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Estimation of the Private Consumption Function in the Iranian Economy (1959-1992) : An Error Correction Mechanism Approach*

Abbas Valadkhani**

I. Introduction

Since private consumption constitutes a large proportion of Gross Domestic Expenditure (GDE), it merits meticulous attention in both developed and developing countries. In this paper the Engle-Granger (1987) two-step procedure is employed to estimate private consumption in the Iranian economy. Annual time series data for the period 1959-1992 are used in the estimation procedure. It should be noted that the application of the widely-used adaptive expectation approach in the estimation of the private consumption equation may yield a spurious regression (Davidson and Mackinnon, 1993). Moreover, multicollinearity maybe a problem when the permanent income hypothesis is used to explain private consumption behaviour. This paper employs an alternative estimation approach to overcome the above-mentioned shortcomings. The theoretical and empirical framework of this study can also be adopted for other Asian economies.

This paper is structured as follows. Section II briefly addresses some relevant econometric procedures used in this study. Section III presents the specification and empirical results for the private consumption equation. Finally, Section IV provides some concluding remarks.

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** A Ph.D. candidate, Department of Economics, The University of Queensland, Brisbane Qld 4072, Australia.

The Engle-Granger (1987) two-step procedure is utilised to estimate private consumption in this study. In order to provide a brief explanation of this method, let us consider the simple following linear regression equation:

$$PC_t = \beta Y_{dt} + u_t \qquad (1)$$

where $u_t \sim IN(0, \sigma^2)$.

In the first stage one should make sure that both private consumption (PC_t) and disposable income (Y_{dt}) are of the same order of integration. The augmented Dickey-Fuller (1979, 1981) test (ADF) can be used for this purpose. It was found that both private consumption (PC_t) and disposable income (Y_{dt}) are integrated of order one, i.e. I(1). Then Equation (1) should be estimated to obtain $\hat{u}_t$. Now if the resulting residual, *i.e.* $\hat{u}_t$, is integrated of order zero, it can be said that PC_t and Y_{dt} are cointegrated, and thus there is a long-run relationship between PC_t and Y_{dt}.

In the second stage, the following equation, which incorporate an error correction mechanism (ECM_t), should be estimated :

$$\Delta PC_t = \lambda_1 \Delta Y_{dt} + \lambda_2 ECM_{t-1} + \varepsilon_t \qquad (2)$$

The term ECM_t has been added to Equation (2) to capture the short-run dynamics. $ECM_t = \hat{u}_t$ and represents the deviation from the long-run equilibrium path. The theoretically expected sign of λ_2 is negative. Equation (2) can be estimated by the OLS method since all the variables in the equation are stationary. In Equation (1) β is the long-run response, and in Equation (2) λ_1 and λ_2 denote the impact effect and the feedback effect, respectively (Hendry, 1995).

In the following section a number of important diagnostic tests will be reported to provide some insights into the reliability of the estimated equation. The diagnostic tests used are as follows: first, the DW test for

autocorrelation; second, the Ramsey RESET test for the functional form and specification of the equation; third, the Jarque-Bera test for normality of stochastic residuals; fourth, the Breusch-Godfrey Lagrange Multiplier (LM) test for first to second order serially correlated disturbances; fifth, the ARCH (auto-regressive conditional hetroscedasticity) test for hetroscedasticity in the disturbances; sixth, the Box-Pierce and Ljung-Box Q statistics for testing first to third order serial correlation; and seventh, the Chow breakpoint test for stability.[1] Examination of the diagnostic tests in this study shows that there is no econometric "pathologies", which indicates that the estimated equation is sufficiently specified and the statistical appropriateness is adequate.

III. Specification and Empirical Results

The theoretical rationale for the specification of private consumption in this study is basically derived from Keynes' fundamental psychological law (1936), Duesenberry's Relative Income Hypothesis (1949), and Friedman's Permanent Income Hypothesis (1957).

Brown (1952) and Evans (1969) have further developed Duesenberry's hypothesis through the use of the adaptive expectations hypothesis. That is, they assume that consumption is determined by lagged consumption and disposable income. The only difference between Brown's specification and Evans' formulation is that the Evans' consumption function excludes the intercept term. According to both Brown and Evans, consumers do not immediately adjust their consumption to a change in income. Consumer habits play a crucial role in determining households' decisions to consume, thus, lagged consumption is included in their equations. Friedman and Cagan (quoted in Wallis, 1973) also used a similar definition of permanent income by using the adaptive expectations hypothesis. They assume consumption is a function of lagged consumption and current disposable income. This theoretical specification has been followed in many macroeconometric models for developing countries, including Iran. For details see Uebe (1995) and Ichimura and Matsumoto (1994).

1. A concise explanation of these diagnostic tests is given by Cuthbertson, Hall and Taylor (1992: 106-18).

termed DHSY hereafter, uses a different representation but it is still consistent with the permanent income hypothesis. The latest version of the DHSY consumption function uses difference forms for income and inflation as explanatory variables and an ECM in order to incorporate the short-run dynamics between the cointegrated time series. The DHSY consumption function is differenced quarter-to-quarter to deseasonalise, and uses dummy variables to capture special economic effects. For a discussion of the DHSY consumption function see Charemza and Deadman (1992) and Pokorny (1987).

