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Credit Card Usage and Inflation: A Case Study of a Small Open Economy

(Penggunaan Kad Kredit dan Inflasi: Satu Kajian Kes Ekonomi Kecil Terbuka di Malaysia)

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ABSTRACT

This study examined the influence of credit card usage on inflation in a small open economy, Malaysia. The existing studies used money supply, and bank lending as the key monetary determinants of inflation in Malaysia. These two variables had also been re-examined separately for comparison purpose. Other macroeconomic variables were economic activity and imports. The paper employs The Autoregressive Distributed Lag (ARDL) approach using time series data with monthly observations over 1997-2017. The results of this study showed that the price level, the imports and economic activity were cointegrated. In the long-run, credit card usage was more elastic than bank lending. The economic activity remained the most elastic determinant of price level. In the short-run, bank credit growth, and money supply growth determine the inflation. Meanwhile, imports growth and economic growth did not influence the inflation. The past inflation rates were found to be informative to the current inflation. Hence, this study suggested that inflation in Malaysia was due to 'too much financing'. This study also provided policy implications.

Keywords: Bank credit; credit card usage; cointegration; inflation; money supply

ABSTRAK

Kajian ini mengkaji kesan penggunaan kad kredit terhadap inflasi di sebuah ekonomi kecil terbuka di Malaysia. Kajian sedia ada telah menggunakan penawaran wang, dan pinjaman bank sebagai penentu kewangan utama bagi inflasi di Malaysia. Kedua-dua pemboleh ubah ini juga dikaji semula secara berasingan bagi tujuan perbandingan. Pemboleh ubah makroekonomi yang lain adalah aktiviti ekonomi dan import. Kertas ini menggunakan pendekatan Autoregressive Distributed Lag (ARDL) dengan data siri masa meliputi pemerhatian bulanan bagi tempoh 1997-2017. Hasil kajian ini menunjukkan bahawa tingkat harga, import, dan aktiviti ekonomi adalah berkointegrasi. Dalam jangka masa panjang, penggunaan kad kredit adalah lebih anjal daripada pinjaman bank. Aktiviti ekonomi masih kekal sebagai penentu paling anjal bagi tingkat harga. Dalam jangka masa pendek, pertumbuhan pinjaman bank, dan penawaran wang mempengaruhi inflasi. Sementara itu, pertumbuhan import, dan pertumbuhan ekonomi adalah tidak mempengaruhi inflasi. Kadar inflasi lepas didapati mengandungi maklumat terhadap inflasi semasa. Oleh itu, kajian ini mendapati inflasi di Malaysia adalah disebabkan oleh "terlalu banyak pembiayaan". Kajian ini juga membincangkan implikasi dasar.

Kata kunci: Pinjaman bank; penggunaan kad kredit; kointegrasi; inflasi; penawaran wang

INTRODUCTION

Inflation is generally defined as an average rate of increase in the overall price level of goods and services which is measured by the consumer price index (CPI) in a country over a respective period. It reflects an increase in the cost of living because of the falling in the value of fiat money. More generally, classical view considered inflation as a monetary phenomenon which was assumed to have happened in every country because there was "too much money" in the markets (Friedman, 1970). This was to say that an increase in money supply by the country would bring an increase in the general price level. Meanwhile, Keynesian theory (Keynes, 1936) postulated that when the increase in the aggregate demand exceeded the aggregate supply, the price level increased- under an assumption of full employment, a rise in consumption would result in higher aggregate demand by households, which consequently increased the general price level.

Figure 1 illustrates how Malaysia's inflation behaves historically from1960 to 2016. It was interesting to highlight that the country had recorded an unfavourable inflation episodes almost every decade from the mid-1970s to the late 2000s. The average inflation rates were about 14%, and 8.2% in 1973-1974, and 1980-198, respectively, in which the first inflation shock was due to the sharp world oil price increased that resulted in world inflation, while similarly external factors contributed to the second episode of the inflation. On 2nd June 1995,

Malaysia had initiated the so-called 'zero inflation' campaign that zero inflation could be achieved if prices of necessities remained stable; mentioning that zero inflation was not only desirable but also achievable. Indeed, Cheng and Tan (2002) had forwarded that Malaysia was able to maintain a stable and low inflation rate during 1988-1996. Additionally, as noted by Syarisa (2002) Malaysia's inflation rate hiked up from 2.7% in 1997 to 5.3% in 1998 due to the Asian financial crisis because of the increase in food prices. In the early 2000s, Malaysia's inflation rates were in the range of about 1-2%, and it had recorded 5.4% in 2008 because of the global financial crisis where the sub-prime mortgage and housing bubble had led to a banking crisis in the United States; that shock had been transmitted to the Malaysian economy (Abidin & Rasiah, 2009). The recent inflation rates in Malaysia were relatively *controllable* about 2-3% averaged per annum between 2010 and 2016. As noted by the Monetary Policy Statement by Bank Negara Malaysia on 12 September 2019, the average headline inflation year-to-date was 0.3%., and it was projected to average higher for the remaining months of the year and into 2020.

A fundamental concern forwarded by this study was that, according to a statement by the Bank Negara Malaysia (Central Bank of Malaysia), in 2017, "*Malaysia's inflation surges to its highest in 8 years and economists believed that the global oil price was the principal reason for the escalation of the inflation*".[1] As noted by Nolt, "*Inflation is better understood as too much credit chasing too few goods. The major cause of inflation through history is credit and not just money, expanding faster than real output*."[2] There were a few studies (e.g. Tang 2001a; Tang 2001b; Tang 2004) that looked at the effect of bank lending expansion on inflation in Malaysia. Their studies acknowledged this hypothesis. In fact, the widespread use of credit cards could increase trading efficiency, but would consequently result in inflation (Geanakoplos & Dubney 2010, p. 325). As of June 2017, there were about 3.6 million credit card holders in Malaysia, and their outstanding balance was RM36.9 billion where 7.3% or RM2.7 billion was overdue balance.[3] The number of credit card transactions had been increasing throughout the years from 359.6 million in 2015 to 383.8 million in 2016, and 406.5 million in 2017.[4] As such, there was a 6.73% increased from 2015 to 2016, and a 5.91% increased from 2016 to 2017 in credit card transactions, respectively. These statistics reflected a positive correlation between credit card usage and the inflation in Malaysia. Nevertheless, there were only two studies available (e.g. Geanakoplos & Dubney 2010; Yilmazkuday 2010) that examined this hypothesis about the effect of credit cards on inflation, but none in Malaysia. This study filled this gap.

