Relationship between price and money stock in Iranian economy (1961-2008)

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Abstract: *The main purpose of this paper is to investigate the relationship between money and inflation in the Iranian economy with cagan(1956) money demand function . In doing so,I have first reviewed theoretical and empirical literature of causality throughout the world and then it be used Granger's method for detecting causality between money and inflation in the Iranian economy. according to this working paper elasticity of demand for real balances in money market toward inflation for Iranian economy are approximately 0.9 and Money is exogenous reward to WPI,CPI and PPI in Iranian economy.*

Key words*:* money stock,price indexes , Iranian economy ,Causality test,stationary test.

Introduction

The concept of macroeconomic instability is widely used in the policy-oriented literature. However, this concept is almost never really defined, and seems to refer in turn to high inflation, overvalued currency, unstable real exchange rate, balance of payment deficit, or fiscal deficit, etc. Roughly speaking, everything that is going wrong in a country's macroeconomic condition is often called macroeconomic instability.It is then implicitly entailed that what a country suffering from these ills ought to do is to implement a stabilization policy. John Maynard Keynes once said that according to Lenin there is no surer way of overturning a society than to degrade its currency. Inflationary processes, it is clear, can be very disruptive in the short run, even if they do not cause revolutions. But they also have long lasting effects. Fernand Braudel believed that price revolutions represented the strongest secular pattern in modern history. In fact, over the past eight centuries, the

world economy has experienced four major price-revolutions whose inflationary forces ultimately transformed economic and social structures. These four price-revolutions took place approximately in the late medieval period, from 1180 to 1350, after the age of great discoveries in the sixteenth-century, from 1470 to 1650, during the Industrial Revolution era, from 1730 to 1815, and during the twentieth century, from the 1890s to the 1980s .(Hackett Fischer, 1996).

The main goal of this paper is to investigate the causality between money and inflation in the Iranian economy. In doing so, we have first reviewed theoretical and empirical literature of causality throughout the world and then we used Granger's method for detecting causality between money and inflation in the Iranian economy. We then used cagan(1956) money demand function for estimating relationship between money and price in iranian economy.Testing for Relationship between price index and money supply; in Iran economic is included of these steps:

- monthly surveing of price and money variables in 1961-2008 for Iranian economy.
- testing for stationary of price and money log variables.(according to cagan model)
- Granger causality test between price and money
- try to estimate money supply function
- try to estimate cagan model equation in limited and full information method.

Literature review

In standard economic theory, inflation is associated with money supply growth.

At equilibrium, money determines price level and implies equilibrium in markets for other assets.At equilibrium,money demand depends primarily on income and interest rates. But there are several factors keeping money demand unstable, such as financial innovations as well expectations. Indeed, one of the major causes of the complexity in stabilizing inflation together with other macroeconomic variables is that expectations of producers, consumers and investors may play a key role in the dynamics. Indeed, investment allocations or inflation expectations are influenced by ex-ante values of the risk premia and ex-post returns are rough approximations of these. Thus, "inflationary expectation" occurs when people begin to raise prices not because of actual changes in supply or demand or cost or the size of the money supply, but out of fear that some such changes might happen. In the 1990s, when Alan Greenspan, the chaireman of the US Federal Reserve, said that the U.S. was still suffering from the inflationary expectations caused by the monetary excess of the 1970s, he was directly addressing the potential for inflation caused by "inflationary expectations." When European central banks added liquidity to the gold market in an attempt to prevent an increase in the price of gold from creating concerns about a decrease in the value of the dollar, they were addressing the psychological component of price stability involved in "inflationary expectations." (D. Sornette et al; 2008)

In recent years money supply increased rapidly and some researchers thought this increase in money supply was going to translate quickly into inflation.

But inflation did not grow much and empirical evidence shows that shocks to the petrol and meat supply mainly affected

inflation(Mostafavi,2007). In the long-run the relationship between money supply and price is very strong and their correlation is almost one. Lucas (1995) emphasized the long-term relationship between money and prices in his Nobel Prize lecture by mentioning McCandless and Weber (1995).

