Non-Accelerating Inflation Rate Of Unemployment (NAIRU) In Iran

Nahid Kalbasi, North Central University, Arizona, USA
Maryam Ashtary, Islamic Azad University, Iran

ABSTRACT

The recent literature on monetary policy has raised many questions about the trade-off between inflation and unemployment and the assumption of a constant NAIRU. This paper tries to investigate the effects of monetary policy on NAIRU in Iran. We implement a structural Vector Auto Regression (VAR) model to measure the effects of monetary policy in shaping NAIRU in Iran's economy. Our results suggest that monetary policy has negligible effects on NAIRU and the unemployment rate is mainly affected by labor market imperfections, such as wage rigidity, labor law, regulations, and institutions that do not match with today's world economy.

Keywords: Non-Accelerating Inflation Rate of Unemployment (NAIRU); Non-Linear Phillips Curve; Vector Auto Regression Model (VAR); Hysteresis; Wage Staggering

INTRODUCTION

The unemployment rate in Iran has been very volatile during the past three decades, exceeding 17% in the late 1980s, dropping to almost 15% in the early 2000, and rising back to 16% in 2010. Our results suggest that expansionary monetary policy has failed to reduce the unemployment rate in Iran in accordance with Gordon (1994) who believes monetary policy is unable to reduce the unemployment rate in the long run.

Since little empirical study has been carried out on the NAIR in Iran's economy, we try to explore what are the determinants of NAIRU and how does monetary policy affect the NAIRU in a government controlled economy like Iran, which is weakened by international sanctions. Effectively, our results suggest that NAIRU is not affected by monetary policy, but by labor market rigidities and unfavorable international condition, which has reduced the capacity utilization and labor productivity to very low levels.

The remainder of this paper contains sections on literature review on NAIRU, estimation of NAIRU for Iran's economy and exploration of the interaction of monetary policy with NAIRU through a structural VAR, followed by a conclusion which provides some grounds for further research in this area.

LITERATURE REVIEW

A controversial topic that has received too much attention in the monetary policy area is the shape of Phillips curve and its determinants. The shape of Phillips curve plays an important role in designing monetary policy and has important implications for policymakers. Not surprisingly, the Phillips curve has been the core of monetary policy studies in both business cycle and Keynesian perspectives.

In earlier studies, the Phillips curve was assumed to be linear, but many recent studies have raised doubts about the linearity of the Phillips curve (Semmler and Zehang, 2004). It is argued that a Phillips curve may have three different shapes. The first group of researchers - Clark, Laxton and Rose (1996), Schaling (1999) and Bean (2000) - argue that the Phillips curve is convex. A convex Phillips curve is likely to appear in an economy subject to capacity constraints. The second group of researchers, including Eisner (1997), articulates that the Phillips curve is concave. A concave Phillips curve may exist in an economy where full competitiveness does not exist. The third

group of researchers, including Filardo (1998) - based on some empirical studies with U.S. data - state that the Phillips curve is not purely convex or concave, but instead convex-concave. He finds that the Phillips curve is convex if the output gap is positive and concave if the output gap is negative (Semmler and Zehang, 2004). Indeed, the shape of the Phillips curve has important policy implications for the central banks since the optimal monetary policy changes with the concavity or convexity of the Phillips curve.

Another important topic in the context of monetary policy is the stability of NAIRU and whether it is constant during the time or if it is time-varying. In 1968, Friedman and Phelps proposed a vertical long-run Phillips curve. The traditional view is that money cannot influence the unemployment rate in the long run therefore returning the unemployment rate to its natural rate or NAIRU, which is presumed to be constant. The recent literature, however, has cast some doubts about a vertical long-run Phillips curve and constant NAIRU (Gordon, 1997).

Many researchers have tried to estimate a time-varying NAIRU. An earlier survey on the estimation of the NAIRU is mentioned by Staiger, Stock and Watson (1996). Stiglitz (1997) articulates that the NAIRU may have feedbacks on policies in the sense that it might produce a moving target for monetary policy. Therefore, an economic model with an exogenous NAIRU might not explore monetary policy properly.