This study aimed to explore the inflation (price level) behaviour in Malaysia by further considering the effect of credit cards usage as suggested by Yilmazkuday (2010). This study also re-estimated the effect of money supply and bank credit on inflation in Malaysia for comparison purpose. A feasible research question to be answered in this study was "*Does either too much money or too much financing (via credit cards) result in inflation in a small open economy, in Malaysia?"* The answer was '*too much financing via credit cards"*. This study found that credit card usage had increased Malaysia's inflation rate in the long-run. It was based on the long-run estimates of the Autoregressive Distributed Lag (ARDL) approach for monthly data between 1997 and 2017. Conversely, this study extended the body of knowledge of the Malaysian inflation that the existing studies in Malaysia had over-looked this variable, i.e. credit cards usage that financed households' consumption. Mansor (2000), Cheng and Tan (2002), Fahmi et al. (2008), Shahidan et al. (2012),

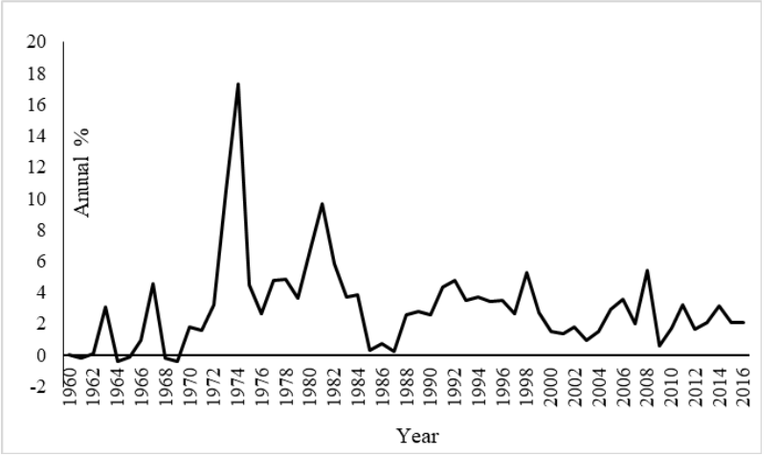


FIGURE 1. The Malaysian inflation, 1960-2016
**Source*: https://data.worldbank.org/

and Venkadasalam (2015) found the cointegration property of inflation (price) equations at the most to be the macroeconomic variables (e.g. money supply, interest rate, income, private consumption, government expenditure, exchange rate, trade balance and capital inflows). Maryam et al. (2014), and Rabiul et al. (2017) had directly estimated the inflation model without testing its cointegration. Abdul Majid (2007) only considered the causalities among money supply, industrial production index, and CPI, while Zaidi et al. (2016) was based on SVAR estimates. The existing studies had heavily trusted the traditional inflation (price) model where Milton Friedman was believed to have once said, "*Inflation is always and everywhere a monetary phenomenon".* They had examined the influence of money (e.g. money supply) as a fundamental determinant of inflation in Malaysia. Indeed, the potential influence of "finance" was ignored, except for Tang (2001a; 2001b; 2004) who had incorporated bank lending in order to estimate the inflation models in Malaysia. However, Tang (2001a) found that bank lending, and money supply M3 were statistically insignificant. This study applied credit card usage that assumed to finance the households' consumption as 'fresh' determinant of inflation in Malaysia, in the comparison of money supply, and bank lending. Undoubtedly, this study offered a better understanding of inflation determination to policy makers, especially to the central banker, Bank Negara Malaysia on monetary policy- that credit card usage was more feasible as policy instrument along with money supply, and bank lending.

The next section was about literature review for the selected studies, globally as well as those that examined the case of Malaysia. Section3 described the empirical inflation models, variables, and estimation procedure -ARDL (autoregressive-distributed lag) procedure. The empirical results were reported in Section 4 that included the cointegration tests, and both the long-run and short-run estimates. The major findings were summarised in Section 5 including a brief policy implication.

LITERATURE REVIEW

Over the past decades, inflation had been extensively studied as a fundamental economic topic by both theorist and empiricist, especially in modelling and estimating the macroeconomic determinants that explained inflation. One of the early studies was Laidler and Parkin (1975) entitled "Inflation: A Survey" in *The Economic Journal* that described the core concept of inflation where the role of money in co-ordinating economic activity ensured that changes in its value over time impinged upon the well-being of everyone. Generally speaking, most of the past studies were country-specific oriented, with empirical estimation of the macroeconomic determinants of inflation. This section looked at the recently published empirical studies on inflation around the world, in general, followed by the studies of inflation in Malaysia. Lim and Sek (2015) estimated inflation behaviour for a panel data of 14 high and 14 low inflation groups for the period 1970-2011. The results of dynamic panel autoregressive distributed lag (ARDL) tests suggested that GDP (gross domestic product) growth, and imports of goods and services had long-run impact on inflation in low inflation countries, while money supply, national expenditure, and GDP growth were found to be important in high inflation countries. In the short-run, none of the variables was significant in the high inflation group, but money supply, imports of goods and services, and GDP growth were significant to explain inflation in the low inflation group. Deniz et al. (2016) studied how inflation rates of an emerging panel data of 17 and 23 industrial economies (2002-2012) were affected by money growth, real effective exchange rate, budget balance, GDP growth, real wages, and output gap. Their results showed that the real effective exchange rate had a higher negative impact on inflation in the emerging economies than that of the industrialised economies. Money growth explained inflation in emerging economies, but was insignificant for industrialised economies. Demand for currencies of industrialised economies prevented the link from money growth to inflation. Real wage impacted inflation positively in emerging economies, but was negative for industrialised economies. Budget balance for emerging economies and inflation targeting industrialised economies had a negative implication on inflation, but had opposite sign for non-inflation targeting industrialised economies.

In a case study of India, Mohanty and John (2015) considered crude oil prices, output gap, fiscal policy, monetary policy, and intrinsic inflation persistence as the determinants of inflation that were to be examined. Their data covered quarterly observations between 1996/97 and 2013/14, where the structural vector auto regression (SVAR) model was applied. They found that the inflation dynamics in India had changed over time with various determinants showing significant time variation in the recent years, in particular after the global financial crisis. Alam and Alam (2016) found that wholesale price index, money supply, exchange rate, world oil price, and supply bottleneck (i.e. the difference between actual GDP and potential GDP) were cointegrated, in India. The study applied ARDL procedure for data between 1989/90 and 2012/13. Their empirical estimates showed that money supply, depreciation of the rupee, and supply bottleneck increased domestic price level in the long-run. A similar finding was obtained in the short-run.

