The New Keynesian Phillips Curve in an Inflation Targeting Country: The Case of Turkey

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Abstract

The possible short-run trade-off between the inflation (gap) and the output (gap) remains a critical policy issue for any emerging economy; particularly when an implicit or an explicit inflation targeting monetary policy is considered. The New Keynesian Phillips Curve (NKPC) has recently set up a framework on the trade-off between the inflation (gap) and the difference between the actual output and potential (efficient) output under the assumption of real wage rigidities. In this paper, we estimate the NKPC based on this framework for the Turkish economy over a period of implicit and explicit inflation targeting monetary policy. The results from Generalized Methods of Moments (GMM) estimation suggest that empirical findings are consistent with the theoretical background and the parameter restrictions are satisfied.

Keywords: New Keynesian Phillips Curve, Real Wage Rigidity, Short-run Trade-off, Turkey, Developing Economies

JEL Classification: E24, E31, C52

1. Introduction

The relationship between inflation and unemployment was firstly examined by Phillips (1958). His seminal paper has started an endless debate in the macroeconomics literature that the existence of a possible trade-off between stabilizing inflation and unemployment. Phelps (1967; 1968) and Friedman (1968) then suggested that a stable trade-off based on the definition of equilibrium rate of unemployment called as natural rate of unemployment, and on the role of inflation expectation. Phelps (1967; 1968) and Friedman (1968) suggested the existence only of a short-run trade-off, and this did not come from inflation itself but from unexpected shock on inflation. Friedman (1968) indicated that the inflation expectation was an important variable to evaluate nominal wages, and the traditional paper of Phillips (1958) was found biased empirical results just because he did not make a disparity between real and nominal wages. This topic was subsequently

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examined by Lucas (1972) in an incomplete information model. In his model, when there was an increase in the price of goods, producers did not know whether there has been a change in relative prices or this rise has motivated by inflation. The producer rationally responded not only to fraction of the change in relative increasing prices, but also to aggregate inflation. Thus, his/her decision would be to raise production in some proportion in the short-run, and this allowing for a positively sloped supply curve in the short-run. This implication of the positively sloped short-run supply curve gave support to the hypothesis of short-run trade-off. As a consequence, in the short-run, monetary policy might affect the real economic activity.

On the other hand, the New Keynesian literature posited that both prices and wages showed some rigidity due to slowness of the adjustment in a new market condition. The existence of price and wage contracts was among the main reasons to explain price and wage rigidities. Even in the absence of contracts, firms might face menu-costs or fear the distaste of customers for frequent changes in prices. Thus, one should expect slowness of price adjustment. On the theoretical basis of price rigidity, a commonly used framework was firstly proposed by Rotemberg (1982) and Calvo (1983). In their framework, for each period, only a fraction of all firms were able to change prices under some probability, and this was independent from time and remaining firms. The framework of Calvo (1983) has become the point of origin for derivation of the New Keynesian Phillips Curve (NKPC). The standard version of the NKPC has been subject to controversy because it suggested the no trade-off between stabilizing inflation and the output (gap), when it was compared with the original Phillips Curve. However, one can think that a monetary authority that was able to commit itself to stabilize the output gap also can simultaneously stabilize inflation. Proposition of the standard NKPC was clearly contrast to the empirical evidences such as found by Clarida et al. (1999), Gali and Gertler (1999), Gali et al. (2001) and among many others.

Studies of the NKPC have found very different results as to the extent of forward-looking or backward-looking behaviour of price adjustment process. Actually, the hybrid NKPC was an integral part of the standard model of monetary policy. This was due to its microeconomic foundation such as that examined by Clarida et al. (1999), but also the successful estimation of NKPC models on time series data. Actually, a hybrid model was proposed by Gali and Gertler (1999, henceforth GG), who suggested that some firms adopted a backward-looking and others a forward-looking behaviour in the prices adjustment process. Their empirical findings indicated that besides statistically significant price adjustment by the backward-looking rule, it was not quantitatively noteworthy for the United States (US) economy for the period from 1960 to 1997. Also, an alternative approach was used the average real marginal cost (in percentage deviation from steady state level) in substitution of the output gap. Gali et al. (2001, henceforth GGL) showed that a better fitting results to the Euro area and the US data by using this version of the NKPC.

