The dynamics of growth, exports, exchange rate and foreign direct investment: evidence from Malaysia

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Abstract

The paper analyzes dynamic interactions among four macroeconomic variables, namely real gross domestic product (GDP), real exports, real exchange rate and foreign direct investment (FDI) for the Malaysian case using standard time series techniques. Malaysia's GDP seems to be more driven by changes in exports and exchange rate, while FDI plays an insignificant role towards economic growth. We observe that there is a stable long run relationship among economic growth, real exports, real exchange rate and FDI. The empirical results show that the real exchange rate and real exports are found to have significant impact on real GDP in Malaysia. We also note that the real exchange rate is the most exogenous variable in the long run, while the FDI is the weakest endogenous variable in the dynamic interaction. Despite exchange rate being the most exogenous, as far as the GDP is concerned, more of the variation is explained by real exports. . The model suggested that real exchange rate is the most exogenous variable, implying that exchange rate policies should be considered as a policy instrument to bolster economic growth. Exchange rate will also have an indirect impact on the economic growth through real exports by making exports more price-competitive. As a whole, policy makers should weigh in the dynamic interactions among the macroeconomic variables before implementing policy instruments to stimulate economic growth.

Keywords: dynamics, growth, exports, exchange rate, FDI, Malaysia

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1. INTRODUCTION AND OBJECTIVE OF RESEARCH

The dynamic relationship between economic growth and real exports, real exchange rate and foreign direct investment (FDI) has crucial policy implications and huge bearing to the nation's economic planning. The causal link between economic growth and its determinants can be examined and analysed using time series econometric techniques i.e. the unit root test, cointegration test, error correction model (ECM), variance decomposition and impulse response function as this paper intends to explore. If there is a strong relationship between economic growth and one its determinant, for example real exports, the issue will fall on policy makers whether to embark on export expansion policies to stimulate economic growth.

Exports and FDI has been the cornerstone of the Malaysian government's economic policies to accelerate economic growth. This could be observed through the export expansion policies in the 1980s replacing the import substitution framework previously. The country has been proactive in attracting FDI in the form of Promotion of Investment Act 1986, which has shaped the successive national economic plans. The trade and investment policies are supported by a stable and competitive exchange rate. The policy prescriptions had propelled Malaysian into one of the Newly Industrialised Economies.

Therefore, this study is carried out to investigate the dynamic interactions among GDP growth, real exports, FDI and real exchange rate**.** The paper hopes to address the inconsistencies in the Malaysian empirical work on the dynamic relationships among the macroeconomic variables and, at the same time, examine policy implications on export-led growth hypothesis. The objectives of the paper are as follows:

1) To determine whether there exists a long-run relationships among the macroeconomic variables in Malaysia.
1) To identify the direction of causality, if any between real GDP with real exports, real exchange rate and FDI.
3) To identify the main macroeconomic variables that determine economic growth in Malaysia.

4) Assess the dynamic relationship among GDP growth, real exports, real exchange rate and FDI in a more comprehensive time period, from the first quarter of 1991 to yield a more convincing conclusion.
5) Offer policy makers some insights of policy implications on economic growth. This will be pivotal in reviving an economy weighed down by the 2008 financial crisis and the European sovereign debt crisis.

2. LITERATURE REVIEW

The reasoning to favour export expansion policies is discussed by Bhagwati (1978) and Krueger (1978). The arguments generally maintain that export expansion contributes to economic growth by increasing the rate of capital formation and enhancing the growth of factor productivity. Malaysia's rapid expansion in the 1980s has been largely export driven, supported by Malaysian government's accommodative export oriented policies (Al-Yousif 1999). Malaysia pursued policies favouring import substitution during the 1960s gradually shifting to a more outward-oriented strategy in the 1970s as a way to moving towards industrialization.

Tyler (1981) used a sample of 55 middle income developing countries, including Malaysia, to show that manufactured export performance along with capital formation were significant determinants in GDP growth rates. Similarly, Shah and Yusoff (1990) conducted a study on Malaysian economy up to 1987 by using the ordinary least squares (OLS) method. They found out that economic expansion is causally linked to total exports performance. Muzafar and Mohammed (1990) extrapolated quarterly data up to 1987 to examine the export-led growth hypothesis. With single equation technique, they found that export growth simulates GNP growth. More recently, in a cointegration procedure study by Ghatak and Price (1997), they reconfirmed the relationship suggested by Shah and Yusoff (1990) and concluded that aggregate exports cause real GDP and non-export GDP. They showed that the export-led growth for Malaysia was driven by exports of manufactures rather than by traditional (i.e., primary non-fuel) exports. In addition, Khalafalla and Webb (2001) used quarterly data from 1965 to 1996 to establish causal relationship of exports performance and economic growth across quarters instead of annual sample. They indicated that

the exports driven growth were more pronounced in Q1 and Q4 due to increased festivities demand for Malaysian export goods.

