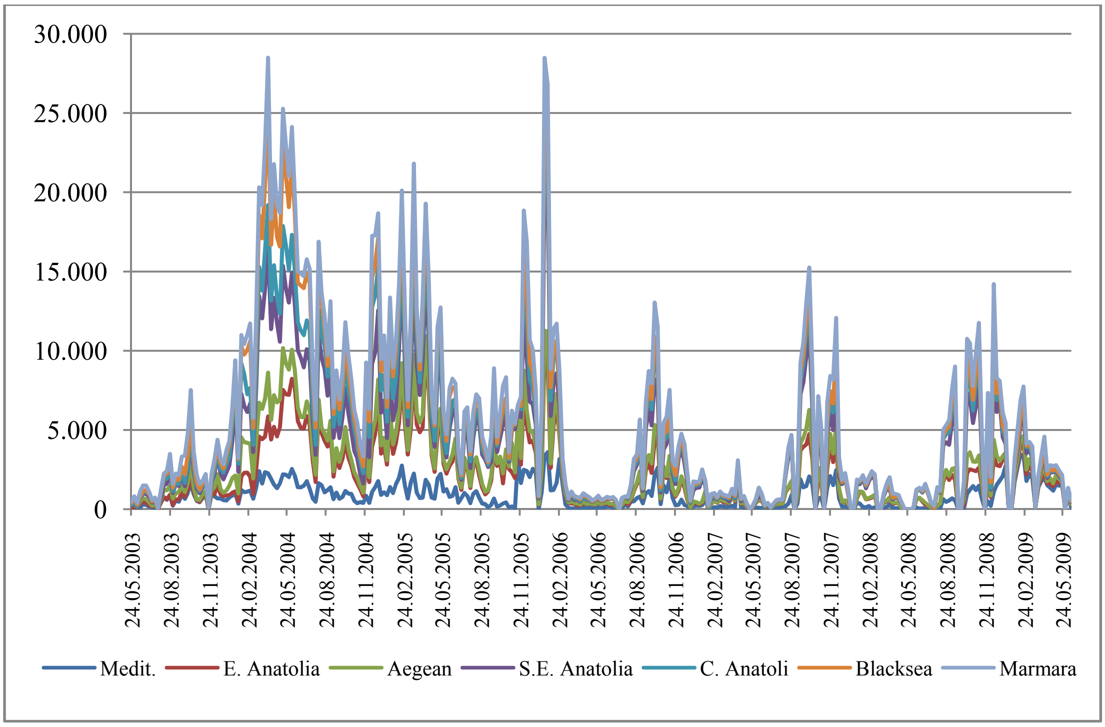
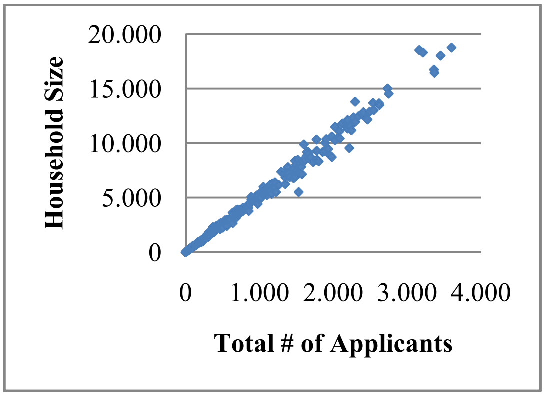


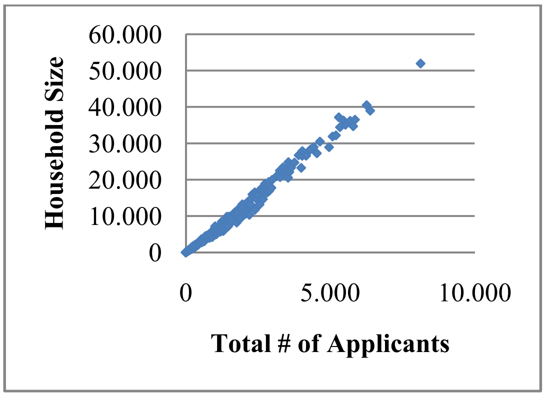
Figure 3. Time Series Plot of Weekly Total CCT Program Applicants According to Geographical Regions

As it can be seen in Figure 3, during the pilot stage of the program in 2003, average number of applicants all over Turkey was around 2,000. After 2004, by spreading out the program all over the country, the total number of applicants rose up quickly. Especially in May of 2004 in Southeastern Anatolia Region, the corresponding number increased through 30,000. Due to increase in the awareness of CCT program all over Turkey, the number of applicants during the time period March 2003 through January 2006 were higher in number than the other time periods. It can also be inferred from the Figure 3 that, after the July 2006, the volatility of the number applicants with respect to geographical regions has decreased.

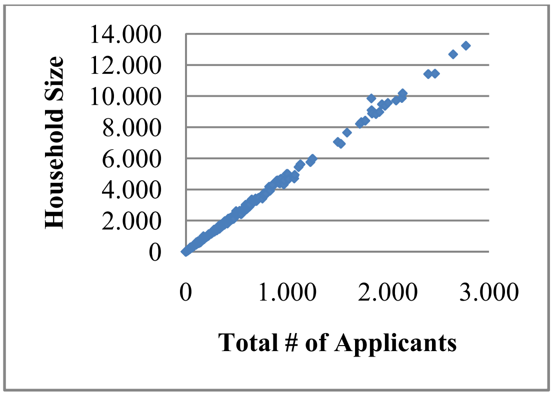
In this part of the study our concern is to investigate the relationship between the total number of applicants in each regions. In other words, whether the increase or decrease in demand for the CCT program in one region affects the demand for the program in other regions. Due to socio-economic levels, geographical distance and migration within the neighborhood regions, we may expect to discover certain relations on the demands for the CCT program in a couple of regions. Especially, because of high ratio of migration rate in Mediterranean Region, demands in there can be affected from demands in the other regions such as, Eastern and Southeastern Anatolia.

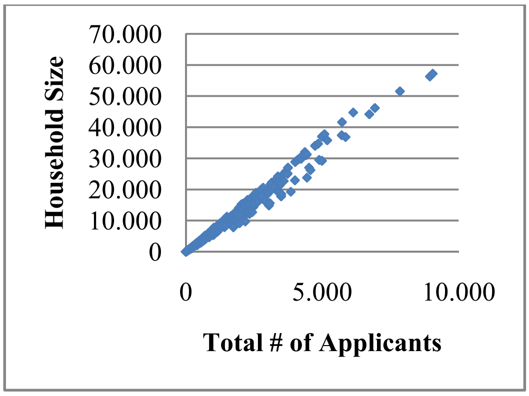
Before starting to model the number of applicants for CCT program with respect to geographical regions, checking the linear association between the endogenous variable (total number of weekly applicants) and exogenous variable (weekly total household size) would be necessary. Hence, to detect this relation, a scatter plot of endogenous variable versus exogenous variables according to seven regions is used.



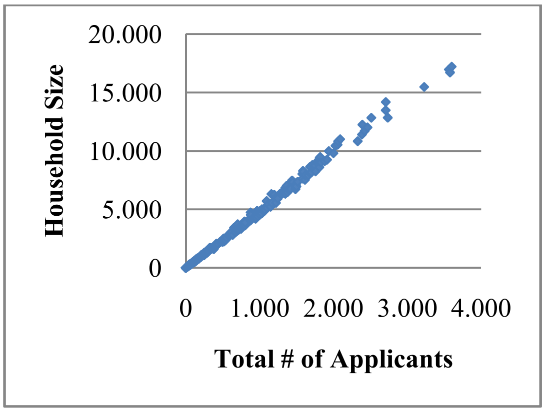


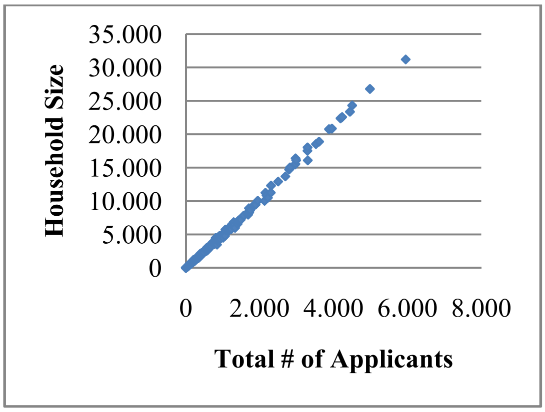
(1) **(2)**



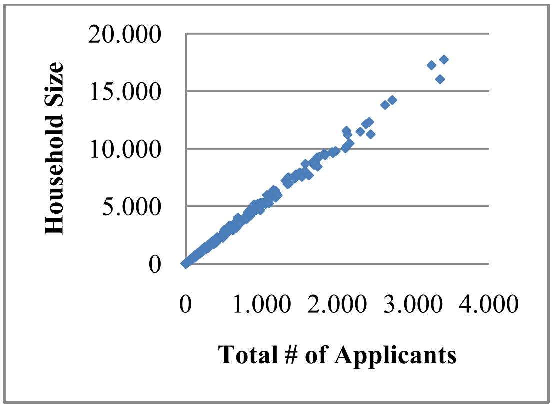


(3) **(4)**





(5) **(6)**



(7)

Figure 4. Total Number of Applicants v.s. Household Size in Mediterranean (1), Eastern Anatolia (2), Aegean (3), Southeastern Anatolia (4), Central Anatolia (5), Blacksea (6) and Marmara Regions (7)

As it can be seen in Figure 4(1) - 4(7), there is strong positive linear association between endogenous variable, which is total number of weekly CCT applicants, and the exogenous variable, which is weekly total number of household size.

In order to stabilize the variation in the endogenous variable Box-Cox transformation method is used. After trying several lambda values for each regions, 0.35 for Mediterranean, Central Anatolia and Blacksea Regions, 0.32 for Aegean and Marmara Regions, 0.42 for Eastern Anatolia Region and 0.39 for Southeastern Anatolia Region found to be applicable (For the lambda values of those series, the smallest AIC and SBC values are obtained). In order to keep the linear association between endogenous and exogenous variables the same transformation is applied to exogenous variable as well. After the power transformation was applied by using the specified values for each region, time series plot of the transformed series was drawn (see Figure 5).

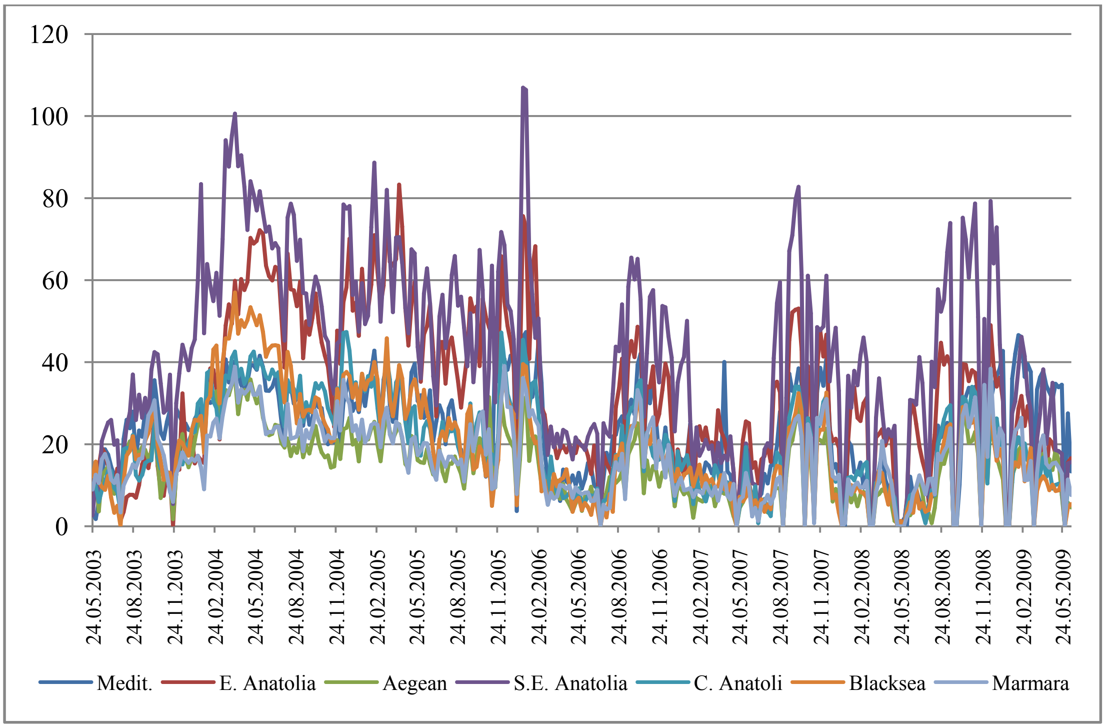


Figure 5. Time Series Plot of Transformed Weekly Total CCT Program Applicants according to Geographical Regions

As it can be seen from plot above, transformation seems helpful and variation in the series seems to be stabilized. Now, it is important to check whether the series has a seasonal or regular unit root. Since there is not any algorithm for checking unit root in multivariate case in software programs, each series will be checked in univariate case.

According to univariate Augmented Dickey-Fuller (ADF) test for both endogenous and exogenous variables for applicants in each region, there are no regular unit roots (all *p* values are significant in single mean and trend). Since data are collected weekly the seasonal unit root at lag 7 should be checked as well. According to ADF test statistics there exist seasonal unit roots (all *p* values are not significant in single mean and trend) for endogenous and exogenous variables as. (see Table 4).

Table 4. Univariate ADF Test for Endogenous and Exogenous Variables for the Applicants of CCT Program According to Geographical Regions

SERIES	TYPE	LAGS	F (END.)	PR > F (END.)	F (EXOG.)	PR > F (EXOG.)
MEDITERRANEAN	Single Mean	1	19.91	0.001	24.19	0.001
		7	3.68	0.1271	4.13	0.0795
	Trend	1	22.15	0.001	25.32	0.001
		7	4.74	0.2257	4.74	0.224
AEGEAN	Single Mean	1	14.05	0.001	17.87	0.001
		7	2.27	0.4892	2.45	0.4436
	Trend	1	19.79	0.001	23.94	0.001
		7	4.81	0.2101	4.75	0.2233
CENTRAL ANATOLIA	Single Mean	1	13.03	0.001	14.73	0.001
		7	1.99	0.5615	2.06	0.5424
	Trend	1	17.79	0.001	20.65	0.001
		7	4.73	0.2271	5	0.1721
BLACKSEA	Single Mean	1	8.36	0.001	9.38	0.001
		7	1.75	0.6238	1.75	0.6241
	Trend	1	12.94	0.001	14.81	0.001
		7	5.2	0.1315	5.2	0.1329
MARMARA	Single Mean	1	16.77	0.001	23.1	0.001
		7	3.87	0.0951	4.42	0.0615
	Trend	1	20.35	0.001	26.84	0.001
		7	5.82	0.0754	6.23	0.0537
EASTERN ANATOLIA	Single Mean	1	11.76	0.001	12.09	0.001
		7	1.91	0.5817	1.77	0.6183
	Trend	1	13.88	0.001	15.32	0.001
		7	3.72	0.4296	3.91	0.3913
S. EASTERN ANATOLIA	Single Mean	1	18.63	0.001	18.87	0.001
		7	2.63	0.398	2.58	0.4108
	Trend	1	22.69	0.001	24.89	0.001
		7	5.14	0.144	5.8	0.0763

In multivariate modeling step seasonal difference for both endogenous and exogenous variables will be taken so as to get rid of seasonal unit root.

The following multivariate linear regression model

$$\mathbf{Y} = \mathbf{X\beta} + \boldsymbol{\varepsilon} \qquad (4.2.1.1)$$

is fitted to the transformed data. Here, Y is an $(n \times p)$ data matrix containing the endogenous variables, X is an $(n \times q)$ matrix containing the factors and β is a $(q \times p)$ data matrix containing the model parameters and ε is an $(n \times p)$ data matrix containing the error term. Design matrix is formed in a way so as to keep different exogenous variables correspond to different endogenous variables in the model. In the Y matrix, the weekly CCT applications for each geographical region are included, and in the X matrix, total household size of the weekly applicants for each regions are included. Since the seasonal difference (at lag 7) is taken for both endogenous and exogenous variables, our data size reduces from 317 to 310. By using the LSE method without the constant term the model parameters are obtained as presented in Table 5.

Table 5. LSE of Model Parameters, Standard Errors and P-Values for Multivariate Regression Model (Applicants)

EQAUATION(*)	PAR.	EST.	STD. ERROR	t - VAL.	PR > |t|	VARIABLE (*)
abast	XL0_1_1	0.55396	0.002	277.27	0.0001	**anuft(t)**
ebast	XL0_2_2	0.58957	0.00179	328.9	0.0001	**enuft(t)**
ibast	XL0_3_3	0.56979	0.00149	383.53	0.0001	**inuft(t)**
mbast	XL0_4_4	0.57321	0.00185	310.37	0.0001	**mnuft(t)**
kbast	XL0_5_5	0.56088	0.00141	397.31	0.0001	**knuft(t)**
dbast	XL0_6_6	0.49533	0.00224	221.1	0.0001	**dnuft(t)**
gbast	XL0_7_7	0.461	0.00214	215.73	0.0001	**gnuft(t)**

(*) See list of Abbreviations

Table 6. Univariate Model White Noise Diagnostics Checks (Applicants)

VARIABLE	DURBIN WATSON	NORMALITY		ARCH	
		CHI-SQUARE	PR>CHISQ	F-VALUE	PR > F
abast	1.36022	281.02	<.0001	5.52	0.0194
ebast	1.3835	4.08	0.1303	0.03	0.8526
ibast	1.2362	2.68	0.2623	17.7	<.0001
mbast	0.95638	3.57	0.1679	51.8	<.0001
kbast	1.36851	21.02	<.0001	6.43	0.0117
dbast	0.7277	89.52	<.0001	100.64	<.0001
gbast	0.77719	49.44	<.0001	94.37	<.0001

Durbin Watson statistics do not get close to two, which show a correlation between error terms. It is obvious that multivariate linear regression do not seem to be fitted well to our data set.

A VARX(p,s) model, as given in (3.1.1), was fitted to the data. Since the data is differenced at lag seven (i.e. seasonally differenced), values including seven for p and s will be tried.

Table 7. Schematic Representation of Partial Autoregression for Applicants

VARIABLE	LAGS									
	1	2	3	4	5	6	7	8	9	10
abast	+......	.+.....	....	...-...	....	-+..-..	-......	..+....	+......	..-....
ebast	.+.....	....	......+	...-...	....	....	.-.....	.+.....	....	....
ibast	..+....	....	..-...+	......+	....	....-..	+......	..+....	....	....
mbast	...++..	....	..-.+..	...-..+	....	....-..	...-...	....	....	.+-....
kbast	....+..	....	..-.+..	...-...	....	.+..-..	....	..+....	.....-.	.+-....
dbast	-....+.	....	..-...+	......+	....	....	...-.-.	.....+.	....	....
gbast	....+.+	....	..-.+..	......+	....	....	....	...-...	....	..-....

Table 8. Schematic Representation of Partial Cross Correlations for Applicants

VARIABLE	LAGS									
	1	2	3	4	5	6	7	8	9	10
abast	+....-.	....	....	...-...	...+...	-+.....	-.++...	+..-...	+......	....
ebast	.+.....	+..+...	...+...	....	....	....	.-.+...	.+.....	....+..	....
ibast	..+.+..	.+.....	..-....	-......	....	...+...	..-....	+.+.+..	....	-...-.-
mbast	...+...	.-.....	....-..	.-.--..	....+..	...-.+.	...-...	+..+..-	....	....
kbast	-..++.+	.....+.	....+..	....	....	....-..	....-..	....+..	....	....
dbast	.....+.	....	.-.....	....	.....-.	+...+..	..-..-.	.....+.	....-..	....
gbast	.-....+	...+.-.	..+....	.....+.	....	......-	......-	......+	.+.....	....

According to Table 7 and Table 8, moving average (MA) term could be included in the model. However, when MA term was included in the model, SAS fails to estimate the parameters due to optimization problem, and it ignores them. Therefore, the estimation will be done without MA terms.

By using a couple of different p and s values for the model, the smallest finite-population corrected Akaike Information Criteria (AICC) obtained when p=(1,7) and s=2 without the constant term. Here, p shows the *Ylag* values and s shows the *Xlag* values. A more explicit form of the fitted VARX(7,2) model is given below:

$$y_t = A_1 y_{t-1} + A_2 y_{t-7} + B_0 x_t + B_1 x_{t-1} + B_2 x_{t-2} + w_t \ , \qquad (4.2.1.2)$$

where $y_t = (y_{1t}, ..., y_{7t})'$ is a seven-dimensional vector of endogenous variables and $x_t = (x_{1t}, ..., x_{7t})'$ is a seven-dimensional vector of exogenous variables. A_1 and A_2 are (7×7) and B_0, B_1, B_2 are (7×7) coefficient matrices, respectively, and w_t is a seven-dimensional error vector.

Table 9. Univariate Model White Noise Diagnostics for VARX(7,2) (Applicants)

VARIABLE	DURBIN WATSON	NORMALITY		ARCH	
		CHI-SQUARE	PR>CHISQ	F-VALUE	PR > F
abast	1.98329	330.46	<.0001	0	0.9882
ebast	2.06632	1.55	0.4616	0.02	0.8966
ibast	1.96964	0.21	0.8985	0.77	0.3822
mbast	1.94263	2.18	0.3363	0.07	0.7982
kbast	1.98488	9.35	0.0093	0.02	0.9018
dbast	1.88105	14.26	0.0008	4.15	0.0424
gbast	1.89841	33.29	<.0001	4	0.0463

According to significant model parameters by LSE of VARX(7,2) (see Table 25 in Appendix A) and Table 9, VARX(7,2) model seems to fit reasonably good. DW statistics are closer to two for each individual variable. Besides, normality of the residuals for Aegean, Central Anatolia and Marmara Regions seem to be distributed as normal. The residuals from Eastern Anatolia and Blacksea Regions do not seem normal according to Normality Chi-square values obtained by SAS (see Table 9). It is interesting that, p-values obtained in Anderson Darling (AD) test statistics for checking the normality of residuals from Eastern Anatolia Region were found to be 0.103 and those for Blacksea Region was found to be 0.02 in MINITAB.

