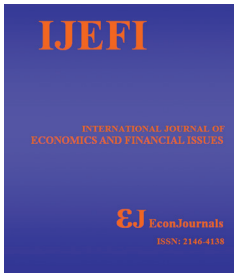

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Can Inflation be Claimed as a Monetary Phenomenon? The Malaysian Experience

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ABSTRACT

The purpose of this study is to empirically re-investigate the money-prices nexus for Malaysia through the cointegration and causality techniques. This study covered the monthly data from 1971:M1-2014:M8. The Maki multiple breaks cointegration test suggests that the variables are cointegrated. Furthermore, the MWALD test shows a unidirectional causal relationship run from money supply (M2) to aggregate prices, meaning that only the monetarist's view exist in the Malaysian economy. However, the time-varying causality tests indicate that inflation is not always a monetary phenomenon in Malaysia. Therefore, the contractionary monetary policy may not an effective instrument in managing inflationary behaviour in Malaysia.

Keywords: Cointegration, Inflation, Money, Recursive Regression, Rolling Regression
JEL Classifications: C22, E31, E51

1. INTRODUCTION

There is an increasing interest in examining the empirical question of whether inflation is a monetary phenomenon which also refers to the causal relationship between money supply and aggregate prices. The issue is important due to its relation to the formulation and implementation of appropriate macroeconomic policies in prevention inflation. Thus, the aim of this study to examine the causal relationship between money supply and aggregate prices (inflation). Theoretically, monetarists and structuralists schools of thought have essentially rooted this causal relationship. Based on the quantity theory of money (hereafter QTM), the monetarists believe that inflation is purely monetary phenomenon who claimed that a continuing increase of aggregate prices in an economy is caused by the excessive rate of expansion of the supply of money. In other words, there will be a causality running from money supply to aggregate prices. Thus, the contractionary monetary policy will be an effective anti-inflationary instrument according to the monetarists view. However, according to structuralists' school, the root cause of inflation is the structural bottlenecks in the development process (Masih and Masih, 1998). Pinga and Nelson (2001) noted that policymakers and central banks are in interest to expand the money supply by ratifying the inflationary pressures, rather than high unemployment rate or jeopardise the consumption and investment behaviour. Under this view, the causal relationship between money supply and aggregate prices is expected to run from aggregate prices to money supply.

In order to have a common consensus between monetarists and structuralists, academicians examine the causal relationship between money supply and aggregate prices in both developed and developing countries. However, the existing empirical studies thus far failed to produce consensus causal link evidence. Turnovsky and Wohar (1984) found that the causality between money supply and aggregate prices in the United States is rather neutral over the analysis period of 1929-1979. Hence, they surmised that these variables are not related in the context of the United States. On the contrary, using the United States data from 1953 to 1984, Jones and Uri (1987) found a unidirectional causality runs from money supply to aggregate prices (Jones, 1985). In addition to that, Burdekin and Weidenmier (2001) found that a drastic money supply changes will lead to drastic aggregate prices changes in the United States. This positive relationship is consistent with the conventional monetarists' wisdom that inflation is a monetary phenomenon.

As far as Malaysia is concerned, empirical studies on the causal relationship between money supply and aggregate prices or

inflation is relatively few and their finding also failed to reach unanimous results. On one hand, Abdullah and Yusop (1996) used quarterly data from 1970:1 to 1992:4 to analyze the causal relationship between growth rate of money supply and inflation rate in Malaysia. They discovered a unidirectional causality runs from money supply to inflation rate regardless of the lag structure. Next, Masih and Masih (1998) employed the Granger causality test, modified Sims causality test and vector error-correction modeling (VECM) approach to examine the causality direction between money supply and aggregate prices in the Southeast Asia economies (i.e., Malaysia, the Philippines, Singapore and Thailand). For Malaysia, they found that all causality tests are consistently implied that money supply (M1 and M2) Granger-causes aggregate prices (Lee and Li, 1985; Tan and Cheng, 1995). Using monthly data from 1975 to 1995, Tan and Baharumshah (1999) employed the Johansen's cointegration test and VECM approach to investigate the dynamic linkages between money, output, interest rate and prices in Malaysia. An interesting finding emerged from their study is that the causal effect runs from money supply to aggregate prices in the short run, but there is no evidence of reverse causality. Hence, they surmised that monetary policy may be a good choice for price stability in Malaysia. More recently, Tang (2004) employed the relatively new causality testing procedure developed by Toda and Yamamoto (1995) - modified Wald (MWALD) test to re-investigate the causal relationship between money supply and aggregate prices in Malaysia. The sample period covers the quarterly data from 1970 to 1998. The MWALD test result shows that money supply (M2) leads aggregate prices in Malaysia; however aggregate prices do not Granger-cause money supply (Karim et al., 2001). Ghazali et al. (2008) have also examined money and prices using Toda and Yamamoto causality test and found uni-directional causality running from money supply and price (proxy by consumer price index [CPI]) and also supported the QTM view. Tang (2010) re-investigates the money-prices nexus for Malaysia through the Johansen multivariate cointegration and the modified Wald (MWALD) causality techniques for 1971:M1-2008:M11 period. The MWALD causality test shows a bi-directional causal relationship between money supply (M2) and aggregate prices, meaning that both the monetarist's and also the structuralists' views are vindicated in the Malaysian economy. However, the time-varying cointegration and causality tests indicate that the cointegrating and also the causal relationships are not stable over the analysis period. These results suggest that inflation in Malaysia is not purely a monetary phenomenon.