On the other had, other literature suggested that the relationship is reversed. Reinhardt (2000) postulated that economic growth drove export performance instead. This view was supported by a study of 87 countries by Dorado (1993), suggesting export performance has a negative effect on economic growth in Malaysia, that is GDP growth promotes export growth. While the relationship direction has been a subject for debate, there are literatures suggesting bi-directional relationship between the two variables. Dutt and Ghosh (1994) and Thornton (1997) illustrated this bidirectional relationship in their empirical studies. In a complex relationship between export growth and economic expansion, a two-way causality is more probable for Malaysia (Doraisami 1996).

Riezman et al. (1996) had examined 126 countries annual data from 1965 to 1999, including Malaysia to analyse causal relationship between economic growth and other independent variables. The models used were bivariate, tri-variate and 5-variable models. The independent variables chosen were real export growth, real import growth, ratio of total investment over output and primary school enrolment. They concluded that there was no short-run deterministic relationship in the Malaysian case. Similarly, Al-Yousif (1999) suggested there was no long-run relationship between real GDP and real export in his bivariate cointegration model. He tested the causal links of real exports, real effective exchange rate and labour exclusively for Malaysia. Nevertheless, he proved a strong evidence of relationship among these variables when he used the multivariate framework instead. In contract with Riezman et al. (1996), Al-Yousif (1999) reported a short-run causal relationship among the variables. He suggested a short run relationship from real exports to real GDP, not the reverse.

The literature on exports performance and economic growth is ambiguous for the case of Malaysia. These conflicting finding could be attributed to different sample periods and different methodologies used such ordinary least square (OLS), cointegration procedures and Granger causality frameworks. There are limitations to each of the modelling methods used. On the sample period, Dutt and Ghosh (1996) argued that an annual time series, rather than quarterly or monthly

data, is the appropriate unit for measuring the link between growth and exports. The choice and number of variables is also a cause of inconsistent findings on the determinants of Malaysian economic growth. There are a number of determinants giving effect to economic growth and more variables need to be included alongside exports performance to avoid specification bias (Shan and Sun 1998). Rana and Dowling (1988) pointed out that foreign capital inflows and exports are two important determinants that explained economic performance, and the regression results would be biased when any of these two variables were omitted. The other variables chosen alongside real exports in this paper are FDI and real exchange rate.

For FDI variable, it is expected that the countries which receive high FDI will have a better economic performance compared to countries which receive less FDI inflows. Balasubramanyam et al. (1996) analyses how FDI affects economic growth in developing economies. Using cross-section data, he finds that FDI has a positive effect on economic growth in host countries. Olofsdotter (1998) confirmed the finding as she found that an increase in FDI is positively related to growth and that the effect is stronger for host countries with a higher level of institutional capability as measured by the degree of property rights protection and bureaucratic efficiency. Baharumshah and Thanoon (2006) concluded that FDI played an important role in Malaysian economic growth and development. They found that FDI is positively related to economic growth.

A study by Borensztein et al. (1998) using cross country regression framework in 69 developing countries, including Malaysia suggested that FDI is a major channel for access to advanced technologies, contributing relatively more to growth than domestic investment. This was echoed by Chakraborty, and Basu (2006) suggesting that large flows of FDI into the country will introduce the country to new technologies and create technology spillovers which lead to an increase in the GDP level and market size of the host country. FDI will also contribute to the economic growth through transfer of capital and management knowledge from an enterprise (of an investing country) (Kojima 1985).

According to Mohd Nazari Ismail (2001), FDI plays a significant role in the Malaysian economy especially in the electronic industry. In addition to creating more jobs and generating export, the foreign multinationals have also contributed to the development of the technical capabilities of the

locals. This is through the process of technology transfer. Similarly, Yussof and Ismail (2002) found that inward FDI has been an important source of knowledge transfer in technology and international linkages for Malaysia. Using the OLS estimation procedure, Wong and Jomo (2005) found that FDI and economic growth were positively related while it had a negative effect on the domestic savings rate.

