

Relationship between Inflation and Economic Growth in Malaysia - An Econometric Review

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Abstract—One of the most important basic objectives for any countries is to sustain high economic growth together with low inflation. However, there has been considerable debate between structuralists and monetarists on the nature of the inflation and economic growth relationship over the past few decades. The structuralists believe that inflation is essential for economic growth, where as the monetarists see inflation as detrimental to economic growth. Some findings say there is significant short-run relationship but not in the long-run. Considering all types of findings this paper investigates the same issue in the economy of Malaysia. The data are taken from IFS, yearly data and methodologies are ADF, PP Unit Root Test, Vector Error Correction , Vector Auto Regression, Impulse response function and Variance Decomposition, etc . According to this study there exist short-run causality between the variables and direction of causality is from inflation to economic growth but in the long-run economic growth Granger Causes inflation.

Key Words: Inflation, Economic Growth, Cointegration, Vector Auto regression, Impulse Response Function, Variance Decomposition, Granger Causality

JEL Classification Codes: C32, F10, F32

I. INTRODUCTION

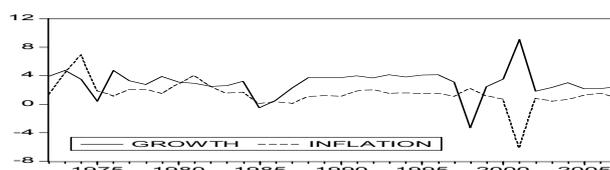
The relationship between inflation and economic growth is one of the most important macro economic controversies among the macro economists, policy makers and central monetary authorities of all the nations. Specifically the bone of contention is that whether inflation is necessary for economic growth or it is detrimental to growth. Basically the rate of economic growth depends primarily on the rate of capital formation and the rate of capital formation depends on the rate of savings and investment. Therefore, whether inflation affects economic growth depends on whether it affects savings and investment.

Some economists hold that the view that inflation is conducive to economic growth and there is positive

relationship between inflation and economic growth. According to their logic during the period of inflation there is a time lag between the rise in output prices and the rise in input prices, particularly the wage rate that is known as wage-lag. When the wage lag persists over a long-period of time, it enhances the profit margin. The enhanced profits provide incentive and investible funds to the firms. The result in an increase in investment, production capacity and a higher level of output. Secondly, inflation tends to redistribute incomes in favour of higher income groups whose incomes consist mostly of profits and non-wage incomes. This kind of inflation – induced redistribution of incomes increases total savings, since upper income classes have a higher propensity to save. The increase in savings increase the supply of investible funds and lowers the interest rates which stimulates investment as well as economic growth. The concept of *Phillips curve* also hypothesizes that high inflation positively affects the economic growth by contributing creation of a low unemployment rate.

But there is a term in economic literature that is *stagflation*, which is an empirical phenomenon. It is a situation of rising inflation with falling or stable output. So the positive relationship is not the only case in practice. Monetarists also believe that in the long-run prices are mainly affected by the growth of money supply keeping no real effect on growth. In reality however inflation does have real consequences for other macro economic variables through its impact on capital accumulation, investment and exports, inflation can adversely impact a country's growth rate. In this context it is pertinent to a researcher to investigate the relation between inflation and economic growth in the economy of Malaysia, since the movement of growth and inflation in Malaysia through the period of study are similar(except inform 1995-2001). From figure below shows the time plot of growth and inflation.

Figure 1. time plot of growth and inflation



II. STUDY DONE BEFORE

Solow and Swan in 1956 opined their growth model that, scientific innovation or technological change replaced investment (growth of capital) as the primary factor explaining long term growth and the level of technological change is determined exogenously, that is independent of all other factors, including inflation.

Mundel (1965) and Tobin (1965) predict a positive relationship between the rate of inflation and the rate of capital formation, which in turn implies a positive relationship between the two variables. According to their logic inflation reduces people's wealth. Since the rate of return on individuals real money balances falls. To accumulate desired wealth, people save more by switching to assets, greater savings means greater capital accumulation and thus faster output growth.

Sidrauski (1967) found an increase in inflation (due to growth of money supply) does not affect the steady state capital stock. As such neither output nor economic growth is affected.

