Contents

Is There Any Difference to Use Various Definition of Money in Analyzing Money Neutrality?

Bahram Sahabi[1], Alireza Keikha[2], Esmaeil Jafarimehr[3]

Abstract

During past years, economists have been endeavoring to determine both relationship and causality direction between real macroeconomic and nominal economic variables. In this regard, many studies have been carried out on the relation between money and inflation, resulting in the introduction of the notion of money neutrality which implies that permanent change of money supply just affects the nominal variables and has no lasting and real effect on production and employment. Furthermore, even when constant changes of money growth have no real impact whatsoever (except on real monetary equilibriums); money is stated to be super neutral in the long run. Although the majority of economists (with disparate schools of thought) concur with long-term money neutrality, there are still different opinions on the short-term and middle-term neutrality of the money. In following some major of them are presented. This paper investigates the existence of money neutrality in the Iranian economy applying Fisher and Seater approach during 1973 and 2014. The time series analysis, ARIMA model, is used to examine the problem and we consider various monetary aggregates, M1 and M2. Results show that we cannot reject the hypothesis test of money neutrality in Iran. Because all variables are non-stationary and integrated of order one I (1) we can only test the money neutrality. So it is strongly verified that money is neutral and it does not have any significant effects on real non-oil GDP in Iran. Also it was shown that the results are not sensitive to different aggregate money supply.

Keywords: Money Neutrality; ARIMA Model; Stationary Test; Iran.

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Introduction

According to classical point of view, money is neutral and just affects the nominal sector of the economy. The adherents of this view believe that the expansionary monetary policy influences nominal income in terms of increasing general level of prices. Hence, the monetary policy would be inflationary in the economy. Proposing dichotomy theory between real and monetary sectors of the economy, economists attempted to justify that money is not effective on the economy. On the contrary, Keynesians are of the opinion that nominal values such as money volume provide a reasonable explanation for violations or business circles. They reject the classics' thoughts about the relationship between nominal and real variables and state that changes nominal values, for example money supply, can affect real variables like production and employment.

Monetarists hold the belief that Philip's curve and aggregate supply of economy are vertical in the long term and thus money is neutral and non-efficient in the long run. In such a standpoint, the effects of short-term monetary fluctuations on real variables differ from those in the long run. Although nominal impulses may influence real economic variables in the short term, yet dichotomy hypothesis of the economy between monetary and real sectors still exists. Hence, money neutrality in the long term is presumed in monetarism school. Advocates of this school believe that real sector variables of the economy are determined by real factors (i.e. population growth, workforce output, savings rate etc.). However, they agree with Keynesians that nominal variables and money supply in particular, are able to impact economic activities in the short term. Proposing rational expectations, Neo-classics believe that only unpredicted shocks of money can trigger off violations to the economy, whereas forecasted money shocks are neutral in the economy. In their approach, the predictable policy does not have any influence on real production and employment and just nominal quantities are affected. In fact, just the unpredicted money policy is able to affect real production.

In accord with Walrasian general equilibrium system, business cycle school supports the classical theory of dichotomy among monetary and real sectors. They believe that Walras' general equilibrium system specifies the quantities of products and services, employment as well as relative prices regardless of taking means of exchange or money supply into consideration. In addition, nominal variables such as price levels, wage and interest rate are determined through the balance in the money market. However, since nominal variables have no effect on real ones, money market would be of little importance.

