

Reactions of Long-run Private Consumption in Malaysia to Crises, Economic Leadership and Telecommunication Technology

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Abstract: We estimate the long-run reactions of private consumption in Malaysia to crises, economic leadership, information and communications technology (ICT), and other key determinants using time series econometrics. This study covers the quarterly sample from 1990:Q1 to 2020:Q4. We find that Malaysia's private consumption and its key determinants are cointegrated, demonstrating that a reliable long-run private consumption function can be estimated. We find that both economic and health crises, namely the Asian financial crisis in 1997/98, SARS and COVID-19 pandemic are likely to reduce private consumption in Malaysia. However, the long-run estimation results show that ICT and economic leadership are positively related to consumption. Therefore, policymakers should set the goal of encouraging the development of ICT infrastructure and good economic leadership in order to promote private consumption, which eventually sustains long-term economic growth and development.

Keywords: COVID-19, cointegration, economic leadership, Malaysia, private consumption
JEL classification: C22, E21

1. Introduction

This study attempts to understand the behaviour of private consumption spending in Malaysia because this is a major component of national income. In addition, this segment of spending attracted a lot of attention as it reflects household living standards and quality of life. However, the spending behaviour is fragile and contingent upon surrounding socio-economic environments including economic crises and epidemics. At the beginning of the year 2020, a new coronavirus, namely COVID-19 had been identified and is currently circulating over the globe. COVID-19 has been declared a pandemic by the World Health Organization (WHO) since the infection and death cases

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jump at an alarming rate, leaving all communities sharing the same trepidation about their future.

Furthermore, Malaysia is one of the Southeast Asian countries that was seriously affected by the COVID-19 pandemic, and thus makes Malaysia a very valuable research subject in evaluating the impacts of the crisis. As of January 8, 2022, Malaysia had recorded nearly 2.8 million confirmed cases of COVID-19 with approximately 32,000 cases related to deaths. The daily number of confirmed cases is still increasing, with an average of 3,000 new cases per day, although its recovery rate was 97.4% which is higher than the ASEAN average recovery rate of 86%. To curb the pandemic situation, implementation of strict prevention and control measures have greatly affected many economic sectors in Malaysia, ranging from retail, catering, residential tourism and cultural entertainment industries to manufacturing sectors. Revenues for these sectors have fallen sharply, and the slow resumption of work, especially in manufacturing, real estate and construction sectors due to limited mobility, poses different and varied challenges to Malaysia’s economy. Consequently, private consumption in Malaysia is adversely affected. Noticeable from Figure 1, Malaysia’s private consumption spending received a brutal hit and declined by approximately 5% or RM42,400 million in year 2020, and was the worst-performing year over the past decade. Moreover, referring to the statistics, although private consumption has increased in the past, but the increasing rate is diminishing, showing that the growing momentum of private consumption spending in Malaysia is gradually decreasing.

The Malaysian government has always attached great attention to the development of private sectors; the degree of emphasis and determination can be seen in the blueprint for the new economic model by the sixth prime minister of

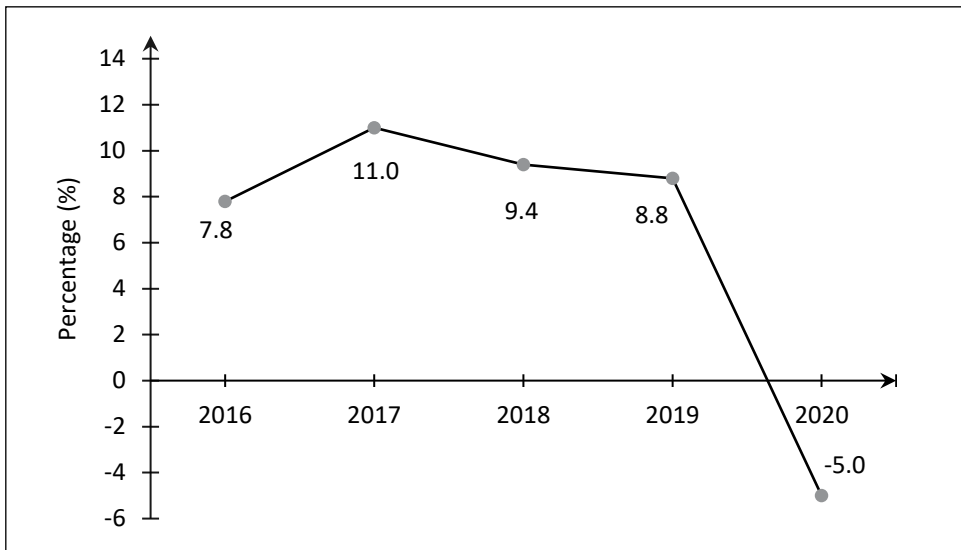


Figure 1. Annual growth rate of private consumption in Malaysia
Source: Monthly Highlights and Statistics, Bank Negara Malaysia.

