The Long-Run Determinant of Inflation in Malaysia: A Philips Curve Review

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Abstract

Inflation is a critical element of the market economy, where instability in the inflation rate consequently affects the cost of living index. This paper aims to check the Phillips curve's long-term efficacy by using unemployment as a long-term determinant of inflation in Malaysia; Empirical data is obtained between 1991 and 2018. The ARDL bound test cointegration and ECT b[1]used ARDL model is used to test the long-run Granger movement, and the Wald test is used to demonstrate short-run causation. consequently, the ECT_{t-1} statistics significantly verified the long-term inverse causative association, running from UNE to INF. Nevertheless, the study accepted the null hypothesis that the short-term association does not exist between UNE and INF. The results are broadly in line with several Phillips Curve theory literature.

Keywords: *ARDL, Cointegration, ECT, Inflation, Unemployment*

Introduction

A.W. Phillips, who has become known for his work, entitled the connection in the middle of unemployment and the rate of change in the United Kingdom's money wage rates. Phillips (1958) showed a strong negative correlation in the middle of UNE and INF, which was as Phillips curve. Thus, the "Phillips Curve" is now recognized for this economic interaction found by Phillips. Since in economic literature, several studies have investigated this correlation, among those Gordon (1970), King & Watson (1994) and Samuelson & Solow (1960) found the Phillips trade-off curve considered to be alive and healthy. Similarly, Lipsey (1960), Fuhrer (1995), Turner & Seghezza (1999), Islam & Mustafa (2017), Dereli (2013), Mahmudul Hassan (2012), Katria et al. (2010), (Shaari et al., 2018) and Behera et al. (2017) proposed that there were considerably reverse relations in the middle of the variables of interest. Following, the Phillips curve was

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an important tool in different countries for formulating macroeconomic policy, provided that the major study was undertaken in the sense of the developing economies on the Phillips curve. According to Furuoka & Munir (2014), the equilibrium in the middle of the UNE rate and INF rate in Malaysia has been created. Along the same lines, Malaysia has a long-term trade-off in the middle of INF and UNE (Furuoka, 2007; Furuoka & Munir, 2014; Tang & Lean, 2007). In other words, by using the idea of labor demand and supply, one can understand the basic theoretical basis of the Phillips Curve, when demand for labor is greater than supply, excess labor demand will raise wage pressure, which is responsible for high INF in the region. In this case, it would be easy to find positions for employees and hold the unemployment rate down. In other terms, businesses would attempt to raise output levels by recruitment of more employees during the years of economic boom. Low unemployment will coexist with high INF during this economic upheaval. On the other side, businesses will attempt to reduce their manufacturing levels during the economic recessions by cutting the number of workers. Furthermore, the Phillips Curve theorem has major policy ramifications as well as a strong scientific basis. Price stability is one of the central bank's major policy goals in every nation and can be accomplished by inflationary regulation. In order to keep INF as low as possible, the Central Bank has a duty to devise and enforce monetary policy. If an inverse relation occurs in the middle of INF and UNE, therefore, it would be possible to achieve a low INF rate When the rate of unemployment is strong. It entails a big challenge for the central bank to pick in the middle of the weak INF and strong UNE. However, Earlier empirical study of Malaysian INF and UNE mostly concentrated; the determinants of INF, the research of traditional techniques for cointegration in the long-term correlation, inflationary modeling, and unemployment models (see Habibullah, 1998; Tan & Cheng, 1995). In addition, some researchers have used the error correction model (see Furuoka, 2007; Furuoka & Munir, 2009, 2014; Puzon, 2009; Tang & Lean, 2007). Despite that, the primary motives behind this research article are to assess the causal association, moving from unemployment to INF, whereas INF is the function of UNE in Malaysia with recent data span from 1991 to 2018. In addition, a new ARDL bound test econometric approach is used to assess the cointegration, and ECT based ARDL model is used to test the long-run causation. In fact, in a developing country like Malaysia, the existence of the trade-off Phillip curve is an important tool for adjusting the crucial macroeconomics variables. According to Samuelson & Solow (1960), the Phillips curve is an INF and UNE control menu for policymakers. If the Phillips trade-off curve persists, a parallel decline in inflation, as well as unemployment, could shed some light on supply-side economic policies.