Indeed, as shown in Table 1, inflation in the second half of the 20th century is a global phenomenon. (Pierre L. Siklos(2000)) Even in the so-called economies in transition formerly referred to as centrally planned economies inflation has been a fixture of their experience, though a combination of subsidies and artificial price fixing produced a form of repressed inflation until the transition to market began in earnest in the 1990s. The dating of the transition is not uniform across these countries; see S. Fischer and R. Sahay (2000). Even Mainland China is not immune to the inflation disease. The Table masks the fact that several countries, particularly in Latin and South America, have lived for decades with chronically high inflation (roughly 20% or more inflation on an annual basis). Finally, it is noteworthy that inflation continues to persist in all part of the world with the exception of the industrial countries where inflation has dropped sharply during the 1990s. Indeed, inflation among these countries is now not much higher that during the high point of the gold standard era (1900-13) when average inflation rates in the US and UK were, respectively, 1.23% and 1.22% per annum. There is some evidence that central banks with a mandate to control inflation hence the name inflation targeting has contributed significantly to this outcome (see Bernanke, Laubach, Mishkin and Posen 1999).

Table 1

Post World War II CPI Inflation in Selected Areas of the World

Country Grouping	1969-99	1991-99
	(percent per annum)	
Asia	8.90	8.34
Developing Countries	27.49	29.30
Europe	48.35 (1971-99)	79.84
Industrial Countries	5.63	2.46
Middle Eastern Countries	13.62	12.39
Western Hemisphere	80.23	92.65
Economies in Transition	41.61 (1961-89)	101.18 (1991-98)
Mainland China	9.37 (1987-99)	8.28

***Source**: International Monetary Fund CD-ROM (Washington, DC: International Financial Statistics).*

table 2. **Main Episodes of Hyperinflation**

Country	Year Ended	Duration (No. of Months)	Average Monthly Inflation Rate (percent)
Pre-World War II			
Austria	1922	11	47.1
Germany	1923	15	37.2
Poland	1924	13	81.1
Russia	1924	37	57.0
Hungary I	1924	28	46
Greece	1944	13	365
Hungary II	1946	12	2345×10^{3}
Post-World War II			
Taiwan	1949	17	30.7
Bolivia	1985	18	48.1
Peru	1989	8	48.4
Yugoslavia	1989	4	50.9
Poland	1990	4	41.2
Brazil	1990	4	68.6
Argentina	1990	11	66.0
Ukraine	1993	14	1024
Georgia	1994	13	44.1
Zaire	1994	36	665

Source: *Pierre L. Siklos (2000)*

The relationship between inflation and the demand for money has been investigated extensively, and several studies have focused on money demand during periods of hyperinflation. Perhaps the most famous is Cagan(1956) study of the inflationary circumstances in the countries of post–World War II Europe, including Germany, Austria, Hungary,Greece, Poland, and Russia.

Asilis, Honohan, and McNelis (1993) provide a similar study of hyperinflation and money demand in another Latin American country, Bolivia.2 Between 1980 and 1985, Bolivia experienced inflation comparable to that of Peru. These authors examine this five-year period of hyperinflation in which Bolivian inflation rates reached nearly 20,000 percent and the three-year stabilization period that followed. As in the Cagan study, money demand depended on the inflation rate during the Bolivian hyperinflation, but two other factors were also involved the degree of uncertainty that people felt about future inflation, and the amount of money they had held in the previous period. Jones and Uri (1987) used three econometric methods to examine causality between money and inflation in the USA during the period 1953-1984. Failing to find a clear causal direction, they concluded that the broadly money stock does not determine inflation, though the effect of narrow money on inflation was suggested.Anderson et al (1988) reexamined Cagan's model for two hyperinflation cases, Greece (1943-44) and Hungry (1945-46). They find evidence in favour of a one-way causality from inflation to money growth. Makinen and Woodward (1989) studied hyperinflation in Taiwan. Their empirical findings show that while causality from money growth to inflation is countered, causation in the opposite direction cannot be ruled out. This implies a unidirectional causality from inflation to money. Lahiri (1991) studied causality in Yugoslavia and concluded that there is a bidirectional causal relationship between money

and inflation. Beltas and Jones's (1993) investigated causality between money, (M1 and M2), and inflation using the Granger methodology in Algeria for the period 1970-1988. Their conclusion was a unidirectional causality from money to inflation. Choudhry (1995) applied a causality test between money stock and inflation in Argentina during the period 1935-1962. He concluded that there was bi-directional causality between aggregate real money and inflation both in the long period and in short period exists. Kamas (1995) tested the impact of money on inflation in Colombia with a crawling pegged exchange rate. Using a VAR model, Kamas proved that domestic money has little role in changing for inflation, while income has much effect in inflation. Cointegration techniques are used by Ahumada (1995) to reexamine a monetary model on monthly data for Argentina over the period 1978-1991. His results suggest a long-run relationship between money and inflation, however, in order to test the monetarist contention that money determines inflation, he used weak exogeneity tests but the results of his tests showed there to be no evidence for the monetary argument. This in turn means that money appears to grow passively.