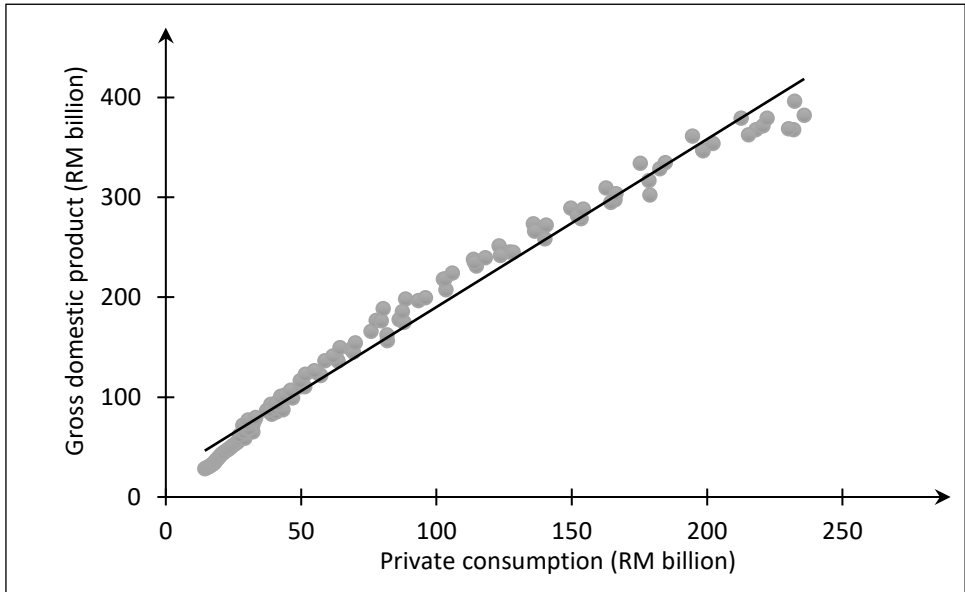


Figure 2. Scatterplot between private consumption and GDP
Source: Monthly Highlights and Statistics, Bank Negara Malaysia.

Malaysia in 2010. In this economic blueprint, Malaysia is determined to enhance the private sector’s development further and make it the key sector for the Malaysian economy to achieve the transformation into a high-income and sustainable growth country. Thus, the private sector is the key to the nation’s economic development as attested by the scatter plot between GDP and private consumption (see Figure 2). Furthermore, the tremendous decline in private consumption expenditure due to the onset of the pandemic issue at the start of 2020, resulted in a deceleration in Malaysia’s economic growth for the following quarters. Thus, a precise assessment of the crisis impact on Malaysia’s private consumption is essential and will be emphasised by the present study.

Although a large amount of literature has conducted research on the impact of crisis on consumption, most of the research focuses on the impact of COVID-19, severe acute respiratory syndrome (SARS) and the economic-related crises separately. For example, Baker et al. (2020), Chen et al. (2021) and Martin et al. (2020) focused on how the government’s pandemic containment actions such as state lockdowns and social distance policies affect consumption patterns in China and the United States respectively. Moreover, Beutels et al. (2009), Hai et al. (2004) and Siu and Wong (2004) focused on the assessment of the damage brought by SARS to Beijing and Hong Kong’s economies. Their studies pointed out that the Chinese economy received a severe hit. Local consumption, export services, aviation and tourism are the main sectors that bear the brunt of this health crisis. Apart from the scholars mentioned above who have focused on the impact of health crises on national economies, another group of scholars focused on economic-related crises such as De Nardi et al. (2012), Petra et

al. (2013) and Scutaru et al. (2015). Specifically, these studies examined the effects of the global financial crisis (2007/2008) on household consumption, unemployment and macroeconomic performance. Without exception, the research mentioned earlier highlighted the implications of health and economic-related crises in jeopardising the economy. It is undeniable that the above research reports have listed the impact of the related crisis on the national and global economy, however, several crises have blown the worldwide economy seriously throughout history. For example, Malaysia has experienced well-known health-related crises such as SARS and COVID-19 and the famous economic-related crises, namely the Asian and global financial crises. Since Malaysia has experienced various crises, past research that mainly focused on a single crisis is insufficient to provide a precise understanding of the impact of the crises on private expenditures in Malaysia.

Contrary to the existing literature, our research investigates the impact of a series of shocks (crises) on private consumption in Malaysia. By doing so, we can compare the impact of the different crises and their severity on consumer expenditures. The findings can be more comprehensive and informative for policymakers to take targeted actions against the crisis. Apart from shock and the conventional determinants of consumption, another central contribution of the present study is to explore the private consumption behaviour in Malaysia from different perspectives by accommodating additional factors such as economic leadership and telecommunication technologies. It is also important to highlight that a new economic leadership indicator by augmenting the Barro's misery index will be proposed in this study to investigate its implication on private consumption in Malaysia.

The enormous role of science and technology during the period of preventing and controlling pandemic outbreaks has been more obvious and evident. In recent years, online distribution platforms, door-to-door service platforms, online education, online medical care, online life service, logistics, customised catering distribution, errands, and other internet-based projects have ushered in unprecedented market demand and recognition. These revolutions and developments make technologies and Internet services become more inseparable from humans daily and play a significant role in determining private consumption. Malaysia is the regional king of e-shopping, according to the data and findings of Yendamuri et al. (2020), which focuses on the regional digital economy and e-commerce situation. By 2021, approximately 88% of the overall population in Malaysia are digital consumers, compared to 78% in Southeast Asia. Apart from that, online channels in Malaysia are playing a four-fold larger role than traditional channels and the numbers are expected to accelerate in the coming future. Due to the significance and wide use of telecommunication technologies, it is worthy to investigate the impact of telecommunication technologies on private consumption expenditures in Malaysia.

A battery of advanced time-series econometric approaches will be employed to achieve the research objectives. Specifically, the Augmented Dickey-Fuller (ADF) and Kwiatkowski-Phillips-Schmidt-Shin (KPSS) tests for unit root will be used in this study to determine the order of integration. Moreover, the multiple breaks (m-breaks) unit root test proposed by Kapetanios (2005) will also be applied in the present study to affirm the order of integration. Next, the Johansen-Juselius system-wide test for cointegration

will be utilised to examine the existence of a long-run relationship between private consumption and its determinants in Malaysia. If the variables are found to be co-integrated, then a meaningful long-run private consumption model can be estimated for the Malaysian economy.

