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HOW RELEVANT IS THE NEW (KEYNESIAN) PHILLIPS CURVE? THE CASE OF TURKEY

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The New Keynesian microfoundations provide a new perspective in understanding inflation output trade-off or policy effectiveness phenomena. Roughly speaking, the New Keynesian theory can be described as an attempt to re-formulate the familiar Phillips Curve on the basis of new microfoundations. According to this new formulation of the relationship between effects of demand shocks and price-setting behaviour, average inflation is one of the most important determinants of the degree of the trade-off. In high inflationary environments, agents are more willing to revise their prices, while in a low inflationary environment, they may ignore and postpone price adjustment as a reaction to a series of demand shocks. To test the relevancy of such a claim related to the Phillips Curve, a generalised impulse-response analysis is performed by using Turkish data which can easily be divided into two periods. In the first period between 1988:Q3 and 1996:Q1, inflation rates in the Turkish economy have increased, and in the second (from 1996:Q2 to 2003:Q4), it has been decreasing. The findings of this study support the hypothesis that "price adjustment frequency decreases (rises) sharply with lower (higher) rates of inflation, reducing the real effect of inflation on output", as claimed by Devereux and Yetman (2002:95).

1. INTRODUCTION

The consensus in macroeconomic theory prevailing until the early seventies has disappeared mainly for two reasons. The first was empirical; the conventional Phillips Curve, which provided a stable long-run trade-off relationship between inflation and employment, did not adequately explain the stagflation problem of the seventies. The Phillips Curve argument was an analytical framework that received widespread acceptance within academic and political circles and was providing a "menu of policy choice" for governments, particularly in the

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Keynesian tradition. However, due to high and rising rates of inflation combined with high rather than low unemployment in the second half of the seventies, the stable relationship has broken down empirically. Many economists, including Keynesians, were a bit surprised and abandoned the idea of a stable trade-off between unemployment and inflation.

The second reason was theoretical. It was about the gap between microeconomic principles and macroeconomic application. The classical and new classical economists had built their macroeconomic theories on the assumption that wages and prices are fully flexible. They believe that prices "clear" markets by adjusting quickly to the shocks. According to the classical assumption of perfect competition, underlying the classical view of price determination, price rigidity is extremely unlikely in a perfectly competitive market. As a result, demand policies are ineffective and money is neutral. New Keynesians, however, object to the “neutrality result” focused on the market clearing assumption. They believe that market-clearing models cannot explain short-run economic fluctuations, and hence they advocate models with "sticky" wages and prices. The main questions that New Keynesians ask are whether or not perfect competition exists, prices and wages are flexible and adjust fast enough to clear the markets. Keynesians point out that a relatively small part of the economy is perfectly competitive. They argue that prices are fixed in nominal terms and maintained for some period of time. Therefore, Keynesians explain monetary non-neutrality by saying that if prices are sticky, the price level cannot adjust immediately to offset changes in the money supply, and money is not neutral.

Therefore, New Keynesians as a school have emerged in the late seventies and started to build a new macroeconomics on, so to speak, “firm” microeconomic foundations. The first group of New Keynesians (e.g. Fischer (1977), Phelps and Taylor (1977), Gray (1978), and Taylor (1979, 1980), etc.) focused on nominal wage rigidity arising from the presence of contracts in the labour market. The second group, Mankiw (1985), Romer and Ball (1987), Calvo (1983), Akerlof and Yellen (1985), Blanchard and Kiyotaki (1987) and Ball, Mankiw and Romer (1991) etc.) emphasised some obstacles which prevent prices from fully adjusting as a reaction to the nominal demand shocks.

This paper is an attempt to test the relevancy of the New Keynesian hypothesis that demand shocks or disturbances give rise to a large fluctuation in the economic activity level. Built on a solid neoclassical foundation, the New Keynesians claim that the effects of nominal rigidities in the presence of economic shocks vary according to the level of inflation and inflationary expectations. For an empirical test of the hypothesis, the Turkish economy is selected because inflation and inflationary expectations have been varying during the last thirty years with two separate trends. From 1988 to 1996, inflation rates in the Turkish economy have been increasing while steadily decreasing on average in the second phase from 1996 up to the present. Therefore, Turkish data seem to be very suitable for our purpose.

