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The P-star Model in Iran (1960-2005)

Ahmad Tashkini*

Abstract

This paper studies the usefulness of the P*-model in the analysis of the behaviour of prices in Iranian economy. The P*-model is based on the Quantity of Theory of Money. This model believes that the price level tends to move towards the equilibrium price level. The P* model uses price gap to forecast inflation, if the equilibrium price is greater than the current price, there is a tendency for the price level to rise and vice versa. The equilibrium price in this approach is determined by potential output, the equilibrium velocity of money and the amount of money in the economy. In this study, potential output and equilibrium velocity are derived using the Hodrick and Prescott filter.

Keywords: P-star model, Potential Output, Equilibrium Price, Long-Run Velocity, Forecast of Inflation.

1. Introduction

The Quantity Theory of money postulates that a long-run relationship between money and the price level provides a basis for modeling inflation. However, this relationship has been complicated in recent years by deregulation of markets and an increasing degree of capital market integration. Nonetheless, Hallman, Porter and Small(HPS) introduced a model based on the theory of money to forecast inflation, which refer to the equilibrium level of price(P-star) to which actual prices(P) tend to adjust. From the gap between equilibrium and actual prices (price gap), the P-star model predicts the direction of movement of

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*- Ph. D. Student, University of Tehran, Deportmant of Economics

the inflation rate. Also, it predicts that inflation will rise, fall or remain unchanged as actual prices are below, above or at their equilibrium level.

In standard models of inflation, the output gap is an important explanatory variable whereas in the P-star approach, in addition to the output gap, the velocity gap is also considered as an explanatory variable. This is an important novelty of this approach. Thus, measuring potential output and long-run velocity is a crucial task of any study which uses the P-star framework. Many empirical studies testing for the P-star model considered long-run velocity as a constant series or have modeled it as a series with a deterministic trend. In this study the potential output and long-run velocity are derived using the Hodrick and Prescott filter (HPF).

Thus, this study discusses the usefulness of the P-star model for Iran inflation. The plan of the paper is as follows: in the next section the P-star model and in section three the calculation of the equilibrium price level(P-star) are explained. Section four briefly details the data series and their and time series properties, and reports the results of the tests of the P-star model for Iran. Section five concludes the paper with some suggestions for future research.

2. The P-Star Model

The P-star model combines the Quantity Theory of money with the observed empirical fact of lagged price adjustment into a predictive model. The simple Quantity Theory equation is as follows:

$$p = M\left(\frac{V}{Y}\right) \qquad (1)$$

Where P denotes the price level, M is the stock of money in circulation, Y is the real output and V is the velocity of money. Based on equation 1, HPS define the equilibrium price level (P-star) in the following manner:

$$p^* = M\left(\frac{V^*}{Y^*}\right) \qquad (2)$$

Where Y* is the potential real output and V* is the equilibrium velocity of money. If V* and Y* are independent of the money stock, then the equilibrium price level moves proportionally with the stock of money. Furthermore, HPS hypothesis that at the equilibrium, the price gap has a theoretical value of zero

and thus the price level tends to adjusts to its equilibrium. Combining equation(1) and (2) gives, the following, where lower case letters denote the natural logarithms of the respective capital letters.

$$P - P^{*} = (v - v^{*}) + (y - y^{*}) \qquad (3)$$

The price gap consists of an output gap and a velocity gap and changes in these gaps will result in change in the price gap which is used to predict inflation. A negative price gap implies an increase in price level whereas a positive gap implies the opposite. A dynamic relationship between the rate of inflation and the price gap is written as follows:

$$\Pi_t = a(P_{t-1} - P^{*}_{t-1}) + \Pi_{t-1} \qquad (4)$$

Where a<0 and ? denotes inflation. Rearranging equation (4) we get the following:

$$\Delta \Pi_t = a(P_{t-1} - P^{*}_{t-1}) \qquad (5)$$

Equation (5) is used to derive the estimating equation, in the form of a constrained version of an error correction model, which is used to test the P-star approach:

$$\Delta \Pi_t = a_0 + a_1 (P_{t-1} - P^{*})_{t-1} + \sum_{j=1}^{n-1} \delta_j \Delta \Pi_{t-j} + e_t \qquad (6)$$

If al is significant, P-star model is a valid method of forecasting Iran inflation.

