

Inflation Persistence and Inflation Targeting in Iran

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Abstract. This paper analyzes inflation persistence in Iran by applying an autoregressive model and a grid bootstrap method over the period of 1970 to 2011. The findings show that the coefficient of inflation persistence is 0.44 and the absolute value is $0.44 < 1$. This implies that there are at least some effective policies for controlling inflation persistence in Iran's economy. Also, the results indicate that inflation persistence is 0.34 from 1992:03 to 2002:02 (fixed exchange rate with quarterly data) while it is 0.37 from 2002:03 to 2012:02 (floating exchange rate with quarterly data). This suggests that fixed exchange rate regime is more capable of controlling inflation persistence in Iran's economy than the floating exchange rate regime with inflation targeting.

Keywords: Exchange Rate, Inflation Persistence, Grid Bootstrap Method, Autoregressive Model

1. Introduction

In recent years, some Asian countries have shifted to a floating exchange rate system with inflation targeting as their monetary policy strategies. Gerlach and Tillmann (2012) explain that this policy choice is made for the same reason that led to the adoption of inflation targeting in many advanced countries. Korea (1998), Indonesia and Thailand (2000), and the Philippines (2002) have abandoned the fixed exchange rate system and adopted inflation targeting after the Asian financial crisis 1997 (Ito and Hayashi, 2004). Similarly, fearing of escalating inflationary pressure, Iran had moved to a floating exchange rate regime with inflation targeting in 2002. Historically, Iran is one of the countries with high inflation. However, up to date there is no study has been carried out on inflation persistence in Iran. This study is the first to measure inflation persistence in Iran over the period 1970 to 2011. Applying quarterly data spanning from 1992 to 2012, we examine whether inflation persistence has changed under different monetary regimes over the last two decades.

Understanding the persistence of inflation is important for policymakers. Appropriate responses to inflation depend on the degree of inflation persistence. The horizon at which monetary policy should aim for price stability depends on the persistence of inflation. With less persistence, inflation can be stabilized in a shorter time following a shock. Accordingly, the degree of inflation persistence is an important factor determining the medium-term orientation of monetary policy. Furthermore, detecting whether persistence has fallen is crucial in assessing the possibility of recidivism by the monetary authority (Pivetta and Reis, 2007).

The rest of this paper is organized as follows. Section 2 reviews literature related to the issue of exchange rate regimes and inflation persistence. Section 3 presents the methodology of the study while section 4 discusses the findings. Finally, Section 5 concludes the study by highlighting the key findings of the study.

2. Literature Review

From the relative PPP theory vantage point, price fluctuations are associated with exchange rate variations (Pakko and Pollard, 1996). It also interprets that economies with relatively higher inflation rates will experience a depreciating currency (McDonald, 2007). According to Alogoskoufis and Ron (1991), inflation tends to persist under the condition of floating exchange rates. In this case, monetary policy is

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capable of accommodating the inflation shocks. The first-order autoregressive of an annual change in the GDP deflator for the US is estimated and the estimates are 0.27 and 0.70 for the periods of 1948-67 and 1968-87 respectively. Comparable findings are similarly derived from the UK case. In the same vein, Alogoskoufis (1992) expands a bigger investigation which covered 21 OECD nations. The findings bore close resemblance to those of Alogoskoufis and Ron (1991). He detects that inflation persistence increases under the floating exchange rate regime in 20 cases out of 21 for the individual country.

The issue is addressed further by Obstfeld (1995). Analyzing 12 OECD countries over the period 1953 to 1994, he divides the periods into two; 1953-72 under fixed exchange rates and 1973-94 under floating exchange rates. He discovers that, in the later period, persistence rises for all nations, excluding the US, there is strong persistence in the fixed-rate period. Obstfeld asserts that such results can be stemmed from the reserve-currency role played by the United States under the Bretton Woods system.

Using annual data from the US, Canada, the UK, and Sweden and also applying a process to recognize multiple structural breaks in a persistence regression, Burdekin and Siklos (1999) demonstrate that there is a statistically significant (but rather small) upward movement in the persistence of inflation sometime between 1974 and 1981 in every single country.

