CHAPTER FIVE

RESULTS AND DISCUSSION

5.0 Introduction

This chapter is discussed in two parts. The first part comprises the discussion of the Singapore case, while the second part analyzes the Malaysian case. Recent time series techniques are employed, including the Unit Root Test, the Johansen Cointegration Test, Normalized Cointegrating Regression for one cointegrating vector equation/ long run elasticities and Granger Causality (GC) Test to examine the properties of the studied variables for both countries. The volatility of the given series has been included as additional information for both countries' analyses.

The cointegration analysis for both Singapore and Malaysia was accomplished using Econometric Views (E-views) software version 3.0. This was done to estimate the preference parameters and to test the predictions of the model. The results of both countries' analyses are summarized in the tables and will be discussed in the following sections.

5.1 PART I SINGAPORE ANALYSIS

5.1.1 Unit Root Test Results: For Singapore Case

As mentioned before, Unit Root Test is a test of stationarity. The existence of unit root in a time series indicates that the time series is nonstationary. The null hypothesis suggests unit roots, which is maintained unless there is evidence to reject it.

Unit Root Test is done according to the Augmented Dickey Fuller (ADF) Test and Phillips-Perron (PP) Test. These two tests are used to examine for a unit root and to determine the stationarity of the data series. They consist of running a regression of the level and the first-differences of the series against the series lagged once, lagged difference terms, and optionally, a constant and a time trend. All series are transformed into natural logarithms.

The results of the Unit Root Test for the lagged differenced series are presented in Table 1. Table 1 shows the outcomes of the Augmented Dickey Fuller and Phillips-Perron tests for levels as well as first-differences employing different lagged-lengths. Figures in parentheses below the absolute ADF or PP Tau calculated values, are Tau critical values for 1%, 5% as well as 10% significance level, have been reported.

From the results, it is shown that the Augmented Dickey Fuller Test, the τ-calculated statistics or Tau calculated statistics for all the series in levels with different lag-periods are insignificant at the 1%, 5% as well as 10% significance level which depicts that the values in absolute terms do not exceed the 1%, 5% and 10% critical values. Hence, all these series are nonstationary in level term and it fails to reject the null hypothesis suggesting unit roots.

For the Phillips-Perron Test, all the series in levels with various lagged-lengths were also insignificant at the 1%, 5% as well as 10% significance level. Therefore, the null hypothesis cannot be rejected and the model contained unit roots.

For first-differences, the Augmented Dickey Fuller Test for the log of demand for medical care were significant at the 5% and 10% level respectively for models with intercept without trend and with trend with 2 lags. Here the Tau calculated values in absolute terms exceed the absolute Tau critical values. Nevertheless, this series is only significant at the 10% critical value for models with intercept without trend with 1 lag and 5 lags.

On the other hand, the log of net consumption expenditure is significant at the 5% level at 1 lag as well as 2 lags for intercepts with and without trend. The log of the relative price of medical care is also significant at the 5% level for lags 1 and 2, with and without trend.

Using the Akaike Information Criterion (AIC) and also the Bayesian Schwarz Criterion (BIC), the optimum lag-length can be determined. Here, the model is optimal at 2 lags. All the series are significant in first-differences.

Based on the definition of Phillips-Perron Test, **Phillips and Perron (1988)** proposed non-parametric correction as an alternative to the inclusion of lag terms. It accounts for non-independent variables and identically distributed according to non-parametric adjustment to the standard Dickey Fuller procedure. Therefore, it has all its values in absolute terms exceeding the 5% and 10% critical values. The null hypotheses can be rejected for all first-differenced stationary terms.

The Phillips-Perron Test is a better test to examine the stationarity compared to the Augmented Dickey Fuller Test because the Phillips-Perron Test employs non-parametric adjustment for non-independent variables.

Table 1: Results of the Augmented Dickey-Fuller And Phillips-Perron Unit Root Test: Singapore's Case

Variables/ Series	IN LEVEL FORM				
	ADF			PP	
	Lag - Length	Intercept Without Trend	Intercept With Trend	Intercept Without Trend	Intercept With Trend
LNM	1	-1.666990 (-2.9446)	-1.820891 (-3.5386)	-1.569315 (-2.9422)	-1.547561 (-3.5348)
	2	-1.266199 (-2.9472)	-2.517153 (-3.5426)	-1.488623 (-2.9422)	-1.692485 (-3.5348)
	3	-1.416523 (-2.9499)	-2.224621 (-3.5468)	-1.494188 (-2.9422)	-1.712274 (-3.5348)
	4	-1.944355 (-2.9527)	-4.164195 [-4.2605]	-1.471771 (-2.9422)	-1.758281 (-3.5348)
	5	-1.216900 (-2.9558)	-2.890570 (-3.5562)	-1.499913 (-2.9422)	-1.722537 (-3.5348)
LNC	1	-1.806678 (-2.9446)	-2.427812 (-3.5386)	-1.567197 (-2.9422)	-1.700716 (-3.5348)
	2	-1.944260 (-2.9472)	-2.117966 (-3.5426)	-1.564790 (-2.9422)	-1.718438 (-3.5348)
	3	-1.568053 (-2.9499)	-3.401194 (-3.5468)	-1.533907 (-2.9422)	-1.766570 (-3.5348)
	4	-1.148598 (-2.9527)	-2.770754 (-3.5514)	-1.521916 (-2.9422)	-1.780303 (-3.5348)
	5	-1.215995 (-2.9558)	-3.114219 (-3.5562)	-1.540970 (-2.9422)	-1.745111 (-3.5348)
LNP_M	1	-0.317327 (-2.9446)	-3.955070 [-4.2324]	-0.125261 (-2.9422)	-3.001228 (-3.5348)
	2	-0.113515 (-2.9472)	-3.050104 (-3.5426)	-0.122427 (-2.9422)	-3.015140 (-3.5348)
	3	-0.320727 (-2.9499)	-2.625367 (-3.5468)	-0.158187 (-2.9422)	-2.950665 (-3.5348)
	4	-0.467559 (-2.9527)	-2.527369 (-3.5514)	-0.194295 (-2.9422)	-2.887490 (-3.5348)
	5	-0.343128 (-2.9558)	-3.590919 [-4.2712]	-0.211041 (-2.9422)	-2.846165 (-3.5348)

Source: Series for medical care expenditure, series for consumption expenditure and relative price of medical care were taken from the breakdown components of national accounts 1964-2001 (Department of Statistics Singapore).

Note 1: LNM represents demand for medical care in logarithm form.
LNC represents net consumption expenditure in logarithm form.

LNP_M represents relative price of medical care in logarithm form.
Figures in ( ) indicate τ -critical values at 5% significance level.
Figures in [ ] indicate τ -critical values at 1% significance level.
Figures in { } indicate τ -critical values at 10% significance level.
ADF indicates Augmented Dickey Fuller Test.
PP indicates Phillips-Perron Test.

Note 2: -The demand for medical care considered as the breakdown component of medical care and health expenses in constant price series.
-The net consumption expenditure is total consumption expenditures in constant price series less total medical care expenditures in constant price series.
-The relative price of medical care is implicit deflators for medical care expenses which constructed by dividing nominal series by the 1990 constant price series.

