

# The Determinant of Consumer Price Index in Malaysia

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**Abstract**—This study tries to notice out the significance of macroeconomic variables such as broad money, gross domestic product and household final consumption expenditure towards the consumer price index in Malaysia on long run economy. Augmented Dickey-Fuller with lag length on Schwarz Info Criterion and Phillips-Perron with Newey West Bandwidth used to test the stationarity of the data. Johansen-Juselius system co-integration test applied to find the stationary linear combination of the non-stationary variables. The Long run relationship between dependent and independent variables estimated on Vector Error Correction (VEC) model. The results show that there is a relationship within the dependent variable and its independent variables. On the long run, the broad money, export of goods and services, gross domestic product and household final consumption expenditure are significantly positively related to the consumer price index. The results show a sign of complete pass-through of household final consumption expenditure to the consumer price index. The future research shall be testing this variable to examine the pass-through factor. The findings have important implications for understanding the volatility of aggregate demand and supply of price level in a developing country and able to conclude the effectiveness of the monetary policy.

**Index Terms**—Consumer price index, broad money, gross domestic product, household final consumption expenditure.

## I. INTRODUCTION

In developing economies, the inflation is an unavoidable phenomenon. Many scholars conducted many surveys to understand the reasons of the rising prices. Based on previous studies it can be conclude that the main cause of rise of price is depends on macroeconomic variables [1] such as money supply growth [2], [3], real exchange rate [4], interest rate [5], gross domestic product [6], national expenditure [7], external cost shock [8], local credit [9], liquidity and import price [10] and etc.

For a country like Malaysia, upraise of consumer price index by 97.86187 points over a half century (1960-2013) is not a common one. Countries such as Singapore whom almost 100%, depending on outside supply and possessing very limited physical commodity production are having lower (96.71595 points over the same period) compare to Malaysia. Thus, what is determining the consumer price in Malaysia ended the long run?

The purpose of this work is to test some of the macroeconomic variables effect towards the Malaysia's consumer price index. The objectives of the research were threefold:

- 1) To analyse the stationarity of the consumer price index and other macroeconomic variables
- 2) To analyse the co-integration vector of the consumer price index and other macroeconomic variables
- 3) To analyse the relationship of the consumer price index and other macroeconomic variables on long run
- 4) To identify the weakly exogenous variables
- 5) To analyse the relationship of the consumer price index and other macro-economic variables on short run.

## Definition of Key Terms

Consumer price index reflects changes in the cost to the average consumer of acquiring a basket of goods and services that may be fixed or changed at specified intervals, such as yearly.

Broad money is the core of currency outside banks; demand deposits other than those of the central government; the time, savings, and foreign currency deposits of resident sectors other than the central government; bank and traveler's checks; and other securities such as certificates of deposit and commercial composition.

GDP at purchaser's prices is the totality of gross value added by all resident producers in the economy plus any product taxes and minus any subsidies not included in the value of the merchandise. It is counted on without making deductions for depreciation of fabricated assets or for depletion and degradation of natural resources. Data are expressed in current U.S. dollars. Dollar figures for GDP are converted from domestic currencies using single year official exchange rates. For a few states where the official exchange rate does not reflect the rate effectively applied to actual foreign exchange transactions, an alternative conversion factor is applied.

Household final consumption expenditure (formerly private consumption) is the market value of all goods and services, including durable products (such as automobiles, washing cars, and home computers), purchased by families. It excludes purchases of dwellings, but includes imputed rent for owner-occupied homes. It also includes payments and fees to governments to obtain licenses and permissions. Here, household consumption expenditure includes the expenditures of nonprofit institutions serving households, even when reported separately from the land. This detail also includes any statistical discrepancy in the utilization of resources relative to the provision of resources. Data are expressed in current U.S. dollars.

Exports of commodities and services comprise all transactions between residents of a rural area and the remainder of the world calling for a change of ownership from residents to non-residents of general merchandise, net exports of goods under merchanting, nonmonetary gold, and overhauls. Data are expressed in current U.S. dollars.

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The remainder of the report will provide the literature review related to the research in Section II, methodology, how the inquiry will be conducted in Section III, discussion of the results will be embraced in Section IV and lastly the conclusion will be derived in Section V.