Blanchard and Quah (1989) argue that fluctuations in unemployment are due to two types of disturbances; disturbances - those have a permanent effect on output and those that do not. They interpret the first as supply disturbances and the second as demand disturbances. Demand disturbances have a hump-shape mirror image effect on output and unemployment, which disappears after two or three years. The effect of supply disturbances on output and unemployment increases steadily over time, peaking after two years and reaching a plateau after five years. They argue that the response of unemployment and output are suggestive of the presence of rigidities, both nominal and real. Nominal rigidity can explain why, in response to a positive supply shock, aggregate demand does not initially increase enough to match the increase in output and to keep the unemployment constant. On the other hand, real wage rigidities can explain why increases in productivity can lead to a decline in unemployment. They conclude that demand disturbances make a substantial contribution to output at short and medium-term horizons.

Some neoclassical economists (Lucas and Sargent, 1978) have dismissed the Philips curve as an econometrics failure since the negative long-run correlation of the 1960s contrasted with the positive correlation of the data of the 1970s. At that point, many neoclassical economists stopped paying attention to the empirical studies on the Philips curve and turned to real theories of aggregate output fluctuations in which the behavior of inflation is neither explored nor explained. This treatment was opposite to that implied by the Philips curve where the growth of real GDP is implicitly treated as a residual.

Gordon (1994) argues that the American economy of the mid-1990s has been the source of puzzlement for macroeconomists since inflation has been declining despite the fact that unemployment dipped below 6%. "With falling medium and long-run interest rates, the economy achieved a state of high growth, non-inflationary bliss that some have dubbed the Goldilocks economy (neither too hot nor too cold, but just right)". Gordon believes that food-energy and import price effects were holding down inflation from 1996 to 1998. He also argues that computer prices, medical care prices, and improvements in the measurement of prices contributed to a decline in time-varying NAIRU.

The NAIRU is meaningful, only within a well specified model of inflation (Gordon, 1997). He develops a triangle model and concludes that supply shocks can cause a positive correlation between inflation and unemployment gap. The observation that the correlation between inflation and unemployment is positive rather than negative in the 1970s is consistent with the triangle model due to its explicit treatment of supply shocks, such as rise and fall of oil prices. He concludes that both demand and supply shocks influence both inflation and unemployment.

Ball (1997) argues that the rise in average unemployment was severe in the European community where 1994 unemployment averaged 11.7%. Although the jump was caused by business cycles, there was also a rise in the long-run trend of NAIRU. OECD estimates of NAIRU rose for most countries in both the 1970s and 1980s. Much literature has sought to explain this phenomenon, mainly focusing on imperfections in the labor market arising from

labor unions, government interventions, such as unemployment insurance, and firing restrictions. Rules and regulations designed for an earlier era have created labor markets that are too rigid to adjust to productivity growth. Ball argues that the main cause of rising unemployment was tight monetary policy that most OECD countries pursued to reduce inflation. His cross-country comparison suggests that countries with larger decrease in inflation and longer disinflationary periods had larger increase in NAIRU. His argument is inconsistent with traditional "natural rate" theories of Friedman and Phelps (1968) but is consistent with "hysteresis" theory of Blanchard and Summers (1986). He examines the role of labor market imperfection in the rise of NAIRU. He considers various measures of distortion and finds that their cross-correlation with NAIRU is low, except for the duration of unemployment benefits which has a large effect on the size of NAIRU. Indeed, his results approve the hysteresis theory which attributes the persistence of unemployment to labor market distortions.

Ball and Mankiw (2002) argue that NAIRU in the U.S. has changed over time, particularly in the second half of the 1990s, due to demographics and government policies. Yet, their hypothesis is that fluctuations in NAIRU appear to be related to fluctuations in productivity; in the 1970s, the NAIRU rose when the productivity slowed down. In the 1990s, NAIRU fell when the productivity jumped up. They argue that changes in monetary policy and aggregate demand push inflation and unemployment in opposite directions in the short run. Once this short-run trade-off is admitted, there must be some level of unemployment consistent with stable inflation in the long run. Because unemployment was low through the 2000s without accelerating inflation, a consensus emerged that the NAIRU had fallen. A central feature of the new economy of the late 1990s was a growth rate in labor productivity. In a steady state with constant growth of labor productivity, the growth of real wage is determined by the growth of productivity. If the productivity falls as it did in the 1970s, fundamentals dictate that real wage growth must fall as well. However, workers try to maintain a wage increase. To the extent that workers have some influence over their wages, this means that wage setters will try to achieve a real wage increase above the level achieved by productivity growth. This mismatch between real wage aspiration and productivity growth worsens the inflation-unemployment trade-off, leading up to a rise in NAIRU.