For Mediterranean and Southeastern Anatolia Regions data seem to have outliers (see Figure 6) since the error terms in those regions do not satisfy the normality assumptions. In order to remove the effect of outliers in the data set dummy variables are created corresponding to unusual residual values and they were included in the model. However, this did not make residuals to have normal distribution. Moreover, total R-square for each model seems to decrease and DW statistic become worse. Unfortunately, in multivariate case, most of the statistical software including SAS do not provide an outlier detection algorithm.

ARCH values for each region is not high and p-values are higher, which does not show ARCH structure in error terms, except for Southern and Southeastern Anatolia Regions. But the p-values are closer to 0.05. It may be due to outliers and can be considered as they do not have ARCH structure. According to model parameter estimates, insignificant parameters are removed from the model and final model parameter estimates are given in Table 26 in Appendix A. In restricted model, estimated parameters shown in Table 26, the couples of *Xlags* seem to be insignificant. But when they were removed from the model, variance-covariance matrix became singular. Hence, they were kept in the model although they are insignificant.

Table 10. Covariance Matrix for the Innovation for Restricted VARX(7,2) (Applicants)

VARIABLE	abast	ebast	ibast	mbast	kbast	dbast	gbast
abast	0.5901	0.02447	-0.00214	0.04429	0.05653	0.10308	0.18855
ebast	0.02447	0.17888	0.06063	0.09698	0.0309	0.07126	0.14461
ibast	-0.00214	0.06063	0.22943	0.13279	0.07065	0.0549	0.1743
mbast	0.04429	0.09698	0.13279	0.28755	0.08126	0.08644	0.2071
kbast	0.05653	0.0309	0.07065	0.08126	0.20756	0.07367	0.23433
dbast	0.10308	0.07126	0.0549	0.08644	0.07367	1.15037	0.67989
gbast	0.18855	0.14461	0.1743	0.2071	0.23433	0.67989	2.76276

Table 11. Schematic Representation of Cross Correlations of Residuals from Applicant Series

VARIABLE	LAGS								
	0	1	2	3	4	5	6	7	8
abast	+...+++	....	.....+.	....	....	.+.....	....	-.....-	....
ebast	.++++++	..-....	....	.+.....	.-.....	....	.+.....	.-.-...	..+....
ibast	.++++.+	+......	-......	.+.....	...+.-.	......-	....	.----..	..++...
mbast	.++++++	....	-......	....	.....--	.+.+.+.	....	..---..	....
kbast	+++++++	+.+....	....	....	.....-.	....-.-	-......	..---.-	....
dbast	++.++++	......+	....	..+++..	....	-......	....	.....--	....
gbast	+++++++	+......	..+.+..	.+.....	....	....	+......	...----	....

It can be inferred that, Schematic Representation of Cross Correlation of Residuals (see Table 11) reveals an MA structure (since couples of lags are still significant). As it was explained in the estimation step, it would be meaningful to include MA term in the model. But due to technical problems in SAS they were unable to be included in the model. Since they were excluded, p-value for portmanteau test statistics in lags eight up to twelve were all obtained as smaller then 0.001. But this does not show that our model is not suitable. It would be reasonable to check the univariate model diagnostics, ARCH structure and some other distributions for the ε_t in addition to normal (Lütkepohl, 2005). However, fitting distribution to residuals other than normal in VARMA modeling using SAS is not applicable. Hence, only the residuals for the restricted model will be checked if they are uncorrelated, and if they have an ARCH structure or not in univariate level.

Table 12. Univariate Model White Noise Diagnostics for Restricted VARX(7,2) (Applicants)

VARIABLE	DURBIN WATSON	NORMALITY		ARCH	
		CHI-SQUARE	PR>CHISQ	F-VALUE	PR > F
abast	1.97238	351.58	<.0001	0	0.9664
ebast	2.08614	1.47	0.4806	0.05	0.8273
ibast	1.97507	0.58	0.7477	0.03	0.8697
mbast	1.94112	2.98	0.2258	0.03	0.8717
kbast	1.97893	14.06	0.0009	0.13	0.7186
dbast	1.86866	10.78	0.0046	3.78	0.0529
gbast	1.85965	27.83	<.0001	4.21	0.0411

As it can be seen in Table 12, p-value for the ARCH test for Eastern Anatolia Region series seem to increase from 0.042 to 0.052 after the insignificant parameters are removed from the model. However, for the normality, the chi-square value for Blacksea Region series seems to increase as well due to a number of outliers reside in data set.

Table 13. Anderson-Darling (AD) and Shapiro-Wilk (SW) Normality Tests for the Residuals from Applicant Series

STAT.	MED. RES	A. RES	C. RES	M. RES	B. RES	E. RES	S.E. RES
MEAN	0.02136	-0.00428	0.00852	0.00074	0.00626	0.01334	0.0187
ST.DEV	0.7476	0.4116	0.4661	0.5218	0.4434	1.044	1.618
N	303	303	303	303	303	303	303
AD	3.337	0.311	0.298	0.496	1.097	0.595	1.1215
P-VALUE (AD)	<0.005	0.551	0.586	0.212	0.007	0.119	<0.005
SW	0.965	0.998	0.998	0.997	0.992	0.995	0.99
P-VALUE (SW)	<0.01	>0.1	>0.1	>0.1	<0.01	0.044	<0.01

It can be seen in Table 11 that, cross correlations among residuals of each series is not significant. As it was stated previously, p-value for the normality chi-square of the residuals in Eastern Anatolia Series was obtained to be 0.0046 using SAS (which shows that residuals are not normally distributed). However, according to the AD test statistics obtained by MINITAB at 10% significance level the residuals from Eastern Anatolia region seems to be normally distributed (p-value 0.119), and according to Shapiro-Wilk (SW) statistics residuals of those regions is normally distributed at 1% significance level (p-value 0.044).

In a more explicit form, the model can be written as follows:

$$\begin{bmatrix} abast_t \\ ebast_t \\ ibast_t \\ mbast_t \\ kbast_t \\ dbast_t \\ gbast_t \end{bmatrix} = \begin{bmatrix} 0.295 & 0 & 0 & 0 & 0.019 & -0.015 & 0.007 \\ 0.008 & 0.26 & 0 & 0 & 0.009 & 0 & 0 \\ 0 & 0 & 0.349 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0.518 & 0 & 0 & 0 \\ 0 & -0.010 & 0 & 0 & 0.246 & 0 & 0 \\ -0.021 & 0.075 & -0.028 & 0 & -0.031 & 0.629 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0.541 \end{bmatrix} \begin{bmatrix} abast_{t-1} \\ ebast_{t-1} \\ ibast_{t-1} \\ mbast_{t-1} \\ kbast_{t-1} \\ dbast_{t-1} \\ gbast_{t-1} \end{bmatrix} +$$

$$\begin{bmatrix} 0.013 & -0.030 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & -0.014 & 0.007 & 0 \\ 0.007 & 0 & 0 & 0 & 0 & 0 & -0.005 \\ 0 & 0.012 & 0 & -0.011 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & -0.009 & 0.006 & 0 \\ 0 & 0.035 & 0 & 0 & -0.023 & 0 & 0 \\ 0 & 0.041 & -0.045 & 0 & 0 & 0 & 0 \end{bmatrix} \begin{bmatrix} \text{abast}_{t-7} \\ \text{ebast}_{t-7} \\ \text{ibast}_{t-7} \\ \text{mbast}_{t-7} \\ \text{kbast}_{t-7} \\ \text{dbast}_{t-7} \\ \text{gbast}_{t-7} \end{bmatrix} +$$

$$\begin{bmatrix} 0.557 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0.585 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0.568 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0.568 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0.560 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0.495 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0.459 \end{bmatrix} \begin{bmatrix} \text{anuft}_{t} \\ \text{enuft}_{t} \\ \text{inuft}_{t} \\ \text{mnuft}_{t} \\ \text{knuft}_{t} \\ \text{dnuft}_{t} \\ \text{gnuft}_{t} \end{bmatrix} +$$

$$\begin{bmatrix} -0.172 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & -0.150 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0.196 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & -0.292 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & -0.133 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & -0.308 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & -0.249 \end{bmatrix} \begin{bmatrix} \text{anuft}_{t-1} \\ \text{enuft}_{t-1} \\ \text{inuft}_{t-1} \\ \text{mnuft}_{t-1} \\ \text{knuft}_{t-1} \\ \text{dnuft}_{t-1} \\ \text{gnuft}_{t-1} \end{bmatrix} + \qquad (4.2.1.3)$$

$$\begin{bmatrix} 0.001 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0.005 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0.003 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0.001 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & -0.0001 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0.003 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & -0.002 \end{bmatrix} \begin{bmatrix} \text{anuft}_{t-2} \\ \text{enuft}_{t-2} \\ \text{inuft}_{t-2} \\ \text{mnuft}_{t-2} \\ \text{knuft}_{t-2} \\ \text{dnuft}_{t-2} \\ \text{gnuft}_{t-2} \end{bmatrix} + \begin{bmatrix} w_{1,t} \\ w_{2,t} \\ w_{3,t} \\ w_{4,t} \\ w_{5,t} \\ w_{6,t} \\ w_{7,t} \end{bmatrix}$$

$$\hat{\Sigma} = \begin{bmatrix} 0.5901 & 0.02447 & -0.00214 & 0.04429 & 0.05653 & 0.10308 & 0.10308 \\ 0.2447 & 0.17888 & 0.06063 & 0.09698 & 0.0309 & 0.07126 & 0.14461 \\ -0.00214 & 0.06063 & 0.22943 & 0.13279 & 0.07065 & 0.0549 & 0.1743 \\ 0.04429 & 0.09698 & 0.13279 & 0.28755 & 0.08126 & 0.08644 & 0.2071 \\ 0.05653 & 0.0309 & 0.07065 & 0.08126 & 0.20756 & 0.07367 & 0.23433 \\ 0.10308 & 0.07126 & 0.0549 & 0.08644 & 0.07367 & 1.15037 & 0.67989 \\ 0.18855 & 0.14461 & 0.1743 & 0.2071 & 0.23433 & 0.67989 & -0.002 \end{bmatrix}$$

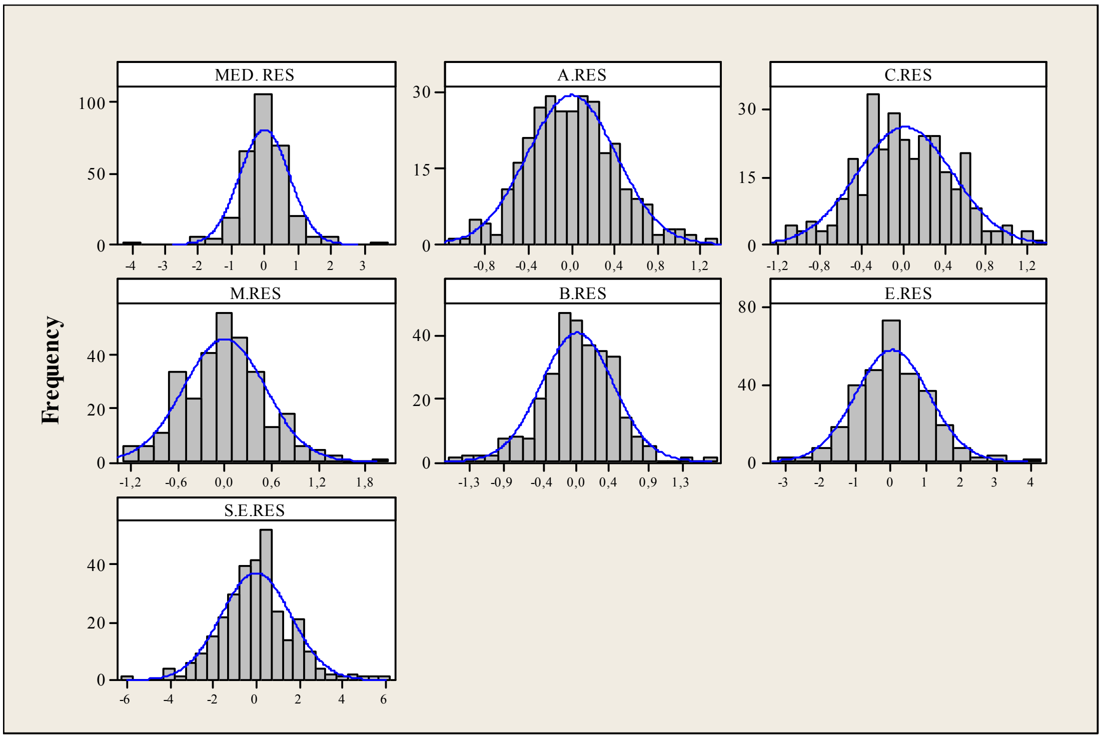


Figure 6. Histogram of the Residuals from Applicant Series According to Geographical Regions (Checked Distribution: Normal)

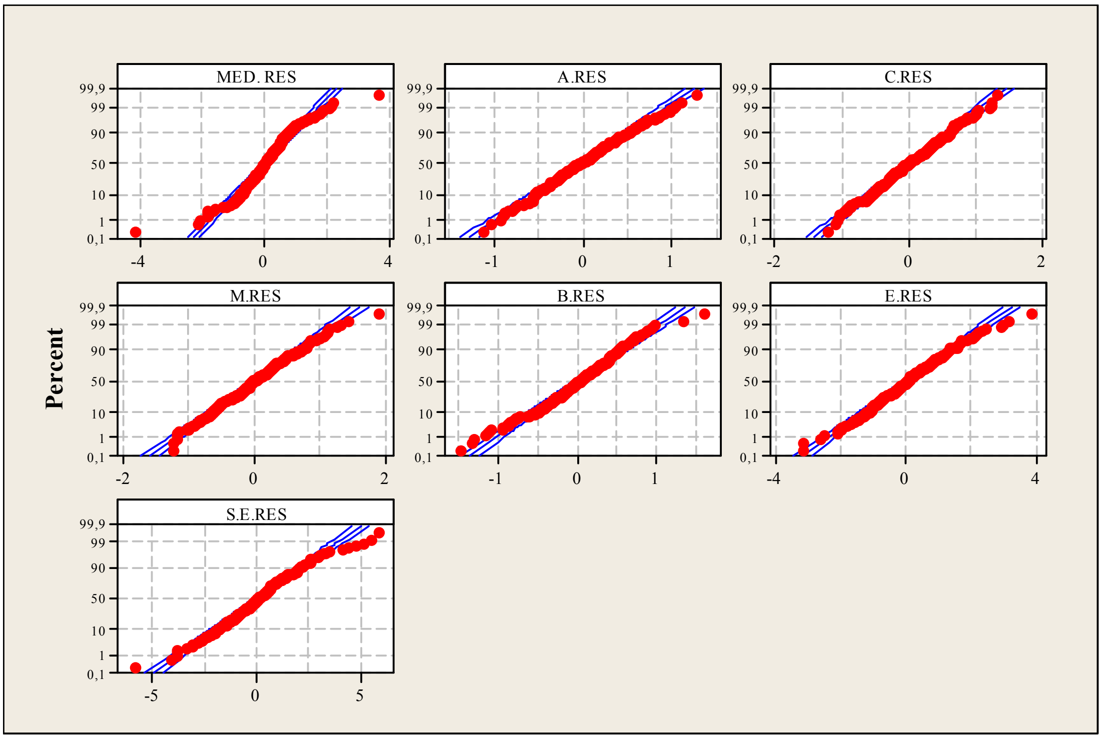


Figure 7. Normal Probability Plot of the Residuals from Applicant Series According to Geographical Regions with Normal 95% Confidence Interval

Now each of the fitted series and 10 forecasted values from the models above will be plotted against the observed values for each geographical region. In order to obtain the forecasts, 10 last observations of the exogenous variables are used. (Since the exogenous variables are the total household size, it is not meaningful to have rapid changes in them). Besides, using unconditional forecasts results in higher forecast errors, so conditional forecast is used.

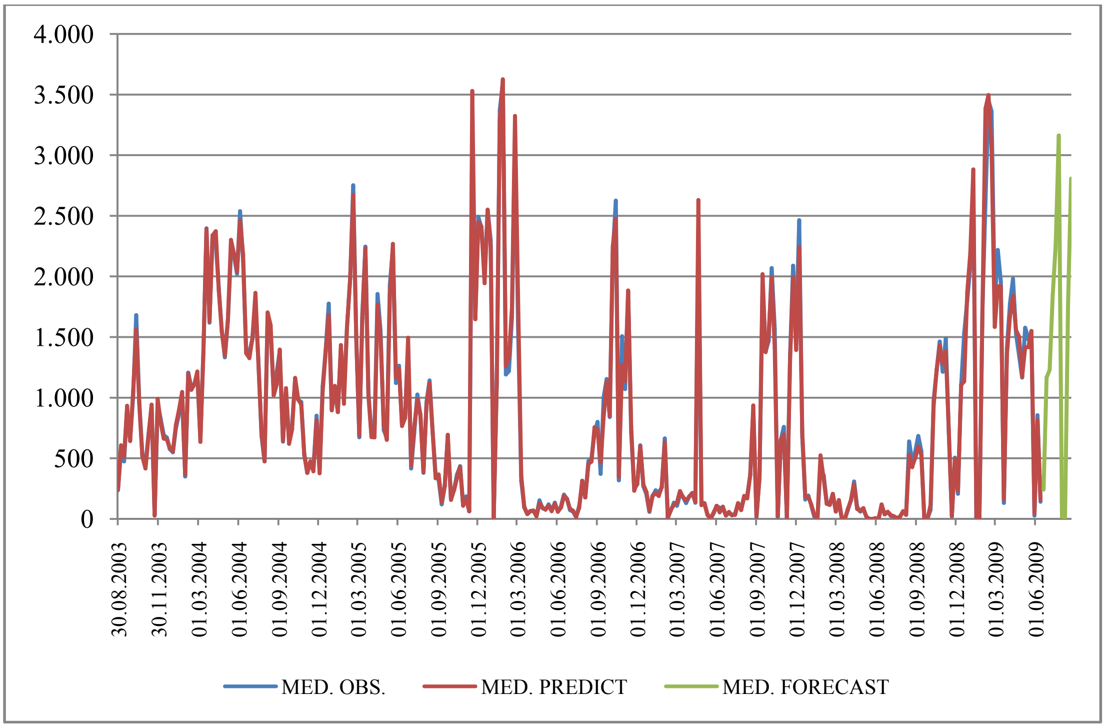


Figure 8. Observed versus Fitted and Forecasted Values of Applicants for Mediterranean Region

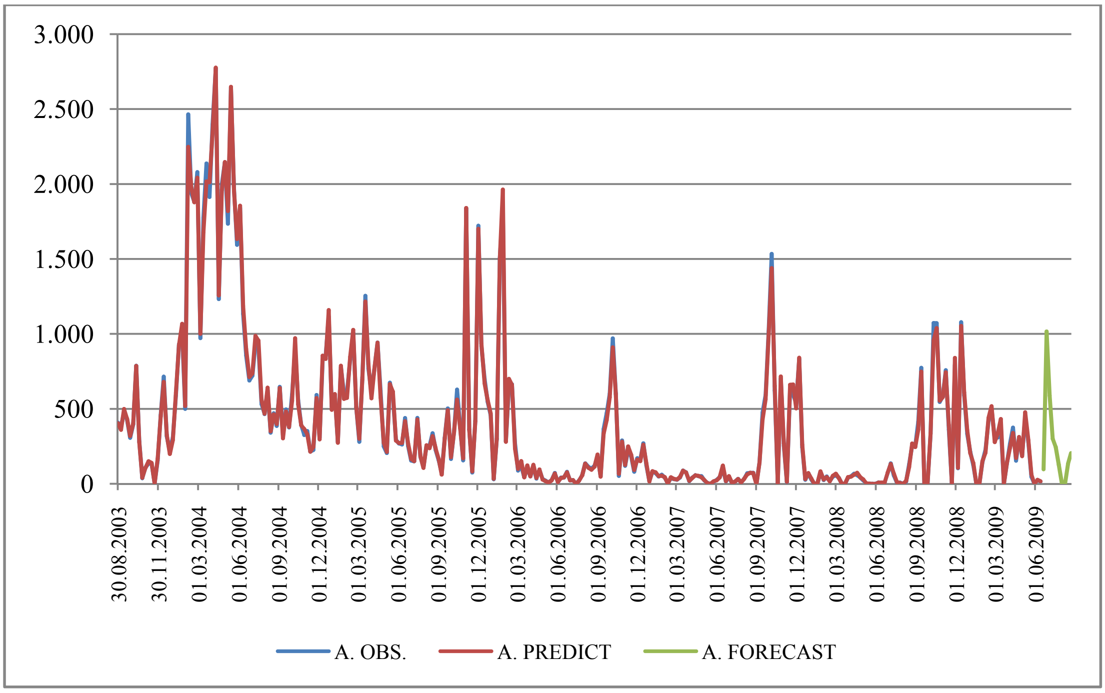


Figure 9. Observed versus Fitted and Forecasted Values of Applicants for Aegean Region