Several papers have overlooked those evidences by using the same data set as well as the GMM methodology, and they raised some empirical issues that questioned the robustness of the results of the GG and the GGL. For instance, Bardsen et al. (2004)

showed the principle that the estimates of the GGL most likely were biased in favour of a significant role for expected (future) inflation just because this variable was found negligible in re-examined models where variables from the instruments set significantly and directly caused inflation. Linde (2005) and Rudd and Whelan (2005; 2006) argued that the upward bias of the forward-looking estimates might be large when estimating the structural-form of the NKPC (as the GG suggested) rather than the closed-form solution of the model. Mavroeidis (2006) also demonstrated that the parameters of the GG were weakly identified and that the US inflation dynamics were consistent with both backward-looking and forward-looking behaviour, whereas real marginal costs appeared to be an irrelevant determinant of inflation.

Gali et al. (2005) replied the some of these criticisms, and they kept going to defence their main conclusion about the importance of the forward-looking behaviour for explaining inflation dynamics. They re-asserted that the NKPC, as the dominance of forward-looking behaviour was robust to choice of estimation procedure and specification bias. By the way, Rudd and Whelan (2007) could not reject the hypothesis that inflation and real marginal costs were completely unrelated when using data of the GG for inflation analysis. However, they used revised labour share data as proxy variable for real marginal costs. Their findings showed that the empirical evidence of the GG was not robust to revisions in data. Furthermore, Kurmann (2007) and Fanelli (2008) re-examined the empirical evidences in a framework of the GG and the GGL by using econometric methods that based on likelihood estimation. Using a reversed estimation technique, Kurmann (2007) showed that the cross-equation restrictions could be considered as constraints of the Vector Autoregressive (VAR) coefficients as the explanatory variable in the hybrid NKPC. In parallel with findings of the GG, Kurmann (2007) concluded that the NKPC based on the same US data could not be rejected by a conventional likelihood-ratio test. Fanelli (2008) also proposed a two step procedure that consists of specifying agents' expectations by using possibly cointegrated VAR models, and he derived at the cross-equation restrictions that the NKPC imposed on the VAR framework. In contrast to findings of the GGL, Fanelli (2008) concluded that the hybrid NKPC based on the same data set was far from being a suitable approach in explaining inflation dynamics of the Euro area. Boug et al. (2010) examined that the evidences of the GGL by using the VAR framework and likelihood based estimation techniques and they paid a particular attention to the stationary and non-stationary (and possibly cointegrated) nature of explanatory variables. Their results showed that the exact as well as the in exact-form of the hybrid NKPC certainly were not suitable into the Euro area data. On the other hand, seminal finding that the inexact hybrid NKPC was a good first approximation to the US inflation dynamics by the GG were seemed to be more suitable in the US data. However, the assumption of the model that the stochastic term formed a sequence of innovations might be problematic as they found that indication of autocorrelation in estimated residuals. The exact-form of the hybrid NKPC was clearly rejected by the US data. Fanelli and Palomba (2011) applied the hybrid NKPC into the Euro area, and they showed that the forward-looking component of inflation dynamics was much larger than the backward-looking component. Furthermore, the sequence of

restrictions implied by the cointegrated NKPC under learning dynamics was not rejected over the period 1984-2005. Nymoen et al. (2012) recently built up a framework for an interpretation of the empirical results of the NKPC for inflation dynamics. Both the rational expectations solution of the structural NKPC and the reduced-form VAR analysis of the multivariate time series properties gave insight about the joint-implications of the evidence in the NKPC literature. They suggested that the unit-root form of non-stationary might be implied for inflation, even though their econometric model initially assumed stationary. The uniqueness and form of a rational expectations solution might depend on whether dynamic homogeneity was present, and on the size of the forward-looking coefficient of the NKPC.