Logeay and Tober (2003) articulate that during the past 30 years, the NAIRU has changed markedly in the euro area. In the mid-1970s, the NAIRU was slightly below 3%; by the mid-1980s, it jumped to 8.5%; and after rising further in the first half of the 1990s to more than 10%, it reached 8.4% in 2003 (Logeay and Tober, 2003). They use five exogenous variables, two variants of short-term real interest rates, the interest rate gap, the tax wedge, and productivity to estimate NAIRU for the European Union. All five variables were found to be significant when used separately. Their hypothesis is that a combination of exogenous shocks, institutions and macroeconomic policy was instrumental in causing the marked increase in the NAIRU since the mid-1970s. Institutional factors include the level and duration of unemployment benefits, minimum wage law, insider power, and restrictions on laying-off employees. These institutional factors were enhanced in the 1970s and are likely to have increased the equilibrium unemployment rate to some extent. Many recent studies have reached the conclusion that macroeconomic shocks played a key role in bringing about the sharp increase in the unemployment rate. Four shocks include two oil shocks in 1974 and 1981, the marked slowdown in productivity growth in the 1980s relative to the 1970s, and a higher level of international real interest rates. Their results suggest that the real influence of macroeconomic policy is relatively large: A restrictive or expansionary monetary policy not only increases (decreases) current unemployment, but also the NAIRU, and can thus exert a long-term real effect on the economy.

ESTIMATED RESULTS ON NAIRU IN IRAN

The historical data on inflation and unemployment in Iran reveal an interesting trend. During the 1970s, the average inflation rate stood at 12% versus an average unemployment rate of 10.5%. As a matter of fact, despite the favorable oil price in the 1970s, the monetary policy was restrictive, contributing to a lower inflation rate. However, in the 1980s, the average inflation rate rose to almost 19%, whereas the unemployment jumped up to 14.2%. In contrast to a downward Philips curve, we observed both higher inflation and higher unemployment rate in the 1980s. The rise in inflation was mainly due to the war, restrictions on imports, and oil shocks, whereas the jump in unemployment rate can be attributed to destruction of infrastructures and a dramatic fall in investment projects as a result of the Iraq-war. During the 1990s, the inflation rate accelerated, reaching a peak of 25%, whereas unemployment decelerated to 11.8%. The acceleration of inflation rate during the 1990s can be attributed to reconstruction process, expansionary monetary policy, unification of exchange rate, and higher imported prices due

to sanctions. The lower unemployment rate in the 1990s was due to post-war reconstruction process and some economic reforms and privatization process that later was interrupted. During the 2000s, the average inflation rate decelerated to 17%, whereas the unemployment rate accelerated to 15%. Indeed, during the 2000s we confronted lower inflation and a higher unemployment rate. The rise in unemployment in the 2000s is mainly due to sanctions imposed by the international community on Iran's economy, which has interrupted many investment projects, particularly the foreign direct investment (FDI). In sum, the historical trend of inflation unemployment trade-off in Iran suggests a time-varying NAIRU in accordance with other empirical studies, including those of Blanchard and Quah (1989) and Gordon (1994).

In the following section, we estimate the NAIRU for Iran's economy and then investigate the impact of monetary policy on unemployment rate using a structural VAR model.

Based on Blanchard and Quah's model, we try to measure the NAIRU in Iran's economy and then we will investigate the effects of monetary policy on NAIRU within a Structural VAR model. We use yearly data from 1971 through 2010. The list of variables we use includes m_t (money supply), π_t (CPI inflation), and u_t (unemployment rate).