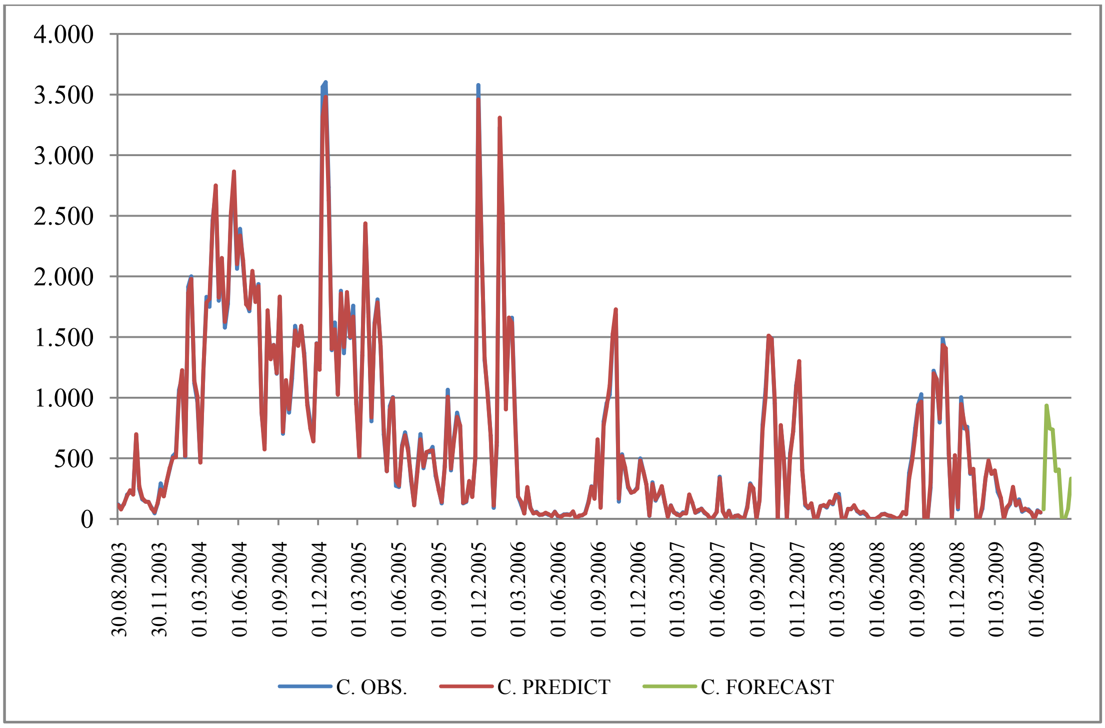


Figure 10. Observed versus Fitted and Forecasted Values of Applicants for Central Anatolia Region

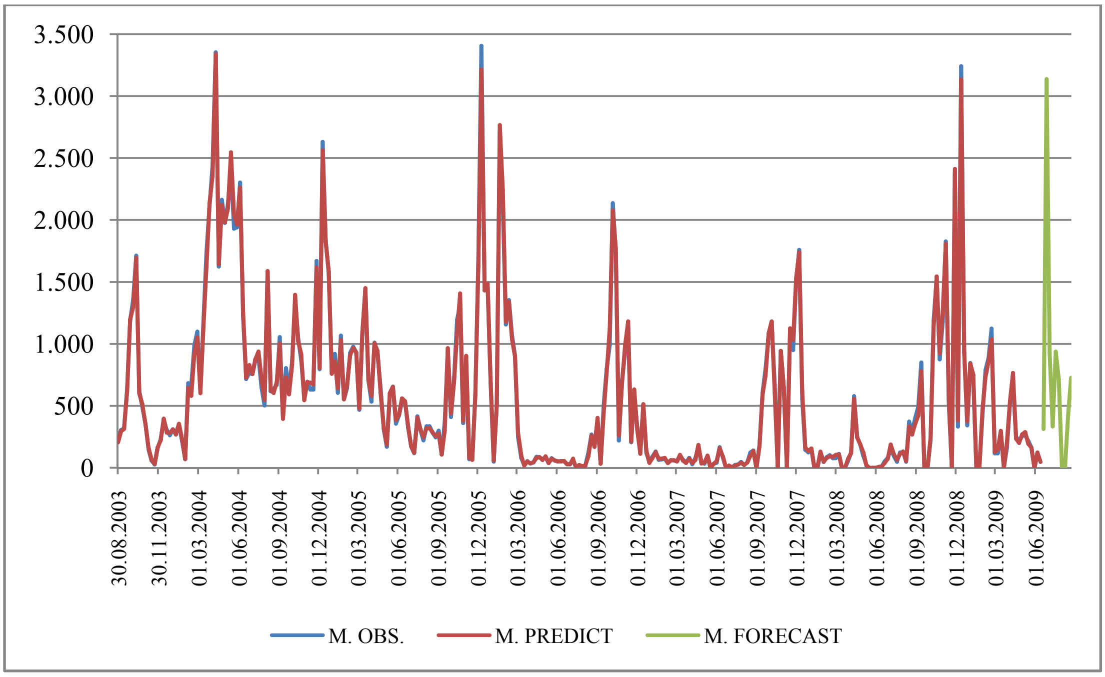


Figure 11. Observed versus Fitted and Forecasted Values of Applicants for Marmara Region

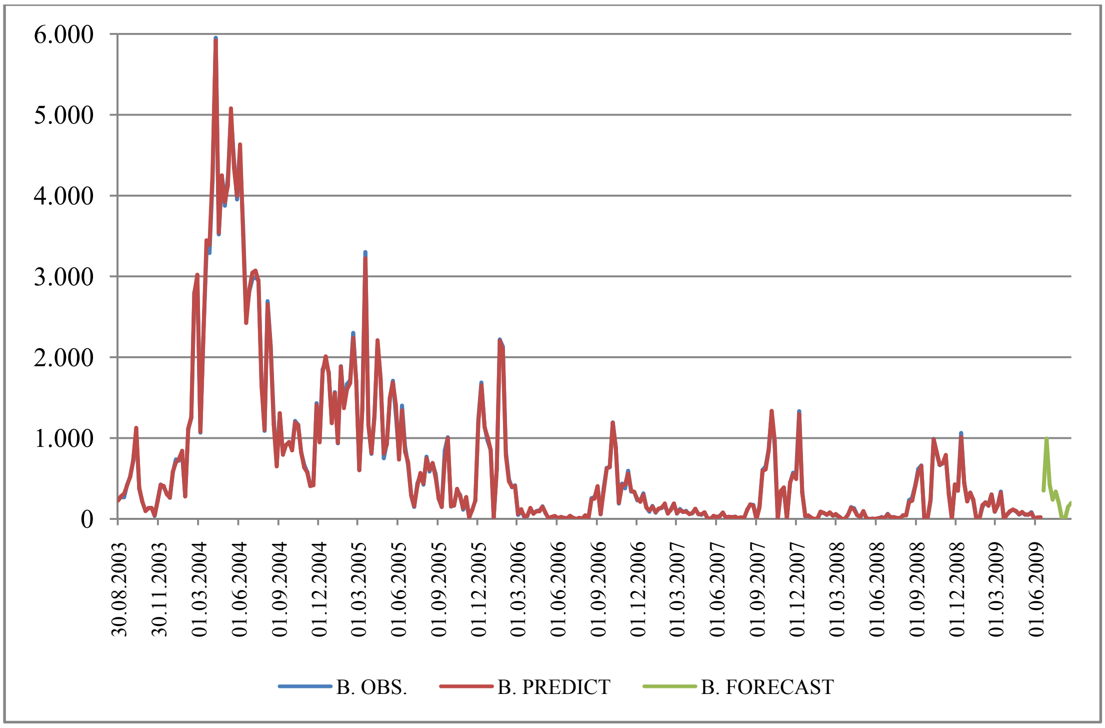


Figure 12. Observed versus Fitted and Forecasted Values of Applicants for Blacksea Region

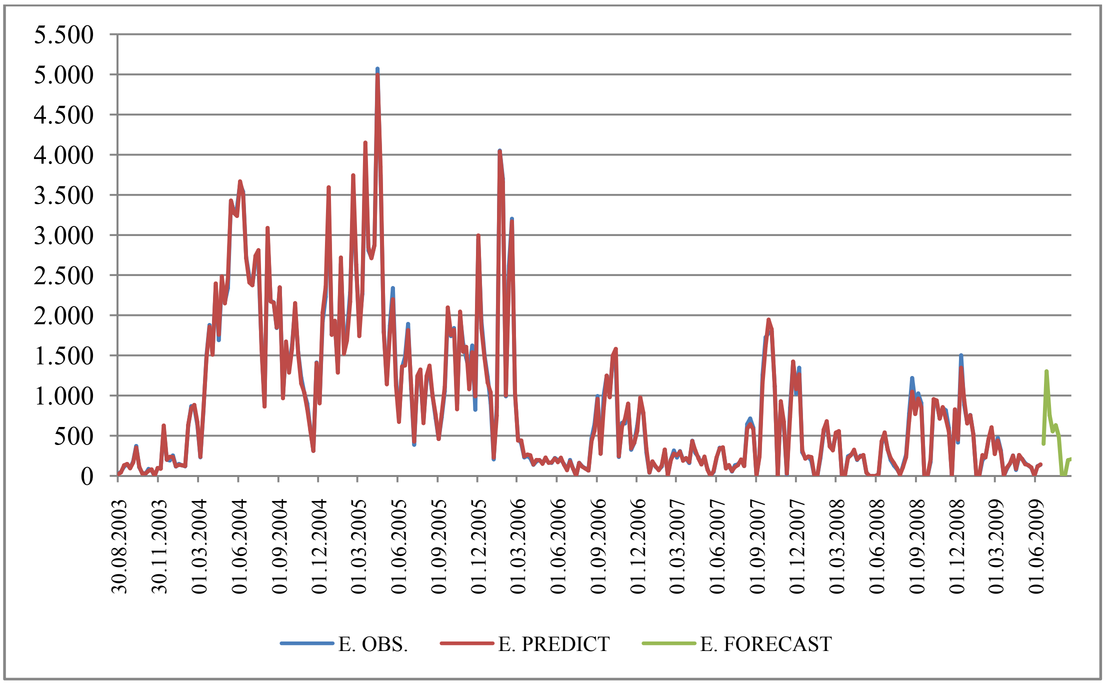


Figure 13. Observed versus Fitted and Forecasted Values of Applicants for Eastern Anatolia Region

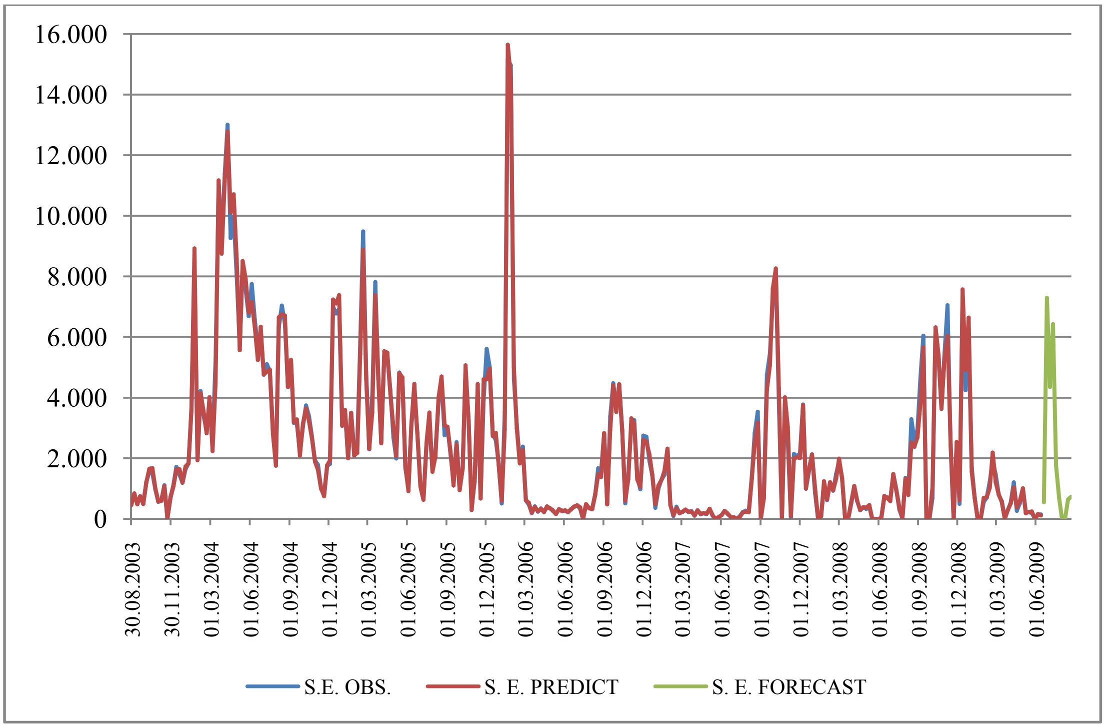


Figure 14. Observed versus Fitted and Forecasted Values of Applicants for Southeastern Anatolia Region

As it can be seen from Figures 8-14, the multivariate model seems to have a good fit for the number of applicants for each regions. (For details on forecasts of applicants, please check Table 29-32 in Appendix B)

Table 14. Granger-Causality Wald Test for the Applicant Series

VARIABLES		TEST	DF	CHI-SQUARE	PR> CHI-SQUARE
GROUP 1	GROUP 2				
abast	dbast	1	2	4.9	0.0863
abast	gbast	2	2	8.74	0.0127
mbast	dbast	3	2	0.84	0.6581
mbast	gbast	4	2	7.29	0.0262

According to Wald Test presented in Table 14, the p-values for test two and test four are significant. Also p-value for the first test is closer to 0.05. This means that the total number of weekly CCT program applicants from Eastern Anatolia Region affects positively the total number of weekly CCT program applicants from Mediterranean Region (using the 10% significance level). Also, applicant series from Southeastern Anatolia Region affects positively the Marmara and Mediterranean Regions as well. In fact, Southeastern Anatolia Region, which has the highest number of applicants and beneficiary households in CCT program, has crucial importance on the behavior of applicants all over Turkey. It was also checked if the applicant series in Marmara and Mediterranean Regions have an effect on the applicant series Southeastern Anatolia Region and Eastern Anatolia Region. The applicant series in other regions was also check if they have relation with any other applicant series of each region, and they were found to be insignificant by Wald Test at 10% of significance level.

4.2.2. Findings from modeling of applicants according to geographical regions

As the applications of the CCT program was examined, during the pilot stage of the program in 2003 average number of applicants all over the Turkey was around 2,000. But after 2004, by widening the program all over the country, the total number of applications rose up quickly. Especially in May 2004 in Southeastern Anatolia Region the corresponding number increased to 30,000. As the settlements of the applicants are considered, 55% of them are from city/town centers and 45% of them are from rural areas.

After the variance stabilization technique was applied to the total number of CCT applicant series, it was checked whether the data contain unit roots by ADF test or not. Since the data is weekly grouped, the seasonal unit root in lag seven is to be checked. However, SAS cannot check seasonal unit root at lag seven (it can only check at lags 2,4, or 12) for multivariate case. Therefore endogenous and exogenous variables are checked in univariate modeling procedure. It was found that they do not contain regular unit roots but they all have seasonal unit roots. So endogenous and exogenous variables are differenced at lag seven and the modeling is done with the differenced data. To model the total number of weekly applicants from each geographical region for the CCT program, a VARX(7,2) model was fitted to data.

After the insignificant parameters are removed from the model a restricted VARX(7,2) was obtained.

By looking at the significant parameters in restricted VARX(7,2) model for the applicants, it can be inferred that the time-varying applicants in regions have an effect on the applicants in neighborhood of the corresponding regions. That is to say, total number of applicant in one region is not only affected by the lags of household size in that region but also it was affected by the lags of its and neighborhood regions of applicants as well. For example applicant series in Mediterranean Region is highly affected and explained by household size of that region, 1^{st} and 7^{th} lag of itself and 1^{st} lags of applicants in Eastern and Southeastern Anatolia Regions. This finding also conforms to the Wald Test for Granger Causality results for those 3 regions. In other words, Applicant series in Eastern and Southeastern Anatolia Regions have a positive effect (i.e. increasing affect) on the applicants of Mediterranean Region.

According to model adequacy results of fitted VARX(7,2) model for the applicants, it can be inferred that residuals in Aegean, Central Anatolia, Marmara and Blacksea Regions follow a normal distribution with zero mean and constant variance. Residuals in Eastern Anatolia Region do not seem to be normal according to normality chi-square values obtained by SAS. However, they were found to be normal by AD test done by MINITAB. Normality assumptions for the residuals in Mediterranean and Southeastern Anatolia Regions were unable to be satisfied. This may be caused by possible outliers in those regions. Couples of techniques are used to remove the effect of outliers in the data set. Since there is no algorithm in detection of the outliers in Multivariate Time Series Analysis in SAS (or in any other software), observations corresponding to unusual residuals are treated as outliers and dummy variables are created so as to decrease the weights of them in the model. Created dummy variables are included as regressors in the model. Some of them found to be significant but still they were unable to satisfy the normality conditions for the residuals of corresponding series. Moreover they have an adverse effect on *R*-square (*R*-square for the models including dummy variables are decreased) and DW statistic (DW statistic become distant from two after the dummy variables are included in the models).

By examining the plots for predicted values from the VARX(7,2) model for the applicant series versus observed values according to geographical regions, the fitted model seems to be quite satisfactory for each regions. Since exogenous variables are included in the model, prediction and as well as forecast errors observed quite small. Conditional forecast method is used and the exogenous variables (household size for each geographical region) are controlled. Since the household size of the applicants does not change in a short period of time the final ten weeks of observations for exogenous variables are used in forecasting. According to this fitted model, total number of applicants for the first week was forecasted to be 2,030 with a 95% confidence interval (1.654 and 2.459). The observed value for the first week is 1.965 (For forecasted values of applicants in each region check tables through 29-32 in Appendix B).

4.2.3. Modeling of beneficiary households according to geographical regions

In this part, weekly total number of beneficiary households in CCT program according to geographical regions will be modeled.

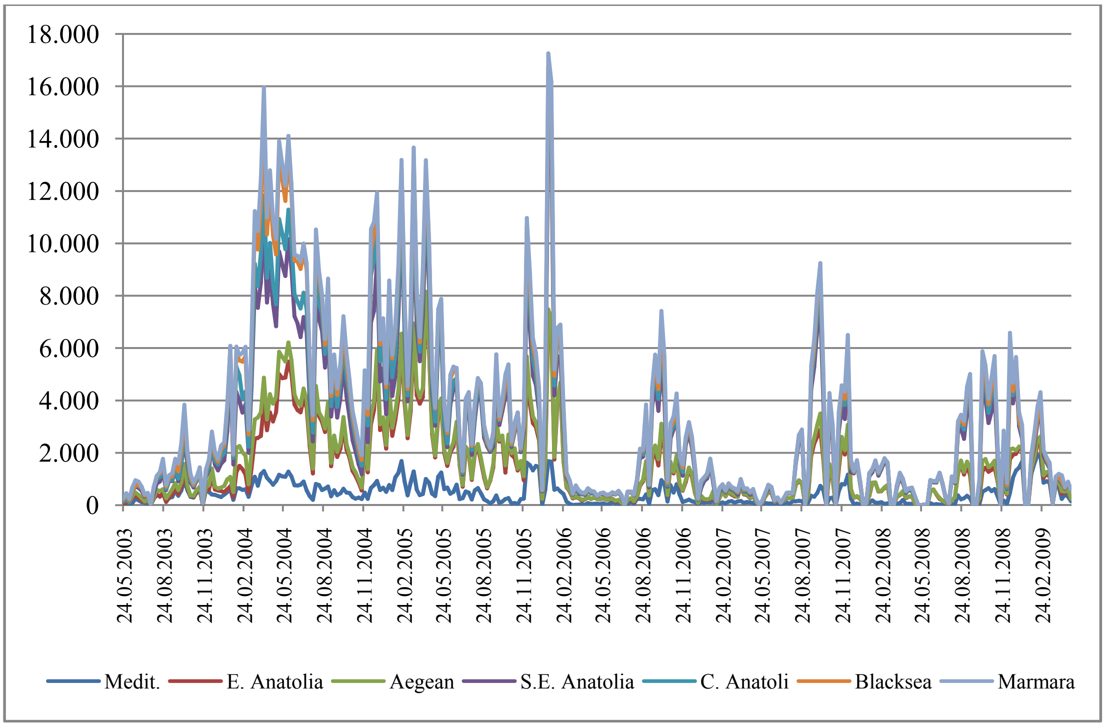


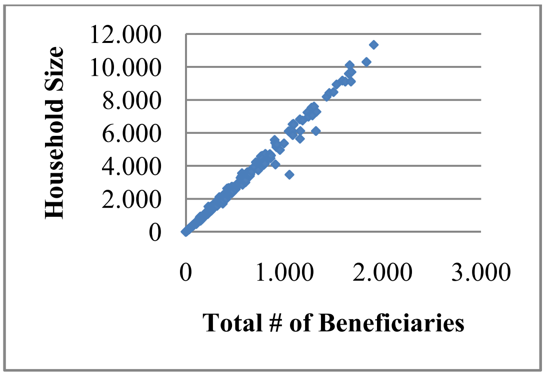
Figure 15. Time Series Plot of Weekly Total CCT Program Beneficiary Households According to Geographical Regions

The time series plot of the weekly total number of CCT program beneficiary households given in Figure 15 indicates, during the pilot stage of the program in 2003, average number of beneficiary households all over Turkey was around 1,200. After 2004, by widening the program all over the country, the total number of beneficiary households has risen up quickly. Especially in May 2004 in Southeastern Anatolia Region, the corresponding number increased to 16.000.

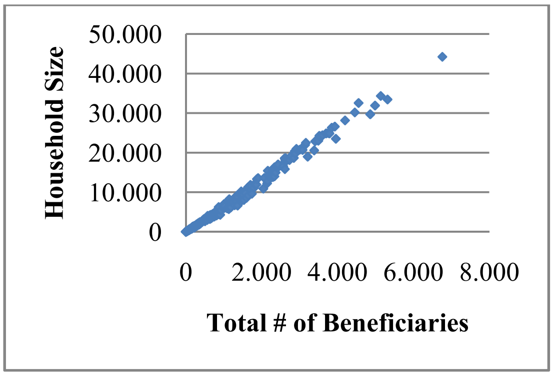
Considering the total number of beneficiary household in CCT program in a supply and demand phenomenon; after rolling out of the program in 2004, the demands for the CCT program and number of beneficiaries with respect to these demands rose up until 2006. After this year, demands and the number of beneficiary households have tendency to decrease.

In this part of the study, our concern is to investigate the relation between the total number of beneficiary households in each region. In other words, whether the increase or decrease in the number of beneficiaries for the CCT program in one region affects the number of beneficiaries for the program in other regions.

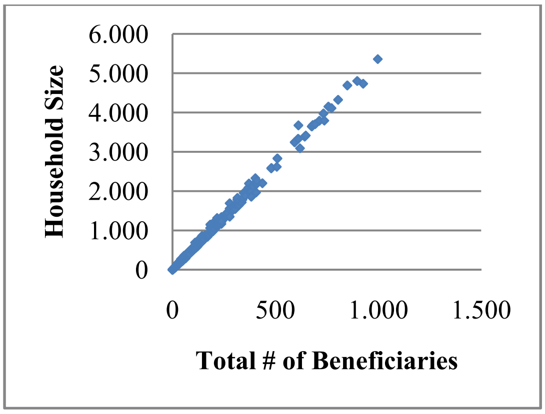
Before starting to model, the number of beneficiary households for CCT program According to geographical regions, checking the linear association between the endogenous variable (total number of weekly beneficiaries) and exogenous variable (weekly total household size) would be necessary. In order to detect this relation, a scatter plot of endogenous variable and exogenous variable according to seven regions will be used.