Variables/ Series	FIRST-DIFFERENCES				
	ADF			PP	
	Lag - Length	Intercept Without Trend	Intercept With Trend	Intercept Without Trend	Intercept With Trend
LNM	1	-2.904594***	-3.065429	-5.270194*	-5.554631*
		{-2.6118}	(-3.5426)	(-2.9446)	(-3.5386)
	2	-2.991052*	-3.234752***	-5.340375*	-5.595976*
		(-2.9499)	{-3.2056}	(-2.9446)	(-3.5386)
	3	-2.073740	-2.598004	-5.340669*	-5.580514*
		(-2.9527)	(-3.5514)	(-2.9446)	(-3.5386)
	4	-2.499603	-2.676582	-5.391672*	-5.597785*
		(-2.9558)	(-3.5562)	(-2.9446)	(-3.5386)
	5	-2.766323***	-2.756559	-5.386058*	-5.580065*
		{-2.6181}	(-3.5614)	(-2.9446)	(-3.5386)
LNC	1	-3.797736*	-4.256768*	-4.028205*	-4.320113*
		(-2.9472)	(-3.5426)	(-2.9446)	(-3.5386)
	2	-3.019184*	-3.678714*	-3.898786*	-4.197407*
		(-2.9499)	(-3.5468)	(-2.9446)	(-3.5386)
	3	-2.469656	-2.638839	-3.958409*	-4.215422*
		(-2.9527)	(-3.5514)	(-2.9446)	(-3.5386)
	4	-2.299212	-2.509068	-4.008240*	-4.230654*
		(-2.9558)	(-3.5562)	(-2.9446)	(-3.5386)
	5	-1.757591	-1.810546	-3.992541*	-4.203218*
		(-2.9591)	(-3.5614)	(-2.9446)	(-3.5386)
LNP_M	1	-4.828757*	-4.730586*	-4.016363*	-3.945827*
		(-2.9472)	(-3.5426)	(-2.9446)	(-3.5386)
	2	-4.048072*	-3.889511*	-3.885888*	-3.806922*
		(-2.9499)	(-3.5468)	(-2.9446)	(-3.5386)
	3	-3.362386*	-3.184933	-3.729191*	-3.635040*
		(-2.9527)	(-3.5514)	(-2.9446)	(-3.5386)
	4	-2.421581	-2.296963	-3.650660*	-3.543295*
		(-2.9558)	(-3.5562)	(-2.9446)	(-3.5386)
	5	-2.858112***	-2.577143	-3.624264*	-3.509447***
		{-2.6181}	(-3.5614)	(-2.9446)	{-3.2009}

Source: Series for medical care expenditure, series for consumption expenditure and relative price of medical care were taken from the breakdown components of national accounts 1964-2001 (Department of Statistics Singapore).

Note 1: LNM represents demand for medical care in logarithm form.
LNC represents net consumption expenditure in logarithm form.
LNP_M represents relative price of medical care in logarithm form.

Critical τ -value of ADF intercept without trend for LNM significance level: lag 1 ~ -3.6289(1%), -2.9472(5%), -2.6118(10%).
Critical τ -value of ADF intercept with trend for LNM significance level: lag 1 ~ -4.2412(1%), -3.5426(5%), -3.2032(10%).
Critical τ -value of ADF intercept without trend for LNM significance level: lag 2 ~ -3.6353(1%), -2.9499(5%), -2.6133(10%).
Critical τ -value of ADF intercept with trend for LNM significance level: lag 2 ~ -4.2505(1%), -3.5468(5%), -3.2056(10%)
Critical τ -value of ADF intercept without trend for LNM significance level: lag 5 ~ -3.6576(1%), -2.9591(5%), -2.6181(10%).
Critical τ -value of ADF intercept with trend for LNM significance level: lag 5 ~ -4.2826(1%), -3.5614(5%), -3.2138(10%).
Critical τ -value of ADF intercept without trend for LNC significance level: lag 1 ~ -3.6289(1%), -2.9472(5%), -2.6118(10%).
Critical τ -value of ADF intercept with trend for LNC significance level: lag 1 ~ -4.2412(1%), -3.5426(5%), -3.2032(10%).
Critical τ -value of ADF intercept without trend for LNC significance level: lag 2 ~ -3.6353(1%), -2.9499(5%), -2.6133(10%)
Critical τ -value of ADF intercept with trend for LNC significance level: lag 2 ~ -4.2505(1%), -3.5468(5%), -3.2056(10%).
Critical τ -value of ADF intercept without trend for LNP_M significance level: lag 1 ~ -3.6289(1%), -2.9472(5%), -2.6118(10%).
Critical τ -value of ADF intercept with trend for LNP_M significance level: lag 1 ~ -4.2412(1%), -3.5426(5%), -3.2032(10%).
Critical τ -value of ADF intercept without trend for LNP_M significance level: lag 2 ~ -3.6353(1%), -2.9499(5%), -2.6133(10%).
Critical τ -value of ADF intercept with trend for LNP_M significance level: lag 2 ~ -4.2505(1%), -3.5468(5%), -3.2056(10%).
Critical τ -value of ADF intercept without trend for LNP_M significance level: lag 3 ~ -3.6422(1%), -2.9527(5%), -2.6148(10%)
Critical τ -value of ADF intercept with trend for LNP_M significance level: lag 3 ~ -4.2605(1%), -3.5514(5%), -3.2081(10%).
Critical τ -value of ADF intercept without trend for LNP_M significance level: lag 5 ~ -3.6576(1%), -2.9591(5%), -2.6181(10%).
Critical τ -value of ADF intercept with trend for LNP_M significance level: lag 5 ~ -4.2826(1%), -3.5614(5%), -3.2138(10%).
Critical τ -value of PP intercept without trend for different LNM significance levels: -3.6228(1%), -2.9446(5%), -2.6105(10%).
Critical τ -value of PP intercept with trend for different LNM significance levels: -4.2324(1%), -3.5386(5%), -3.2009(10%).
Critical τ -value of PP intercept without trend for different LNC significance levels: -3.6228(1%), -2.9446(5%), -2.6105(10%).
Critical τ -value of PP intercept with trend for different LNC significance levels: -4.2324(1%), -3.5386(5%), -3.2009(10%).
Critical τ -value of PP intercept without trend for different LNP_M significance levels: -3.6228(1%), -2.9446(5%), -2.6105(10%).
Critical τ -value of PP intercept with trend for different LNP_M significance levels: -4.2324(1%), -3.5386(5%), -3.2009(10%).

An asterisk * indicates critical at 5% significance level.
** indicates critical at 1% significance level.
*** indicates critical at 10% significance level.

Figures in ( ) indicate τ -critical values at 5% significance level.

Figures in [ ] indicate τ -critical values at 1% significance level.

Figures in { } indicate τ -critical values at 10% significance level.

ADF indicates Augmented Dickey Fuller Test.

PP indicates Phillips-Perron Test.

Note 2: -The demand for medical care considered as the breakdown component of medical care and health expenses in constant price series.