De Mello (1999) on the other hand only finds weak indications of a positive relationship between FDI and economic growth for a sample of 32 countries. Carkovic and Levine (2002) used a panel dataset covering 72 developing countries in order to analyse the relationship between FDI inflows and economic growth and concluded that there is no robust link running from FDI to economic growth. The causality between economic and FDI was questioned by Choe (2003), as he found that the causality runs in either direction and with a tendency towards growth causing FDI.

For exchange rate variable, it is an indirect determinant to economic growth as exchange rate could determine the competitiveness of an exporting good and influence the attractiveness of country as a destination for FDI. According to Shah and Yusoff (1990) and Ghatak and Price (1997), export expansion is likely to induce economic growth in Malaysia. Smith (2003) suggested that the economic growth in New Zealand shows a marginally higher degree of sensitivity to the exchange rate. Using the Granger causality analysis, Rafayet Alam (2010) found that the real exchange is a good indicator on export growth since it shows the price of the country's goods and services relative to the price of goods and services of other countries. Furthermore, a study done by Tang (2007) found that in both long run and short run, foreign income and prices are very important determinants of export demand on five electrical goods exports in Malaysia.

Kozo and Urata (2004) claimed that a currency depreciation of the host country is likely to support economic growth by way of attracting FDI while high volatility of the exchange rate is likely to discourage FDI. These findings were confirmed by Lui et al. (2006) as they found that weaker domestic currency will attract more inward FDI because it reduces the costs of funding. They concluded that exchange rate volatility in general has strong negative effects on economic growth through reduction in FDI. Nevertheless, Tuman and Emmert (1999) observed that exchange rate has an insignificant effect on economic growth in a share regression.

To the best knowledge of the author, there has been limited, if any, research work dedicated to empirically establishing linkages between the combination of real GDP, real exports, real exchange rate and FDI for the Malaysian case using the latest quarterly data. Earlier empirical works have omitted any one of the variables under consideration or have used different time period for their study. This is the research gap that this study seeks to address. Following that, we will now proceed with the quantitative analysis of this study.

3. RESEARCH METHODOLOGY, RESULTS AND INTERPRETATION

This study employs a time series technique, in particular, cointegration, error correction modelling and variance decomposition, in order to find empirical evidence of the nature of relations between GDP and its determinants as alluded to in the introductory paragraphs. This method is favoured over the traditional regression method for the following reasons.

Firstly, most economic variables are non-stationary. This means that performing ordinary regression on the variables will render the results misleading, as statistical tests like t-ratios and F statistics are not statistically valid when applied to non-stationary variables. Performing regressions on the differenced form of these variables will solve one problem, at the expense of committing an arguably even graver mistake. When variables are regressed in their differenced form, the long term trend is effectively removed. Thus, the regression only captures short term, cyclical or seasonal effects. In other words, the regression is not really testing long term (theoretical) relationships.

Secondly, in traditional regression, the endogeneity and exogeneity of variables is predetermined by the researcher, usually on the basis of prevailing or a priori theories. Cointegration techniques are advantageous in that it does not presume variable endogeneity and exogeneity. In the final analysis, the data will determine which variables are in fact exogenous, and which are exogenous. In other words, with regression, causality is presumed whereas in cointegration, it is empirically proven with the data.

Thirdly, cointegration techniques embrace the dynamic interaction between variables whereas traditional regression methods, by definition, exclude or discriminate against interaction between variables. Economic intuition tells us that the interaction between real GDP, real exports, real exchange rate and FDI is dynamic in nature.

The data used here are the quarterly data starting from 1991. An earlier start date was not possible given limitation of data availability. A total of 84 observations were obtained. The source of data was DataStream and Malaysia's Department of Statistics.

3.1. TESTING STATIONARITY OF VARIABLES

We begin our empirical testing by determining the stationarity of the variables used[1]. In order to proceed with the testing of cointegration later, ideally, our variables should be I(1), in that in their original level form, they are non-stationary and in their first differenced form, they are stationary. The differenced form for each variable used is created by taking the difference of their log forms. For example, $DGDP = LGDP - LGDP_{t-1}$. We then conducted the Augmented Dickey-Fuller (ADF) and Phillips-Perron tests on each variable (in both level and differenced form). The table below summarizes the results.

