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TESTING THE LUCAS CRITIQUE IN MALAYSIA: A COMMENT

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ABSTRAK

Kemunculan 'hipotesis jangkaan rasional' pada tahun 1970-an telah mewujudkan perdebatan ke atas keberkesanan polisi permintaan agregat dalam mempengaruhi aktiviti ekonomi benar. Seiring dengan ini, Kritik Lucas (Lucas, 1976), yang didasari oleh hipotesis jangkaan rasional telah mempersoalkan keberkesanan peraturan polisi yang sering diamalkan di dalam perlaksanaan polisi monetari. Komentari ini mengimbas landasan utama Kritik Lucas dan kajian empirikal yang dilaksanakan oleh Habibullah, Azali dan Baharumshah (2001) (ringkasnya HAB) ke atas kritik berkenaan di dalam persekitaran ekonomi Malaysia. Landasan bagi Kritik Lucas dijelaskan dengan lebih terperinci melalui pembentukan model ekonomi yang mengambil kira tingkah laku agen ekonomi yang bercirikan jangkaan rasional. Ujian empirik ringkas menunjukkan bahawa penolakan Kritik Lucas seperti yang diutarakan oleh HAB perlu diperincikan lagi sebelum ianya boleh diterima umum.

ABSTRACT

The advent of 'rational expectation hypothesis' (REH) in 1970's sparked intense debate on the effectiveness of discretionary aggregate demand policies in influencing real economic activities. In line with this, the Lucas Critique (Lucas, 1976), that embodies the REH, questions the effectiveness of policy rule that frequently adopted in the set up of monetary policy. This commentary revisited the foundations of Lucas Critique and empirical studies reported by Habibullah, Azali dan Baharumshah (2001) (in short, HAB) on the validity of the critique within the Malaysian economy. The Lucas Critique is explained in greater detail based on an economic model that incorporates the behaviours of economic agents that form their expectation rationally. Brief

empirical analysis indicates that rejection of Lucas Critique as proposed by HAB requires further investigations before it can be a generalization.

INTRODUCTION

The advent of 'rational expectation hypothesis' (REH) in the 1970's which subsequently became a major theme of macroeconomic research challenging the long standing belief that discretionary aggregate demand policies (monetary and/or fiscal) are effective in influencing real economic activities. The works of Muth (1961), Lucas (1972, 1973), and Sargent and Wallace (1975), among others, argue that only unanticipated policies matter while those anticipated are neutral, rendering key elements of Keynesian type-Phillips curve based policies, i.e. real output-inflation tradeoff, to be invalid. A critical element of the REH is that economic agents understand the economy very well and do not make systematic mistakes in forecasting the future. Agents' behaviour patterns vary systematically with changes in policies or *rules of the game*. Parameters of econometric models estimated based on past experience that guide policy makers are sensitive to these rules, thus, nullifying any possible real effects and causing econometric evaluation of implemented policies to be a worthless exercise – this became widely termed as the Lucas Critique (LC, henceforth) due to Lucas (1976). Lucas (1976) argues that assumptions that parameters of econometric models are time invariant, i.e. agents acts are independent of policy environment, are refuted by the insertion of rational expectation, thereby invalidating the forecast of empirically estimated equations of econometric models derived through observations of agents' past behaviour.

The LC receives volumes of theoretical and empirical debate with mixed findings (see for example Mayer (1993), Erricsson and Irons (1995), Stanley (2000), and Rudebusch (2002) for recent surveys). In the previous issue of this *Journal (Vol. 8, No. 1& 2)* , Habibullah, Azali, and Baharumshah (2001) (in short *HAB*) report an empirical study rejecting the LC. In brief, *HAB* investigate money-income causal relationships, an important macroeconomic link affected by the presence of LC, for the Malaysian economy over a period from 1981:1 to 1994:4. *HAB's* rejection of LC mainly relies on the evidence that money (both narrow-M1 and broader-M2 money) are found to be exogenous with respect to income equation. In particular, the null of superexogeneity

of money in income equation cannot be rejected (the same applies to null of weak and strong exogeneity), thus, supporting the time invariant hypothesis that leads to the rejection of LC's proposition.[1] The authors conclude by favoring the use of monetary aggregates as intermediate targets for monetary policy purposes.