-The net consumption expenditure is total consumption expenditures in constant price series less total medical care expenditures in constant price series.

-The relative price of medical care is implicit deflators for medical care expenses which constructed by dividing nominal series by the 1990 constant price series.

5.1.2 Results of the Johansen Cointegration Test in the Singapore Case

Johansen-Juselius (1990) developed the Johansen Cointegration Test (with unrestricted intercept and no trends) to examine the long run relationship between two or more series. The result of the Johansen Cointegration Test for the Singapore case is presented in Table 2, which demonstrates the cointegration relationships between the log of demand for medical care, the log of net consumption expenditure and the log of relative price of medical care. As determined by Akaike Information Criterion (AIC) and also Bayesian Schwarz Criterion (BIC), the optimum lag for this case is 2 lags. Hence, the test proceeds on this optimum of 2 lags.

Regarding the result from Table 2, there is only one cointegrating vector between these three series. This is shown by the value (30.67467) exceeding the 5% critical value (29.68). So the null hypothesis ($r = 0$) can be rejected and it implies that only one cointegrating vector exists in the long run, represented by the symbol ($r \leq 1$). However, the findings show that the likelihood ratio for the null hypothesis ($r \leq 2$) is insignificant at the 5% as well as 1% critical level.

Here, it strengthens the fact by showing only one cointegrating vector in the model explaining the integration of short run dynamics towards the long run equilibrium.

Table 2: Results of the Johansen Cointegration Test: Singapore's Case

H_0	H_1	Likelihood Ratio	95% Critical Value	99% Critical Value	Eigenvalue
<u>Lag 2</u>					
r = 0	r = 1	30.67467*	29.68	35.65	0.435700
r ≤ 1	r = 2	10.64875	15.41	20.04	0.234199
r ≤ 2	r = 3	1.309617	3.76	6.65	0.036726

Notes: (*) denotes rejection of the hypothesis at (5%) significance level.
(**) denotes rejection of the hypothesis at (1%) significance level.
Optimum lag-length: 2 lags.
r is the maximum number of cointegrating vectors.
Series: LNM - Demand for medical care in logarithm form.
LNC - Net consumption expenditure in logarithm form.
LNP_M - Relative price of medical care in logarithm form.

5.1.3 Results of the Normalized Cointegrating Regression for One Cointegrating Vector Equation in the Singapore Case

Table 3 exhibits the long run elasticities obtained from the normalized equation for the Singapore case. Transmitted into equation form, the equation can be written as:

$$\ln M_t = -4.243 + 0.035t + 0.503 \ln C_{t-1} - 1.002 \ln P_{M,t-1} - 0.320 u_{t-1}$$
$$(1.694)^* \quad (1.987)^* \quad (-2.886)^{**} \quad (-2.235)^*$$

$R^2 = 0.995880$ DW = 1.518660

A linear time trend is included in the above cointegrating regression because the preference shock in the health sector is assumed to be trend-stationary[56]. Since the log of

[56] Since Lee and Kong (1999) assumed that the preference shock in the health sector is trend-stationary, therefore, a linear time trend is included in the cointegrating regression.

medical care expenditure is used as the dependent variable, so that the estimated cointegrating vector of $\ln M_t$ on $\ln C_{t-1}$ and $\ln P_{M,t-1}$ is written as $[1, \alpha/\gamma, -1/\gamma]$ = [1, 0.503, -1.002]. The normalized cointegrating regression comprises long run elasticities. All the estimated parameters have the theoretically correct signs.

The log of net consumption expenditure is statistically significant at the 5% significance level. It has a positive relationship with the log of demand for medical care. This can be explained, as when net consumption expenditure increases by 1%, on the average medical care demand would increase by about 0.5%, holding all other variables constant. The medical care service is considered as a necessary good because it seems to have an inelastic consumption curve with consumption elasticity less than unity.

On the other hand, the log of the relative price of medical care has a negative effect on medical demand, in accordance with the principle of diminishing marginal productivity of health capital with a downward sloping demand curve. It is significant at the 1% critical levels. The relative price elasticity is close to unity in absolute terms.

The outcomes are therefore consistent with the theory suggesting that demand and consumption have a positive relationship, while demand and relative price have a negative association. Since the residual reveals that the variables in the cointegrating equation are cointegrated and they share a common stochastic trend, thus, we can conclude that the log of demand for medical care $\ln M(t)$, the log of net consumption expenditure $\ln C(t)$ and the log of the relative price of medical care $\ln P_M(t)$ are difference-stationary variables.

In addition, since both the log of net consumption expenditure and the relative price of medical care are significant in the regression, therefore, we suggest that net consumption expenditure and the relative price of medical care are the key determinants in the medical care demand equation (cited in Lee and Kong, 1999; pp. 329).

Table 3: Results of the Normalized Cointegrating Regression ~ 1 Cointegrating Vector Equation/Long-run Elasticities: Singapore's Case

Lag 2					
LNM	LNC	LNP_M	t	u_{t-1}	C
1.000000	0.502713*	-1.001792**	0.034958*	-0.320325*	-4.242705
	(1.98663)	(-2.88582)	(1.69434)	(-2.23458)	
Log likelihood		217.8818			

Notes: (*) denotes rejection of the hypothesis at (5%) significance level.
(**) denotes rejection of the hypothesis at (1%) significance level.
( ) Figures in bracket indicate as t-calculated values.
Optimum lag-length: 2 lags.
LNM – Demand for medical care in logarithm form.
LNC – Net consumption expenditure in logarithm form.
LNP_M – Relative price of medical care in logarithm form.
t indicates as a linear time trend.
u_{t-1} indicates as one-period lagged value of the residual.
C indicates as constant term.
1% t-critical value = 2.440 or -2.440.
5% t-critical value = 1.691 or -1.691.
10% t-critical value = 1.307 or -1.307.

5.1.4 Results of the Granger Causality Test in the Singapore Case

The Granger Causality Test consists of Bivariate and Multivariate Granger Causality. Bivariate Granger Causality Test involves only two variables or two series whereas Multivariate Granger Causality Test, also known as Pairwise Granger Causality Test, is performed for more series. Table 4 depicts the results of Granger Causality Test where it reports the output in the form of Bivariate as well as Multivariate (Pairwise) Granger Causality. The optimum lag-length is determined through AIC or BIC.

The results for Bivariate as well as Pairwise Granger Causality Test reveal that a unilateral relationship exists between medical care demand with net consumption expenditure and also between medical care demand with relative price of medical care. These relationships can be discussed through the one-way direction relationship from both tests where only medical care demand granger-causes the net consumption expenditure and also the relative price of medical care. They are respectively significant at the 5% level. For instance, the F-statistical values or the p-values (on the right hand side) showing one asterisk each denotes the 5% significance level as (3.749) exceeds (3.275) and (3.302) exceeds (3.275). This is the same when we rely on the p-values where 0.035 smaller than 0.05 and 0.045 is less than 0.05.

However, there is no bilateral relationship that exists between the net consumption expenditure and the relative price of medical care. Neither one of these series is significant at the 1% nor 5% even 10% significance level. They are not reverse granger causes to each other.