Cooley and Hansen (1989) assumes that the marginal product of capital is positively related to the quantity of labour. Thus when the quantity of labour declines in response to a rise in inflation, the return to capital falls and the steady state quantities of capital and output decline. They showed that the level of output permanently falls as the inflation rate increases. Thus the theoretical review demonstrates mixed results regarding this controversy.

III. OBJECTIVE OF THE STUDY

In this study an attempt has been taken to explore the relationship between inflation and economic growth in the economy of Malaysia.

IV. METHODOLOGY OF THE STUDY

In econometric analysis, when time series data are used, the preliminary statistical step in to test the relationship the stationarity of each individual series. Unit root tests provide information about stationarity of the data. Non-stationarity data would contain unit roots. Results derived from the regression models would produce 'Spurious' results if we use the data without checking their stationarity properties. In order to test for the existence of unit roots, and to determine the degree of differencing we have applied ADF that is Augmented Dickey-Fuller Test (1979) and Phillips-Perron (PP) Unit Root Test (1988). For ADF test using OLS we run the unrestricted regression

$$Y_t - Y_{t-1} = \alpha + \beta_t + (\rho - 1)Y_{t-1} + \sum_{j=1}^p \lambda_j \Delta Y_{t-j} \quad (1)$$

And then, the restricted regression,

$$Y_t - Y_{t-1} = \alpha + \sum_{j=1}^p \lambda_j \Delta Y_{t-j} \quad (2)$$

where, $\Delta Y_t = Y_t - Y_{t-1}$, then a standard F ratio is calculated to test whether the restrictions ($\beta=0$, $\rho=1$) hold. Then we compare this computed F value to the table value given by Dickey-Fuller. If the computed value is greater than the table value at certain level of significance we reject the null hypothesis of non-stationarity.

Phillips and Perron (1988) have generalized the Dickey -Fuller tests to the situations where disturbance process ε_t are serially correlated. The PP test is intended to add a 'Correction Factor' to the DF test statistic. The PP test is based on the estimation of the following form of equation.

$$\Delta Y_t = \Phi + (\rho - 1)Y_{t-1} + \gamma\left(t - \frac{T}{2}\right) + \varphi \Delta Y_{t-1} + \xi_t \quad (3)$$

In this study both ADF and PP unit root tests have been performed. If the two variables are integrated of the same order, then the estimation of the following cointegration regression has been considered.

$$\Delta \text{GDP}^*_t = \alpha_1 + \beta_1 \Delta \text{CPI}^*_t + \varepsilon_t \quad (4)$$

$$\Delta \text{CPI}^*_t = \alpha_1 + \beta_1 \Delta \text{GDP}^*_t + \zeta_t \quad (5)$$

where ΔGDP^*_t is the economic growth and ΔCPI^*_t is the inflation. The residuals are ε_t and ζ_t . If the residuals are stationary at level then two variables are cointegrated. If both the variables are stationary at level then they are automatically cointegrated.

The *Vector Error Correction Modeling* provides important information on the short-run relationship between any two cointegrated variables. The focus of the VEC Model analysis is the one period lagged error terms from the previously estimated cointegrating equations. This lagged terms provide an explanation of the short-run deviations from the long-run equilibrium.

While testing the long-run dynamic relationship between model variables concerned, we may not make any a priori assumption of endogeneity and exogeneity of variables concerned. In such situation, *Vector Auto-regression Model* (VAR) can be used. This model treats all variables systematically without making reference to the issue of dependence or independence. Moreover, a VAR model allows us to study the 'Impulse Response Function' and 'Variance Decomposition' for the variables. We have tried to apply all these techniques in this study.

As far as data are concerned, it has been collected from *International Financial Statistics (IFS)* yearly issues. The time period covers from 1971 to 2007. The GDP data are deflated by GDP deflator (base 1995=100) to convert to real GDP. Then 1st difference of log real GDP is considered as GDP Growth. On the other hand the CPI data are

converted to common base (1995=100) and then 1st difference of log CPI is considered as inflation. Hence in this study *growth* and *inflation* are the two variables. Symbolically, GRH, INF respectively.