The remainder of this paper is structured as follows. In the next section, we will briefly discuss the theoretical model and data used in the present study. Section 3 will deliberate the econometric techniques employed in this paper. This is followed by Section 4 which consists of the empirical findings and lastly, this study will conclude with some policy recommendations in Section 5.

2. Consumption Theories, Model Specification and Data

2.1 Theories

Consumption is one of the widely discussed economic topics apart from economic growth and development. Retrospectively, there are five major consumption theories discussed in the literature, namely the absolute income hypothesis (AIH) of Keynes (1936), the relative income hypothesis (RIH) of Duesenberry (1949), the permanent income hypothesis (PIH) of Friedman (1957), the life-cycle hypothesis (LCH) of Ando and Modigliani (1963), and the random walk hypothesis (RWH) of Hall (1978). Each of these consumption theories has its own uniqueness in justifying consumption behaviours.

Keynes' (1936) AIH is relatively one of the oldest consumption theories which emerged after the Great Depression in the 1930s. This theory relates consumption with the current disposable income and the marginal propensity to consume (MPC) is hypothesised to be positive but less than unity. It assumes that a change in the absolute level of disposable income will invite a simultaneous change in consumption and savings. However, Duesenberry's (1949) RIH considers the psychological aspect by contending that utility gain from consumption will be enhanced when consumption increases in contrast to others in the same community with whom the individual feels they are competing. With respect to this, individual consumption is associated with neighbours' consumption. As such, the RIH argued that consumer behaviour does not depend heavily on their absolute income but rather on relative income.

Besides, Friedman's (1957) PIH consumption model segregates income into permanent and transitory income. The model proposed that consumers look beyond transitory and current absolute income, but their spending behaviour is significantly influenced by a permanent change in income, which is what a person reasonably expects to earn on a consistent basis over the planned horizon. This is because only a permanent change will cause individuals to reform their expectations towards their future income which would eventually affect the individuals to change their consumption behaviour. Similar to the PIH model, Ando-Modigliani's LCH consumption model is also against the conventional assertion that the decision to consume depends mainly on current absolute income. This is because rational consumers' spending decisions are intertemporal choices in their entire lifetime. More specifically, the LCH postulates that rational consumers tend to plan their spending based on all available resources and distribute them across their entire lifetime in order to maximise their

total utility. For example, both young- and old-age consumers are the dis-savings population. Thus, their consumption will be financed by past savings and borrowing since they are either non-productive or earning a low income. On the contrary, the consumers of the working age are relatively productive and earn a higher income. Thus, they are likely to save for their children and future consumption at the retirement age. With respect to this important assertion on intertemporal choice in consumption decision, the behaviour of consumption tends to vary across the age structure of the population, resource availability, and the rate of return (interest rate) for postponing their current consumption. Obviously, both PIH and LCH consumption models fulfilled the basis of intertemporal choice whereby consumers are making choices according to their future resources and distributing their permanent income through formulating a consumption pattern that can maximise their utilities by doing a trade-off between choices of current consumption, savings or future consumption in various points of time.

Although the above-mentioned consumption theories, especially the PIH and LCH well-explained the importance and distribution of income across consumers' lifetime in affecting consumer behaviour, the assumption of perfect information about income for lifetime planning is one of the imperfections highlighted in Hall (1978). Hall (1978) borrowed the rational expectation theory to construct RWH by arguing that one would not be able to perfectly predict their income and there might be some degree of uncertainties about their future income due to imperfect information. Thus, Hall (1978) observed that consumers would adjust their consumption level based on their anticipated consumption whenever there is a shock in income or uncertain events. Literally speaking, the RWH contended that both permanent and transitory changes in income would significantly explain consumption behaviour.

2.2 Model Specification

Based on the mentioned consumption theories, consumption behaviour is in a nutshell explained by income, wealth, borrowing (debts), interest rate return and uncertainty. Literally, Aydede (2008) and Estrada et al. (2015) also take into account these explanatory variables in estimating consumption function. Therefore, the baseline consumption function can be specified as follows:

$$C_t = f(Y_t, W_t, R_t, B_t, U_t) \quad (1)$$

where C_t refers to consumption level, Y_t represents disposable income, W_t is the household wealth, R_t is the interest rate, B_t represents borrowing (debts), and U_t refers to uncertainty. Given the interest of the present study to investigate the impact of economic leadership (EL), telecommunication technology (ICT), and a series of health and economic shocks on private consumption in Malaysia, the model can be re-written as below:

$$\ln PC_t = \beta_0 + \beta_1 \ln DI_t + \beta_2 R_t + \beta_3 \ln WEALTH_t + \beta_4 \ln BOR_t + \beta_5 \ln EL_t + \beta_6 \ln ICT_t + \beta_7 \ln EUNC_t + \beta_8 \ln HUNC_t + \varepsilon_t \quad (2)$$

where $\ln PC_t$ is the log of per capita real private consumption spending, $\ln DI_t$ is the log of per capita real private disposable income, R_t is the real interest rate adjusted with

CPI-based inflation rate, $\ln\text{WEALTH}_t$ represents the log of Malaysia's housing price index. $\ln\text{BOR}_t$ is the log of per capita real household debt used to capture borrowing, $\ln\text{EL}_t$ is the economic leadership measured by modifying the misery index, and ICT_t refers to information and communication technologies infrastructure. Moreover, HUNC_t and EUNC_t are the dummy variables used to capture the health and economic uncertainties that happen in Malaysia from 1990 to 2020. In this study, the health uncertainties include the outbreak of SARS and COVID-19 pandemic. However, the economic crises include the 1997/1998 Asian financial crisis (D97) and the 2007/2008 global financial crisis (D08).