In conclusion, in this unilateral relationship, medical care demand plays an important role in influencing the net consumption expenditure and the relative price of medical care. Any changes in the medical care demand would affect the net consumption expenditure and the relative price of medical care to change.

Table 4: Results of the Granger Causality Test: Singapore's Case

Multivariate Granger Causality Test

Null Hypothesis	F-Statistic (p-value)
Δ(LNC) does not Granger Cause Δ(LNM)	1.01440 (0.37472)
Δ(LNM) does not Granger Cause Δ(LNC)	3.74891 (0.03522)*
Δ(LNP_M) does not Granger Cause Δ(LNM)	1.44668 (0.25130)
Δ(LNM) does not Granger Cause Δ(LNP_M)	3.30197 (0.04529)*
Δ(LNP_M) does not Granger Cause Δ(LNC)	2.25972 (0.12186)
Δ(LNC) does not Granger Cause Δ(LNP_M)	0.28008 (0.75768)

Notes: * denotes significant at 5% significance level.
** denotes significant at 1% significance level.
*** denotes significant at 10% significance level.
Figures in ( ) indicate as p-values.
Δ(LNM) represents the changes in log of demand for medical care.
Δ(LNC) represents the changes in log of net consumption expenditure.
Δ(LNP_M) represents the changes in log of relative price of medical care.
Lags: 2 periods (optimum lag).

Bivariate Granger Causality Test

The Unrestricted Regression Model (UR) and The Restricted Regression Model (R): Singapore's Case

Variables/ Series	$M \rightarrow C$	$C \rightarrow M$	$M \rightarrow P_M$	$P_M \rightarrow M$	$C \rightarrow P_M$	$P_M \rightarrow C$
RSS_u	1.312	2.443	1.312	2.419	2.443	2.419
RSS_r	1.188	3.336	1.423	3.527	2.475	2.964
F-value	3.749*	1.014	3.302*	1.447	0.280	2.260

Note 1: * denotes significant at 5% significance level.
** denotes significant at 1% significance level.
*** denotes significant at 10% significance level.
Optimum lag-length: 2 lags.
M represents the changes in log of demand for medical care.
C represents the changes in log of net consumption expenditure.
P_M represents the changes in log of relative price of medical care.
RSS_u ~ Unrestricted Sum of Square
RSS_r ~ Restricted Sum of Square

Note 2. $H_0 : \sum_{i=1}^{n} \alpha_i = 0$

$H_A : \sum_{i=1}^{n} \alpha_i \neq 0$

$$F_{\alpha;p,n-2p-1} = \frac{(RSS_r - RSS_u)/p}{RSS_u/(n-2p-1)}$$

n = Total number of observations.
p = Number of lagging in restriction terms when calculating ESS_r
2P = Number of lags for dependent and independent variables, the number of degrees of freedom lost from lagging.
1 = Number of parameter in constant term from unrestricted model.
n-2p-1 = Degrees of freedom for unrestricted model.

Note 3: F-critical value (F_{cri}) = $F_{\alpha;p,n-2p-1}$

Reject H_0 if $F > F_{\alpha;p,n-2p-1}$

Reject H_o if the values in absolute terms are exceeding 1% critical level, F-critical value = 5.285.
Reject H_o if the values in absolute terms are exceeding 5% critical level, F-critical value = 3.275.
Reject H_o if the values in absolute terms are exceeding 10% critical level, F-critical value =2.465.

5.1.5 Series Volatility in the Singapore Case

According to **Gujarati (2003)**, time series models often exhibit the phenomenon of volatility clustering, that is, the error variance may be correlated over time.

Table 5 depicts the results for the volatility of the studied series in the Singapore case, which draws upon raw data for all series. Medical care demand is considered the most volatile compared to the other series as its coefficient of variation demonstrates an increasing trend. This is followed by net consumption expenditure, which only has a middle region of volatility, almost 0.2% less compared to that of medical care demand. The relative price of medical care only demonstrates 0.24% of volatility, considered the least amongst the three series.

In conclusion, medical care demand is the most volatile when the utility preferences of the market have been changed[57]. Although the net consumption expenditure will also change, it is slower to adjust. The relative price, which is moving in the opposite direction, is considered relatively less volatile.

[57] According to Gujarati (2003), the varying variance or volatility which refers to the variance of time series over time is influenced by the price and also the behavior of the buyers, therefore if the utilities preferences in the market have changed, it will then effected the demand as well as consumption.

Table 5: Volatility of the Studied Series: Singapore's Case

	LNM	LNC	LNP_M
Mean	20.41933	23.62873	4.300881
Median	20.36647	23.63146	4.334744
Maximum	21.65523	24.68826	5.065755
Minimum	18.93519	22.38991	3.605498
Std. Dev.	0.829064	0.692989	0.500698
Observations	38	38	38
Coefficient of Variation (Percentage)	**0.669259**	**0.467596**	**0.244101**

Notes: Std. Dev. ~ Standard Deviation.
LNM denotes as demand for medical care in logarithm form
LNC denotes as net consumption expenditure in logarithm form.
LNP_M denotes as relative price of medical care in logarithm form

5.2 PART II MALAYSIAN ANALYSIS

5.2.1 Unit Root Test Results: For Malaysian Case

The existence of unit root in a time series shows that the time series is nonstationary. In order to investigate the stationarity in a time series, Unit Root Test is usually employed as an alternative test of stationarity. The null hypothesis in this test is maintained unless there is evidence to reject a unit root.

As noted, Unit Root Test can be divided either in the Augmented Dickey Fuller (ADF) Test or Phillips-Perron (PP) Test. In this study, both ADF and PP tests are used to examine and determine a unit root in a stationarity test. They consist of running a regression of the level and the first-differences of the series against the series lagged once, lagged difference terms, and optionally, a constant and a time trend. All these series are transformed into natural logarithms.

Table 6 portrays the results of the Augmented Dickey Fuller and the Phillips-Perron Tests for levels as well as first-differences through employing lagged different series for Malaysia case. Figure in parenthesize below the absolute ADF or PP Tau calculated values represented Tau critical values at the 1%, 5% and 10% significance level. The outcomes for Augmented Dickey Fuller Test in levels show that all the series in absolute values do not exceed the 1%, 5% and 10% critical values since all their Tau or τ-calculated values with different lag-lengths are less than their τ-critical values. Thus, they are considered nonstationary in level term and it fails to reject the null hypothesis suggesting the model still contains a unit root.

On the other hand, for the Phillips-Perron Test, all these series in level form with various lagged-lengths are also insignificant at the 1% or 5% even 10% critical level. Hence, the unit root is accepted and it is insufficient evidence to reject the null hypothesis.

From the aspect of first-differences, the Augmented Dickey Fuller Test for the log of demand for medical care only reveals significant at the 5% significance level at optimum 1 lag for both models intercepts with and without trend. Here, their τ-calculated values in absolute term exceed their absolute τ-critical values.