Neo-Keynesians assume that in spite of rational expectation hypothesis, due to imperfect competition circumstances of labor, commodity and credit markets, nominal and real bond price and prevalent credit limitations, monetary fluctuations are still effective on real production. Therefore, they support the idea that money is not neutral and monetary policies are influential in the short run. Austrians consider money endogenous to production, meaning that the increase of money supply is an immediate response of more production and consequently the need for more money among individuals and investors. In this point of view, imposing monetary policies will not act as a solution to raising the level of production. (Snowdon et al, 1994)

Therefore, whether the money can affect real variables or not has been of controversial matters on theoretical and experimental macroeconomic literature. In this regard, two main hypotheses of money neutrality and super neutrality in the long run are presented to describe the relationship between monetary and real sectors of the economy. According to Fisher and Seater (1993), money neutrality occurs if general level of prices varies in proportion to permanent and exogenous change in the amount of money while real variables remain unchanged. In addition, money super neutrality describes the time when nominal interest rate changes proportionally following permanent and exogenous change in money supply without having any effect on the level of real variables (Fisher et al, 1993). The time series analysis, ARIMA model, is used to examine the problem and we consider various monetary aggregates, M1 and M2, according to Leong and McAleer (2000).

Literature Review

In this section, at first, some studies regarding money neutrality in foreign countries are briefly investigated. Then, a summary of researches done in Iranian economy are put forward.

Among the first studies on money neutrality, Barro (1976), examined it in the United States during 1946-1973. The results showed that only the growth of unpredicted money in the short term has a significant positive effect on production, and money is neutral in the long term (Barro, 1976). Wallace and Shelly (2004) have investigated the long-term neutrality and super neutrality tests in the Nicaraguan economy during 1960-1999 and concluded that money has been neutral whereas, super neutrality of money was rejected in that period (Frederick

et al, 2004). Tawadros (2007) carried out his research on money neutrality hypothesis in the Middle East. In order to examine money neutrality, the author applied seasonal accumulation and integration and money volume and production data of Morocco, Jordan and Egypt. The results indicate that money and price levels are integrated while they have no integration with production, confirming thus money neutrality in the long run (Tawardos, 2007). Using the auto-regressive structural vector model approach, Chuku (2011), did a research on money neutrality for the Nigerian economy. As conclusions show, although money is neutral in the long term and has no impact on production, in the short term it slightly influences production (Chuku, 2011).

Sulka (2011) followed Fisher and Seater's autoregressive integrated moving average (ARIMA) model and utilized quarterly data from 1997 to 2006 to investigate long-term money neutrality in Turkey. They concluded that money is neutral under different definitions of money (M1, M2, M2y and M3) (Sulka, 2011). Kafayat et al. (2010) studied money neutrality and super neutrality in South Africa's economy using a trivariate structural vector auto-regression model with quarterly data during 1960-2010. The conclusions acknowledged the super neutrality of the money, implying that monetary policy cannot alleviate the major and chronic unemployment in South Africa (Kafayat, 2010). Osuji et al (2012) investigated the money neutrality test in Nigeria from 1972 to 2010 applying different econometric techniques, including Philips Prone, Johansson co-integration and VAR model to test stationary and other hypotheses. The results proved that money has no effect on domestic production, confirming that money neutrality is not

rejected for the aforementioned period. (Osuji et al, 2012)

Using SVAR model, Rahman and Qayum (2013) examined whether money was neutral in Bangladesh during 1974 and 2008 or not. According to the results, if money incorporates just M1, the money was not neutral. While if it extended to include M2, the money would be neutral in the Bangladeshi economy (Rahman et al, 2013). Jayaramanan et al (2014) conducted their research on the money neutrality in Fiji during 1970-2011 by using the generalized method of moments (GMM) as well as Johansson co-integration models. The results showed that economy growth was influenced by money; hence money was not neutral in this country (Jayaraman et al, 2014).

Teshkini and Shafiei (2005) studied money neutrality in the period of 1995 to 2003 using the seemingly unrelated regression (SUR) method. The conclusions verify the assumption that unpredicted as well as forecasted policies have been neutral in Iran economy during the mentioned period (Tashkini et al, 2005). Monjazeb (2006) used neo-classical models of Baru, Mykyn, Gordon and Pesaran to investigate the impacts of money supply on inflation and production in Iran economy over 1988-2004. As can be inferred from the conclusions, money volume is of no effect on production during that period, pointing to money neutrality in the long run (Monjazeb, 2006). Shahmoradi and Naseri (2009) exploited the King and Watson methodology (1997) in the introduction of money volume so as to examine money neutrality and non-neutrality in Iran. The authors utilized VAR and quarterly data from 1988 to 2005 to investigate the above tests. The results show that according to the methodology, the money neutrality hypothesis is accepted in most of the investigated states (Shahmoradi et al, 2009).

