# CHAPTER FIVE: EMPIRICAL RESULTS

## 5.0 INTRODUCTION

The results obtained from the various sets of statistical tests are described in this chapter. The unit root test used is in order to examine the order of integration, while co-integration test is to investigate the long-term equilibrium relations. Besides that, causal relations between variables are investigated by using Granger-causality test.

## 5.1 UNIT ROOT TESTS

The results of ADF and PP unit root tests, based on the null hypothesis of non-stationary against a stationary alternative, are reported in Table 1. The tests applied to both levels and first differences of all the series. Under ADF test, the null hypothesis that savings rate have a unit root cannot be rejected at the levels. Then, in the case of first difference, the series rejected the null hypothesis of unit root at the 1% significance level. The finding suggests that savings rate appear to be difference stationary process or integrated of order one. However, this result was confirmed again under PP test which the first difference series rejected the null hypothesis of unit root at the 1% significance level. Specifically, both ADF and PP tests suggested that a rejection of a unit root for a high order of integration ($1^{st}$ difference) with drift and deterministic trend term at the significance level of 1% of the time series data for saving.

Similarly, for the levels of the series, for all the independent variables, none rejects the null hypothesis of non-stationary at the 5% level. Then, the series are rejected the null hypotheses of unit root at the 1% significance level for a high order of integration. Thus, the evidence suggests the presence of I(1) for all the independent variables at the significance level of 1%. As a result, the unit root tests suggest that, the variables appear to be I(1) which indicates that they are possible likely to help in explain the trend in savings rate. Since the series are integrated of the same order, it is necessary tested for the existence of long-term relationship among them i.e. co-integration.

**Table 1: Unit Roots Tests**

| | | ADF | | PP | |
|---|---|---|---|---|---|
| Variable | Level/First Diff. | $t_\mu(m)$ | $t_\tau(m)$ | $t_\mu$ | $t_\tau$ |
| gns | Level | -0.7886(1) | -2.9527(1) | -0.7953 | -3.1352 |
| | First Diff. | -9.0065(1)* | -8.9806(1)* | -12.2521* | -12.2138* |
| gnp | Level | -1.4382(4) | -2.5227(4) | -1.0507 | -2.8023 |
| | First Diff. | -4.6268(3)* | -4.7339(4)* | -13.1858* | -13.2283* |
| i | Level | -2.5287(1) | -2.4613(1 | -2.4408 | -2.3664 |
| | First Diff. | -6.7079(1)* | -6.7188(1)* | -8.9815* | -8.9751* |
| dr | Level | -0.4166(4) | -2.1171(4) | -2.6704 | -1.8282 |
| | First Diff. | -9.4237(2)* | -10.7659(2)* | -13.0116* | -13.7716* |
| ca2 | Level | -1.8439(4) | -3.4075(4) | -2.7696 | -3.3207 |
| | First Diff. | -7.5282(3)* | -7.4729(3)* | -11.0834* | -11.080* |

Note:* indicates statistical significance at 1% level.

$t_\mu$ = drift term; $t_\tau$ = drift and deterministic trend.

See Mackinnon (1991) for the critical values.

The parenthesis shows lag length $m$ for the ADF tests which are selected by the SIC criteria.

## 5.2 CO-INTEGRATION TESTS

As the unit root tests show the variables are integrated of the same order, co-integration test are perform to detect the long run relationship between saving and its determinants. Test for co-integration that based on Johansen method and Trace statistic, are summarized in Table 2. The null hypothesis of $r = 0$ against alternative hypothesis $r = 1$ is rejected at the significance level of 5%. However, in the next step, the null hypothesis of at most 1 co-integrating vector cannot be rejected at the 5 % level of significance. This implies that, both maximal eigen-value and Trace test suggests there is evidence of one co-integrating ( $r = 1$ ) vector in the system. Thus, the Johansen test results suggest that there is a long run relationship among savings rate and its determinants in Malaysia. In addition, this also implies that the variables are trend together in the long run.