On the other hand, Pinga and Nelson (2001) found that money supply and aggregate prices in Malaysia do not Granger-cause each other. Then, Cheng and Tan (2002) employed the Johansen's cointegration test and VECM approach to examine the long run equilibrium relationship and the causality direction between inflation and its determinants (i.e., money supply, output, interest rate, exchange rate and trade balance) in Malaysia. They found that the variables are cointegrated, but there is no evidence of direct causal effect runs from money supply to inflation in Malaysia. Their finding suggests that external forces such as the Association of Southeast Asian Nations inflation rate and exchange rate have significant influences on inflation rate in Malaysia. Recently, Tang and Lean (2007) found that the effect of money supply (M1) on inflation in Malaysia is negative and statistically significant at 1% level. This finding did not support the monetarists' view that inflation is a result of excessive rate of expansion of money supply.

The goal of this study is to re-investigate the role of money supply on aggregate price level in Malaysia over the period of 1971:M1-2014:M8. The main motivation for revisiting the Malaysia's money-prices relationship is initiated by the weaknesses in the estimation techniques used in the existing studies. First, a weakness relate to the existing studies in Malaysia is that none of a research effort has considered the implication of structural break(s) in unit root tests. Perron (1989) argued that if the estimated series contained structural break(s), the power of standard unit root test decreases tremendously and lead to spurious rejection of null hypothesis of a unit root when the structural break(s) is ignored. Second, unlike the earlier studies, we utilize the newly proposed multiple breaks cointegration test developed by Maki (2012) to examine the presence of long-run equilibrium relationship between aggregate prices and its determinants (e.g., money supply and output) in Malaysia. To the best of our knowledge, no studies in Malaysia have considered the implication of breaks on cointegration test, especially those related to money-prices nexus.

Third, until now causality testing in most empirical studies were based on VAR and VECM approaches, except Tang (2004). He and Maekawa (2001) pointed out that the use of F-statistics for Granger causality test within the VAR framework often leads to spurious causality result when one or both of the estimated series are non-stationary. Granger (1988) stated that if the first differenced variables are used such as Abdullah and Yusop's (1996) and Pinga and Nelson's (2001) studies, the Granger causality test result may be bias owing to loss of long-run causality information. In addition to that, Zapata and Rambaldi (1997) argued that both likelihood ratio test and Wald test are very sensitive to the specification of short run dynamics in the ECMs even in the large samples. In this context, the uses of VAR or VECM for causality tests seem to be problems.

In this study, we attempt to re-investigate the money-prices nexus for Malaysia through the multivariate cointegration and causality techniques. This study differs from the extant literature in at least four dimensions. First, we undertake a thorough investigation of the time series properties of the data. Apart from using the conventional unit root test - Augmented Dickey Fuller (ADF), we also employ the Lagrange multiplier (LM) unit root tests with one and two structural breaks developed by Lee and Strazicich (2003; 2004). The advantage of LM unit root tests over the ADF-type endogenous structural break(s) unit root tests (Zivot and Andrews, 1992; Lumsdaine and Papell, 1997) is that the ADF-type endogenous break tests tend to identify the incorrect break point. Lee and Strazicich (2001) showed that these tests tend to determine the break point at one period before the true break point and thus the frequency of spurious rejection is greater. Apart from that, the ADF-type endogenous structural break unit root tests assumed no break(s) under the null hypothesis of unit root and derived their critical values accordingly. Nunes et al. (1997) indicated that this assumption will lead to size distortions problem in the presence of

a unit root with structural break(s). Therefore, when utilizing the ADF-type endogenous structural break(s) unit root tests, one tends to conclude that the time series is trend stationary. However, the LM unit root tests are unaffected by the above size distortion problem.

Second, we utilize the newly proposed multiple breaks cointegration test developed by Maki (2012) to examine the presence of long-run equilibrium relationship between aggregate prices and its determinants (e.g., money supply and output) in Malaysia. Third, we follow Tang's (2004) study to use the MWALD test to examine the causality direction between money supply and aggregate prices in Malaysia. Finally, this study propose to incorporate the recursive regression and also rolling regression procedures into the MWALD test to examine the persistency of causality test result, particularly on the monetarist view. By doing this, we are able to assess the effectiveness of monetary policy in combating inflation in Malaysia. In other words, if causality result for monetarist view (i.e,. money supply Granger-causes aggregate prices) is stable, monetary policy will be the effective price stability instrument. Otherwise, the use of contractionary monetary policy to combat inflation will detrimental the economic development in Malaysia.