The log of net consumption expenditure is significant at the 5% level at optimum 1 lag for both intercepts with and without trend. However, it is merely significant at the 5% level with 2 lags for the intercept without trend with the τ-calculated value (-3.312733) smaller than the τ-critical value (-3.0199). Besides, it is respectively significant with 3 lags and 4 lags for intercepts with and without trend. For example, the net consumption expenditure is significant at the 5% level at 3 lags for both intercepts with and without trend with their absolute τ-calculated values larger than their absolute τ-critical values. Whereas, it is only significant at the 5% critical level with 4 lags for the intercept without trend but significant at the 10% level for the intercept with trend.

The log of the relative price of medical care is also significant at the 5% level at optimum 1 lag for both intercepts with and without trend. Whereby, for the intercept without trend at 2 lags, it is only significant at 5% level because the τ-critical value (-3.0199) exceeds the τ-calculated value (-3.112901).

Using the Akaike Information Criterion (AIC) and also the Bayesian Schwarz Criterion (BIC), optimum lag-length can be determined. In the Malaysian case, the output obtained optimum at 1 lag and the entire test would be proceeding based on that optimum lag. The entire results are significant in first-differences.

All the series are significant at the 5% level in Phillips-Perron Test. The definition of Phillips-Perron Test, as recognized by **Phillips and Perron (1988)**, proposed non-parametric correction as an alternative to the inclusion of lag terms. From here, it accounts for non-independent variables and identically distributed according to non-parametric adjustment to the standard Dickey-Fuller procedure. Therefore, this test has all the values in absolute terms greater than the 5% significance level. Yet, the null hypotheses can be rejected in first-differences.

The Phillips-Perron Test is a better test to investigate the stationarity compared to the Augmented Dickey Fuller Test since Phillips-Perron employs non-parametric adjustment for non-independent variables.

Table 6: Results of the Augmented Dickey-Fuller And Phillips-Perron Unit Root Test: Malaysia's Case

Variables/ Series	IN LEVEL FORM				
	ADF			PP	
	Lag - Length	Intercept Without Trend	Intercept With Trend	Intercept Without Trend	Intercept With Trend
LNM	1	-0.808615 (-3.0038)	-1.476035 (-3.6330)	-0.919028 (-2.9969)	-2.121525 (-3.6219)
	2	-1.199076 (-3.0114)	-0.176202 (-3.6454)	-1.480314 (-2.9969)	-2.089927 (-3.6219)
	3	-1.632368 (-3.0199)	-0.231988 (-3.6591)	-1.551519 (-2.9969)	-2.201641 (-3.6219)
	4	-2.446800 (-3.0294)	-1.391880 (-3.6746)	-1.474924 (-2.9969)	-2.240367 (-3.6219)
	5	-1.600182 (-3.0400)	-1.336572 (-3.6920)	-1.559653 (-2.9969)	-2.174797 (-3.6219)
LNC	1	-1.078064 (-3.0038)	-3.089672 (-3.6330)	-0.741798 (-2.9969)	-2.421525 (-3.6219)
	2	-0.192893 (-3.0114)	-3.656153 [-4.4691]	-0.760580 (-2.9969)	-2.527940 (-3.6219)
	3	-0.628819 (-3.0199)	-3.673174 [-4.5000]	-0.757163 (-2.9969)	-2.512212 (-3.6219)
	4	-0.812023 (-3.0294)	-2.185968 (-3.6746)	-0.743592 (-2.9969)	-2.438887 (-3.6219)
	5	-0.990345 (-3.0400)	-2.109536 (-3.6920)	-0.729010 (-2.9969)	-2.349202 (-3.6219)
LNP_M	1	-0.399357 (-3.0038)	-2.314316 (-3.6300)	-1.208941 (-2.9969)	-2.671225 (-3.6219)
	2	-0.029420 (-3.0114)	-2.011163 (-3.6454)	-1.209285 (-2.9969)	-2.733395 (-3.6219)
	3	-0.103817 (-3.0199)	-1.615115 (-3.6591)	-1.218300 (-2.9969)	-2.743059 (-3.6219)
	4	-0.364381 (-3.0294)	-2.083342 (-3.6746)	-1.215128 (-2.9969)	-2.774916 (-3.6219)
	5	-0.801898 (-3.0400)	-2.366525 (-3.6920)	-1.209231 (-2.9969)	-2.805827 (-3.6219)

Source: Series for medical care expenditure was taken from the Indicators for Monitoring and Evaluation of Strategy for Health (Ministry of Health Malaysia). Series for consumption expenditure and relative price of medical care were taken from System of National Accounts Annual National Product and Expenditure Accounts 1987-2001 (Department of Statistics Malaysia).

Note 1: LNM represents demand for medical care in logarithm form.
LNC represents net consumption expenditure in logarithm form.
LNP_M represents relative price of medical care in logarithm form.
Figures in ( ) indicate τ -critical values at 5% significance level.
Figures in [ ] indicate τ -critical values at 1% significance level.
Figures in { } indicate τ -critical values at 10% significance level.
ADF indicates Augmented Dickey Fuller Test.
PP indicates Phillips-Perron Test.

Note 2: -The demand for medical care allocates the medical care and health services in terms of operating expenditures in current price series. The constant price series are calculated based on the index of total Gross Domestic Product (GDP).
-The net consumption expenditure is total consumption expenditures in constant price series less total medical care expenditures in constant price series. The constant price series for medical care expenditures are calculated based on the index of total Gross Domestic Product (GDP).
-The relative price of medical care is implicit deflators of total Gross Domestic Product (GDP) which constructed by dividing nominal series by the 1987 constant price series.

Variables/ Series	FIRST-DIFFERENCES				
	ADF			PP	
	Lag - Length	Intercept Without Trend	Intercept With Trend	Intercept Without Trend	Intercept With Trend
LNM	1	-4.220334*	-4.366124*	-4.609706*	-4.648261*
		(-3.0114)	(-3.6454)	(-3.0038)	(-3.6330)
	2	-1.639677	-1.746236	-4.498856*	-4.553412*
		(-3.0199)	(-3.6591)	(-3.0038)	(-3.6330)
	3	-1.236962	-1.495378	-4.487612*	-4.540747*
		(-3.0294)	(-3.6746)	(-3.0038)	(-3.6330)
	4	-0.030945	-0.408291	-4.503118*	-4.543005*
		(-3.0400)	(-3.6920)	(-3.0038)	(-3.6330)
	5	-0.514732	-0.340148	-4.498087*	-4.540384*
		(-3.0521)	(-3.7119)	(-3.0038)	(-3.6330)
LNC	1	-3.548207*	-3.732394*	-4.477859*	-4.418737*
		(-3.0114)	(-3.6454)	(-3.0038)	(-3.6330)
	2	-3.312733*	-2.916341	-4.538693*	-4.494943*
		(-3.0199)	(-3.6591)	(-3.0038)	(-3.6330)
	3	-3.751808*	-3.729687*	-4.539068*	-4.497387*
		(-3.0294)	(-3.6746)	(-3.0038)	(-3.6330)
	4	-3.152205*	-3.332307***	-4.502629*	-4.457915*
		(-3.0400)	{-3.2856}	(-3.0038)	(-3.6330)
	5	-1.749032	-1.851761	-4.463484*	-4.408646*
		(-3.0521)	(-3.7119)	(-3.0038)	(-3.6330)
LNP_M	1	-3.766541*	-3.696589*	-4.458690*	-4.333888*
		(-3.0114)	(-3.6454)	(-3.0038)	(-3.6330)
	2	-3.112901*	-3.042063	-4.476837*	-4.346309*
		(-3.0199)	(-3.6591)	(-3.0038)	(-3.6330)
	3	-2.089379	-2.192717	-4.550936*	-4.408640*
		(-3.0294)	(-3.6746)	(-3.0038)	(-3.6330)
	4	-1.993821	-2.369355	-4.607274*	-4.460376*
		(-3.0400)	(-3.6920)	(-3.0038)	(-3.6330)
	5	-2.251021	-3.001676	-4.653432*	-4.504842*
		(-3.0521)	(-3.7119)	(-3.0038)	(-3.6330)