Literature review on Inflation and Unemployment (Phillips Curve)

A significant contribution to the Phillips Curve work has been made by (Dinardo & Moore, 1999; Gordon, 1970; King & Watson, 1994; Samuelson & Solow, 1960), Who reported that the trade-off ties in the middle of UNE and INF were negative. Likewise, according to prominent American economists Samuelson & Solow (1960), the correlation in the middle of these two macroeconomic variables, unemployment, and INF, is inverse and trad-off in the case of the United States. Evidently similar findings were contributed by (Ewing & Seyfried, 1999; Fuhrer, 1995; Lipsey, 1960; Malinov & Sommers, 1997; Payne et al., 2000; Shaari et al., 2018; Turner & Seghezza, 1999). Nonetheless, Friedman (1968), Phelps (1967), Atkeson & Ohanian (2001), Galbraith (1997) suggested the presence of trade-offs in the middle of joblessness and inflation was debunked. They recognized that there could only be a negative correlation in the middle of UNE and INF in the short term. Analogously, Lucas (1976) argued that trade-offs in the middle of UNE and INF could only be formed when employees did not expect politicians to create a high inflation fictitious situation combined with low unemployment. Inflation has significantly affected long-term and short-term unemployment in Nigeria, this ensures that higher government expenditure lowers unemployment (Idenyi et al., 2017). By the same token, Abu (2019) suggests that there is a trade-off in the middle of the factors, thus increased unemployment in the long term leads to lower inflation in the case of Nigeria. Nevertheless, according to Orji et al. (2015), unemployment is a major determinant of inflation, and Nigeria's inflation-unemployment rate correlation is affirmative. In like fashion, inflation has a significant positive connection with Pakistan's unemployment (Haq et al., 2012). In comparison to Phillips ' curve hypothesis, this analysis advocated the criticism of Lucas (1976); similarly, the same association in the middle of variables was verified by (Alogoskoufis & Smith, 1991; Berentsen et al., 2008; Egan & Leddin, 2017; Furuoka & Munir, 2009; Hart, 2003; Niskanen, 2002; Ormerod et al., 2013; Qianyi & Fei, 2013). On the other side, Zaman et al. (2011) conducted a research to examine the association in the middle of INF and UNE in Pakistan, and the study found that INF and UNE have a long-standing and inverse association. Furthermore, they suggested that in the short term, there is a fleeting causality, while in the long run, there is a lasting correlation. The results offer empirical proof of the Phillips curve.

Research on the Phillips curve in Malaysia is limited. While some researchers placed valuable contributions in this regard, listed as Furuoka (2007), Examine inflation and UNE relationships in Malaysia in the case of Phillips framework. The finding of this report consists that in the long-term trade-off relationship in the middle of the UNE rate and INF rate exist in Malaysia. In other terms, this paper has provided an analytical suggestion that the Philips curve is suitable. Furthermore, Furuoka & Munir (2014) concluded that Malaysia has an inverse correlation in the middle of UNE and INF. Thus, the results of this study, therefore, endorse the logic of the theory of the Phillips Curve. Moreover, similar findings were showed by Tang & Lean (2007), who investigate the Phillips curve market equilibrium in Malaysia. The study contains the annual details in the middle of 1970 and 2005. This study found that the Phillips trade-off curve is both short-term and long-term in Malaysia. In comparison, Malaysia has a healthy long-term trade-off between INF and UNE levels. Likewise, Kogid et al. (2011) analyze the commercial ties in the period from these two variables in Malaysia, the research study indicates that there is a long-term correlation in the period from INF to UNE, but the assumption that inflation has affected unemployment is unidirectional. Considering the above discussion, Furuoka (2007), Furuoka & Munir (2014), Tang & Lean (2007), and (Kogid et al., 2011) all are in the same line that the long-run tradeoff association exists in the period from INF and UNE levels in Malaysia. Notwithstanding, Furuoka & Munir (2009) used the panel analysis to study the connection in the period from UNE and INF in ASEAN countries. The panel data analysis mainly shows that there are no trade-offs in these ASEAN countries in the period from the UNE and INF rates. In like manner, equivalent results were presented by Puzon (2009), Who wanted to explore the Philippine, Thailand, Indonesia and Malaysia nature of the Philippines Curve. In addition to unemployment, other macroeconomic variables were encountered in the study, namely, interest rates, exchange rates, and inflation shocks. It was discovered that for ASEAN-4, the correlation in the period from UNE and INF does not seem healthy on a one-to-one basis. King & Watson (1994) checked the Phillips curve with the macroeconomic details of the post-war US. Such results confirmed the nature of the trade-off in the period from UNE and INF empirically. They noticed that the Phillips curve might occur if long and short noise were excluded from the data. Similar studies were carried out by Lipsey (1960), Fuhrer (1995) and Shadman-Mehta et al. (1996) in the UK to examine the correlation between the nominal wage rate growth and the unemployment rate, the ties between the variables of concern were substantially reverse. In contrast, Turner (1997) proposed that at least one major structural split in the UK might take place from the 1970s and that the Phillips curve is fragile. Moreover, Galbraith (1997) argues that the empirical evidence of a long-run vertical Philips curve is poor and lower in the last ten years. In recent years, Hart (2003) Use the hourly pay in Britain to test the Phillips principle, and no variant of the Phillips hypothesis was endorsed.