In summary, most monetary authorities in developed economies perceived a trade-off between stabilizing inflation and stabilizing the gap between output and potential or efficient output. However, the standard New Keynesian framework implied no such trade-off. A trade-off between stabilization of the inflation and stabilization of the output gap by the monetary authorities was presented in the NKPC framework of Blanchard and Gali (2007). This possible short-run trade-off between the stabilizing inflation (gap) and the output (gap) remains a critical policy issue for any emerging economy; particularly when an implicit or an explicit inflation targeting monetary policy is considered (Mazali and Divino, 2010). The inflation dynamics of Turkey and inflation targeting monetary policy in Turkey and its effects on exchange rate predictability and stock market volatility has investigated in many papers (Kumar, 2010; Cagli et al., 2011; Gozgor, 2012). However, the Phillips Curve (PC) (particularly the NKPC) is a rather unexplored research topic for Turkey. The PC or the standard NKPC have been examined in a few papers, such as that by Onder (2004; 2009), Yazgan and Yilmazkuday (2005), Kustepeli (2005), Hasanov et al. (2010), Saz (2011), Catik et al. (2011), and Cicek (2012).

However, to the best of our knowledge, there is still no paper that directly estimates the NKPC framework of Blanchard and Gali (2007) for Turkey. As we have already mentioned, a trade-off between stabilization of the inflation and stabilization of the output gap was presented in their NKPC framework. In this paper, we estimate both the PC and the NKPC based on Blanchard and Gali (2007)'s framework for the Turkish economy over a period of implicit and explicit inflation targeting monetary policy. As an emerging economy, Turkey adopted free floating exchange rate regime in February 2001, and then the implicit inflation targeting carried out from January 2002 to December 2005. The explicit inflation targeting started in January 2006. This study focuses on the period over January 2005-June 2012. We select the date of January 2005 as beginning just because unemployment rate data in monthly frequency are only available from this date. We suggest that using monthly inflation and unemployment rates are important for examining the NKPC in any developing economy because higher frequency data generate additional information in the volatility of inflation that is lost on quarterly or annual frequency data.

The remainder of this paper is organized as follows. In the second section we discuss the theoretical backgrounds of the PC and the NKPC. In the third section we elaborate the methodology and the empirical findings, and the fourth section is concluding the remarks.

2. Theoretical Background

The simplest Phillips Curve model is the traditional Phillips curve of Phillips (1958), and the original equation is given such as (Karanassou et al., 2010, p. 21),

$$\pi_t = c - bu_t + \varepsilon_t \tag{1}$$

In this equation, *c* and *b* are positive constants. π_t is rate of inflation, u_t is rate of unemployment and ε_t is the error term. In the static nature of the Equation (1), the steady-state and rate of long-run unemployment are identical. Also, a dynamic extension of the Equation (1) is the so-called traditional Keynesian Phillips curve can be written as follows:

$$\pi_t = c + a\pi_{t-1} - bu_t \tag{2}$$

In the Equation (2), the autoregressive parameter is $|a| < 1$. Similarly to the static case in the Equation (1), there is a long-run trade-off and no natural rate of unemployment.

In the seminal contributions by Phelps (1967; 1968) and Friedman (1968), hypothesis of natural rate of unemployment (u^n) gave rise to the Expectations Augmented Phillips Curve that can be shown as follows:

$$\pi_t = \pi_{t-1} - b(u_t - u^n) \tag{3}$$

In the Equation (3), adaptive expectations are identical to the Expectations Augmented Phillips Curve under the random walk/rational expectations assumption. The main difference between two frameworks is that the random walk/rational expectations are able to separate the short and the long-run (Karanassou et al., 2010, pp. 22-23).