We estimate a structural VAR model with the following equations:

$$\boldsymbol{\pi_t = \alpha_1 + \beta_{12} u_t + \beta_{13} m_t + \gamma_{11}\, \pi(t-i) + \gamma_{12}\, u(t-i) + \gamma_{13}\, m(t-i) + \varepsilon_{\pi t}}$$

$$\boldsymbol{u_t = \alpha_2 + \beta_{21} \pi_t + \beta_{23} m_t + \gamma_{21}\, \pi(t-i) + \gamma_{22}\, u(t-i) + \gamma_{23}\, m(t-i) + \varepsilon_{ut}}$$

$$\boldsymbol{m_t = \alpha_3 + \beta_{31} \pi_t + \beta_{32} u_t + \gamma_{21}\, \pi(t-i) + \gamma_{22}\, u(t-i) + \gamma_{23}\, m(t-i) + \varepsilon_{ut}}$$

The above equations can be shown in the following matrix format:

$$\begin{bmatrix} \pi_t \\ u_t \\ m_t \end{bmatrix} = \begin{bmatrix} \alpha_1 \\ \alpha_2 \\ \alpha_3 \end{bmatrix} + \begin{bmatrix} 0 & \beta_{12} & \beta_{13} \\ \beta_{21} & 0 & \beta_{23} \\ \beta_{31} & \beta_{32} & 0 \end{bmatrix} \begin{bmatrix} \pi_t \\ u_t \\ m_t \end{bmatrix} + \begin{bmatrix} \gamma_{11} & \gamma_{12} & \gamma_{13} \\ \gamma_{21} & \gamma_{22} & \gamma_{23} \\ \gamma_{31} & \gamma_{32} & \gamma_{33} \end{bmatrix} \begin{bmatrix} \pi(t-i) \\ u(t-i) \\ m(t-i) \end{bmatrix} + \begin{bmatrix} \varepsilon_{\pi t} \\ \varepsilon_{ut} \\ \varepsilon_{mt} \end{bmatrix} \quad \textbf{(1)}$$

In these equations, $\varepsilon_{\pi t}$, ε_{ut}, ε_{mt} are disturbance terms with variances of σ_m , σ_u , σ_π which are independent from each other. Each of the endogenous variables is related to the i_m other endogenous variables; therefore, we can rewrite the matrix as follows:

$$\begin{bmatrix} \pi \\ u \\ m \end{bmatrix} = \begin{bmatrix} c_1 \\ c_2 \\ c_3 \end{bmatrix} + \begin{bmatrix} a_{11} & a_{12} & a_{13} \\ a_{21} & a_{22} & a_{23} \\ a_{31} & a_{32} & a_{33} \end{bmatrix} \begin{bmatrix} \pi(t-i) \\ u(t-i) \\ m(t-i) \end{bmatrix} + \begin{bmatrix} e_{\pi t} \\ e_{ut} \\ e_{mt} \end{bmatrix} \quad \textbf{(2)}$$

This is a standard form of VAR, where the disturbance terms $e_{\pi t}$, e_{ut} , e_{mt} are a function of $\varepsilon_{\pi t}$, ε_{ut}, ε_{mt}.

$$\begin{bmatrix} e_{\pi t} \\ e_{ut} \\ e_{mt} \end{bmatrix} = \begin{bmatrix} b_{11} & b_{12} & b_{13} \\ b_{21} & b_{22} & b_{23} \\ b_{31} & b_{32} & b_{33} \end{bmatrix} \begin{bmatrix} \varepsilon_{\pi t} \\ \varepsilon_{ut} \\ \varepsilon_{mt} \end{bmatrix} \quad \textbf{(3)}$$

Or we can rewrite it as follows:

$$\begin{bmatrix} \varepsilon_{\pi t} \\ \varepsilon_{ut} \\ \varepsilon_{mt} \end{bmatrix} = \begin{bmatrix} b_{11} & b_{12} & b_{13} \\ b_{21} & b_{22} & b_{23} \\ b_{31} & b_{32} & b_{33} \end{bmatrix}^{-1} \begin{bmatrix} e_{\pi t} \\ e_{ut} \\ e_{mt} \end{bmatrix} \quad \textbf{(4)}$$