Dinardo & Moore (1999) and Ewing & Seyfried (1999) predict the Phillips curve. Whilst shifting perceptions played a part in creating a Phillips Curve methodological collapse in the 1970s, supply shocks were at least as important. Islam & Mustafa (2017) explore the connection in the period from the rate of INF and UNE by using the conventional econometric approach in order to find a Phillips Curve. The result undermines the hypothesis that the Phillips curve should be vertical in the long term, and finding supports the existence of the Phillips curve in the long-term. Malinov & Sommers (1997) and Dinardo & Moore (1999) test the presence of the robust Phillips curve, analyze OECD countries. They observed that, except for Switzerland and the United States, seventeen OECD countries had healthy Phillips curves. Likewise, in 28 of 35 OECD countries, the Phillips curve theory remains observational. Complementing macro stimulations and operational microeconomic changes will increase the effectiveness of trade-offs in incomes and jobs between businesses and employees to increase the importance of UNE and INF competition in these economies (Bhattarai, 2016). Despite that, Turner & Seghezza (1999) used the panel data system in 21 OECD countries to analyze the' Phillips curve. They use the SURE approach for the interpretation of the collected data. The results of this research indicate that the standard Phillips curve is strongly supported by 21 OECD countries. Correspondently, identical results were prescribed while testing Phillips curve authentication in SAARC countries in agreement with Katria et al. (2010) to define the connection in the period from INF and UNE in SAARC countries. This study has provided significant results; in the SAARC countries, there is a negative correlation in the period from INF and UNE. Payne et al. (2000) use a lagging inflation factor to catch the inertia impact as a measure for expected inflation. They found a stable association in the period from INF and UNE. Shadman-Mehta et al. (1996) re-evaluate the nature of a long-standing wage/employment correlation in the UK. In addition, a long-term inverse correlation in the period from the INF rate and the UNE rate is reflected. Nevertheless, the main impact of departures from this long-term equilibrium is not the inflation rate but unemployment. Dereli (2013), the trade-off cointegration correlation has been found in the period from INF and UNE in Turkey. According to Mahmudul Hassan (2012), the presence of the Phillips curve in the case of Bangladesh is confirmed by empirical evidence. Based on his research findings, the cointegration indicates a long-term correlation in the period from the variables. None the less, it goes against the idea that the Phillips Curve is linear in the long run. What is critical is that Bangladesh's inflation dynamics are firmly reversed. Meanwhile, the opposite side picture is presented by Rasna (2010), who analyzes Phillips Curve's applicability in Bangladesh. The Johansen multivariate check of cointegration reveals that the Phillips long-term curve in Bangladesh does not occur. Once more, the Granger causality test shows a unidirectional optimistic causality from the INF rate to the unemployment rate which is completely the other way around the predicted Phillips affiliation. The key finding is that in Bangladesh stagflation is evident. In the same way, similar study has been conducted in Philippines by Zayed et al. (2018) to investigates whether the curve of Phillips in the Philippines is identified. The model has been established to assess the long-term affiliation in the period from these variables in conjunction with the Phillips curve. The analysis calculated the affiliation in the period from the variables over a long period of time. The conclusion of small developed economy North Cyprus with regard to Phillips curve verification is presented by Shahbaz et al. (2011) according to them the long-term trade-off association exists in the period from UNE and INF. A like, the estimators of the model verified the stable affiliation in the period from assign variables. Shaari et al. (2018) aim in the high-income countries to investigate the nature of the Phillips curve. A twofold connection in the period from UNE and INF in both long and short runs is the most interesting result of the research. Despite that, an opposite finding is replicated with an address to the Phillips curve is as Ormerod et al. (2013) mentioned for the United States, the United Kingdom, and Germany, the mechanisms of inflation and unemployment are discussed. The analysis shows that reliance for political purposes on all forms of trade-offs in the period from INF and UNE is totally unreliable. Dritsaki & Dritsaki (2013) explores the affiliation in the period from INF and UNE in Greece from 1980 to 2010. The results show that INF and UNE have a long-term and causal connection. Eventually, the triggers of forecasts suggest that inflationary changes would lead to a decline in the first few years following a slight rise in the UNE rate for the remaining years under analysis. Behera et al. (2017) discuss the issue of inflation determinants in India in a Phillips curve context, and the results suggest that both core inflation and headlining inflation showed a prove to traditional Philips curve. likewise, identical findings were presented and according to Thiruneelakandan & Ullamudaiyar (2018) the macroeconomic variables inflation and UNE are inversely cointegrated in the case of Indian economy for assign period of time. Evidently, the statistical estimates confirm the existence of Phillips curve for India. Qianyi & Fei (2013) explores the association and causality in the period from INF and joblessness rate for 1978 to 2011 in China. Surprisingly, it is not feasible to consider a causal affiliation in the period from INF rate and UNE in the empirically defined Phillips curve. Consequently, identical findings were replicated and mentioned by Egan & Leddin (2017) according to them the Phillips curve is calculated with linearity and parameter constancy. They illustrate inflation patterns in China in the period from 1987 and 2014; however, the existence of structural ruptures in Chinese inflation dynamics makes standard linear model unsuitable analytical instruments. Our results show that the gradient of the Chinese Phillips is nonlinear. Dua & Gaur (2010) discusses inflation determinations for eight Asian countries, Japan, Hong Kong, Korea, Singapore, the Philippines, Thailand, China, and India as part of a forward-looking as well as a conventionally retroactive Phillips curve for the open economy. The forward-looking Phillips curve is better suited for all nations. Simionescu (2014) Test for Romania, in the period from 1990 and 2013, the nature and consistency of the Phillips curve. A negative affiliation is formed in the period from short-term inflation and UNE, with a positive long-term affiliation. Sasongko et al. (2019) carried out with the aim of evaluating the causality of inflation and a transparent rate of unemployment in Indonesia in the period from 2013 and 2017 in 33 provinces. The study showed that there was a one-way and short-term correlation in the period from INF and unemployment. Bhanthumnavin (2002) study Phillips curve verification in Thailand and mentioned that the association in the period from macroeconomic variables such as INF and UNE only began after the Asian crises. However. There is not prior evidence of emerging affiliation after a powerful systemic shock to the competitive capability and financial sector of the country.