**Table 2: Co-Integration Tests**

| Tests | | | |
|---|---|---|---|
| Null | Alternative | Eigen-value | Likelihood ratio |
| $r = 0$ | $r = 1$ | 0.2359 | 73.6067** |
| $r \leq 1$ | $r = 2$ | 0.1694 | 42.1199 |
| $r \leq 2$ | $r = 3$ | 0.0970 | 20.4044 |
| $r \leq 3$ | $r = 4$ | 0.0689 | 8.4611 |
| $r \leq 4$ | $r = 5$ | 0.0009 | 0.1085 |

Note: ** indicates statistical significance at the 5% level.
$r$ represents the number of co-integrating relations.

## 5.3 LONG-RUN EQUILIBRIUM

Given the co-integration results, which indicate long run equilibrium relationships exist between savings and its determinant. Then, the next episode in our model building process requires the estimation of long run equilibrium by normalizing on savings equation where the time series are found to be co-integrated. The results of the long run saving equation are summarized in Table 3.

**Table 3: Normalizing Co-Integration Vector**

| sav | gnp | i | dr | ca2 | C |
|---|---|---|---|---|---|
| 1.0000 | 1.1665* | 0.3507 | 2.6782* | -0.4248** | -6.1001 |
| | (0.3245) | (0.2786) | (0.5437) | (0.2098) | |

Note:* indicates statistical significance at the 1% level.
** indicates statistical significance at the 5% level.
The number in parentheses represents the standard errors.

Based on Table 3, the long run equilibrium saving equation can be reported as below:

$$sav = -6.1001 + 1.1665gnp + 0.3507i + 2.6782dr - 0.4248ca^2$$

Since all the variables are in logarithms term except $i$, the estimated coefficients can be interpreted as long run elasticities of national savings with respect to all variables except $i$. Empirically, the long-run elasticity of Malaysia national savings with respect to economic growth is 1.17 which implies that 1-percentage point raise in economic growth will increase national savings by about 1.17 percent on average and are significant at 1%

significance level. This means that a positive temporal causality relationship between savings rate and economic growth rate. Thus, the results allow us to corroborate the view that national savings will increase if high growth rate are associated and which also supports the literature of **Modigliani (1970), Carroll and Weil (1994), Schimidt-Hebbel and Serven (2002) and Baharumshah (2003).**

Besides that, the evidence showing that the behavior of the interest rate on savings rate is positively correlated for this panel of study. Empirically, 1-percentage point rise in interest rate will increase the national saving by about .35 percent on average. Interest rates will increase savings that implies that inter-temporal substitution effect was greater than the income effect. The result is consistent with the studies of **Vegara (2001)** and **Baharumshah (2003)**, which have investigated the positive relationship between savings and the term of interest rate.

The studies started with the assumption that interest rate play an important role in encouraging national savings. But our estimated long run results show that interest rates do not play a significant function on the movement of national savings. Then, these might be related to the financial liberalization embraced in a country since 1980s but there is no significant evidence supporting a positive net effect of liberalization on savings. This is because of inefficiencies or the lack of financial markets and binding liquidity constraints in developing countries **(Muradoglu and Taskin, 1996).** Generally, financial conditions in a country played an important role in producing virtuous circles of high savings. **Fry. M. (1984)** showed that the positive effects of financial liberalization on savings would

appear to become smaller overtime. It is because, the magnitudes of the effects are not large enough to warrant much policy significance in a country.

Furthermore, the evidence suggests that dependency ratio carries a positive effect on savings and is statistically significant at 1% significance level. Empirically, the long run elasticity reveals that, 1-percentage point increase in dependency ratio will raise the national savings by about 2.68 percent on average. This implies that, the higher dependency ratio is expected to raise the national savings, which consistent with previous studies i.e. **Faruquee and Husain (1995)** and **Baharumshah (2003).** Normally, when number of children in a family goes up, the parent will tend to leave a larger bequest. Thus, this explanation is based on bequest motive assumption, which explores the positive causal link between saving-dependency relations.

The long run elasticity of national savings with respect to foreign savings is .42. This means one percentage point increase in foreign savings will lead to decrease national savings by about .42 percent on average and significant at 5% significance level. The evidence suggests that foreign savings exerted a negative and significant effect on national savings. As a result, foreign savings or capital inflows will act as substitutes to national savings. This result is consistent with the view of **Giovannini (1985), Obsfeld (1995), Muradoglu and Taskin (1996) and Baharumshah (2003)**, which stated that raising the amount of foreign savings has negative effect on national savings.