The rest of the paper is organized as follows. The next section gives a brief outline of the data, model and econometric techniques used in this study. The empirical results are presented and discussed in Section 3. Finally, Section 4 presents the conclusions.

2. DATA, MODEL AND ECONOMETRIC TECHNIQUES

2.1. Data and Model

The data used in this study are the monthly data from 1971:M1 to 2014:M8. These data were extracted from International Monetary Funds International Financial Statistics and Bank Negara Malaysia Monthly Statistical Bulletin. The data for money supply (M2), (CPI, 2010), and industrial production index (IPI, 2010) are used in this study. The series IPI is used as a proxy for output due to unavailability of monthly data for gross domestic products. However, all data are transformed into natural logarithm form.

To examine the money-prices nexus for Malaysia, we apply the trivariate model specification which has been derived from the QTM. The model is presented as follow:

$$\ln P_t = \alpha_1 + \alpha_2 \ln M2_t + \alpha_3 \ln Y_t + \varepsilon_t \quad (1)$$

Where, ln denotes as the natural logarithm. $\ln P_t$ is the aggregate prices, $\ln M2_t$ is the money supply M2 and $\ln Y_t$ represents the transaction output proxy by IPI. The residuals ε_t are assumed to be white noise and spherical distribution.

2.2. Econometric Techniques

2.2.1. Lagrange multiplier unit root tests

To determine the order of integration, we use the Lee and Strazicich (2003; 2004) LM unit root tests with one and two structural breaks. In this study, we use Model C and Model CC for one and two breaks tests, respectively because they perform better than other models (Sen, 2003). The LM unit root tests with one and two structural breaks can be obtained by estimating the following regression model:

$$\Delta y_t = \delta' \Delta Z_t + \phi \tilde{S}_{t-1} + \sum_{i=1}^{k} \gamma_i \Delta \tilde{S}_{t-i} + \xi_t \quad (2)$$

Where, $\tilde{S}_{t-1} = y_t - \tilde{\psi}_x - Z_t \tilde{\delta}$, t = 2,…,T; $\tilde{\delta}$ are coefficients estimated in the regression of Δy_t on ΔZ_t; The lagged augmented terms $\Delta \tilde{S}_{t-i}$ are included into the model to remove the serial correlation problem; $\tilde{\psi}_x$ is given by $y_1 - Z_1 \tilde{\delta}$; y_1 and Z_1 are the first observations of y_t and Z_t, respectively. Z_t is a vector of exogenous variables. In the case of the model C, one structural break unit root test, $Z_t = [1, t, D_{1t}, DT_{1t}]'$ while in the case of the model CC, two structural breaks unit root test, $Z_t = [1, t, D_{1t}, D_{2t}, DT_{1t}, DT_{2t}]'$, where $D_{jt} = 1$, $DT_{jt} = t - T_{Bj}$ for $t \geq T_{Bj} + 1$, j = 1,2 and zero otherwise. T_{Bj} is the time period of the structural break(s) and $\delta' = (\delta_1, \delta_2, \delta_3)$. The LM unit root tests statistics is given by: τ = t-statistics for testing the null hypothesis of a unit root $\phi = 0$. The location of the structural break(s) (T_{Bj}) is determined by selecting all plausible break point(s) for the minimum statistic as follow:

$$\text{Inf}\, \tilde{\tau}(\tilde{\lambda}_i) = \underset{\lambda}{\text{Inf}}\, \tilde{\tau}(\lambda), \text{ Where, } \lambda = \frac{T_B}{T}$$

The break points search is carried out over the 80% trimming region (0.10T, 0.90T), where T is the total numbers of observations. Critical values for LM unit root test with one structural break case are tabulated in Lee and Strazicich (2004), while the critical values for two structural breaks case are tabulated in Lee and Strazicich (2003). Finally, the RATS programming codes will be used to compute both LM tests for unit root.

2.2.2. Cointegration test with multiple breaks

In this section, we will briefly discuss the newly residual-based test for cointegration with multiple breaks introduced by Maki (2012). With regard to this, Maki (2012) proposed to use the following four regression models to test for cointegration with multiple breaks:

Model 0 - (C): Level shift without trend

$$y_t = \mu + \sum_{i=1}^{k} \theta_i D_{i,t} + \beta' x_t + \varepsilon_t \quad (3)$$

Model 1 - (C/T): Level shift with trend

$$y_t = \mu + \sum_{i=1}^{k} \theta_i D_{i,t} + \gamma t + \beta' x_t + \varepsilon_t \quad (4)$$

Model 2 - (C/S): Regime shift

$$y_t = \mu + \sum_{i=1}^{k} \theta_i D_{i,t} + \beta' x_t + \sum_{i=1}^{k} \varphi_i' x_t D_{i,t} + \varepsilon_t \quad (5)$$

Model 3 - (C/T/S): Regime and trend shift

$$y_t = \mu + \sum_{i=1}^{k} \theta_i D_{i,t} + \gamma t + \sum_{i=1}^{k} \theta_i t D_{i,t} + \beta' x_t + \sum_{i=1}^{k} \varphi_i' x_t D_{i,t} + \varepsilon_t \quad (6)$$