Nell (1999) studies causality between rate of change of money (gM3) and inflation using Pesaran et al (1996) methodology in South Africa over the period 1966-1997. He deflated inflation by CPI, GDP, and GDE separately, and he further applied two types money: gM, and excess money (egM). Nell concluded that both types of money cannot cause inflation in South Africa, and it has merely been passive in the inflationaryprocess. The only exception was the causality between egM and inflation, which there was a bi-directional causality between them. In general, the empirical findings of the different studies tend to suggest that endogeneity of money supply cannot be rejected, implying that governments often allow money supply to act as an endogenous variable A second approach in the empirical literature has been testing Cagan's model adequacy or a variant of it in describing the demand for money in Brazil as in Phylatkis and Taylor (1993) Engsted (1993 a), Rossi (1994) or a variant of it as in Feliz and Welch (1997) and Tourinho (1996).Whilst most of the evidence in this strand has been favourable to the Cagan model, its relatively simplicity in describing the money demand as a function of expected inflation does not allow a more detailed analysis of the long run relationships present in the sector. The Cagan model was proposed originally to describe short periods of high inflation rates, whereas the history in Brazil has showed a different phenomenon, namely high inflation being questionable its use in modelling empirically the money demand. Furthermore Phylatktis and Taylor (1993) and Engsted (1993 a) concentrated their attention to a period where actually inflation rates were moderate with both samples ending in 1986 when the Brazilian economy experienced the first stabilization plan. Such restriction is present also in other papers that devoted to study the Brazilian case as Juselius (2002), Durevall (1998), Feliz and Welch (1997), all of them imposing 1986 as the ceiling point in the sample length.The findings in Juselius (2002) of a stable liquidity ratio and a long run relationship where prices grow less than proportionally to the expansion of M3, only reinforces the argument that simply testing the adequacy of the Cagan model to the money demand in Brazil and arguing that it adequately describes the

data, is a procedure that leaves out subtle economic relationships which could only be explored in a deeper econometric analysis.

An interesting conclusion can be drawn from the article by Dwyer and Hafer (1999). These authors compare the relation between average money growth and average inflation rate in two periods, 1987–1992 and 1993–1997. In the second period, the average inflation rate (across all countries in the sample) is lower. The reduction in the average inflation rate leads to the creation of two horizontal clusters of observations close to the origin. Thus, the weakening relation between money growth and inflation, as we progress towards zero money growth, may be associated with the average money growth of a country.

The second type of empirical study uses single country time-series analysis. Within this class of studies, an initial approach has been to analyse the long-term quantity theory relationship after transforming time series into the frequency domain. Representative papers are Lucas (1980) and Fitzgerald (1999).These studies tend to confirm the proportionality prediction of the quantity theory, although their methodology has been criticised by McCallum (1984) and Rolnick and Weber (1995). McCallum (1984) warns us that associating high-frequency time series with long-run economic propositions is not always warranted. More recently,researchers have adopted another—more satisfactory approach in analysing the time-series properties of inflation, output and money. In this context, the empirical studies using the P-star model should also be mentioned. This model, suggested by Hallman, Porter and Small (1991), was further explored by Vega and Trecroci (2002) and Gerlach and Svensson (2004); see also Jansen (2004) for a recent exposition. The P-star model may be regarded as a modern monetarist approach to modelling inflation. It starts by defining the price gap as the difference between the price level and the long-run equilibrium price level, which is implied by the long-run quantity relation. The model then specifies a direct effect from the lagged price gap and the current price level. Studies designed to test the QTM using data on one or a few countries (the second group) often overlap with the third type of studies very long-term historical analyses of the relation between money and prices, or investigations of this relation over a particular period in the past. One such long historical analysis was carried out by Smith (1988), who explores the relation between money and prices in the British colonies.(Grauwe,2005)