## II. LITERATURE REVIEW

Studies on examining the determinants of consumer price or inflation aren't new. Thither are many attempts was made by the scholar across globe in several countries particularly in growing nations.

Ratnasiri [2] analyse the primary causal factors of inflation in Sri Lanka over the period 1980 – 2005 using Vector Auto regression analysis. He leads the analysis on the effect of money supply growth, rice price, exchange rate and the output gap toward the inflation over the short and long run. The work found that money supply growth and rice price are significantly connected to rising prices on long runs and rice price is the primary determinant of rising prices on short runs.

Khan & Gill [13] used four price indicates such as the consumer price index, wholesale price index, sensitive price index and gross domestic product deflator as long run determinants of inflation in Pakistan using OLS model estimation. The study reveals statistically significant between these variables.

Bashir *et al.* [12] expands the inflation field in Pakistan by include the supply side and demand side of the determinant. He used Johansen Co-integration and vector error correction approach. The results reveal money supply, gross domestic product, government consumption and imports are the contributors on long runs.

Tafti [10] used Impulse Response Functions (IRF) and Forecast Error Variance Decomposition to measure and analyse the causal factors of inflation in the Islamic Republic of Iran. The outcomes indicate that the response of the consumer price index (CPI) to shock in import price index liquidity is important. As a similar work led in Vietnam by Nguyen, Cavoli and Wilson (2012) using variance decomposition method and conclude that money supply and external cost shock are important contributors to rising prices.

Mhamdi [20] purports to shape up a structure modelling of the monetary politics in Tunisia and to provide elements that lead to the apprehension of the determinants of inflation. His study constructs the fundamental equation to use by structural macro econometric models in relation to the theoretical bases of the Phillips curve. In another subject on the same year in Pakistan, Shams, Parveen and Ramzan found a long run relationship between local credit, GDP, exchange rate and inflation.

Very recently, Ahmed, Muhammad, Noman *et al.* [19] examine consumer price index, exchange rate, government borrowing, non-government borrowing, real GNP, indirect taxes, growth rate of money supply, import price index, real demand relative to real supply and wheat support price money supply. All these variables show significant.

As a summary, all these studies are studying the relationship between the inflation and the macroeconomic variables. On that point are diverse approaches can be used to

hold the answers between these dependent and independent variable. The approaches are stationarity test to ensure the data not a spurious using ADF and PP [2], [10], [11], Co-integration test to identify the relationship between the variable using Johansen Co-integration [2], [10], [12], estimation test using VAR, VECM and Granger casualty [2], [4], [6], [7], [11]-[13].

### A. Model and Hypotheses

Established along the theory and previous works, consumer price index is based on macroeconomic variables.

The estimating equation for use in this study expressed as below:

$$\text{Ln CPI}_t = \beta_0 + \beta_1 \text{Ln BM}_t + \beta_2 \text{Ln EX}_t + \beta_3 \text{Ln GDP}_t + \beta_4 \text{Ln HCE}_t + \varepsilon_t$$

where

Ln CPI<sub>t</sub> is natural logarithm of consumer price index in Malaysia,

Ln BM<sub>t</sub> is the natural logarithm of broad money,

Ln EX<sub>t</sub> is the natural logarithm of exports of goods and services,

Ln GDPI<sub>t</sub> is the natural logarithm of gross domestic product,

Ln HCE<sub>t</sub> is the natural logarithm of household final consumption expenditure and  $\varepsilon_t$  is the error term.

Since the equation is expressed in natural logarithm, the final results expected to provide the peak part of modification in the dependent variable cause by the point portion of the independent variables.

## III. METHODOLOGY AND DATA COLLECTION

The objective of this work is to determine the long run and short run relationship of consumer price index in Malaysia to the macroeconomic variables. For that understanding, an available secondary information on consumer price index (2005 = 100), broad money (% of GDP), export of goods and services (% of GDP), gross domestic product (constant LCU) and household final consumption expenditure (% of GDP) from the World Bank database was gathered up from year 1960 till the year 2012. Total 53 observations are noted.

