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INTERSECTORAL INTEGRATION IN MALAYSIAN ECONOMIC TRANSITION AND CHANGE: A COINTEGRATION ANALYSIS

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ABSTRACT

The present study investigates empirically the inter-sector integration in Malaysian economic transition and change over the period 1960-1998. It is obvious that all the economic sectors moved together over time and none of them developed in its own way. The interest GDP (Gross Domestic Product) sectors are outputs of agriculture, manufacturing, and services. The results of cointegration analysis (Pesaran et al., 2001) find no long run equilibrium relationship among these sectors. In the short run, the agriculture output influences the manufacturing output, and affects services output negatively. The manufacturing sector has little influence on agriculture output. The implications that can be drawn are that long-term structural and integrated policies are necessary to bring back the sectors' disequilibriurn in economy. It can be implemented through sound fiscal and monetary policies. In addition, promoting agriculture sector growth is needed because any increase in agricultural output might have positive and sizeable effects on the manufacturing output.

Key words: *cointegration; bounds test; intersectoral integration; unrestricted error correction model*

ABSTRAK

Kajian ini telah menyiasat secara empirikal integrasi antara-sektor di peralihan dan perubahan ekonomi Malaysia menjelang tempoh 1960-1998. Kebiasaannya, kesemua sektor ekonomi bergerak bersama sepanjang masa dan tiada yang dibangunkan secara bersendiri. Sektor KDNK (Keluaran Dalam Negara Kasar) yang dikaji ialah pertanian, perkilangan dan perkhidmatan. Keputusan ujian kointegrasi (Pesaran, et al., 2001) menunjukkan bahawa tidak wujud hubungan jangka panjang antara sektor-sektor yang dikaji. Dalam jangka pendek, output pertanian mempengaruhi output perkilangan, dan memberi kesan negatif terhadap output perkhidmatan. Sektor perkilangan mempunyai pengaruh kecil terhadap output pertanian. Implikasi yang boleh dibuat adalah polisi struktur jangka panjang dan integrasi diperlukan untuk mencapai hubungan kointegrasi bagi sektor ekonomi dalam jangka panjang. Ini boleh dilaksanakan melalui polisi fiskal dan kewangan. Tambahan pula, meningkatkan pertumbuhan sektor pertanian adalah perlu sebab sebarang peningkatan output pertanian akan membawa kesan yang positif dan mencukupi terhadap sektor perkilangan.

Kata Kunci: *kointegrasi; ujian bounds; integrasi antara sektor; model pembetulan ralat tanpa konstren*

INTRODUCTION

The present study centers on re-investigating the long run intersectoral equilibrium relationship among agriculture, manufacturing and services[1] in Malaysian economic transition and change[2]. The short run effects among these GDPs sectors have also been investigated. Hwa (1989, p. 107) has stated that there are important linkages and dynamic interactions between different sectors of an economy and noted that *the relationship between agriculture and industry is one of interdependence and complementarity.* This is important to understand LDC's (Least Developed Countries) intersectoral linkages for the policy formulation process that might help to avoid or diminish unintended outcomes of policy interventions. The government policies in LCDs are often aimed explicitly at boosting the output of particular sectors, or they implicitly favor certain sectors (Gemmell et al., 1998, p.6).

The structure of Malaysian output (Gross Domestic Product, GDP), export and import has experienced a rapid change over the period 1960-1998 reflecting the dynamic process of development experienced, from the shifts of import substitution industrialisation in the 1960s to export-oriented industrialisation in the 1970s, and then industrialization based on heavy industries in the 1980s together with sound macroeconomic policies, which enabled the economy to achieve rapid economic growth and significant structural changes. The country's economy has been transformed from an agriculture-based economy into a manufacturing based economy with export orientation. Moreover, the recent development strategy of Malaysian economy transformation is from a product-based to a knowledge-based economy (K-economy).