The paper explains the central tenets of the New Keynesian analysis in the first section. The empirical studies relevant to the issue are reviewed in the second section and an empirical investigation based on the Turkish data is performed in the third section. A conclusion is given at the end.

2. CENTRAL TENETS OF THE NEW KEYNESIAN THEORY

Similar to traditional Keynesians, New Keynesians also believe that output fluctuations arise largely from fluctuations in nominal aggregate demand shocks. The basic reason for such a result comes from some kind of nominal imperfection. Only a partial or "sub-optimal" adjustment of prices in response to demand shocks is responsible for the business cycles. With nominal rigidities, wages and prices do not adjust instantaneously to offset shocks hitting the economy. These shocks, therefore, may cause fluctuations in real variables. It means that nominal demand shocks may have real effects on the economy (Mankiw, 1991:29). Adopting the rational expectations like New Classicals, New Keynesians, therefore, give a central role to the rigidities of nominal prices and/or nominal wages in explaining business cycles or the policy effectiveness phenomena[1].

In New Keynesian economics, the staggered price setting behaviour is believed to be widespread among economic agents due to reasons

[1] They do not regard this standpoint as a departure from the principle of rationality. Akerlof and Yellen's (1985) concept of "near rationality" can give a clear definition of the New Keynesian perception concerning the principle of rationality.

such as the cost of changing nominal prices or stickiness in nominal wages. According to Calvo (1983:383), "each price setter (or firm) can change its price whenever a random signal is 'lit-up' ", and " in a period only a fraction of firms will receive the signal". Therefore, after a demand shock such as a monetary expansion, the aggregate price level is determined in each period in the following way:

$$dP/dM = q\,(dP_1/dM) + (1 - q)\,(dP_2/dM),$$

where M, P, P_1, P_2, q are money supply, aggregate price level, sticky prices, flexible prices and a fraction of the firms which do not revise their prices after the shock (Scarth, 1996: 216). Since $dP_1/dM = 0$, a fraction of firms adjusts the price each period so that the price level becomes a smooth variable and changes only gradually over time being accompanied by output adjustments. The New Keynesian economists believe that "price setters are unlikely to continue following simple menu cost rules in the presence of high rates of inflation" (Devereux and Yetman, 2002:95). Therefore, the number of firms adjusting their prices as a response to a demand shock increases as average inflation rates in the economy rise. This finding has an important implication in terms of the effects of demand shock on economic activity: "at higher rates of inflation, the trade-off is reduced, and at the high enough rates of inflation, it disappears" (Akerlof, Dickens, Perry, 2000:21-22).

The presence of price and wage rigidities does not dispense with the imperfect competition. Under the assumption of perfect competition, both firms and employees do not fully control their nominal prices and wages. In other words, the objective function should be differentiable in an agent's own wages and prices. As Akerlof and Yellen (1985:826) point out, this assumption does not hold in a competitive model. "In the competitive model, lower prices or higher wages than the market-clearing levels confer no benefits on the firm". Therefore, one of the integral parts of the New Keynesian analysis becomes the assumption of imperfect competition. Since that assumption requires usually mark-up pricing firms, the responsiveness of prices and persistence may depend on the state of the firms' costs structure. If one assumes that wage expenditures constitute a large part of the firms' total cost, the nominal wage stickiness may cause optimal prices to remain fixed in the short-

run in a constant mark-up over the wage price setting framework [2]. If that is the case, one can say that after a demand shock, a firm will not have to change its prices as long as nominal wages are sticky[3]:

As a result, the nature of the new "inflation-output trade-off" becomes more straightforward in the New Keynesian Theory. In Kreiner's words, "menu costs and imperfectly competitive behaviour interact in such a way that nominal demand disturbances give rise to large fluctuations in output" (Kreiner, 2002:384).

3. THE EMPIRICAL LITERATURE ON THE NEW KEYNESIAN THEORY

Starting in the early nineties in particular, some researches have been carried out that investigate the quantitative relevancy of the New Keynesian micro foundations to both inflation dynamics and inflation-output trade-off issues. These studies differ from each other particularly in terms of their choice of variables and estimation techniques.