Methodological Framework

Data Discussion

The time series data is used for the duration 1991 to 2018 in this analysis, in order to examine the long-term Grander causal movement form UNE (Unemployment) as a dependent regressor to INF (Inflation) dependent series. In the wake of, data is obtained from World Bank Development Indicators (WDI 2020). Auto-regression with distributed lag is used for dependent and independent series respectively, see Table 1.

Table 1: Data Labels Descriptions and Sources

Series	Description	Calculation	Source
INF	Inflation, consumer prices (annual %)	PMB_t / PMB_0 * 100	IMF, International Financial Statistics, and data files.

UNE	Unemployment, total (% of total labor force) (national estimate)	Number of unemployed / Total Labor Force * 100	ILO, ILOSTAT database. Data retrieved on March 1, 2020.
*Unemployment relates to the proportion of staff without employed, eligible for and looking for jobs. Workforce concepts and unemployment vary from country to country. Now included in the WDI archive are the sequence for ILO forecasts. *Inflation represents an annual cost increase for the average consumer, determined by the consumer price index, when buying a portfolio of products and services that can be set or adjusted at specific intervals, like each year. The Laspeyres formula is generally used. Were price of market basket (PMB) current year is divided by PBM base year and multiplied by 100.			

Unit Root

According to Nelson & Plosser (1982) findings, the macroeconomic sequences are not always stable and stationary, due to that the time series cannot adequately describe the desired patterns in data series, although that is the pure source of fluctuation and trends because of real factors. By virtue of the data has Unit Root, prior to going for co-integrations, we can apply certain methods of data stationery. Persuading this, Enders (1995) describes two useful methods Augmented Dickey-Fuller (ADF), and Phillips-Perron (PP) presented and preferred by (Dickey & Fuller, 1979; Phillips & Perron, 1988)**.** The optical lag selection for ADF and PP is selected based on the lowest SIC (Schwarz information criterion), suggested by (Pesaran & Shin, 1998). In virtue of, the degree of co-integration is I (0) & I (1), see Table.2.