During the 1991-2000 period, the GDP grew at an average rate of 7.0 per cent and achieved the target for the Second Outline Perspective Plan (OPP2). The high growth rate was achieved in an environment of low inflation, stable prices and low unemployment (Malaysia, 2001). Table 1 reports the performance of agriculture and manufacturing sectors over the two-year period before and after the Asian Financial crisis 1997-98. The growth of agriculture output was less than 1 per cent in 1998 and 1999 as well its declining share on real GDP. An encouraging growth of the manufacturing sector was observed after the 1997-98 crisis period, which has been traced as the engine of the recovery growth. This sector contributed about 30 per cent of the total RGDP over the period. The situation and prospects of the manufacturing sector have changed significantly after the economic downturn after mid-1997 and the U.S economic slowdown. To move ahead towards sustained output and export growth, strategies are required to meet growing competition for foreign direct investment (FDI) and slower pace of local investment (Malaysia, 1998).

Table 1
The Growth and Share of Malaysian Agriculture and Manufacturing Sectors 1995-2000

Year	Agriculture Change in %	% Share of RGDP	Manufacturing: Change in %	% Share of RGDP
1995	-2.5	10.3	11.4	27.1
1996	4.5	9.8	18.2	29.1
1997	0.7	9.2	10.1	29.9
1998	-2.8	9.6	-13.4	27.9
1999	0.4	9.1	13.5	29.9
2000	0.6	8.4	21	33.4

Note: The data are obtained from Monthly Statistical Bulletin, Bank Negara Malaysia. RGDP and the output of agriculture and manufacturing sectors are based on 1987 prices.

Over the period 1960-1998, the annual growth rate of agriculture; manufacturing; and services and other sector were 4.23 per cent, 10.10 per cent and 6.64 per cent, respectively (in real term). According to Yao (1994, p.229), it is obvious that all the ecnomic sectors moved together over time and none of them developed in its own way. This implies that economic forces were able to tie the different sectors together to form a long run structural equilibrium, even though some sectors might have grown much faster than others in the short run.

Some GDP sectors' linkages in either the long or the short run are expected in the policy point of view, particularly in designing and implementing the policy response of the 1997-98 Asian Financial Crisis. One of the Malaysian government's responses to the Asian Financial crisis (1997-98) is to give priority to the development of resource-based industries (these industries are known to have low import content) and to accelerate the development of backward linkages for non resource-based industries in order to increase the utilization of local inputs (Malaysia, 1998). The resource-based industries account for 17 per cent of total manufacturing value added and 10 per cent of the 2.3 million employed in manufacturing activities.[3]

Few works have been carried out empirically in examining the long run equilibrium relationship between agriculture and non-agricultural sectors. Yao (1994) examined the cointegration relationship between agriculture and non-agriculture sectors in the Chinese economy during 1952-1992 (annual data). The results of Johansen's multivariate cointegration test identified three cointegration vectors among agriculture, industry, construction, transport and services. On the other hand, Kanwar (2000), using the same cointegration approach, found that the GDP sectors of the Indian economy are moving together (cointegrated) over the sample period 1950/51-1992/93.

A part of Gemmell et al.'s (1998) study is to investigate the linkages between agricultural, manufacturing and services GDP sectors in Malaysia. They used limited annual data that is from 1965 to 1991 covering 27 observations. The results of Johansen's test fail to reject the null of none cointegrating vector with finite sample adjusted critical values (Cheung and Lai, 1993) at 10 per cent significance level. In contrast, the null hypothesis can be rejected using asymptotic (unadjusted) critical values (Osterwald-Lenum, 1992) at the 10 per cent level (see Gemmell et al., 1998, p. 23, Table A1). Furthermore, Kremers et al. (1992) stated that the significance of error correction term might be traced as alternative test for cointegration in small sample study. The estimated error correction term in final error correction model (Gemmell et al., 1998, p. 16, equation (5)) is significant (t-ratio is -4.40). This indicates the presence of a long run equilibrium relationship among three GDP's sectoral series. Thus, their results are mixed and interpreted with caution.