Ball, Mankiw and Romer (1991) propose a two-equation model measuring average inflation-output trade-off and test it with a cross-section data for 43 industrialised countries. This study mainly tests the new Phillips Curve by using the following regression equations:

$$y_t = constant + \tau \Delta x_t + \lambda y_{t-1} + \gamma(time) + u_t, \quad (1)$$

$$\tau = constant + \pi_t + v_t^1 \quad (2)$$

In the model, y, Δx and π denote the log of real GNP, change in nominal GNP and average inflation rates respectively. The coefficient of change in nominal demand, τ, is the parameter of central interest for the study. The trade-off parameter, τ, explains the effect of an aggregate demand shock on output in the first year.

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[2] Taylor (1979, 1980) and Fischer (1977) are leading writings in this area of study. In this body of literature, nominal wage rigidities play some crucial roles. Taylor focuses on the asynchronised (or staggered) aspects of nominal wage revision across the firms in the economy On the other hand, Fischer gives greater importance on contract length.

[3] Gordon (1990) and Blanchard and Kiyotaki (1999) discuss in detail the crucial importance of nominal wage stickiness in understanding real effects of demand shock in an imperfectly competitive environment.

One of the main concerns of the present paper is whether the cross-country variation in the estimated trade-off parameter, τ, can be explained by variations in the level of average inflations. The theoretical implication of the model suggests that τ should be low in the countries where the variability of aggregate demand and the average level of inflation are high[4] (Ball etc..1991:180). The test results display a negative relation between average inflation and trade-off parameter.

There are also many other arguments concerning the appropriate specifications of inflation dynamics that claim to be consistent with the New Keynesian micro foundations. Gali and Gertler (1998) develop and estimate a structural model of inflation. The econometric specification for inflation dynamics in the model is:

$$\pi_t = \lambda s_t^N + \gamma_f \pi_{t+1} + \gamma_b \pi_{t-1} + \epsilon_{t+1},$$
$$\text{where } \epsilon_{t+1} = E_t\pi_{t+1} - \pi_t.$$

The model includes both forward-looking and backward-looking price-setting behaviours and a measure of marginal costs, namely labour income share (s)[5]. Although the link between inflation and some measure of overall real economic activity is in the spirit of the familiar Phillips Curve, Gali and Gertler use the measures of real marginal cost in place of an ad hoc output gap. They believe that there is an approximate log linear relationship between the two variables. Their findings are: (i) real marginal cost is indeed a statistically significant and qualitatively important determinant of inflation, (ii) the forward-looking behaviour is very important, (iii) the backward-looking behaviour is statistically significant but has only limited quantitative importance[6].

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[4] Lucas (1981) also devoloped a very similar model to test the relation between nominal GDP volatility and output-inflation trade-off.

[5] Roberts (1995) offers "price of crude oil" as a proxy for costs.

[6] Rudd and Whelan (2001) argue against the empirical relevancy of hybrid New Keynesian Phillips Curve (NKPC) which includes both lagged and expected inflation as well as output gap. In critizing Gari and Gertler's (1998) inflation model, they advocate that the importance of future inflation term was overrated. They also try to show that the coefficients of the lagged inflation and output gap terms will be biased, because the influence of lagged inflation and output gap on current inflation is already partly captured by $\pi_{(t+1)}$. Another problem is related to the choice of the instruments. According to them, a good set of instruments needs to be correlated with the part of $\pi t+1$ that is orthogonal to lagged inflation and output gap.

Gali (2000) displays a number of alternative specifications of the so called "New Phillips Curve" (NPC). According to him, firms choose a price that is a constant markup over a weighted average of expected future marginal cost. So, inflation dynamics can be expressed in terms of future expected inflation and a marginal cost variable. But he adds that the marginal cost variables should be a function of the output gap[7]. As a result, the study obtains an NPC in terms of future expected inflation and output gap[8]. He suggests that the evidence seems to be reinforced by many of the estimates of the hybrid Phillips Curve in the following form:

$$\pi_t = \Phi\pi_{t-1} + (1-\Phi)E\{\pi_{t+1}\} + \delta(y_t - y_t^*).$$

Such a formulation of the NPC bears some difficulties related to the use of the output gap as an explanatory variable. The first difficulty is about the natural level of output. It is an unobservable variable and fluctuates over time as a result of different types of shocks (fiscal, technology, etc.) to the economy. Another difficulty lies in the formulation of the marginal costs as a function of the output gap. Even if the output gap was observable, the condition under which it is proportional to the marginal cost may not be satisfied. In order to overcome such problems, Gali uses a model in which the function of future expected inflation and real marginal cost are derived proportional to the labour income share, s_t^N.