3. Calculation of Equilibrium Price Level (P-star)

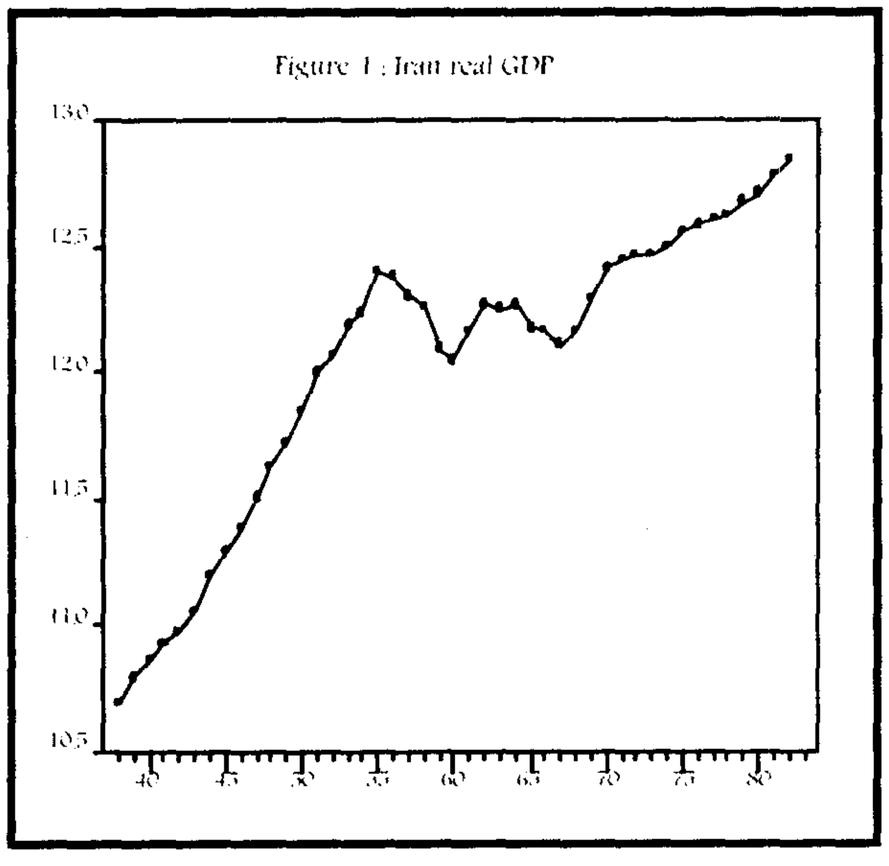
Calculating the equilibrium price level (which is an unobserved variable); one needs the estimates of potential output and long-run velocity of money. Many researchers use different methods to measure these serie s. Some researchers assume that the long-run velocity and the potential output follow a deterministic trend and use a linear trend model to construct these series whereas some measure these series by using their average values assuming that the series revert to their mean values in the long-run. But, the real GDP series in many

countries contains a unit root; therefore it may not be appropriate to model potential GDP as a series with a deterministic trend.

Therefore, in this study the Hodrick-Prescott filter, an appropriate filter for stochastic trends, is used to measure the long-run values of GDP and the velocity of money. Once the potential output and the long-run velocity of money series are constructed, the equilibrium price (P-star) is defined using equation (2) and the price gap(P-P*)is used to model inflation In Iran.

4. The Data and Results

In this article, Annual data for Iran economy for period 1338-83 are used to test the P-star model. The real GDP is used for real output, and the GDP Deflator is used for Iran price level. Graphical representations of log of all these series are depicted in figures 1-4. Also, the long-run velocity and potential output are measured using the Hodrick-Prescott filter (HPF). These series together with the actual series are depicted from figures 5-6.