According to Toda (1994, 1995), the available Monte Carlo evidence on the minimum sample size considered necessary for cointegration testing is around 100. As stated by Cheung and Lai (1993, p. 316), finite-sample analyses can bias the likelihood ratio (LR) tests (Johansen approach) toward finding cointegration either too often or too infrequently as the case in Gemmell et al. (1998). As justified by Mah (2000), in the case that the data set is of small sample size, the conventionally used cointegration tests (like Engle-Granger, 1987; Johansen, 1988, and Johansen and Juselius 1990) are not reliable. Therefore, Mah (2000) proposed the use of the bounds testing and unrestricted error correction model in Pesaran et al. (2001) in small sample study. The UECM allows separate identification of both long run and short run coefficients of explanatory variables as well as cointegration test. Some studies that have applied the Pesaran method for studies that involved small sample size are Pattichis (1999), Mah (2000) and Tang (2001). This approach has been applied in the present study.

DATA AND METHOD

The present study employs a set of annual data for GDP's output of agriculture, manufacturing and services (see footnote 1) over 1960-1998. The real value is obtained with nominal value (in RM billions) deflated by GDP deflator (in 1995 prices). All data are obtained from *World Tables*, World Bank (*EcoData*). The sample span is longer than in Gemmell et al.(1998). They used annual data from 1965 to 1991, yielding 27 observations.

Contrary to Toda's (1994, 1995) argument, Hakkio and Rush (1991) have argued that increasing the number of observations by using monthly or quarterly data does not add any robustness to the results in tests of cointegration.[4] Davidson and MacKinnon (1993, p. 714) have highlighted that one possibility to avoid using seasonally adjusted data to compute unit root tests, is to use annual data. Moreover, they stated that the power of these tests depends more on the span of the data (i.e., the number of years the sample covers) than on the number of observations. Thus, based on their arguments the sample span covering 39 annual observations as in present study might be sufficient for analysis.

Table 2

Phillip-Perron Unit Root Tests

Variables:	#Level	First Difference
Ln A	-1.790	-6.316
Ln M	-1.653	-3.576
Ln S	-3.331	-6.096
MacKinnon Critical Values: 1%	-4.2165	-3.6171
5%	-3.5312	-2.9422
	(Constant and Trend)	(Constant only)

Note: A= Agriculture, M= Manufacturing, and S= Services. Ln is natural logarithm form.

#All the series found to be nonstationary in level by excluding the time trend variable in PP equation.

Table 2 reports the results of the Phillip-Perron (PP) unit root test (Phillip and Perron, 1988). The PP test is designed to be robust for the presence of autocorrelation and heteroscedasticity. As discussed by Schwert (1989), small-sample studies show that it is more appropriate to use the PP test. The results show that all of the series of interest are non-stationary or integrated in order one, I(1).

Next, a set of UECM regressions (Ordinary Least Squares, OLS) is estimated to investigate the long and short run inter-linkages between agriculture, manufacturing, and services GDP sectors. For example, the UECM regression for the agriculture (At) is specified as follow:

$$\Delta LnA_t = b_0 + \sum_{i=0}^{k1} b_{1i}\Delta LnM_{t-i} + \sum_{i=0}^{k2} b_{2i}\Delta LnS_{t-i} + \sum_{i=1}^{k3} b_{3i}\Delta LnA_{t-i}$$

$$+b_4 LnA_{t-1} + b_5 LnM_{t-1} + b_6 LnS_{t-1} + e_t \tag{1}$$

where Δ is first difference operator; A_t, M_t, and S_t are output of agriculture, manufacturing, and Service GDP' sectors respectively. *Ln* is natural logarithm form.

To investigate the presence of a long run relationship among M_t, A_t, and St, Pesaran et al. (2001) proposed the bounds test which is based on Wald or *F*-statistics. The asymptotic distribution of the *F*-statistic is non-standard under the null hypothesis of no cointegration relationship between the examined variables, irrespective of whether the explanatory variables are purely I(0) or I(1).