The gathered information will then be examined for their stationary using Augmented Dickey-Fuller (ADF). This test needed to identify the weather the data is valid or spurious. In parliamentary law to generate a valid data, both the variables and the error term must be stationary. It does signify that the error term must have a way of reverting to its average value. Hence, the means ( $\mu$ ) and the variance ( $\sigma^2$ ) of error term must me constant. Thus, the following equation was examined using ADF:

$$\Delta Z_t = \alpha + \theta_t + \lambda Z_{t-1} + \sum_{\phi_i}^k \Delta Z_{t-1} + \varepsilon_t$$

Null hypotheses,  $H_n = \lambda = 0$  ( $Z_t$  is not stationary,  $Z_t$  contain unit root)

Alternative hypotheses,  $H_a = \lambda < 0$  ( $Z_t$  is stationary)

The examination will be taken along with the trend and intercept at level first. If the null hypothesis fail to decline, then the first difference taken. The second difference is only

tested if the first difference is non important. From there, all variable will be identified and assign their lag interval. The robustness of ADF test will verify using the Phillip-Parron (PP) test. ADF test lacks power and tends to accept the unit root null too often [14].

Base on above results, the co-integration test will be taken to determine the relation within the variables. There are diverse methods to examine the co-integration. (EG) and (JJ) can be done if all the variable are in first difference (I1) or uncertain between the I(1) or I(0). If there is a mixture within the variable of level (I0) and first difference (I1), the (ADRL) is worthy for the co-integration test. If all the variables is lag I(0), then the co-integration test can be skipped and directly use the classical method ordinary least square (OLS) to get the long run equation estimation.

If there is a unique co-integration, the VEC model or VAR level framework will be adopted to analysis the long run relation within these variables. If there was not any co-integration within these variables, then the VAR first difference model will be utilised to determine the long run equation. VAR model able to capture dynamic short run interactions [15] and empirical irregularities in the data [16]. The VAR model also allows all variables to be potentially endogenous and imposes minimal restrictions [17]. Lastly, the Granger causality test will used to identify which variable runs on short run relations.

#### IV. DISCUSSION OF THE RESULTS

Table I presents the unit root test result of all the variables which conducted on Augmented Dickey-Fuller and Phillip-Parron tests. All the variables are non-stationary in level and stationary in first difference. Except the natural logarithm of consumer price index (LCPI), other variable are stationary at significant level of 1%. Meanwhile the natural log of consumer price index is significant at 5%. The lag interval is set at I(1) for all variables to avoid more statistical mistake.

TABLE I: UNIT ROOT TEST

Variables	ADF (SIC)		PP	
	Level	1 <sup>st</sup> Difference	Level	1 <sup>st</sup> Difference
LCPI	-1.821745 (0.6795)	-4.059806** (0.0128)	-1.694161 (0.7398)	-4.018758** (0.0141)
LBM	-1.800201 (0.6904)	-6.735950*** (0.0000)	-1.826770 (0.6773)	-7.518459*** (0.0000)
LEX	-1.953465 (0.6123)	-5.809169*** (0.0001)	-2.098126 (0.5346)	-5.741246*** (0.0001)
LGDS	-1.064168 (0.9252)	-6.343670*** (0.0000)	-1.288372 (0.8799)	-6.347938*** (0.0000)
LHCE	-2.037778 (0.5673)	-7.158508*** (0.0000)	-2.027509 (0.5728)	-8.330588*** (0.0000)

\*\*\*, \*\* and \* indicate the rejection of the null hypotheses of non-stationary series data at 1%, 5% and 10%

Table II provides the Johansen co-integration test results. The trial was conducted using lag order 3, which will suffice to melt off the error term auto correlations. The result explains these variables are connected together in unique co-integrating vector. The null hypothesis no co-integration was rejected at 1% significance level by both trace and

max-Eigen tests. Further, the null hypothesis at most one co-integration also rejected at 1% significance level by trace test and 5% significance level by max-Eigen test. Meanwhile, the null hypothesis at most two co-integrations was failed to decline. This indicates that there is two co-integrating vectors exist.