Theoretical Background

It has become standard to use the cagan (1956) model in empirical analyses of high inflation. The model postulates that the demand for real balances is solely determine by the expected rate of inflation:

$$m_t - p_t = \alpha - \beta(E_t p_{t+1} - p_t) + u_t \qquad \beta > 0 \qquad (1)$$

Where m_t is the logarithm of nominal money, p_t is the logarithm of the general price level (in this working we assume producer price index PPI for price level index), $E_t p_{t+1}$ c is the expected future price level and α , β are parameters (β is the semi elasticity of demand for real balances). u_t is a stochastic variable which represents shocks to money demand or velocity. In this paper u_t is usually assumed to follow a random walk: $u_t = u_{t-1} + \varepsilon_t$ is white noise.

The simplifying assumption to make is that of instantaneous clearing in the money

market, so that money demand is always equal to money supply. By making this assumption, equation (1) becomes a dynamic relation which determines the price level as a function of money supply and expected future prices:

$$p_t = (1-b)(m_t - \alpha) + bE_t p_{t+1} - (1-b)u_t \qquad , b = \frac{\beta}{1+\beta} \tag{2}$$

What needs to be specified in order to close the model is how to expectations of the future price level are formed. If expectations are formed rationally, equation (2) can be solved recursively forward to give:

$$p_t = (1-b)\sum_{i=0}^{n-1} b^i E_t(m_{t+i} - u_{t+i} - \alpha) + b^n E_t p_{t+n} \tag{3}$$

The interesting point about equation (3) is that it, in general, involves multiple solutions. The *fundamental solution* F_t is obtained by assuming that:

$$\lim_{n \to \infty} b^n E_t p_{t+n} = 0 \tag{4}$$

Where by equation (3) becomes:

$$p_t = (1-b)\sum_{i=0}^{n-1} b^i E_t(m_{t+i} - u_{t+i} - \alpha) \equiv F_t \tag{5}$$

In this solution the price level is uniquely determined by the discounted value of expected future money supply and velocity shocks. If instead, the price level is expected to grow at a rate that exceeds the discount factor b, the transversality condition (equation 4) is violated, and the solution becomes:

$$p_t = F_t + B_t \tag{6}$$

Where B_t is found as the homogeneous solution to equation (2): $E_t B_{t+1} = b^{-1} B_t$.

B_t is the rational bubble component and reflects the situation where the price level is driven by self-fulfilling expectations, independently of market fundamentals.

The basic idea of this working paper is to estimate the underlying model(cagan money demand function) using two different techniques; a limited-information technique, for example, the instrumental variable technique proposed by McCallum (1976), and a full-information technique. Since the limited-information estimator does not depend on any transversality condition (like equation (4) in the cagan model), it gives consistent estimates of the parameters even in the presence of bubbles. On the other hand, the full-information estimators rely on a transversality condition when using information on the process which generates the fundamentals variable and therefore, only gives consistent estimates in the absence of bubbles. With the cagan specification (equation 1) as the underlying model, cagan equation can be calculated by estimating the following three equations:

$$p_t - m_t = -\alpha(1-b) + b(p_{t+1} - m_t) - (1-b)u_t + e_{t+1} \tag{7a}$$

$$m_t = \varphi_0 + \varphi_1 t + \ldots + \varphi_n t^n + \Theta_1 m_{t-1} + \ldots + \Theta_q m_{t-q} + v_{1t} \tag{7b}$$

$$p_t = \mu_0 + \mu_{11} t + \ldots + \mu_{1n} t^n + \mu_{21} m_t + \ldots + \mu_{2q} m_{t-q+1} + v_{2t} \tag{7c}$$

Equation 23a is obtained from equation1 by setting b equal to $b = \frac{\beta}{1+\beta}$, rearranging terms, and replacing $E_t P_{t+1}$ by p_{t+1}, where by an expectations error e_{t+1} is created which, under the assumption of rational expectations, has zero mean and is serially uncorrelated. Equation 7b is the stochastic process for the fundamental variable m_t (where deterministic trends are allowed for). This process can be thought of as a money supply rule and or a forecasting equation for the money supply. Equation 7c is a closed form relation for the price level as a function of market fundamentals.