The test is conducted in the following way. The null of no cointegration relation among M_t, A_t, and S_t is tested by considering the estimated UECM, for example equation (1) with excluding the lagged variables of LnA_{t-1}, LnM_{t-1} and LnS_{t-1}. More formally, we perform a joint significance test (Wald or *F*-test) for the null $H_O : b_4 = b_5 = b_6 = 0$ against the alternative, $H_A : b_4 \neq b_5 \neq b_6 \neq 0$. For some conventional significance level, 1, 5, and 10 per cent, if the test statistic (*F*-statistics) falls outside the critical bounds, a conclusive inference can be made without considering the order of integration of the explanatory variables. For example, if the *F*-statistic is higher than the upper critical bound then the null hypothesis of no cointegration is rejected. The null hypothesis cannot be accepted if the test statistic is less than the lower critical bound. The same steps are applied for UECM with normalizing manufacturing (M) and services (S) variables.

EMPIRICAL RESULTS

The estimated UECMs are reported in Table 3. One lag length has been chosen (k1=k2=k3=1) considering the degree of freedom due to limited annual data. The estimated UECMs are residuals white noise (Q-statistics) and normally distributed (Jarque-Bera test). More importantly, as the CUSUM plots in Figure 1 reveal, all of the estimated parameters of UECMs are stable over the sample period. The UECMs of two or higher lag length specification fail to satisfy the above criteria.

Table 4 documents the results of bounds test for cointegration analysis. The test statistic of UECM (1) cannot exceed the upper bound at 10, 5, and 1 per cent level, thus the null of no cointegration cannot be rejected. By considering strong form significant level (one per cent), the null hypothesis cannot be rejected, while the *F*-statistic (4.087) is smaller than lower bound (5.15). No cointegraion relationship for M_t, A_t, and S_t could be made[5]. By normalizing other variables, LnA_t and LnS_t as in UECM (2) and (3), the test statistics (0.656 and 0.772) are less

Table 3
Estimation of UECMs

Dependant Variable:	$\Delta Ln\ M_t$ UECM (1)	$\Delta Ln\ A_t$ UECM (2)	$\Delta Ln\ S_t$ UECM (3)
Constant	-1.241	0.300	0.465
ΔLnM_t	--	0.326 (2.603)**	0.18 (1.244)
ΔLnM_{t-1}	0.450 (2.492)**	-0.010 (-0.069)	0.153 (0.957)
ΔLnA_t	0.598 (2.601)**	--	-0.465 (-2.464)
ΔLnA_{t-1}	-0.186 (-0.689)	-0.204 (-0.211)	-0.401 (-1.928)***
ΔLnS_t	0.282 (1.244)	-0.383 (-2.464)**	--
ΔLnS_{t-1}	0.392 (1.517)	0.201 (1.029)	-0.135 (-0.621)
LnM_{t-1}	-0.323 (-3.00)*	0.058 (0.632)	0.105 (1.059)
LnA_{t-1}	0.562 (3.20)*	-0.157 (-1.054)	-0.084 (-0.506)
LnS_{t-1}	0.140 (1.323)	0.003 (0.034)	-0.122 (-1.424)

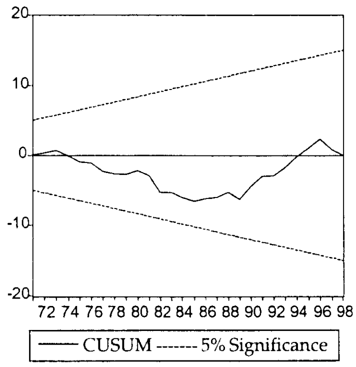
( ) is t-ratio. *, **, and *** denote 1%, 5% and 10% significant level

R^2	0.558	0.487	0.416
Adjusted R^2	0.432	0.34	0.249
S.E.	0.056	0.042	0.046
F-Statistic (p-value)	4.416 (0.002)	3.322 (0.009)	2.489(0.035)
Jarque-Bera (p-value)	0.568 (0.753)	0.742 (0.690)	0.293 (0.864)

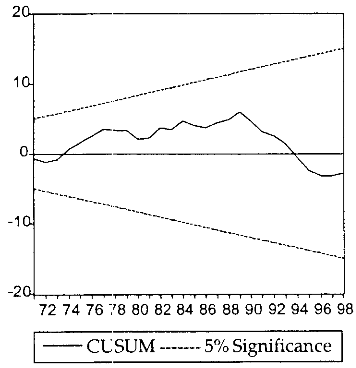
Note: M, A, and **S** denote the real output of Manufacturing sector, Agriculture sector and Services sectors.