TABLE II: JOHANSEN CO-INTEGRATION TEST

Rank	Max-Eigen Statistic	Critical Value (Eigen) at 5%	Trace Statistic	Critical Value (Trace) at 5%
None (r=0)	42.93088***	33.87687	98.22467***	69.81889
At most 1 (r≤1)	31.79247**	27.58434	55.29379***	47.85613
At most 2 (r≤2)	19.19840	21.13162	23.50132	29.79707
At most 3 (r≤3)	3.909298	14.26460	4.302925	15.49471
At most 4 (r≤4)	0.393627	3.841466	0.393627	3.841466

\*\*\* and \*\* denotes rejection of the null hypothesis at the 1% and 5% significance level

The lag order specified for the test is 3 which find sufficient to render the error term serially correlated.

In order to identify the long run causality, VECM model is used to estimate the long run equation. VEC restrictions imposed to testing the significance of each coefficient {eg. B(1,1)=1, B(1,2)=0}. Similar restriction tests conducted to distinguish the weak exogeneity {eg. A(1,1)=0}. Weak exogeneity tests conducted to identify which variable should responsible of adjustment. Table III presents the long run co-integrating vectors obtained from the VECM estimation.

TABLE III: LONG RUN CO-INTEGRATING VECTORS AND WEAK EXOGENEITY TEST

Null Hypothesis is	Model			
	Long Run Coefficients	P-values	Weak Exogeneity Statistics	P-values
LCPI <sub>t-1</sub>	1.000000***	0.002050	-0.01464	0.990637
LBM <sub>t-1</sub>	-0.346913***	0.002773	1.01124	0.305525
LEX <sub>t-1</sub>	-0.638427***	0.000859	0.30838	0.785828
LGDP <sub>t-1</sub>	-0.375793***	0.001574	-0.39427	0.638573
LHCE <sub>t-1</sub>	-2.084366***	0.000916	2.90267**	0.018109

\*\*\* and \*\* denotes rejection of the null hypothesis at the 1% and 5% significance level

The long run relationship within the LCPI, LBM, LEX, LGDP and LHCE is express as followed;

$$\begin{aligned} \text{Ln CPI}_{t-1} = & -18.14260 + 0.346913***\text{LnBMT}_{t-1} + \\ & 0.638427***\text{LnEXT}_{t-1} + 0.375793***\text{LnGDPT}_{t-1} + \\ & 2.084366***\text{LnHCET}_{t-1} \end{aligned}$$

\*\*\* denotes significance at 1% significance level.

Based on result, the consumer price index is positively related to the broad money, exports of goods and services, gross domestic product and household final consumption expenditure at 1% significance level. 1 % of broad money growth will increase the consumer price by 0.35%. If an

export of goods and services is increased by 1%, it will increase the consumer price by 0.64%. Growth of gross domestic product by 1% will spike the consumer price about 0.38%. Eventually, if the household consumption is increase by 1%, it will results an increase of consumer price by 2.08%.

Established along the weak exogeneity test, the broad

money, export of goods and services and GDP are to be weakly exogenous. This implies that, while they may respond to cyclical changes in other variables, they do not have the burden of adjustments toward the long run. The null hypothesis that household consumption is weakly exogenous is rejected at the 5 % significance level.

TABLE IV: GRANGER CAUSALITY TESTS

Dep. Variable	Independent variable					ECT <sub>t-1</sub>
	$\chi^2$ statistic of lagged 1st Difference term[p-value]					coefficient
	$\Delta$ LCPI	$\Delta$ LBM	$\Delta$ LEX	$\Delta$ LGDP	$\Delta$ LHCE	(t-ratio)
$\Delta$ LCPI	-	0.626259 [0.8904]	0.523971 [0.9136]	2.470106 [0.4807]	0.026008 [0.9989]	-
$\Delta$ LBM	0.441815 [0.9315]	-	0.968580 [0.8089]	0.182497 [0.9804]	0.428232 [0.9344]	-
$\Delta$ LEX	4.525596 [0.2100]	0.250014 [0.9691]	-	1.149201 [0.7652]	0.889991 [0.8278]	-
$\Delta$ LGDP	1.670207 [0.6436]	0.782014 [0.8538]	1.562215 [0.6680]	-	2.066962 [0.5586]	-
$\Delta$ LHCE	14.27682*** [0.0026]	5.031588 [0.1695]	9.118399** [0.0278]	6.647271* [0.0840]		-0.013582** [-6.59035]