Furthermore, the standard NKPC has some fractions; such as, firms, people, efficient allocation (first best), flexible price equilibrium (second best) and staggered price equilibrium. The standard NKPC can also be written as follows (Blanchard and Gali, 2007, p. 36):

$$\pi_t = \beta E\pi_{t+1} + \kappa(y_t - y_t^*) \tag{4}$$

In the Equation (4), inflation (π_t) is a function of expected future inflation ($E\pi_{t+1}$), of the deviation from actual (y_t) and potential output (y_t^*) namely, the output gap. At this point, Blanchard and Gali (2007) introduced real wage rigidities into the standard NKPC framework, and re-examined flexible price equilibrium (second best) and staggered price equilibrium. Thus, their framework allows policy trade-offs and implications for the output cost of disinflation. They also discussed some alternative approaches, such as distortion shocks, different structure of wage and price setting and the behaviour of inflation (Blanchard and Gali, 2007, pp. 37-51). They derived at the relationship between inflation and unemployment. For this purpose, they firstly and explicitly introduced unemployment. Secondly, they rewrote the inflation equation in terms of unemployment that can be written as follows (Blanchard and Gali, 2007, p. 53):

$$\pi = \frac{1}{1+\beta}\pi(-1) + \frac{\beta}{1+\beta}E\pi(+1) - \frac{\lambda(1-\alpha)(1-\gamma)\phi}{\gamma(1+\beta)}u + \frac{\alpha\lambda}{1+\beta}\Delta v + \zeta \quad (5)$$

In the Equation (5), inflation is a function of past and expected future inflation, of the unemployment rate (u), and of the change in the real price of the non-produced input (Δv). The term ζ is proportional to $(\pi - E(\pi|-1)$ so it is a white noise, and orthogonal to all variables at $t-1$. On the other hand, λ is the price rigidity and γ is the wage rigidity. At this model, terms of trade shocks on open economy is indirectly described within the real price of the non-produced input in the Equation (5). It is important to note that there are also different "open-economy" frameworks for the NKPC in the literature, such as those examined by Batini et al. (2005), Rumler (2007), Kuttner and Rabinson (2010) and Mihailov et al. (2011).

The framework of the NKPC in Equation (5) can be estimated by using Instrumental Variables (IV) or GMM that parameters have certain constraints. Blanchard and Gali (2007) considered the US data. In the next section we discuss the constraints of parameters and examine the Turkish case.

3. Methodology and Empirical Findings

In this section we estimate the Expectations Augmented Phillips Curve in Equation (3) and the NKPC framework in Equation (5) for the Turkish Economy. Unemployment is the rate of unemployment for population 15 years and over. We calculate the natural rate of unemployment from the long-term unemployment that is obtained from the World Bank Development Indicators. We use the Consumer Price Index (CPI) for actual inflation and inflation expectation because the Central Bank of the Republic of Turkey (CBRT) targets the CPI. Change in the real price of the non-produced input is calculated from the Producer Price Index (PPI) raw material index as same as used in the framework of Blanchard and Gali (2007).

We focus on the period from January 2005 to June 2012, and obtain all related data from the CBRT. As we have already discussed, we select January 2005 as a beginning date of our empirical analysis just because unemployment rate data in monthly frequency are only available from this date. Note that estimated standard deviations are robust to heteroskedasticity and autocorrelation of unknown form in the GMM estimation technique. We report the results from the Expectations Augmented Phillips Curve in Equation (3) and the NPKC in Equation (5) in Table 1.

Results in Table 1 emphasize that the OLS estimation for the Expectations Augmented Phillips Curve equation do not fit with recent data from the Turkish economy. However, as seen in Table 1, all explanatory variables are statistically significant at 5% significance level in the NKPC framework of Blanchard and Gali (2007), and they are efficient, unbiased and consistent. They have also expected and correct signs.

From the consistency perspective, we would like to emphasize that (C1) and (C2) parameters are subject to certain constraints in the estimation. The first constraint

Table 1: Results of the Expectations Augmented (EAPC) and the New Keynesian Phillips Curve (NKPC) Estimations for Turkey (Sample: January 2005-June 2012)