Abbas and Seyyed (2016) employed simultaneous equations in order to examine the determination of inflation in Iran for the period 1975-2012. Money was found to be the main determinant of inflation, while budget deficit was through an increase in money

supply which indirectly affected inflation. The expected inflation rates resulted in inflation. Ellahi (2017) discussed the determinants of inflation in Pakistan based on the observations between 1975 and 2015. ARDL tests suggested a long-run relation among inflation, money supply, national expenditure, imports of goods and services, and GDP growth. More precisely, national expenditure, and imports of goods and services had a positive impact on inflation, but money supply and GDP growth had implied a negative impact on inflation. A study by Hossain and Mitra (2017) found that the U.S. inflation rate, unemployment rate, long-term interest rate, trade openness, budget deficit, money supply, economic growth, exchange rate were cointegrated over the period of 1978-2014. The long-term interest rate and trade openness had significant positive short-run effects on inflation rate, but no significant short-run trade-off was observed between inflation and unemployment rates. Also, Heim (2017) in his chapter entitled "*Determinants of inflation- the Phillips curve model*" found that the U.S. inflation was determined by unemployment, money supply, trade deficit to GDP, savings to GDP, foreign borrowing, and the oil price shocks of the 1970s.

Using the ARDL procedure, Bane (2018) investigated the determinants of inflation in Ethiopia from 1975 to 2015. Inflation in Ethiopia was found to be a monetary phenomenon (i.e. money expansion, government spending, and real interest rate) in the short-run and long-run, and could also be explained by structural factors (i.e. shocks to the real sector). The underlying variables were found to be cointegrated. Mohammad (2018) investigated the major determinants of inflation in Bangladesh. The determinants were categorised by monetary sector (i.e. money supply, and exchange rate), real sector (i.e. GDP), external sector (i.e. exports, and imports), and fiscal sector (i.e. government expenditure, and government revenue). These variables were cointegrated over the period of 1980-2016. In the long-run, GDP, and imports were the two major determinants of the country's inflation, while the government revenue and money supply had moderate effects. Exports, government expenditure, and exchange rate had negatively affected the Bangladesh's inflation. In the short-run, the previous year's inflation had a strong influence, and it was followed by the previous year's imports. Chaudhary and Li (2018) looked at the impacts of macroeconomic variables on inflation in Nepal from 1975 to 2016. The estimates of a multiple OLS (ordinary least square) regression model showed that Nepal's inflation was positively associated with broad money supply, and Indian prices, but negatively related to the real GDP. Muktadir-Al-Mukit (2018) examined both demand-side and supply-side factors causing inflation in Bangladesh. A long-run relation was confirmed between inflation and its determinants (i.e. real GDP, money supply, imports, interest rate, remittances, and exchange rate) for the period of 1977- 2014. In the long-run, all the variables were statistically significant with a positive sign, except for imports, remittances, and exchange rate that had a negative sign. The real GDP was found to be highly elastic. Also, the Granger non-causality tests suggested a unidirectional causality from money supply to inflation and from exchange rate to inflation. A bilateral causality was observed between inflation and GDP, inflation and imports, inflation and interest rate, and between inflation and remittance. Alnefaee (2018) employed Johansen and Julius cointegration tests (Johansen & Juselius 1990) and found a cointegration among inflation, money supply, domestic demand, exchange rate, and oil prices in Saudi Arabia for the period of 1987-2017. Inflation was positively explained by money supply, domestic demand, and oil prices, but it was negatively determined by the exchange rate in the long-run. Inflation in Saudi Arabia was also highly affected by money supply, and domestic demand in the short-run. The Granger non-causality tests supported a bi-directional causality between the money supply and inflation, while a unidirectional causality was observed from domestic demand and oil prices to price level. Using ARDL procedure, Adjei (2018) found a strong positive relationship between Ghana's inflation and money growth, both in the long run and short run. The results were based on the annual observations between 1965 and 2012. Inflation, broad money M2, imports of goods and services, domestic credit (to private sector), broad money to GDP ratio, and GDP per capita were found to be cointegrated.

Rehman et al. (2019) examined the nonlinear impact of oil prices and inflation on residential prices, which had also been included as a component of inflation in the U.S., the U.K., and Canada for the quarterly period from 1975 to 2017. The nonlinear autoregressive distributed lag (NARDL) results showed that oil prices, interest and inflation rates, and income had an asymmetric relationship with residential prices. Jongwanich and Wongcharoen (2019) estimated the determinants of producer and consumer price (CPI) inflation in 10 Asian countries for the period of 2000–2015. The study found that the external cost-push factors (oil and food prices) were more important in explaining producer price inflation than that of CPI, while demand-pull factors still explained much of the variation for the CPI inflation. More interestingly, Chen (2019) considered the GlaxoSmithKline (GSK) corporation as a sample and analysed the inflation risk and its determinants. The dependent variable, i.e. inflation rate was expected to be explained by the return on assets (ROA), return on equity (ROE), corporate governance index, Tobin's Q, Altman-Z score, GDP growth rate, and the unemployment rate. The macroeconomic determinants, i.e. GDP growth, and unemployment rate had a larger effect than that of the firm-specific factors in explaining the inflation rate (and inflation risks) faced

by GSK corporation. Al-Mutairi et al. (2020) examined whether inflation in Kuwait was influenced by exchange rate, interest rate, taxation, imports, current account, unemployment, GDP, and money supply or not for the period of 1979-2015. The multiple linear regressions showed that the country's inflation was positively affected by interest rate spreads, imports of goods and services, and money supply, but was negatively affected by tax revenue, and the current account balance. In fact, GDP and unemployment were found to be statistically insignificant.

For a small open economy, Malaysia, an early study by Tang (2001a) reviewed 9 studies (e.g. Lajman1975; Ministry of Finance 1978; Leong et al. 1976; Malaysia Institute of Economic Research, MIER1990; Dhakal & Kandil 1993; Merican et al. 1994; Wong 1995; Mansor 1996; Cheng & Tan 2000). The study employed an *ad hoc* inflation equation that related Malaysia's inflation (price level) to GDP, exports of goods and services, import prices, exchange rate, government expenditure, and oil price (Tang 2001a, pp. 276-277). There were more studies that aimed to re-examine the inflation (price level) behaviour in Malaysia with a set of macroeconomic determinants by employing the standard testing methods for cointegration (long-run), short-run estimates, and or non-causality (e.g. Mansor 2000; Cheng & Tan 2002; Abdul Majid 2007; Fahmi et al. 2008; Tang 2008; Tang 2001a; 2001b; 2014; Shahidan et al. 2012; Venkadasalam 2015; Zaidi et al. 2016; Rabiul et al. 2017).