\*\*\*, \*\* and \* indicate significant at 1%, 5% and 10% significance level

Since the null hypothesis of household consumption is weakly exogenous is rejected. The error correction coefficient of consumer price index, broad money, exports of goods and services and GDP restricted to zero. These limitations are not rejected given  $\chi^2 = 2.050486$  and  $p$ -value = 0.143927. Table IV introduces the Granger causality tests result based on the VECM model after the aforementioned limitations. The results suggest there are limited short run interactions among the variables. Above result shows short run causality runs only consumer price to household consumer, broad money to household consumption, exports of goods and services to household consumption, and GDP to household use. This evidence may be ascribable to the unfitness of the Granger causality test to capture the indirect effects of a variable on the remaining variables. To get the total impact of the remaining variables, a generalised impulse response functions using level VAR with lag order 3 was copied. The generalised impulse response functions capture the directions, magnitudes and persistence of variable's responses to impulses in the system [18]. Fig. 2 presents the plots of the generalized impulse response functions.

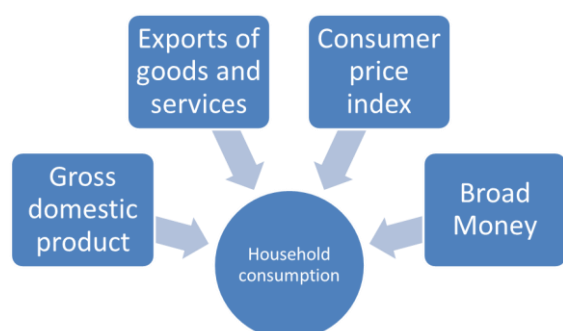


Fig. 1. Short run relationship framework.

As mentioned earlier, the household consumption is not

weakly exogenous. This variable adjusts the deviations from the variables' long run route. The estimated coefficient of the error correction for the output equation is negative as expected for the intersection toward the long run to occupy position. The results suggest the long run causality from the included variables to household use.

$$\Delta LHCE_t = f(\Delta Z) - 0.013582 ECT_{t-1}$$

$$ECT_{t-1} = LHCE_{t-1} - (8.707728 + 0.474813LCPI_{t-1} - 0.162761LBM_{t-1} - 0.302169LEX_{t-1} - 0.180949LGDP_{t-1})$$

Long Run relation

$$LHCE_t = 8.707728 + 0.474813LCPI_t - 0.162761LBM_t - 0.302169LEX_t - 0.180949LGDP_t$$

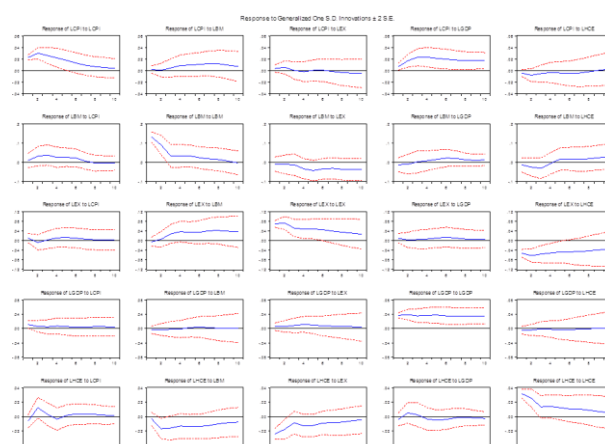


Fig. 2. The generalized impulse response functions.

## V. CONCLUSION

The purpose of this paper is the related the macroeconomic variable such as broad money, exports of goods and services,

gross domestic products and household use of goods and services to the consumer price index. Time series techniques such as unit root test, co-integration test, vector error correction or vector auto regression model and causality test was utilised for this determination.

The unit root test indicated all variables are stationary at first difference. Established along the co-integration test, the finding suggests that there is a common ways to connect up these variables in the long run. The long run between consumer price and other variables is calculated using the VEC model. The consumer price significantly positively related to broad money, exports of goods and services, GDP and household use of goods and services. On the weakly exogenous test, the household consumption is positively adjusting the long run relation with other variables. The long run causality was suggested between the consumer price, broad money, exports and GDP to the household consumption.

On short run causality test, establish that there is a significant reaction of consumer costs, exports of goods and services, GDP and broad money to home use. On the simulated impulse response functions, the consumer price immediately response to GDP, and exports response to household consumption for the first five years.

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