V. EMPIRICAL FINDINGS:

TABLE I. RESULTS OF ADF AND PP UNIT ROOT TESTS

Country	Variable	Exogenous	ADF stat.	Prob*.	PP stat	Prob
Malaysia	GRH	Constant	-4.784	0.001	-4.734	0.005
		C+lin. trend	-4.865	0.002	-4.871	0.002
		None	-2.080	0.037	-1.757	0.075
	INF	Constant	-3.266	0.024	-3.383	0.018
		C+lin. trend	-4.179	0.011	-4.263	0.009
		None	-1.916	0.053	-1.639	0.095

* Mackinon one-sided P-values

Findings: The variables are stationary at level. Since both the variables are stationary at level therefore they are automatically *cointegrated* that is there exist a long-run relationship between the inflation and growth in the economy of Malaysia. To test the

stability of the long-run relationship we estimate VEC model

Vector Error Correction Model and Estimation:

The VEC model can be written as

$$DGRH_t = \alpha + \rho Z_{t-1} + \beta_i \sum_{i=1}^k DGRH_{t-i} + \gamma_i \sum_{i=1}^k DINF_{t-i} + \mu_{1i}$$

(6)

$$DINF_t = \alpha + \rho Z_{t-1} + \beta_i \sum_{i=1}^k DINF_{t-i} + \gamma_i \sum_{i=1}^k DGRH_{t-i} + \mu_{2i}$$

(7)

In our study for estimation of VEC model, the number of lag is selected through SIC (Schwarz Information Criterion). With this lag selection

criterion for VEC model it has been observed that lag1 is selected. The results of the VEC model estimation is shown in the Table-2.

TABLE II. RESULTS OF VEC ESTIMATION

D.V.	ECM($\hat{\rho}$)	DGRH _{t-1}	DINF _{t-1}	others
DGRH _t	-0.5421	-0.0047	-0.5607	R ² =0.3245
s.e.	(0.2324)	(0.2043)	(0.2391)	F= 4.81
t-value	[-2.332]*	[-0.023]	[-2.344]*	SSR=0.009
DINF _t	0.4609	-0.1539	-0.56074	R ² =0.306
s.e.	(0.1379)	(0.1212)	(0.23913)	F=4.43
t-value	[3.341]*	[-1.269]	[-2.344]*	SSR=0.003

D.V =Dependent Variable, * implies statistically significant.

Findings: It is clear from Table-2 that last period's **inflation affects negatively current growth** and this is statistically significant. In both the cointegrating equation the error correction term is significant. Hence it proves that the long-run relation between inflation and growth is stable in Malaysia.

Now to obtain the long-run causality we estimate VAR (Vector Auto Regression) model.

Vector Auto-Regression Model and Estimation:

The VAR model can be written as

$$GRH_t = \alpha + \beta_i \sum_{i=1}^k GRH_{t-i} + \gamma_i \sum_{i=1}^k INF_{t-i} + \mu_{1i} \quad (8)$$

$$INF_t = \alpha + \beta_i \sum_{i=1}^k INF_{t-i} + \gamma_i \sum_{i=1}^k GRH_{t-i} + \mu_{2i} \quad (9)$$

In this study for estimation of VAR model, the number of lag is selected through SIC (Schwarz Information Criterion). The results of the estimation of the VAR model of is shown in the Table-4.

TABLE III. RESULTS OF THE VAR MODEL ESTIMATION

D.V.	GRH _{t-1}	INF _{t-1}	Other
GRH _t	0.2067	-0.1109	R ² = 0.04
s.e.	0.1754	0.2155	F=0.73
t-value	1.1783	-0.5147	SSR=0.008
INF _t	0.2653	0.439591	R ² = 0.35
s.e.	0.1185	0.14565	F= 8.83
t-value	2.2385*	3.01815	SSR=0.3557

D.V =Dependent Variable, [t-value],* implies statistically significant.