Source: Series for medical care expenditure was taken from the Indicators for Monitoring and Evaluation of Strategy for Health (Ministry of Health Malaysia). Series for consumption expenditure and relative price of medical care were taken from System of National Accounts Annual National Product and Expenditure Accounts 1987-2001 (Department of Statistics Malaysia).

Note 1: LNM represents demand for medical care in logarithm form.
LNC represents net consumption expenditure in logarithm form.
LNP_M represents relative price of medical care in logarithm form.

Critical τ -value of ADF intercept without trend for LNM significance level: lag 1 ~ -3.7856(1%), -3.0114(5%), -2.6457(10%).
Critical τ -value of ADF intercept with trend for LNM significance level: lag 1 ~ -4.4691(1%), -3.6454(5%), -3.2602(10%).
Critical τ -value of ADF intercept without trend for LNC significance level: lag 1 ~ -3.7856(1%), -3.0114(5%), -2.6457(10%).
Critical τ -value of ADF intercept with trend for LNC significance level: lag 1 ~ -4.4691(1%), -3.6454(5%), -3.2602(10%).
Critical τ -value of ADF intercept without trend for LNC significance level: lag 2 ~ -3.8067(1%), -3.0199(5%), -2.6502(10%).
Critical τ -value of ADF intercept with trend for LNC significance level: lag 2 ~ -4.5000(1%), -3.6591(5%), -3.2677(10%).
Critical τ -value of ADF intercept without trend for LNC significance level: lag 3 ~ -3.8304(1%), -3.0294(5%), -2.6552(10%).
Critical τ -value of ADF intercept with trend for LNC significance level: lag 3 ~ -4.5348(1%), -3.6746(5%), -3.2762(10%).
Critical τ -value of ADF intercept without trend for LNC significance level: lag 4 ~ -3.8572(1%), -3.0400(5%), -2.6608(10%).
Critical τ -value of ADF intercept with trend for LNC significance level: lag 4 ~ -4.5743(1%), -3.6920(5%), -3.2856(10%).
Critical τ -value of ADF intercept without trend for LNP_M significance level: lag 1 ~ -3.7856(1%), -3.0114(5%), -2.6457(10%).
Critical τ -value of ADF intercept with trend for LNP_M significance level: lag 1 ~ -4.4691(1%), -3.6454(5%), -3.2602(10%).
Critical τ -value of ADF intercept without trend for LNP_M significance level: lag 2 ~ -3.8067(1%), -3.0199(5%), -2.6502(10%).
Critical τ -value of ADF intercept with trend for LNP_M significance level: lag 2 ~ -4.5000(1%), -3.6591(5%), -3.2677(10%).
Critical τ -value of PP intercept without trend for different LNM significance levels: -3.7667(1%), -3.0038(5%), -2.6417(10%).
Critical τ -value of PP intercept with trend for different LNM significance levels: -4.4415(1%), -3.6330(5%), -3.2535(10%).
Critical τ -value of PP intercept without trend for different LNC significance levels: -3.7667(1%), -3.0038(5%), -2.6417(10%).
Critical τ -value of PP intercept with trend for different LNC significance levels: -4.4415(1%), -3.6330(5%), -3.2535(10%).
Critical τ -value of PP intercept without trend for different LNP_M significance levels: -3.7667(1%), -3.0038(5%), -2.6417(10%).
Critical τ -value of PP intercept with trend for different LNP_M significance levels: -4.4415(1%), -3.6330(5%), -3.2535(10%).

An asterisk * indicates critical at 5% significance level.
** indicates critical at 1% significance level.
*** indicates critical at 10% significance level.
Figures in ( ) indicate τ -critical values at 5% significance level.
Figures in [ ] indicate τ -critical values at 1% significance level.
Figures in { } indicate τ -critical values at 10% significance level.
ADF indicates Augmented Dickey Fuller Test.
PP indicates Phillips-Perron Test.

Note 2: ~The demand for medical care allocates the medical care and health services in terms of operating expenditures in current price series. The constant price series are calculated based on the index of total Gross Domestic Product (GDP).

~The net consumption expenditure is total consumption expenditures in constant price series less total medical care expenditures in constant price series. The constant price series for medical care expenditures are calculated based on the index of total Gross Domestic Product (GDP).

~The relative price of medical care is implicit deflators of total Gross Domestic Product (GDP) which constructed by dividing nominal series by the 1987 constant price series.

5.2.2 Results of the Johansen Cointegration Test in the Malaysian Case

Johansen-Juselius (1990) developed the Johansen Cointegration Test (with unrestricted intercept and no trends) to examine the long run relationship between two or more series. Table 7 demonstrates the result of the Johansen Cointegration Test for the Malaysian case, which shows the relationships between the log of demand for medical care, the log of net consumption expenditure and the log of relative price of medical care. The optimum lag-length for Malaysia case is 1 lag, which is determined by using Akaike Information Criterion (AIC) and Bayesian Schwarz Criterion (BIC). Henceforth, the test proceeds on this optimum of 1 lag.

From the results, only one cointegrating vector appears between these three series. This can be seen from the corroboration of the likelihood ratio where the value (32.00376) exceeding the 5% critical value (29.68). Thus, the null hypothesis ($r = 0$) can be rejected and it implies that only one cointegrating vector exists in the long run, represented by the symbol ($r \leq 1$). However, the findings show that the likelihood ratio for the null hypothesis ($r \leq 2$) is insignificant at the 5% or even 1% critical level.

Therefore, only one cointegrating vector in the model explaining the integration of short run dynamics towards the long run equilibrium.

Table 7: Results of the Johansen Cointegration Test: Malaysia's Case

H_0	H_1	Likelihood Ratio	95% Critical Value	99% Critical Value	Eigenvalue
Lag 1					
$r = 0$	$r = 1$	32.00376*	29.68	35.65	0.608949
$r \leq 1$	$r = 2$	11.34759	15.41	20.04	0.347424
$r \leq 2$	$r = 3$	1.957392	3.76	6.65	0.085129

Notes: (*) denotes rejection of the hypothesis at (5%) significance level.
(**) denotes rejection of the hypothesis at (1%) significance level.
Optimum lag-length: 1 lag.
r is the maximum number of cointegrating vectors.
Series: LNM – Demand for medical care in logarithm form.
LNC – Net consumption expenditure in logarithm form.
LNP_M – Relative price of medical care in logarithm form.