Figure 1

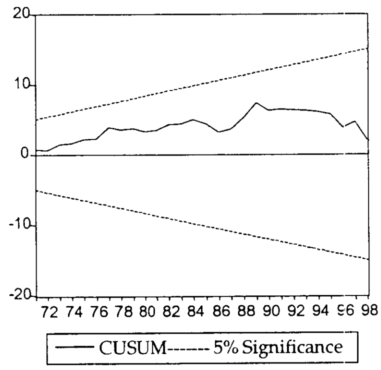
Plot of CUSUM Test for Estimated UECM (1), (2) and (3)



UECM (1)



UECM (2)



UECM (3)

than lower bound at 10 per cent level (3.17) indicating the null of no cointegration cannot be rejected. The above results strongly indicate that output of agriculture, manufacturing and services are not cointegrated or unstable, meaning that there is a tendency those GDPs' output tend to drift wide apart in the long run. The result is consistent with Gemmell et al.'s (1998) finding as agricultural, manufacturing and service GDP sectors for Malaysia are not cointegrated.[6]

In the absence of long run relationship, the estimated UECMs are still able to give an estimate of the short run relationship. The coefficients of the first difference variables capture the short run elasticity as in Table 3. The agriculture sector influences manufacturing positively (0.6) but has negative effect on services output, -0.47 (significant at 5 per cent

Table 4
Bounds Test for Cointegration (Pesaran et al. 2001)

Dependent Variable:		$\Delta Ln\ M_t$ UECM (1)	$\Delta Ln\ A_t$ UECM (2)	$\Delta Ln\ S_t$ UECM (3)
Test statistics (*F-statistic*) by restricting coefficients of LnM_{t-1}, LnA_{t-1}, and $Ln\ S_{t-1}$		4.087	0.656	0.772
#Critical bounds				
Lower and Upper bounds	1%	5.15 and 6.36		
	5%	3.79 and 4.85		
	10%	3.17 and 4.14		

the critical bounds statistics are obtained from Pesaran et al. (2001) with unrestricted intercept, no trend and two regressors case.

level). On the other hand, the manufacturing sector has little influence on agriculture output. The estimated elasticity is 0.33.

CONCLUSIONS AND POLICY IMPLICATIONS

The present study investigates the long run linkages among GDP output of agriculture, manufacturing and services in Malaysia. The available annual data are from 1960 to 1998 yielding 39 observations. The bounds testing approach and unrestricted error correction model (Pesaran et al., 2001) are employed in the present study considering the biases of finite sample study in cointegration test. The study reveals no long run inter-linkages among the three broadly defined GDP output, indicating those sectors are apart away in the long run, and developed in its own way. Some signficant short run inter-effects are observed.

The finding of no long run linkages among the three interest sectors can be related to the over-emphasizing policy on a single economic sector. The manufacturing sector has been heavily emphasized under the export led growth strategies, particularly after the country's 1985-88 recession. Exports of manufacturing goods contributed about 71 per cent of the total Malaysian gross exports for the period of 1990-1999 compared to 13 per cent in 1970-1979 (*World Tables*, World Bank). Using Malaysian data, Doraisami (1996) found a support for bi-directional growth between exports and output as well as a positive long run relationship between both variables. In contrary, Al-Yousif (1999) used the multivariate approach and found that export-led growth thesis is a short-run phenomenon in Malaysia. This indicates export-led growth is not an appropriate development strategy for long term.