2.3 Data

This study utilises the seasonally-adjusted quarterly data from year 1990:Q1 to 2020:Q4. These data are extracted from various reliable sources. Specifically, the per capita real private consumption spending, per capita real disposable income, the 3-month treasury bill rate and the household debt are collected from the *Monthly Highlights and Statistics* published by the Central Bank of Malaysia (Bank Negara Malaysia – BNM).¹ Likewise, the data used to construct economic leadership indicators such as inflation rate, unemployment rate, interest rate, per capita real GDP growth rate and household debt to GDP ratio are also collected from the same source. Besides, the Malaysian housing price index datasets are collected from the Valuation and Property Service Department (Jabatan Penilaian dan Perkhidmatan Harta – JPPH) of the Ministry of Finance Malaysia. Furthermore, the dataset of the percentage of Internet users is obtained from the Malaysian Communication and Multimedia Commission (MCMC). Nonetheless, the Internet users is based on an annual basis. As such, we apply the linear interpolation technique to derive the quarterly observations from annual data as this is the simplest method to transform low-frequency data to high-frequency data.² Moreover, some empirical studies proved that this method performs well when dealing with missing data (e.g. Bourmpoula et al., 2017; Hakura, 1997; Noor et al., 2006). Finally, the dummies for both health and economic crises are constructed according to the year of the events that happened based on reports from the World Health Organization, newsletters, and previous literature.

3. Econometric Methods

Given that time-series data is used in this study, testing for the order of integration and cointegration are both essential to avoid spurious regression and enhance the accuracy of the estimation results. More importantly, if the variables are found to be cointegrated, a stable long-run equilibrium relationship between private consumption and its determinants can be derived.

¹ There are various ways to construct the disposable income with respect to macroeconomic textbooks. In this study, the disposable income is computed by summing the private consumption and private savings data.

² MCMC used the same method to prepare quarterly data.

3.1 Kapetanios (2005) Unit Root Test

Apart from the conventional augmented ADF unit root test, this study also applies the multiple endogenous breaks (*m*-break) unit root test developed by Kapetanios (2005). This approach can detect more than two structural breaks endogenously. This is one of the uniqueness of this approach in relation to other unit root tests with structural breaks (e.g., Lumsdaine & Papell, 1997; Narayan & Popp, 2010; Zivot & Andrews, 1992). Similar to existing literature, Kapetanios (2005) proposed three types of trend break models, namely (a) Model A, which allows for the structural break(s) in the intercept of the trend function; (b) Model B, which allows for the structural break(s) in the slope of the trend function; and (c) Model C, which allows for the structural break(s) in both the intercept and the slope of the trend function. Despite Perron (1989) documented that most of the macroeconomic time-series adequately fit the specification of either Model A or Model C, the simulation results of Sen (2003) revealed that Model C gain substantive statistical power compared with Model A. Moreover, the loss in statistical power is very marginal if Model C is used but the characteristics of the breaks are well-fitted with Model A. Given Model C is superior to Model A, the Model C of Kapetanios (2005) will be used to affirm the order of integration of private consumption and the determinants. The Model C for the *m*-break unit root test can be written as below:

$$z_t = \alpha_0 + \alpha_1 t + \delta z_{t-1} + \sum_{i=1}^k \omega_i \Delta z_{t-i} + \sum_{j=1}^3 \theta_j DU_{j,t} + \sum_{j=1}^3 \gamma_j DT_{j,t} + \varepsilon_t \quad (3)$$

where $\Delta = (1 - L)z_t$, t is the deterministic time trend variable, and ε_t is the disturbance term assumed to be normally distributed and white noise. Δz_{t-i} is the lagged dependent variable incorporated into the model to address serial correlation. Besides, the optimum lag (k) is determined by the Bayesian Information Criterion (BIC). $DU_{j,t}$ and $DT_{j,t}$ are the dummy variables for breaks in the intercept and breaks in the slope of the trend function. $DU_{j,t} = 1$ if $(t > TB_j)$, $DT_{j,t} = 1$ if $(t > TB_j)(t - TB_j)$, zero otherwise where $TB_j + 1$ represents the dates of the i th breakpoints. The breakpoint (TB_j) is ascertained endogenously by the minimum value of t -statistics for δz_{t-1} .

3.2 Johansen-Juselius Cointegration Analysis

If the order of integration of the series are found to be uniform $I(1)$, one can examine the presence of cointegration using the Johansen-Juselius system-wide cointegration test. To do so, we estimate the following vector error-correction model (VECM):

$$\Delta Z_t = \phi D_t + \Pi Z_{t-1} + \sum_{j=1}^{k-1} \Gamma_j \Delta Z_{t-j} + v_t \quad (4)$$

where Δ is the first difference operator, v_t is the disturbance term, and D_t is a vector of deterministic components. Based on the context of this study, Z_t is a vector of endogenous variables, namely private consumption, private disposable income, interest rate, borrowing, economic leadership and ICT.