We read *HAB's* article with great interest. The article adds further evidence in analyzing the LC and contributes significantly to the issue, particularly its employment of superexogeneity test and data from a developing country such as Malaysia. In addition, it sheds further light into the mechanics of monetary conduct for Malaysian policy makers. Nevertheless, we however, feel that the article needs further (and deeper) elaboration of the LC. The insights of LC offered in the writing is too brief, impeding appreciation of issues significant to the critique and its policy implications.[2] The foundations for LC's proposition are unclear. Further appreciation of the issues requires additional insights into the REH, pillars and implications of LC. We offer further discussions on this in Section 2. Section 3 discusses econometric issues related to *HAB*. To ensure that the empirical findings are rigorous, we conduct a brief re-run of the empirical analysis, focusing on the time invariant properties of the parameters with the presence of structural break. Our results indicate instability in the parameters of conditional output equation in line with the LC, contradicting the stand taken in *HAB*. Thus, LC invalidation requires further investigations before it can become a generalization.

THE INSIGHTS OF LUCAS CRITIQUE

An important implication of the LC is its focus on the usefulness of econometric models that explain optimal decisions of agents in determining various economic variables (such as investments, consumptions, income, and etc.) as functions of variables that summarize agents' information set in making those decisions. For all their sophisticated mathematical expressions, these econometric models generally modeled past behaviors in extrapolating future outcome. An underlying flaw of these models, according to Lucas (1976), is the improper belief that agents' behaviors are merely a straight forward extrapolations of the past, independent of policy changes. Lucas (1976, pp.41) states " *...given that the structure of an econometric model consists of optimal decision rules of economic agents, and that optimal decision rules vary systematically with changes in the structure of series relevant to the decision maker, it follows that any change in policy will systematically alter*

the structure of econometric models." The key to this instability is the revolution brought about by the REH.

Another major implication found in Lucas (1976), and as highlighted by *HAB*, is on the effectiveness of the *monetary rule* that governs conduct of monetary policy. Consider a monetary rule that specifies growth of monetary aggregates in term of lagged real output (y_t) and money growth (m_t):

$$m_t = \phi_0 + \phi_1 y_{t-1} + \phi_2 m_{t-1} + \omega_t \qquad (1)$$

Equation (1) reflects the feedback rule frequently used by monetary authorities in setting money growth, which generally aims at influencing patterns of economic performance as measured by real output. Will this rule be effective in influencing the pattern of real output? Can the authority accurately predicts patterns of real output following injection or contraction of money guided by this rule? According to the LC, the answer is no. Assume a traditional IS-LM representation

together with the Lucas (1973) aggregate supply curve as follows:

$$\text{IS} \quad : \quad y_t = \delta_1 y_t + \delta_2 [\, r_t - ({}_{t-1}p^e_{t+1} - {}_{t-1}p^e_t)] + g_t + \varepsilon_{1t} \qquad (2)$$

$$\text{LM} \quad : \quad m_t - p_t = \theta_1 y_t - \theta_2 r_t + \varepsilon_{2t} \qquad (3)$$

$$\text{Lucas AS} : \quad y_t = y^n + y^c + \nu_t$$

$$= y^n + \alpha (p_t - {}_{t-1}p^e_t) + \nu_t \qquad (4)$$

Where: r_t is the nominal interest rate at time t, ${}_tp^e_{t+i}$ is the expected price for time $t+i$ formed at time t, g_t is real government expenditure, and ε_{1t}, ε_{2t}, and ν_t are independently distributed disturbance terms with zero mean and constant variance for income (IS), money demand (LM) and aggregate supply (AS). Equation (4) is the aggregate supply function postulated by Lucas (1973). Accordingly, output supplied in the economy can be decomposed into two, i.e. , natural rate-full employment level of output (y^n) and a cyclical component (y^c). The cyclical component is envisaged to be proportionate to the deviation of actual prices from prior expectations, i.e., $y^c = \alpha (p_t - {}_{t-1}p^e_t)$ or in other words, price surprise. Producers attribute part of the deviation of actual price from the anticipated level as changes in relative price and therefore, respond by expanding output supplied. A critical element in the LC is the assumption that economic agents form their expectations rationally, such that for any variable X:

$$_{t-1}X^{e}_{t} = E(X_t \mid I_{t-1}) \quad (5)$$

Equation (5) asserts that agents' subjective expectation of the value of X at time t form at time $t-1$ ($_{t-1}X^{e}_{t}$) equals the mathematical expectation of X given information set (I_{t-1}) at time $t-1$. Thus, intuitively, agents do not make systematic mistakes and expected forecast error $E(_{t-1}X^{e}_{t} - E(X_t \mid I_{t-1}))$ is therefore zero, reflecting the fact that, on average agents are correct in their forecasts. Conditional expectation of (2) and (3) at time $t-1$ equal:

$$_{t-1}y^{e}_{t} = \delta_1 {}_{t-1}y^{e}_{t} + \delta_2 [{}_{t-1}r^{e}_{t} - ({}_{t-1}p^{e}_{t+1} - {}_{t-1}p^{e}_{t})] + {}_{t-1}g^{e}_{t} \quad (6)$$

$$_{t-1}m^{e}_{t} - {}_{t-1}p^{e}_{t} = \theta_1 {}_{t-1}y^{e}_{t} - \theta_2 {}_{t-1}r^{e}_{t} \quad (7)$$

Substracting (6) and (7) from (2) and (3) respectively, and incorporating (4) provides the deviation of output from its natural rate[1]:

$$y_t - y^n = (1/D)[\alpha\delta_2(m_t - {}_{t-1}m^{e}_{t}) + \alpha\theta_2(g_t - {}_{t-1}g^{e}_{t}) + \Omega_t] \quad (8)$$

where;

$D = 1 / \{\alpha[\theta_1\delta_2 + \theta_2(1-\delta_1)] + \delta_2\}$, and

$\Omega_t = [\alpha\theta_2\varepsilon_{1t} - \alpha\delta_2\varepsilon_{2t} + \delta_2\nu_t]$

Equation (8) conveys the Lucas, Sargent, and Wallace (LSW) policy ineffectiveness proposition, i.e., real output deviate from its natural level only in response to unanticipated money changes ($m_t - {}_{t-1}m^{e}_{t}$) and unanticipated government expenditures ($g_t - {}_{t-1}g^{e}_{t}$) plus random demand (ε_{1t} and ε_{2t}) and supply (ν_t) disturbances. Invoking rational expectation (5) where agents are on average correct in their anticipation shows that anticipated policies (monetary or fiscal) are ineffective in bringing changes to real activities.

The link between parameters of monetary rule (1) and real output path (8) can be seen by inserting conditional expectation of (1) at time t-1 into (8). Abstracting government sectors (assume $g_t = {}_{t-1}g^{e}_{t} = 0$) gives:

$$y_t - y^n = (1/D)[\alpha\delta_2(m_t - \phi_0 - \phi_1 y_{t-1} - \phi_2 m_{t-1}) + \Omega_t] \quad (8)$$

and after simplifying:

$$y_t = y^n + \beta_0 + \beta_1 m_t + \beta_2 y_{t-1} + \beta_3 m_{t-1} + \Phi_t \quad (9)$$

where:

$\beta_0 = -(\alpha\delta_2\phi_0 / D)$ $\qquad$ $\beta_1 = \alpha\delta_2 / D$

$\beta_2 = -(\alpha\delta_2\phi_1 / D)$ $\beta_3 = -(\alpha\delta_2\phi_2 / D)$

$\Phi_t = (\alpha\theta_2\varepsilon_{1t} - \alpha\delta_2\varepsilon_{2t} + \delta_2 v_t) / D$

Equation (9) is the reduced form equation dictating the output path subjects to monetary rule adhered by the monetary authority. This is a similar version of the conditional output equation of *HAB* (Equation 4, pp. 72)[4]. **Its is important to note that the reduced form parameters (β_0, β_2, and β_3) are sensitive to parameters of monetary rule (ϕ_0, ϕ_1 and f_2).** Thus, any attempt by the monetary authority to influence output by altering parameters of monetary rule will affect the reduced form parameters. According to LC, reduced form parameters are **not invariant** with respect to regime change and by examining the impact of initiated policy on real output so as to judge the effectiveness of the monetary rule is a worthless effort. The null of superexogeneity tested by *HAB* implies that reduced form parameters are free from being influenced by parameters of monetary rule. Thus, failure to reject the null indicate that money plays significant roles in influencing real output path, a conclusion found in *HAB*.