This equation can be derived explicitly from the Cagan model (equation5) when the

transversality condition (equation4) is imposed. By substituting for the infinite sum in equation (5) from the forecasting equation (equation 7c), equation 7c is obtained, where the parameters (μ_1, μ_2,...μ_{2q}) become complicated functions of α,β and the parameters in equation 7b.Equation 7b can be estimated by OLS. Since p_{t+1} is correlated with the error term, an instrumental variable technique must be applied in estimating equation 7a. by choosing the variables on the right-hand side of equation 7b as instruments, a two-stage least-squares estimation of the parameters in equation 7a is obtained. Since contemporaneous error term in equation 7a will generally exhibit MA (1) – behavior, which has to be taken into account in calculating the standard errors of the estimates. In estimating equation 7c it is important to distinguish between the case where m_t is allowed to be endogenous, as noted by Casella (1989). If equation 7b is viewed as the true structural equation describing money supply, m_t is, in effect, exogenous with respect to the parameters in equation 7c, which can then be estimated by OLS. If instead there is a feedback from prices to money, equation 7b must be seen as a univariate approximation to the true money supply process, in this case v_t will be correlated with contemporaneous and lagged u_t because information on past and present prices can improve forecasts of future money supply. This in effect, makes v_{2t} serially correlated and also correlated with m_t in equation 7c; so, instrumental variable techniques have to be applied in estimating equation 7c. a natural choice of instruments is. As before, the right-hand-side variables in equation 7b. By estimating the three equations in the way described, two different estimates of the parameters α and β are obtained: the limited-information estimates from equation 7a, and the full-information estimates from equations 7b and 7c.

Paper Content

The data which will be used in this study are monthly observation on price indexes[1] (PPI,CPI,WPI) and money supply index[2] (M1). According to CBI (1993-2009) Table3 and graphs(1)-(4) show characteristic growth of these variables, for Iran economic in period of 1961-2008.

Stationary test for price and money

A preliminary time-series analysis on the data(logarithmic form) using unit root test was conducted. Accoroding to Augmented Dickey Fuller(ADF), The result shows that the growth rate of money *m* for Iran can be approximated as stationary around a linear deterministic trend. This probably also holds for the inflation rate.(table 4 , 5).

Money supply process in Iranian economic

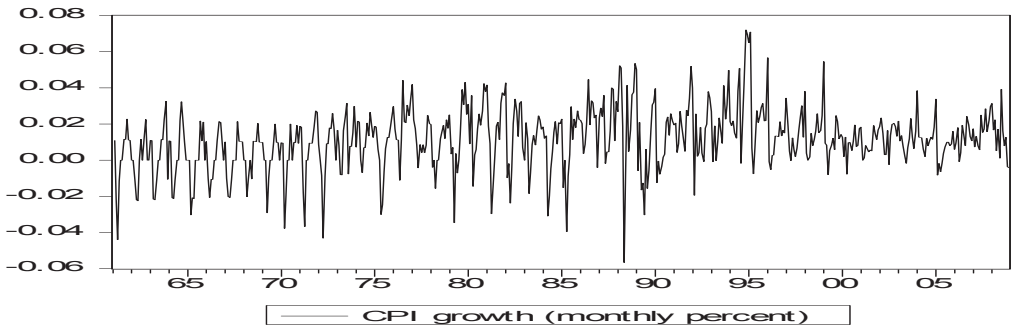
As a first step, univariate stochastic processes for the money supply were estimated. As described earlier, a preliminary time-series analysis showed that the growth rate of money is most likely to be regarded as stationary around a linear deterministic trend. Therefore, AR-processes for the first difference of m_t were estimated, where a constant term and a trend are including among the regressors. With this specification it turns out that a simple AR (1) for Δm_t is sufficient to capture the dynamics of the money supply in Iran economic:(table 6)

$$\Delta m_t = \varphi_0 + \varphi_1 t + \Theta.\Delta m_{t-1} + v_{1t} \qquad (8)$$