Johansen and Juselius (1990) proposed to verify the presence of long-run equilibrium relationship among the endogenous variables with the likelihood ratio (LR) test, namely the trace and maximum eigenvalue tests as expressed below.

$$LR(\lambda_{\text{Trace}}) = -T \sum_{i=r+1}^k \ln(1 - \lambda_i) \quad (5)$$

$$LR(\lambda_{\text{max}}) = -T \ln(1 - \lambda_{i+1}) \quad (6)$$

where \ln is the natural logarithm, T is the sample size, and λ denotes the eigenvalues. Like the standard inferential statistics, the null hypothesis of no cointegration can be rejected if the LR test is greater than the critical values.

4. Empirical Results and Discussions

In this section, we will present the findings of the present study, beginning with the stationary analysis. This is because regression results with non-stationary and non-cointegrated series will be subjected to spurious effects, thus providing bias and not reliable outcomes (Granger & Newbold, 1974; Phillips, 1986). As such, determining the stationarity or the order of integration of the variables is a common and important practice in time series analysis. To ascertain the order of integration, this study first employed the non-structural unit root tests, specifically the ADF (Dickey & Fuller, 1981), and KPSS (Kwiatkowski et al., 1992). Table 1 displays the results of the unit root tests.

Table 1. Results of unit root tests with and without structural breaks

| Variables | Non-structural break unit root tests | | Kapetanios' unit root test with break – Model C | |
|--------------------------|--------------------------------------|--------------|---|---------------------------|
| | ADF test | KPSS test | m -break test | Break dates |
| <i>Level:</i> | | | | |
| $\ln PC_t$ | -2.226 (1) | 0.242 (9)*** | -6.947 (9) | 1997:Q4; 2006:Q4; 2011:Q4 |
| $\ln DI_t$ | -3.324 (2) | 0.174 (7)** | -5.359 (11) | 1997:Q3; 2005:Q1; 2011:Q4 |
| R_t | -2.795 (2) | 0.238 (8)*** | -5.134 (12) | 1994:Q4; 2001:Q3; 2008:Q3 |
| $\ln BOR_t$ | -2.422 (1) | 0.147 (8)** | -2.412 (7) | 1995:Q4; 2001:Q1; 2006:Q1 |
| $\ln WEALTH_t$ | -2.071 (2) | 0.221 (9)*** | -5.377 (10) | 1997:Q1; 2010:Q4; 2015:Q4 |
| ICT_t | -2.628 (5) | 0.122 (0) | -5.226 (12) | 2007:Q1; 2012:Q4; 2016:Q4 |
| $\ln EL_t$ | -2.798 (6) | 0.244 (9)*** | -5.773 (6) | 1998:Q1; 2002:Q3; 2009:Q1 |
| <i>First difference:</i> | | | Critical values [#] | |
| $\Delta \ln PC_t$ | -13.449 (0)*** | 0.044 (3) | 1 per cent | -7.401 |
| $\Delta \ln DI_t$ | -8.258 (4)*** | 0.117 (28) | 5 per cent | -7.006 |
| ΔR_t | -11.159 (1)*** | 0.040 (7) | 10 per cent | -6.686 |
| $\Delta \ln BOR_t$ | -6.978 (0)*** | 0.103 (5) | | |
| $\Delta \ln WEALTH_t$ | -4.112 (1)*** | 0.143 (8) | | |
| ΔICT_t | -3.762 (1)** | 0.138 (8) | | |
| $\Delta \ln EL_t$ | -6.347 (5)*** | 0.107 (22) | | |

Notes: *** and ** denote 1% and 5% significant levels, respectively. Figures in parentheses () indicate the optimal lag structure for ADF and bandwidth for KPSS determined by Akaike's Information Criterion (AIC) and Newey-West Bartlett Kernel, respectively. # are critical values for m -break unit root test collected from Kapetanios (2005).

Looking at the results of ADF and KPSS tests, we find that the tests consistently reveal $\ln PC_t$, $\ln INC_t$, R_t , and $\ln EL_t$ are non-stationary at level, but the variables become stationary after transforming into the first difference. As such, these variables are integrated of order one, $I(1)$. Nonetheless, there are some extents of inconsistent findings between the ADF unit root test and KPSS null stationarity test for the ICT_t variable. On the one hand, the results of the ADF test demonstrate that ICT_t is an $I(1)$ variable because we find that the test fails to reject the null hypothesis of a unit root at level, but it can be rejected when the variable comes to first differencing, ΔICT_t . On the other hand, the results of KPSS test show that ICT_t is stationary at both levels and first difference. As such, the KPSS test suggests that ICT_t is an $I(0)$ variable.

However, the traditional unit root tests may be susceptible to structural break(s) problems and produce biased results, hence the m -break unit root test by Kapetanios (2005) is employed to reinforce the results of the order of integration. Turning to the findings of m -break unit root test reported in Table 1, the results show no contradictory evidence to the ADF test. Nevertheless, the finding of m -break, especially for the ICT_t is slightly different from the one provided by the KPSS test. The m -break unit root test is unable to reject the null hypothesis of a unit root for all the variables at the level including ICT_t . As such, we can conclude the variables used in this study are integrated of order one, $I(1)$. The evidence of $I(1)$ is not surprising as this is in line with the findings of Nelson and Plosser (1982), who suggested that the majority of economic variables are $I(1)$.