We estimated the standard version of VAR as follows:

$$\begin{bmatrix}\pi\\ u\\ m\end{bmatrix}=\begin{bmatrix}8.8235\\ 5.9983\\ 27.9994\end{bmatrix}+\begin{bmatrix}0.4391 & -0.0119 & 0.0375\\ -0.0617 & 0.5605 & -1.0577\\ 0.0956 & -0.0114 & 0.3886\end{bmatrix}\begin{bmatrix}\pi(-1)\\ u(-1)\\ m(-1)\end{bmatrix}+\begin{bmatrix}e_{\pi t}\\ e_{ut}\\ e_{mt}\end{bmatrix} \quad \textbf{(5)}$$

The results suggest that the inflation rate and money supply have a negative impact on unemployment rate. A one basis point increase in money supply reduces the unemployment by 1.05% and a shock of one basis point in inflation rate reduces the unemployment rate by 0.06%. However, in order to estimate the structural VAR and the long-run effects of supply and demand shocks on NAIRU, we need to consider the relations between the disturbance terms of standard VAR and the structural version. Since in the standard version of the model less parameters are estimated compared to structural version, we need to impose some restrictions on some parameters to avoid an under-identification problem. We impose three restrictions on the model; therefore, the triangle matrix will look as follows, consistent with Blanchard:

$$\begin{bmatrix}\boldsymbol{e_{\pi t}}\\ \boldsymbol{e_{ut}}\\ \boldsymbol{e_{mt}}\end{bmatrix}=\begin{bmatrix}\boldsymbol{b_{11}} & \mathbf{0} & \mathbf{0}\\ \boldsymbol{b_{21}} & \boldsymbol{b_{22}} & \mathbf{0}\\ \boldsymbol{b_{31}} & \boldsymbol{b_{32}} & \boldsymbol{b_{33}}\end{bmatrix}\begin{bmatrix}\boldsymbol{\varepsilon_{\pi t}}\\ \boldsymbol{\varepsilon_{ut}}\\ \boldsymbol{\varepsilon_{mt}}\end{bmatrix}$$

In other words, it is assumed that the unemployment and money supply shocks have no effect on the inflation rate and the money supply shock has no effect on the unemployment rate. Hence, the above matrix was estimated as follows:

$$\mathbf{B}=\begin{bmatrix}\mathbf{14.1913} & \mathbf{0} & \mathbf{0}\\ \mathbf{-1.4017} & \mathbf{4.2165} & \mathbf{0}\\ \mathbf{5.9557} & \mathbf{-11.2802} & \mathbf{11.0066}\end{bmatrix}$$

Since the aim of this study is to investigate the effects of supply and demand shocks on NAIRU, we rewrite the endogenous variables based on these shocks:

$$\begin{bmatrix}\boldsymbol{\pi}\\ \mathbf{u}\\ \boldsymbol{m}\end{bmatrix}=\begin{bmatrix}\mathbf{1}-\boldsymbol{A_{11}}^{-1} & -\boldsymbol{A_{12}}^{-1} & -\boldsymbol{A_{13}}^{-1}\\ -\boldsymbol{A_{21}}^{-1} & \mathbf{1}-\boldsymbol{A_{22}}^{-1} & -\boldsymbol{A_{23}}^{-1}\\ -\boldsymbol{A_{31}}^{-1} & -\boldsymbol{A_{32}}^{-1} & \mathbf{1}-\boldsymbol{A_{33}}^{-1}\end{bmatrix}\begin{bmatrix}\boldsymbol{b_{11}} & \mathbf{0} & \mathbf{0}\\ \boldsymbol{b_{21}} & \boldsymbol{b_{22}} & \mathbf{0}\\ \boldsymbol{b_{31}} & \boldsymbol{b_{32}} & \boldsymbol{b_{33}}\end{bmatrix}\begin{bmatrix}\boldsymbol{\varepsilon_{\pi t}}\\ \boldsymbol{\varepsilon_{ut}}\\ \boldsymbol{\varepsilon_{mt}}\end{bmatrix}$$