Where, $y_t = [\ln P_t]$ and $x_t = [\ln M2_t, \ln Y_t]'$ are the I(1) variables. ε_t is the equilibrium error term. The parameters μ and $\beta' = [\beta_1, \beta_2]$ are the cointegrating coefficients before the structural break occurs. However, $\theta_i' = [\theta_1, \ldots, \theta_5]$ are the level shift coefficients, while $\varphi_i' = [\varphi_1, \ldots, \varphi_5]$ and $\vartheta_i' = [\vartheta_1, \ldots, \vartheta_5]$ denote the change in the slope of the cointegrating coefficients and the slope of the time trend. $D_{i,t} = 1$ if $t > TB_i$ $(i=1,\ldots,k)$ and zero otherwise, where k is the maximum number of breaks and TB_i is the time period at which the structural break occurs. Similar to the Gregory and Hansen (1996) and Hatemi (2008) tests for cointegration, the potential breakpoints are unknown. In light of this, the sequential searching procedure proposed by Bai and Perron (1998; 2003) will be used to detect the potential breakpoints and the number of break where the test statistic is minimum.

A set of asymptotic critical values are tabulated in Maki (2012) with reference to number of breaks and explanatory variables. Nevertheless, these critical values are generated for sample size of 1,000 and 10,000 replications. Since the provided asymptotic critical values in Maki (2012) are for very large sample, it might not be suitable for study with smaller sample such as the present study (T = 524). Therefore, we compute a new set of critical values specific to the sample size of this study. In addition, these new critical values are computed based upon the GAUSS code used to generate the original set of critical values. If the calculated test statistic is greater than the critical values, then the null hypothesis of no cointegration can be rejected. Interested reader may refer to Maki (2012) for the details procedure to generate critical values for residuals-based test for cointegration with multiple breaks.

2.2.3. Causality test

To ascertain the direction of causality between money supply (M2) and aggregate prices in Malaysia, this study employs the MWALD test developed by Toda and Yamamoto (1995). To implement the MWALD test, we estimate the augmented VAR model as presented in equation (7).

$$\begin{bmatrix} \ln P_t \\ \ln M2_t \\ \ln Y_t \end{bmatrix} = \begin{bmatrix} \beta_1 \\ \beta_2 \\ \beta_3 \end{bmatrix} + \begin{bmatrix} B_{11,1} & B_{12,1} & B_{13,1} \\ B_{21,1} & B_{22,1} & B_{23,1} \\ B_{31,1} & B_{32,1} & B_{33,1} \end{bmatrix} \times \begin{bmatrix} \ln P_{t-1} \\ \ln M2_{t-1} \\ \ln Y_{t-1} \end{bmatrix} + \cdots + \begin{bmatrix} B_{11,k} & B_{12,k} & B_{13,k} \\ B_{21,k} & B_{22,k} & B_{23,k} \\ B_{31,k} & B_{32,k} & B_{33,k} \end{bmatrix} \times \begin{bmatrix} \ln P_{t-k} \\ \ln M2_{t-k} \\ \ln Y_{t-k} \end{bmatrix} + \begin{bmatrix} B_{11,p} & B_{12,p} & B_{13,p} \\ B_{21,p} & B_{22,p} & B_{23,p} \\ B_{31,p} & B_{32,p} & B_{33,p} \end{bmatrix} \times \begin{bmatrix} \ln P_{t-p} \\ \ln M2_{t-p} \\ \ln Y_{t-p} \end{bmatrix} + \begin{bmatrix} \varepsilon_{1t} \\ \varepsilon_{2t} \\ \varepsilon_{3t} \end{bmatrix} \quad (7)$$

Where k is the optimal lag orders and p represents k+1 lag orders. From equation 7, $B_{12,k} \neq 0 \forall_k$ implies that money supply (M2) Granger-causes aggregate prices; whereas if $B_{21,k} \neq 0 \forall_k$ means aggregate prices Granger-cause money supply (M2). However, it should be pointed out here that the parameters for the extra lag, i.e., $d_{max} = 1$, in equation 7 are unrestricted because the inclusion of extra lag is to ensure that the asymptotic χ^2 distribution critical value can be applied when the test for causality between the integrated variables are conducted. The $d_{max} = 1$ is chosen because it performs better than other maximal order of integration (Dolado and Lütkepohl, 1996).

3. EMPRICIAL RESULTS

3.1. Unit Root Test Results

Prior to Johansen cointegration and also causality tests, it is necessary for this study to conduct unit root tests to determine the time properties for each series. In order to ascertain the order of integration, we begin by applying the ADF unit root test. The testing results suggest that the variables [$\ln P_t$, lnM2, $\ln Y_t$] are each integrated of order one, I(1). To conserve space, the ADF test results are not reported here. Nevertheless, as we discussed in Section 1, the conventional ADF unit root test has low power when the series contained structural break(s). To circumvent this, we performed the LM unit root tests with one and two structural break(s) to affirm the order of integration and the results are presented in Table 1.