Since the stationary test proves that all the variables are integrated of order one $I(1)$, this study will then proceed to explore the existence of long-run relationship between Malaysia's private consumption and its determinants with the multivariate test for cointegration introduced by Johansen (1988) using the maximum likelihood estimator. According to theoretical findings by Phillips and Loretan (1991), the full system estimation by maximum likelihood is the most desirable technique in cointegration estimation, while Johansen's cointegration is the simplest way to estimate a fully specified error-correction model through the maximum likelihood estimator. Furthermore, Johansen's cointegration technique performs better than other tests, even in events where the lag structure specifies incorrectly, and the errors are not normally distributed (Gonzalo 1994; Johansen & Juselius 1990). Therefore, the Johansen cointegration test is the appropriate technique to be used in this study. Although the Johansen cointegration test is widely used in testing for cointegration, the findings are elastic to the lag structure and also the choice of deterministic components in the model. The system-wide SBC statistic is used to determine the optimal lag structure and the statistic suggests performing Johansen's cointegration test with one-period lag. Furthermore, we borrow Pantula's principle as used in Johansen (1992) to select a model with the best combination of deterministic terms. Among the three commonly used models in Johansen's test for cointegration (i.e., Models 2, 3 and 4), Pantula's principle suggests that Model 3 which allows only intercept in the cointegrating equation (CE) and the vector autoregression (VAR) is the most suitable case for our study.³ In

³ Model 2 takes into account intercept in the CE but no intercept or deterministic trend in the VAR model whereas Model 4 is a model that considers both intercept and deterministic trend in the CE, but the deterministic trend is excluded from the VAR model. To conserve space, the entire outputs of the Pantula's principle are not reported here, but they are available upon request from the authors.

Table 2. Results of Johansen’s cointegration analysis

| Hypothesis | | Tests statistics | Critical values | |
|---|------------|------------------|-----------------|---------|
| H_0 | H_1 | | 5% | 1% |
| LR(λ_{Trace}) | | | | |
| $r = 0$ | $r \geq 1$ | 210.716*** | 125.615 | 135.973 |
| $r \leq 1$ | $r \geq 2$ | 129.962*** | 95.754 | 104.962 |
| $r \leq 2$ | $r \geq 3$ | 64.962 | 69.819 | 77.819 |
| $r \leq 3$ | $r \geq 4$ | 39.648 | 47.856 | 54.682 |
| $r \leq 4$ | $r \geq 5$ | 18.541 | 29.797 | 35.458 |
| $r \leq 5$ | $r \geq 6$ | 9.391 | 15.495 | 19.937 |
| $r \leq 6$ | $r \geq 7$ | 3.603 | 3.841 | 6.635 |
| LR(λ_{Max}) | | | | |
| $r = 0$ | $r = 1$ | 80.753*** | 46.231 | 52.308 |
| $r \leq 1$ | $r = 2$ | 65.000*** | 40.078 | 45.869 |
| $r \leq 2$ | $r = 3$ | 25.315 | 33.877 | 39.370 |
| $r \leq 3$ | $r = 4$ | 21.106 | 27.584 | 32.715 |
| $r \leq 4$ | $r = 5$ | 9.1499 | 21.132 | 25.861 |
| $r \leq 5$ | $r = 6$ | 5.788 | 14.265 | 18.520 |
| $r \leq 6$ | $r = 7$ | 3.603 | 3.841 | 6.635 |

Notes: *** denotes statistically significant at the 1% level. The system-wide SBC is used to determine the optimal lag structure (lag = 1). The critical values for cointegration are collected from MacKinnon et al. (1999).

light of this, we perform Johansen’s cointegration test with Model 3 and the results are reported in Table 2.

As mentioned in the earlier section, two likelihood ratio tests have been proposed by Johansen and Juselius (1990) to determine the existence of cointegration and the number of cointegrating ranks among the variables in the system. According to the cointegration evidence in Table 2, we find that the null hypotheses of $r = 0$ and $r \leq 1$ are rejected by both the trace and maximum-eigenvalue tests at the 1% significance level. However, the tests do not reject the rest of the null hypotheses. These findings suggest that the variables under review in this study are cointegrated with up to two cointegrating vectors. Since we find that the variables are cointegrated, a meaningful long-run private consumption function for Malaysia can be estimated.

In this regard, the present study estimates the long-run private consumption function using multiple methodologies to cross validate and enhance the robustness of results found. More specifically, the ordinary least square (OLS) estimator used in Engle and Granger (1987), the fully modified OLS (FMOLS) introduced by Phillips and Hansen (1990), the canonical cointegrating regression (CCR) made available by Park (1992), and the dynamic OLS (DOLS) proposed by Stock and Watson (1993) are used in this study. The application of these long-run estimators is attributed mainly to their unique advantages in estimation. For instance, Stock (1987) documented that OLS is an efficient and super-consistent long-run estimator, in particular when all the variables are $I(1)$ and cointegrated. Furthermore, the FMOLS, CCR and DOLS are consistent and robust

estimators as they address both the impacts of serial correlation and endogeneity bias. Given the highlighted uniqueness, additional long-run estimators, particularly FMOLS, CCR and DOLS are utilised in the present study to validate and strengthen the reliability of the estimation results. The estimation results of long-run private consumption in Malaysia are presented accordingly in Table 3.

Before interpreting the estimation results, we begin our analysis by checking the diagnostic tests. As demonstrated in Table 3, the Jarque-Bera normality test indicates that estimated residuals of the models are normally distributed. As such, the standard inferential statistics, especially those subject to normality assumption can be used for hypothesis testing. Besides, the ARCH test attests that the estimate residuals are likely to behave homogeneously. Moreover, the Ramsey RESET test confirm that the model used in this study does not subject to both functionality and specification errors. In other words, our private consumption model for Malaysia is well-specified. On the contrary, the result of the Breusch-Godfrey test for autocorrelation is statistically significant at the 5% level, revealing the existence of autocorrelation. In light of this imperfection, the procedure of the Newey-West robust standard errors is employed to address the problem and we can proceed to interpret the estimation results including the inferential statistics.