Model Specification

The major objective of this study is to measure UNE as a long-term determinant of INF in the case of Malaysia. To this end, the ARDL bound test approach of co-integrations is used for the purpose of the study. The ARDL bound test approach is used with ECM (Error Correction Model) to entertain long-term and short-term movement in the model. The approach is developed and preferred based on the study of (Pesaran & Shin, 1998; Pesaran et al., 2001; Pesaran & Pesaran, 1997). indeed, we can employ different co-integration techniques. Whereas, the ARDL approach has several pros compared to other methods of co-integrations. Besides, according to Pesaran & Shin (1998), the model can be applied irrespectively of co-integration order, this meant that the order of integration can be I (0) or I (1) or mutually co-integrated, but the order should not be I (2). Adding something more, the model is also useful when the explanatory series are exogenous (see Pesaran & Shin, 1998; Pesaran et al., 2001). Also, the result can best describe and appropriate for small sample descriptions (Haug, 2002). With attention to, the order of co-integration in our study is I (0) & I (1). Hence, we use a single co-integration ARDL approach of investigation mentioned by (Pesaran & Shin, 1998; Pesaran et al., 2001). The general form of the ARDL (p, q) model is as follows in eq.1.

$$Y_t = \alpha_0 + \sum_{j=0}^{q} \beta_j L^J X_t + \sum_{j=0}^{p} \theta_i \, L^j Y_t + \varepsilon_t \qquad (1)$$

Where:

p & q are the order of ARDL lag for dependent and independent series, β & θ are coefficients, α is the trend, ε_t is error term and L^j is X_{t-j} and Y_{t-j}. Besides, The Standardize error correction version of the ARDL model is presented in Eq.2; see Table.4 for empirical analysis. The restricted VAR model is deployed for choosing optimal lag length criteria for standardizing the ARDL model (see Eq.2). Selecting optimal lag length information criteria is proposed based on the study of Liew (2006) findings, AIC and Final Prediction Error (FPE) have been recorded to be higher lag information criteria compared to others especially in the case of auto-regressive time series and fewer sample size. Based on the above mention criteria, the optimal lag length for our study is Lag (1).

$$\Delta \mathrm{lnINF}_t = \alpha_0 + \sum_{i=1}^{p} \beta_i \Delta \mathrm{lnINF}_{t-1} + \sum_{i=1}^{p} \theta_i \Delta \mathrm{lnUNE}_{t-1} + \mu_1 \mathrm{lnINF}_{t-1} + \mu_2 \mathrm{lnUNE}_{t-1} + \varepsilon_t \qquad (2)$$

Where:

β, θ represents the short-term coefficients of the model in order to measure short-term consistency in the model. Whereas μ describes the long- term dynamics in the model. To put it differently, the ARDL approach of co-integration describes long-term associations in two ways. First, F-statistics is employed to check co-integration, and the second F- statistical value is compared with F-tabulated value (see Pesaran et al., 2001). See Table.3. Likewise, the Wald test F-statistics is used to check for co-integrations in the period from UNE and INF. If Wald test F-statistics are larger than the Upper Critical Limit, then null hypothetic is rejected, (see Table.6). However, the results said to be inconvenient if the calculated F-statistics value is below than Lower Critical Bound (LCB) when the results are satisfactory. Hence, we can apply Eq.3 for long-term coefficients diagnose. See Table.6, Model 2 for empirical results.

$$lnINF_t = \alpha_0 + \sum_{i=1}^{p} \beta_1 lnINF_{t-1} + \sum_{i=1}^{p} \beta_2 lnUNE_{t-1} + \varepsilon_t \qquad (3)$$

Where:

β is long-term coefficients for the autoregressive distributed lag of INF and UNE, p is the order of the ARDL model and the ε_t is the error correction term. Whenever the results of the long-term model.2 suggest that the long-term combine effect of regressors is sufficient, then the next step is to find short-term causal impact moving from UNE to INF, which is presented in Eq.4, see Tab.5 & 6, Model.1 for joint coefficient diagnose and significant level.

$$\Delta \mathrm{lnINF}_t = \alpha_0 + \sum_{i=1}^{p} \beta_1 \Delta \mathrm{lnINF}_{t-1} + \sum_{i=1}^{p} \beta_2 \Delta \mathrm{lnUNE}_{t-1} + \mu \mathrm{ECT}_{t-1} + \varepsilon_t \qquad (4)$$

Where:

ECT_{t-1} is Error Correction Term, and μ is the coefficient, which represents the speed of adjustment towards equilibrium. This means that shock to UNE can cause volatility to INF, and that can be permanent and adjust to its equilibrium in the long-term based on the speed of adjustment coefficient, which is related to the co-integration equation.