Augmented Dickey-Fuller (ADF) Test			
Variable	**Test Statistic**	**Critical Value**	**Implication**
Variables in Level Form			
LGDP	-2.5327	-3.4673	Variable is non-stationary
LEXPORTS	-1.4976 (AIC)	-3.4673	Variable is non-stationary
	-1.9263 (SBC)	-3.4673	Variable is non-stationary
LEXR	-1.2047	-3.4673	Variable is non-stationary
LFDI	-3.8629 (AIC)	-3.4673	Variable is non-stationary
	-4.3256 (SBC)	-3.4673	

[1] A variable is stationary when its mean, variance and covariance are constant over time.

Variables in Differenced Form			
DGDP	-5.6116	-2.8991	Variable is stationary
DEXPORTS	-5.4654 (AIC)	-2.8991	Variable is stationary
	-6.6606 (SBC)	-2.8991	Variable is stationary
DEXR	-7.8057	-2.8991	Variable is stationary
DFDI	-5.0686	-2.8991	Variable is stationary

Phillips-Perron (PP) Test		
H_0: Non Stationary >10%, non-stationary, accept the null, not significant <10%, stationary, reject the null, significant		
Variable	**p-value**	**Implication**
Variables in Level Form		
LGDP	0.162	Variable is non-stationary
LEXPORTS	0.108	Variable is non-stationary
LEXR	0.211	Variable is non-stationary
LFDI	0.038	Variable is stationary
Variables in Differenced Form		
DGDP	0.000	Variable is stationary
DEXPORTS	0.000	Variable is stationary
DEXR	0.000	Variable is stationary
DFDI	0.000	Variable is stationary

The main disadvantage of the PP test is that it is based on asymptotic theory. Therefore it works well only in large samples and unfortunately for this paper, it is constrained by the limitation of the data availability. PP test is also sensitivity to structural breaks, given a small number of observations. Although PP test can address the issue of heteroskedasticity, I will use the results of ADF test to proceed instead.

Relying primarily on the AIC and SBC criteria (from ADF test), the conclusion that can be made from the above results is that all the variables we are using for this analysis are I(1), and thus we may proceed with testing of cointegration[2]. Note that in determining which test statistic to compare with the 95% critical value for the ADF statistic, we have selected the ADF regression order based on the highest computed value for AIC and SBC. In some instances, AIC and SBC give different orders and in that case, we have taken different orders and compared both (for example, this applies to the variable LEXPORTS, LFDI and DEXPORTS, see the table above). This is not an issue as in all cases, the implications are consistent.

3.2. DETERMINATION OF ORDER OF THE VAR MODEL

Before proceeding with test of cointegration, we need to first determine the order of the vector auto regression (VAR), that is, the number of lags to be used. As per the table below, results show that AIC recommends order of 2 whereas SBC favours zero lag)[3].

	Choice Criteria	
	AIC	**SBC**
Optimal order	2	0

Given this apparent conflict between recommendation of AIC and SBC, if we adopt a lower order, we may encounter the effects of serial correlation, while if we opt for a higher order, we may risk over-parameterization. Considering the trade-off between lower and higher orders, we decided to **choose the higher VAR order of 2.**

3.3. TESTING COINTEGRATION

[2] The null hypothesis for the ADF test is that the variable is non-stationary. In all cases of the variable in level form, the test statistic is lower than the critical value and hence we cannot reject the null. Conversely, in all cases of the variable in differenced form, the test statistic is higher than the critical value and thus we can reject the null and conclude that the variable is stationary (in its differenced form).

[3] Based on highest computed values for AIC and SBC, after stipulating an arbitrary relatively high VAR order of 6

Once we have established that the variables are I(1) and determined the optimal VAR order as 2, we are ready to test for cointegration. As depicted in the table below, the maximal Eigenvalue, Trace and HQC indicate that there is one cointegrating vector whereas according to AIC and SBC, there are 3 and zero cointegrating vectors, respectively)[4].

Criteria	**Number of cointegrating vectors**
Maximal Eigenvalue	1
Trace	1
AIC	3
SBC	0
HQC	1

We are inclined to believe that there is one cointegrating vector as intuition as well as familiarity with contemporary equity markets tells us that GDP are typically "connected" or "integrated" in that the performance of other macroeconomic variables to varying degrees. Based on the above statistical result as well as our insight, for the purpose of this study, we shall assume that there is one cointegrating vector, or relationship.