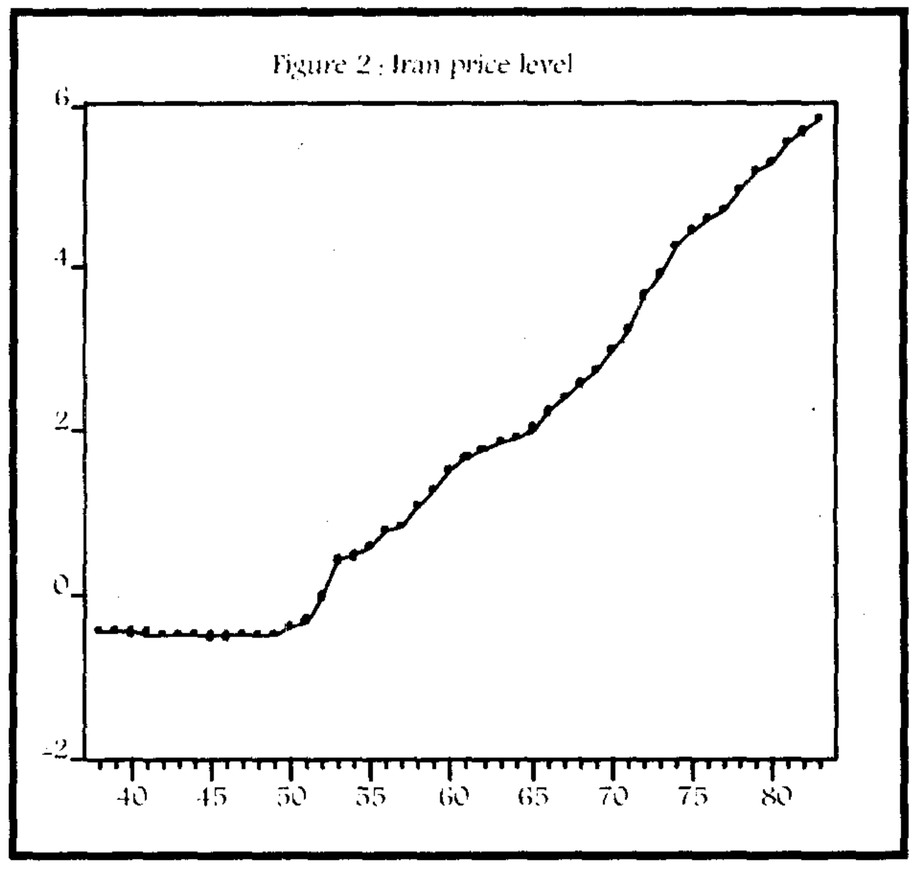


Figure 3 : Iran m2

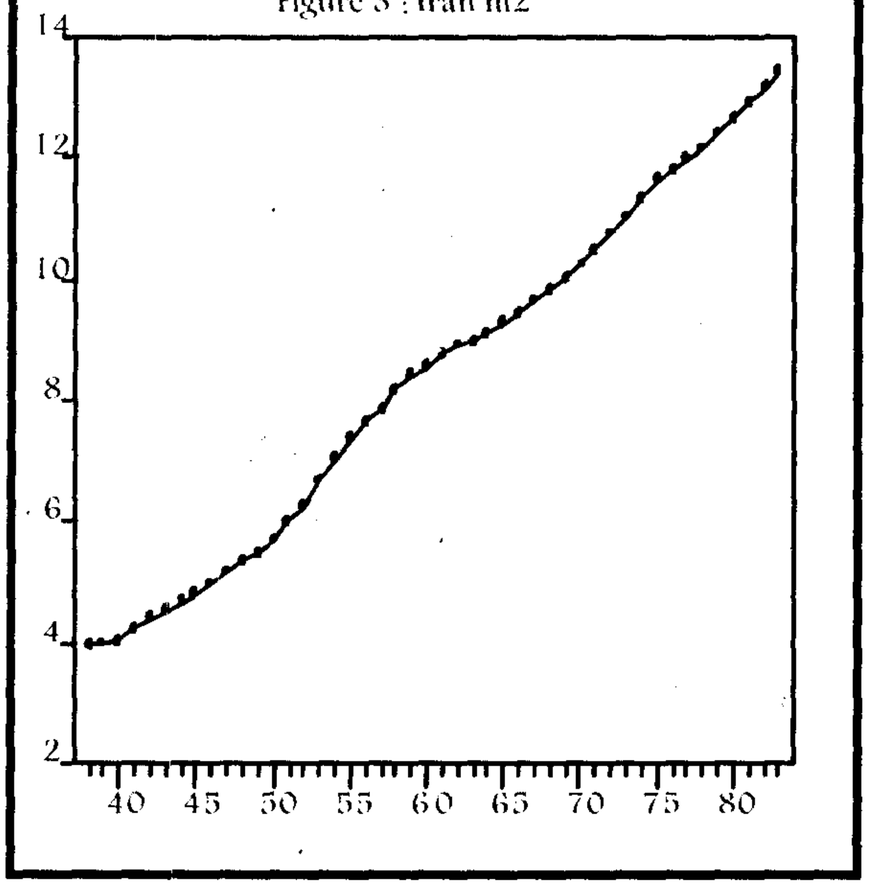