Gali estimates the model giving a highly important role to the forward-looking price-setting behaviour and finds a positive relation between inflation and marginal cost. His model estimates are:

$$\pi_t = 0{,}92\, E_t\{\pi_{t+1}\} + 0{,}04\, s_t^n .$$

Roberts (2001) discusses and estimates a model with different specifications of NPC. Similar to Gali, he advocates that the marginal costs may be rising in parallel to the aggregate economic activity. So under such an assumption, inflation can be expressed as a function of

[7] Gali defines output gap as the deviations of the level of real output from its natural level which would be obtained under flexible prices.

[8] $\pi_t = \beta E\{\pi_{t+1}\} + \lambda\kappa(y_t - y_t^*)$.

expected future inflation[9] and a measure of the output gap. But unlike Gali, Roberts (2001) points out that the model conditional on labour costs is looking at a narrower set of phenomena than the Phillips Curve, and is implicitly leaving out any influence of aggregate economic activity on labour costs. The model used in the paper is as follows:

$$\Delta P_t = \gamma y_t + (1 - w)\, M\Delta P_{t+1} + w\rho\Delta P_{t-1} + \epsilon_t .$$

In the model, inflation expectations are calculated as a weighted average of rational expectations and used as a simple autoregressive rule of thumb to forecast inflation. Therefore, a lagged inflation term is included in the model. In the study, several alternative measures of inflation such as CPI inflation or GDP chain-type price index are used in addition to economic activity measures such as detrend GDP, capacity utilisation in the manufacturing sector and unemployment rates. The study finds a significantly high correlation between the slope of the Phillips Curve and estimates the degree of non-rationality in the pricing behaviour.

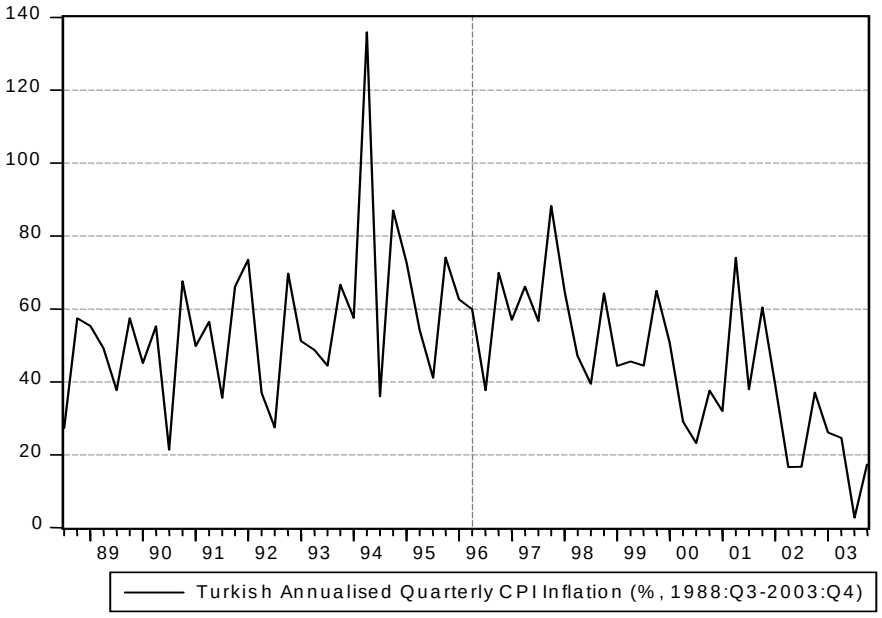
Leong (2002) is another study that attempts to reconcile the New Keynesian model with observed inflation persistence. Assuming rational expectations, inflation is seen as a function of the mathematical expectation of future inflation and an excess demand term (or output gap) in the New Keynesian-type Phillips Curve. In the paper, as a result of the empirical failure, Leong has made some modifications to the model in such a way that backward-looking components now appear. One of the distinctive parts of this analysis is that the model uses real exchange rates as a determinant of inflation. The model is specified as follows:

$$\pi_t = \beta_1 E\pi_{t+1} + \beta_2 y_t + \beta_3 (100 \ln Q_t) + \nu_t .$$

[9] We know that inflation expectation is not an observable variable. Thus, we need some proxies for expected inflation. As Roberts (1995:980-1) puts it, there may be two types of proxies for this variable. One approach is to use a survey of price expectations. In the second approach, the actual future value of inflation is used as a proxy for the expectation. Such a model requires instrumental variables estimation since there is an additional source of error arising from the forecast error, v = (EΔPt+1 – ΔPt+1). But there are also many other studies which use lagged inflation as a proxy to take the inflation expectations into account.