Statistically, the above results indicate that the variables we have chosen, in some combination, result in a stationary error term. The economic interpretation, in our view, is that the 4 macroeconomic variables are theoretically related, in that they tend to move together, in the long term. In other words, the 4 macroeconomic variables are cointegrated, that is, their relations to one another is not merely spurious or by chance. This conclusion has an important implication for policy makers. Given that these macroeconomic variables are cointegrated, the policy makers could design policy instruments to significantly affect the target variable, which usually is the real GDP. Resources could be focused on macroeconomic variables that have a long term impact on

[4] In the case of Maximal Eigenvalue and Trace, the test statistic for null of r = 0 is greater than the 95% critical value whereas for other null hypotheses, statistic is less than the critical values. For AIC, SBC and HQC, the number of cointegrating vectors is obtained by locating the highest numbers.

the real GDP, minimising opportunity cost and maximising allocation of resources. As policies have a lagged effect on the targeted variables, having the knowledge of which variables is co-integrated with the target variable in the long run is extremely useful in policy making.

For the sake of completeness, Engle Granger test were carried out. Engle Granger tests whether the variables are co-integrated, if the error term is stationary, the variables will move constantly, deviation the same, move together in the long run. Engle Granger test, however, is limited to testing only one co-integration. From the Engle Granger results table, the test shows that there is one co-integration (LEXPORTS, SBC) in the relationship and implies that the variables will move together in the long run . However, due to the limitation of Engle Granger, we would proceed with the Johansen test instead.

Engle Granger Test			
H_0 : Error term is non-stationary Stats >CV = stationary, co-integrated Stats <CV = non-stationary, not co-integrated			
Variable	**Test Statistic**	**Critical Value**	**Implication**
Variables in Level Form			
LGDP	-3.2952	-4.2432	non-stationary, not co-integrated
LEXPORTS	-3.4534 (AIC)	-4.2432	non-stationary, not co-integrated
	-4.2738 (SBC)	-4.2432	stationary, co-integrated
LEXR	-3.8751	-4.2432	non-stationary, not co-integrated
LFDI	-4.1132 (AIC)	-4.2432	non-stationary, not co-integrated
	-3.4291 (SBC)	-4.2432	non-stationary, not co-integrated

3.4. LONG RUN STRUCTURAL MODELLING (LRSM)

Next, we attempt to quantify this apparent theoretical relationship among the macroeconomic variables. We do this in order to compare our statistical findings with theoretical (or intuitive) expectations. Relying on the Long Run Structural Modelling (LRSM) component of MicroFit, and

normalizing our variable of interest, the real GDP, we initially obtained the results in the following table . Calculating the t-ratios manually, we found two variables to be significant – EXPORTS and EXR.

Variable	**Coefficient**	**Standard Error**	**t-ratio**	**Implication**
LGDP	-	-	-	-
LEXPORTS	-0.28889	0.047893	-6.032	Variable is significant
LEXR	0.34111	0.054000	6.317	Variable is significant
LFDI	0.0055849	0.013616	0.410	Variable is insignificant

These initial results were generally intuitively appealing. We, then proceed to verify the significance of the variables by subjecting the estimates to over-identifying restrictions. We did this for all the variables (making one over-identifying restriction at a time) and the results confirmed earlier findings that only EXPORTS and EXR were significant, as detailed in the table below

Variable	**Chi-Sq p-value**	**Implication**
LGDP	-	-
LEXPORTS	0.000	Variable is significant
LEXR	0.000	Variable is significant
LFDI	0.677	Variable is insignificant

From the above analysis, we arrive at the following cointegrating equation (numbers in parentheses are standard deviations):

$$GDP - \underset{(0.48)}{0.29}EXPORTS + \underset{(0.05)}{0.34}EXR + \underset{(0.01)}{0.01}FDI \rightarrow I(0)$$

3.5. VECTOR ERROR CORRECTION MODEL (VECM)

From our analysis thus far, we have established that at least three macroeconomic variables are cointegrated to a significant degree – GDP, EXPORTS and EXR. However, the cointegrating equation reveals nothing about causality, that is, which index is the leading variable and which is the laggard variable. Information on direction of Granger-causation can be particularly useful for policy makers. By knowing which variable is exogenous and endogenous, policy makers can better forecast or predict expected results of their decision making. Typically, a policy maker would be interested to know which index is the exogenous variable because then the policy maker would monitor the performance of that macroeconomic variable as it would have significant bearing on the expected movement of other macroeconomic variables in which the policy maker is interested in.

In light of this, the next part of our analysis involves the Vector Error Correction Model (VECM). Here, in addition to decomposing the change in each variable to short-term and long-term components, we are able to ascertain which variables are in fact exogenous and which are endogenous. The principle in action here is that of Granger-causality, a form of temporal causality where we determine the extent to which the change in one variable is caused by another variable in a previous period. By examining the error correction term, e_{t-1}, for each variable, and checking whether it is significant, we found that there is only one exogenous variable, EXR, as depicted in the table below. The other variables were found to be endogenous .