In the eyes of policy implication, longer term structural and integrated policy are desired in order to bring back the sector's disequilibrium in Malaysian economy. It can be implemented through reinforcement of fiscal and monetary policies. The agriculture sector should be further developed because any increase in agricultural output might cause the manufacturing output positively in the short run. Mohammad and Tang (2002) found that agricultural-based exports and agricultural banks financing do jointly *Granger* causes agricultural output in long run. A cointegration relation among those variables is documented. The study indicates the role of agricultural export and bank lending as engine of growth in agriculture sector. Moreover, Tang (2000) found that bank lending and real GDP are moving together in the long run, and commercial bank credit can be used to adjust any disequilibrium. The speed of adjustment is about 5 years. Thus, banking institutions in Malaysia play a prudential intermediation role in channeling domestic source for various GDP sectors. Moreover Tang and Faoziah's (2001) study documented that strengthening the Malaysian banking institution fundamental is useful for financing the country's economic growth. Over the period 1990-1997, only 3.4 per cent of the commercial banks credit was channeled into agriculture sector compared to 23 per cent for manufacturing purposes (figures are calculated from data of *Monthly Statistical Bulletin*, Bank Negara Malaysia, various issues). During the crisis period (1997-1998) a minimum of 8 per cent of annual loans growth was targeted for all banking institutions in order to enable the country to achieve 1 per cent GDP growth in 1999.[7]

Mohammad, et al. (2001) examined the issues on crisis management pertaining to the Malaysian plantation industry. They recommend Government intervention, mono-crop culture departure, and orderly marketing arrangements among major producers are needed (p. 36). It is encouraging that the focus on agriculture sector under the OPP3 will be on increasing food production to meet the growing domestic demand as well as for export. The agriculture sector is targeted to be an important source of growth during the OPP3 period, 2001-2010. Its growth will mainly be derived from the significant increase in industrial crops, food production and contribution from new activities. Towards this end, efforts will be focused on restructuring and modernizing the agriculture sector to be more dynamic and competitive (Malaysia, 2001).

Finally, the Government policies as proposed in OPP3 mainly focus on a balanced development among the GDP sectors. Specifically, in strengthening sector-wise dynamism, the growth of the agriculture, manufacturing and services sectors will be further promoted with greater emphasis on knowledge inputs. Particularly, in the services sector, efforts will focus on tourism, education, health, finance, ICT and transportation sectors in order to become internationally competitive. The development thrusts for OPP3 period (2001-2010) will be to create wealth and promote new sources of growth in the manufacturing, services and agriculture sectors (Malaysia, 2001, p. 169-170).

ENDNOTES

1. Services refers to the sum of the following categories, that are mining & quarrying, construction, electricity, gas & water, transport, storage & communication, whole sale and retail trade, hotels & restaurants, finance, insurance, real estates & business services, Government services, and other services.

2. To account for the loss of degree by including all possible variables that are agriculture; mining and quarrying, manufacturing; construction; electricity, gas and water; transport, storage and communication; wholesale and retail trade, hotels and restaurants; finance, insurance, real estates and business services, Government services and other services. Those three sectors have been emphasized on OPP3.

3. The resource-based industries include rubber-based products (tyres, footwear, gloves, condoms and catheters); palm oil-based products (oleo-chemicals, margarine, soap, detergents and personal care products); and wood-based products (sawn timber, veneer, plywood products, furniture and moldings) (Malaysia, 1998).

4. Sinha (1997) adopted this justification and employed the cointegration approach (Johansen multivariate procedure) to ana-

lyse aggregate import demand function for Thailand using annual time series data for the 1953-1990 period.

5. The author performs Engle-Granger (1987) residual based cointegration test on $LnM_t = a + b^*LnA_t + c^*LnS_t + u_t$ (cointegrating equation). The test statistic (t-statistic) is -2.411 (includes constant term) that fail to reject the null of no cointegration relation using MacKinnon critical value, -2.608 (10 per cent level).

6. This result is based on the failure to reject the null of none cointegrating vector by considering finite sample corrected critical values (Cheung and Lai, 1993) at 10 per cent significance level (see Gemmell et al., 1998, p. 23, Table A1).

7. See The Star, 1998, *Loans target still short of RM36.7bil*. November, 14 (p.1).

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