5.2.3 Results of the Normalized Cointegrating Regression for One Cointegrating Vector Equation in the Malaysian Case

Table 8 depicts the normalized cointegrating regression or the long run elasticities for the Malaysian case. Converted the series into equation form and presents the equation as below:

$$\ln M_t = -12.198 + 0.037t + 0.075\ln C_{t-1} - 1.367\ln P_{M,t-1} - 0.759u_{t-1}$$

(1.732)* (0.326) (-3.515)** (-2.087)*

$R^2 = 0.997614$ DW = 1.434452

A linear time trend is included in the above cointegrating regression due to the preference shock in the health sector is assumed to be trend-stationary[58].

It can also be written the estimated cointegrating vector of $\ln M_t$ on $\ln C_{t-1}$ and $\ln P_{M,t-1}$ as $[1, \alpha/\gamma, -1/\gamma]$ = [1, 0.075, -1.367] since the log of medical care expenditure is used as the dependent variable and the normalized cointegrating regression considered as long run elasticitites.

Here, all the estimated parameters have the theoretically correct signs. Although the log of net consumption expenditure has a correct positive sign, it is insignificant at any critical level. The positive relationship in the log of demand for medical care can be explained, as when net consumption expenditure increases by 1%, on the average medical

[58] Since Lee and Kong (1999) assumed that the preference shock in the health sector is trend-stationary, therefore, a linear time trend is included in the cointegrating regression.

care demand would increase by about 0.08%, holding all other variables constant. However, medical care service in Malaysia is considered as a necessary good since it has an inelastic consumption curve with consumption elasticity less than unity.

On the other hand, the log of relative price of medical care is in accordance with the law of diminishing marginal productivity of health capital, which is shown by the negative sign and is supported by a downward sloping demand curve. It is significant at the 1% significance level. However, it also seems to have an inelastic relative price of elasticity, which shows the relative price of elasticity in excess of unity (-1). The 1% increase in relative price will cause medical care demand on the average to decline by about 1.37%, holding all other variables constant. Thereby, increase in revenue due to the increase in relative price is more than the decrease in revenue due to the decrease in quantity demanded. In other words, the relative price strategy is an important influence on the revenue and also the quantity demanded.

In conclusion, the results are consistent with the theory suggesting that demand and consumption have a positive relationship, while demand and relative price have a negative association. Since the residual reveals that the variables in the cointegrating equation are cointegrated and they share a common stochastic trend, thus, we can conclude that the log of demand for medical care $\ln M(t)$, the log of net consumption expenditure $\ln C(t)$ and the log of the relative price of medical care $\ln P_M(t)$ are difference-stationary variables.

However, only the log of the relative price of medical care is significant in the regression. So, we suggest that the relative price of medical care is the key determinant in the medical care demand equation. Besides, although the net consumption expenditure is insignificant in the regression, but since the residual is stationary and cointegrated, therefore the net consumption expenditure also affected the medical care demand in Malaysia.

Table 8: Results of the Normalized Cointegrating Regression ~ 1 Cointegrating Vector Equation/Long-run Elasticities: Malaysia's Case

Lag 1					
LNM	LNC	LNP_M	t	u_{t-1}	C
1.000000	0.074818	-1.367015**	0.037118*	-0.758519*	-12.19753
	(0.32627)	(-3.51480)	(1.73164)	(-2.08655)	
Log likelihood		105.2475			

Notes: (*) denotes rejection of the hypothesis at (5%) significance level
(**) denotes rejection of the hypothesis at (1%) significance level
( ) Figures in bracket indicate as t-calculated values
Optimum lag-length: 1 lag.
LNM – Demand for medical care in logarithm form
LNC – Net consumption expenditure in logarithm form.
LNP_M – Relative price of medical care in logarithm form.
t indicates as a linear time trend.
u_{t-1} indicates as one-period lagged value of the residual
C indicates as constant term.
1% t-critical value = 2.518 or -2.518.
5% t-critical value = 1.721 or -1.721.
10% t-critical value = 1.323 or -1.323.

5.2.4 Results of the Granger Causality Test in the Malaysian Case

As noted, Granger Causality Test consists of Bivariate and Multivariate Granger Causality. Bivariate Granger Causality Test encompasses only two series while Multivariate Granger Causality Test involves more series. Multivariate Granger Causality Test also called as the Pairwise Granger Causality Test, is employed in this research. The results of the Bivariate as well as Multivariate Granger Causality Test are reported in Table 9. As usual, the optimum lag-length is determined through AIC or BIC.

The results for Bivariate and Multivariate Granger Causality Test reveal that a unilateral relationship has been found between the relative price of medical care with the medical care demand and also between the relative price of medical care with the net consumption expenditure. This unilateral relationship is shown by the one-way causality from both tests where only the relative price of medical care granger-causes the medical care demand and also the net consumption expenditure, which are respectively significant at the 5% level with F-statistical values in absolute term exceeding the F-critical values or with the p-values (place on the right hand side of the F-statistical values) less than the 5% critical values.

However, it did not show that any bilateral relationship exist between these series since they are insignificant either at 1% or 5% even 10% significance level. Thus, the model does not disclose any reverse two-way causality linkages. In brief, they are not reverse granger-causes each other.

In conclusion, in this unilateral relationship, relative price plays an important role in influencing the medical care demand and the net consumption expenditure. Hence, any changes in the market price mechanism would thus trigger the chain of causality.

Table 9: Results of the Granger Causality Test: Malaysia's Case

Multivariate Granger Causality Test

Null Hypothesis	F-Statistic (p-value)
Δ(LNC) does not Granger Cause Δ(LNM)	0.26697 (0.61134)
Δ(LNM) does not Granger Cause Δ(LNC)	0.97180 (0.33662)
Δ(LNP_M) does not Granger Cause Δ(LNM)	6.45096 (0.03996)*
Δ(LNM) does not Granger Cause Δ(LNP_M)	0.37350 (0.54835)
Δ(LNP_M) does not Granger Cause Δ(LNC)	4.83361 (0.04050)*
Δ(LNC) does not Granger Cause Δ(LNP_M)	1.70172 (0.20764)

Notes : * denotes significant at 5% significance level.
** denotes significant at 1% significance level.
*** denotes significant at 10% significance level.
Figures in ( ) indicate as p-values.
Δ(LNM) represents the changes in log of demand for medical care.
Δ(LNC) represents the changes in log of net consumption expenditure.
Δ(LNP_M) represents the changes in log of relative price of medical care.
Lags: 1 period (optimum lag).

Bivariate Granger Causality Test

The Unrestricted Regression Model (UR) and The Restricted Regression Model (R): Malaysia's Case

Variables/ Series	$M \rightarrow C$	$C \rightarrow M$	$M \rightarrow P_M$	$P_M \rightarrow M$	$C \rightarrow P_M$	$P_M \rightarrow C$
RSS_u	0.727	3.625	0.727	0.638	3.625	0.638
RSS_r	0.933	0.492	1.033	0.231	2.424	0.898
F-value	0.972	0.267	0.374	6.451*	1.702	4.834*

Note 1: * denotes significant at 5% significance level.