Variable	**ECM(-1) t-ratio p-value**	**Implication**
LGDP	0.000	Variable is endogenous
LEXPORTS	0.087	Variable is endogenous
LEXR	0.707	Variable is exogenous
LFDI	0.023	Variable is endogenous

The implication of this result is that, as far as the analyzed macroeconomic variables are concerned, the variable of interest to policy makers would be the real exchange rate (EXR). This variable, being the exogenous variable, would receive market shocks and transmit the effects of those shocks to other variables. Policy makers who are concerned bolstering economic growth, stimulating exports demand and attracting foreign direct investment, would be interested to monitor movements in the EXR, as changes to that variable is likely to affect to performance of GDP, EXPORTS and FDI in a significant way. Likewise, news, events and developments that are likely to affect the EXR would be of interest to that investor.

3.6. VARIANCE DECOMPOSITION (VDC)

Whilst we have established that the EXR is the exogenous index, we have not been able to say anything about the relative endogeneity of the remaining indices. In other words, of the remaining indices, which is the most laggard variable compared to others, or, the least laggard? As the VECM is not able to assist us in this regard, we turn our attention to variance decomposition (VDC). Relative endogeneity can be ascertained in the following way. VDC decomposes the variance of forecast error of each variable into proportions attributable to shocks from each variable in the system, including its own. The least endogenous variable is thus the variable whose variation is explained mostly by its own past variations.

We started out applying orthogonalized VDCs and obtained the following results:

Orthogonalized VDCs				
Forecast at Horizon = 25 (quarters)				
Variable	GDP	EXPORTS	EXR	FDI
GDP	**12.65%**	61.63%	25.44%	0.29%
EXPORTS	8.67%	**86.99%**	3.67%	0.67%
EXR	6.39%	0.02%	**93.40%**	0.18%
FDI	2.60%	41.69%	0.51%	**55.21%**

Orthogonalized VDCs				
Forecast at Horizon = 50 (quarters)				
Variable	GDP	EXPORTS	EXR	FDI
GDP	**6.88%**	65.29%	27.60%	0.23%
EXPORTS	8.40%	**87.19%**	3.73%	0.68%
EXR	6.47%	0.02%	**93.33%**	0.19%
FDI	2.67%	42.44%	0.50%	**54.39%**

For the above two tables, rows read as the percentage of the variance of forecast error of each variable into proportions attributable to shocks from other variables (in columns), including its own. The columns read as the percentage in which that variable contributes to other variables in explaining observed changes. The diagonal line of the matrix (highlighted) represents the relative exogeneity. According to these results, the ranking of indices by degree of exogeneity (extent to which variation is explained by its own past variations) is as per the table below:

No	**Variable Relative Exogeneity**	
	At Horizon = 25	**At Horizon = 50**
1	EXR	EXR
2	EXPORTS	EXPORTS
3	FDI	FDI
4	GDP	GDP

We need to recognize two important limitations of orthogonalized VDCs. Firstly it assumes that when a particular variable is shocked, all other variables are "switched off". Secondly and more importantly, orthogonalized VDCs do not produce a unique solution. The generated numbers are dependent upon the ordering of variables in the VAR. Typically, the first variable would report the highest percentage and thus would likely to be specified as the most exogenous variable.

Recognising the limitation of orthogonalized VDCs, we decided to rely instead on Generalized VDCs, which are invariant to the ordering of variables. We obtained results as per Appendix 6E

to 6H. In interpreting the numbers generated by the Generalized VDCs, we need to perform additional computations. This is because the numbers do not add up to 1.0 as in the case of orthogonalized VDCs. For a given variable, at a specified horizon, we total up the numbers of the given row and we then divide the number for that variable (representing magnitude of variance explained by its own past) by the computed total. In this way, the numbers in a row will now add up to 1.0 or 100%.

The tables below show the results.