Mansor (2000) examined the dynamic relationship between the consumer price index, and the effective exchange rates by considering a set of control variables, namely money supply M1, income (industrial production Index), and interest rate (3-month Treasury bill rate. The results of Johansen multivariate cointegration tests showed that the underlying variables were cointegrated over a period, from 1975 to 1997. The estimated long-run coefficients were in their expected sign as the theories said i.e. negative for income, and positive for money supply M1, and interest rate, respectively. However, the Ringgit effective exchange rate had a negative effect (between -0.96 and -0.78) where the depreciation had resulted in an inflation in Malaysia. Cheng and Tan (2002) re-examined the Malaysian inflation behaviour by considering more macroeconomic determinants, namely money supply M1, interest rate, income, private consumption, government expenditure, exchange rate, trade balance, capital inflows, the rest of ASEAN's inflation, and the rest of the world's inflation. They found that these variables were cointegrated for the period 1973-1997. More specifically, the exchange rate, and the rest of ASEAN's inflation had directly caused domestic inflation. Other variables (e.g. money supply, government expenditure, interest rate, and private consumption) had indirectly caused Malaysia's inflation. However, income, trade balance, capital inflow, and the rest of the world's inflation had no causal effect on Malaysia's inflation.

Abdul Majid (2007) investigated the inter-linkages (causality) among monetary aggregates (e.g. M1, M2 and M3), industrial production index, and the CPI in Malaysia for the period of 1979-2000. Toda and Yamamoto (1995) non-causality tests showed that monetary aggregates caused CPI, but no reversed direction. Fahmi et al.'s (2008) study found a cointegrating relation between money supply, and CPI for the period 1974-2006. Tang's (2008) study had also delivered a finding that aggregate price, money supply M2, and industrial production index were cointegrated during the observed periods of 1971-2008. Money supply and output were statistically significant in inflating the CPI. Also, the study confirmed a unidirectional causality from money supply to CPI.

Shahidan et al. (2012) estimated a price equation that related CPI to crude oil price, and the exchange rates. The results were based on the monthly observations between 2005 and 2012, and the price equation was confirmed to be cointegrated. In the short-run, the vector error correction model (VECM) showed that oil price affects inflation, and a bi-directional causality existed between the oil crude price and inflation. Maryam et al. (2014) found that GDP, government expenditure, imports, and interest rate had a negative relationship with inflation, while there was a positive sign for money supply. Venkadasalam's (2015) study documented that CPI, broad money, exports of goods and services, GDP, and household final consumption were cointegrated over the period of 1960-2012 as based on the results of Johansen multivariate cointegration tests. All of these determinants had a positive sign. Household expenditure was the most important factor with an estimated elasticity of 2.08, while money supply was the smallest (i.e. 0.347). The estimated elasticities of exports and GDP were 0.638, and 0.375, respectively. Zaidi et al. (2016) explored the effect of policy change on disaggregated inflation of 9 prices (food; beverages and tobacco; clothing and footwear; gross rent, fuel and power; furniture, furnishings and household equipment and operation; medical care and health expenses; transport and communication; recreation, entertainment, education and cultural services; and miscellaneous goods and services) in Malaysia for the sample period of 1982-2008. The SVAR estimates showed that a modest monetary policy shock resulted in varying degree of responses in disaggregated inflation. Rabiul et al. (2017) also studied the inflation determination in Malaysia by using annual observations between 1980 and 2014. The underlying determinants were money supply, exchange rate, and unemployment rate. The estimated regression equation showed that the dollar exchange rate and unemployment rate had a negative sign with -1.688, and -0.596, respectively. Surprisingly, money supply was statistically insignificant.

Nevertheless, there were a few empirical studies that considered the role of financial variable (i.e. financing) in explaining the inflation behaviour in Malaysia. For example, Tang (2001a) explored the influence of bank lending on CPI in Malaysia for the period 19731997. The results of ARDL tests showed that the price level in Malaysia was cointegrated with bank credit, import price, money supply M3, and real GDP. Import price, and real GDP were the major determinants in explaining the country's inflation in the long-run. However, bank credit and money supply M3 were statistically insignificant. By the same token, Tang (2001b) re-investigated a long-run relation of price level by adding interest rate to capture a monetary policy for the annual data 1968-1997. Other variables were as in Tang (2001a), namely money supply, imports price, bank credit, and domestic demand. These variables were found to be cointegrated. Interestingly, all the variables including interest price are statistically significant, and in their expected sign, except for money supply (i.e. in a negative sign). Similar work by Tang (2004) found that CPI, bank credit, imports, money supply M1, and the real GNP were cointegrated as the Johansen multivariate cointegration tests had suggested over the period from 1959 to 1997. However, money supply was found to be statistically insignificant, whereas bank lending, imports and GNP are statistically significant with their estimated elasticities of 0.23, 0.31 and -0.66, respectively.

Based on the literature review several gaps had been identified, in particular for the Malaysian context. First and foremost, money supply a traditionally theorised variable by the quality theory of money was found to be inconclusive. The past studies had heavily employed money supply while other important financial sector variable(s) were ignored such as bank credit, interest rate, and so on. 'Financing' might be a better explanatory variable to inflation than just 'money' in the era of globalisation as well as financial markets integration (liberalisation). Second, past studies had included as many variables as possible to estimate the inflation behaviour in Malaysia, but most of them were found to be statistically insignificant, and they had caused infeasible estimates due to huge loss of the degree of freedom in the estimated regression equation(s). Lastly, several studies had either partially or solely applied the non-causality tests randomly, which might not offer better understanding on the factors explaining inflation, or had priced level as "*an effect cannot occur before its cause"*– it was a concern about the 'effect' instead of the 'cause' by the policymakers.