In the model, π, y, Q and v are inflation, output gap as the de-trended log of GDP, real exchange rate and white noise supply-shocks respectively. An important finding of the model is that the exchange rate channel is important for generating inflation persistence in a fully forward-looking New Keynesian model.

Figure 1. Inflation in the Turkish Economy, 1988-2004



4. HOW RELEVANT ARE THE NEW KEYNESIAN MICROFOUNDATIONS: THE CASE OF TURKEY

So far, we have outlined the New Keynesian perspective on the inflation-output trade-off issue, called "the Phillips Curve". The relevancy of the theoretical contributions of the New Keynesians to the inflation-output trade-off and policy effectiveness issues are also of an empirical interest because the new micro-founded Phillips Curve raises some interesting insights in understanding the dynamics of nominal price movements and the effectiveness of demand policies. The New Keynesian argument of whether *higher rates of inflation in an economy reduce the trade-off and the trade-off disappears at the high enough rates of inflation* (Akerlof, Dickens, Perry, 2000:21-22) needs to be

tested empirically. For this purpose, this section attempts to clarify such an outcome of the New Keynesian analysis in terms of the Turkish economy that has been suffering from the inflation problem over the last thirty years**.** In the said period, inflation in the Turkish economy has been both high and varying from one year to another and has weakened Turkey's economic performance in various ways.

When we check out the inflation rates measured in terms of Consumer Price Index (CPI), one interesting feature of the Turkish case is that the CPI inflation rate on average has been increasing between 1988 and 1996 and decreasing from 1996 up to the present. Therefore, following the Akerlof, Dickens and Perry (2001) methodology to perform an impulse-response analysis, we divide our full sample (1988:Q3-2003:Q4) into two sub-samples (1988:Q3-1996:Q1 and 1996:Q2-2003:Q4). In doing so, we expect to see whether the new Keynesian theory is valid so that inflation reacts to output gap more aggressively in the first period compared with the second. The intuition behind such an expectation comes from the claim that in a more inflationary environment like the first period, agents are more willing to take the future expected inflation into account in making their decision on pricing. Therefore, the real effects of a demand shock disappear quickly, being fully absorbed by the nominal price movements.

An impulse-response analysis seems to be the most appropriate technique to test such an argument of the New Keynesian analysis. In order to perform the test, we employ vector autoregresion VAR (1)[10] specifications on three variables consistent with a new Keynesian inflation dynamics: consumer price index (CPI) annualised inflation rates, real exchange rate index and capacity utilisation ratio as a proxy of output gap[11]. While lagged inflation variables in the equation for inflation

[10] To decide the lag-length, we use Akaike's Information Criterion (AIC) and the Schwarz Criterion (SC). Both criteria support VAR(1) specification. The LM test predicts that there is no serial correlation for this specification.

[11] All variables were obtained from the base data of the Central Bank of Turkey. The variables were detrended by using the HP filter except for capacity utilisation ratio (CUR). To calculate the output gap, we use the formula 100*(log(CUR)-log(100)), since 100 may represent a sort of "natural rate". After detrend, we call the capacity utilisation ratio as "output gap". In addition, before filtering, CPI inflation was annualised by the formula $400*(\log(CPI_t)-\log(CPI_{t-1}))$. According to the Augmented

dynamics may be regarded as a measure of expected inflation, real exchange rate and output gap variables are believed to be proxies capturing "cost-push" and "demand-pull" influences on inflation respectively.