Explanatory Variables	EAPC (OLS) Coefficients	NPKC (GMM) Coefficients
$u_t - u^n$	–0.096 (0.305) [0.681]	-
Inflation Rate (-1) (%) (C1)	0.583 (0.101) [0.000]	0.659 (0.292) [0.028]
Inflation Expectation (%) (C2)	-	0.341 (0.158) [0.035]
Unemployment Rate (u) (C3)	-	–0.122 (0.051) [0.019]
PPI Raw Material Index (Δv) (C4)	-	0.044 (0.008) [0.000]
Jarque-Bera	1.096 [0.43]	0.875 [0.64]
Q(1)	2.175 [0.00]	0.194 [0.66]
Q(2)	0.293 [0.81]	0.231 [0.89]
Q(5)	2.862 [0.72]	3.450 [0.63]
Q(12)	12.11 [0.41]	14.23 [0.29]
J-statistic	-	2.701 [0.91]
Adjusted R-squared	0.32	0.76

Notes: Dependent variable is the rate of inflation (%). Regressions include the constant terms. We use robust standard errors in the Ordinary Least Square (OLS) estimation. The Jarque-Bera shows the test results of the normal distribution (null hypothesis of normally-distributed error terms is valid). Q(1), Q(2), Q(5) and Q(12) statistics are reported for autocorrelation analysis, and results show that there is no remaining autocorrelation in the estimations. Under the null hypothesis of the over-identifying restrictions are valid, the J-statistic of Hansen (1982) tests the validity of the over-identifying restrictions in the GMM estimation. The instruments are inflation rate, unemployment rate, and the PPI raw material index from lag 1 to lag 4 in the GMM estimation. We use the Heteroskedasticity and Autocorrelation Consistent (HAC) estimation weighting matrix of Newey and West (1987) with the quadratic-spectral Kernel, and the bandwidth selection method of Andrews (1991) in the GMM estimation. The optimal number of lag is selected by the observation based selection method of Newey and West (1994). The p-values are in brackets, and standard errors are in parentheses.

is $0.5 \leq (C1) \leq 1$ because $(C1) = 1/[1+\beta]$, and $0 \leq \beta \leq 1$. The estimated value of (C1) is 0.659, and it satisfies this constraint. The second constraint is $0 \leq (C2) \leq 0.5$ because $(C2) = \beta/[1+\beta]$. The estimated value of (C2) is 0.341, and this is also consistent with the theoretical background. The third restriction is $(C1) + (C2) = 1$, and this is already obtained in the estimation (see, Blanchard and Gali 2007, pp. 52-54 for details).

Furthermore, the parameters of (C3) and (C4) are functions of the structural parameters, and they cannot be individually identified. The parameters of price rigidity (λ) and wage rigidity (γ) are the structural parameters. Recall that $(C4) = \alpha\lambda/[1+\beta]$. The estimated value of (C4) is 0.044, and the discount factor (β) can be calculated from (C1)

as $\beta = 0.517$. Thus, we can write $\alpha\lambda = 0.067$ where α is the share of the non-produced input in the production function of Cobb and Douglas (1928). We can also calculate that the wage rigidity in the coefficient of $(C3) = -\lambda(1-\alpha)(1-\gamma)\phi / [\gamma(1+\beta)]$ that can be rewritten as $\gamma = -\lambda\phi(1-\alpha) / [(C3)*(1+\beta) - \lambda\phi(1-\alpha)]$. Also, note that $\lambda = \theta^{-1}(1-\theta)(1-\beta\theta)$.

On the other hand, we can analyze the trade-off between the stabilizing inflation (gap) or the stabilizing output (gap) between actual output and potential (or efficient) output in the presence of a supply shock. In the inflation targeting monetary policy framework, aim of the monetary authority (the CBRT in this study) is to keep inflation steady around the inflation target. In the case of a supply shock, the output gap will be influenced, and this case can be indicated as $\partial(y - y_i) / \partial\upsilon = -(1-\alpha)\Theta / [(1-\alpha)(1-\Theta)] = -\alpha\gamma / [(1-\gamma)*(1+\phi)]$. Thus, $\partial(y - y_i) / \partial\upsilon = -0.163$. Hence, in the case of the monetary authority try to keep inflation steady (as assumed to be certainly implemented in the inflation targeting framework in Turkey), if the non-produced input price increase at 1%, the gap between actual output and potential output will decrease at 0.163% for first period, and the actual output will edge away from efficient output. We can easily calculate the persistence of this supply shock effect by using the autoregressive parameter, and it can be found as $\Theta = 0.194$.