As mentioned above, most of studies verify that money is neutral in long run but there are some researches which have shown the opposite of that claim. Rahman and Qayum (2013) and Jayaraman and Chen (2014) have demonstrated that money is not neutral in Bangladesh and Fiji respectively. In Bangladesh, if M1 is considered as monetary variable, the neutrality of money would be rejected.

Methodology

Fisher and Seater (1993) emphasize that there are two necessary properties to be satisfied: the exogenity of the money and specific non-stationary conditions of the monetary and real variables. Especially, if both monetary and real variables are integrated of order one then money neutrality can be tested. Otherwise, money super neutrality test needs that the order of integration of the monetary variable be equal to one plus the order of the real variable.

They investigate neutrality and super neutrality of money with the help of time series framework. The following model has been established:

$$a(l)\Delta^j m_t = b(l)\Delta^i y_t + u_t$$

$$c(l)\Delta^i y_t = d(l)\Delta^j m_t + w_t$$

The orders of integration of money and real GDP are j and I, respectively. The vector (u_t, w_t) is identically distributed.

They verify that for analyzing neutrality and super neutrality of money, there should be non-stationary condition for the money. Also, if the money is the stationary in the level or I (0) then there are no permanent changes in monetary variables

and, therefore, money neutrality and super neutrality are not testable.

In addition to non-stationary condition for monetary variable, there is another necessary condition that should be satisfied. So in this framework, the exogenity of money must be verified by assuming b (1) $=b_{uw}=0$ in equation (1). After this assumption, Fisher and Seater indicated that $\frac{d(1)}{c(1)}$ equals to the frequency zero regression coefficient when $\Delta^i y_t$ is regressed on $\Delta^j m_t$.

The estimator of $\frac{d(1)}{c(1)}$ is attained by $\lim_{k\to\infty} b_k$, b_k is the slope coefficient of the following regression

$$\sum_{r=0}^{k} \Delta^i y_{t-r} = a_k + b_k \sum_{r=0}^{k} \Delta^j m_{t-r} + e_{kt} (2)$$

There are three possible models for examining of neutrality subject to the degree of integration:

(a) When i=j , long run money neutrality is tested by equation (3) to estimate b_k:

$$y_t - y_{t-k-1} = a_k + b_k(m_t - m_{t-k-1}) + e_{kt}(3)$$

(b) When i=1, j=2, long run money neutrality cannot be rejected and long run money super neutrality can be tested by equation (4)

$$y_t - y_{t-k-1} = a_k + b_k(\Delta m_t - \Delta m_{t-k-1}) + e_{kt}(4)$$

(c) When i=2, j=2, the permanent change in the growth rate of money affects the growth rate of output in the same way the level of money affects the level of output. To test long run money super neutrality in this case, first of all long run money neutrality should be held. If neutrality holds, the super neutrality can be tested by deriving equation (6)

Long run money neutrality:

$$\Delta y_t - \Delta y_{t-k-1} = a_k + b_k(\Delta m_t - \Delta m_{t-k-1}) + e_{kt}(5)$$

Long run money super neutrality:

$$\Delta y_t - \Delta y_{t-k-1} = a_k + b_k(\Delta^2 m_t - \Delta^2 m_{t-k-1}) + e_{kt}(6)$$

In this paper an ARIMA model is used for analyzing former equations (Keikha et al, 2012). The equation (3) to (6) can be estimated by applying the Newey-West (1997) approach to obtain consistent estimates of b_k (Newey et al, 1987).