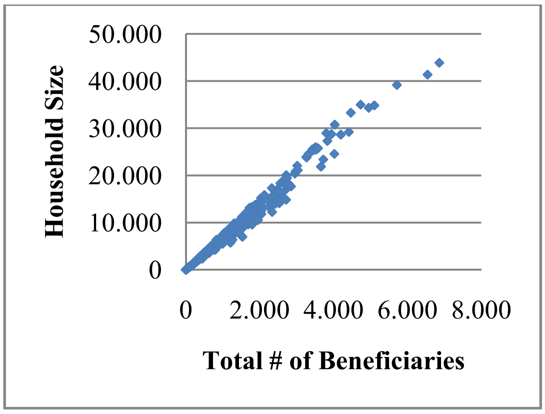
(1)



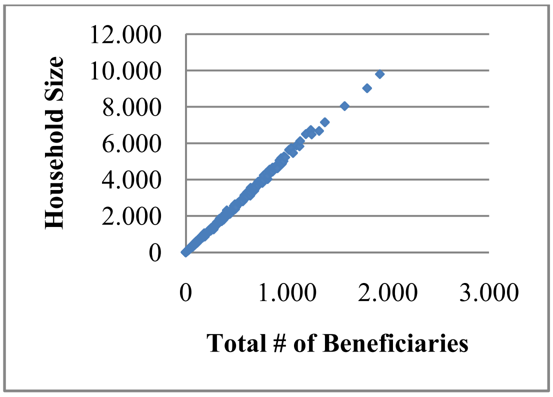
(2)



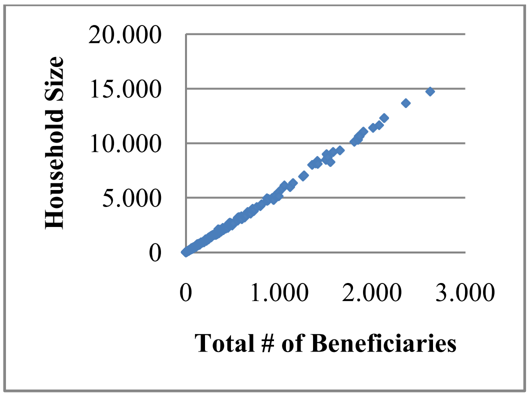
(3)



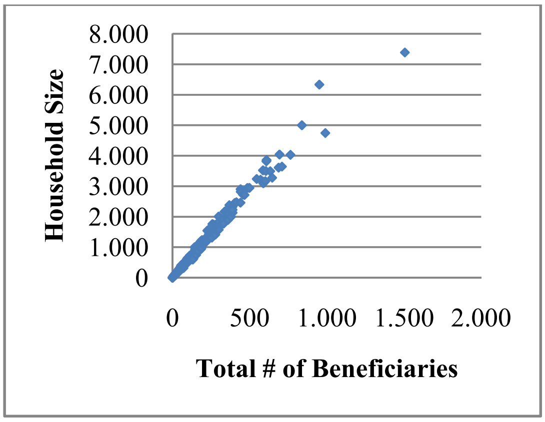
(4)



(5)



(6)



(7)

Figure 16. Total Number of Beneficiary Households v.s. Household Size in Mediterranean (1), Eastern Anatolia (2), Aegean (3), Southeastern Anatolia (4) Central Anatolia (5), Blacksea (6) and Marmara Regions (7)

Based on the scatter-plots according to seven geographical regions given in Figure 16(1) – 16(7), there is strong positive linear association between endogenous variable which is total number of weekly beneficiary households in CCT program, and exogenous variable which is weekly total number of household size.

In order to stabilize the variation in the endogenous variable Box-Cox transformation method is used. After trying several lambda values for each regions, 0.35 for Mediterranean, Central Anatolia and Blacksea Regions, 0.32 for Aegean and Marmara Regions, 0.42 for Eastern Anatolia and Southeastern Anatolia Regions found to be applicable (In those lambda values the smallest AIC and SBC values are obtained). In order to keep the linear association between endogenous and exogenous variables the same transformation is applied to exogenous variable as well. After the power transformation was applied to all the series by using the specified values for each region, time series plot of the transformed series was drawn (See Figure 17).

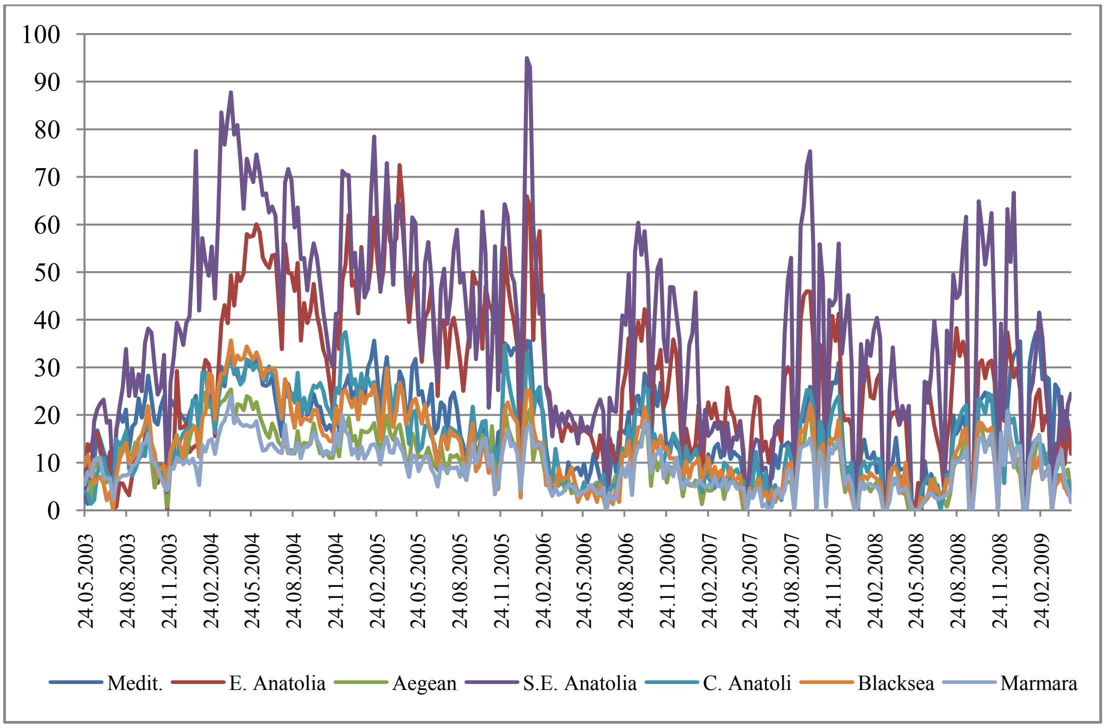


Figure 17. Time Series Plot of Transformed Weekly Total CCT Program Beneficiary Households According to Geographical Regions

As it can be seen from above plot transformation seems helpful and the variation in the series' variances seems to be stabilized. Now, it is important to check if the series have a seasonal or regular unit root. Since there is not an algorithm for checking unit root in multivariate case in software programs, each series will be checked in univariate case as stated before.

According to univariate ADF test for both endogenous and exogenous variables for beneficiary households in each region, there are no regular unit roots (all p values are significant in single mean and trend). Since data are collected weekly the seasonal unit root at lag 7 should be checked as well. According to ADF test statistics there exist seasonal unit roots (all *p* values are not significant in single mean and trend) for endogenous and exogenous variables as well (See Table 15).

Table 15. Univariate ADF Test for Endogenous and Exogenous Variables for the Beneficiary Households of CCT Program According to Geographical Regions

SERIES	TYPE	LAGS	F (END.)	PR > F (END.)	F (EXOG.)	PR > F (EXOG.)
MEDITERRANEAN	**Single Mean**	1	19.16	0.001	24.96	0.001
		7	2.95	0.3143	3.34	0.2155
	Trend	1	22.8	0.001	27.09	0.001
		7	4.16	0.3412	3.99	0.3753
AEGEAN	**Single Mean**	1	13.63	0.001	18.47	0.001
		7	2.06	0.5442	2.21	0.5045
	Trend	1	19.94	0.001	24.32	0.001
		7	4.45	0.2832	3.99	0.3758
CENTRAL ANATOLIA	**Single Mean**	1	12.27	0.001	15.43	0.001
		7	1.87	0.5921	2.09	0.5365
	Trend	1	17.14	0.001	20.95	0.001
		7	4.85	0.2037	4.97	0.1788
BLACKSEA	**Single Mean**	1	8.14	0.001	10.34	0.001
		7	1.76	0.6205	1.77	0.6189
	Trend	1	12.63	0.001	15.61	0.001
		7	5.27	0.1172	4.92	0.1894
MARMARA	**Single Mean**	1	15.17	0.001	23.83	0.001
		7	2.79	0.3576	3.18	0.2557
	Trend	1	19.71	0.001	27.46	0.001
		7	4.6	0.254	4.32	0.3092
EASTERN ANATOLIA	**Single Mean**	1	11.51	0.001	12.48	0.001
		7	1.94	0.5741	1.79	0.6139
	Trend	1	13.28	0.001	15.31	0.001
		7	3.62	0.4515	3.75	0.4253
S. EASTERN ANATOLIA	**Single Mean**	1	18.46	0.001	20.7	0.001
		7	2.72	0.3735	2.7	0.38
	Trend	1	22.47	0.001	25.9	0.001
		7	5.17	0.1383	5.45	0.0954

In multivariate modeling step, seasonal difference for both endogenous and exogenous variables will be taken so as to get rid of seasonal unit root.

The following multivariate linear regression model,

$$\mathbf{Y} = \mathbf{X}\boldsymbol{\beta} + \boldsymbol{\varepsilon} \qquad (4.2.3.1)$$

is fitted to the transformed data. Here, Y is an $(n \times p)$ data matrix containing the endogenous variables, X is an $(n \times q)$ matrix containing the factors and β is a $(q \times p)$ data matrix containing the model parameters and ε is a $(n \times p)$ data matrix containing the error term. Design matrix is formed in a way so as to keep different exogenous variables correspond to different endogenous variables in the model. In the Y matrix, the weekly CCT beneficiary households for each seven geographical region are included, and in the X matrix, total household size of the weekly beneficiary households for each region is included. Since the seasonal difference (at lag 7) is taken for both endogenous and exogenous variables, our data size reduces from 311 to 304. By using the LSE method without the constant terms the model parameters are obtained as presented in Table 16.

Table 16. LSE of Model Parameters, Standard Errors and P-Values for Multivariate Regression for Beneficiary Households

EQAUATION(*)	PAR.	EST.	STD. ERROR	t - VAL.	PR > |t|	VARIABLE(*)
ahakt	XL0_1_1	0.53876	0.00243	221.93	0.0001	**ahaknuft(t)**
ehakt	XL0_2_2	0.55752	0.00239	233.38	0.0001	**ehaknuft(t)**
ihakt	XL0_3_3	0.54609	0.00157	348.3	0.0001	**ihaknuft(t)**
mhakt	XL0_4_4	0.57016	0.00319	178.82	0.0001	**mhaknuft(t)**
khakt	XL0_5_5	0.56288	0.00165	340.21	0.0001	**khaknuft(t)**
dhakt	XL0_6_6	0.4937	0.00197	249.99	0.0001	**dhaknuft(t)**
ghakt	XL0_7_7	0.45239	0.00191	236.86	0.0001	**ghaknuft(t)**

(*) See list of Abbreviations

Table 17. Univariate Model White Noise Diagnostics Checks (Beneficiary Households)

VARIABLE	DURBIN WATSON	NORMALITY		ARCH	
		CHI-SQUARE	PR>CHISQ	F-VALUE	PR > F
ahakt	1.39004	4464.78	<.0001	9.34	0.0024
ehakt	1.33401	0.35	0.8396	2.34	0.1271
ihakt	1.31101	4.23	0.1205	34.01	<.0001
mhakt	0.99052	15.28	0.0005	80.02	<.0001
khakt	1.68286	11.21	0.0037	4.83	0.0287
dhakt	0.7405	27.19	<.0001	128.81	<.0001
ghakt	0.91407	21.46	<.0001	43.98	<.0001

Durbin Watson statistics do not get close to two, which show a correlation between error terms. It is obvious that multivariate linear regression do not seem to be fitted well to our data set.

A VARX(p,s) model as explained in (3.1.1) was fitted to the data. Since the data is differenced at lag seven (i.e. seasonally differenced) values including seven for p and s will be tried.

Table 18. Schematic Representation of Partial Autoregression for Beneficiary Households

VARIABLE	LAGS									
	1	2	3	4	5	6	7	8	9	10
ahakt	+......	....	..-+...	....	....	....	-......	....	....	....
ehakt	.+.....	....	..-...+	...-...	....	....	.-.....	.+.....	....	....
ihakt	..+....	....	..-...+	......+	....	....	+......	..+....	....	....
mhakt	...+...	....	..-....	...-..+	.-.....	....	...-...	-.+....	....	....
khakt	....+..	....+..	..-.+.+	...-..+	....	....-..	....	..+....	....	.+-....
dhakt	.....+.	....+..	..-...+	......+	....	....	.....-.	..+..+.	....	....
ghakt	......+	....	..-....	......+	....	....	....	......+	....	.+-....

Table 19. Schematic Representation of Partial Cross Correlations for Beneficiary Households

VARIABLE	LAGS									
	1	2	3	4	5	6	7	8	9	10
ahakt	+......	+......	....	-......	....	.+.....	- .+...+	+..-...	....	....
ehakt	.++.+..	...+...	.+.+...	....	...-.-.	.-.....	.-.....	.+.....	....	....+.+
ihakt	.++.+..	.++..-.	....	....	....	....	..-....	..+..+.	....	..+.-.-
mhakt	...+...	....	+..+-..	....	....	...-...	...-...	+..+..-	....-..	...-...
khakt	....+.+	....++.	....+..	....	....	..-.-..	....-..	....+..	....	....
dhakt	.....+.	...-...	+......	...-...	.....-.	....+-.	..-..-.	.....+.	....	....
ghakt	.-....+	.+.+.-.	..+....	.....+.	+......	......-	......-	.....++	....	....

According to Table 18 and Table 19, MA term could be included in the model. However, when MA term was included in the model, SAS fails to estimate the parameters due to optimization problem and it ignores them. Hence, the estimation will be done without MA terms.

By using couple of different *p* and *s* values for the model the smallest finite-population corrected Akaike Information Criteria (AICC) obtained when *p*=1 and *s*=2 without the constant term. Here, *p* shows the *Ylag* values and *s* shows the *Xlag* values. A more explicit form of the fitted VARX(*1,2*) model is given as below:

$$y_t = A_1 y_{t-1} + B_0 x_t + B_1 x_{t-1} + B_2 x_{t-2} + w_t \qquad (4.2.3.2)$$

where $y_t = (y_{1t}, \ldots, y_{7t})'$ is a seven-dimensional vector of endogenous variables and $x_t = (x_{1t}, \ldots, x_{7t})'$ is a seven-dimensional vector of exogenous variables. A_1 is (7×7) and B_0, B_1, B_2 are (7×7) coefficient matrices, respectively, and w_t is a seven-dimensional error vector.

Table 20. Univariate Model White Noise Diagnostics for VARX(1,2) (Beneficiary Households)

VARIABLE	DURBIN WATSON	NORMALITY		ARCH	
		CHI-SQUARE	PR>CHISQ	F-VALUE	PR > F
ahakt	1.90816	3781.15	<.0001	0.12	0.7315
ehakt	1.96276	0.53	0.769	0.2	0.6564
ihakt	1.88981	2.29	0.3178	2.58	0.109
mhakt	1.90523	1.73	0.4201	9.62	0.0021
khakt	1.96162	8.91	0.0116	3.01	0.0837
dhakt	1.89398	3.42	0.1805	6.25	0.0129
ghakt	1.98676	51.23	<.0001	0.61	0.4364

According to significant model parameters by LSE of VARX(1,2) (see Table 27 in Appendix A) and Table 20, VARX(1,2) model seems to fit reasonably good. DW statistics are closer to two for each individual variable. Additionally, normality of the residuals for Aegean, Central Anatolia, Marmara, Blacksea and Eastern Anatolia Regions seem to be satisfied. (Although for Blacksea Region p-value for normality checking was obtained to be 0.0116 it would still be considered as normal). For Mediterranean and Southeastern Anatolia Regions, the data seem to have outliers possibly because of this the error terms in those regions do not seem to be distributed as normal. In order to remove the effect of outliers in the data set dummy variables are created corresponding to unusual residual values and they were included in the model. However, this did not make residuals to have normal distribution. Moreover, total R-square for each model seems to decrease and DW statistic become worse. Unfortunately, in Multivariate case, most of the statistical software and as well as SAS do not provide an outlier detection algorithm. According to the model parameter estimates, insignificant parameters are removed from the model (i.e. restricted) and final model parameters are given in the Table 28 in Appendix A.

In restricted model, estimated parameters shown in Table 28, the couples of *Xlags* seem to be insignificant. But when they were removed from the model, variance-covariance matrix became singular. Hence, they were kept in the model although they are insignificant.

Table 21. Covariance Matrix for the Innovation for VARX(1,2) (Beneficiary Households)

VARIABLE	ahakt	ehakt	ihakt	mhakt	khakt	dhakt	ghakt
ahakt	0.52436	0.01221	0.0299	0.03575	0.02174	0.0659	0.13664
ehakt	0.01221	0.18215	0.0814	0.10353	0.05653	0.0555	0.10149
ihakt	0.0299	0.0814	0.18147	0.10031	0.07543	0.08062	0.19188
mhakt	0.03575	0.10353	0.10031	0.24914	0.07812	0.07578	0.19134
khakt	0.02174	0.05653	0.07543	0.07812	0.14356	0.09412	0.15845
dhakt	0.0659	0.0555	0.08062	0.07578	0.09412	0.73805	0.423
ghakt	0.13664	0.10149	0.19188	0.19134	0.15845	0.423	2.0227

Table 22. Schematic Representation of the Cross Correlations of Residuals from (Beneficiary Households)

VARIABLE	LAGS								
	0	1	2	3	4	5	6	7	8
ahakt	+.....+	....+..	....	....	..+....	+...+..	+......	-.....-	....
ehakt	.++++++	+...+..	....	...+...	.-.....	....	....	.-----.	-.+....
ihakt	.++++++	+......	.....+.	....	.....-.	....	....	.----.-	....
mhakt	.++++++	+...+..	....	....	....	....	....	.-----.	-......
khakt	.++++++	+......	....+..	....	...+...	....	....	..----.	....
dhakt	.++++++	...+...	....	....+..	....	....	..+....	.....--	....
ghakt	+++++++	+......	....++.	....	....	....	+......	..---.-	-......

It can be inferred that, Schematic Representation of Cross Correlation of Residuals (see Table 22) reveals an MA structure (since couples of lags are still significant). As it was explained in the estimation step, it would be meaningful to include MA term in the model. But due to technical problems in SAS they were unable to be included the model. Since they were excluded, p-value for portmanteau test statistics in lags two up to twelve were all obtained as smaller then 0.001. But this does not show that our model is not suitable. It would be reasonable to check the univariate model diagnostics, ARCH structure and some other distributions for the ε_t in addition to normal (Lütkepohl, 2005). However, fitting distribution to residuals other than normal in VARMA modeling using SAS is not applicable. Hence only the residuals for the restricted model will be checked if they are uncorrelated and if they have an ARCH structure or not in univariate level.

Table 23. Univariate Model White Noise Diagnostics for Restricted VARX(1,2) (Beneficiary Households)

VARIABLE	DURBIN WATSON	NORMALITY		ARCH	
		CHI-SQUARE	PR>CHISQ	F-VALUE	PR > F
ahakt	1.93017	4119.13	<.0001	0.13	0.722
ehakt	1.98316	0.4	0.8197	0.35	0.5569
ihakt	1.86129	2.12	0.3462	3.25	0.0723
mhakt	1.91342	1.99	0.3696	10.36	0.0014
khakt	1.97029	9.92	0.007	3.42	0.0653
dhakt	1.90772	3.96	0.1382	6.12	0.0139
ghakt	1.97182	50.97	<.0001	0.44	0.5098

As it can be seen in Table 23, p-value for the Chi-Square normality check for Blacksea Region series looks like to decrease from 0.0116 to 0.007 after the insignificant parameters are removed from the model. For Mediterranean and Southeastern Anatolia Regions residuals do not follow normal distributions due to a number of outliers reside in the data set.