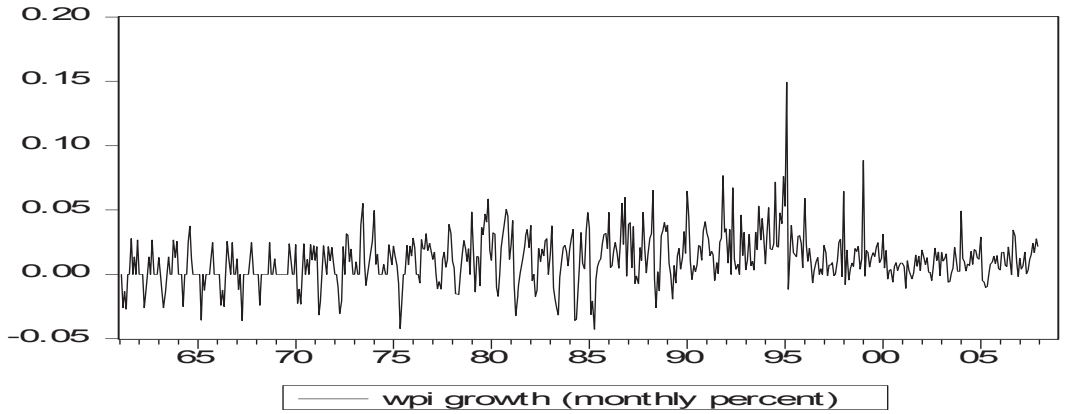
[1]PPI: Producer Price Index , CPI: Consumer Price Index , WPI: Whole Price Index

[2]M1: M1=CU+DD (first explanation of money)

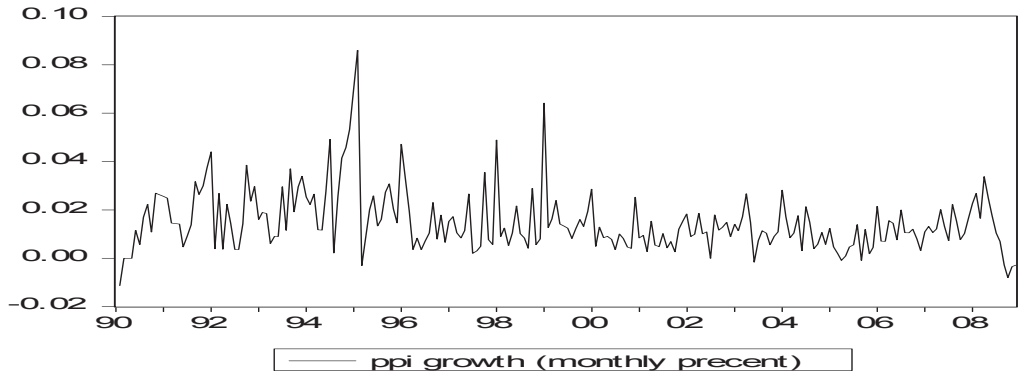
***Graph1**. monthly growth rate of CPI in Iran (1961-2008)*