Figure 4 : Iran Inflation

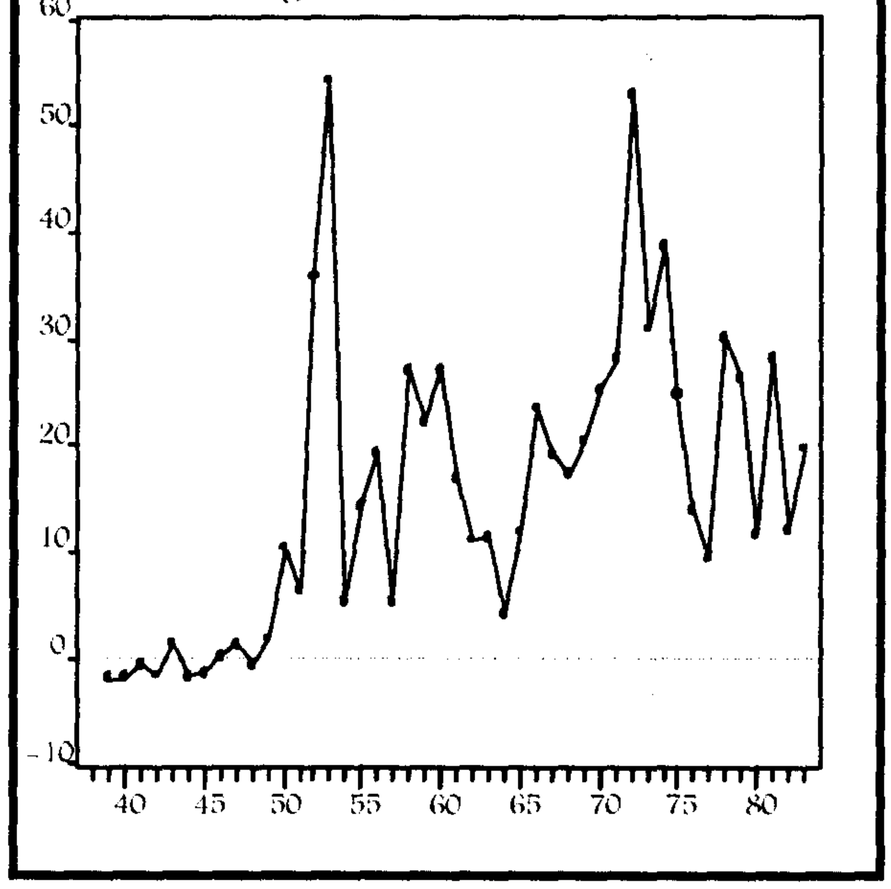


Figure 5 : Actual and