Table 24. Anderson-Darling (AD) and Shapiro-Wilk (SW) Normality Tests for the Residuals for Restricted VARX(1,2) (Beneficiary Households)

STATISTICS	MED. RES	A. RES	C. RES	M. RES	B. RES	E. RES	S.E. RES
MEAN	0.001	-0.0027	0.0038	-0.0074	0.0076	0.01192	-0.0079
ST.DEV	0.7132	0.4024	0.4196	0.4916	0.3732	0.8462	1.401
N	302	302	302	302	302	302	302
AD	6.322	0.218	0.327	0.65	1.434	0.419	1.511
P-VALUE (AD)	<0.005	0.839	0.518	0.089	<0.005	0.325	<0.005
SW	0.906	0.998	0.998	0.997	0.991	0.996	0.987
P-VALUE (SW)	<0.01	>0.1	>0.1	>0.1	<0.01	>0.1	<0.01

Due to outliers in data set for Mediterranean and Southeastern Anatolia Regions normality assumption for the residuals were unable to be satisfied. As it was explained previously after the model was restricted, normality chi-square p-value for the residuals in Blacksea Region was increased and this was also verified by AD test and SW test statistic obtained by MINITAB as well. In a more explicit form the model can be written as follows:

$$\begin{bmatrix} ahakt_t \\ ehakt_t \\ ihakt_t \\ mhakt_t \\ khakt_t \\ dhakt_t \\ ghakt_t \end{bmatrix} = \begin{bmatrix} 0.282 & 0 & 0 & 0.035 & 0 & 0 & 0 \\ 0 & 0.276 & 0.008 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0.274 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0.448 & 0 & 0 & 0 \\ 0 & -0.016 & 0.009 & 0.019 & 0.105 & 0 & 0 \\ 0 & 0.049 & -0.038 & 0 & 0 & 0.601 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0.493 \end{bmatrix} \begin{bmatrix} abast_{t-1} \\ ebast_{t-1} \\ ibast_{t-1} \\ mbast_{t-1} \\ kbast_{t-1} \\ dbast_{t-1} \\ gbast_{t-1} \end{bmatrix} +$$

$$\begin{bmatrix} 0.539 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0.553 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0.543 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0.563 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0.563 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0.493 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0.451 \end{bmatrix} \begin{bmatrix} anuft_t \\ enuft_t \\ inuft_t \\ mnuft_t \\ knuft_t \\ dnuft_t \\ gnuft_t \end{bmatrix} + \qquad (4.2.3.3)$$

$$\begin{bmatrix} -0.165 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & -0.154 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0.144 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & -0.246 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & -0.064 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & -0.296 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & -0.222 \end{bmatrix} \begin{bmatrix} anuft_{t-1} \\ enuft_{t-1} \\ inuft_{t-1} \\ mnuft_{t-1} \\ knuft_{t-1} \\ dnuft_{t-1} \\ gnuft_{t-1} \end{bmatrix} +$$

$$\begin{bmatrix} 0.003 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0.007 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0.003 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0.003 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0.005 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0.002 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & -0.002 \end{bmatrix} \begin{bmatrix} \text{anuft}_{t-2} \\ \text{enuft}_{t-2} \\ \text{inuft}_{t-2} \\ \text{mnuft}_{t-2} \\ \text{knuft}_{t-2} \\ \text{dnuft}_{t-2} \\ \text{gnuft}_{t-2} \end{bmatrix} + \begin{bmatrix} w_{1,t} \\ w_{2,t} \\ w_{3,t} \\ w_{4,t} \\ w_{5,t} \\ w_{6,t} \\ w_{7,t} \end{bmatrix}$$

$$\hat{\Sigma} = \begin{bmatrix} 0.52436 & 0.01221 & 0.0299 & 0.03575 & 0.02174 & 0.0659 & 0.13664 \\ 0.01221 & 0.18215 & 0.0814 & 0.10353 & 0.05653 & 0.0555 & 0.10149 \\ 0.0299 & 0.0814 & 0.18147 & 0.10031 & 0.07543 & 0.08062 & 0.19188 \\ 0.03575 & 0.10353 & 0.10031 & 0.24914 & 0.07812 & 0.07578 & 0.19134 \\ 0.02174 & 0.05653 & 0.07543 & 0.07812 & 0.14356 & 0.09412 & 0.15845 \\ 0.0659 & 0.0555 & 0.08062 & 0.07578 & 0.09412 & 0.73805 & 0.423 \\ 0.13664 & 0.10149 & 0.19188 & 0.19134 & 0.15845 & 0.423 & 2.0227 \end{bmatrix}$$

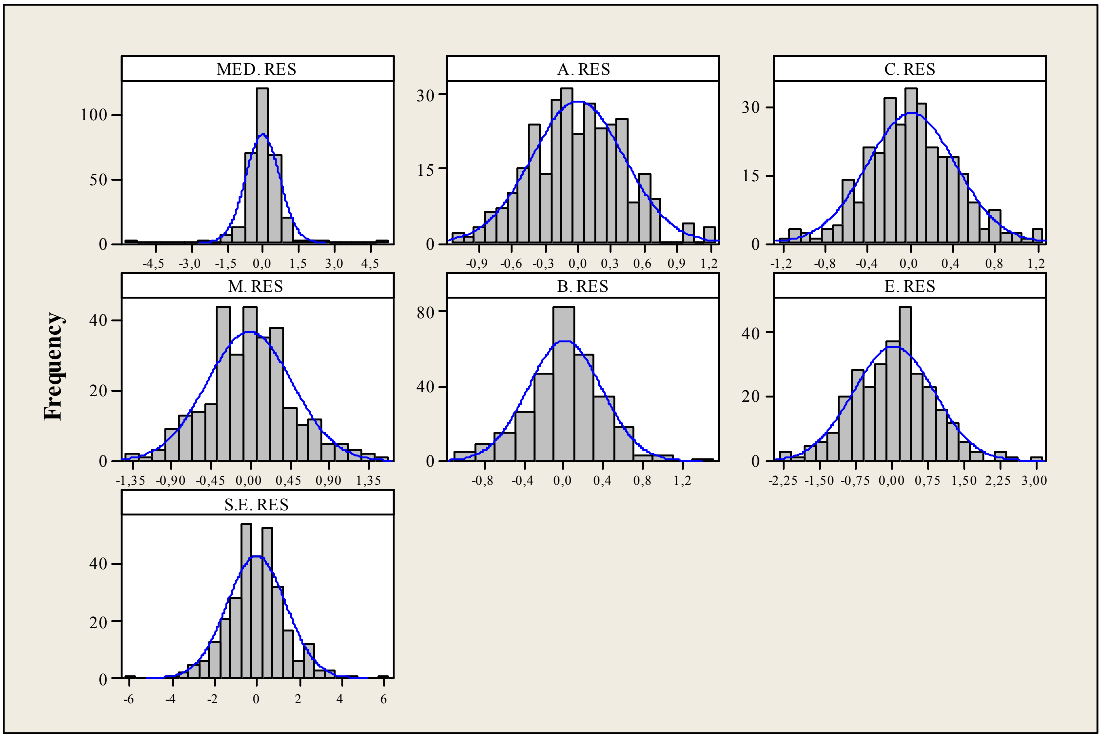


Figure 18. Histogram of the Residuals from Beneficiary Households Series According to Geographical Regions (Checked Distribution: Normal)

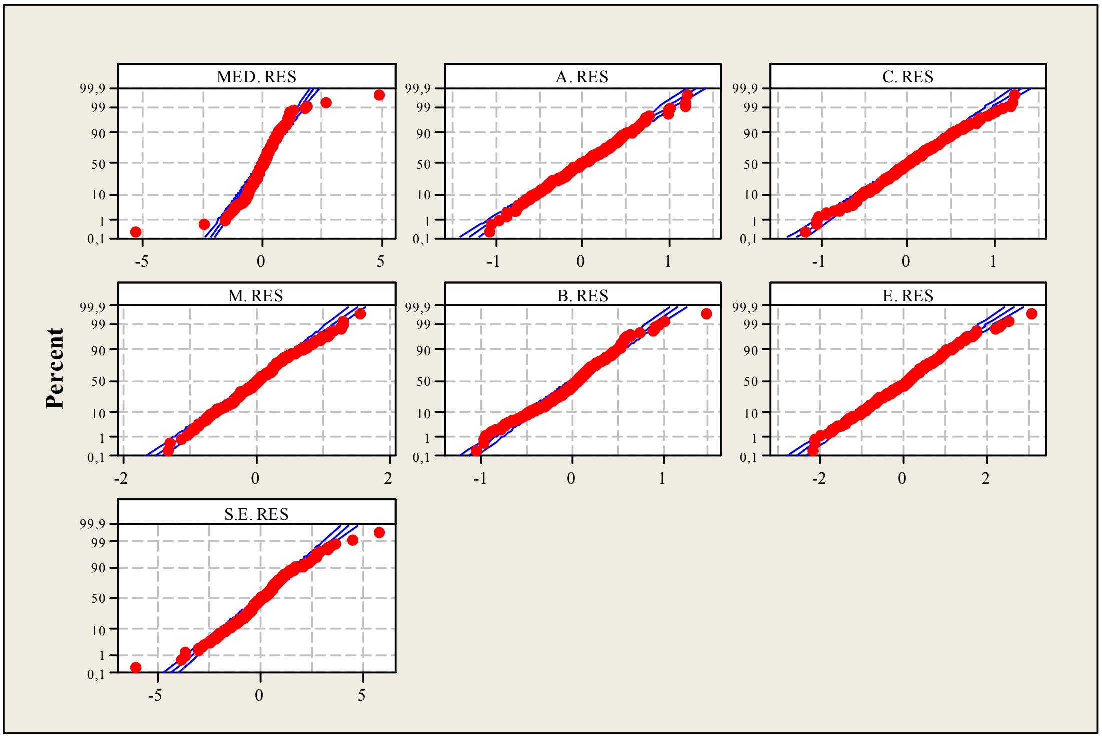


Figure 19. Normal Probability Plot of the Residuals from Beneficiary Households Series According to Geographical Regions with Normal 95% Confidence Interval

Now each of the fitted series and 10 forecasted values from the models above will be plotted against the observed values for each of the geographical regions. To obtain forecasts, 10 last observations of the exogenous variables are used. (Since the exogenous variables are the total household size, it is not meaningful to have rapid changes in them). In addition, unconditional forecast method results in higher forecast errors, so conditional forecast method is used.

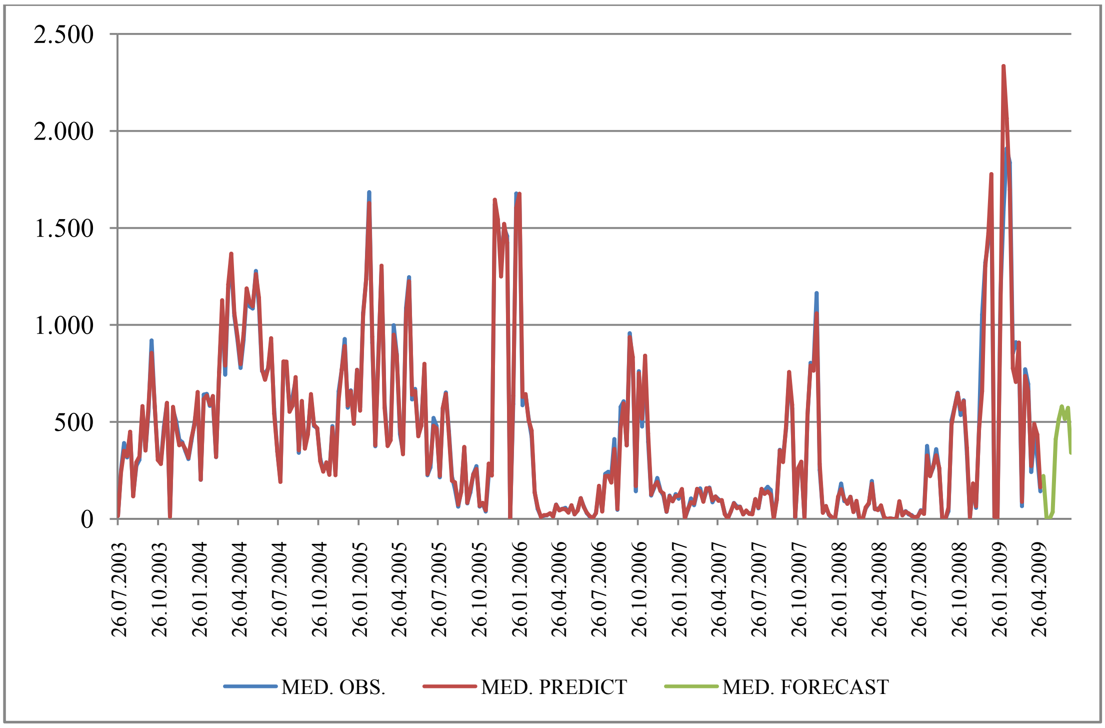


Figure 20. Observed versus Fitted and Forecasted values of Beneficiary Households for Mediterranean Region

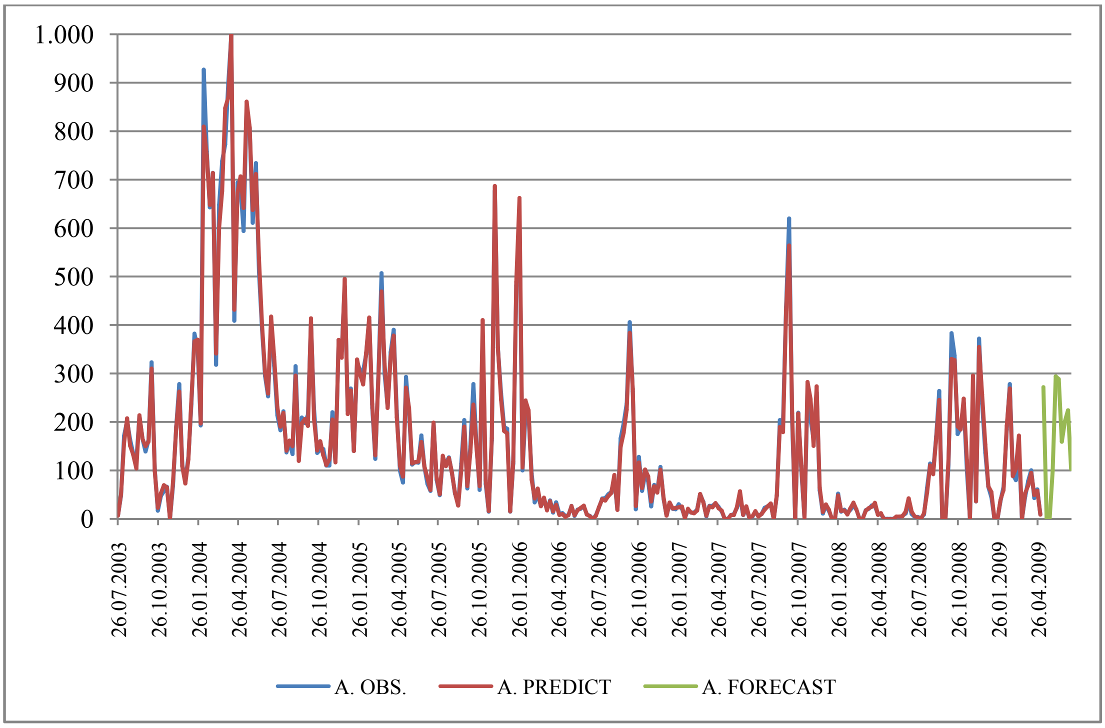


Figure 21. Observed versus Fitted and Forecasted values of Beneficiary Households for Aegean Region

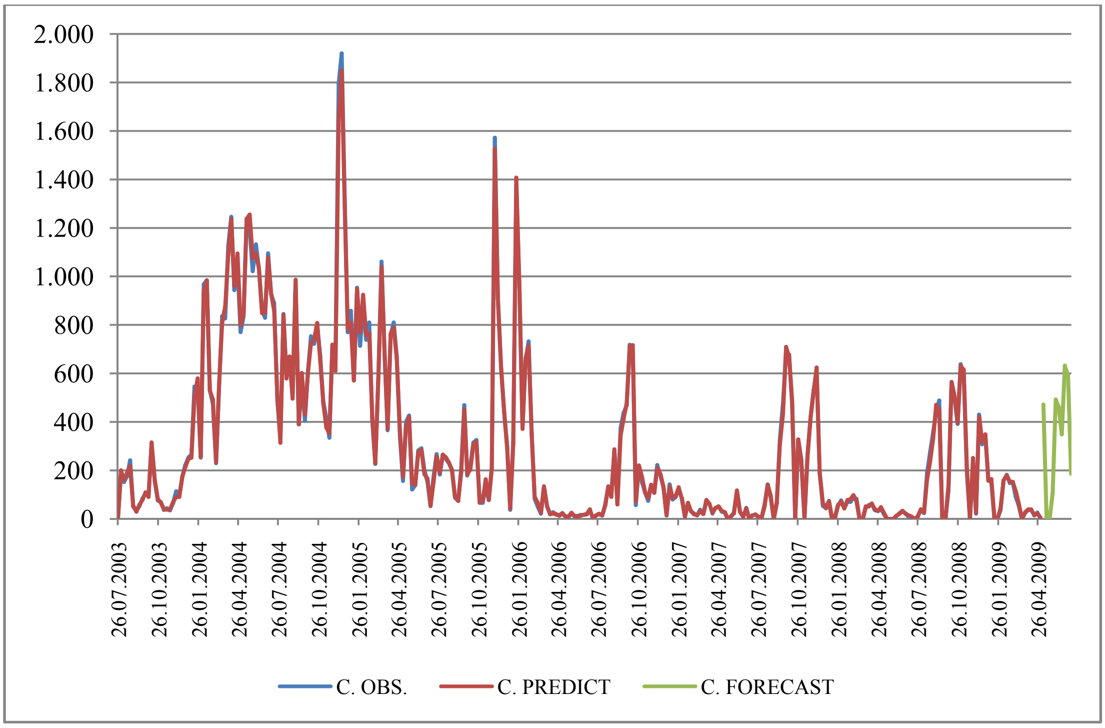


Figure 22. Observed versus Fitted and Forecasted values of Beneficiary Households for Central Anatolia Region

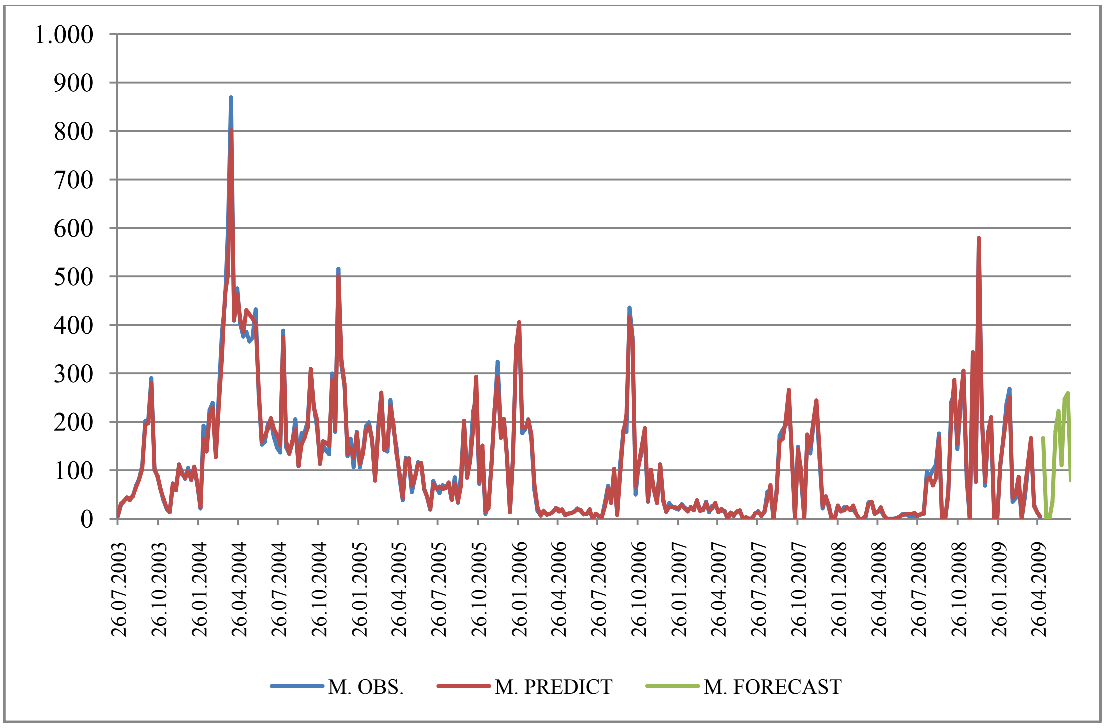


Figure 23. Observed versus Fitted and Forecasted values of Beneficiary Households for Marmara Region

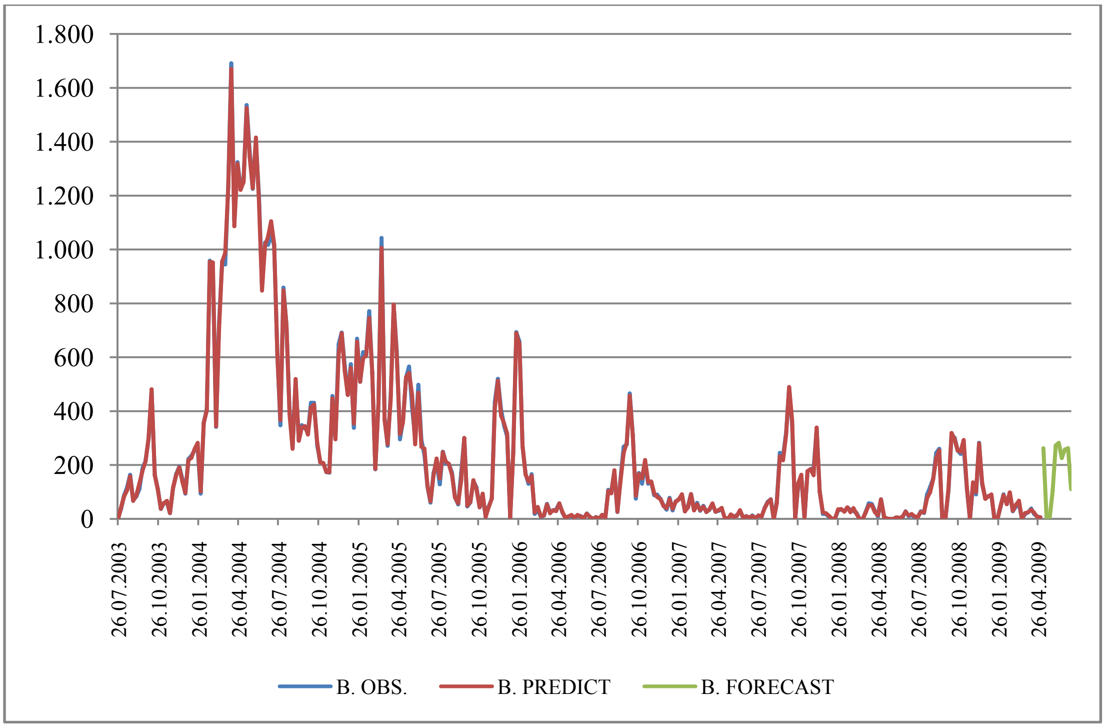


Figure 24. Observed versus Fitted and Forecasted values of Beneficiary Households for Blacksea Region

