An Econometric Model for Hyper Inflation

H.G.K. Dineshanrathna* and U.N.B. Dissanayake

Department of Mathematics, Faculty of Science, University of Peradeniya

Introduction

Short-Run Philip curve provides useful information for policymakers to reduce the unemployment rate temporally. But, according to the non-accelerated inflation rate versus unemployment model (NAIRVUM), this reduction below the "Natural Rate" will be temporally and in the long run it leads to higher inflation, (en.wikipedia.org/wiki/Philips_curve) again.

Our objectives are to model the interaction of inflation with socio-economic variables in an abstract setup and to investigate its functional behavior via econometric analysis (EMA). This study is based on Sri Lankan economic factors and our aim is to investigate the geometrical significance of the explanatory variables against the β - weights of the crucial variables which may generate hyper inflation.

Materials and methods

Inflation is the persistence increase in the level of consumer price or a persistence decline in the purchasing power of money, caused by an increase in available currency and credit beyond the proportion of available goods and services. In a non-abstract setup, measuring inflation is a mere arithmetic exercise. This is done by subtracting last year consumer price index (CPI) from this year consumer price index and converting it to percentage with respect to (w.r.t) the last year CPI.

In this study, inflation rate (inflation) is the explanatory variable and in the local context, the variables used to explain the inflation rate **I** are , UR=unemployment rates-U, MS=money supply-M, NIR=nominal interest rates-N, FER=foreign exchange rates-F, GE=government expenditure-G, EDS=external debt services-E, GDPGR=GDP-growth rate-R, POP=population-P, DC=domestic credits-C, PI=political instability-Y, WE=war expenditure-W, RUM=rural-urban migration-T. Here, we use pooled data, and the data source is Socio-Economic Survey Department of the Central Bank of Sri Lanka. Most of the available models constructed via casual modeling predict an inverse relationship between inflation rate and unemployment rate. In this study, we shall analyze the multi-dependence of the inflation I w.r.t. the above mentioned twelve socio-economic factors (www.cbsl.gov.lk).

Increasing in unemployment rates, external debit servicing and growth rates of GDP are expected to decrease the inflation rates; increasing in money supply, nominal interest rates, real exchange rates, government expenditure, population and domestic credits are expected to increase the inflation rate. With this prior information for nine factors, we set the mathematical grounding of the model in the following format: $I=f(U, M, N, F, G, E, R, P, C, \varepsilon)$; $\varepsilon=g(Y, W, T)$ and linearizing the functional form as the preliminary step with partial regression slopes β_i ; where i = 0, 1, 2, 3, 4, 5, 6, 7, 8, 9 and 10, we get $I = \beta_0 + \beta_1 UR + \beta_2 MS + \beta_3 NIR + \beta_4 FER + \beta_5 GE + \beta_6 EDS + \beta_7 GDP + \beta_8 POP + \beta_9 DC + \beta_{10} \varepsilon$; where β_1, β_6, $\beta_7 < 0$; β_2, β_3, β_4, β_5, β_8, $\beta_9 > 0$. Using the data in the matrix format $\underline{Y}_{13\times 1} = \underline{X}_{13\times 11}\underline{\beta}_{11\times 1}$ and assuming $\varepsilon_i \approx N(0,\sigma^2)$ for $1 \le i \le 13$, we compute the column vector $\beta = (X^T X)^{-1}(X^T Y)$. Exogenous parameters in the model are expected to have sign and size, which conform to the theory and practice. The significance of the estimates of parameters will be carried out at the level of 0.05 (standard significant level).

Results

H_0 : $\beta_i = 0$ for $\forall\, i$
(Null Hypothesis)

H_1 : at least one $\beta_i \neq 0$
(Alternative Hypothesis)

F-test

F- *value* $= \dfrac{MSR}{MSE} = 8.846$ (Figure 1);
n = 13, p = 10.

$F_{9,3}(0.05) = 8.81 < 8.846$. Hence, the null hypothesis H_0 is rejected and the functional

relationship for **I** is valid at the 5% significant level.

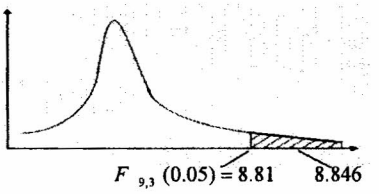

Figure 1. Probability distribution graph (F-test)

t-test

H_0 : $\beta_i = 0$ (Null Hypothesis)

H_1 : $\beta_i \neq 0$ (Alternative Hypothesis)

$$T = \frac{\hat{\beta}_i - \beta_i}{\sqrt{Var(\hat{\beta}_i)}} \approx t_{13-10}$$;(Figure 2)

T values corresponding to β values are given by (Figure 2)

$T_{\beta_0} = -10.1253$

$T_{\beta_4} = -4.0801$

$T_{\beta_7} = -3.191$

$T_{\beta_9} = -2.0367$

$T_{\beta_2} = 2.0221$

$T_{\beta_3} = 2.9552$

$T_{\beta_8} = 3.203$

$T_{\beta_1} = 4.5837$

$T_{\beta_5} = 6.096$

$T_{\beta_6} = 6.182$

Null hypothesis is valid for the coefficients of MS, NIR and DC. Thus, we infer that at the standard significant level, the coefficients β_2, β_3 and β_9 must vanish and moreover, we get

$0.92 < R^2 = 0.9209 < 1$

i.e $R^2 \approx 1$

Thus, the functional model is appropriate and the regression hyper plane representing the inflation function **I** take the following format in a MATLAB output (Table 1).

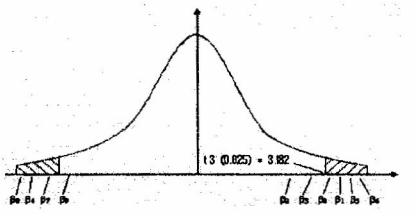

Figure 2. Probability distribution graph (t-test)

Conclusions

Component of the β-vector indicates that unemployment rates, exchange rates, government expenditure, external debit services, GDP growth rates and increase in population are key-factors in the functional form for **I** at the 95% confidence level. According to our model, we infer that β-weights of UR, EDS and POP are major contributors for the hyperinflation; but, money supply, nominal interest rates, domestic credits do not appear as accelerators for the hyper inflation.

References

Gujarati, D.N. Basic Econometrics

http://www.cbsl.gov.lk/

http://en.wikipedia.org/wiki/Phillips_curve

Table 1. Inflation function

Inf = -94.5658 + 1.7213 UeR - 0.7812 RER + 0.2782 GoE + 2.0309 EDS - 0.6988 GDPGR + 13.1975 Pop