Time Series Analysis: A Case Study on Forecasting Turkey's Inflation and Unemployment

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Abstract

Economic strategies and policies of a country is the most important factor of complete employment and secure economy throughout low inflation. This case study focused on unemployment and inflation for a particular period from 2000 to 2014. Statistical data for the period 2000 to 2014 was collected from a Turkish statistical institute website**.**

The first intention of this research is to forecast inflation and unemployment for 2015 and 2016. Inflation and unemployment has forecasted by autoregressive model as a time series method.

The second intention of this research is to determine the relationship between unemployment and inflation in Turkey for the period 2000 to 2014, through Phillips curve, which is conducted in 2014 and the simple linear regression analysis were used. The result shows that unemployment negatively effects inflation in Turkey economy and it was seen that there was a statistically significant relationship between inflation and unemployment.

Keywords: *Unemployment, Inflation, Phillips curve, Autoregressive time series model.*

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Özet

Bir ülkenin ekonomik strateji ve politikaları düşük enflasyonla birlikte tam istihdam ve güvenli ekonominin en önemli faktörüdür. Bu çalışma 2000 yılı ile 2014 yılı arası işsizlik ve enflasyona odaklanmıştır. 2000-2014 periyodu için istatistiksel veri Türkiye İstatistik Kurumu web sitesinden alınmıştır.

Araştırmanın ilk amacı 2015 ve 2016 yılları için enflasyon ve işsizliği tahmin etmektir. Eflasyon ve işsizlik bir zaman serileri yöntemi olan otoregresif model ile tahmin edilmiştir.

Araştırmanın ikinci amacı 2000-2014 periyodu için işsizlik ve enflasyon arasındaki ilişkiyi belirlemektir. Bunun için 2014 yılına ait verilerle basit doğrusal regresyon analizi uygulanmıştır. Elde edilen bulgular, Türkiye ekonomisinde işsizliğin enflasyonu negative yönde etkilediğini göstermiş ve işsizlik ile enflasyon arasında istatistiksel olarak anlamlı bir ilişki olduğu görülmüştür.

Anahtar Kelimeler: *İşsizlik, Enflasyon, Phillips eğrisi, Otoregresif zaman serileri*

Introduction

The aim of this research is to clarify the relationship between unemployment and inflation in Turkey perception of Phillips curve. Time series data shall be used for the phase 2000-2014. Unemployment rate is taken as independent variable whereas inflation rate is taken as dependent variable. The link between them would be finding by Simple Linear Regression.

The key reason of this work is to examine ways of extending the theory of inflation and unemployment. This research is about time series analysis and forecasting Turkey's inflation and unemployment. The most important purpose for selecting this topic is to get the knowledge and identify the different time series models. The idea of this schoolwork is to know the logic of inflation and unemployment strategy of Turkish Government and fluctuation of both in different years. To forecast Turkish inflation by exercising models of econometric and to describe the term of inflation and unemployment broadly by studying historical data. Turkey has practiced

extreme and insistent inflation for more than twenty years. Firstly Literature on inflation shall be cover in details so as to be able to discuss, understand and classify more about inflation. The second literature shall be about unemployment.

The autoregressive time series model will be used to forecast inflation and unemployment individually by different Lag values.

Inflation is one of the most important concepts in economics. In the basic level inflation is a rise in prices. When there is raise in the price of goods and services, than the value of dollar shall go down, as we will not be able to buy as enough with the dollar as we could have last time or last period. Mostly people thinks that inflation is the increase in price but according to economist inflation is the decreasing power of dollar. What causes inflation? Why do we have inflation? Why do prices go up every year? The more currency circulation creates inflation. On the other side less money circulation creates deflation. Many people think that inflation is a bad thing, but for those whose income is increasing through time to time has no problem with inflation. It gives problem to those who has a fixed income or retires when price increases. Inflation messes up the terms of long term contracts. Too much inflation can destroy the wealth of a nation. Most economists think and approve that inflation of about 2 percent or 3 percent yearly is a normal function of a growing economy. I think if you have Zero inflation every time, the prices of commodities should become lower since producers would contest for the top class and smallest price goods, and then customers could buy extra, so the wealth in the country would increase. And certainly the way to prevent inflation is to stay to a financial standard, like gold.