Furthermore, if the monetary authority targets to keep the gap between actual output and potential output as steady, inflation rate will rise. This case can be shown as $d\pi_t / d\upsilon = \lambda\alpha\gamma / [(1-\beta\gamma)[\alpha\gamma + (1-\alpha)]]$, and $d\pi_t / d\upsilon = 0.126$. This finding suggests that if a supply shock increases the non-produced input price at 1%, this will lead to 0.126% increase in next period inflation. Therefore, the monetary authority should decide between the different policy implications that tolerating for 0.163% divergence between actual output and potential output as increasing output gap; allowing for 0.126% increase in the next period inflation; or any trade-off combination of these extremities in policy implications.

4. Concluding Remarks

There is a widespread literature to examine the standard NKPC in developed economies. The standard version of the NKPC has been criticized for not to explain the trade-off between stabilizing the inflation (gap) and stabilizing the output (gap). The NKPC framework, such as that proposed by Blanchard and Gali (2007) has recently set up a framework on the trade-off between the inflation and the difference between actual output and potential (efficient) output under the assumption of real wage rigidities. This possible short-run trade-off between the inflation (gap) and the output (gap) remains a critical policy issue for any emerging economy; particularly when an implicit or an explicit inflation targeting monetary policy is considered. This paper successfully estimates the NKPC equation in the framework of Blanchard and Gali (2007) for the Turkish economy over the period of implicit and explicit inflation targeting monetary policy.

The results from the GMM estimation suggest that the empirical findings are consistent with the theoretical background and the parameter restrictions are satisfied, and also they are efficient and unbiased. Even the original framework of Blanchard and Gali

(2007) used the IV method; the GMM estimation technique in this paper is also well-fitted with the rational expectation nature of the model. We suggest that monetary authority should decide between the different policy implications that tolerating for divergence in output gap, allowing for an increase in the next period inflation, or any trade-off combination of these policy implications.

This study simply shows the NKPC framework of Blanchard and Gali (2007) can successfully be estimated for the recent data from the Turkish economy. Future researches about this topic can investigate several issues of the NKPC dynamics in the Turkish economy. First, one can focus on the data of larger period that includes several supply shocks, monetary shocks or a financial crisis. Second, one can evaluate the NKPC for developing economies in a panel data framework. Third, one can use the different econometric methodology, such as VAR models or the likelihood based estimation techniques. Fourth, one can discuss the impact of the reaction function of the monetary authority or the different monetary policy implications on the NKPC framework, such as that investigated by Kurozumi and Van Zandweghe (2010).

Finally, probably foremost, one can examine the role of inflation expectation in the NKPC framework; particularly it can be constituted by the term structure of government bonds. The relationship between the term structure of government bonds (nominal or real yield curve) and the new Keynesian macroeconomics have recently been well-documented in many front-page papers, such as those by Bekaert et al. (2010), Christensen et al. (2010), Joyce et al. (2010), and Gurkaynak and Wright (2012).

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References

Andrews, D.W., 1991, 'Heteroskedasticity and autocorrelation consistent covariance matrix estimation', *Econometrica*, 59, pp. 817-858.

Bardsen, G., Jansen, E.S. and Nymoen, R., 2004, 'Econometric evaluation of the new Keynesian Phillips curve', *Oxford Bulletin of Economics and Statistics,* 66, pp. 671-686.

Batini, N., Jackson, B. and Nickell, S., 2005, 'An open-economy new Keynesian Phillips curve for the U.K.', *Journal of Monetary Economics*, 52, pp. 1061-1071.

Bekaert, G., Cho, S. and Moreno, A., 2010, 'New Keynesian macroeconomics and term structure', *Journal of Money, Credit and Banking*, 42, pp. 33-62.

Blanchard, O.J. and Gali, J., 2007, 'Real wage rigidities and the new-Keynesian model', *Journal of Money, Credit and Banking*, 39, pp. 35-65.