Bleaney (2000) argues that allowance should be made for possible shifts over time in the mean inflation, as it is able to affect the estimates of persistence significantly. Upon making such an allowance, he finds no evidence of higher inflation persistence during the 1984-1999 period among eight developed countries with floating rates, compared with seven countries, which either they are members of the European Monetary System (EMS) or pegged their currencies. He also reports no evidence that monetary policy in OECD countries became more accommodative under floating ERs.

Unlike previous studies, Levin, Natalucci, and Piger (2004) find that the adoption of the floating exchange rate with inflation targeting can reduce the level of inflation persistence in developed countries as indicated by their bootstrap analysis. Similarly, and following the Ball and Sheridan's (2005) analysis, Goncalves and Salles (2008) undertake an analysis over 36 developing economies and find that 13 cases out of 36 carry out a floating exchange rate regime with inflation targeting framework. Their findings propose that the option of the floating exchange rate regime bring about benefit for emerging nations. Specifically, they observe that the substantial reduction in inflation.

In a most recent work, Gerlach and Tillmann (2012) measure inflation persistence using the sum of the coefficients in an autoregressive (AR) model for inflation period during 1985:1 to 2010:1. They calculate the median unbiased estimator and bootstrapped confidence bands. They find that persistence declines following the adoption of inflation targeting. The speed by which persistence falls varies across countries. Interestingly, the economies not adopting inflation targeting show a smaller decline in persistence. Overall, they conclude that inflation targeting has performed well in Asia.

3. Methodology and Data

3.1. Simple Interpretive Model

It would be helpful if a straightforward model for inflation is considered firstly for the purpose of interpreting the findings from the econometric analysis below. It is presumed that in the analyzing of the inflation, π_t , it encompasses an element of permanent $\bar{\pi}_t$, in compliance with a random walk, and on the other hand a temporary inflation shock, $\vartheta_t \sim N(0, \sigma_\vartheta^2)$. This can be formally formulated,

$$\pi_t = \bar{\pi}_t + \vartheta_t \quad (1) \quad \text{with} \quad \bar{\pi}_t = \bar{\pi}_{t-1} + \rho_t \quad (2) \quad \text{and} \quad \rho_t \sim N(0, \sigma_\rho^2).$$

This can be regarded as an abridged form model, in the way that σ_ρ^2 is not perceived independent of policy. In effect, someone perhaps assume that σ_ρ^2 is conversely associated with the central bank's control of inflation. Accordingly, a central bank that take an appropriate action powerfully against economic disturbances for precluding enduring movements in π_t from occurring can be regarded as lessening the variance of the innovations to the permanent shock σ_ρ^2 . An ideal inflation control would be considered of as a case in which $\sigma_\rho^2 = 0$. Assume that the estimate of a first-order autoregressive model for inflation is

$$\pi_t = \beta \pi_{t-1} + \varepsilon_t \quad (3)$$

the estimation of the autoregressive parameter $\hat{\beta}$ is indicated by Gerlach and Tillmann (2012) as follows:

$$\hat{\beta} = \frac{(T-1)\sigma_\rho^2}{(T-1)\sigma_\rho^2 + \sigma_\vartheta^2} \quad (4)$$

In which T implies the sample and $\hat{\beta}$ is between zero and unity. In fact, $\hat{\beta}$ is a measure of the relative significance of permanent, ρ_t , to temporary, ϑ_t , shocks to inflation in any finite sample. $\hat{\beta}$ would tend to close to unity in economies in which permanent shocks dominate. As discussed earlier, the both σ_ρ^2 and $\hat{\beta}$ are supposed to be close to zero in the condition of inflation targeting or any other monetary policy strategy. Consequently, β is assessed and applied for the purpose of evaluating the inflation control of central bank in the remainder of the research.

