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The Welfare Cost of Inflation in Iran

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Abstract

The purpose of this paper is to estimate the welfare cost of inflation in Iran. We first use the long-horizon regression approach developed by Fisher and Seater (1993) to obtain an estimate of the inflation rate elasticity of money demand and then the Baily's consumer surplus approach to calculate the welfare cost function. The results show that reducing inflation rate from 40% to 0% increases the welfare of money holders by 0.3% of GDP. The welfare cost function helps the central bank to estimate the welfare effects of monetary policy.

Keywords: Integration; Co-integration; Long-run derivative; Interest elasticity

1- Introduction

Lucas (2000) provides estimates of the welfare cost of inflation based on U.S. time series for 1900-1994. In doing so, he defines the money supply as simple sum M1, assumes an interest elasticity of -0.5, and estimates the welfare cost of inflation using Bailey's (1956) consumer surplus approach. Lucas's calculations, based on the double log money demand function, indicate that reducing the inflation rate from 3% to zero yields a benefit equivalent to an increase in real output of about 0.009 (or 0.9%).

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Serletis and Yavari (2003) calculate the welfare cost of inflation for Canada and the United States, in the post-World War II period, from 1948 to 2001. In doing so, they use the same double log money demand specification used by Lucas (2000), but they pay particular attention to the integration and co-integration properties of the money demand variables and use recent advances in the field of applied econometrics to estimate the interest elasticity of money demand. They conclude that the welfare cost of inflation is significantly lower than Lucas reported.

Serletis and Yavari (2004) use different money demand function to estimate the welfare cost of inflation for a group of Latin American countries. This demand function depends on inflation rate rather than nominal interest rate because the money demand in developing countries is not very responsive to the central bank's fixed nominal interest rate and the data on the market rate is usually unavailable.

In this paper, we also use the inflation-based money demand function and the advanced econometrics technique to estimate the welfare cost of inflation for Iran using annual data over the period from 1960 to 2000. The organization of the article is as follows. The next section provides a brief summary of the theoretical issues regarding the estimation of the welfare cost of inflation. Section 3 discusses the data, presents empirical evidence regarding the interest elasticity of money demand, and presents the welfare cost. Section 4 closes with a brief summary and conclusion.

2- Theoretical Foundations

Consider the following money demand function

$$M/P = L(\pi, y), \qquad (1)$$

Where M denotes nominal money balances, P the price level, y real income, and π the inflation rate (assuming that the opportunity cost of holding money is the inflation rate). Assuming that the $L(\pi, y)$ function takes the form $L(\pi, y) = \Phi(\pi)y$, the money demand function can be written as $m = \Phi(\pi)y$, where m denotes real money balances, M/P. Equivalently, we can write

$$,z = m/y = \Phi(\pi), \qquad (2)$$

Which gives the demand for real money balances per unit of income as a function of the inflation rate π. The specification of the money demand function is crucial in the estimation of the welfare cost of inflation. Bailey (1956) and Friedman (1969) use a semi-log demand schedule whereas Lucas (2000) uses a double log (constant elasticity) schedule on the grounds that the double log performs better on the U.S. data that does not include regions of hyperinflation or rates of interest approaching zero. In this paper we use the semi-log functional form because of the high inflation characteristics of the Iranian economy. So, we have

$$\ln\Phi(\pi) = \alpha - \xi\pi, \tag{3}$$

or, equivalently,

$$\Phi(\pi) = \beta e^{-\xi\pi} \tag{4}$$

where $\beta = e^{a}$ and ξ is the interest elasticity[1].

We take the traditional approach for estimating the welfare cost of inflation, developed by Bailey (1956)[2]. It uses tools from public finance and applied microeconomics and defines the welfare cost of inflation as the area under the inverse money demand schedule. That is the consumer surplus that can be gained by reducing the inflation rate from a positive level of π to the lowest possible level (perhaps zero). In particular, based on Bailey's consumer surplus approach, we estimate the money demand function $z = \Phi(\pi)$, calculate its inverse $\pi = \Psi(z)$, and define

$$w(\pi) = \int_{\Phi(\pi)}^{\Phi(0)} \psi(x)dx = \int_{0}^{\pi} \Phi(x)dx - \pi\Phi(\pi), \tag{5}$$

1- Equation (2) is obtained from equation (1) by writing (1) as e $\ln\Phi(\pi)$ = e $\alpha-\xi\pi$, which implies $\Phi(\pi)$ = eα e$-\xi\pi$ = Be$-\xi\pi$, where B = eα.

