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Estimating the Phillips Curve in Iran, Comparative Method

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Abstract

Nowadays, the relationship between inflation and unemployment is known as the Phillips curve. Since this curve is an important indicator of the economic relationship between the unemployment and inflation, much attention has been paid to it. Phillips showed an inverse relationship between unemployment and wage rates being paid, so that the decline in the unemployment rate leads to an increase in wage rates or prices. In this study, we estimate the Phillips curve for inflation and unemployment rates in Iran by using a time series data from 1996-2012 and by using comparative method. We conclude that this model can be either logarithmic – linear or linear- logarithmic best model to the Phillips curve in Iran.

Keywords: inflation, unemployment, Phillips curve, Iran

Introduction

Over the last five decades, the subject of price/wage inflation and unemployment has been a major concern for economists and common economic agents. This approach started in 1958, when a British Economist A. W. Phillips wrote an article on “The Relationship between Unemployment and the Rate of Change of Money Wage Rates in the United Kingdom” by using a data set from 1862 to 1957. This empirical study was formed by a reasonably smooth curve which is known as “Phillips Curve”. Phillips curve shows a trade-off between rate of inflation and unemployment. Phillips Curve interprets that if unemployment is to be reduced than we have to accept the rising price level in the economy. Various theories have been put forward to explain continuing inflation all over the world.

In Iran, the subject of inflation has been the central issue in most of macroeconomics studies. Various factors are considered in the literature as strong forces for determining price inflation. These factors are monetary expansion, stagnation of output, increasing import prices, increasing wage rates and sticky expectations etc.

The objective of this paper is to estimating the Phillips curve for inflation and unemployment rates in Iran, by using a time series data from 1996-2012. In this paper, for select the best Phillips curve we use the comparative method.

Literature Review

Paul Samuelson and Robert Solow were among the researchers, who supported the Phillips hypothesis. Samuelson and Solow (1970) examined the relationship between the inflation and unemployment rate in the United States. An inverse relationship was established between inflation and unemployment. In another study conducted by 4 and unemployment. In another study conducted by Solow (1970) and Gordon (1971), result reveals the existence of a negative trade-off relationship between unemployment and inflation using U.S. macroeconomic data. These empirical findings have been known as the “Solow-Gorden affirmation” of the Phillips curve.

Among research studies done in the 1990s, Alogoskoufis and Smith (1991) showed the empirical evidence to support the “Lucas critique” which denied the existence of trade-off relationship. By contrast, King and Watson (1994) tested the existence of the Phillips curve using the U.S. post-war macroeconomic data. Their findings provided empirical support to the existence of the trade-off relationship between unemployment and inflation in the USA over the researched period. Hansen and Pancs (2001) examined the existence of the Phillips curve in Lativa. They also found out that there is a significant correlation between the unemployment rate and the actual inflation rates. Furthermore, Islam et al. (2003) examined the hypothesis of Philips curve through US economic data from 1950 to 1999. They find out the weak long-run cointegrating relationship and long-run causality between unemployment and inflations. On the other hand, Hart (2003) tested the Phillips hypothesis by employing the hourly wage earning. He concluded that during inter-war period (1926-66) in Britain, the Phillips curve is "not supported by our data". Marsiglia Fasolo (2004) presented some new estimates for the relationship between inflation and unemployment in Brazil based on a new Keynesian hypothesis about the behavior of the economy. A non-linear relationship between inflation and unemployment is able to provide better explanations for the inflation-unemployment relationship in the Brazilian economy in the last 12 years. Ogbokor (2005) invoke linear and logarithmic regression models to empirically test the validity of the Short-run Phillips curve for Namibia by relying on macroeconomic time-series data running from 1991 to 2005. His results offer some support for the presence of the phenomenon of stagflation in Namibia. Furuoka (2007) examined the long-run & trade-off relationship and also causal relationship between the unemployment rate and the inflation rate in Malaysia during the period of 1975-2004). Zaman and Ikram (2011) showed in a developing country like Pakistan, Phillips Curve approach is employed on a data set of 35 years starting from 1975-2009. Phillips Curve helps in examining the relationship between inflation and unemployment. There is a non-proportional negative relationship between inflation and unemployment. Todorova (2012) studied the time path of inflation and unemployment using the Blanchard treatment of the relationship between the two and taking the monetary policy condition into account he solved the model both in continuous and discrete time and compare the results. The economic dynamics of inflation and unemployment shows that they fluctuate around their intertemporal equilibrium, inflation around the growth rate of nominal money supply, respectively, and unemployment around the natural rate of unemployment. Jinpeng Ma (2012) reported empirical evidence that uncovers some of its mysteries. The rate of inflation and the unemployment rate are closely related to business cycles.