Generalized VDCs				
Forecast at Horizon = 25 (quarters)				
Variable	GDP	EXPORTS	EXR	FDI
GDP	**12.98%**	58.36%	27.71%	0.96%
EXPORTS	8.09%	**87.05%**	3.89%	0.96%
EXR	5.99%	0.94%	**93.03%**	0.04%
FDI	2.54%	25.24%	1.51%	**70.71%**

Generalized VDCs				
Forecast at Horizon = 50 (quarters)				
Variable	GDP	EXPORTS	EXR	FDI
GDP	**7.23%**	61.18%	30.53%	1.06%
EXPORTS	7.87%	**87.22%**	3.95%	0.95%
EXR	6.06%	0.97%	**92.93%**	0.04%
FDI	2.61%	25.64%	1.52%	**70.23%**

We can now more reliably rank the indices by relative exogeneity, as depicted in the table below.

No	Variable Relative Exogeneity	
	At Horizon = 25	**At Horizon = 50**
1	EXR	EXR
2	EXPORTS	EXPORTS
3	FDI	FDI
4	GDP	GDP

From the above results, we can make the following key observations:

- Both the Orthogonalized and Generalized VDCs confirm the results of the VECM in that EXR is the most exogenous variable.

- The relative rank in exogeneity is somewhat stable as time passes. Between 25 quarters and 50 quarters, there is no change in the ranking.

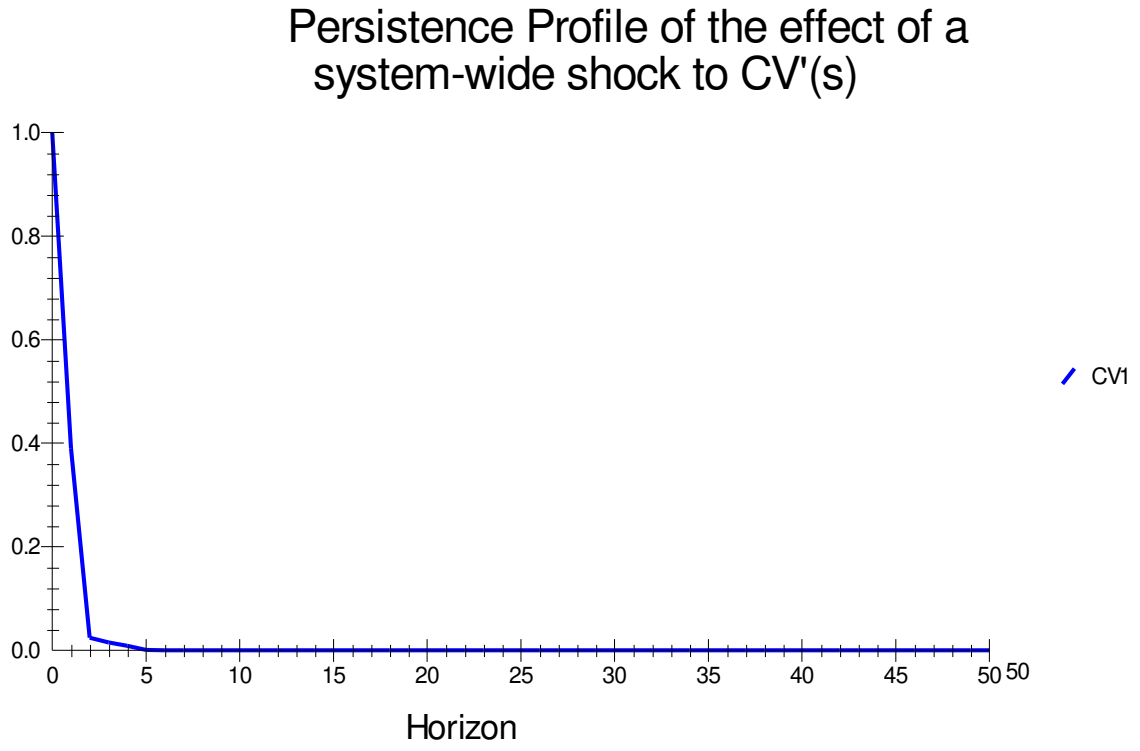
3.7. IMPULSE RESPONSE FUNCTIONS (IRF)

The impulse response functions (IRFs) essentially produce the same information as the VDCs, except that they can be presented in graphical form. For the sake of completeness, we have included the various graphs of IRFs (both orthogonalized and generalized) in Appendix 7A to 7H.

3.8. PERSISTENCE PROFILE

The persistence profile illustrates the situation when the entire cointegrating equation is shocked, and indicates the time it would take for the relationship to get back to equilibrium. Here the effect of a system-wide shock on the long-run relations is the focus (instead of variable-specific shocks

as in the case of IRFs). The chart below shows the persistence profile for the cointegrating equation of this study.