Based upon the unit root results presented in Table 1, we find that both LM unit root tests cannot reject the null hypothesis of a unit roots for all series. Thus, we can conclude that all of the series in this study are integrated of order one, I(1). This result is consistent to Nelson and Plosser's (1982) assertion that most of the macroeconomics series are non-stationary at level, but it is stationary after first differencing. With these findings, we can proceed to investigate the presence of a long-run equilibrium relationship between aggregate prices, money supply (M2) and output in Malaysia using the residuals-based test for cointegration with multiple breaks proposed by Maki (2012).

3.2. Cointegration Test Results

The results of Maki residuals-based test for cointegration with multiple breaks and the simulated critical values with respect to the sample size of this study are together presented in Table 2.

Table 1: The results of unit root tests with structural breaks(s)

Panel A: Univariate LM test for unit root with one structural break			
	$\ln P_t$	$\ln M2_t$	$\ln Y_t$
TB1	1985:M8	1979:M9	2001:M2
S_{t-1}	−3.772	−2.183	−4.313
Lag length	6	1	1
Critical values			
1%	−5.15	−5.07	−5.11
5%	−4.45	−4.47	−4.51
Panel B: Univariate LM test for unit root with two structural breaks			
TB1	1985:M7	1983:M2	1988:M2
TB2	1994:M1	1993:M9	2008:M12
S_{t-1}	−4.564	−3.024	−5.627
Lag length	6	1	1
Critical values			
1%	−6.45	−6.45	−6.42
5%	−5.67	−5.67	−5.65

The RATS programme codes provided by Junsoo Lee have been used to perform the above LM tests for unit root with one and two structural breaks, respectively

Table 2: The results of multiple break cointegration tests

	Model 0 - (C)	Model 1 - (C/T)	Model 2 -(C/S)	Model 3 - (C/T/S)
TB1	1975:M11	1973:M3	1973:M10	1975:M2
TB2	1978:M5	1975:M11	1981:M1	1980:M11
TB3	1985:M6	1981:M1	-	1983:M1
TB4	1987:M9	1995:M5	-	1998:M1
TB5	1997:M11	2003:M9	-	2008:M10
Test statistics	−5.725**	−6.582***	−6.096***	−7.418
Exact critical values (T=524)				
1%	−6.1243	−6.3038	−5.9180	−8.1810
5%	−5.5034	−5.7942	−5.3758	−7.5667

*** and ** denote significance at the 1%, 5% and 10% levels respectively

In this study, we employ four models, namely C, C/T, C/S and C/T/S as suggested by Maki (2012). Overall, we find that the test statistics of 3 out of 4 models (i.e.,

C, C/T and C/S) reject the null hypothesis of no cointegration at the 1% and 5% significance levels. Therefore, we conclude that lnP_t, $lnM2_t$ and lnY_t in Malaysia are cointegrated and there exists a long-run relationship between these variables.

Having established that the variables in this study are cointegrated, we estimate the long-run impacts of money supply and output on aggregate price in Malaysia using four different long-run estimators to check for the robustness of the estimation results. Among the long-run estimators used in the present study are the ordinary least squares (OLS) proposed by Engle and Granger (1987), fully ordinary modified least squares introduced by Phillips and Hansen (1990), dynamic OLS developed by Stock and Watson (1993) and canonical cointegrating regressions suggested by Park (1992). The long-run elasticities are presented in Table 3. Unlike Tang and Lean (2007), we find that money supply has significant positive impact on aggregate prices in Malaysia as suggested by the four estimators. Nonetheless, the results reveal that output does not affect aggregate prices in the long-run. Obviously, our findings support the monetarists' view that output is constant in the long-run and money supply is the root cause of inflationary problem. More specifically, we find that a 10% increase in money supply, on average, increases the aggregate price level in Malaysia by approximately 2.4% in the long-run.

Turning to the short-run relationship, we estimate the VECM with the aggregate prices as the dependent variable. The estimation results are reported in Table 4. The estimated lagged error-correction terms (ECT_{t-1}) is negative and statistically significant at the 1% level, meaning that the finding of cointegration is valid as suggested by Kremers et al. (1992). In addition, it also implies that the model is correctly specified (Perman, 1991). Conceivably, the estimated models can thus be accepted as a tentatively adequate representation of the data generating process and can be used to explain the inflationary phenomenon in Malaysia. The coefficients size for the lagged ECT is relatively small which means that the speed of convergence to the long-run equilibrium is slow once the system is exposed to a shock. This result is corroborating to our prior expectation and also the monetarist views.