Boug, P., Cappelen, A. and Swensen, A.R., 2010, 'The new Keynesian Phillips curve revisited', *Journal of Economic Dynamics and Control*, 34, pp. 858-874.

Cagli, E.C., Mandaci, P.E. and Kahyaoglu, H., 2011, 'Volatility shifts and persistence in variance: evidence from the sector indices of Istanbul Stock Exchange', *International Journal of Economic Sciences and Applied Research*, 4, 3, pp. 119-140.

Calvo, G., 1983, 'Staggered prices in a utility maximizing framework', *Journal of Monetary Economics*, 12, pp. 383-398.

Catik, A.N., Martin, C. and Onder, A.O., 2011, 'Relative price variability and the Phillips curve: evidence from Turkey', *Journal of Economic Studies*, 38, pp. 546-561.

Christensen, J.H.E., Lopez, J.A. and Rudebusch, G.D., 2010, 'Inflation expectations and risk premiums in an arbitrage-free model of nominal and real bond yields', *Journal of Money, Credit and Banking*, 42, pp. 143-178.

Cicek, S., 2012, 'Globalization and flattening of Phillips curve in Turkey between 1987 and 2007', *Economic Modelling*, 12, pp. 1655-1661.

Clarida, R., Gali, J. and Gertler, M., 1999, 'The science of monetary policy: a new Keynesian perspective', *Journal of Economic Literature*, 37, pp. 1661-1707.

Cobb, C.W. and Douglas, P.H., 1928, 'A theory of production', *American Economic Review*, 18, pp. 139-165.

Fanelli, L., 2008, 'Testing the new Keynesian Phillips curve through Vector Autoregressive models: results from the Euro area', *Oxford Bulletin of Economics and Statistics*, 70, pp. 53-66.

Fanelli, L. and Palomba, G., 2011, 'Simulation based tests of forward-looking models under VAR learning dynamics', *Journal of Applied Econometrics*, 26, pp. 762-782.

Friedman, M., 1968, 'The role of monetary policy', *American Economic Review*, 58, pp. 1-17.

Gali, J. and Gertler, M., 1999, 'Inflation dynamics: a structural econometric analysis', *Journal of Monetary Economics*, 44, pp. 233-258.

Gali, J., Gertler, M. and Lopez-Salido, D., 2001, 'European inflation dynamics', *European Economic Review*, 45, pp. 1237-1270.

Gali, J., Gertler, M. and Lopez-Salido, D., 2005, 'Robustness of the estimates of the hybrid new Keynesian Phillips Curve', *Journal of Monetary Economics*, 52, pp. 1107-1118.

Gozgor, G., 2012, 'Inflation targeting and monetary policy rules: further evidence from the case of Turkey', *Journal of Applied Finance and Banking*, 2, pp. 127-136.

Gurkaynak, R.S. and Wright, J.H., 2012, 'Macroeconomics and the term structure', *Journal of Economic Literature*, 50, pp. 331-367.

Hansen, L., 1982, 'Large sample properties of Generalized Method of Moments estimators', *Econometrica*, 50, pp. 1029-1054.

Hasanov, M., Arac, A. and Telatar, F., 2010, 'Nonlinearity and structural stability in the Phillips curve: evidence from Turkey', *Economic Modelling*, 27, pp. 1103-1115.

Joyce, M.A.S., Lildholdt, P. and Sorensen, S., 2010, 'Extracting inflation expectations and inflation risk premia from the term structure: a joint model of the UK nominal and real yield curves', *Journal of Banking and Finance*, 34, pp. 281-294.

Karanassou, M., Sala, H. and Snower, D.J., 2010, 'Phillips curves and unemployment dynamics: a critique and a holistic perspective', *Journal of Economic Surveys*, 24, pp. 1-51.

Kumar, M., 2010, 'A time-varying parameter Vector Autoregression model for forecasting emerging market exchange rates', *International Journal of Economic Sciences and Applied Research*, 3, pp. 21-39.

Kurmann, A., 2007, 'VAR-based estimation of Euler equations with an application to new Keynesian pricing', *Journal of Economic Dynamics and Control*, 31, pp. 767-796.