Assuming that: $\Delta = (\mathbf{I}-\mathbf{A})^{-1} * \mathbf{B} = \begin{bmatrix}\boldsymbol{\varphi_{11}} & \boldsymbol{\varphi_{12}} & \boldsymbol{\varphi_{13}}\\ \boldsymbol{\varphi_{21}} & \boldsymbol{\varphi_{22}} & \boldsymbol{\varphi_{23}}\\ \boldsymbol{\varphi_{31}} & \boldsymbol{\varphi_{32}} & \boldsymbol{\varphi_{33}}\end{bmatrix}$

$$\begin{bmatrix}\boldsymbol{\pi}\\ \mathbf{u}\\ \boldsymbol{m}\end{bmatrix}=\Delta\begin{bmatrix}\boldsymbol{\varepsilon_{it}}\\ \boldsymbol{\varepsilon_{nt}}\\ \boldsymbol{\varepsilon_{mt}}\end{bmatrix}\Rightarrow\begin{bmatrix}\boldsymbol{\pi}\\ \mathbf{u}\\ \boldsymbol{m}\end{bmatrix}=\begin{bmatrix}\boldsymbol{\varphi_{11}} & \boldsymbol{\varphi_{12}} & \boldsymbol{\varphi_{13}}\\ \boldsymbol{\varphi_{21}} & \boldsymbol{\varphi_{22}} & \boldsymbol{\varphi_{23}}\\ \boldsymbol{\varphi_{31}} & \boldsymbol{\varphi_{32}} & \boldsymbol{\varphi_{33}}\end{bmatrix}\begin{bmatrix}\boldsymbol{\varepsilon_{\pi t}}\\ \boldsymbol{\varepsilon_{ut}}\\ \boldsymbol{\varepsilon_{mt}}\end{bmatrix}$$

We estimate a series of equations to measure the NAIRU. The results of the estimated equations are as follows:

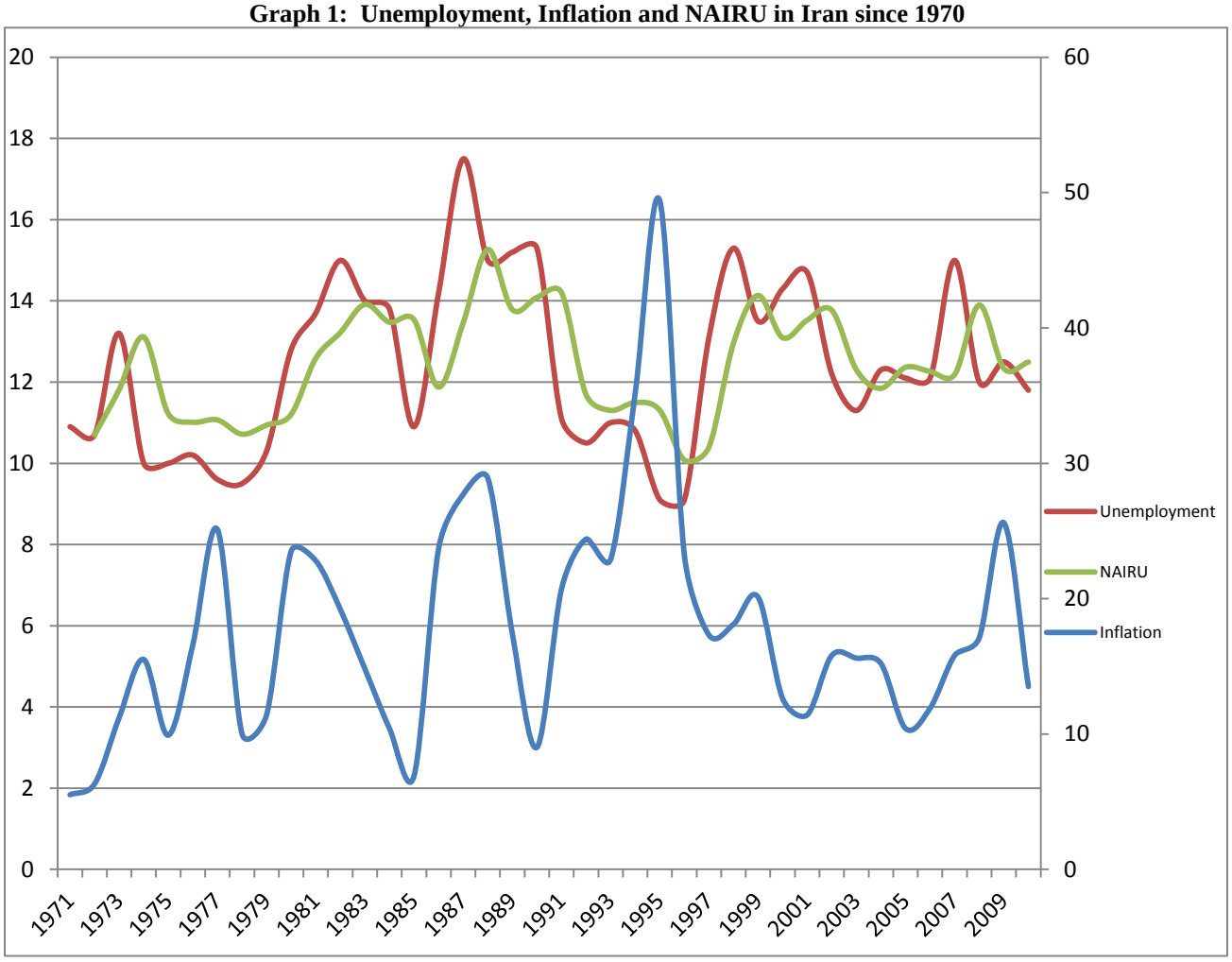
P = 8.8235+ 0.4391*** P(-1)** −0.0119 *** U(-1)** + 0.0375 *** M(-1)**