ROBUSTNESS OF *HAB's* TESTS

HAB's analysis centers on the conditional output equation (Equation 4, pp.72) that explains output with its own lagged terms and money growth. Inclusion of money variable partly implies the stability of money demand function that links money and output. Taking into account the proper money demand function and the openness of the Malaysian economy, the incorporation of exchange rates into the equation may have an important contribution to the analysis. McKinnon (1982, pp. 342) argues that *"national monies are substitutable to the extent of making national money demand appear quite unstable if foreign exchange considerations are ignored"*. Aside from its potential effect on the stability of money demand, inclusion of exchange rates in money demand has implications for stabilization policy. McGibny and Nourzad (1995) indicate that regardless of whether the adjustment process is modeled within as error-correction or a partial-adjustment framework, exchange rate volatility is negatively related to the demand for real M2 balances. This relationship is more pronounced when exchange rates are expressed in real terms. Thus, the exclusion of exchange rate in *HAB* may ignore the importance of the exchange rate in determining the behavior of income in the conditional model. Thus, specifications used in *HAB* may suffer Hendry's (1980) general-to-specific model requirements and looks like a simple-to-specific approach.

HAB's rationale of using exports as proxy for income with exports based on studies that link export to economic growth should be accepted with caution. The use of exports as proxy for income may be misleading. It should be noted that these relationships depend, among others, on the stage of production and the externality effect of exports (for examples see Feder (1983) and Dodaro (1991)). According to Ramos (2001), a strong correlation between exports and economic performance has nothing to do with the GDP trend development, as this may merely arise from a purely short-run relationship. Masih and Masih (1996, p. 423) suggest that "*output was relatively the leading variable being the most exogenous of all, and all other variables including money supply, rate of interest, exchange rate, and prices had to bear the brunt of adjustment endogenously in different proportions in order to accommodate that real shock.*" Thus, under this condition, the conditional equation such as proposed in *HAB* would be an incorrect way to explain variations in output.

In addition to model specifications, *HAB's* conclusion which supports superexogeneity is also subject to constancy of parameters for the conditional equation. Besides weak exogeneity, superexogeneity also requires constancy in the parameters of the conditional model and nonconstancy in the marginal model. For the second part of the condition, we first need to test for constancy in the parameters of the marginal model. If there is constancy, there is no indication to support superexogeneity. If constancy in the marginal model cannot be fulfilled, we need to search for dummies or other variables that might model this variation. We then include these variables in the conditional model test for joint significance. If they are jointly significant, the parameters are invariant to the parameters in the marginal model, validating the LC.

Furthermore, regime switching and structural breaks also need to be considered in investigating the presence of LC, as this may affect the cointegration relationships of variables considered. The cointegration test performed in *HAB* does not indicate the use of the cointegration with structural breaks despite their earlier proposal that the process of financial liberalization and innovation affect interrelationships among economic variables. Campos et al. (1996) suggest the procedures for testing cointegration when structural breaks exist.[5] We conduct a brief test on the coefficients of *HAB's* Equation (4) for structural breaks by observing the behavior of the recursive coefficients.[6] As depicted in

Figure 1
Coefficients from *HAB's* Equation (4) Based on Recursive Estimation (OLS)