Kurozumi, T. and Van Zandweghe, W., 2010, 'Labor market search, the Taylor principle and indeterminacy', *Journal of Monetary Economics*, 57, pp. 851-858.

Kustepeli, Y., 2005, 'A comprehensive short-run analysis of a (possible) Turkish Phillips curve', *Applied Economics*, 37, pp. 581-591.

Kuttner, K. and Robinson, T., 2010, 'Understanding the flattening Phillips curve', *North American Journal of Economics and Finance*, 21, pp. 110-125.

Linde, J., 2005, 'Estimating New-Keynesian Phillips curves: a full information maximum likelihood approach', *Journal of Monetary Economics*, 52, pp. 1135-1149.

Lucas, R.E. Jr., 1972, 'Expectations and the neutrality of money', *Journal of Economic Theory*, 4, pp. 103-124.

Mavroeidis, S., 2006, 'Testing the new Keynesian Phillips curve without assuming identification', *Brown University Economic Papers*, 13.

Mazali, A.A. and Divino, J.A., 2010, 'Real wage rigidity and the new Phillips curve: the Brazilian case', *Revista Brasileira de Economia*, 64, pp. 291-306.

Mihailov, A., Rumler, F., and Scharler, J., 2011, 'The small open-economy new Keynesian Phillips curve: empirical evidence and implied inflation dynamics', *Open Economies Review*, 22, pp. 317-337.

Newey, W. and West, K.D., 1987, 'A simple positive semi-definite, heteroskedasticity and autocorrelation consistent covariance matrix', *Econometrica*, 55, pp. 703-708.

Newey, W. and West, K.D., 1994, 'Automatic lag selection in covariance matrix estimation', *Review of Economic Studies*, 61, pp. 631-653.

Nymoen, R., Swensen, A.R. and Tveter, E., 2012, 'Interpreting the evidence for new Keynesian models of inflation dynamics', *Journal of Macroeconomics*, 34, pp. 253-263.

Onder, A.O., 2004, 'Forecasting inflation in emerging markets by using Phillips curve and alternative time series models', *Emerging Markets Finance and Trade*, 40, pp. 71-82.

Onder, A.O., 2009, 'The stability of the Turkish Phillips curve and alternative regime shifting models', *Applied Economics*, 41, pp. 2597-2604.

Phelps, E.S., 1967, 'Phillips curve, expectations of inflation and optimal unemployment over time', *Economica*, 34, pp. 254-281.

Phelps, E.S., 1968, 'Money-wage dynamics and labor market equilibrium', *Journal of Political Economy*, 76, pp. 678-711.

Phillips, A.W., 1958, 'The relationship between unemployment and the rate of change of money wages in the United Kingdom 1861-1957', *Economica*, 25, pp. 283-299.

Rotemberg, J.J., 1982, 'Sticky prices in the United States', *Journal of Political Economy*, 90, pp. 1187-1211.

Rudd, J. and Whelan, K., 2005, 'New tests of the new Keynesian Phillips curve', *Journal of Monetary Economics*, 52, pp. 1167-1181.

Rudd, J. and Whelan, K., 2006, 'Can rational expectations sticky-price models explain inflation dynamics?', *American Economic Review*, 96, pp. 303-320.

Rudd, J. and Whelan, K., 2007, 'Modelling inflation dynamics: a critical review of recent research', *Journal of Money, Credit and Banking*, 39, pp. 155-170.

Rumler, F., 2007, 'Estimates of the open economy new Keynesian Phillips curve for Euro area countries', *Open Economies Review*, 18, pp. 427-451.

Saz, G., 2011, 'The Turkish Phillips curve experience and the new Keynesian Phillips curve: a conceptualization and application of a novel measure for marginal costs', *International Research Journal of Finance and Economics*, 63, pp. 8-45.

Yazgan, M.E. and Yilmazkuday, H., 2005, 'Inflation dynamics of Turkey: a structural estimation', *Studies in Nonlinear Dynamics and Econometrics*, 9, pp. 1-13.