U = 5.9983 −0.0617*** P(-1)** + 0.5605 *** U(-1)** −1.0577 *** M(-1)**

M =27.9994 + 0.0956*** P(-1)** −0.0114 *** U(-1)** + 0.3886 *** M(-1)**

Graph 1 depicts the NAIRU versus real unemployment in Iran. NAIRU is currently at 12.49% in Iran. As you may see, the results are in accordance with the theory. In other words, when the real unemployment was lower than NAIRU, inflation accelerated and when the unemployment was higher than NAIRU, inflation decelerated.

Graph 1: Unemployment, Inflation and NAIRU in Iran since 1970



MONETARY POLICY AND NAIRU

Since one of our goals is to measure the effects of monetary policy on NAIRU, we use the following VAR model with the estimated amounts of NAIRU from the previous section.

$$\begin{bmatrix} \mathbf{NAIRU_t} \\ M_t \\ \pi_t \end{bmatrix} = \begin{bmatrix} c_1 \\ c_2 \\ c_3 \end{bmatrix} + \begin{bmatrix} d_{11} & d_{12} & d_{13} \\ d_{21} & d_{22} & d_{23} \\ d_{31} & d_{32} & d_{33} \end{bmatrix} \begin{bmatrix} \mathbf{NAIRU_{t-i}} \\ M_{t-i} \\ \pi_{t-i} \end{bmatrix} + \begin{bmatrix} \mathbf{e_{NAIRUt}} \\ \mathbf{e}_{Mt} \\ \mathbf{e}_{\pi t} \end{bmatrix}$$

Based on Akaike and Schwartz's criteria, we use one lag in our VAR model. The estimated results are as follows:

$$\begin{bmatrix} \mathbf{NAIRU_t} \\ M_t \\ \pi_t \end{bmatrix} = \begin{bmatrix} 0.4380 & -0.5584 & 0.0721 \\ -0.0115 & 0.4845 & 0.0409 \\ 0.0390 & -0.1053 & 0.4982 \end{bmatrix} \begin{bmatrix} \mathbf{NAIRU_{t-1}} \\ M_{t-1} \\ \pi_{t-1} \end{bmatrix} + \begin{bmatrix} \mu_{1t} \\ \mu_{2t} \\ \mu_{3t} \end{bmatrix}$$

To see which variables are more important in driving NAIRU's shape in Iran, we use a variance decomposition technique. As it may be seen, the role of monetary policy in shaping NAIRU is almost non-existent in the short run, but it steadily increases from 14.6% in the medium term to 15.3% in the long run. The results are in

sharp contrast with Neo-Keynesians theory where the effect of monetary policy on unemployment rate and NAIRU is more important in the short run than in the long run. Our results suggest that since an expansionary monetary policy induces inflationary expectations, people adjust their activities and production plans accordingly; therefore, the short-run effects of monetary policy on employment and labor market in the short run will be negligible.