There were two studies that had examined the influence of 'new' monetary variable (or financing) that was credit cards on the behaviour of inflation. The first study was based on a series of theorems theoretically developed by Geanakoplos and Dubney (2010) that credit cards had inflationary effects on price levels. They assumed an absence of monetary intervention, the widespread of credit cards increased trading efficiency, as well as the velocity of money, that would result in higher inflation rates. If, default on credit cards exists, the increased price levels would be greater i.e. there were less efficiency gains. Stagflation might be occurred, if the monetary authority did not cut efficiency below pre-credit card levels. The second study was an empirical work by Yilmazkuday (2010) that examined the volume of credit card transactions to explain inflation in Turkey, which was the credit channel of the monetary transmission mechanism. The study analysed the monthly data between 2002 and 2009 that depicted an implicit-targeting regime in 2002 as well as an explicit inflation targeting regime in 2006. The empirical results showed that credit card usage had a negative effect on inflation over the sample period. The study recommended that more policies are necessary on the credit channel, and that credit cards were being considered as a policy instrument. This study followed this fashion by looking at a case study in Malaysia.

RESEARCH METHODOLOGY

BASELINE MODEL – INFLATION MODEL

Over the past decades, the existing studies provided sufficient empirical ground on the relevant determinants that explained how inflation behaved. Quantity theory of money had long acknowledged the role of money in a baseline model of inflation. Friedman (1970) outlined the underlying assumptions that this monetarist model of inflation to take place. First, there is the role of mechanism in the market clearing, i.e. goods, labour, and money markets. Second, the respective economic agents behave rationally, and they are not suffering from the 'money illusion'. Thirdly, 'supply creates its own demand', and lastly, an economy is always in equilibrium with full employment. More technically, the association between money supply and inflation could be expressed as, where M is stock of money in circulation, $V$is velocity of money which is eventually small (assumed to be exogenous, and is fixed in respect to the equation), P is general price level, and Y is real income or economic activity that is assumed to be constantly given full employment. A value of is a total value of payments which should be made to which is the money value of national income or economic activities. Re-arranging P to the left-hand side, a price equation could be written in a form of which is positively related to the stock of money supply with one-to-one equivalent. That was an excess money supply by 10% in an economy would lead to domestic inflation by 10%, for example.

An alternative baseline model of inflation replaced 'money' by 'financing' that was the usage of credit cards

(Yilmazkuday, 2010) by the mean of credit channel of monetary transmission mechanism. It was expected to have a positive effect on inflation in Malaysia. For simplicity purpose, this study followed an *ad hoc* inflation model that was employed by Tang (2004, p. 7) which related CPI to money supply, commercial bank lending, value of imports, and real gross national product. The empirical equations (1), (2), and (3) considered credit card usage (CC), bank lending (BC), and money supplyM3, respectively with other two determinants, namely imports (IM), and income or activity variable (Y). These models incorporated demand-side variables that might affect inflation in a small open economy. The supply-side factors were assumed to be absent here as were also in previous studies because of their data unavailability, e.g. costs of production (prices of raw materials, wages, and so on), quantities supplied, and so on. Also, it was feasible to keep an inflation model as simple as possible by including a few regressors, in particular for Malaysia with small sample size in order to safeguard a sufficient degree of freedom. Meanwhile, this study used total imports instead of price of imports because the data is not available from International Financial Statistics (IFS) and Monthly Bulletin of Statistics, Bank Negara Malaysia. Imports in local currency captures the price effect i.e. import price and considered exchange rate element.

$$P_t = \beta_0 + \beta_1 CC_t + \beta_2 IM + \beta_3 Y_t + e_t \quad (1)$$

$$P_t = \beta'_0 + \beta'_1 BC_t + \beta'_2 IM + \beta'_3 Y_t + e'_t \quad (2)$$

$$P_t = \beta''_0 + \beta''_1 M3_t + \beta''_2 IM + \beta''_3 Y_t + e''_t \quad (3)$$

All the determinants were assumed to have a positive sign as postulated by the past studies (see, Tang, 2004). The variables were transformed into natural logarithm (*ln)*, so that the estimated coefficient could be interpreted directly as elasticity, and they could be compared among the equations (1)-(3). These equations avoided the potential multicollinearity bias among credit card usage, bank credit, and money supply those were expected to be strongly correlated. Tang (2001a; 2001b; 2004) incorporated both bank credit and money supply simultaneously; therefore, his results might be interpreted with caution.

DATA AND VARIABLES EXPLANATION

The variables used in this study were described in Table 1. The observations covered monthly data between 2007m1 and 2017m12 with 132 observations given their data availability. Table 2 summarises the statistics of the underlying variables that are presented in their raw values. More importantly, Table 3 reports the results of the unit root tests, namely the Augmented Dicky-Fuller (ADF)(Dickey & Fuller 1979) and Phillips-Perron (PP) (Phillips & Perron, 1988) in order to determine the degree of integration, *I*(d) of the underlying variables. Conversely, a *I*(0) time series variable indicated a time series that was stationary at levels, which fluctuated around a mean value with a tendency to converge to the mean. However, a *I*(1) variable was non-stationary at levels, but it became stationary after differencing once, and a *I*(2) variable was stationary after differencing twice. Conventional estimator such as OLS (ordinary least squared) on non-stationary variables would yield the so-called 'spurious' regression, in which the estimates were invalid. According to Engle and Granger (1987), if a linear combination of two or more non-stationary series was stationary *I*(0), or to say a cointegrating relation, OLS estimates (i.e. static) were valid, and an error correction model (ECM) could be estimated for the short-run (i.e. dynamic). This study found that the

TABLE 1.The variables

Variable	Measured by	Source
Price level, P	Consumer Price Index (CPI) captured the expenditure pattern of all households in Malaysia (2010=100).	Table 3.5.8, Consumer Price Index, Monthly Highlights and Statistics, Bank Negara Malaysia.
Money supply, M3	M3 is sum of M2 and deposits placed with other banking Institutions. It was reported in RM millions.	Table 1.3.1, Broad Money M3, as above.
Imports, IM	Retained imports- Its value was derived by deducting the estimated import value of re-exports of goods from the value of imports of goods (in RM millions).	Table 7.10 Imports by End-use, as above.
Income or economy activity, Y	Proxied by Industrial Price Index, an index that measures real output in the manufacturing, mining, public utilities such as electricity, gas and water, relative to a base year (2010=100).	Table 3.5.1 Industrial Price Index, as above.
Bank lending, BC	Both of commercial banks and Islamic banks. The data were measured in RM millions.	Table 1.7.2 Commercial Banks and Islamic Banks: Statement of Assets, as above.
Credit card usage, CC	Measured by the number of card transactions, in unit of millions.	Table 1.30 Credit Card Operations in Malaysia, as above.