## 5.4 ERROR-CORRECTION MODEL

In the presence of a long-run relationship among the variables, it is necessary to investigate the short-term relationships among national savings, economic growth, interest rates, dependency ratio and foreign savings. An error-correction model is appropriate to examine the adjustment parameter and short-run dynamics among the variables. In the system of equation, the current value of endogenous variable is related to its own and other variables past lags and an error correction term. For parsimony considerations, the insignificant variables were eliminated and only the variables with significant coefficient estimates are included.

**Table 4: The ECM for Malaysia National Savings Function**

$$\Delta sav_t = 0.0833 - 0.5576ECM_{t-1} + 0.1646\Delta sav_{t-5} + 1.3207\Delta gnp_{t-1} + 0.0278\Delta i_{t-6}$$
$$(3.34) \quad (-2.05)^{**} \qquad (2.54)^{**} \qquad (3.67)^{**} \qquad (1.76)$$

$$- 0.0084\Delta ca_{t-1} - 0.0153\Delta ca_{t-4} + 1.1277\Delta dr_{t-4}$$
$$(-0.81) \qquad (-1.79) \qquad (2.74)^{**}$$

$$\overline{R}^2 = 0.690 \qquad D.W. = 1.967 \qquad HET = 0.318(0.591) \qquad Normality = 0.390(0.831)$$

Notes: ** denotes significance at 5% level.

The Malaysia national savings equation based on error-correction model is summarized in Table 4. The lagged residual in the error-correction term is statistically significantly (at 5% significance level) negative. This suggests the validity of a long-run equilibrium

relationship among the variables in savings equation. Then, the coefficient of $\alpha$ is approximately equal to 0.55, which reveals that the speed of adjustment back to equilibrium is quite fairly rapid. This means that more than 55% of the adjustment is completed which due to short-run adjustment. This also implies that, the system corrects its previous period's dis-equilibrium by about 55% a year. Diagnostic test statistics show no evidence of misspecification of functional form, no problem of auto-correction and heteroscedasticity.

The empirical results showed that short run movement in economic growth and dependency ratio variables capturing the effect of national savings, which have emerged as significant determinants of the savings function for Malaysia. The coefficients of GNP are positively signed which suggest that economic growth trends toward increased savings in Malaysia both short run and long run, respectively. Empirically, the short run elasticity of national savings with respect to economic growth lagged one year is greater than unity. This means that the national savings increases more than proportionately to the increase in economic growth.

Then, the empirically suggest that dependency ratio is positively correlated with national savings in the short run. Empirically, the short run elasticity of national savings with respect to dependency ratio lagged four years is greater than unity. This implies that the national savings increases more than proportionately to the increase in dependency ratio. This results is inconsistent with a few number of past studies i.e. studies by **Lahiri (1989), Muradoglu and Taskin (1996) and Higgins and Williamson (1997)**. But, it is

consistent with few studies such as **Faruquee and Husain (1995)** and **Baharumshah (2003)**. Therefore, it is empirically believed that high dependency ratio is encouraged to national savings implying positive causal relationship.

Besides that, the interest rates coefficient reported to be insignificant positive signed which implies that substitution effect is dominant than income effect in the short run. Empirically, the short run elasticity of national savings with respect to interest rates lagged six years is inelastic. This implies that the national savings increases less than proportionately to the increase in interest rates. Similarly, national savings exerted an insignificant negative signed with respect to foreign savings. Empirically, the short run elasticities of national savings with respect to foreign savings lagged one and four years are about 0.008 and 0.015, respectively. This implies that the national savings increases less than proportionately to the decrease in foreign savings. In addition, the negative causal relation in the short run also means that foreign capital inflow has pernicious effects on domestic savings, which consistent with most of the studies in our literature.

## 5.5 GRANGER-CAUSALITY TEST

The results of Granger-causality tests are summarized in Table 5. The results indicate that changes in economic growth can lead change in national savings and are significant at the 5% significance level, and not vice-versa. As a result, the unidirectional causality running from economic growth to national savings has been detected in the short run. This finding suggests that economic growth will stimulate national savings for the time period of estimation.