Empirical Analysis

The ADF and PP tests statistics for data unit root are presented in Table 2 for the time series INF and UNE, and the data is transformed into a natural log. The ADF and PP tests result for INF confirmed series stationarity at level with the same probability of the value of (0.0026) for both test results. Whereas the statistics of both tests accept the null hypothesis, that series has a unit root at a level in the case of UNE.

Likewise, the results of ADF and PP procedures at first difference verified that the UNE is stationary with correspondent p-values of (0.0022) and (0.0012) for ADF and PP methods, respectively. Understanding that the variables of this study do not follow unit root at I (0) and I (1) co-integration order, which is an appropriate pre-requisite condition for using the ARDL bound test approach.

Table 2: ADF & PP Test Statistics for Unit Root

At level					
	ADF		**PP**		**Conclusion**
	Statistics	Probability*	Statistics	Probability*	
INF	-4.265171	0.0026**	-4.265171	0.0026**	I (0)
UNE	-2.633524	0.0989	-2.579999	0.1093	I (0)
At first difference					
UNE	-4.355958	0.0022**	-4.588350	0.0012**	I (1)

*MacKinnon (1996) one-sided p-values. ADF: Augmented Dickey-Fuller test statistic, PP: Phillips-Perron test statistics.
* ADF & PP test critical values are significant at 1 %** and 5%*, all variables are in natural log transformation
*Lag length criteria are selected based on the lower value of SIC.

Table.3 describes the cointegration bound test. The result of F-statistics confirms the cointegration between INF and UNE. However, the guideline for long-term associations is described and based on the study of (Pesaran & Shin, 1998; Pesaran et al., 2001; Pesaran & Pesaran, 1997) findings, concluded that if calculated F-statistics is greater than UCB (upper critical bound) tabulated F-statistics, then there is a co-integration between variables. Accordingly, in our study, the calculated F-statistic is 5.684593, which is greater than UCB tabulated statistics 4.16. the findings are aligned with (Dereli, 2013; Furuoka, 2007; Furuoka & Munir, 2014; Islam & Mustafa, 2017; Katria et al., 2010; King & Watson, 1994; Lipsey, 1960; Mahmudul Hassan, 2012; Payne et al., 2000; Shadman-Mehta et al., 1996; Shahbaz et al., 2011; Zaman et al., 2011; Zayed et al., 2018; Fuhrer, 1995).

Table 3: ARDL Cointegration Bound Test

F-statistic	**Significant**	**Lower Bound**	**Upper Bound**
5.684593*	5%	3.62	4.16

*Lowe bound presents I (0) co-integration degree and Upper bound show I (1) degree of CI.
F-statistics is significant at 5%

The Bivariate standard ARDL model with short-term and long-term dynamics is presented in Table.4. See Eq.2. Where: $\Delta \ln INF_{t-1}$ & $\Delta \ln UNE_{t-1}$ (Model 1) describe short-term dynamics for auto-regression (INF) and lag distribution (UNE) regressors based on lag (1) information criteria chosen with the help of AIC and FPE methods. Beyond, $\ln INF_{t-1}$ and $\ln UNE_{t-1}$ (Model 2) evaluate long-term movement in the model. However, the long-term fluctuations in the INF occur because of its own shock, which is significant at a 1% level, although the F-statistics for multivariant effect is significant at a p-value of (0.007287) for the model. In addition, the coefficient of UNE is -0.366919, see Table.6, for Model.1 & Model.2 multivariate effect.

Table 4: Standard ARDL Model with Long-term and Short-term Dynamics, Bivariate analysis				
Regressors	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
Trend	1.117419	1.418567	0.787709	0.4397
$\Delta lnINF_{t-1}$	-0.146325	0.225276	-0.649539	0.5230
$\Delta lnUNE_{t-1}$	-0.342081	1.256514	-0.272246	0.7881
$lnINF_{t-1}$	-0.839183	0.287370	-2.920214	0.0082**
$lnUNE_{t-1}$	-0.366919	1.149339	-0.319244	0.7527
*Model test coefficient statistics are significant at 1%** & 5%*, and least Squire method is used for series estimations *R- squire is 0.472010, Adjusted R-squire is 0.371441, F-statistics is 4.693371, with a p-value of 0.007287, AIC criteria is 1.904969, SIC criteria is 2.146911 and DW statistics is 2.045678. ΔINF is dependent series.				