Potential GDP

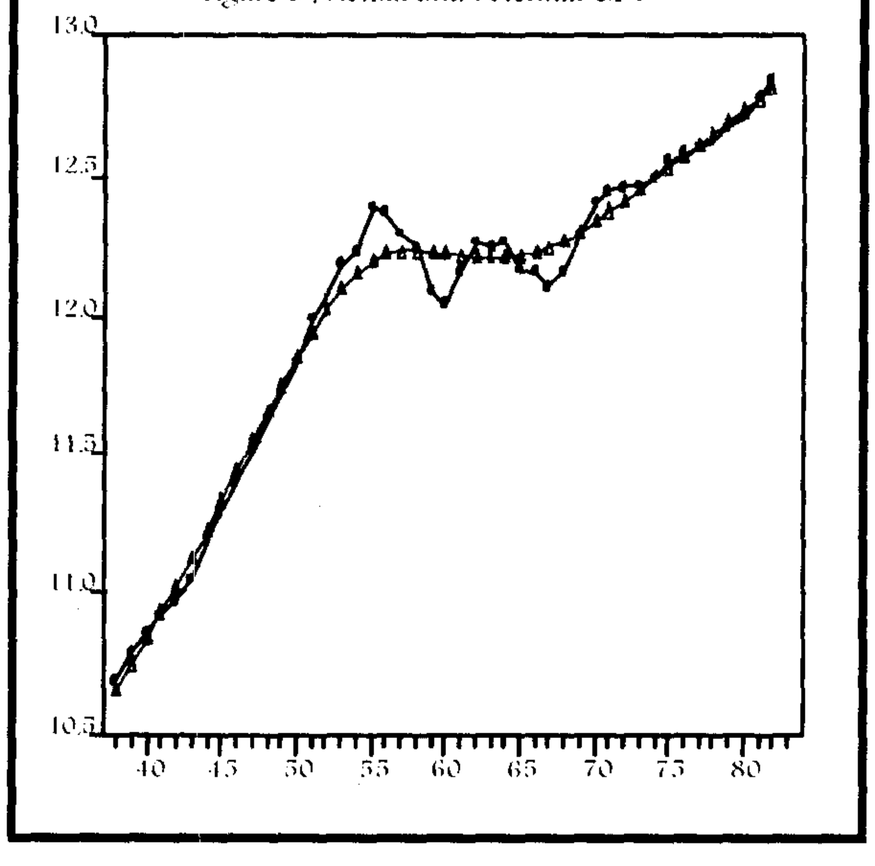
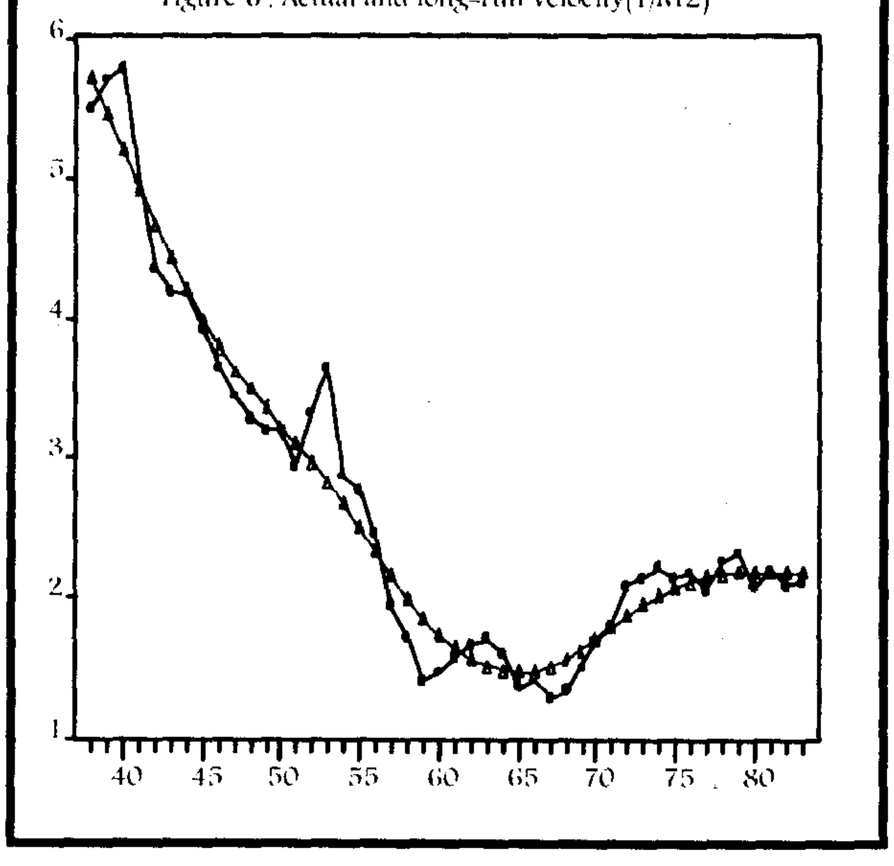