***Graph2**. monthly growth rate of WPI in Iran (1961-2008)*



***Graph3**. monthly growth rate of PPI in Iran (1990-2008)*



***Graph4**. monthly growth rate of Money (M1) in Iran (1961-2008)*

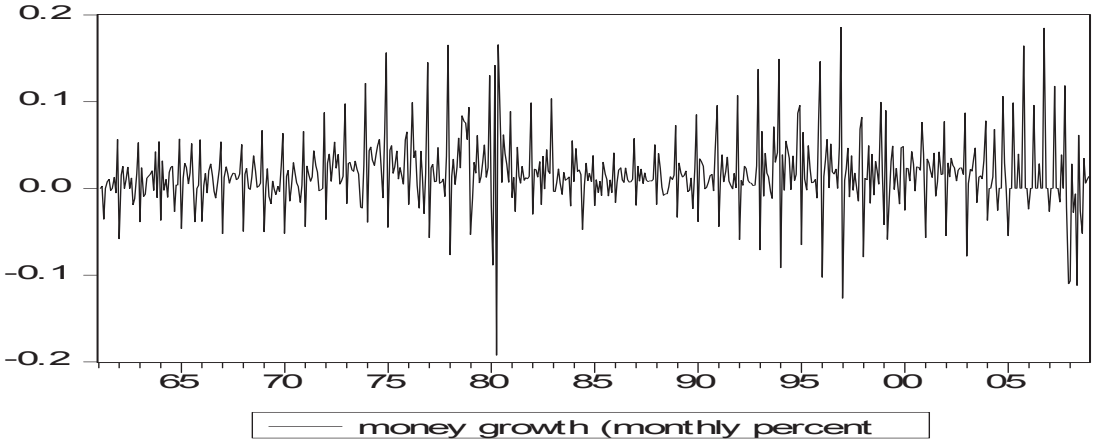


***Table 3**. money and price monthly growth in iran*

Variable symb.	variable	Sample	Obs	max		min		mean	Jarque-Bera st	Prob of J-B
Gcpi (%)	Concumer price index growth	1961:02 2008:12	575	0.0720	11/94	-0.056	5/88	0.0112	56.244	0.0
Gwpi (%)	Whole price index growth	1961:02 2007:12	575	0.1493	2/95	-0.042	4/85	0.0112	720.608	0.0
Gppi (%)	Producer price index growth	1990:01 2007:12	216	0.0860	2/95	-0.007	10/208	0.1487	460.471	0.0
Gm (%)	Money supply (M1) growth	1961:02 2008:12	575	0.1856	12/96	-0.192	4/80	0.0168	437.521	0.0

Cagan model estimation for Iranian economic

The next step is to estimate the Cagan model using a limited-information procedure and a full-information procedure.

Because of the non-stationary of p_t and m_t, and the assumption that the velocity shock u_t follows a random walk, equation 7a is estimated an first- difference form:

$$\Delta(p_t - m_t) = b.\Delta(p_{t+1} - m_t) + \delta_t \qquad (9)$$

Where $\delta_t = -(1-b)\varepsilon_t + \Delta e_{t+1}$ is the composite disturbance term exhibiting MA (1)- behavior. The standard error of *b* is corrected for heteroscedasticity and first-order autocorrelation using the Newey and West

(1987) correction. Table 7 contains the results of estimating equation 9 for Iran economic. The Cagan model with rational expectations cannot be rejected by the data. In this case (IRAN) the parameter estimate of *b* lies between 0 and 1, which is necessary in order to get a negative elasticity of money demand with respect to expected inflation.

Unrestricted estimation of closed-form Cagan- model under rational expectations

Turning to the full-information estimation of the Cagan model under rational expectations, it is necessary to derive the parameter restriction formula in Hansen and Sargent (1980) for the auto regressive parameters, and West (1989) for the deterministic terms, one gets the following closed form expression for the price level when the Cagan model constitutes the underlying model, the transversality condition (equation 4) holds and equation (8) characterizes the money supply process:

$$p_t = \frac{b\left\{\varphi_0 + \left[\frac{\varphi_1}{1-b}\right]\right\}}{(1-b)(1-\Theta b)} - \alpha + \frac{b\varphi_1}{(1-b)(1-\Theta b)}t + m_t + \frac{\Theta b}{1-\Theta b}\Delta m_t + v_{2t}$$

(10)

Here v_{2t} is equal to u_t if money is exogenous, and equal to u_t plus some noise which is autocorrelated and correlated with m_t, if money is endogenous. Because of the non-stationary of p_t and m_t, equation (10) is estimated in first-difference form:

$$\Delta(p_t - m_t) = \mu_{11} + \mu_{21}\Delta\Delta m_t + v_{3t}$$

(11)

Where v_{3t} is equal to ε_t if money is exogenous, and equal to ε_t plus noise correlated with $\Delta\Delta m_t$ if money is endogenous. μ_{11} and μ_{21}then obey the following restrictions:

$$\mu_{11} = \frac{b\varphi_1}{(1-b)(1-\Theta b)} \quad , \quad \mu_{21} = \frac{\Theta b}{1-\Theta b}$$

(12)

In the former case OLS will give consistent parameters when equation (4) holds, but in the latter case $\Delta\Delta m_t$ needs to be instrumented in order to obtain consistency. The instruments chosen are the right-hand-side variables in equation (8). Since v_{3t} is not necessarily white noise when money is endogenous.