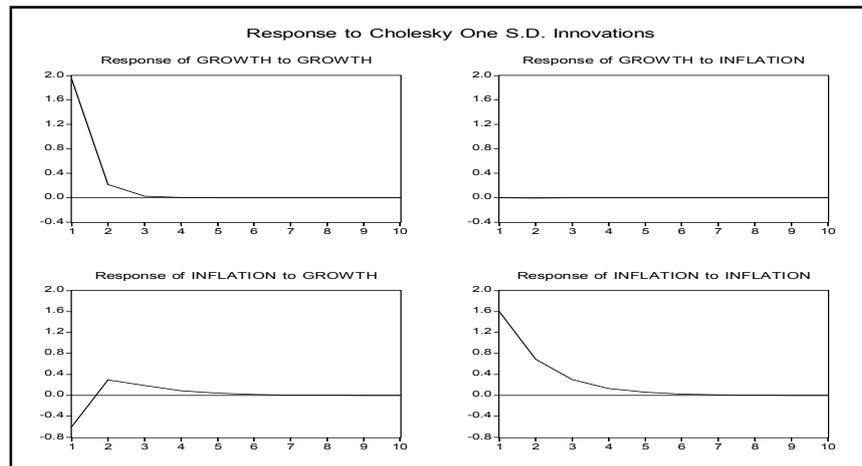
Findings:Last period's growth positively affects current inflation in the long-run. Hence in *Malaysia* there exists the possibility of *long-run causality from growth to inflation*. Last period's inflation also positively affects current inflation.

variables not only directly affects the respective variable only, but also it would be transmitted to all of the endogenous variables in the model through dynamic (lag) structure of VAR. An Impulse Response Function tries to find out the effect of one time shock to one of the innovations on current and future values of the endogenous variables.

VI. IMPULSE RESPONSE FUNCTION AND VARIANCE DECOMPOSITION

A VAR model allows us to study the 'Impulse Response Function' and the 'Variance Decomposition' of the variables. Any shocks to any

Figure 2. Impulse Response Function



Findings: from diagram it is clear that response of growth due to impulse of inflation is insignificant; where as the response of inflation due to shocks in growth is effective up to fourth year in future. It supports our VAR findings that Growth granger causes inflation in Malaysia. But the reverse is not true.

Variance Decomposition: Although the Granger Causality tests which can be established through VEC (Short-run) and VAR model (long-run) to show the presence of a causal relationship between the variables involved, they do not sufficiently answer the question on what is the extent of causality and as such, is it destabilizing in nature? Variance Decomposition helps to determine the proportion of

the total variance in the volatility of one variable explained by innovations in the volatility of the other

variables. Table-12 shows the Variance Decomposition of the variables.

TABLE IV. RESULTS OF VARIANCE DECOMPOSITION OF GROWTH AND INFLATION

Variance Decomposition of GROWTH:				Variance Decomposition of INFLATION:			
Period	S.E.	GROWTH	INFLATION	Period	S.E.	GROWTH	INFLATION
1	1.937861	100.0000	0.000000	1	1.705275	12.21008	87.78992
2	1.949703	99.99967	0.000330	2	1.863930	12.69334	87.30666
3	1.949840	99.99957	0.000428	3	1.897217	13.23608	86.76392
4	1.949841	99.99955	0.000448	4	1.903670	13.36107	86.63893
5	1.949841	99.99955	0.000452	5	1.904886	13.38560	86.61440
6	1.949841	99.99955	0.000452	6	1.905113	13.39024	86.60976
7	1.949841	99.99955	0.000453	7	1.905156	13.39111	86.60889
8	1.949841	99.99955	0.000453	8	1.905164	13.39127	86.60873
9	1.949841	99.99955	0.000453	9	1.905165	13.39130	86.60870
10	1.949841	99.99955	0.000453	10	1.905166	13.39131	86.60869

Table-4 depicts the results of the variance decomposition analysis. This analysis is used to supplement the *Granger Causality* test results to examine the out of sample causality. These results show how much an economic growth's own shock is explained by movements in its own variance and the other variable. More than 13% variability of inflation is accounted by growth innovations over the time horizon. It supports our Granger causal relation.

VII. CONCLUSION

In this study, the relationship between the inflation and economic growth in Malaysia has been examined with the data covering 1971 to 2007. In the short-run inflation plays the vital role for affecting economic growth negatively on the other hand in the long-run economic growth leads to change (positively) in inflation. The transmission mechanism has not been enquired; moreover this study leads to further scope to investigate the threshold level of inflation. It also suffers to make any prediction that higher inflation lead to greater inflation uncertainty or not? Or, what is the relationship between inflation and inflation uncertainty? Further investigation should analyze these problems in details and more perfections.

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