Figure 6 : Actual and long-run velocity(Y/M2)



The next step is to investigations the time series properties of the data using the augmented Dickey Fuller(ADF)test. Table 1 reports the results of these tests for the levels of the series, and table 2 reports the results of unit root tests for the growth rates of these series. The results of these tables show that all data series are non-stationary. In other words, these data are I(1).

Table 1: Unit Root results (Log Level)

	CPI	M2	GDP	V
With Trend and Intercept	-1.2	-0.2	1.2	-0.3
Critical Value	-3.5	-3.5	-3.5	-3.5
Lagged Number	1	0	1	2
With Trend and Intercept	0.25	1.34	0.4	-1.2
Critical Value	-2.9	-2.9	-2.9	-2.9
Lagged Number	1	0	1	2
With Trend and Intercept	-0.2	-1.2	0.3	0.24
Critical Value	-1.9	-1.9	-1.9	-1.9
Lagged Number	1	2	1	2

Table 2: Unit Root results (Growth Rates)

	CPI	M2	GDP	V
With Trend and Intercept	-3.6	-3.8	-3.51	-3.89
Critical Value	-3.5	-3.5	-3.5	-3.5
Lagged Number	2	1	1	1
With Trend and Intercept	-3.1	-3	-3.1	-3.2
Critical Value	-2.9	-2.9	-2.9	-2.9
Lagged Number	2	0	1	0
With Trend and Intercept	-2	-2.1	-2.3	-2.8
Critical Value	-1.9	-1.9	-1.9	-1.9
Lagged Number	1	2	2	2

As noted above the equilibrium paths for output and velocity of money, which are needed for obtaining the equilibrium price level (P-star), were constructed using the HPF, the price gap must have an inverse relation with the actual inflation rate. The negative or inverse relation ensures that prices tend to converge to the equilibrium price level in the long-run. Table 3 presents the estimates of the P-star model for Iran for the period 1338-83. The low t-value of the price gap indicates that this variable is not significant. Overall, this study suggests that a P-star model is not useful in forecasting Iran inflation.

Table 3 : OLS Estimates of the P-star Model

Explanatory Variables	Coefficient	t-statistic
C	3.2	3.2
P-P*(-1)	-2.1	-1.2
Inf(-1)	-1.07	-4.2
Inf(-2)	-0.45	-0.2
Diagnostic Tests		
Serial Correlation	0.22(0.63)	
Functional Form	2.6(0.22)	
Normality	4.2(0.7)	
Heteroscedasticity	1.18(0.3)	

5. Conclusions

The P-star model of inflation arose from an attempt to identify the inflationary potential of the economy. In this study the P-star framework proposed by Hallman, Porter and Small is used to model Iran inflation for the period 1338-83. The equilibrium price is obtained using output gap and the velocity gap. The potential output and the long-run velocity of money are measured using the Hodrick-Prescott filter. The results do not support the P-star model for Iran inflation data.

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