Note: Money supply M3, imports, and bank lending were deflated by CPI.

TABLE 2. Summary statistics

	P	Y	CC	BC	M3	IM
Mean	106.4	111.0	6,606.0	959,742	1,180,036	38,959.8
Median	104.8	110.0	6,851.9	989,786	1,251,221	42,577.2
Standard Deviation	6.9	10.5	1,608.7	235,468	211,618	11,618.5
Minimum	99.3	88.4	3,525.1	560,928	781,377	3,568.0
Maximum	120.9	136.5	10,185.4	1,286,906	1,433,048	54,204.8

TABLE 3. Results of ADF and PP unit roots tests

Variable	ADF	PP	Degree of Integration, *I*(d)
$ln\mathrm{P}_t$	-2.136[2] (0.520)	-2.018[8] (0.586)	
$\Delta ln\mathrm{P}_t$	-8.261[1] (0.000)***	-8.155[4] (0.000)***	*I*(1)
$ln\mathrm{CC}_t$	-1.531[12] (0.813)	-7.871[5] (0.000)***	
$\Delta ln\mathrm{CC}_t$	-5.458[11] (0.000)***	-39.645[34] (0.000)***	*I*(0) / *I*(1)
$ln\mathrm{BC}_t$	-0.711[0] (0.999)	1.479[9] (0.999)	
$\Delta ln\mathrm{BC}_t$	-4.758[2] (0.000)***	-9.260[4] (0.000)***	*I*(1)
$ln\mathrm{M3}_t$	-0.463[0] (0.984)	-0.454[5] (0.985)	
$\Delta ln\mathrm{M3}_t$	-10.251[0] (0.000)***	-10.259[2] (0.000)***	*I*(1)
$ln\mathrm{IM}_t$	-3.503[1] (0.043)**	-3.058[3] (0.121)	
$\Delta ln\mathrm{IM}_t$	-13.632[0] (0.000)***	-13.633[0] (0.000)***	*I*(0) / *I*(1)
$ln\mathrm{Y}_t$	-1.752[11] (0.722)	-9.169[5] (0.000) ***	
$\Delta ln\mathrm{Y}_t$	-3.457[12] (0.011)**	-49.842[44] (0.000)***	*I*(0) / *I*(1)

Notes: ***, **, * denote significant level at 1%, 5% and 10% based on MacKinnon's critical value (MacKinnon, 1996) respectively. The constant and time trend was included into unit root regression for data at levels, while only constant for data at first differences. The reported value is *t*-statistic, value in square brackets [.] is optimum lag, and parentheses (.) for *p*-value. The null hypothesis for both tests is that the series has a unit root.

consumer price index (*ln*P), money supply (*ln*M3), and bank credit (*ln*BC) were stationary at first difference or *I*(1) as both the ADF and PP tests statistics reject the null hypothesis of a unit root (at least, at 10% level) for the first-differenced data. However, credit cards usage (*ln*CC), imports (*ln*IM), and real income (*ln*Y) were inconclusive between the two tests that credit cards usage, and real income showed *I*(1) by ADF tests, but PP tests suggested to be *I*(0). The opposite story was revealed for imports variable. These findings helped to determine the testing methods used for estimating both the long-run and short-run effects of the underlying variables on inflation determination in Malaysia as described in the next sub-section.

ESTIMATION PROCEDURE - ECONOMETRIC PROCEDURES

Given *ln*CC, *ln*IM, and *ln*Y were inconclusive between *I*(0) and *I*(1), ARDL (autoregressive-distributed lag) of bounds testing procedure proposed by Pesaran et al. (2001) was appropriate and employed by this study. Unlike the conventional cointegration methods (e.g. Engle & Granger 1987; Johansen & Juselius 1990) and by Jenkinson (1986) those required all of the underlying variables were *I*(1). The ARDL procedure could be applied irrespective of the regressors were *I*(0) or *I*(1), see Pesaran and Pesaran (1997, pp. 302-303). This approach could be carried out by an error correction version of ARDL equation which was written as (4).

where X is either credit cards usage (*ln*CC), bank lending (*ln*BC), or money supply (*ln*M3) a 'financing' or 'money' variable that to be tested. Other determinants were as defined in Table 1. The equation (4) was estimated by OLS estimator. A level (long-run) relationship among the underlying variables (*ln*P, *ln*X, *ln*IM, and *ln*Y) could be tested for the null hypothesis, (i.e. no level relationship) against the alternative hypothesis that (i.e. a level relationship) by running a

$$\Delta lnP_t = c + \sum_{i=1}^{n} \beta_{1i} \Delta ln\, P_{t-i} + \sum_{i=0}^{n} \beta_{2i} \Delta\, lnX_{t-i} + \sum_{i=0}^{n} \beta_{3i} \Delta\, lnIM_{t-i} + \sum_{i=0}^{n} \beta_{4i} \Delta ln\, Y_{t-i} + \gamma_0 lnP_{t-1} + \gamma_1 lnX_{t-1} + \gamma_2 lnIM_{t-1} + \gamma_3 lnY_{t-1} + u_t \quad (4)$$

usual *F*-test (i.e. bounds tests). The respective statistical inferences were described as follows:

1. if the computed *F*-statistic exceeds the upper bound of the critical value band *I*(1) as in the Table F (Pesaran & Pesaran, 1997, p. 478), the null hypothesis can be rejected (at a conventional level of significant, 1%, 5%, or 10%) and the underlying variables are cointegrated (i.e. a long-run relation);
2. if the computed *F*-statistic falls below the lower bound of the critical value band *I*(0), the null hypothesis cannot be rejected, hence no cointegration among the variables (i.e. no level relationship) can be delivered; and
3. given the computed *F*-statistic is between the critical value band *I*(0) and *I*(1), no conclusion can be inferenced. It is a requirement to run a unit root test(s) in order to ensure the degree of integration *I*(d) among the variables are either *I*(0) or *I*(1), but not all *I*(0) or all *I*(1), and none of *I*(2) regressor(s).