From the estimated results reported in Table 3, we find that besides the interest rate (R_t) and the 2008/2009 Global Financial Crisis (D08), other explanatory variables are likely significant at the conventional levels (i.e., 1%, 5% or 10%) across the four long-run estimators. With a 1% increase in disposable income, holding other explanatory variables constant, the long-run private consumption in Malaysia will increase by about 0.178% to 0.248%. This positive income effect on private consumption is consistent with the consumption theories and also past empirical findings as attested by Gerdtham and Johannesson (2004).

Likewise, the regression results also reported that private consumption is positively affected by household borrowings, and this is within expectation. Since borrowing is an alternative source of income, an increase in household borrowing will uplift their ability to consume. Indeed, households tend to borrow because consumers prefer smooth consumption over the lifetime as attested by the life-cycle theory of Ando and Modigliani (1963). Moreover, the significance of household borrowing in determining private consumption tends to be more prominent when consumers treat debts and credits as a substitution of income in maintaining consumption (Nau et al., 2015; Sullivan et al., 2001), especially when the cost of borrowing is low due to intense competition among the lenders (Prinsloo, 2002). As such, it is not surprising to find that borrowing has a positive impact on private consumption. Specifically, a 1% increase in borrowing tends to uplift private consumption by approximately 0.152% to 0.256%.

Besides disposable income and borrowing, the four long-run estimators consistently show that private consumption tends to increase by around 0.300% to 0.458% in the long-run for every 1% increase in wealth, holding other factors unchanged. Wealth is among the prominent determinant of private consumption, apart from telecommunication technologies. The reaction of consumption towards wealth copes with the life-cycle hypothesis (Ando & Modigliani, 1963) that suggests individuals would divide their lifetime income according to their stages of life, and their consumption at

Table 3. Results of long-run private consumption in Malaysia

| Variables | OLS | FMOLS | CCR | DOLS |
|-----------------------|------------------------|-----------------------|-----------------------|-----------------------|
| Constant | 2.555*** (0.251) | 1.403*** (0.488) | 1.342** (0.579) | 1.328** (0.562) |
| $\ln DI_t$ | 0.248*** (0.041) | 0.178*** (0.055) | 0.217*** (0.083) | 0.238*** (0.083) |
| R_t | -0.006** (0.003) | -0.002 (0.004) | -0.002 (0.005) | -0.003 (0.005) |
| $\ln BOR_t$ | 0.152*** (0.046) | 0.256*** (0.061) | 0.220*** (0.065) | 0.208*** (0.073) |
| $\ln WEALTH_t$ | 0.300*** (0.049) | 0.452*** (0.044) | 0.455*** (0.048) | 0.458*** (0.049) |
| ICT_t | 0.002** (0.001) | 0.004*** (0.001) | 0.004*** (0.001) | 0.004*** (0.001) |
| $\ln EL_t$ | 0.067*** (0.024) | 0.094*** (0.024) | 0.104*** (0.029) | 0.079** (0.037) |
| Economic uncertainty: | | | | |
| D97 | -0.102*** (0.010) | -0.056*** (0.020) | -0.048** (0.024) | -0.072** (0.032) |
| D08 | 0.010 (0.009) | 0.019 (0.020) | 0.017 (0.023) | 0.015 (0.024) |
| Health uncertainty: | | | | |
| SARS | -0.075*** (0.007) | -0.067*** (0.017) | -0.067*** (0.018) | -0.067*** (0.018) |
| COVID | -0.106*** (0.018) | -0.093*** (0.030) | -0.095*** (0.034) | -0.067** (0.033) |
| Diagnostic tests: | | | | |
| R^2 | 0.999 | 0.995 | 0.994 | 0.995 |
| Adjusted- R^2 | 0.998 | 0.994 | 0.993 | 0.994 |
| F-statistics | 4185.870*** [0.000] | 997.129*** [0.000] | 997.459*** [0.000] | 894.564*** [0.000] |
| χ^2_{NORMAL} | 3.813 [0.149] | 1.991 [0.369] | 1.945 [0.378] | 1.437 [0.487] |
| χ^2_{AUTO} | 4.039** [0.045] | - | - | - |
| χ^2_{ARCH} | 1.322 [0.250] | - | - | - |
| χ^2_{RESET} | 0.023 [0.878] | - | - | - |

Notes: The asterisks *** and ** denote statistically significant at the 1% and 5% levels, respectively. Figures in parentheses () refer to the robust standard-errors whereas [] indicates the p-values.

each period of life will be determined by the present value of the individual's predicted lifetime assets accumulated wealth. Moreover, the significant relationship between wealth and private consumption is in line with previous empirical results such as Ibrahim (2014) and Kazmi (2015).

Apart from that, our study discovers that telecommunication technologies' development and revolution help promote private consumption which is in line with the findings of Gurning and Khaliqi (2021) and Ma et al. (2020). In terms of magnitude, we find that on average, a 1% point increase in telecommunication technologies (ICT_t) will increase the long-run private consumption in Malaysia by approximately 0.2% to 0.4% which is slightly lower than the effect of wealth. The significance of telecommunication technologies is expected as the flourishing of Internet services and e-commerce platforms in Malaysia is helping businesses to create a more competitive advantage, making products and services more accessible to the consumers, more efficiently and transparently. According to Yendamuri et al. (2020), online media in Malaysia are presently four times more influential than conventional channels, and this trend is projected to continue in the near future. In this sense, the section on communications technologies should be prioritised to coincide with the Fourth Industrial Revolution.