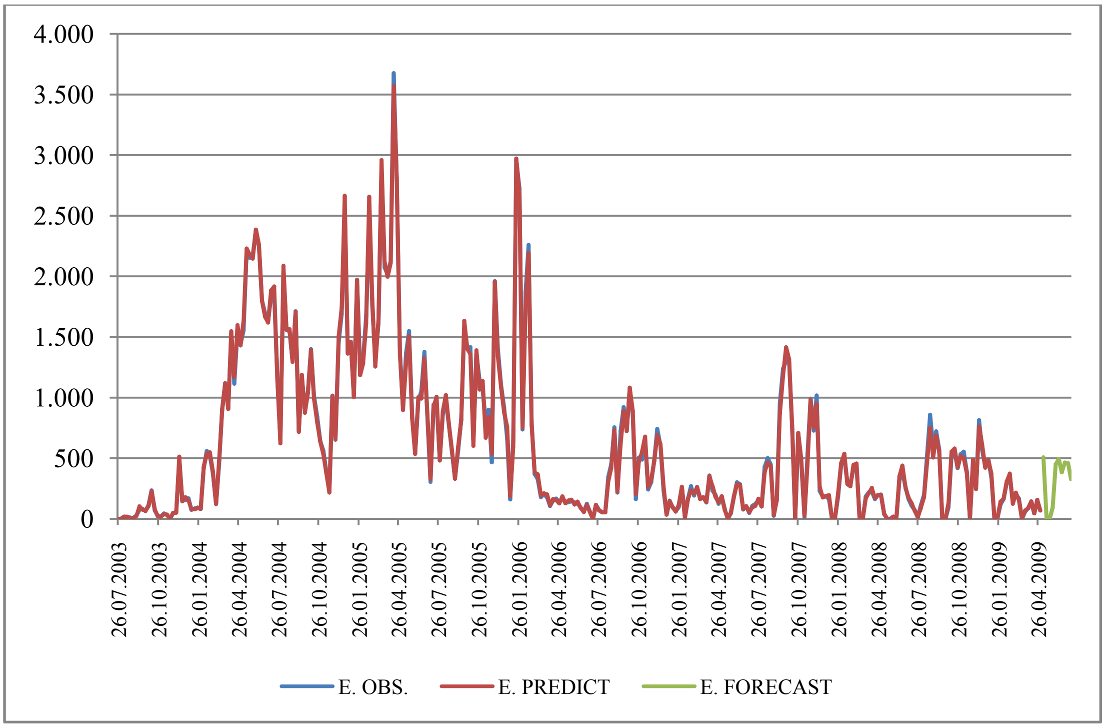


Figure 25. Observed versus Fitted and Forecasted values of Beneficiary Households for Eastern Anatolia Region

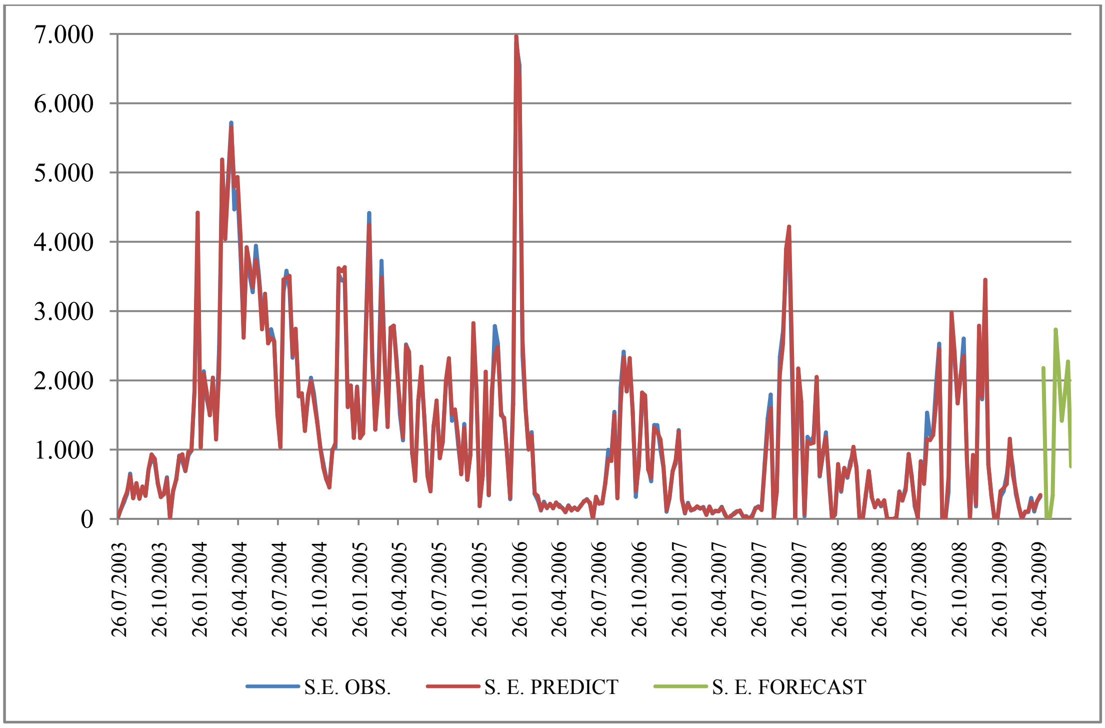


Figure 26. Observed versus Fitted and Forecasted values of Beneficiary Households for Southeastern Anatolia Region

As it can be seen from the each plot of observed and fitted as well as forecasted values the multivariate model seem to have a good fit for beneficiary households of CCT program According to geographical regions. (For details on forecasts of beneficiary households check Table 33-36 in Appendix B)

4.2.4. Findings from modeling of beneficiary households according to geographical regions

As the beneficiary households of the CCT program was examined, during the pilot stage of the program in 2003, average number of beneficiary households all over the Turkey was around 1,200. After 2004, by introducing the program all over the country, this risen up quickly. Especially in May 2004 in Southeastern Anatolia Region the corresponding number increased to 16,000. Considering the total number of beneficiary household in the CCT program in a supply and demand phenomenon, after rolling out of the program in 2004, the demands for the CCT program and number of beneficiaries with respect to these demands rose up until 2006. After this year, demands for the CCT program and the corresponding number of beneficiary households has tendency to decrease.

After the variance stabilization technique was applied to total number of beneficiary household series in CCT, it was checked if the data contain unit roots by ADF test or not. As in the applicant series case, each beneficiary household series only contain seasonal unit roots. So both endogenous and exogenous variables are differenced at lag seven and the modeling is done with the differenced data. So as to model the total number of weekly beneficiary household series each geographical region for the CCT program a VARX(1,2) model was fitted to data. After the insignificant parameters are removed from the model a restricted VARX(1,2) was obtained.

By looking at the significant parameters in restricted VARX(1,2) model for the beneficiary household series, in almost all regions the weekly total number of beneficiary households in one region is only affected by its 1^{st} lag, the corresponding exogenous variable, and 1^{st} lag of those variable. In other words, total number of weekly beneficiary households in one region is not affected by total number of beneficiary household series in the neighborhood of that region except for the series in Eastern Anatolia and Blacksea. But this relation does not verified by the results of Wald test.

According to the model adequacy results of fitted VARX(1,2) model for the beneficiary households, it can be inferred that residuals in Aegean, Central Anatolia, Marmara, Blacksea and Eastern Anatolia Regions follow a normal distribution with zero mean and constant variance. Normality assumptions for the residuals in Mediterranean and Southeastern Anatolia Regions were unable to be satisfied. This can be caused by outliers in those regions. Similar actions are taken so as to remove the effects of them in the model as it was done in residuals of applicant series case. Also due to similar reasoning the effects of them were unable to remove from the model.

By examining the plots for predicted values from the VARX(1,2) model for the beneficiary household series versus observed values According to geographical regions, the fitted model seem quite satisfactory for each regions. Prediction and forecast errors were observed quite small. Conditional forecast method is used and the final ten weeks of observations for exogenous variables are employed in forecasting. According to this fitted model, total number of beneficiary households for the first week was forecasted to be 4,078 with a 95% confidence interval (3,603 and 4,592). The observed value for the first week is 3,994. (For forecasted values of beneficiary households in each region check tables through 33-36 in Appendix B).

CHAPTER 5

CONCLUSION

CCT is a social assistance program which aims for increasing the accessibility to health and education services of poor families by enabling them to send their children to schools and making those families to visit health services regularly. In this program, the poorest community is targeted and their basic needs like education, health and nutrition are met so that, they tend to create a positive behavior on accessing health and education services. Thus, transfer of intergenerational poverty among those families is to be prevented.

There are two fundamental goals of the CCT program. In the short run, it is aimed to decrease poverty by means of cash transfers, and in the long run, it is aimed to invest in children's human capital by providing basic preventative health care, regular school attendance and nutrition. Under the state of these aims, countries implemented/implementing their own CCT programs taking into account the regional and local differences.

The CCT program in Turkey started in order to decrease the adverse effects of economic crisis in 2001 within the SRMP that was financially supported by the World Bank, and it was constituted under the SASF. Started as a pilot program in 2003, CCT has rolled-out all over the country and it was adopted by poor families in a little while. The demands for the program have increased significantly over years. To examine these demands and variation of the number of beneficiary households over time geographically, multivariate time series models were used and future demands for the CCT program and as well as the possible number of beneficiary households were forecasted.

In the pilot stage of the CCT program in 2003 average number of applicants all over the Turkey was around 2,000. However, after 2004, by rolling out of the program all over the country, the total number of applications rose up quickly. It reached 30,000 in Southeastern Anatolia Region during May 2004. Considering the settlements of the applicants, 55% of them live in urban areas, whereas 45% of them live in rural areas. According to Address Based Population Registration System 2008 Population Census Results, proportion of population living in province and district centers is 75%, whereas proportion of the population living in rural areas is only 25%. According to this fact, the demand for CCT program in rural areas is almost twice of those in urban areas. This result can be verified by the TSI's poverty study revealing that the risk of poverty in rural areas is higher than that in urban areas. Especially with a crowded family, family size being equal or greater than seven, in rural areas the risk of poverty goes up to 50.26% whereas it is 33.14% in urban areas (TUIK, 2008). This surely explains why the tendency to apply for the CCT program in Eastern and Southeastern Anatolia Regions are higher when compared to other regions. Since, the average household size in Eastern Anatolia Regions is greater than six, and that in Southeastern Anatolia Region is greater than seven.

In order to model the total number of weekly applicants from each geographical region for the CCT program, a VARX(7,2) model was fitted to data. After the insignificant parameters were removed from the model a restricted VARX(7,2) was obtained. Considering the significant parameters in restricted VARX(7,2) model for the applicants, it can be inferred that the time-varying applicants in regions have an effect on the applicants in neighborhood of the corresponding regions. For example, applicant series in Mediterranean Region is highly affected and explained by household size of that region, its past values and applicants in Eastern and Southeastern Anatolia Regions. According to Wald Test for Granger Causality results for those three regions, applicant series in Eastern and Southeastern Anatolia Regions have a positive effect on the applicants of Mediterranean Region. This is meaningful under the scope of migration phenomenon. Poor families in Eastern and Southeastern Anatolia Regions move/immigrate to Mediterranean Region for a possibility of job and a better standard of living conditions. This results in an increase in the poor population of Mediterranean Region. Besides, these families have high number of household size which makes them vulnerable to decent shocks, economic crises, and these factors increase their poverty risk. Due to problems that they may face, after they have migrated to a new city or region, it is inevitable for them to apply for the CCT program where they have moved or migrated. In other words, they use the past information about CCT program that they have gathered where they have moved from. This explains the positive relation between applicant series in Mediterranean Region and applicant series in Eastern and Southeastern Anatolia Regions.

Migration discussion can be extended for the regions in the neighborhood of the other regions as well. But the main interest in this study is to analyze the effects of high number of applicants (more than 885,000 applicants) for CCT Program in Eastern and Southeastern Anatolia Regions on the other regions. For example, Marmara Region having the highest density of population in Turkey should be affected by the migrants from other regions in terms of applicants of the CCT program. However it was not the case according to our VARX(7,2) model. This can be explained due to structural form of scoring formula used in the CCT program for determining the poorest in that region. Household size for the migrants are important to increase the chance of being beneficiary, but the parameter weight of Marmara Region in scoring formula is not as high as Mediterranean, Eastern or Southeastern Anatolia Regions. So, poor migrants from Southeastern or Eastern Anatolia Regions may not become beneficiary easily in the CCT program when they apply it in Marmara Region compared to the applicants in Eastern or Southeastern Anatolia Regions.

Residuals of Aegean, Central Anatolia, Marmara and Blacksea Regions from the fitted VARX(7,2) model for the applicants, follow a normal distribution with zero mean and constant variance. Residuals in Eastern Anatolia Region do not seem to be normal according to normality chi-square values obtained by SAS. Rather than chi-square normality test, AD test is conducted by MINITAB and the residual of that region was found to be normal. Residuals in Mediterranean and Southeastern Anatolia Regions do not follow a normal distribution due to possible outliers. Since there is no algorithm in detection of the outliers in Multivariate Time Series Analysis in SAS (or in any other software) they were unable to be removed from the model. (See chapter 4.2.2. for a detailed discussion). As a future research, it would be quite helpful to study on the algorithms and commands for outlier detection in Multivariate Time Series Analysis in software programs.

According to plots of applicants versus predicted values, the fitted VARX(7,2) model with respect to geographical regions seems to be quite satisfactory. Due to including exogenous variables in the model, prediction and forecast errors are observed quite small. By using conditional forecast method, following ten weeks of applications according to geographical region was obtained. According to forecast result, total number of applicants for the first week was found to be 2,030 with a 95% confidence interval (1.654 and 2.459). The observed value for the first week is 1.965 (For forecasted values of applicants in each region check tables through 29-32 in Appendix B).

Considering the recent economic crises in Turkey that broke out in the middle of 2008, one may expect that application for the CCT program tend to increase after that period. However, it was not the case. As seen in Figure 3, the tendency to apply for the CCT program in 2007 is similar to those in 2008. The highest application rate in those years is observed between time period August and December which seem to follow a seasonal behavior.

In the pilot stage of the CCT program in 2003 average number of beneficiary households over the Turkey was around 1,200. However, after 2004, by rolling out of the program all over the country, the total number of beneficiary households rose up quickly. It reached 16,000 in Southeastern Anatolia Region during May 2004. Hence, after rolling out of the program in 2004, the demands for the CCT program and number of beneficiary households with respect to these demands rose up until 2006. After this year, they tend to decrease.

In order to model the total number of weekly beneficiary household series according to geographical region for the CCT program a VARX(1,2) model was fitted to data. After the insignificant parameters are removed from the model a restricted VARX(1,2) was obtained. In almost all regions the weekly total number of beneficiary households in one region is only affected by its past values not the other regions. According to the model adequacy results it can be inferred that residuals in Aegean, Central Anatolia, Marmara, Blacksea and Eastern Anatolia Regions follow a normal distribution with zero mean and constant variance. Normality assumptions for the residuals in Mediterranean and Southeastern Anatolia Regions were unable to be satisfied due to outliers in those regions. Unfortunately the effects of outliers were unable to be removed from the model.

According to the plots of beneficiary household series versus predicted values, the fitted VARX(1,2) model with respect to geographical regions seems to be quite satisfactory. Due to including exogenous variables in the model, prediction and forecast errors are observed quite small. By using conditional forecast method, following ten weeks of beneficiary household according to geographical region was obtained. According to forecast result, total number of beneficiary household for the first week was found to be 4,078 with a 95% confidence interval (3,603 and 4,592). The observed value for the first week is 3,994. (For forecasted values of beneficiary households in each region check tables through 33-36 in Appendix B).

Multivariate ARCH and GARCH models were also tried to be fitted for the applicants and beneficiary household series. However most of the statistical packages are not capable of fitting those models. Although MGARCH models are experimental in SAS 9.1.3, models up to two-dimensional or in some cases up to three-dimensional system can be fitted. But, exogenous variables cannot be included in the MGARCH models in SAS although theoretically it is possible. Due to optimization technique used in MGARCH models, including high number of parameters are not acceptable. For the applicant series in Mediterranean and Southeastern Anatolia Regions this type of modeling is used but R-square and DW statistic are not quite good because of not including the exogenous variables in the models. Hence, as a future study it would be quite helpful to study on Multivariate ARCH and GARCH models with exogenous variables in statistical software programs having more than three-dimensional cases.

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APPENDIX A

LEAST SQUARES ESTIMATION OF MODEL PARAMETERS

Table 25. LSE of Model Parameters, Standard Errors and P-Values for VARX(7,2) (Applicants)

EQUATION	PAR.	EST.	STD. ERROR	t - VAL.	PR > |t|	VARIABLE
abast	XL0_1_1	0.55659	0.00217	256.47	**0.0001**	**anuft(t)**
	XL1_1_1	-0.16618	0.03158	-5.26	**0.0001**	**anuft(t-1)**
	XL2_1_1	0.00029	0.00215	0.13	0.8939	**anuft(t-2)**
	AR1_1_1	0.28223	0.05812	4.86	**0.0001**	**abast(t-1)**
	AR1_1_2	0.00352	0.01173	0.3	0.7646	**ebast(t-1)**
	AR1_1_3	0.00316	0.01079	0.29	0.7702	**ibast(t-1)**
	AR1_1_4	0.00836	0.00962	0.87	0.3858	**mbast(t-1)**
	AR1_1_5	0.01441	0.00984	1.47	0.144	**kbast(t-1)**
	AR1_1_6	-0.0168	0.00553	-3.04	**0.0026**	**dbast(t-1)**
	AR1_1_7	0.0058	0.0038	1.53	0.1277	**gbast(t-1)**
	AR7_1_1	0.01659	0.00612	2.71	**0.0071**	**abast(t-7)**
	AR7_1_2	-0.0234	0.01223	-1.91	**0.0568**	**ebast(t-7)**
	AR7_1_3	-0.00911	0.0103	-0.88	0.3773	**ibast(t-7)**
	AR7_1_4	-0.00135	0.00966	-0.14	0.8888	**mbast(t-7)**
	AR7_1_5	0.00027	0.01009	0.03	0.9786	**kbast(t-7)**
	AR7_1_6	-0.00055	0.00535	-0.1	0.9187	**dbast(t-7)**
	AR7_1_7	0.0006	0.00382	0.16	0.8754	**gbast(t-7)**
ebast	XL0_2_2	0.58455	0.00204	286.58	**0.0001**	**enuft(t)**
	XL1_2_2	-0.15226	0.03193	-4.77	**0.0001**	**enuft(t-1)**
	XL2_2_2	0.00459	0.00195	2.35	**0.0197**	**enuft(t-2)**
	AR1_2_1	-0.00818	0.00324	-2.52	**0.0122**	**abast(t-1)**
	AR1_2_2	0.26257	0.05468	4.8	**0.0001**	**ebast(t-1)**
	AR1_2_3	0.00899	0.00586	1.53	0.1263	**ibast(t-1)**
	AR1_2_4	-0.0083	0.00529	-1.57	0.1174	**mbast(t-1)**
	AR1_2_5	0.01011	0.0055	1.84	**0.067**	**kbast(t-1)**
	AR1_2_6	0.00235	0.0031	0.76	0.4479	**dbast(t-1)**

Table 25. (Continued)

EQUATION	PAR.	EST.	STD. ERROR	t - VAL.	PR > |t|	VARIABLE
ebast	AR1_2_7	-0.00218	0.00208	-1.05	0.2942	**gbast(t-1)**
	AR7_2_1	0.00366	0.00322	1.14	0.2566	**abast(t-7)**
	AR7_2_2	0.00493	0.00674	0.73	0.465	**ebast(t-7)**
	AR7_2_3	-0.00222	0.00563	-0.39	0.6937	**ibast(t-7)**
	AR7_2_4	-0.00474	0.00534	-0.89	0.3751	**mbast(t-7)**
	AR7_2_5	-0.01403	0.00547	-2.57	**0.0108**	**kbast(t-7)**
	AR7_2_6	0.00752	0.00292	2.57	**0.0106**	**dbast(t-7)**
	AR7_2_7	-0.00117	0.00208	-0.56	0.5756	**gbast(t-7)**
ibast	XL0_3_3	0.56713	0.00164	346.73	**0.0001**	**inuft(t)**
	XL1_3_3	-0.18485	0.02754	-6.71	**0.0001**	**inuft(t-1)**
	XL2_3_3	0.00247	0.00163	1.52	0.1309	**inuft(t-2)**
	AR1_3_1	0.00079	0.00363	0.22	0.8267	**abast(t-1)**
	AR1_3_2	-0.00533	0.00717	-0.74	0.4583	**ebast(t-1)**
	AR1_3_3	0.33863	0.04757	7.12	**0.0001**	**ibast(t-1)**
	AR1_3_4	-0.00972	0.00598	-1.63	0.1053	**mbast(t-1)**
	AR1_3_5	-0.0005	0.00611	-0.08	0.9352	**kbast(t-1)**
	AR1_3_6	0.00072	0.00342	0.21	0.8331	**dbast(t-1)**
	AR1_3_7	0.00072	0.00233	0.31	0.7588	**gbast(t-1)**
	AR7_3_1	0.01291	0.00363	3.55	**0.0004**	**abast(t-7)**
	AR7_3_2	0.00864	0.0075	1.15	0.2505	**ebast(t-7)**
	AR7_3_3	0.00205	0.00635	0.32	0.7474	**ibast(t-7)**
	AR7_3_4	-0.00701	0.00602	-1.17	0.245	**mbast(t-7)**
	AR7_3_5	-0.00781	0.0062	-1.26	0.2087	**kbast(t-7)**
	AR7_3_6	-0.00372	0.00331	-1.12	0.2626	**dbast(t-7)**
	AR7_3_7	-0.00282	0.00235	-1.2	0.2326	**gbast(t-7)**
mbast	XL0_4_4	0.56742	0.00199	284.56	**0.0001**	**mnuft(t)**
	XL1_4_4	-0.28855	0.02462	-11.72	**0.0001**	**mnuft(t-1)**
	XL2_4_4	0.00052	0.00189	0.28	0.7815	**mnuft(t-2)**
	AR1_4_1	0.001	0.00408	0.24	0.8069	**abast(t-1)**
	AR1_4_2	-0.00101	0.00808	-0.13	0.9006	**ebast(t-1)**
	AR1_4_3	0.00402	0.00737	0.55	0.5858	**ibast(t-1)**
	AR1_4_4	0.49859	0.04405	11.32	**0.0001**	**mbast(t-1)**
	AR1_4_5	0.00233	0.00693	0.34	0.737	**kbast(t-1)**
	AR1_4_6	0.00428	0.00382	1.12	0.2639	**dbast(t-1)**
	AR1_4_7	-0.00024	0.00263	-0.09	0.9267	**gbast(t-1)**
	AR7_4_1	0.00538	0.00408	1.32	0.1885	**abast(t-7)**
	AR7_4_2	0.01914	0.00845	2.26	**0.0244**	**ebast(t-7)**