Table 5 depicts the empirical output of Eq.4, and the ECT (Error correction term) represents the Granger causality running from UNE to INF. In other words, the rule of thumb for ECT is that the coefficient should be less than zero and significant, however, since in our case the statistics meet the criteria that coefficient statistics is (-0.838428) and significant at 1% level, which represents that there is Graner causality moving from UNE to INF. Aside from this, The error correction coefficient indicates the pace at which short-term variations adapt to long-term equilibrium means that 83% disequilibrium in the data from the previous year is converging back to its long-term equilibrium each year. However, the table reveals that the coefficients for short-term dynamics are not significant, also see Table.6 for short-term multivariate significance level Model.1. The outputs are in line with the findings of (Abu, 2019; Dereli, 2013; Kogid et al., 2011; Shahbaz et al., 2011; Simionescu, 2014).

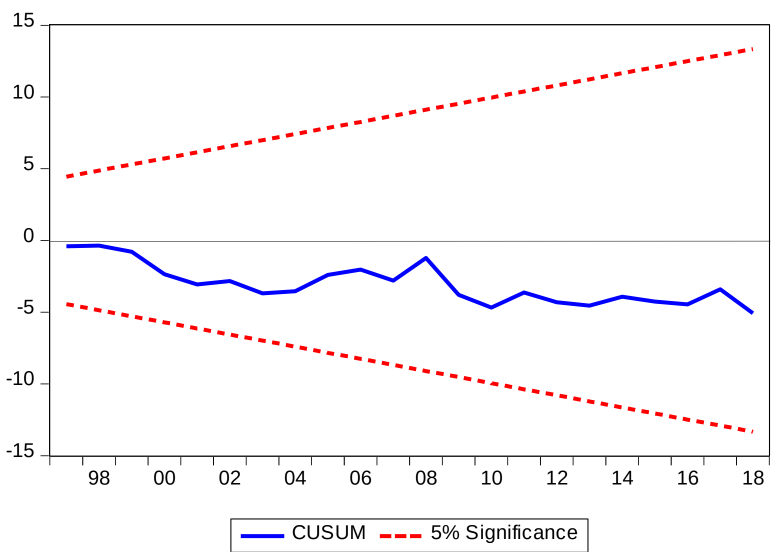
Table 5: Granger Causality ECT, Short-term Bivariate Model				
Regressors	**Coefficient**	**Std. Error**	**t-Statistic**	**Probability**
trend	-0.055725	0.110458	-0.504487	0.6189
$\Delta lnINF_{t-1}$	-0.147151	0.219906	-0.669152	0.5104
$\Delta lnUNE_{t-1}$	-0.297735	1.105427	-0.269340	0.7902
ECT_{t-1}	-0.838428	0.280660	-2.987346	0.0068**
*Coefficients are significant at** at 1% and* 5% level, least squire method is used for estimations *R-squire, adjusted R-squire, F-statistics p-value, AIC, SIC and DW statistics are 0.471845, 0.399824, 0.002477, 1.828359, 2.021913 and 2.043956, respectively. ΔINF is dependent series.				

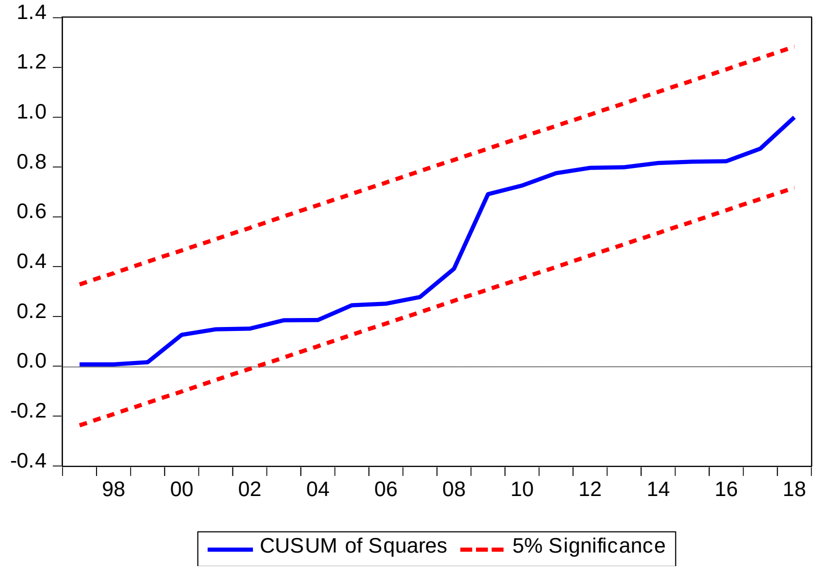
The quantitative analysis for Eq.3 & Eq.4 are illustrated in Table 6, and can be line-up with the majority of Phillips curve literature (see Abu, 2019; Dereli, 2013; Furuoka, 2007; Furuoka & Munir, 2014; Mahmudul Hassan, 2012; Payne et al., 2000; Shahbaz et al., 2011; Tang & Lean, 2007; Zaman et al., 2011; Zayed et al., 2018). Where Model.1 represents short-term causal association moving from UNE to INF and Model.2 depicts the long-term causality running from regressors to dependent series. In the case of Model.1, we are unable to reject the null hypothesis with a probability value of (0.7923), means in the short-term UNE cannot cause INF, or there is no causal association in the period from UNE and INF in the short run. Despite that, we cannot accept the null hypothesis with a p-value of (0.0279) in the case of Model.2, which justifies that there is a long-term casual association running from regressors to ΔINF.