Materials and Methods

After collecting the data, we used EViews software to test the stationary of data and we make sure that the data are stationary. Then we estimate all the regression equations which can be considered between inflation and unemployment. To easily and accurately comparing, the regression equations are divided into two categories, and in each category, we select the regression equation that has the greatest explanatory power. Then we select one of this regression equations or each of this regression equations for the best Phillips curve. To select the best and optimum Phillips curve we must use the below steps.

I)Step 1:

In this step we divide the regression equations into two categories, and in each category, we select the regression equation that has the greatest explanatory power. In first category the dependent variable (inflation) is linear but in the second category the dependent variable is logarithmic.

$$D(x) = x_t - x_{t-1}$$
$$y_t = D(\text{inflation}), \mathrm{x}_t = D(unemployment)$$
$$1)\ \mathrm{y}_t = \alpha + \beta * x + u_t$$
$$\alpha = -.48, \beta = -2.73,$$
$$\mathrm{t}_\alpha = -.41, \mathrm{prob} = .68, t_\beta = -3.42, prob = .005,$$
$$\bar{R}^2 = 0.45, F = 11.76, prob(F) = 0.004, Durbin - watson = 2.62$$

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$$y_t = D(\text{inflation}), x_t = D(\log(unemployment))$$
$$2)\ y_t = \alpha + \beta * x_t + u_t$$
$$\alpha = -.44, \beta = -31.72$$
$$t_\alpha = -.39, prob(\alpha) = 0.7, t_\beta = -3.5, prob(\beta) = 0.004$$
$$\bar{R}^2 = .47, F = 12.3, prob(F) = .004, Durbin - watson = 2.64$$

In the first regression equation, as the amount of probability of α is higher than.05, the intercept is insignificant. But because the amount of probability of β is lesserthan.05, β is significant. Also because the amount of probability of F is lesser than .05, the regression equation is significant. The amount of $\bar{R}^2$ shows that the regression equation can display the 45 percentage of observations. Also the amount of Durbin-Watson stat shows that there is no autocorrelation.
In the second regression equation, as the amount of probability of α is higher than .05, the intercept is insignificant. But the amount of probability of β is lesser than .05, β is significant. Also the amount of probability of F is lesser than .05, then the regression equation is significant. The amount of $\bar{R}^2$ show that the regression equation can display the 47 percentage of observations. Also the amount of Durbin-Watson stat shows that there is no autocorrelation.

In third regression equation, as the amount of probability of all coefficients is higher than .05, then all coefficients is not significant (this regression equation is significant equation in among all of the nonlinear regression equations). Also the amount of probability of F is lesser than .05, then the regression equation is significant. The amount of $\bar{R}^2$ show that the regression equation can display the 42percentage of observations. Also the amount of Durbin-Watson stat show there is autocorrelation, but if we resolve the autocorrelation for this regression equation, the amount of probability of F would be higher than .05, then the regression equation is insignificant, and this regression equation is not equation that we need.

We choose the regression equation that can explain our observation more and better than other equations, so we choose the regression equation that has the greatest amount of $\bar{R}^2$. So the second regression equation is what we are looking for.

Now we consider the other regression equation (the equation that dependent variable is logarithmic) and then choose the optimum regression equation like before.

$y_t = D(\log(\text{inflation})), x_t = D(unemployment)$

1) $y_t = \alpha + \beta * x_t + u_t$

$\alpha = -0.02, \beta = -0.14$

$t_\alpha = -0.45, prob(\alpha) = 0.65, t_\beta = -3.27, prob(\beta) = 0.006$

$\bar{R}^2 = 0.43, F = 10.73, prob(F) = 0.006, \text{Durbin-Watson} = 2.38$

$y_t = D(\log(\text{inflation})), x_t = D(\log(unemployment))$

2) $y_t = \alpha + \beta * x_t + u_t$

$\alpha = -.02, \beta = -1.6$

$t_\alpha = -.4, prob(\alpha) = 0.66, t_\beta = -3.26, prob(\beta) = .006$

$\bar{R}^2 = .42, F = 10.6, prob(F) = 0.006, \text{Durbin-Watson} = 2.36$

$y_t = D(\log(\text{inflation})), x_t = D(\log(unemployment)), z_t = D(unemployment)$

3) $y_t = \alpha + \beta_1 * x_t \wedge 2 + \beta_2 * z_t$

$\alpha = -0.04, \beta_1 = .98, \beta_2 = -0.16$

$t_\alpha = -.54, prob(\alpha) = 0.6, t_{\beta_1} = .33, prob(\beta_1) = .74, t_{\beta_2} = -2.4, \text{prob}(\beta_2) = 0.03$