Table4*. ADF test non-stationary of variables money stock for Iranian economic*

Variable	Sample	Lags	MC Kinnon critical point ( )	Dickey-fuller statistic	Result
LOGM1*	1961:02 2008:12	3	-3.97	-1.86	Non-statonary
D(LOGM1)**	1961:02 2008:12	2	-3.97	-10.98	stationary
LOGM1	1990:02 2008:12	3	-3.46	-2.18	Non- statonary
D(LOGM1)	1990:02 2008:12	4	-3.46	-8.08	statonary

**(logarithm of M1)*

***(first difference logarithm of M1)*

***Table5**. ADF test non-stationary of price index variables for Iranian economic*

variable	Sample	lags	MC Kinnon critical point ( )	Dickey-fuller statistic	result
LOGPPI	1990:06 2008:12	4	-3.46	-3.25	Non-statonary
D(LOGPPI)	1990:06 2008:12	4	-3.46	-4.95	stationary
LOGCPI	1961:06 2008:12	4	-3.44	3.15	Non- statonary
D(LOGCPI)	1961:02 2008:12	4	-3.44	-10.98	statonary
LOGWPI	1961:05 2007:12	3	-3.44	2.49	Non- statonary
D(LOGWPI)	1961:06 2007:12	3	-3.44	-10.22	statonary

***Table 6.** Estimation of money supply processes*

Estimation method: OLS											
Index	sample	Obs	φ_0	φ_0 t-student	φ_1	φ_0 t-student	Θ	Θ t-student	R^2	DW	F
M1	1961:01 2008:12	574	0.01	5.62	0.00000546	1.18	-0.25	-6.21	0.06	2.06	19.42
M1	1990:01 2008:12	226	0.02	4.73	-0.0000757	-1.68	-0.23	-3.56	0.05	2.07	7.29

***Table7**. Limited-information estimation of cagan model under rational expectations using McCallums instrumental variables technique.*

Price Index	Money Index	Sample	Observation	Estimation method	Independent Var. coef. ()	T statistic ()	R^2	DW
PPI	M1	1990:02 2008:11	226	OLS	0.99	50.09	0.91	2.80
WPI	M1	1961:02 2007:11	562	OLS	0.91	42.96	0.76	2.80
CPI	M1	1961:02 2008:11	574	OLS	0.97	58.15	0.85	2.50

***Table8**. Causality test between money and price indexes in Iran(1961-2008)*

Sample	Null hypothesis	F	Probability of null-hypothesis acceptation	result
1961:01 2008:12	$dLogWPI \xrightarrow{NO} dLogM$	2.59	0.12	Money is exogenous reward to WPI
	$dLogM \xrightarrow{NO} dLogWPI$	4.97	0.0	
1961:01 2008:12	$dLogM \xrightarrow{NO} dLogCPI$	8.55	0.0	Money is exogenous reward to CPI
	$dLogCPI \xrightarrow{NO} dLogM$	2	0.13	
1990:01 2008:12	$dLogM \xrightarrow{NO} dLogPPI$	3.87	0.02	Money is exogenous reward to PPI
	$dLogPPI \xrightarrow{NO} dLogM$	0.14	0.86	

***Table 9** ; Unrestricted estimation of closed-form Cagan- model under rational expectations in Iranian economy.(1961-2008)*

Price Index	Money Index	sample	Observation	Estimation Method	μ_{11}	T statistic μ_{11}	μ_{21}	T statistic μ_{21}	$\overline{R}^2$	DW	F
PPI	M1	1990:03 2008:12	226	OLS	-0.001	-0.82	-0.51	-17.25	0.56	1.47	297
WPI	M1	1961:03 2007:12	562	OLS	-0.005	-4.69	-0.52	-26.6	0.55	1.65	709
CPI	M1	1961:03 2008:12	574	OLS	-0.004	-4.23	0.52	-28.39	0.58	1.41	806

Causality test between money and price

Since the question of whether money is exogenous or endogenous is rather crucial for the conclusions, a simple test for feedback from prices to money using Granger-causality tests was made. F tests for the hypothesis is that the inflation rate does not Granger-cause money growth. As can be seen, this hypothesis is not rejected for iran at a standard 5% level of significance.(see table 8)

The results of estimating equation (11) are showed in table 8. according to this test, Money is exogeneity of money reward to price in Iranian economic, Unrestricted estimation of closed-form Cagan-model under rational expectations for Iranian economic is showed in table9.

Conclusions

In this paper it has been examined whether prices in producers levels were partly driven by self-fulfilling rational expectations during (1990-2007) in Iran. According to this working paper the conclusions of this paper are:

a) Price and money logarithm variables

are follow a non-stationary process in 1961-2008 and the first difference of these variables are follow a stationary process.

b) Elasticity of demand for real balances in money market toward inflation for Iranian economy for Iranian economy are approximately 0.9

c) Money is exogenous reward to WPI,CPI and PPI in Iranian economy.

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