Time series analysis could be an outstanding for analysis, mathematical statistics, finance and economic science. Previous couple of years, it's been a prolific field of study in terms of analysis and applications. Historically, time series are studied among statistics, a field wherever most advances are obtained.

Objectives

In this thesis, the primary objective is to separately forecast inflation and unemployment using Autoregressive time series model and getting the best and appropriate model or equation for accurate forecasting. The secondary aim of the study is to find the connection between the Unemployment and Inflation. So my main focus is on finding the tradeoff between them. This research will conduct by using the method of Regression.

Material and Methods

Mostly data is secondary data which is taken from the Turkish Statistical Institute www.turkstat.gov.tr and Central Bank of Turkey TCMB www.tcmb.gov.tr for the period 2000 to 2014. Autoregressive time series model is used for forecasting. A forecasting technique that takes benefit of the relationship of values (Yt) to the previous period values ($Y_{t-1}, Y_{t-2}, Y_{t-3}$ ... .) is called autoregression. (Ken Black, 2009).

Autoregression is a numerous regression method with in which the selfdetermining factor or independent variables are time lagged volume of the needy variable; it means we forecast a value of y from values of y_{t-1}. The independent variable can be lagged for 1, 2, 3, or more time periods. An autoregressive model containing independent variables for three time periods looks like this: (Ken Black, 2009).

In autoregressive forecasting, the dependent variable (y) is treated the same way it is in other regression models within this chapter. However, each independent variable represents previous values of the dependent variable (Ronald, J. Brian, Lawrence, 2008).

Different observation was done through different legs to get the most fitted model for forecasting inflation and unemployment. After different legs experiments For forecasting inflation the first order First order Autoregressive model by leg one is the most fitted model here its testify.

$$\hat{Y}_t = 4.2873 + 0.612704Y_{t=1}$$

Next step is to test for the significance $ø_1$ of the highest order parameter. The highest-order parameter estimate, for the fitted 1st order autoregressive model is 0.612704, with a standard error of 0.204130656.

Testing the hypotheses H_0:$ø_1$=0 against H_1:$ø_1$≠0 , t test value was found as 3.0015329. Using α=0.05 level of significant the two tail test t test with 12 degrees of freedom has critical ±2.179. Because t statistic 3.00153>2.179 or because the p value= 0.0110352<0.05. Then, H_0 is rejected therefore it can be concluded that the first order parameter of the autoregressive model is significant and should remain in the model. For the given data of inflation the most appropriate model is the first order autoregressive model.

Using the estimates α_0= 4.287344 and α_0= 0.61270488 and the most recent data or year valueY_{2014}=*9.15*. For forecasting year 2015 inflation the equation would be as follows:

$$\hat{Y}_t = 4.2873 + 0.612704Y_{y-1}$$

$$\hat{Y}_{2015} = 4.2873 + 0.612704\ (9.15)$$

$$\hat{Y}_{2015} = 9.89$$

$$\hat{Y}_{2015} = 4.2873 + 0.612704\ (9.89)$$

$$\hat{Y}_{2016} = 10.35$$

Now for forecasting unemployment the same procedure was done and after different legs experiments For forecasting inflation the first order First order Autoregressive model by leg one is the most fitted model here its testify.

$$\hat{Y}_t = 5.8049 + 0.4572Y_{t-1}$$

Next step is to test for the significance $ø_1$ of the highest order parameter. The highest-order parameter estimate, for the fitted 1st order autoregressive model is 0.4572, with a standard error of 0.1814. Testing the null hypothesis H_0:$ø_1$=0 against H_1:$ø_1$≠0, t-test value was found as 2.519. Using α=0.05 level of significant the two tail test t test with 12 degrees of freedom has critical value ±2.179.Because t statistic 2.519>2.179 or because the p value= 0.026<0.05 I can reject therefore I conclude that the first order

parameter of the autoregressive model is significant and should remain in the model. For the given data of employment the most appropriate model is the first order autoregressive model.