$\bar{R}^2 = .38, F = 5.02, prob(F) = .02, \text{Durbin-Watson} = 2.38$

The interpretation of this equations is similar to the other equations that we interpreted in the beginning of this step (third regression equation is significant equation among all of the nonlinear regression equations. Also the amount of Durbin-Watson stat shows there is autocorrelation, but if we resolve the autocorrelation for this regression equation, the amount of probability of F is higher than .05, so the regression equation is insignificant, and this regression equation is not the equation that we need). In this three regression equation the first equation is what we are looking for, where as this equation has greatest $\bar{R}^2$.

So in this step we choose the below equations.

$y_t = D(\text{inflation}), x_t = D(\log(unemployment))$

i) $y_t = \alpha + \beta * x_t + u_t$

$y_t = D(\log(\text{inflation})), x_t = D(unemployment)$

ii) $y_t = \alpha + \beta * x_t + u_t$

II) Step 2:

In this step we estimate the second regression equation and other things we do are as follows:

$y_t = D(\log(\text{inflation})), x_t = D(unemployment)$

$y_t = \alpha + \beta * x_t + u_t$

Then we fit y and define another variable.

$fit\ \ y_h$

$genr\ \ y_{hh} = \exp(y_h)$

Now we estimate the first regression equation with two methods.

$y_t = D(\text{inflation}), x_t = D(\log(unemployment))$

$1) y_t = \alpha + \beta * x_t + u_t$

$\alpha = -.44, \beta = -31.72$

$t_\alpha = -.39, prob(\alpha) = 0.7, t_\beta = -3.5, prob(\beta) = 0.004$

$\bar{R}^2 = .47, F = 12.3, prob(F) = .004, Durbin - watson = 2.64$

$y_t = y_{hh}, x_t = D(\log(unemployment)), \text{z}_t = AR(1)$

$2) y_t = \alpha + \beta * x_t + \gamma * z_t + u_t$

$\alpha = .98, \beta = -1.68, \gamma = -0.01$

$t_\alpha = 167.14, prob(\alpha) = 0.0, t_\beta = -1.68, prob(\beta) = 0.0, t_\gamma = -.12, prob(\gamma) = 0.90$

$\bar{R}^2 = 0.98, F = 311.00, prob(F) = .0, Durbin - watson = 2.12$

Since the second equation has greatest $\bar{R}^2$, so the ii equation is our answer for optimum regression equation.

III) Step 3:

This step like step 2.

$y_t = D(\text{inflation}), x_t = D(\log(unemployment))$

$\text{I}) y_t = \alpha + \beta * x_t + u_t$

Then we fit y and define another variable.

$fit\ \ y_h$

$genr\ \ y_{hh} = \exp(y_h)$

Now we estimate the second regression equation with two methods.

$y_t = D(\log(\text{inflation})), \text{x}_t = D(unemployment)$

$1) y_t = \alpha + \beta * x_t + u_t$

$\alpha = -0.02, \beta = -0.14$

$t_\alpha = -0.45, prob(\alpha) = 0.65, t_\beta = -3.27, prob(\beta) = 0.006$

$\bar{R}^2 = 0.43, F = 10.73, prob(F) = 0.006, \text{Durbin} - \text{Watson} = 2.38$

$y_t = y_{hh}, \text{x}_t = D(unemployment)$

$1) y_t = \alpha + \beta * x_t + u_t$

$\alpha = -1.71, \beta = -2.18$

$t_\alpha = -2.59, prob(\alpha) = 0.06, t_\beta = -3.34, prob(\beta) = 0.02$

$\bar{R}^2 = .67, F = 11.16, prob(F) = 0.02, \text{Durbin\_watson} = 2.39$

Like step 2, the one we are looking for is the i regression equation.

Since in two steps (step 2 and step 3) we received two answers, so two regression equations (the equation i and equation ii) are our answers.

$$y_t = D(\text{inflation}), \text{x}_t = D(\log(\mathit{unemployment}))$$
$$\text{i)} y_t = \alpha + \beta * x_t + u_t$$

$$y_t = D(\log(\text{inflation})), \text{x}_t = D(\mathit{unemployment})$$
$$\text{ii)} y_t = \alpha + \beta * x_t + u_t$$

Results and Discussion

In this paper we found that the optimum Phillips curve or regression equation between inflation and unemployment for Iran economic is either linear - logarithmic or logarithmic – linear regression equation.

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