An error correction version of the ARDL equation (4) captured the long-run and short-run models. The long-run model such as in equations (1)-(3) was captured by the bottom line of equation (4) , in which a long-run coefficient (or elasticity) of regressor X_t was calculated as $-(Y_1/Y_0)$, while $-(Y_2/Y_0)$ and $-(Y_3/Y_0)$ were for imports and income, respectively(see, Pesaran, Shin, & Smith, 2001, p. 294). By the way, these values were computed directly by *Eviews* statistical software.The estimated represented the coefficient of error correction term, ect_{t-1}, in which its statistically significant (i.e. in a negative sign) reaffirmed a long-run (or cointegrating) relation of inflation (price) equation. The upper line of equation (4) was the short-run model that the short-run coefficients were the estimated parameter of the first-differenced variables as denoted by Δ. The estimated were the short-run elasticities of X_{t-1}, and for imports, and for economic activity (income).

EMPIRICAL RESULTS

First of all, Table 4 presents the bound test *F*-statistics for the cointegration property among the underlying variables of price equations (1), (2) and (3), that are respectively based on the error correction version of ARDL equation (4). The computed *F*-statistics were 6.760, 5.426,and 8.939 for credit card usage, bank credit, and money supply M3, repectively that exceeded the critical upper 'bound' value *I*(1), 5.61 at 0.01 level of signficant. Therefore, the null hypothesis of no level relationship (i.e. no cointegration) was rejected indicating that the CPI price level in Malaysia, and its determinant either credit card usage, bank credit, or money supply, and imports, and economy activities (income) were cointegrated (i.e. moving together) in the long-run. That was to achieve its equilibirum among the variables.

Table 5 reports the estimated long-run estimates of price equations (1), (2), and (3) by the ARDL procedure (equation 4) given the presence of a cointegration relation of the respective price equations. It was interesting to tell that credit card usage, and bank credit were statistically

TABLE 4. ARDL *F*-statistics bound test for cointegration

Equation (1): F(*ln*P | *ln*CC, *ln*IM, *ln*Y) = 6.760***		
Equation (2): F(*ln*P | *ln*BC, *ln*IM, *ln*Y) = 15.426***		
Equation (3): F(*ln*P | *ln*M3, *ln*IM, *ln*Y) = 8.939***		
Critical values (k=3)	*Lower bound, I*(0)	*Upper bound, I*(1)
10%*	2.72	3.77
5%**	3.23	4.35
1%***	4.29	5.61

Notes: k is the number of regressors. Given a sample of 132 observations (1997-2017), a lag length of 12 is included ARDL (3,1,0,0) suggested by SIC(Schwarz Information Criterion). Null hypothesis is no levels relationship.

TABLE 5. Long-run estimates of price equation

Variable	Equation (1)	Equation (2)	Equation (3)
$lnCC_t$	0.201(0.028)**	-	-
$lnBC_t$	-	0.128(0.036)**	-
$lnM3_t$	-	-	0.177(0.166)
$lnIM_t$	-0.014(0.498)	0.005(0.784)	0.005(0.847)
lnY_t	0.460(0.017)**	0.350(0.014)**	0.542(0.017)**
Constant	0.928(0.146)	1.283(0.002)***	-0.331(0.774)

Notes: ***, **, * denote significant level at 1%, 5% and 10% based on MacKinnon's critical value respectively. The value in (.) is *p*-value. The trend specification assumes a restricted constant and no trend.

significant, but it was not the case for money supply M3 which was supported by previous studies (Tang 2004; Rabiul et al. 2017; Venkadasalam 2015) that found money supply had the smallest impact on CPI in Malaysia then of other included determinants. The results showed that credit card usage variable was found to have a higher elasticity (0.201) than that of bank credit (0.128). This finding was important to affirm that *there is too much financing by credit card for inflation in Malaysia.* Meanwhile, imports variable was statistically insignificant for the three long-run relations. It indicated that the so-called 'imported-inflation' was not the case for the country. More generally, economy activity (or real income) was found to be the most influential determinant of CPI price level in Malaysia, with the estimated elasticities between 0.35 and 0.542. This explained a trade-off between inflation and economic growth (Behera, 2014), that an increase in real income resulted a higher purchasing power that increased households' consumption which would contribute to a higher aggregate demand that consequently demand '*pulled*' the price level to a higher new level of market equilibrium.

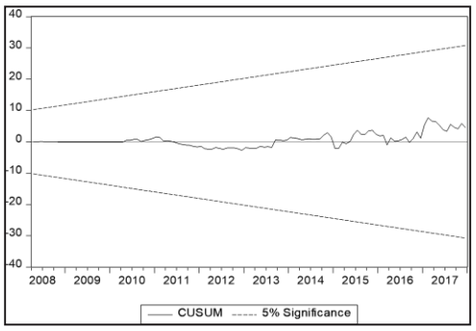
Table 6 reports the short-run (static) component of equation (4), or more formally the estimated error correction model (ECM) that the short-run elasticities were captured by their first-differenced variables (as labelled Δ), and their past inflation rates. The three ECMs were in a parsimonious form of ARDL (3, 1, 0, 0) as selected by SIC that the 'least important' determinants (regressors) were dropped out systematically, e.g. economic growth ($\Delta ln Y_t$), and imports growth ($\Delta ln IM_t$) in the short-run. The R^2 of the estimated ECMs were relatively low between 21% and 39%, but feasible as there were no severe problems with a number of diagnostic tests. The statistics of Durbin Watson test, Breusch-Godfrey Serial Correlation LM test, and Ramsey RESET test revealed that the estiamted ECM equations were free from autocorrelation, serial correlation, and general specification erros. The plots of CUSUM tests suggested that the test statistics were within the 5% bands that the estimated parameters of ECMs were stable over the sample period.

The estimates showed that in the short-run, bank credit growth, and money supply M3 growth were statistically significant in explaining the Malaysian inflation ($\Delta ln P_t$), except for the credit card usage growth. It still acknowledged the role of money supply in explaining the country's inflation, but in the short-run. Unexpectedly, both bank credit growth, and money supply growth were in the negative sign i.e. -0.241, and -0.109 respectively, which could be explained by the intuition that inflation was because too much money in the long-run, but remained ambiguous in the short-run. It highlighted their potential interactive effects in the short-run with other relevant variables, those not implemented in this study. The past one and two months inflation rates were statistically significant with a net positive effect (i.e. 0.06 = 0.306 -0.246) on the current inflation rate. Lastly, the estimated error correction term, ect_{t-1} was statistically significant at 1% level with a negative sign that reaffirmed a cointegrating relation of equations (1), (2), and (3) as suggested by the *F*-statistics (bounds tests) in Table 4. Its estimated coefficient captured the speed of adjustment that any disequilibrium in the short-run would be corrected by 3.2%, 3.7%, and 2.4% per month towards an equilibrium (i.e. 100%), respectively. With the bank credit variable (equation 2), the long-run relation was achieved in 2.25 years, which was quicker than the credit card usage (2.6 years), and money supply (3.47 years).