3.3. MWALD Causality Test Results

According to Granger representation theorem, if the variables are cointegrated, there must be at least one direction of causal

Table 3: The results of long-run coefficients

Variables	OLS	FMOLS	DOLS	CCR
Constant	1.2185***	1.1934***	1.3838***	1.1958***
	(29.4739)	(5.0092)	(13.3962)	(4.9709)
$lnM2_t$	0.2474***	0.2485***	0.2342***	0.2485***
	(33.9718)	(5.9212)	(13.8029)	(5.8604)
lnY_t	0.0009	0.0017	0.0096	0.0014
	(0.0734)	(0.0231)	(0.3336)	(0.0182)

OLS: Ordinary least squares, FMOLS: Fully ordinary modified least squares, DOLS: Dynamic ordinary least squares, CCR: Canonical Cointegrating regressions, The asterisk ***denotes significance at the 1% level. The parenthesis ( ) indicates the t-statistics

Table 4: The results of short-run coefficients

Variables	Constant	$\Sigma\Delta lnM2_t$	$\Sigma\Delta lnY_t$	ECT_{t-1}
Coefficients	0.0012***	0.0432***	0.0165***	−0.0144***
	(3.9764)	(2.6905)	(2.5758)	(−3.3676)
Diagnostic tests:				
χ^2_{SERIAL}	[2]: 2.3425			
χ^2_{ARCH}	[1]: 0.0975			
χ^2_{RESET}	[1]: 0.3270			
Bai-Perron test for stability	22.4210			

The asterisk *** denotes significance at the 1% level. ( ) indicates the t-statistics, while [ ] shows the order of diagnostic tests

relationship to hold the existence of a long-run equilibrium relationship. Therefore, we proceed to estimate the augmented-VAR model to investigate the causality direction between money supply and aggregate prices in Malaysia. As the VAR model is sensitive to the choice of lag structure measures such as system-wide Akaike's Information Criterion (AIC) and system-wide Bayesian Information Criterion (BIC) are used to select the appropriate lag structure. Based upon the system-wide AIC, the best lag structure is 17 months, but the system-wide BIC prefers 3 months. The selected maximal order of integration (d_{max}) is one, thus we estimate the VAR(18) as an augmented model for MWALD tests.

We report the result of MWALD test in Table 5. The MWALD test statistics suggest that money supply is statistically significant at the 5% level in the aggregate prices equation, but the aggregate prices is not statistically significant in money supply (M2) equation at the 10% level. These imply that there is unidirectional causality running from money supply to aggregate prices, but there is no evidence of reverse causality. Therefore, only the monetarists'

Table 5: The results of Toda-Yamamoto causality tests

Null hypotheses	MWALD tests (P-values)	
	AIC	BIC
$\ln M2_t \not\rightarrow \ln P_t$ (Monetarists' view)	74.3568*** (0.0000)	8.8453** (0.0120)
$\ln P_t \not\rightarrow \ln M2_t$ (Structuralists' view)	11.2728 (0.7923)	5.8527 (0.0536)

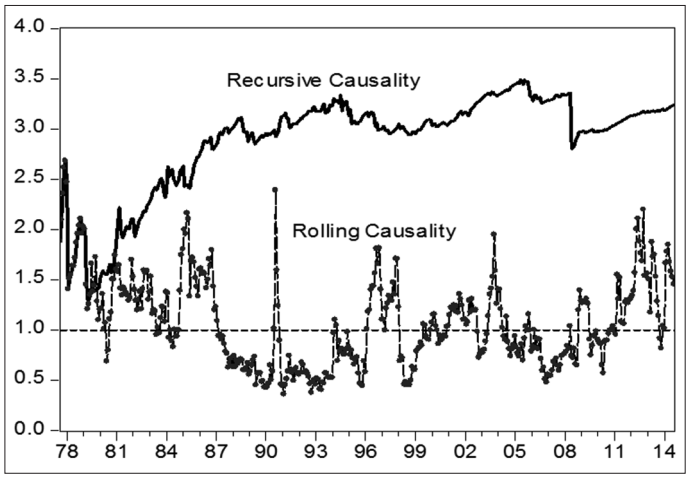
The asterisks *** and ** denote statistically significant at the 1% and 5% levels

view is supported by the Malaysian data over the period of 1971:M1-2014:M8. This result is corroborated to the findings of Tang (2004) that structuralists' may not exist in the context of Malaysian economy. This evidence may shed some light that inflation is a monetary phenomenon but insufficient in assessing the effectiveness of monetary policy in curbing inflation. This is because the causal relationships may change over time owing to the change of economic and political environments (Tang, 2013). To deal with this possibility of time-varying causality, we employ both recursive and also rolling causalities, methods that explicitly allow for changes in the causal relationships between money supply and aggregate prices. To the best of our knowledge, very few research efforts have considered this issue, especially for the case of Malaysia. Therefore, it is interesting for this study to examine the stability or persistency of monetarists' view in explaining inflationary behaviour in Malaysia through the time-varying causality tests.

In running the recursive and rolling regression procedures, we have to pre-specify the observations to start and rolling window size, respectively. To the best of our knowledge, there is no formal statistical procedure to select the optimal sample for recursive and rolling regressions, thus the choice of initial sample seem arbitrary. For this reason, we set the initial sample as 80 for monthly data (i.e., 6 years). In addition, the χ^2 - statistics for MWALD causality tests will be normalized by the 10% critical value. If the ratio is above one then the null hypothesis of money supply does not Granger-causes aggregate prices can be rejected. In other words, if inflation always a monetary phenomenon in Malaysia, then a large number of significant statistics should be observed when the sample is forwards.