3.2. Measuring Inflation Persistence

A successful inflation targeting decreases the persistence of shocks to inflation. The ideal measure of persistence is the sum of the autoregressive coefficients in a univariate method, following O'Reilly and Whelan (2005) and Levin and Piger (2006). Let α be an intercept term and ε_t a serially uncorrelated shock. It can then be generalized (3) to an AR(q) process.

$$\pi_t = \alpha + \sum_{k=1}^m \beta_k \pi_{t-k} + \varepsilon_t \quad (5)$$

As Andrews and Chen (1994) demonstrate, given that there is a monotonic association among β and the cumulative impulse response function of π_{t-j} to ε_t , β can be regarded as the greatest scalar measure of persistence in π_t . The modified expression (4) can be presented as:

$$\pi_t = \alpha + \beta \pi_{t-1} + \sum_{k=1}^m \beta_k \Delta \pi_{t-k} + \varepsilon_t \quad (6)$$

where $\Delta \pi_t = \pi_t - \pi_{t-1}$. If $\beta = 1$, the inflation procedure embraces a unit root. According to the stylized model developed above, this condition can be taken into consideration in which inflation control is not powerful enough as well as the variance of the permanent shocks is considerably larger in comparison with the variance of the transitory shocks. In comparison $|\beta| < 1$, the procedure is static and there exists some inflation control as a minimum. An apposite lag length q is selected mainly based on the Akaike information criterion (AIC) in the empirical application outlined below. The grid bootstrap method is utilized in the current study in order to estimate the β coefficient.

4. Findings

4.1. Inflation Persistence

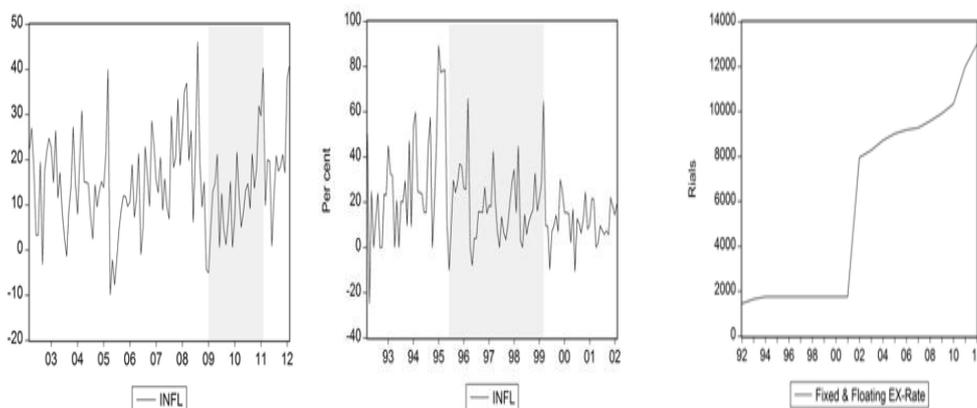
According to Gerlach and Tillmann (2012) if the absolute value of β is smaller than unity, $|\beta| < 1$, this means that the procedure is stationary and there exists at least some inflation control. In other words, there is inflation control and the variance of the permanent shocks is not much greater than the variance of the transitory shocks. Therefore, in this analysis (Table 1), the inflation persistence value is 0.44 at 90% Grid-t confidence interval, $\beta = 0.44$, and $|0.44| < 1$ which shows that there are at least some effective policies for controlling inflation in Iran's economy. Further, $\hat{\beta}$ is defined as $\frac{(T-1)\sigma_\rho^2}{(T-1)\sigma_\rho^2 + \sigma_\vartheta^2}$ (4) in which σ_ϑ^2 is the variance of the temporary inflation shock and σ_ρ^2 is the permanent shock. It shows that permanent shocks are smaller than temporary shocks, therefore, the effects of policies on stabilizing Iran's inflation are effective. The confidence interval shows that the β is limited between 0.28 and 0.84 with 90% validity but the upper value of the confidence interval is closer to unity. This suggests that the influence of policies to control inflation is not enough.