The chart indicates that it would take approximately 5 quarters for the cointegrating relationship to return to equilibrium following a system-wide shock.

4. ANALYSIS OF RESULTS

The above results would have the following plausible implications for policy makers. Among the macroeconomic variables considered, it appears that the EXR is the most exogenous macroeconomic variable. This is followed by EXPORTS, FDI and then GDP.

The results stipulate that EXR is the most exogenous variable in the dynamic interaction among the four macroeconomic variables. This is line with intuition and previous empirical studies. Exchange rate functions as a proxy for price competitiveness in the global markets (Henriques and Sadorsky 1996) and its indirect influence on economic expansion via the export channel (Al-Yousif 1999). According to neoclassical growth theory, world demand for exported goods will determine the export goods production in developing countries. The world demand in this case relies on the price of goods and purchasing power of buyers of the importing country. Consequently, the favourable exchange rate is essential for a small open economy like Malaysia, which relies on price competitiveness. As a result, exchange rate will likely influence economic growth. If the Malaysian ringgit depreciates, the exports will be more competitive, which subsequently will bolster economic growth

Despite EXR being the most exogenous, as far as the GDP is concerned, more of the variation of the latter is explained by EXPORTS. This is in line with international trade and development theory proposing that exports expansion is an important catalyst in improving total factor productivity (TFP). Balassa (1985) suggested that export production is concentrated on efficient sectors of the industry. Therefore, an expansion in export will focus investment in the efficient sectors. As a result, the overall productivity of the economy will increase. Furthermore, Kavoussi (1984) suggested real exports have a positive impact on higher rates of capital that will subsequently improve total productivity of the economy. It is expected that exports expansion will have significant impact on economic growth. This is in line with the findings of Shah and Yusoff (1990); Ghatak and Price (1997); Khalafalla and Webb (2001). They suggest that an increase in real exports performance, will likely improve GDP expansion.

Nevertheless, the results show that FDI is the most endogenous variable and is not a significant variable in the long run. Most of the empirical studies, however, identify a positive relationship between FDI and economic growth. Initially, the results could be counter intuitive, and is contrary to a study done by Zhang (2004). He found that FDI accelerates China's economic growth as FDI provide domestic capital for exports, help technology transfer, facilitate access to new and large foreign markets, provide training for local workforce and upgrade technical and management

skills. However, upon further analysis, the results could be explained by the transformation of Malaysia's economy into a more domestic driven growth. Domestic investment could play a more significant role in GDP growth, as compared with FDI, as illustrated by the results of this empirical study. Another intuitive reasoning is that FDI has been on a declining trend since new emerging markets such as China, India and Indonesia have successfully attracted FDI away from Malaysia in recent years. The importance of this empirical study shows that the declining influence of FDI on GDP growth should shift the policy making towards a more domestic driven growth, underpinned by domestic consumption and private investment demand.

5. CONCLUSION

From the analysis, there is a stable long run relationship among economic growth, real exports, real exchange rate and FDI. The empirical results show that the real exchange rate and real exports are found to have significant impact on real GDP in Malaysia, while the FDI is the weakest endogenous variable in the dynamic interaction. The model suggested that real exchange rate is the most exogenous variable, implying that exchange rate policies should be considered as a significant tool to bolster economic growth. Exchange rate will also have an indirect impact on the economic growth through real exports by making exports more price competitive.

From these findings, policies recommendations should be based on the impact and dynamic relationship among the macroeconomic variables. Malaysian GDP could be stimulated with sound policy prescription in the form of stable exchange rate. A prudential exchange rate policy is paramount to maintain a good and stable economy, as movements in the exchange rate have significant impact on economic expansion.

The government should also implement effective trade policies to encourage exporting activities and incentivise exporting goods production. As the analysis shows that exports will likely have significant impact on economic growth. The government should encourage the domestic manufacturing sector to further expand their export-oriented activities.

As a whole, policy makers should weigh in all considerations before implementing exchange rate, trade and investment policies to encourage economic growth.

6. LIMITATIONS

The empirical tests for export-led growth may be effective in capturing the export–growth interaction at early and intermediate stages of development, but as a nation's economic structure becomes more complex, causality tests on aggregate export and other macroeconomic variables will likely fail to capture these complicated interrelationships. The single country studies covering a long time period of economic growth may be inconclusive or misleading because they fail to account for differing (or changing) economic structures. Future empirical studies of the export-led growth hypothesis need to consider how to incorporate a broadening of the export base and a diversification of the economic structure into the measurement of export-growth relationship.

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