The time-varying causality tests results are reported in Figure 1. From the graphs, we observed that as the sample size increases the recursive causality test statistics tend to reject the null hypothesis of money supply (M2) does not Granger-causes aggregate prices in Malaysia. The increasing trend of recursive causality test statistics may due to the power of the test increases. Obviously, the conclusion from the causality test result based upon full sample (Table 5) may not be a good guidance. In order to disentangle this effect, the power of the causality test needs to be maintained fixed. Therefore, the rolling causality approach proposed by Tang (2013) with constant sample size will be a good remedy. Based upon the results of rolling causality, we observe that the causality test statistics are varied over the sample period of analysis. Furthermore, most of the test statistics failed to reject the null hypothesis of money supply does not Granger-causes aggregate prices. Specifically, the rejection frequency is only about 51.7%

Figure 1: The results of time-varying causality tests for the null hypothesis of " lnM2 does not Granger-causes lnP"



which is low. With this evidence, we may surmise that inflation is a monetary phenomenon in Malaysia as shown by the full sample causality tests (Table 5), but this is not always the case because our time-varying causality results reveal that the causal relationships are not stable. As a result, the implementation of contractionary monetary policy in order to combat inflation may not be a wise strategy.

4. CONCLUSION AND POLICY IMPLICATIONS

This paper attempts to re-investigate the role of money in explaining the behaviour of inflation in Malaysia through the newly developed multiple breaks cointegration test proposed by Maki (2012) and the MWALD causality tests. Some remarkable findings have been discovered by the present study. First, the evidence from Maki's multiple breaks cointegration test suggests that there is a long-run relationship between aggregate prices and its determinants (i.e., money supply and output) in Malaysia. We find that the money supply (M2) has significant positive on aggregate prices. Second, our empirical result suggests that there is a unidirectional causality running from money supply to aggregate prices. This implies that the monetarist's views exist in Malaysian economy, while we failed to obtain any evidence to support the presence of structuralists' view. Nevertheless, using time-varying causality tests (i.e., recursive and rolling causalities), we find that the causal relationship is not stable over the analysis period. Hence, we surmise that inflation is not always a monetary phenomenon in Malaysia even though the results of full sample causality test support the monetarists' view.

According to the results obtained from this study, since inflation is not always a result of monetary factors the implementation of contractionary monetary policy by central bank alone may not be an effective anti-inflationary instrument. Therefore, other policies such as fiscal and supply-sides economy may be appropriate for controlling inflationary behaviour in Malaysia. Specifically, the supply-sides economy may simultaneously decrease macroeconomics evils, inflation and unemployment

rates, meanwhile this strategy may also increase the Malaysia's output level. In summary, the supply-sides economy will stimulate Malaysia's economic growth and lower inflation as well as unemployment rates in Malaysia. In light of this, the supply-side economy such as giving incentive to businesses to encourage productivity and output will be one of the best strategies to stimulate economic growth, meanwhile controlling inflationary phenomenon in Malaysia.

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REFERENCES

Abdullah, A.Z., Yusop, Z. (1996), Money inflation and causality: The case of Malaysia (1970-92). The Asian Economic Review, 38(1), 44-51.

Bai. J., Perron, P. (1998), Estimating and testing linear models with multiple structural changes. Econometrica 66(1), 47-78.

Bai, J., Perron, P. (2003), Computation and analysis of multiple structural change models. Journal of Applied Economics 18(1), 1-22.

Burdekin, R.C.K., Weidenmier, M.D. (2001), Inflation is always and everywhere a monetary phenomenon: Richmond vs. Houston in 1864. American Economic Review, 91(5), 1621-1630.

Cheng, M.Y., Tan, H.B. (2002), Inflation in Malaysia. International Journal of Social Economics, 29(5), 411-425.

Dolado, J.J., Lütkepohl, H. (1996), Making Wald tests work for cointegrated VAR system. Econometric Reviews, 15(4), 369-386.

Engle, R.F., Granger, C.W.J. (1987), Co-integration and error-correction: Representation, estimation, and testing. Econometrica, 55(2), 251-276.

Ghazali, M.H., Amin, H., Muhammad, M.Z., Samsu, S.H. (2008), Linkage between money and prices: A causality analysis for Malaysia. International Business Research, 1(4), 82-87.

Granger, C.W.J. (1988), Some recent developments in a concept of causality. Journal of Econometric, 39(1-2), 199-211.

Gregory, A.W., Hansen, B.E. (1996), Residual-Based tests for cointegration in models with regime shifts. Joumal of Econometrics, 70, 99-126.

Hatemi, J.A. (2008), Tests for cointegration with two unknown regime shifts with an application tofinancial market integration. Empirical Economics, 35, 497-505.

He, Z., Maekawa, K. (2001), On spurious Granger causality. Economics Letters, 73(3), 307-313.

Jones, J.D. (1985), Money, inflation, and causality (a look at the empirical evidence for the U.S., 1974-1983). Socio-Economic Planning Sciences, 19(5), 363-369.