Table 25. (Continued)

EQUATION	PAR.	EST.	STD. ERROR	t - VAL.	PR > |t|	VARIABLE
mbast	AR7_4_3	0.00244	0.00714	0.34	0.7331	**ibast(t-7)**
	AR7_4_4	-0.01743	0.00698	-2.5	**0.0131**	**mbast(t-7)**
	AR7_4_5	-0.00855	0.00695	-1.23	0.2194	**kbast(t-7)**
	AR7_4_6	-0.0014	0.00371	-0.38	0.7071	**dbast(t-7)**
	AR7_4_7	0.00114	0.00262	0.44	0.6638	**gbast(t-7)**
kbast	XL0_5_5	0.56006	0.00168	333.25	**0.0001**	**knuft(t)**
	XL1_5_5	-0.12487	0.03002	-4.16	**0.0001**	**knuft(t-1)**
	XL2_5_5	-0.00028	0.0017	-0.16	0.8709	**knuft(t-2)**
	AR1_5_1	-0.00062	0.00345	-0.18	0.8578	**abast(t-1)**
	AR1_5_2	-0.01627	0.00692	-2.35	**0.0193**	**ebast(t-1)**
	AR1_5_3	0.00256	0.00627	0.41	0.6839	**ibast(t-1)**
	AR1_5_4	0.00057	0.00564	0.1	0.919	**mbast(t-1)**
	AR1_5_5	0.23097	0.05298	4.36	**0.0001**	**kbast(t-1)**
	AR1_5_6	-0.00109	0.00323	-0.34	0.7369	**dbast(t-1)**
	AR1_5_7	0.00299	0.00223	1.34	0.1803	**gbast(t-1)**
	AR7_5_1	0.00556	0.00349	1.59	0.1124	**abast(t-7)**
	AR7_5_2	-0.00269	0.00723	-0.37	0.7107	**ebast(t-7)**
	AR7_5_3	0.00709	0.00603	1.18	0.2408	**ibast(t-7)**
	AR7_5_4	-0.00456	0.00576	-0.79	0.429	**mbast(t-7)**
	AR7_5_5	-0.014	0.00594	-2.36	**0.0192**	**kbast(t-7)**
	AR7_5_6	0.00579	0.00315	1.84	0.0673	**dbast(t-7)**
	AR7_5_7	-0.00113	0.00224	-0.51	0.6131	**gbast(t-7)**
dbast	XL0_6_6	0.49502	0.00212	233.03	**0.0001**	**dnuft(t)**
	XL1_6_6	-0.30892	0.02115	-14.6	**0.0001**	**dnuft(t-1)**
	XL2_6_6	0.00257	0.00205	1.25	0.2127	**dnuft(t-2)**
	AR1_6_1	-0.01994	0.00831	-2.4	**0.0171**	**abast(t-1)**
	AR1_6_2	0.06306	0.01632	3.86	**0.0001**	**ebast(t-1)**
	AR1_6_3	-0.02739	0.01475	-1.86	**0.0645**	**ibast(t-1)**
	AR1_6_4	0.00192	0.01341	0.14	0.8861	**mbast(t-1)**
	AR1_6_5	-0.02645	0.01375	-1.92	**0.0555**	**kbast(t-1)**
	AR1_6_6	0.63323	0.04366	14.5	**0.0001**	**dbast(t-1)**
	AR1_6_7	-0.0015	0.00528	-0.29	0.7758	**gbast(t-1)**
	AR7_6_1	0.00138	0.00826	0.17	0.8671	**abast(t-7)**
	AR7_6_2	0.03246	0.01718	1.89	0.0599	**ebast(t-7)**

Table 25. (Continued)

EQUATION	PAR.	EST.	STD. ERROR	t - VAL.	PR > |t|	VARIABLE
dbast	AR7_6_3	-0.00013	0.01428	-0.01	0.9925	**ibast(t-7)**
	AR7_6_4	0.00059	0.0135	0.04	0.9651	**mbast(t-7)**
	AR7_6_5	-0.03249	0.01434	-2.27	0.0243	**kbast(t-7)**
	AR7_6_6	-0.00245	0.00752	-0.33	0.7449	**dbast(t-7)**
	AR7_6_7	0.0055	0.0053	1.04	0.3005	**gbast(t-7)**
gbast	XL0_7_7	0.45937	0.0021	218.34	**0.0001**	**gnuft(t)**
	XL1_7_7	-0.24528	0.02014	-12.18	**0.0001**	**gnuft(t-1)**
	XL2_7_7	-0.00326	0.00208	-1.57	0.1182	**gnuft(t-2)**
	AR1_7_1	0.00474	0.01258	0.38	0.7066	**abast(t-1)**
	AR1_7_2	-0.04791	0.02506	-1.91	**0.0569**	**ebast(t-1)**
	AR1_7_3	-0.00993	0.02274	-0.44	0.6626	**ibast(t-1)**
	AR1_7_4	-0.00259	0.02068	-0.13	0.9004	**mbast(t-1)**
	AR1_7_5	0.01614	0.02114	0.76	0.446	**kbast(t-1)**
	AR1_7_6	0.00871	0.01173	0.74	0.4583	**dbast(t-1)**
	AR1_7_7	0.5384	0.04485	12	**0.0001**	**gbast(t-1)**
	AR7_7_1	0.00067	0.01253	0.05	0.9574	**abast(t-7)**
	AR7_7_2	0.04962	0.02594	1.91	**0.0568**	**ebast(t-7)**
	AR7_7_3	-0.04036	0.022	-1.83	**0.0676**	**ibast(t-7)**
	AR7_7_4	-0.03191	0.02085	-1.53	0.1272	**mbast(t-7)**
	AR7_7_5	-0.02082	0.02134	-0.98	0.3301	**kbast(t-7)**
	AR7_7_6	0.00725	0.01137	0.64	0.5242	**dbast(t-7)**
	AR7_7_7	0.01059	0.00817	1.3	0.196	**gbast(t-7)**

Table 26. LSE of Model Parameters, Standard Errors and P-Values for Restricted VARX(7,2) (Applicants)

EQUATION	PAR.	EST.	STD. ERROR	t - VAL.	PR > |t|	VARIABLE
abast	XL0_1_1	0.55651	0.00215	259.01	**0.0001**	**anuft(t)**
	XL1_1_1	-0.17203	0.03041	-5.66	**0.0001**	**anuft(t-1)**
	XL2_1_1	0.0007	0.00208	0.34	0.7372	**anuft(t-2)**
	AR1_1_1	0.29466	0.05587	5.27	**0.0001**	**abast(t-1)**
	AR1_1_5	0.019	0.00827	2.3	0.0223	**kbast(t-1)**
	AR1_1_6	-0.01505	0.00455	-3.31	**0.0011**	**dbast(t-1)**
	AR1_1_7	0.0069	0.00336	2.05	**0.0411**	**gbast(t-1)**
	AR7_1_1	0.01332	0.00491	2.71	**0.0071**	**abast(t-7)**
	AR7_1_2	-0.03023	0.00771	-3.92	**0.0001**	**ebast(t-7)**

Table 26. (Continued)

EQUATION	PAR.	EST.	STD. ERROR	t - VAL.	PR > |t|	VARIABLE
ebast	XL0_2_2	0.58478	0.00196	298.13	**0.0001**	**enuft(t)**
	XL1_2_2	-0.15021	0.03054	-4.92	**0.0001**	**enuft(t-1)**
	XL2_2_2	0.00465	0.00189	2.47	**0.0143**	**enuft(t-2)**
	AR1_2_1	-0.00831	0.00275	-3.03	**0.0027**	**abast(t-1)**
	AR1_2_2	0.2602	0.05236	4.97	**0.0001**	**ebast(t-1)**
	AR1_2_5	0.00936	0.00427	2.19	**0.0291**	**kbast(t-1)**
	AR7_2_5	-0.01352	0.00334	-4.04	**0.0001**	**kbast(t-7)**
	AR7_2_6	0.00687	0.00201	3.42	**0.0007**	**dbast(t-7)**
ibast	XL0_3_3	0.56757	0.00157	360.7	**0.0001**	**inuft(t)**
	XL1_3_3	-0.19632	0.02601	-7.55	**0.0001**	**inuft(t-1)**
	XL2_3_3	0.00283	0.00157	1.8	**0.0732**	**inuft(t-2)**
	AR1_3_3	0.34939	0.04555	7.67	**0.0001**	**ibast(t-1)**
	AR7_3_1	0.00725	0.0025	2.9	**0.0041**	**abast(t-7)**
	AR7_3_7	-0.00481	0.0014	-3.45	**0.0007**	**gbast(t-7)**
mbast	XL0_4_4	0.56771	0.00193	294.3	**0.0001**	**mnuft(t)**
	XL1_4_4	-0.29247	0.02349	-12.45	**0.0001**	**mnuft(t-1)**
	XL2_4_4	0.00062	0.00183	0.34	0.7362	**mnuft(t-2)**
	AR1_4_4	0.51795	0.04106	12.61	**0.0001**	**mbast(t-1)**
	AR7_4_2	0.01246	0.00553	2.25	**0.0251**	**ebast(t-7)**
	AR7_4_4	-0.01097	0.00454	-2.41	**0.0164**	**mbast(t-7)**
kbast	XL0_5_5	0.55999	0.00163	344.33	**0.0001**	**knuft(t)**
	XL1_5_5	-0.13271	0.0284	-4.67	**0.0001**	**knuft(t-1)**
	XL2_5_5	-0.00013	0.00164	-0.08	0.9386	**knuft(t-2)**
	AR1_5_2	-0.00969	0.00516	-1.88	**0.0613**	**ebast(t-1)**
	AR1_5_5	0.24646	0.05018	4.91	**0.0001**	**kbast(t-1)**
	AR7_5_5	-0.00939	0.00362	-2.59	**0.0101**	**kbast(t-7)**
	AR7_5_6	0.00594	0.00215	2.77	**0.006**	**dbast(t-7)**
dbast	XL0_6_6	0.49504	0.00204	242.1	**0.0001**	**dnuft(t)**
	XL1_6_6	-0.30797	0.02088	-14.75	**0.0001**	**dnuft(t-1)**
	XL2_6_6	0.0029	0.00201	1.45	**0.1493**	**dnuft(t-2)**
	AR1_6_1	-0.02098	0.00753	-2.79	**0.0057**	**abast(t-1)**
	AR1_6_2	0.07462	0.01438	5.19	**0.0001**	**ebast(t-1)**
	AR1_6_3	-0.02789	0.01223	-2.28	**0.0234**	**ibast(t-1)**

Table 26. (Continued)

EQUATION	PAR.	EST.	STD. ERROR	t - VAL.	PR > |t|	VARIABLE
dbast	AR1_6_5	-0.03135	0.01205	-2.6	**0.0098**	**kbast(t-1)**
	AR1_6_6	0.62893	0.04279	14.7	**0.0001**	**dbast(t-1)**
	AR7_6_2	0.03457	0.01407	2.46	**0.0147**	**ebast(t-7)**
	AR7_6_5	-0.02341	0.01046	-2.24	**0.026**	**kbast(t-7)**
gbast	XL0_7_7	0.45935	0.002	229.79	**0.0001**	**gnuft(t)**
	XL1_7_7	-0.24934	0.01957	-12.74	**0.0001**	**gnuft(t-1)**
	XL2_7_7	-0.00225	0.00196	-1.15	0.2521	**gnuft(t-2)**
	AR1_7_7	0.54072	0.04216	12.82	**0.0001**	**gbast(t-1)**
	AR7_7_2	0.04088	0.01967	2.08	**0.0387**	**ebast(t-7)**
	AR7_7_3	-0.04523	0.01435	-3.15	**0.0018**	**ibast(t-7)**

Table 27. LSE of Model Parameters, Standard Errors and P-Values for VARX(1,2) (Beneficiary Households)

EQUATION	PAR.	EST.	STD. ERROR	t - VAL.	PR > |t|	VARIABLE
ahakt	XL0_1_1	0.53887	0.00268	201.03	**0.0001**	**ahaknuft(t)**
	XL1_1_1	-0.15776	0.03092	-5.1	**0.0001**	**ahaknuft(t-1)**
	XL2_1_1	0.00279	0.00266	1.05	0.2959	**ahaknuft(t-2)**
	AR1_1_1	0.26617	0.05805	4.59	**0.0001**	**ahakt(t-1)**
	AR1_1_2	0.00908	0.0157	0.58	0.5637	**ehakt(t-1)**
	AR1_1_3	0.0038	0.01171	0.32	0.7457	**ihakt(t-1)**
	AR1_1_4	0.02632	0.01643	1.6	0.1103	**mhakt(t-1)**
	AR1_1_5	-0.00186	0.01383	-0.13	0.8932	**khakt(t-1)**
	AR1_1_6	-0.00387	0.00531	-0.73	0.4669	**dhakt(t-1)**
	AR1_1_7	0.00354	0.00383	0.92	0.356	**ghakt(t-1)**
ehakt	XL0_2_2	0.5517	0.00256	215.43	**0.0001**	**ehaknuft(t)**
	XL1_2_2	-0.13711	0.02821	-4.86	**0.0001**	**ehaknuft(t-1)**
	XL2_2_2	0.0071	0.00257	2.76	**0.0062**	**ehaknuft(t-2)**
	AR1_2_1	-0.00645	0.00457	-1.41	0.1587	**ahakt(t-1)**
	AR1_2_2	0.24953	0.05145	4.85	**0.0001**	**ehakt(t-1)**
	AR1_2_3	0.01794	0.00692	2.59	**0.0101**	**ihakt(t-1)**
	AR1_2_4	-0.00192	0.00967	-0.2	0.8429	**mhakt(t-1)**
	AR1_2_5	0.00956	0.00821	1.16	0.2454	**khakt(t-1)**
	AR1_2_6	-0.0023	0.00317	-0.73	0.4674	**dhakt(t-1)**
	AR1_2_7	-0.00364	0.00224	-1.62	0.1058	**ghakt(t-1)**
ihakt	XL0_3_3	0.54249	0.00175	310.11	**0.0001**	**ihaknuft(t)**
	XL1_3_3	-0.14146	0.02499	-5.66	**0.0001**	**ihaknuft(t-1)**

Table 27. (Continued)

EQUATION	PAR.	EST.	STD. ERROR	t - VAL.	PR > |t|	VARIABLE
ihakt	XL2_3_3	0.00327	0.00175	1.87	**0.063**	**ihaknuft(t-2)**
	AR1_3_1	-0.00524	0.00447	-1.17	0.2425	**ahakt(t-1)**
	AR1_3_2	-0.00729	0.00907	-0.8	0.4223	**ehakt(t-1)**
	AR1_3_3	0.27184	0.04567	5.95	**0.0001**	**ihakt(t-1)**
	AR1_3_4	0.00948	0.0096	0.99	0.3242	**mhakt(t-1)**
	AR1_3_5	-0.00024	0.00801	-0.03	0.9764	**khakt(t-1)**
	AR1_3_6	-0.00357	0.00309	-1.16	0.2482	**dhakt(t-1)**
	AR1_3_7	0.00287	0.00223	1.29	0.1992	**ghakt(t-1)**
mhakt	XL0_4_4	0.56218	0.00324	173.44	**0.0001**	**mhaknuft(t)**
	XL1_4_4	-0.23899	0.0247	-9.67	**0.0001**	**mhaknuft(t-1)**
	XL2_4_4	0.00315	0.00324	0.97	0.3322	**mhaknuft(t-2)**
	AR1_4_1	-0.00629	0.00527	-1.19	0.2334	**ahakt(t-1)**
	AR1_4_2	-0.00392	0.01068	-0.37	0.714	**ehakt(t-1)**
	AR1_4_3	0.00426	0.008	0.53	0.5948	**ihakt(t-1)**
	AR1_4_4	0.43751	0.04412	9.92	**0.0001**	**mhakt(t-1)**
	AR1_4_5	0.01322	0.00943	1.4	0.1621	**khakt(t-1)**
	AR1_4_6	0.00016	0.00365	0.04	0.9659	**dhakt(t-1)**
	AR1_4_7	-0.0033	0.00262	-1.26	0.2097	**ghakt(t-1)**
khakt	XL0_5_5	0.5626	0.00197	284.95	**0.0001**	**khaknuft(t)**
	XL1_5_5	-0.06149	0.02742	-2.24	**0.0257**	**khaknuft(t-1)**
	XL2_5_5	0.00546	0.00194	2.82	**0.0052**	**khaknuft(t-2)**
	AR1_5_1	0.00167	0.00399	0.42	0.6765	**ahakt(t-1)**
	AR1_5_2	-0.01846	0.00817	-2.26	**0.0246**	**ehakt(t-1)**
	AR1_5_3	0.01186	0.00616	1.92	**0.0554**	**ihakt(t-1)**
	AR1_5_4	0.0207	0.00859	2.41	**0.0166**	**mhakt(t-1)**
	AR1_5_5	0.09962	0.04906	2.03	**0.0433**	**khakt(t-1)**
	AR1_5_6	-0.00138	0.00277	-0.5	0.6176	**dhakt(t-1)**
	AR1_5_7	-0.00081	0.002	-0.4	0.6874	**ghakt(t-1)**
dhakt	XL0_6_6	0.49296	0.00186	265.06	**0.0001**	**dhaknuft(t)**
	XL1_6_6	-0.29699	0.02119	-14.01	**0.0001**	**dhaknuft(t-1)**
	XL2_6_6	0.00153	0.00186	0.82	0.4119	**dhaknuft(t-2)**
	AR1_6_1	-0.00367	0.00907	-0.4	0.6863	**ahakt(t-1)**
	AR1_6_2	0.05737	0.01841	3.12	**0.002**	**ehakt(t-1)**
	AR1_6_3	-0.02781	0.01387	-2.01	**0.0459**	**ihakt(t-1)**

Table 27. (Continued)

EQUATION	PAR.	EST.	STD. ERROR	t - VAL.	PR > |t|	VARIABLE
dhakt	AR1_6_4	-0.00935	0.01945	-0.48	0.6313	**mhakt(t-1)**
	AR1_6_5	-0.01184	0.01616	-0.73	0.4643	**khakt(t-1)**
	AR1_6_6	0.60652	0.04396	13.8	**0.0001**	**dhakt(t-1)**
	AR1_6_7	-0.00208	0.00452	-0.46	0.6461	**ghakt(t-1)**
ghakt	XL0_7_7	0.45097	0.00194	232.79	**0.0001**	**ghaknuft(t)**
	XL1_7_7	-0.21864	0.02078	-10.52	**0.0001**	**ghaknuft(t-1)**
	XL2_7_7	-0.00209	0.00194	-1.08	0.2824	**ghaknuft(t-2)**
	AR1_7_1	0.02181	0.01488	1.47	0.1437	**ahakt(t-1)**
	AR1_7_2	-0.04174	0.0306	-1.36	0.1737	**ehakt(t-1)**
	AR1_7_3	-0.02174	0.02275	-0.96	0.34	**ihakt(t-1)**
	AR1_7_4	0.0117	0.03207	0.36	0.7156	**mhakt(t-1)**
	AR1_7_5	0.01485	0.02679	0.55	0.5799	**khakt(t-1)**
	AR1_7_6	0.0016	0.01038	0.15	0.8779	**dhakt(t-1)**
	AR1_7_7	0.48734	0.04685	10.4	**0.0001**	**ghakt(t-1)**

Table 28. LSE of Model Parameters. Standard Errors and P-Values for Restricted VARX(1.2) (Beneficiary Households)

EQUATION	PAR.	EST.	STD. ERROR	t - VAL.	PR > |t|	VARIABLE
ahakt	XL0_1_1	0.53916	0.00266	202.9	**0.0001**	**ahaknuft(t)**
	XL1_1_1	-0.16481	0.03024	-5.45	**0.0001**	**ahaknuft(t-1)**
	XL2_1_1	0.00275	0.00263	1.04	0.297	**ahaknuft(t-2)**
	AR1_1_1	0.28189	0.05647	4.99	**0.0001**	**ahakt(t-1)**
	AR1_1_4	0.03505	0.01167	3	0.0029	**mhakt(t-1)**
ehakt	XL0_2_2	0.55263	0.00254	217.57	**0.0001**	**ehaknuft(t)**
	XL1_2_2	-0.15351	0.02634	-5.83	**0.0001**	**ehaknuft(t-1)**
	XL2_2_2	0.00724	0.00253	2.86	**0.0046**	**ehaknuft(t-2)**
	AR1_2_2	0.27611	0.04782	5.77	**0.0001**	**ehakt(t-1)**
	AR1_2_3	0.00795	0.00465	1.71	**0.0888**	**ihakt(t-1)**
ihakt	XL0_3_3	0.54298	0.00173	313.31	**0.0001**	**ihaknuft(t)**
	XL1_3_3	-0.14407	0.02454	-5.87	**0.0001**	**ihaknuft(t-1)**
	XL2_3_3	0.00304	0.00173	1.76	**0.0796**	**ihaknuft(t-2)**
	AR1_3_3	0.27371	0.04495	6.09	**0.0001**	**ihakt(t-1)**
mhakt	XL0_4_4	0.56318	0.00321	175.22	**0.0001**	**mhaknuft(t)**
	XL1_4_4	-0.24616	0.02427	-10.14	**0.0001**	**mhaknuft(t-1)**
	XL2_4_4	0.00334	0.0032	1.04	0.2978	**mhaknuft(t-2)**

Table 28. (Continued)