** denotes significant at 1% significance level.

*** denotes significant at 10% significance level.

Optimum lag-length: 1 lag.

M represents the changes in log of demand for medical care.

C represents the changes in log of net consumption expenditure.

P_M represents the changes in log of relative price of medical care.

RSS_u ~ Unrestricted Sum of Square.

RSS_r ~ Restricted Sum of Square.

Note 2: $H_0 : \sum_{i=1}^{n} \alpha_i = 0$

$H_A : \sum_{i=1}^{n} \alpha_i \neq 0$

$$F_{\alpha;p,n-2p-1} = \frac{(RSS_r - RSS_u)/p}{RSS_u/(n-2p-1)}$$

n = Total number of observations.

p = Number of lagging in restriction terms when calculating ESS_r.

2P = Number of lags for dependent and independent variables, the number of degrees of freedom lost from lagging.

1 = Number of parameter in constant term from unrestricted model.

n-2p-1 = Degrees of freedom for unrestricted model.

Note 3: F-critical value (F_{cri}) = $F_{\alpha;p,n-2p-1}$

Reject H_0 if $F > F_{\alpha;p,n-2p-1}$

Reject H_o if the values in absolute terms are exceeding 1% critical level, F-critical value = 8.025.

Reject H_o if the values in absolute terms are exceeding 5% critical level, F-critical value = 4.325.

Reject H_o if the values in absolute terms are exceeding 10% critical level, F-critical value =2.960.

5.2.5 Series Volatility in the Malaysian Case

Gujarati (2003) mentions that time series model often exhibits phenomenon of volatility clustering, that is, the error variance may be correlated over time.

Table 10 demonstrates the results for the volatility of the studied series in the Malaysian case. This result is drawn upon raw data for all series and conducted as additional information. The net consumption expenditure is considered the most volatile compared to the other series since the coefficient of variation of this series exhibits an increasing trend. This is followed by the medical care demand, which is about 0.02% less volatile compared to that of net consumption expenditure. While, the least volatile amongst the three series is the relative price of medical care with only 0.04% of volatility.

In conclusion, net consumption expenditure is the most volatile series. When the utility preferences of the market have changed, it is the first series to change. The second volatile series is the medical care demand, it would move more slowly compared to net consumption expenditure. The net consumption expenditure is the most volatile results from the behavioral characteristics of the decision makers, who are more sensitive to the market mechanism. On the other hand, the relative price of medical care, which moves in the opposite direction, is considered relatively less volatile. Hence, this series become the slowest to move in response to macro changes.

Table 10: Volatility of the Studied Series: Malaysia's Case

	LNM	LNC	LNP_M
Mean	20.44664	23.36761	4.738888
Median	20.40869	23.29429	4.703023
Maximum	21.35421	24.00296	5.095589
Minimum	19.93099	22.68865	4.333361
Std. Dev.	0.335697	0.359716	0.212939
Observations	24	24	24
Coefficient of Variation (Percentage)	**0.107997**	**0.124004**	**0.043454**

Notes: Std. Dev. ~ Standard Deviation.
LNM denotes as demand for medical care in logarithm form.
LNC denotes as net consumption expenditure in logarithm form.
LNP_M denotes as relative price of medical care in logarithm form.

5.3 Conclusion

In general, for the Unit Root Test, the results show that the series are stationary in first-differences. This can be found from the Augmented Dickey Fuller as well as the Phillips-Perron Test in the first-differenced term. For the Augmented Dickey Fuller Test, all the series are significant at optimum lag-length for both countries. However, in the Phillips-Perron Test, all the series are significant at difference lengths. The ADF and PP Test implies that almost all these series are integrated of order one I(1), and stationary after first differencing. Therefore, it is possible that a common trend exists within them as a group and is cointegrated. In other words, the results indicate that the hypotheses in level form of Unit Root Test are not rejected. However, after first differencing, the hypotheses for all series in a unit root are rejected. Thus, all the series are stationary and integrated at order one process. We then proceeded to the Johansen Cointegration Test.

Johansen Cointegration Test reveals that there is only one cointegrating vector, which exists for both countries. The maximum eigen value test confirms non-zero vectors among the series. While the null hypothesis shows that there is no cointegrating relationship among the series is rejected at most for two cointegrating vectors.

After applying the Johansen Cointegration Test, the cointegrating regression would be obtained for both countries. The net consumption expenditure for both countries has an accurate positive sign. However, it ought to be noted that it was statistically insignificant in Malaysia, but it has impact on medical care demand equation.

In Singapore, since the net consumption expenditure is significant at the critical level, therefore it has significant effect on medical care demand equation.

Nevertheless, the relative price of medical care also showed an accurate negative sign because it follows diminishing marginal productivity of health capital to have a downward sloping demand curve. Furthermore, it has significant effect to influence the medical care demand for both countries.

The results of normalized cointegrating regression or long run elasticities suggest that medical care services is considered as a necessary good in both countries because they have an inelastic consumption curve with consumption elasticities less than unity. However, the relative price elasticity is close to unity for Singapore while inelastic for Malaysia. The residual test shows that the log of demand for medical care, the log of net consumption expenditure and the log of the relative price of medical care are difference-stationary variables in both countries.

From the Granger Causality Test, it is postulated that medical care demand plays an important role in Singapore because it reveals that a unilateral relationship exists between the medical care demand with the net consumption expenditure and with the relative price of medical care.

On the other hand, the Malaysia case also comprises a unilateral relationship between the relative price of medical care with the medical care demand and with the net consumption expenditure. It shows that relative price is an important influence in these two series in Malaysia.

Finally, the results of series volatility implies that medical care demand in Singapore is the most volatile, followed by net consumption expenditure and relative price of medical care. However, in Malaysia, the most volatile is the net consumption expenditure. Demand for medical care is considered as the second volatile, while the least volatile is the relative price of medical care.

Overall, the ultimate results conclude that demand for medical care indicates as a main health indicator in Singapore since it is influenced by the utility preferences of the stock of health capital in the market. On the contrary, the role of medical care demand in Malaysia is not so obvious because it only represents a unilateral one-way causality with the relative price of medical care. However, the linkages are more apparent for relative price of medical care, which not only exhibit unilateral granger causality with medical care demand but also with the net consumption expenditure. So, it shows that relative price plays an important role in influencing those series. Thereby, any changes in the market price mechanism would thus trigger the chain of causality.

As a conclusion, regarding the observed results, it can summarize the entire results in brief as, the net consumption expenditure and the relative price of medical care are the key long run determinants influencing the medical care demand in Singapore since the demand for medical care depends on the net consumption expenditure and the relative price of medical care (suggested by Lee and Kong, 1999). These three series are cointegrated in the long run.

On the other hand, in Malaysia, only the relative price of medical care is considered as the key long run determinant in the medical care demand equation. However, since the cointegration relationship reveals that these three series in the cointegrating equation share a common stochastic trend, thus, the net consumption expenditure also has impact on medical care demand.