The basic idea behind the vector autoregression (VAR) technique is that movements in macroeconomic variables can be explained by contemporaneous links between the variables and by their lagged values. Anything left unexplained is attributed to a "shock" or a disturbance to the macroeconomic variable. VAR (p) models which have been advocated most notably by Sims (1980) can simply be written as:

$$Y_t = \alpha + Y_{t-1}\phi_1 + \ldots + Y_{t-p}\phi_p + U_t, \qquad U_t \sim IID(0,\Omega),$$

where Y_t denotes the t *th* observation on a set of variables, α is a *1 x m* row vector, and ϕ_1 through ϕ_p are *m x m* matrices of coefficients to be estimated. A VAR model expressed in such a form can be regarded as a way to estimate the dynamic relationship among jointly endogenous variables without imposing strong a priori restrictions. The basic premise is that we can use the interaction among several variables to improve our forecast of each individual variable. At time *t*, the forecast of a variable y is a function of its own past values as well as the present and past values of other variables in the system. A VAR does not come with the set of exclusion restrictions necessary to identify and estimate a structural model. In order to estimate a VAR model and perform an impulse-response analysis, we need to determine the degree of VAR, that is 'p', which is a step to find the appropriate lag for each variable in the system. According to model selection criterions, we employ VAR (1) as mentioned above.

The fact that VAR analysis provides us with the behaviour of a particular series in response to the various shocks seems to be appealing for investigating the interaction between "output gap-inflation". However, in order to identify the impulse-responses, we must impose an additional restriction on the VAR system. One possible identification restriction is to use Choleski decomposition. According to Pesaran and Shin (1998:17), if the underlying shocks to the VAR model are orthogonalised in that fashion, this approach will

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Dickey-Fuller (ADF) test performed, for all the variables in the VAR, the presence of unit root was rejected at the %1 significance level.

not be invariant to the ordering of the variables in the VAR. So, they propose an alternative approach to impulse-response to overcome such shortcomings. Following Pesaran and Shin, applying a generalised impulse-response enables us to construct an orthogonal set of innovations that does not depend on the VAR ordering, in contrast to an orthogonalised impulse-response based mainly on Cholesky decomposition.

According to the generalised impulse-response tables, in the first period with a relatively higher and increasing average inflation, the average prices react so aggressively to output gap that the effect of a demand shock disappears in 4-5 quarters. On the other hand, in the second period with relatively lower and decreasing rates, inflation responds to the shock smoothly due to the staggered nature of the nominal prices. As a result, the effects of a demand shock become long-lasting in the second period (about 8-9 quarters) compared with the shock in the first period. These results support the view stated in Devereux and Yetman (2002:95) that "price adjustment frequency decreases (rises) sharply with lower (higher) rates of inflation, reducing the real effect of inflation on output".

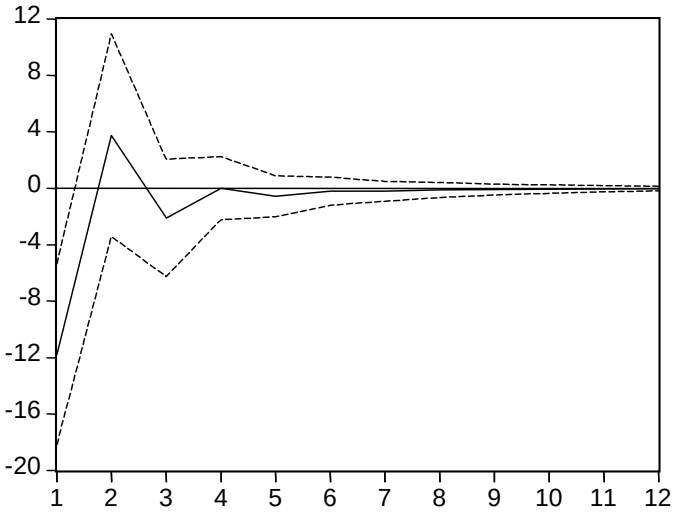
5. CONCLUSION

This study has attempted to test the relevancy of the New Keynesian hypothesis that demand shocks or disturbances may give rise to fluctuation in the economic activity level depending on nominal rigidities existing in an economy. The New Keynesians claim that the effects of nominal rigidities in the presence of economic shocks vary according to the state of inflationary expectations. In high inflationary environments, agents are more willing to revise their prices, while in a low inflationary environment, they may ignore and postpone price adjustment as a reaction to a series of demand shocks.