Using the estimates α_0=5.804 and α_1=0.4572 and the most recent data or year value Y_{2014} = 10.1

For forecasting year 2015 unemployment the equation would be as follows:

$\hat{Y}_t = 5.8049 + 0.4572Y_{y-1}$

$\hat{Y}_{2015} = 5.8049 + 0.4572\ (10.1)$

$\hat{Y}_{2016} = 4.2873 + 0.612704\ (10.42)$

$\hat{Y}_{2016} = 10.57$

A Simple Linear Regression Model is used in accordance with all empirical studies. Here it is suggested that the equation for Inflation (I) is expressed as a function of Unemployment (UN). That can be expresses in the following equations.

$I = \alpha + \beta 1\ (UN)$

Whereas in equation I represent the dependent variable i.e. Inflation, independent variables is Unemployment (UN).

The regression analysis is used because it helps to test on the relationship and the significant of relationship of two phenomena the dependent variable and independent variable.

The following table tells about statistic of dependent and independent variables. Sig value shows the relationship between dependent and each independent variable. In accordance with Table 1 it is concluded that unemployment have a significant effect on Inflation.

Table 1. *Regression Results*

Variables	**Coefficient**	**t**	**Sig.**
(Constant)	79.779	3.263	0.006
Unemployment	-6.236	-2.636	0.021
Adj. R^2	0.298	**F-statistic**	6.956
R square	0.348	**Sig**	0.021

If the β (coefficient) value is positive means that there is positive relationship between independent and dependent variable and the negative value of β means there is negative relationship between independent and dependent variable. It shows there is negative relationship exists between Unemployment, and Inflation.

β value is used to form regression equation, which is:

I= 79.779 -6.236(UN)

Adjusted R square is shows adequacy of model with 0.298 that shows independent variables (Unemployment) can predict 29.8% of variance in dependent variable (Inflation). F statistic shows overall effects of independent variable on our target variable.

Results and Conclusion

In this study we tried to examine Turkey's inflation and unemployment by using time series analysis. Firstly, inflation and its components were studied and the variation of inflation was periodically discussed. Then, unemployment with different types was explained. Unemployment in Turkey with different causes was also tried to be clarified with annual data obtained from international and official databases. At the end of this study, we forecasted inflation and unemployment through Autoregressive Time Series model separately. We found that this model fits to forecast inflation and unemployment. We used different lags to find best, appropriate and significant model which can be fitted and able to forecast next year. The result shows that the forecasted inflation for 2015 and 2016 shall be respectively 9.89 and 10.35. The forecasted unemployment for 2015 and 2016 shall be respectively 10.42 and 10.57.

An effort was made to find the relationship between unemployment and inflation to confirm the reality of Phillips curve in Turkey by the help of time series data for phase of 2000-2014. Unemployment rate is taken as independent variable whereas inflation rate is taken as dependent variable. Regression model is significant because .Regression coefficient is also significant t=-2.636 and P = 0.021<0.05.The outcome of simple linear regression verifies the reality of inverse relationship between unemployment and inflation. It can be saying easily that Phillips curve exist in Turkey. When unemployment increases 1 unit, inflation decreases 6.236 units.

Findings show that inflation and unemployment were much related variables. But there is a negative relationship between them. As we know from the literature of Economics, higher inflation causes lower unemployment and lower inflation causes higher inflation. Then, findings of this research support the same relation.

In addition, it is hoped that this study would contribute to the future studies about time series forecasting and could be of use for both researchers in this field.

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