Data

As Leong and Mcaleer shown the result of money neutrality is sensitive to different types of monetary aggregates. So in this research, we apply two type of money index to Iran economy. In monetary literature, a degree in which money can be liquidized forms various types of money called M1, M2, M3 etc. Since Iran lacks active and competitive monetary and financial markets, there are more limited definitions of money. In such a situation, money in circulation, called M1, consists of the sum of notes and coins in people's hands in addition to individuals' demand deposits in banks. The total sum of savings accounts and long-term deposits are also called quasi-money. M1 together with quasi-money constitutes money volume or M2. Furthermore, since neutrality investigates how the effect of a shock on a nominal variable affects a real variable, both nominal money volume and real GDP must be taken into account. GDP is calculated by dividing nominal GDP by the consumer price index (CPI). In this paper, we have used the data between 1973 and 2014. Statistics related to M1, M2, and CPI has been gathered from statistics centre of Iran (central bank of Iran, 2017). The following figures illustrate the logarithms of M1, M2

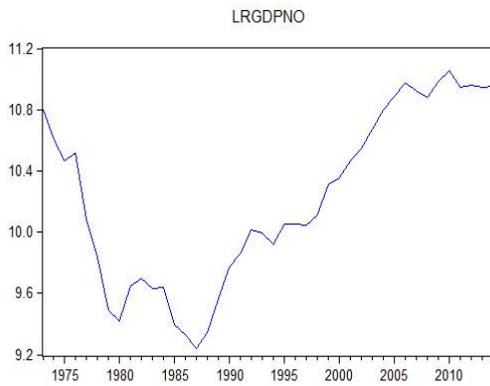and oil-free GDP during the aforementioned period.
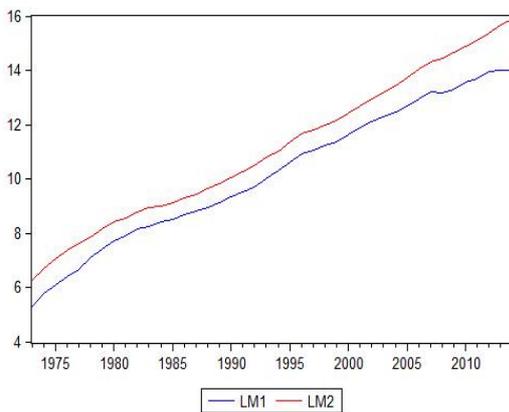

Fig. 1. Logarithm of non-oil real GDP

Fig. 2. Logarithm of nominal money supplies: LM1 and LM2

Figure (1) indicates the trend of non-oil GDP of Iran from 1974 to 2014. As one can see, the growth of Iranian economy has significant fluctuations. There were two main depressions due to the Islamic revolution and Iraq war at the end of the seventies and in the early eighties. Also the positive and negative values of economic growth have been alternatively continued since 40 years. The growth of money supplies is shown in Figure (2). The analysis was done by Eviews 9 software in this research.

Firstly, in this section, for applying the Fisher and Seater (1993) methodology, we verified that all variables (real non-oil GDP, LM1 and LM2) are non-stationary. So the results of stationary tests (ADF and Phillips Perron) are shown in Table (1). As we can see, all the variables are non-stationary and integrated of order one I (1).

Table 1. Stationary tests, ADF and PP tests results				
Variable	ADF test		PP test	
	I(0)	I(1)	I(0)	I(1)
Real non-oil GDP	-0.948 [0.762]	-4.004** [0.003]	-1.063 [0.721]	-4.008** [0.004]
M1	-2.811 [0.0654]	-4.095** [0.002]	-2.798 [0.070]	-4.109** [0.002]
M2	0.634 [0.989]	-4.218** [0.001]	-0.353 [0.907]	-4.196** [0.002]
Notes: ** indicates significance at 95% confidence level. The null hypothesis (H (0)) of ADF and PP tests is: H (0) = series has a unit root. The number in [] shows the P-value of ADF and PP tests.				