**Table 5: Granger-Causality Test**

| Dependent Variable | | $\Delta sav$ | $\Delta gnp$ | $\Delta i$ | $\Delta dr$ | $\Delta ca2$ | $ECT$ |
|---|---|---|---|---|---|---|---|
| $\Delta sav$ | F-Statistic | - | 2.8752 | 0.2567 | 2.6357 | 2.2941 | 9.0470 |
| | Probability | - | 0.0087* | 0.9689 | 0.0159** | 0.0390** | 0.0000* |
| $\Delta gnp$ | F-Statistic | 1.4337 | - | 1.3398 | 1.7544 | 0.1705 | 3.3516 |
| | Probability | 0.1999 | - | 0.2393 | 0.4589 | 0.9906 | 0.0706 |
| $\Delta i$ | F-Statistic | 0.6017 | 1.4041 | - | 0.9591 | 1.1199 | 2.5399 |
| | Probability | 0.7533 | 0.2117 | - | 0.4652 | 0.3564 | 0.1147 |
| $\Delta dr$ | F-Statistic | 3.0087 | 4.8396 | 2.6681 | - | 1.7357 | 0.6053 |
| | Probability | 0.0109** | 0.0000* | 0.0141** | - | 0.1086 | 0.4387 |
| $\Delta ca2$ | F-Statistic | 0.9832 | 1.4331 | 2.1668 | 2.1369 | - | 1.1574 |
| | Probability | 0.1547 | 0.2001 | 0.0432** | 0.0461** | - | 0.1734 |

Note: * indicates statistical significance at the 1% level.
** indicates statistical significance at the 5% level.
$ECT$ denotes the error correction term in the error correction model.

The one-way causal relationship in these two variables are support the view of **Carroll and Weil (1994)**, which stated that the causal relationship is running from growth to national savings than the other way around. In addition, the results show that economic growth lead to national savings is detected in the long run based on significant of F-test though the error correction term. The result is support the view that higher growth rate come before higher savings rate and economic growth is the most important influence of saving in the long run.

Besides that, the F-test does not reject the null hypothesis of non-causality running from interest rates to national savings and vise-versa in the short run. This causal relationship is only detected through the long run effect and significant at 5% significance level. Furthermore, the results reveal that changes in dependency ratio can cause changes in national savings and are significant at the 5% significance level, and vise-versa. Therefore, bi-directional causality running between dependency ratio and national savings has been detected.

This finding suggests two-way causal relationship, which reflects that the age dependency ratio is the most significant determinant of savings in the short run. However, the results are different under estimated of long run horizon. The unidirectional causality running from dependency ratio to national savings is detected based on significant F-test through the error-correction term. So, the empirical results reflect that age dependency ratio may be used as a policy tool to excite savings in the long run.

Then, the empirical results reveal evidence of causal link between foreign savings and domestic savings. As showed by the significant value of F-test in both short and long runs respectively, a unidirectional causality is detected running from foreign savings to national savings. This means that changes in foreign savings can lead change in national savings and not vice-versa. As a result, we can conclude that foreign capital inflows impede domestic savings in Malaysia. This result is consistent with the view of **Giovannini (1985), Obstfeld (1995) and Muradoglu and Taskin (1996)**, which stated that foreign capital inflows are expected to reduce national savings.

## 5.6 CONCLUSION

The co-integration approach and the ECM are used to investigate the long run and short-run interaction between national savings data. Conditioning on co-integration results, we access the causal relationship among the series. The significant causal relations between saving and its determinants is stable across specifications, and we can concluded that the estimated long run and short-run coefficients is very close to those obtained in previous study **(Baharumshah, 2003)**.

Among the main findings reported here are the following: firstly, saving has risen substantially together with growth (growth leads to saving rate). Secondly, interest rate not play a significant role in Malaysia's national savings rate. Then, regard to demographic age structures influence by decreasing in dependency ratio, upward trend in saving is not an aggregation effect generally, but an individual effect. Young generation now save more of their resources than did their parents in the previous time. Lastly, we can conclude that capital inflows are expected to substitute national savings by decreasing its.