Jones, J.D., Uri, D. (1987), Money, inflation and causality (another look at the empirical evidence from the USA, 1953-1984). Applied Economics, 19, 619-634.

Karim, Z.A., Mokhtar, A., Zaidi, M.A.S. (2001), Dasar kewangan, sasaran matlamat pertengahan dan matlamat ekonomi. Jurnal Ekonomi Malaysia, 35, 13-35.

Kremers, J.J.M., Ericsson, N.L., Dolado, J. (1992), The power of cointegration tests. Oxford Bulletin of Economics and Statistics, 54(3), 325-348.

Lee, J., Strazicich, M.C. (2001), Break point estimation and spurious rejections with endogenous unit root tests. Oxford Bulletin of Economics and Statistics, 63(5), 535-558.

Lee, J., Strazicich, M.C. (2003), Minimum Lagrange multiplier unit root test with two structural breaks. Review of Economics and Statistics, 85(4), 1082-1089.

Lee, J., Strazicich, M.C. (2004), Minimum LM Unit Root Test with One Structural Break. Boone, NC: Department of Economics, Appalachian State University.

Lee, S., Li, W. (1985), The lead-lag relationship of money, income and prices in Malaysia. Singapore Economic Review, 28, 73-87.

Lumsdaine, R., Papell, D. (1997), Multiple trend breaks and the unit root hypothesis. Review of Economics and Statistics, 79(2), 212-218.

Maki, D. (2012), Tests for co-integration allowing for an unknown number of breaks. Economic Modelling, 29, 2011-2015.

Masih, A.M.M., Masih, R. (1998), Does money cause prices, or the other way around? Multi-country econometric evidence including error-correction modelling from South-East Asia. Journal of Economic Studies, 25(3), 138-160.

Nelson, C.R., Plosser, C.I. (1982), Trends and random walks in macroeconomic time series: Some evidence and implications. Journal of Monetary Economics, 10(2), 139-162.

Nunes, L., Newbold, P., Kaun, C. (1997), Testing for unit roots with structural breaks; Evidence on the great crash and the unit root hypothesis reconsidered. Oxford Bulletin of Economics and Statistics, 59(4), 435-448.

Park, J.Y. (1992), Canonical co-integrating regressions. Econometrica, 60(1), 119-143.

Perman, R. (1991), Cointegration: An introduction to the literature. Journal of Economic Studies, 18(3), 3-30.

Perron, P. (1989), The great crash, the oil price shock and the unit root hypothesis. Econometrica, 57(6), 1361-1401.

Phillips, P.C.B., Hansen, B. (1990), Statistical inference in instrumental variables regression with I(1) processes. Review of Economic Studies, 57(1), 99-125.

Pinga, V.E.B., Nelson, G.C. (2001), Money, prices and causality: Monetarist versus structuralist explanations using pooled country evidence. Applied Economics, 33(10), 1271-1281.

Sen, A. (2003), On unit-root tests when the alternative is a trend-break stationary process. Journal of Business and Economic Statistics, 21(1), 174-184.

Stock, J.H., Watson, M.W. (1993), A simple estimator of cointegrating vectors in higher order integrated systems. Econometrica, 61(4), 783-820.

Tan, H.B., Baharumshah, A.Z. (1999), Dynamic causal chain of money, output, interest rate and prices in Malaysia: Evidence based on vector-error correction modelling analysis. International Economic Journal, 13(1), 103-120.

Tan, K.G., Cheng, C.S. (1995), The causal nexus of money, output and prices in Malaysia. Applied Economics, 27, 1245-1251.

Tang, C.F. (2010), The money-prices nexus for Malaysia: New empirical evidence from the time-varying cointegration and causality tests. Global Economic Review, 30(4), 303-403.

Tang, C.F. (2013), A revisitation of the export-led growth hypothesis in Malaysia using leveraged bootstrap simulation and rolling causality techniques. Journal of Applied Statistics, 40(11), 2332-2340.

Tang, C.F., Lean, H.H. (2007), Is the Phillips curve stable for Malaysia? New empirical evidence. Malaysian Journal of Economic Studies, 44(2), 95-105.

Tang, T.C. (2004), Causality between money and price in Malaysia: A revisit. Labuan Bulletin of International Business and Finance, 2(1), 71-81.

Toda, H.Y., Yamamoto, T. (1995), Statistical inference in vector auto regressions with possibly integrated processes. Journal of

Econometrics, 66(1-2), 225-250.
Turnovsky, S., Wohar, M. (1984), Monetarism and the aggregate economy: Some long run evidence. Review of Economics and Statistics, 66(4), 619-629.
Zapata, H.O., Rambaldi, A.N. (1997), Monte Carlo evidence on co-integration and causation. Oxford Bulletin of Economics and Statistics, 59(2), 285-298.
Zivot, E., Andrews, D. (1992), Further evidence of the great crash, the oil-price shock and the unit-root hypothesis. Journal of Business and Economic Statistics, 10(3), 251-270.