Table 1: Inflation Persistence in Iran (1970-2011)

| Sample | Mean | Variance | Lag | β | 90% Confidence band |
|-------------|-------|----------|-----|-------------|---------------------|
| 1970 - 2011 | 17.48 | 73.70 | 1 | 0.44 | [0.28 0.84] |

4.2. Inflation Persistence and Exchange Rate Regimes

Generally, Iran experiences two different exchange rate regimes. Graph 1 indicates that Iran adopted a fixed exchange regime from 1992:03 to 2002:2 and a floating exchange rate regime with inflation-targeting from 2002:03 to 2012:02. Graphs 2 and 3 display the inflation rates during the periods. Measuring inflation persistence provides insight on which regime inflation is more successfully control.



Graph 1: Exchange Rate (1992 - 2012) Graph 2: Inflation(1992:03-2002:02) Graph 3 : Inflation (2002:03-2012:2)

One of the major approaches to measure persistence is the Grid Bootstrap method developed by Hansen (1999). This approach has also been used by Grelach and Tillmann (2012) to examine inflation persistence and inflation targeting for Asia-Pacific. Following Hansen, this study also uses Gauss code that calculates the grid bootstrap intervals by applying Matlab. The lag length is selected in accordance with Akaike Information Criterion (AIC) with a highest lag length of one. Table 2 shows the results of inflation persistence in the Iranian economy for these exchange rate regimes.

Table 2 : Inflation Persistence for two Exchange Rate Regimes

| Sample | Lag | Mean | Variance | β | 90 % Confidence band |
|-------------------|-----|-------|----------|-------------|----------------------|
| 1992:03 - 2002:02 | 1 | 19.90 | 374.12 | 0.34 | [0.22 0.52] |
| 2002:03 - 2012:02 | 1 | 15.03 | 114.36 | 0.37 | [0.25 0.54] |
| 1995:06 - 1999:03 | 1 | 18.9 | 251.5 | 0.29 | [0.10 0.67] |
| 2009:01 - 2011:02 | 1 | 12.93 | 104.65 | 0.30 | [0.03 1.12] |

Notes: The table reports Hansen's (1999) mean unbiased estimator of the sum of autoregressive coefficients β and the bootstrapped 90 % confidence bands based on 200 grid points and 3000 replications conditional on breaks in the intercept term. The OLS estimator is denoted by β . The lag order is chosen according to the AIC. Source: authors' calculations

The results in Table 2 displays that the inflation persistence is 0.34 from 1992:03 to 2002:02 and 0.37 from 2002:03 to 2012:02. This suggests that the fixed exchange rate regime is more capable of controlling inflation persistence in Iran's economy than the floating exchange rate with inflation targeting system. The 90% confidence band shows that the coefficients are reliable at Grid-t confidence interval. It is important that none of the intervals have 'one' as their value in the confidence interval. It shows that the processes are stationary and there is at least some inflation control by Iranian's government. One reason for the larger persistence coefficient under the floating currency might be a consequence of the frequent shifts in the inflation target in Iran's economy. Comparison between shaded areas confirms that the fixed exchange rate regime is more effective to control inflation persistence. This is demonstrated by the shaded area in Graph 2 with confidence interval value less than one and a smaller coefficient estimate compared to Graph 3 where the shaded area in Graph 2 is longer in duration than the shaded area in Graph 3.

5. Conclusion

Generally, the findings on inflation persistence in Iran shows that the adopted policies are able to reduce inflation persistence over the period of 1970 to 2011 even though the effects of these policies are not efficient enough when considering the upper value of the confidence interval at 90 per cent grid bootstrap, which is close to unity. The findings suggest that fixed exchange rate policy is better to control inflation persistence in Iran during 1992-2002. This finding is consistent with other studies such as Alogoskoufis and

Ron (1991), Alogoskoufis (1992), Obstfeld (1995), Burdekin and Siklos (1999) and Bleaney (2000), which find that fixed exchange rate is more effective in controlling inflation persistence. It should be mentioned that floating exchange rate with inflation targeting might not have been successful because of the frequent shifts in the inflation targeting employed by the Iranian government in the economy.

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