In this study the consumption function has been formulated in the following manner:

$$PC_t = \alpha_1 PC_{t-1} + \beta_0 Y_{dt} + \beta_1 Y_{dt-1} + \varepsilon_t \qquad (3)$$

where PC_t and Y_{dt} denote private consumption and disposable income, respectively.

This equation assumes that private consumption is determined not only by the current level of disposable income and lagged consumption but by lagged disposable income. Haque, Lahiri and Montiel (1990) have also used the same specification as Equation (3) with the only difference being that they also include the domestic real rate of interest as another explanatory variable.

However, as has been highlighted by Kloek (1988) Equation (3) is plagued by serious multicollinearity since it is highly likely that PC_{t-1}, Y_{dt} and Y_{dt-1} are collinear. In order to overcome this problem we use a first difference specification as follows:

$$\Delta PC_t = \beta_0 \Delta Y_{dt} + (\alpha_1 - 1)(PC_{t-1} - \beta Y_{dt-1}) + \varepsilon_t \qquad (4)$$

or

$$\Delta PC_t = \lambda_1 \Delta Y_{dt} + \lambda_2 ECM_{t-1} + \varepsilon_t \qquad (5)$$

where $ECM_{t-1} = \hat{u}_{t-1}$ is an error correction mechanism and $\hat{u}_t = PC_t - \beta Y_{dt}$.

consumption function. The parameters of Equation (4) or Equation (5) can be estimated using the Engle-Granger two-step procedure. By imposing a restriction, *i.e.* $\beta=(\beta_0+\beta_1)/(1-\alpha_1)$, Kloek (1988) and Hendry (1995) have argued that Equation (4), in which multicollinearity is no longer problematic, is equivalent to Equation (3).

IV. Empirical Results

Prior to reporting the empirical results, a definition of disposable income should be given. In published statistical sources for Iran, disposable income for households is unavailable. For the purpose of this modelling exercise, disposable income has been defined as follows:

Y_{dt}=GDP$_t$(at market price) - Total taxes - Value added by the oil sector where GDP is measured by the sum of sectoral value added.

The reason for subtracting oil sector value added from GDP in the above definition, is that the oil sector value added cannot directly affect private sector income. The oil sector is completely controlled by the Iranian government and it contributes directly to government revenue. Plan and Budget Organisation (1994) database has been used in this empirical analysis.

The estimated equation for the first stage of the Engle-Granger two-stage procedure is as follows:

$$PC_t = 0.705*Y_{dt} \quad \text{Adj } R^2 = 0.98$$
$$(85.25)$$

where the datum in parentheses is a *t* statistic.

This equation indicates that the long run marginal propensity to consume is approximately 71 per cent, which seems quite plausible. It has been determined that both consumption and disposable income are of the same order of integration, *i.e.* I(1), and the resulting stochastic residuals from the estimated equation for PC_t reported here, are stationary. Thus, it can be concluded that consumption and disposable income are cointegrated. In the second stage, Equation (5) is estimated by the OLS method. The econometric results for this equation are reported in Table 1.

Econometric Results for the Short-Run Relationship Between Private Consumption and Disposable Income Using an Error Correction Mechanism, 1960-1992

Variable	Identifier	Coefficient	t Statistic	Order of intergration
Dependent variable (r)	ΔPC_t	1		I(0)
Disposable income (r)	ΔY_{dt}	0.622*	7.101	I(0)
Error correction term (r)	$ECM1_{t-1}$	-0.398*	-2.519	I(0)
Stochastic residuals				I(0)

Estimation method : OLS Adj R^2 = 0.50 F(1,32) = 32.10*

Diagnostic tests : DW = 2.08 Ramsey RESET (specification) F(2,29) = 0.16

Jarque-Bera (normality) $Chi^2(2)$ = 3.93 LM (serial correlation) $Chi^2(2)$ = 0.36

ARCH (hetroscedasticity) $Chi^2(2)$ = 1.19 Ljung-Box (serial correlation) $Chi^2(2)$ = 0.82

Box-Pierce (serial correlation) $Chi^2(2)$ = 0.72 Chow breakpoint test F(2,29) = 0.96

Notes : (a) * indicates that the relevant null hypothesis is rejected at the 5% level of significance.
(b) r denotes real values (1982 prices).

All the estimated coefficients are statistically significant and have the expected signs. The performance of this equation is satisfactory in terms of goodness of fit statistics. This equation also passes all diagnostic tests.

Furthermore, Table 1 reveals that the short-run marginal propensity to consume is 62 per cent. The feed-back effect, which incorporates the short-term dynamics, is estimated to be 40 per cent. In other words, 40 per cent of the resulting disequilibrium between short-run and long run consumption is removed each year.

V. Concluding Remarks

The purpose of this paper is to specify and estimate the private consumption function in the Iranian economy by the Engle-Granger (1987)

1959-1992 have been used for the estimation procedure. The short and long-run marginal propensity to consume are estimated to be 62 per cent, and 71 per cent, respectively. The feed back effect is about 40 per cent, implying that 40 per cent of the resulting disequilibrium between short-run and long run consumption is removed each year. An examination of the diagnostic tests reveals that there is no econometric "pathologies" in the estimated private consumption equation. This indicates that the estimated equation is sufficiently specified and the statistical appropriateness is adequate. Furthermore, almost all the estimated parameters are significant and have the expected theoretical signs.

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