EQUATION	PAR.	EST.	STD. ERROR	t - VAL.	PR > |t|	VARIABLE
mhakt	AR1_4_4	0.4482	0.04248	10.55	**0.0001**	**mhakt(t-1)**
	XL0_5_5	0.56274	0.00196	287.77	**0.0001**	**khaknuft(t)**
	XL1_5_5	-0.06449	0.02729	-2.36	**0.0188**	**khaknuft(t-1)**
	XL2_5_5	0.00526	0.00192	2.74	**0.0065**	**khaknuft(t-2)**
	AR1_5_2	-0.01649	0.00687	-2.4	**0.0171**	**ehakt(t-1)**
	AR1_5_3	0.00939	0.00474	1.98	**0.0484**	**ihakt(t-1)**
	AR1_5_4	0.01925	0.00702	2.74	**0.0065**	**mhakt(t-1)**
	AR1_5_5	0.10525	0.04867	2.16	**0.0314**	**khakt(t-1)**
dhakt	XL0_6_6	0.49289	0.00184	268.6	**0.0001**	**dhaknuft(t)**
	XL1_6_6	-0.29561	0.02112	-13.99	**0.0001**	**dhaknuft(t-1)**
	XL2_6_6	0.00156	0.00185	0.85	0.3987	**dhaknuft(t-2)**
	AR1_6_2	0.04871	0.01537	3.17	**0.0017**	**ehakt(t-1)**
	AR1_6_3	-0.03798	0.01157	-3.28	**0.0012**	**ihakt(t-1)**
	AR1_6_6	0.60061	0.04359	13.78	**0.0001**	**dhakt(t-1)**
ghakt	XL0_7_7	0.45088	0.00191	236.02	**0.0001**	**ghaknuft(t)**
	XL1_7_7	-0.22185	0.02049	-10.83	**0.0001**	**ghaknuft(t-1)**
	XL2_7_7	-0.00171	0.00189	-0.91	0.365	**ghaknuft(t-2)**
	AR1_7_7	0.49329	0.04506	10.95	**0.0001**	**ghakt(t-1)**

APPENDIX B

FORECASTED VALUES. LOWER AND UPPER FORECAST LIMITS FOR THE WEEKLY TOTAL NUMBER OF APPLICANTS AND BENEFICIARY HOUSEHOLDS ACCORDING TO GEOGRAPHICAL REGIONS

Table 29. Forecasted Values. Lower and Upper Forecast Limits for the Weekly Total Number of CCT Applicants in Mediterranean and Aegean Regions

MEDITERRANEAN REGION					AEGEAN REGION			
DATE	**FOREC.**	**OBS.**	**LCL**	**UCL**	**FOREC.**	**OBS.**	**LCL**	**UCL**
20.06.2009	242.21	**231**	192.42	299.65	96.63	**93**	79.14	116.56
27.06.2009	1.166.93	1.153	1.018.67	1.328.53	1.016.02	995	923.98	1.114.10
04.07.2009	1.229.62	1.211	1.075.57	1.397.33	589.48	569	526.14	657.81
11.07.2009	1.837.59	1.798	1.636.40	2.054.20	300.49	289	260.75	344.14
18.07.2009	2.266.33	2.231	2.035.14	2.513.93	245.22	236	210.70	283.38
25.07.2009	3.162.30		2.874.14	3.468.60	127.53		105.61	152.34
01.08.2009	18.26		9.33	31.13	0.00		0.00	0.00
08.08.2009	0.69		0.00	5.93	0.00		0.00	0.00
15.08.2009	1.767.14		1.493.02	2.072.03	133.34		102.18	170.34
22.08.2009	2.806.53		2.432.58	3.215.94	204.62		162.50	253.58
TOTAL	**14.497.60**		**12.767.27**	**16.387.27**	**2.713.32**		**2.370.98**	**3.092.24**

Table 30. Forecasted Values. Lower and Upper Forecast Limits for the Weekly Total Number of CCT Applicants in Marmara and Central Anatolia Regions

MARMARA					C. ANATOLIA REGION			
DATE	**FOREC.**	**OBS.**	**LCL**	**UCL**	**FOREC.**	**OBS.**	**LCL**	**UCL**
20.06.2009	313.18	**302**	263.65	368.66	79.48	**70**	64.26	96.83
27.06.2009	3.136.59	3.029	2.862.72	3.427.75	933.61	923	851.27	1.020.96
04.07.2009	927.49	906	806.44	1.060.33	747.05	742	675.52	823.32
11.07.2009	334.57	342	274.67	402.76	736.35	718	665.44	811.98
18.07.2009	937.57	952	814.55	1.072.63	394.73	404	347.79	445.60
25.07.2009	716.64		614.53	829.70	406.85		358.96	458.71
01.08.2009	0.00		0.00	0.72	0.00		0.00	0.00
08.08.2009	0.00		0.00	0.78	0.00		0.00	0.17
15.08.2009	415.36		320.64	527.47	81.82		59.30	109.19
22.08.2009	727.08		584.88	891.09	331.32		273.38	396.67
TOTAL	**7.508.48**		**6.542.07**	**8.581.89**	**3.711.20**		**3.295.91**	**4.163.43**

Table 31. Forecasted Values. Lower and Upper Forecast Limits for the Weekly Total Number of CCT Applicants in Blacksea and Eastern Anatolia Regions

BLACKSEA REGION					E. ANATOLIA REGION			
DATE	**FOREC.**	**OBS.**	**LCL**	**UCL**	**FOREC.**	**OBS.**	**LCL**	**UCL**
20.06.2009	350.79	**342**	311.92	392.67	399.84	**367**	335.17	471.20
27.06.2009	992.30	964	912.88	1.076.08	1.303.90	1.298	1.150.23	1.468.85
04.07.2009	427.13	417	381.52	476.13	755.42	742	638.67	883.66
11.07.2009	238.20	248	207.21	272.03	556.05	568	457.11	666.37
18.07.2009	337.22	329	298.21	379.40	632.23	623	524.57	751.69
25.07.2009	201.57		173.83	232.02	493.86		400.83	598.29
01.08.2009	0.00		0.00	0.40	0.00		0.00	2.21
08.08.2009	0.00		0.00	1.14	11.39		1.30	31.91
15.08.2009	148.50		117.30	184.61	196.38		125.43	286.22
22.08.2009	196.62		158.92	239.66	208.68		133.24	304.22
TOTAL	**2.892.33**		**2.561.79**	**3.254.16**	**4.557.74**		**3.766.55**	**5.464.61**

Table 32. Forecasted Values. Lower and Upper Forecast Limits for the Weekly Total Number of CCT Applicants in Southeastern Anatolia Region

SOUTHEASTERN ANATOLI REGION				
DATE	**FOREC.**	**OBS.**	**LCL**	**UCL**
20.06.2009	548.14	**560**	408.04	714.17
27.06.2009	7.294.06	7.279	6.481.90	8.165.43
04.07.2009	4.357.46	4.368	3.750.72	5.020.56
11.07.2009	6.424.47	6.397	5.644.00	7.267.43
18.07.2009	1.771.75	1.765	1.424.17	2.166.65
25.07.2009	697.55		506.13	927.58
01.08.2009	0.00		0.00	7.51
08.08.2009	0.00		0.00	14.03
15.08.2009	639.14		397.02	954.67
22.08.2009	732.85		464.13	1.079.65
TOTAL	**22.465.40**		**19.076.11**	**26.317.68**

Table 33. Forecasted Values. Lower and Upper Forecast Limits for the Weekly Total Number of CCT Beneficiary Households in Mediterranean and Aegean Regions

MEDITERRANEAN REGION					AEGEAN REGION			
DATE	**FOREC.**	**OBS.**	**LCL**	**UCL**	**FOREC.**	**OBS.**	**LCL**	**UCL**
09.05.2009	221.161	**210**	176.824	272.120	271.819	**265**	235.662	311.560
16.05.2009	0.000	1	0.000	0.851	0.000	0	0.000	0.125
23.05.2009	0.000	0	0.000	1.129	0.000	0	0.000	0.054
30.05.2009	35.443	32	22.118	52.960	99.694	106	80.966	121.138
06.06.2009	411.316	402	341.366	489.948	294.131	285	254.433	337.830
13.06.2009	513.973		432.785	604.442	288.518		249.346	331.662
20.06.2009	579.895		491.894	677.518	159.236		133.304	188.378
27.06.2009	515.021		404.790	643.070	200.652		159.332	248.675
04.07.2009	572.170		451.709	711.734	224.012		178.609	276.649
11.07.2009	341.548		256.503	443.016	103.193		76.825	135.060
TOTAL	**3.190.53**		**2.577.99**	**3.896.79**	**1.641.25**		**1.368.48**	**1.951.13**

Table 34. Forecasted Values. Lower and Upper Forecast Limits for the Weekly Total Number of CCT Beneficiary Households in Marmara and Central Anatolia Regions

MARMARA					C. ANATOLIA REGION			
DATE	**FOREC.**	**OBS.**	**LCL**	**UCL**	**FOREC.**	**OBS.**	**LCL**	**UCL**
09.05.2009	166.470	**159**	136.656	200.397	471.783	**445**	427.479	518.962
16.05.2009	0.000	0	0.000	0.000	0.000	1	0.000	0.370
23.05.2009	0.000	1	0.000	0.000	0.000	0	0.000	0.115
30.05.2009	34.501	30	23.522	48.420	108.653	102	91.249	128.061
06.06.2009	180.411	178	145.410	220.707	492.370	487	445.050	542.838
13.06.2009	222.028		181.559	268.202	461.499		416.159	509.926
20.06.2009	110.965		86.053	140.328	348.846		311.158	389.372
27.06.2009	246.884		189.628	314.838	632.164		555.628	715.232
04.07.2009	258.824		197.268	332.235	591.387		516.913	672.492
11.07.2009	79.432		52.634	114.132	186.525		151.975	225.785
TOTAL	**1.299.52**		**1.012.73**	**1.639.26**	**3.293.23**		**2.915.61**	**3.703.15**

Table 35. Forecasted Values. Lower and Upper Forecast Limits for the Weekly Total Number of CCT Beneficiary Households in Blacksea and Eastern Anatolia Regions

BLACKSEA REGION					E. ANATOLIA REGION			
DATE	**FOREC.**	**OBS.**	**LCL**	**UCL**	**FOREC.**	**OBS.**	**LCL**	**UCL**
09.05.2009	262.384	**267**	235.522	291.155	507.635	**498**	447.330	572.396
16.05.2009	0.000	1	0.000	0.000	0.000	1	0.000	1.020
23.05.2009	1.370	2	0.282	2.929	0.000	1	0.000	1.937
30.05.2009	105.345	101	90.541	121.623	92.889	96	66.361	124.646
06.06.2009	272.140	256	244.436	301.801	451.230	436	381.780	527.480
13.06.2009	282.091		253.722	312.437	493.543		420.128	573.884
20.06.2009	225.981		201.474	252.339	382.973		319.867	452.739
27.06.2009	257.712		220.586	298.661	463.906		373.536	565.785
04.07.2009	262.245		224.565	303.794	458.512		362.895	567.290
11.07.2009	110.164		89.021	134.294	327.026		247.565	419.528
TOTAL	**1.779.43**		**1.560.15**	**2.019.03**	**3.177.71**		**2.619.46**	**3.806.71**

Table 36. Forecasted Values. Lower and Upper Forecast Limits for the Weekly Total Number of CCT Beneficiary Households in Southeastern Anatolia Region

SOUTHEASTERN ANATOLI REGION				
DATE	**FOREC.**	**OBS.**	**LCL**	**UCL**
09.05.2009	2.177.058	**2.150**	1.944.120	2.425.409
16.05.2009	0.000	1	0.000	4.843
23.05.2009	0.000	2	0.000	3.456
30.05.2009	337.695	345	251.299	439.159
06.06.2009	2.733.841	2.765	2.428.832	3.059.959
13.06.2009	2.121.731		1.859.335	2.404.411
20.06.2009	1.417.056		1.210.846	1.642.284
27.06.2009	1.808.760		1.495.809	2.156.661
04.07.2009	2.271.018		1.894.627	2.687.485
11.07.2009	759.702		564.164	989.657
TOTAL	**13.626.86**		**11.649.03**	**15.813.32**

APPENDIX C

SAS CODE FOR MODELING THE WEEKLY TOTAL NUMBER OF APPLICANTS ACCORDING TO GEOGRAPHICAL REGIONS

```
PROC IMPORT OUT= WORK.fatihtez
            DATAFILE= "C:\basvuru.xls"
            DBMS=EXCEL2000 REPLACE;
     GETNAMES=YES;
RUN;
proc print data=fatihtez;run;
%boxcoxar(fatihtez. abasvuru. const=1. nlambda=60. lambdahi=1.
lambdalo=-1);
%boxcoxar(fatihtez. ebasvuru. const=1. nlambda=60. lambdahi=1.
lambdalo=-1);
%boxcoxar(fatihtez. ibasvuru. const=1. nlambda=60. lambdahi=1.
lambdalo=-1);
%boxcoxar(fatihtez. mbasvuru. const=1. nlambda=60. lambdahi=1.
lambdalo=-1);
%boxcoxar(fatihtez. kbasvuru. const=1. nlambda=60. lambdahi=1.
lambdalo=-1);
%boxcoxar(fatihtez. dbasvuru. const=1. nlambda=60. lambdahi=1.
lambdalo=-1);
%boxcoxar(fatihtez. gbasvuru. const=1. nlambda=60. lambdahi=1.
lambdalo=-1);
/* lambda is taken as 0.35 for a.i.k. 0.32 for e and m. 0.42 for g
and 0.39 for d*/

proc arima data=fatihtez;
identify var=abast minic p=7 q=7 stationarity=(adf=(1.7));
identify var=ebast minic p=7 q=7 stationarity=(adf=(1.7));
identify var=ibast minic p=7 q=7 stationarity=(adf=(1.7));
identify var=kbast minic p=7 q=7 stationarity=(adf=(1.7));
identify var=mbast minic p=7 q=7 stationarity=(adf=(1.7));
identify var=dbast minic p=7 q=7 stationarity=(adf=(1.7));
identify var=gbast minic p=7 q=7 stationarity=(adf=(1.7));
run;
/*seasonal differencing is necessary for endogenous variables in
each regions*/

proc arima data=fatihtez;
identify var=anuft minic p=7 q=7 stationarity=(adf=(1.7));
identify var=enuft minic p=7 q=7 stationarity=(adf=(1.7));
identify var=inuft minic p=7 q=7 stationarity=(adf=(1.7));
identify var=knuft minic p=7 q=7 stationarity=(adf=(1.7));
```

```
identify var=mnuft minic p=7 q=7 stationarity=(adf=(1.7));
identify var=dnuft minic p=7 q=7 stationarity=(adf=(1.7));
identify var=gnuft minic p=7 q=7 stationarity=(adf=(1.7));

run;
/*seasonal differencing is necessary for exogenous variables in each
regions*/

proc varmax data=fatihtez outest=est;
id date interval=week;
model abast = anuft . ebast = enuft . ibast = inuft . mbast = mnuft
. kbast = knuft . dbast = dnuft . gbast = gnuft / dify(7) difx(7)
dftest print=(corry parcoef pcancorr pcorr roots)
MINIC = (TYPE=AICC P=5 Q=5) noint;
 output out=resid;
run;
proc print data=est;run;

proc varmax data=fatihtez outest=est1;
id date interval=week;
model abast = anuft . ebast = enuft . ibast = inuft . mbast = mnuft
. kbast = knuft . dbast = dnuft . gbast = gnuft / dify(7) difx(7)
p=(1.7) xlag=2 dftest  print=(corry parcoef pcancorr pcorr roots)
noint;
causal group1=(abast) group2=(dbast);
causal group1=(abast) group2=(gbast);
causal group1=(mbast) group2=(dbast);
causal group1=(mbast) group2=(gbast);
restrict     AR(1.1.2)=0. AR(1.1.3)=0. AR(1.1.4)=0. AR(7.1.3)=0.
AR(7.1.4)=0. AR(7.1.5)=0. AR(7.1.6)=0. AR(7.1.7)=0.
AR(1.2.3)=0. AR(1.2.4)=0. AR(1.2.6)=0. AR(1.2.7)=0. AR(7.2.1)=0.
AR(7.2.2)=0. AR(7.2.3)=0. AR(7.2.4)=0. AR(7.2.7)=0.
AR(1.3.1)=0. AR(1.3.2)=0. AR(1.3.4)=0. AR(1.3.5)=0. AR(1.3.6)=0.
AR(1.3.7)=0. AR(7.3.2)=0. AR(7.3.3)=0.AR(7.3.5)=0. AR(7.3.4)=0.
AR(7.3.6)=0.
AR(1.4.1)=0. AR(1.4.2)=0. AR(1.4.3)=0. AR(1.4.5)=0. AR(1.4.6)=0.
AR(1.4.7)=0. AR(7.4.1)=0. AR(7.4.3)=0. AR(7.4.5)=0. AR(7.4.6)=0.
AR(7.4.7)=0.
AR(1.5.1)=0. AR(1.5.3)=0. AR(1.5.4)=0. AR(1.5.6)=0. AR(1.5.7)=0.
AR(7.5.1)=0. AR(7.5.2)=0. AR(7.5.3)=0. AR(7.5.4)=0. AR(7.5.7)=0.
AR(1.6.4)=0. AR(1.6.7)=0. AR(7.6.1)=0. AR(7.6.3)=0. AR(7.6.4)=0.
AR(7.6.6)=0. AR(7.6.7)=0.
AR(1.7.1)=0. AR(1.7.2)=0. AR(1.7.3)=0. AR(1.7.4)=0. AR(1.7.5)=0.
AR(1.7.6)=0. AR(7.7.1)=0. AR(7.7.4)=0. AR(7.7.5)=0. AR(7.7.6)=0.
AR(7.7.7)=0;
output out=forecast1 lead=10;
run;
proc print data=est1;run;
proc print data=forecast1;run;
```

APPENDIX D

SAS CODE FOR MODELING THE WEEKLY TOTAL NUMBER OF BENEFICIARY HOUSEHOLDS ACCORDING TO GEOGRAPHICAL REGIONS

```
PROC IMPORT OUT= WORK.fatihtez
            DATAFILE= "C:\haksahibi.xls"
            DBMS=EXCEL2000 REPLACE;
     GETNAMES=YES;
RUN;
proc print data=fatihtez;run;
%boxcoxar(fatihtez. ahak. const=1. nlambda=60. lambdahi=1.
lambdalo=-1);
%boxcoxar(fatihtez. ehak. const=1. nlambda=60. lambdahi=1.
lambdalo=-1);
%boxcoxar(fatihtez. ihak. const=1. nlambda=60. lambdahi=1.
lambdalo=-1);
%boxcoxar(fatihtez. mhak. const=1. nlambda=60. lambdahi=1.
lambdalo=-1);
%boxcoxar(fatihtez. khak. const=1. nlambda=60. lambdahi=1.
lambdalo=-1);
%boxcoxar(fatihtez. dhak. const=1. nlambda=60. lambdahi=1.
lambdalo=-1);
%boxcoxar(fatihtez. ghak. const=1. nlambda=60. lambdahi=1.
lambdalo=-1);
/* lambda is taken as 0.35 for a and i. 0.32 for e and k. 0.28 for
m. 0.42 for g and 0.38 for d*/

proc arima data=fatihtez;
identify var=ahakt minic p=7 q=7 stationarity=(adf=(1.7));
identify var=ehakt minic p=7 q=7 stationarity=(adf=(1.7));
identify var=ihakt minic p=7 q=7 stationarity=(adf=(1.7));
identify var=khakt minic p=7 q=7 stationarity=(adf=(1.7));
identify var=mhakt minic p=7 q=7 stationarity=(adf=(1.7));
identify var=dhakt minic p=7 q=7 stationarity=(adf=(1.7));
identify var=ghakt minic p=7 q=7 stationarity=(adf=(1.7));
run;
/*seasonal differencing is necessary for endogenous variables in
each regions*/

proc arima data=fatihtez;
identify var=ahaknuft minic p=7 q=7 stationarity=(adf=(1.7));
identify var=ehaknuft minic p=7 q=7 stationarity=(adf=(1.7));
identify var=ihaknuft minic p=7 q=7 stationarity=(adf=(1.7));
```

```
identify var=khaknuft minic p=7 q=7 stationarity=(adf=(1.7));
identify var=mhaknuft minic p=7 q=7 stationarity=(adf=(1.7));
identify var=dhaknuft minic p=7 q=7 stationarity=(adf=(1.7));
identify var=ghaknuft minic p=7 q=7 stationarity=(adf=(1.7));
run;
/*seasonal differencing is necessary for exogenous variables in each
regions*/

proc varmax data=fatihtez;
id date interval=week;
model ahakt = ahaknuft . ehakt = ehaknuft . ihakt = ihaknuft . mhakt
= mhaknuft . khakt = khaknuft . dhakt = dhaknuft . ghakt = ghaknuft
/ dify(7) difx(7) dftest print=(corry parcoef pcancorr pcorr roots)
MINIC = (TYPE=AICC P=5 Q=5) noint;
 output out=resid;
run;

proc varmax data=fatihtez outest=est1;
id date interval=week;
model ahakt = ahaknuft . ehakt = ehaknuft . ihakt = ihaknuft . mhakt
= mhaknuft . khakt = khaknuft . dhakt = dhaknuft . ghakt = ghaknuft
/ dify(7) difx(7) p=1 xlag=2 dftest  print=(corry parcoef pcancorr
pcorr roots) noint;
causal group1=(ahakt) group2=(dhakt);
causal group1=(ahakt) group2=(ghakt);
causal group1=(mhakt) group2=(dhakt);
causal group1=(mhakt) group2=(ghakt);
restrict AR(1.1.2)=0. AR(1.1.3)=0. AR(1.1.5)=0. AR(1.1.6)=0.
AR(1.1.7)=0.
AR(1.2.1)=0. AR(1.2.4)=0. AR(1.2.5)=0. AR(1.2.6)=0. AR(1.2.7)=0.
AR(1.3.1)=0. AR(1.3.2)=0. AR(1.3.4)=0. AR(1.3.5)=0. AR(1.3.6)=0.
AR(1.3.7)=0.
AR(1.4.1)=0. AR(1.4.2)=0. AR(1.4.3)=0. AR(1.4.5)=0. AR(1.4.6)=0.
AR(1.4.7)=0.
AR(1.5.1)=0. AR(1.5.6)=0. AR(1.5.7)=0.
AR(1.6.1)=0. AR(1.6.4)=0. AR(1.6.5)=0. AR(1.6.7)=0.
AR(1.7.1)=0. AR(1.7.2)=0. AR(1.7.3)=0. AR(1.7.4)=0.  AR(1.7.5)=0.
AR(1.7.6)=0;
output out=forecast lead=10;
run; proc print data=est1;run;
```