According to the results of stationary tests, the long run money neutrality can be tested by using the Equation (3) and it is sustained if the slope coefficient (b_k) goes to zero as k goes to infinity. Figures (3) and (4) include graphs of estimated b_k's and 95 percent confidence interval according to M1 and M2 for k=1-30. The standard errors used to build the confidence interval are corrected for autocorrelation and heteroskedasticity by the Newey –West method. As we can see in Figures (3) and (4), the long-run neutrality of money could not be rejected for both aggregate supply of money (M1 and M2). Because all the estimated b_k's are negative and insignificant and the confidence band include zero for k=1-30, then money has not any meaningful effect on real non-oil GDP in Iran during 1974 and 2014.
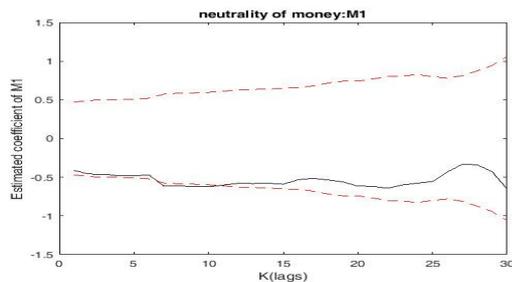
Fig. 3. Long run money neutrality: M1

Continuous line displays the estimatedb_k's, upper dashed line and lower dashed line are the upper bound and lower bound of confidence interval of the estimatedb_k's respectively.

Fig. 4. Long run money neutrality: M2

Continuous line displays the estimatedb_k's, upper dashed line and lower dashed line is the upper bound and lower bound of confidence interval of the estimatedb_k's respectively.
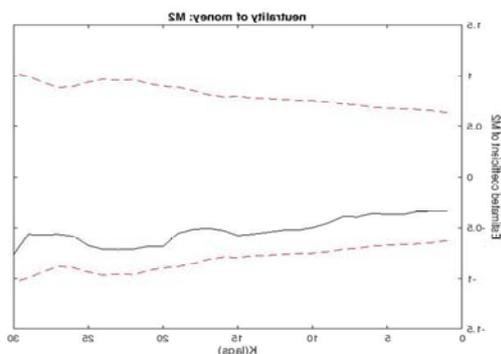
Conclusion

The existence of money neutrality in the Iranian economy is investigated by this research applying Fisher and Seater (1993) during 1973 and 2014. The time series analysis, ARIMA model, is used to examine the problem and considered various monetary aggregates, M1 and M2, according to Leong and McAleer (2000). Because all variables are non-stationary and integrated of order one I (1) we can only test the money neutrality. So it is strongly verified that money is neutral and it does not have any significant effects on real non-oil GDP in Iran. Also it was shown that the results are not sensitive to different aggregate money supply.

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آیا تغییر تعریف پول بر فرضیهٔ خنثایی پول در ایران تغییری ایجاد می کند؟

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چکیده

در این مقاله به دنبال بررسی خنثایی پول در اقتصاد ایران با استفاده از روش کاربردی فیشر و سیتر برای دوره ۱۹۷۳ تا ۲۰۱۴ هستیم. از تحلیل سری‌های زمانی و مدل ARIMA برای بررسی مسئله استفاده شده است. بدین منظور ۲ تعریف مختلف M1 و M2 برای پول استفاده شد. آزمون مانایی متغیرها هم برای لگاریتم GDP غیرنفتی و هم برای لگاریتم متغیرهای پولی تأییدکننده انباشتگی از درجه اول است. بنابراین فقط می‌توانیم خنثایی پول را در بلندمدت بررسی کنیم. نتایج بررسی‌ها نشان می‌دهد که نمی‌توان فرضیه خنثایی پول در بلندمدت را در ایران رد کرد. بنابراین این بررسی قویاً تأیید می‌کند که پول خنثی است و در بلندمدت اثر معنی‌داری بر GDP غیرنفتی نمی‌گذارد. همچنین نتایج نشان داده است که تغییر در تعریف پول از M1 به M2 تأثیری بر نتایج نگذاشته است.

واژه‌های کلیدی: خنثایی پول، مدل آریما، آزمون مانایی، ایران.

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