Table 6: WALD Test for Long-term and Short-term efficacy, Multivariate Models		
Models	**F-statistic**	**Probability**
Model.1 *(Short run)*	0.235279	0.7923
Model.2 *(Long run)*	4.263916	0.0279*
*Restrictions are linear in coefficients. *F-statistics are significant at** 1% and* 5% *Null hypothesis for Model.1 is C (2) = C (3) =0 *Null hypothesis for Model.2 is C (4) = C (5) =0		

The test results of the Breusch-Godfrey Serial Correlation LM Test for autocorrelation, ARCH test for heteroskedasticity, and Jarque-Bera for normality are formed and showed in Table.7. The F-statistics for serial correlation is (2.161759) with a correspondent p-value of (0.1563), which accepts the null hypothesis that residuals have no autocorrelation. Similarly, the F-statistics for the ARCH test is (0.337200) with a probability value of (0.5671), which is unable to reject the null hypothesis, concluding that residuals are homoskedasticity. Finally, the Jarque-Bera test of normality depicts that residuals are normally distributed. Besides, the results of CUSUM and CUSUM of squire tests lie within 5% critical bound, which assures model stability.

Table 7: Residuals Diagnostics		
	F-Statistics	**Probability**
Breusch-Godfrey Serial Correlation LM Test	2.161759	0.1563
ARCH	0.337200	0.5671
	Jarque-Bera	
Normality	1.343507	0.510
*F-statistics p-value is significant at** 1% and* 5% level. The ARCH test is used for Heteroskedasticity.		





Conclusion

A significant pillar in macroeconomic management has been the presence of a negative connection in the period from the unemployment and inflation suggested by William Phillips (1958) and enhanced by the contribution of several economists, that plays a supportive role for different countries to determine appropriate trade-off policies while choosing between two extremes, inflation, and unemployment. Despite a strong controversy that arose from the original Phillips theory and the reality that the bulk of prior Phillips curve research studies were done in the background of the advanced economies. However, we aim to examine the Phillips curve existence and stability in the case of a developing country like Malaysia with a recent data span from 1991 to 2018. For the purpose of the study. ARDL bound econometric test model is used with the ECT based ARDL approach for assessing long-term Grander causality moving from UNE to INF. Accordingly, the Wald test is employed to check for the joint effect of short-term and long-term models. Three equations are made: error correction version of ARDL, long-term cointegration, and ECM (Error Correction Model) for short-term efficacy. The degree of co-integration is I (0) & I (1), and consequently, the empirical findings of ECM-ARDL-based causal test results showed that the trigger ratio from unemployment to inflation was unidirectional, suggesting that UNE influenced INF, means unemployment can cause inflation in the economy and the direction of causality is unidirectional and goes from UNE to INF. Furthermore, Model.2 suggests that there is a long-term inverse or trade-off association in the period from regressors (Auto-regression for inflation, Distributed lag for unemployment) and inflation with a significance level of 5%. Despite that, the study fails to reject the null hypothesis in the instance of Model.1, concluding that there is not exist a short-term association in the period from UNE and INF, which violates the short-term presence of the Phillips curve in the case of Malaysia. Behind this, the evidence revealed that there is a long-term trade-off association in the period from UNE and INF, which identifies that the Phillips curve is alive in Malaysia in the long run, and unemployment is the long-term determinant of Inflation.

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