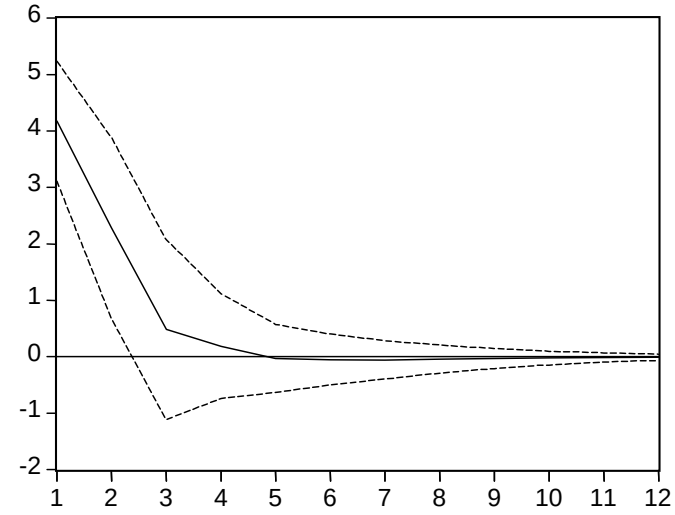
Considering the Turkish inflation-output relationship in the past twenty years, this study finds that the average prices react to output gap so quickly that the effect of a demand shock disappears in 4-5 quarters when the inflationary expectations are high due to high and increasing inflation rates in the first period between 1988:Q3 and 1996:Q1. On the

Response to Generalised One S.D. Innovations ± 2 S.E.

Response of Inflation to Output Gap (1st Period)

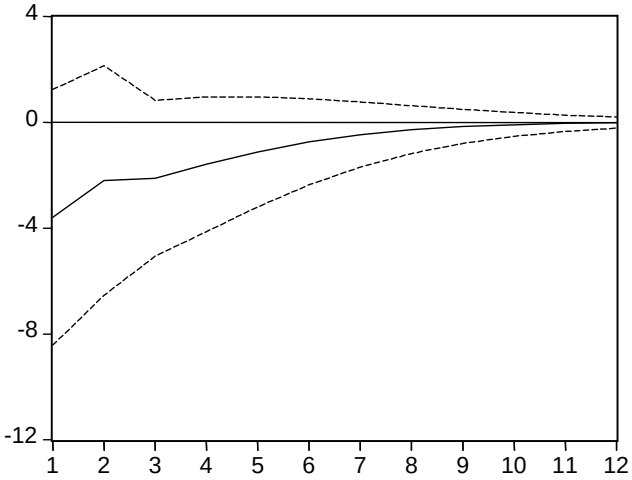


Response of Output Gap to Demand Shock (1st Period)

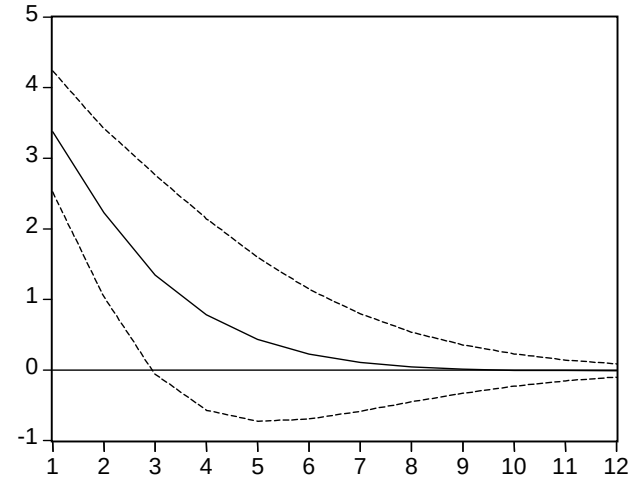


Response to Generalised One S.D. Innovations ± 2 S.E.

Response of Inflation to Output Gap (2nd Period)



Response of Output Gap to Demand Shock (2nd Period)



contrary, the inflation responds to the demand shocks, captured by an output-gap measure in the model, smoothly due to the staggered nature of the nominal prices. Therefore, the effects of a demand shock become long-lasting in the second period (about 8-9 quarters) between 1996:Q2 to 2003:Q4. These results support the view that price adjustment speed in an economy has close ties with rates of inflation and, in turn, determines the degree of inflation-output trade-off.

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