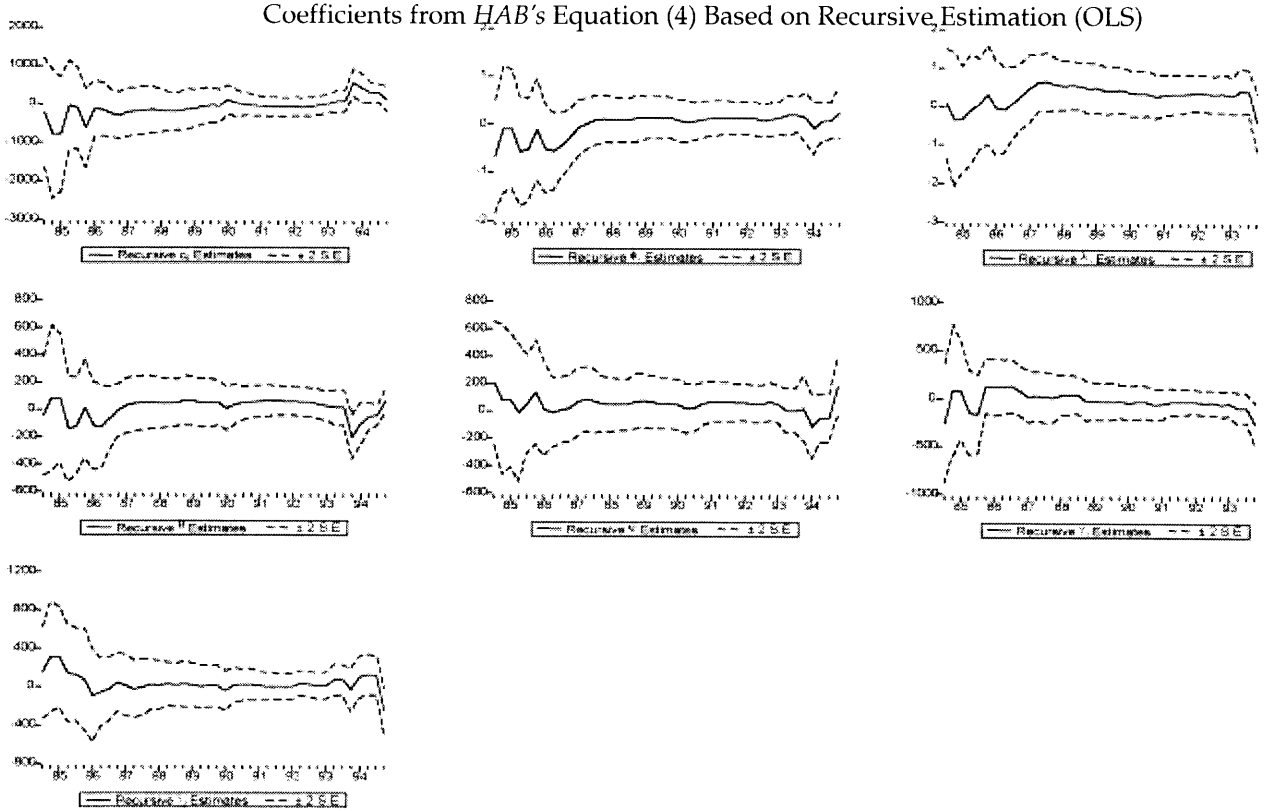

Figure 1, clearly, there exist structural breaks, in particular, from 84:2 to 86:1, 90:1 and 93:2 onwards. Thus, the support for parameter constancy (rejection of LC) as proposed by *HAB* requires further investigations before it can become a generalization.

ENDNOTES

1. See Engle, Hendry, and Richard (1983) for detail illustrations of the superexogeneity test. Empirical employment of superexogeneity test can be found in Fisher (1989), Favero and Hendry (1992), Hurn and Muscatelli (1992), and Engle and Hendry (1993).

2. We are not sure whether the authors intentionally simplified elaboration on LC. The LC was 'quickly' brought into the discussion via several studies that investigate money-income link under liberalized and changing financial environment (Para 2, pp. 70). The main pillars of LC, especially the REH that leads to time variant proposition are not sufficiently highlighted. It seems to us that the writing focuses more on the econometric of the superexogeneioty test rather than LC's related issues. We hope our additional input has enlightened the foundations of LC and complemented *HAB*.

3. The full derivation of the model presented in this section is available upon request from the editorial office of the Journal.

4. For econometric efficiency *HAB's* Equation (4) incorporates lagged residuals to capture seasonality at various frequencies. Conceptually this is the same as our Equation (9).

5. Another interesting work on stability is by Nieuwenhuis & Schoonbeek (1997). They investigate the relationship between the stability of macroeconomic, continuous-time models and the structure of the matrices appearing in those models. In their paper, they derive the general stability results for models with first-order and second-order adjustment lags. It explains why macroeconometric models are 'marginally' unstable.

6. We use the same specification as equation (4) in *HAB* and the notations for coefficients are consistent with equation (4). We employ monthly data set of the same variables as *HAB*. The data set is available upon request from the authors.

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