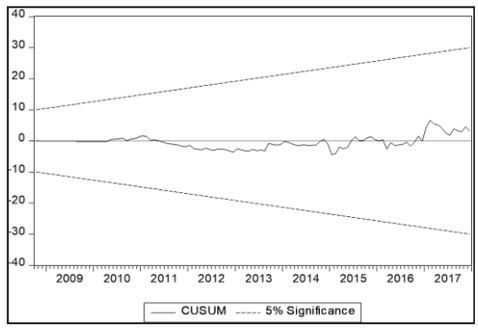
TABLE 6. Error correction equations (dependent variable: inflation rate, $\Delta ln P_t$)

Variable		Equation (1)	Equation (2)	Equation (3)
$\Delta ln P_{t-1}$		0.306 (0.000)***	0.291 (0.000)***	0.277 (0.001)***
$\Delta ln P_{t-2}$		-0.246 (0.004)***	-0.183 (0.014)**	-0.235 (0.004)***
$\Delta ln CC_t$		-0.002(0.549)		
$\Delta ln BC_t$			-0.241(0.000)***	
$\Delta ln M3_t$				-0.109 (0.000)***
ect_{t-1}		-0.032 (0.000)***	-0.037 (0.000)***	-0.024 (0.000)***
Adjusted R^2		0.208	0.389	0.273
Durbin-Watson		1.954	1.902	1.942
LM test (*F*-statistics)	1 lag	0.274 (0.602)	0.942 (0.334)	0.350 (0.555)
	2 lags	3.555 (0.032)	0.588 (0.557)	2.447 (0.091)
	3 lags	1.772 (0.139)	-	1.654 (0.181)
Reset test (*F*-statistics)	1 lag	0.002 (0.968)	0.090 (0.765)	0.036 (0.850)

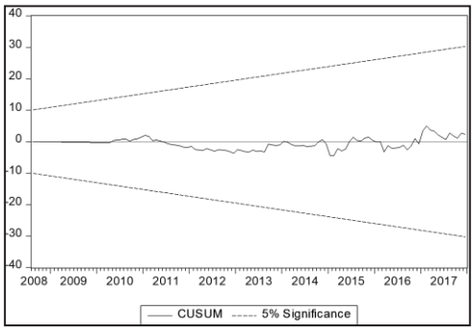
Notes: Their lag specification is based on ARDL (3, 1, 0, 0) for ARDL (*ln*P|*ln*X, *ln*IM, *ln*Y) as has been suggested by SIC, see Notes, Table 4. The estimated coefficients are reported with *p*-value in (.). ***, and **denote significant level at 1%, and 5% of *t*-statistics, while the coefficient of ect_{t-1} is based on MacKinnon's critical value respectively. The constant and time trend was included into unit root regression for data at levels, while only constant for data at first differences. LM test refers to Breusch-Godfrey Serial Correlation LM test.(Godfrey, 1996). Reset test is the Ramsey RESET test (Ramsey, 1969).



Estimated ECM equation (1)



Estimated ECM equation (2)



Estimated ECM equation (3)

FIGURE 2. Plots of CUSUM tests

SUMMARY AND CONCLUSIONS

This study contributed to the existing literature by investigating further the influence of 'financing' pertaining to credit card usage on price level (inflation) for a small open economy, Malaysia. The traditional monetary variable- money supply M3, and the 'financing' variable- bank lending, were included for analysis separately for comparison purpose. Other conventional determinants of inflation that were included were economy activity (real income) and imports.

This study answered the research question, "*Does either too much money or too much financing (i.e. credit cards) results inflation in Malaysia?"* The answer was *"too much financing"*, especially credit cards usage, and bank lending rather than that of money supply that generated higher price level of goods and services in Malaysia in the long-run. This was labelled as 'credit inflation' which eventually increased the households' purchasing power that pushed up the current demand for goods and services, and resulted in higher price level at the new equilibrium level of the market(s).

The main findings obtained from this study could be summarised as follows: (1) Credit cards usage as well as bank lending, and money supply M3 were cointegrated with the price level, real income, and imports in Malaysia; (2) Credit cards usage was the most dominant factor explaining the price level behaviour in Malaysia's inflation than by bank lending in the long-run;(3) Surprisingly, the money supply M3 had no role in the long-run, and was negative in the short-run; (4) Real income, indeed was the most influential (positive) factor among others in the long-run; and (5) Real imports variable had no influence on the Malaysian price level in both the long-run and short-run.

In view of policy implication, the monetary authority- Bank Negara Malaysia was in a feasible position to stabilise (reduce) the price level in the country that was to maintain (lower) the people's cost of living by implementing appropriate policies on credit cards, in particular on its usage. Indeed, Bank Negara Malaysia had announced several new measures in 2011 to ensure reasonable financial and debt management among credit card users including a review on the eligibility requirements for credit cards. For example, minimum income eligibility for new credit card holders at RM24,000 per annum, and the maximum credit limit.[5] Furthermore, 'enhancing' macroeconomic (i.e. aggregate demand) as well as microeconomic (i.e. consumer behaviour) policies for households were needed since this study finds that lower credit card usage was expected to have positive implication on the inflation in Malaysia. On the other hand, fiscal policies that could be acted in order to smooth the long-run economic growth might help to stabilise the price level. A raise of tax was expected to lower the consumption by households, and also to increase the government's

revenue. This scenario would eventually reduce the budget deficits.

There were a few drawbacks that could not be avoided in this study. First, some other conventional determinants were excluded in this study such as interest rate, government spending, unemployment rate, oil price, exchange rate volatility and so on. There were also the supply-side variables such as the costs of production (i.e. wages, prices of raw materials and so on). Secondly, this study applied the testing methods without considering the potential of threshold specification. In fact, some variables might have their effects on the price level if they were above a threshold. It might explain the reason why money supply M3 was found to be statistically insignificant in the long-run where the conventional fashion-quantity theory of money had illustrated that the more money, the higher the price level, and this had a negative short-run elasticity. Further research should consider other relevant variables as outlined above, for a richer price equation. Appropriate threshold techniques could be applied, in which the threshold levels of credit card usages, bank credit, and money supply M3 determined that to take effect on the price level or inflation for Malaysia.

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