2- Recently, Lucas (2000) takes a compensating variation approach to the problem of estimating the welfare cost of inflation, providing a general equilibrium justification for Bailey's consumer surplus approach. See Lucas (2000) and Serletis and Virk (2003) for more details regarding that approach.

where $w(\pi)$ is the welfare cost of inflation, expressed as a fraction of income. With the semi-log money demand function, the above equation takes the form

$$w(\pi) = \left[\frac{B}{-\xi} e^{-\xi\pi} \right]_0^{\pi} - \pi B e^{-\xi\pi} = \frac{B}{\xi}\left[1 - (1 + \xi\pi)e^{-\xi\pi}\right] \qquad (6)$$

3- Welfare Cost Estimate

To investigate the welfare cost of inflation, we use annual data from 1960 to 2000 for Iran. We use data on money, GDP, and the inflation rate (percentage change in the CPI) from the IMF International Financial Statistics. We use the semi-log money demand function and the econometric methodology used by Serletis and Virk (2003) to get an estimate of the inflation rate elasticity, ξ. To obtain an estimate of the inflation rate elasticity, we first investigate the time series properties of the money demand variables to avoid what Granger and Newbold (1974) refer to as spurious regression. We first test for stochastic trends (unit roots) in the autoregressive representation of series z_t and the inflation rate.

According to the p-values [based on the response surface estimates given by MacKinnon (1994)] for the WS, $Z_{(t_\alpha)}$, and mostly the ADF unit root, the null hypothesis of a unit root in levels cannot in general be rejected. Hence, we conclude that both the z_t and π_t series are integrated of order 1 [or I(1) in the terminology of Engle and Granger (1987)]. We also tested the null hypothesis of no-co-integration against the alternative of co-integration between I(1) money measure and π_t using the Engle and Granger (1987) two-step procedure. The tests were first done with z_t as the dependent variable in the co-integrating regression and then repeated with the inflation rate π_t as the dependent variable. The results suggest that the null hypothesis of no-co-integration between z_t and π_t cannot be rejected (at the 5% level).