On top of that, the results of the present study support the Great Man hypothesis, perceiving that a leader possesses a substantial influence on evolution and development. According to our results, private consumption spending of Malaysians will increase by approximately 0.067% to 0.104% following a 1% increase in economic leadership. We believe that the improvement in the effectiveness of the leaders enhances consumers' confidence in the nation's financial standing, makes households feel more optimistic about their economic future, and hence increases their propensity to spend. The considerable role of leaders is further supported by researchers such as Budhathoki (2019), Jones (2009), Jones and Olken (2005) and Tang and Salisu (2021), who suggested that leaders are at the core of economic and social activities, playing a vital role in establishing objectives, making decisions, and influencing the country's economic prosperity.

Next, we turn to the empirical results and discussion of the impacts of health and economic crises on private consumption in Malaysia as reported in Table 3. Overall, both crises carry adverse impacts on the long-run private consumption in Malaysia. In terms of health crises, we find that impact of the COVID-19 pandemic on private consumption is slightly higher than the SARS outbreak. On average, private consumption decreases by approximately 6.9% when Malaysia is exposed to the SARS outbreak. However, the long-run private consumption in Malaysia drops approximately 9.03% due to the COVID-19 pandemic. These corroborate with the findings of previous literature (e.g., Chen et al., 2021; Dong et al., 2021; Hai et al., 2004; Mishra & Dhanerwal, 2020; Siu & Wong 2004) who discovered that private consumption has been significantly reduced along with the prevalence of health-related catastrophe.

Furthermore, four long-run estimators consistently reveal that the Asian financial crisis (D97) has a negative impact on private consumption in Malaysia. Results show that private consumption tends to reduce by approximately 4.8% to 10.2% in the presence of the Asian financial crisis. This result is not startling and supported by a couple of past studies (e.g., De Nardi et al., 2012; Petra et al., 2013; Scutaru et al.,

2015). Moreover, Hall's (1978) study added that unexpected shocks will cause consumers to refine their spending.

5. Conclusion and Policy Implications

The main objective of this study is to estimate the long-run private consumption function in Malaysia by identifying factors that help to explain consumption behaviour. Meanwhile, to ensure the results of the study are robust and reliable, several econometric techniques are employed, such as unit root and cointegration tests. We find that the variables investigated in this study are $I(1)$ and cointegrated. As such, we estimate Malaysia's long-run private consumption function using various long-run estimators to enhance robustness. For the sake of brevity, our study finds that disposable income, borrowing, wealth, ICT and economic leadership have positively affected long-run private consumption. Nonetheless, both health and economic crises have negatively impacted private consumption in Malaysia. Interestingly, some policy recommendations can be derived from our findings to effectively improve private consumption in Malaysia ultimately boosting economic growth.

Given that telecommunication is prominent in fostering and promoting private consumption in Malaysia, the government must prioritise the adoption and development of telecommunication technologies for both hardware and software in the country, especially in the piece of the 5G technology. As a brand-new technology, the 5G technology will herald the next industrial revolution and fundamentally alter the future economy through its ultrafast speeds and the capacity to support millions of devices. Based on the report by IHS Markit (2020) that discusses the role of 5G in a post-pandemic world economy, in the year 2035, 5G technology is expected to gain US\$12.3 trillion in economic output and sustain 22 million employments globally; this shows how crucial the 5G technology is in promoting sustainable growth for the economy. In this sense, the government of Malaysia could subsidise the importation of software products such as 5G frameworks to ensure Malaysia does not lose out of the gate to cope with the evolution trend. Furthermore, the government should increase expenditures to embrace new technical knowledge and infrastructure to improve the advancement of existing technologies and infrastructure to the point where we can sustain the latest and best technologies.

Economic leadership performance is directly related to leaders' quality. Therefore, policymakers should do their utmost to improve the quality of leaders to accelerate economic performance, which requires setting up an independent governance committee board to ensure the quality and performance of leaders. In addition, to improve the ability of leaders, the government should advocate that the leaders rotate between various departments during their tenure, which is conducive to deepening the leaders' understanding of multiple divisions and playing a role in mutual governance. Moreover, policymakers should be aware of the agency problem and regulatory capture. These problems arise when there is a conflict of interest where leaders decide based on personal rather than the public interest. To deal with these challenges, the policymakers first need to overcome the problem of asymmetric information; hence, creating a competent, accountable and transparent (CAT) system that promotes the

free flow of information and complete transparency is essential. Transparency boosts confidence when performances and contributions of the leaders are revealed; allowing the populace to evaluate and vote for leaders in whom they have the greatest faith will help in enhancing the consumers' conviction. This is due to the fact that when the leaders are appointed solely by the inhabitants based on the leaders' abilities and accomplishments, the assigned leader is the 'chosen' one. As a consequence, if the country is led by a group of reputable leaders, consumers tend to have a more positive perspective of the nation's economic prospects, which ultimately encourages private spending and economic expansion.

In summary, given telecommunication technologies and leadership quality can both foster private consumption, policies related to these segments should be the primary focus of the Malaysian government in achieving long-term success and sustainable economic growth. Last but not least, the actual situation in the world encounters frequent and dynamic changes which we are not able to foresee. Although the model presented in this study can account for most of the effects, it does not mean the model is perfect and without flaws. Hence, consistent updates according to the real-world changes is a must before employing the model presented in future studies.

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