However, in the long run, people fail to adjust their investment plans with monetary policy. On the other extreme, wage rigidities limit workers' ability to maneuver; hence, monetary policy plays a more important role in driving NAIRU and unemployment in the long run. Table 1 shows the Variance Decomposition Technique of NAIRU to one standard deviation in inflation and money supply. As it is seen, inflation explains only 0.15% of changes in NAIRU in the short run, but its role increases to 1.49% in the medium term and then rises to 1.59% in the long term. Effectively, NAIRU seems to be more affected by the supply side shocks, including oil shocks, labor market imperfections, wage rigidities, institutional barriers, and international sanctions.

Table 1: Variance Decomposition of NAIRU

Period	S.E.	CPI inflation	NAIRU	M
1	0.956074	0.151216	99.84878	0.000000
2	1.153831	0.567711	92.95443	6.477857
3	1.240215	1.054560	87.69655	11.24889
4	1.277042	1.348448	85.00129	13.65026
5	1.291800	1.492672	83.81116	14.69617
6	1.297408	1.555730	83.32964	15.11463
7	1.299455	1.581239	83.14614	15.27262
8	1.300181	1.591002	83.07913	15.32987
9	1.300433	1.594594	83.05538	15.35003
10	1.300519	1.595877	83.04714	15.35699

CONCLUSION

We explore the historical levels of inflation and unemployment rate in Iran to measure the NAIRU and estimate the effects of monetary policy on NAIRU based on Blanchard and Quah's model. The data suggest that the notion of downward Philips curve, a negative relationship between inflation and unemployment, is non-existent in Iran. For most of the period under consideration, not only inflation, but also unemployment, has been increasing in contrast to a conventional Philips curve.

Indeed, the labor market in Iran shows a kind of hysteresis where the natural rate of unemployment depends on the past rate of unemployment, as Ball and Mankiw (2002) argue. The workers lose their human capital, become less attractive to employers, and reduce their job search as they become accustomed to being unemployed. All these effects make workers less likely to be employed in the future.

Our empirical results, based on a structural VAR model, suggest that monetary policy has trivial effect on the unemployment rate in the short run, indicating that unemployment in Iran is more affected by supply side shocks such as oil shocks, wage rigidities, legal restrictions, labor law, and international sanctions. Indeed, rules and regulations, wage rigidity and institutional barriers designed for an earlier era have failed to improve the labor market conditions in Iran. Though there is no generous unemployment benefit or insurance policy in Iran, the rules and regulations that fringe on the labor market have led to the persistence of high unemployment rate, leading to higher NAIRU despite the disinflationary episode in the 2000s.

More importantly, since Iran's economy has been isolated from the rest of the world due to international sanctions, the unemployment rate remains at an unprecedented high level despite expansionary monetary policy. The 2000s period seems somehow different from previous decades and suggests a different explanation. Despite a lower rate of inflation in the 2000s compared to the previous decade, the unemployment rate has steadily increased from 11.8% to 15%, suggesting that contractionary monetary policy has raised the unemployment rate in Iran in accordance with conventional Phillips Curve; however, the rise in unemployment may be attributed to intense

sanctions imposed by an international community on Iran.

There are many questions that still remain unanswered in this paper; for example, what are the effects of supply side shocks, such as oil, term of trade, and international sanctions on NAIRU in Iran. How has the labor market imperfection and wage rigidity affected NAIRU? Has unemployment benefits had any impact in raising NAIRU and the unemployment rate? These are questions that provide grounds for further research in an area that is worth pursuing.

AUTHOR INFORMATION

Nahid Kalbasi holds a PhD in economics from George Mason University. Her fields of specializations are monetary policy and international finance. She has worked as financial consultant in investment companies in Iran. She has served as a short-term consultant at the World Bank and has published many articles in refereed journals. E-mail: nkalbasi4@yahoo.com

Maryam Ashtary has a MS in economics from Islamic Azad University in Tehran. She has served as a research assistant in macro-economic course. She has also served for some public banks in Tehran for the past 9 years. Her main fields of study are macroeconomics and financing housing sector. E-mail: maryamashtary@yahoo.com

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