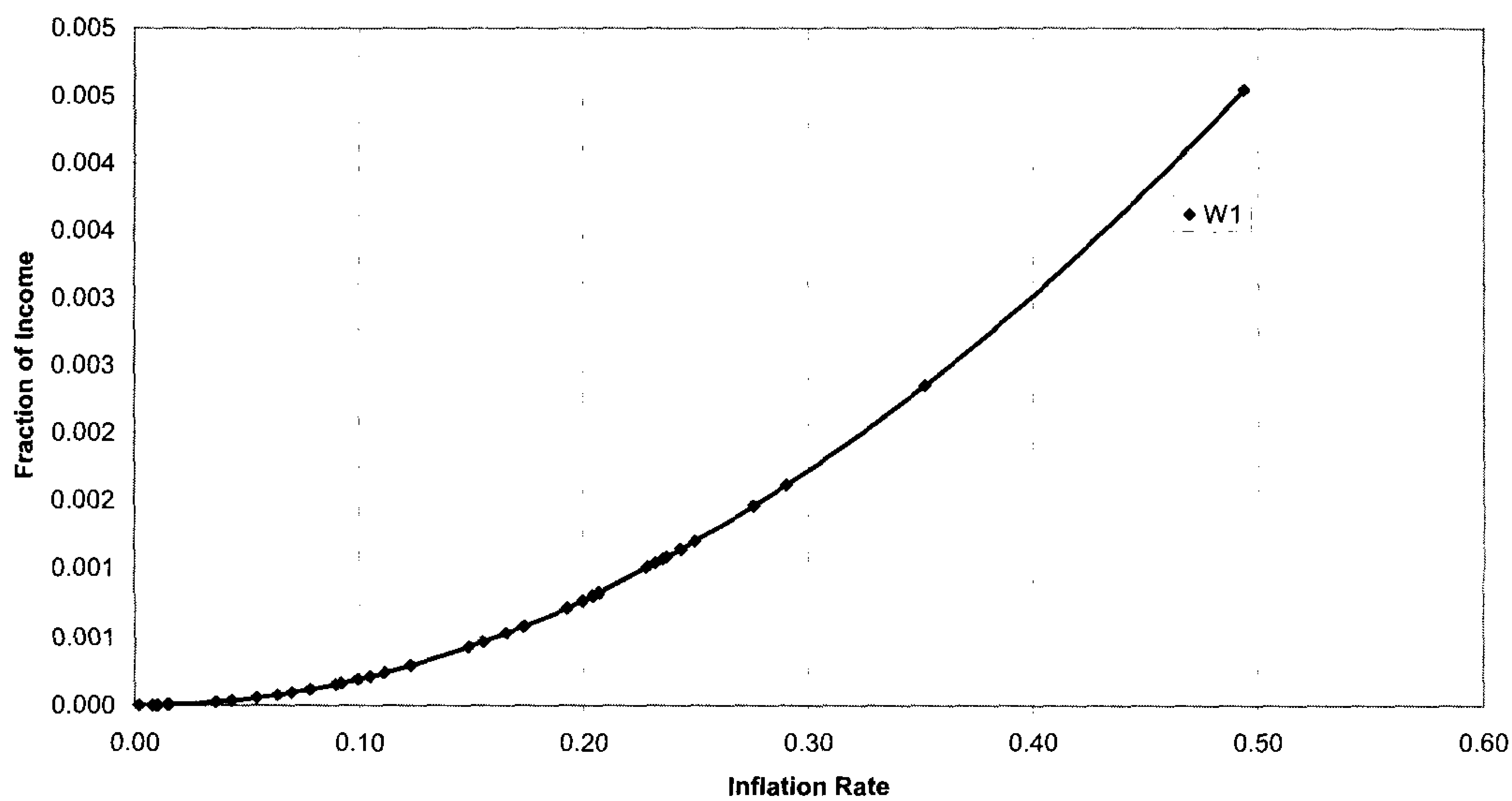
Since we are not able to find evidence of co-integration, to avoid the spurious regression problem we use the long-horizon regression approach developed by Fisher and Seater (1993) to obtain an estimate of the inflation rate elasticity of money demand. One important advantage to working with the long-horizon regression approach is that co-integration is neither necessary nor sufficient for tests on the inflation rate elasticity of money demand; the only requirement is that both z_t and π_t are at least integrated of order one and of the same order of integration.

According to Fisher and Seater (1993), the long-run derivative of a I (1) variable such as z_t with respect to another I(1) variable such as π_t is interpreted as $\lim_{k\to\infty} b_k$ where b_k is the coefficient from the regression

$$\left[\sum_{j=0}^{k} \Delta z_{t-j}\right] = \alpha_k + b_k\left[\sum_{j=0}^{k} \Delta \pi_{t-j}\right] + e_{kt} \tag{7}$$

As the coefficient b_k converges to a fixed number, k will be chosen. Based on Eq. (7) for k=30, our estimate of the inflation rate elasticity is $\xi_k = -0.2$. Using this elasticity estimate, we present welfare cost function, based on equation (6), in Figure 1. The welfare cost curve in Figure 1 is convex, indicating the increasing marginal welfare costs of inflation. Reducing the inflation rate from 40% to 0% yields a welfare gain of 0.3% of GDP for Iran.

Figure 1 - Welfare Cost Function (Based on CPI)



4- Conclusion

We have investigated the welfare cost of inflation for Iran, using tools from public finance and applied microeconomics. For this purpose, we have used the long-horizon regression approach developed by Fisher and Seater (1993) to obtain an estimate of the inflation rate elasticity of money demand and Bailey's (1956) approach to estimate the welfare cost of inflation. Our results show that reducing inflation rates will undoubtedly raise welfare of money holders.

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