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Future Trends of the Export Demand for Selected Malaysian Cocoa Products

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ABSTRACT

Cocoa products' trade is very important to the Malaysian economy and the global cocoa industry. Therefore, this study aims to identify the main factors that shape the export demand for selected Malaysian cocoa products and to make project the trends of the demand for them. It uses annual data over the period 1980-2012 to investigate the export demand for Malaysian cocoa powder and cocoa butter. Two single equation models are specified, to represent each of the cocoa products. The models have been estimated using multivariate cointegration and Error Correction methods for the analysis, through utilizing the Augmented Autoregressive Distributed Lag technique. The long-run income elasticities obtained by estimating the models have been incorporated into a projection framework to forecast the cocoa products export demand. The findings of the study show that the most sequential factor affecting the Malaysian cocoa products export demand is the world level of income, followed by their own prices. Coconut oil emerged to be the main substitute for the Malaysian cocoa butter which is also highly sensitive to the world population growth. The long horizon forecasting reveal expected upward trends in the export demand of both commodities.

Key words: Cocoa products, export demand, autoregressive distributed lag model, projections, JEL:Q11

INTRODUCTION

The Malaysian cocoa sector plays very important role to the country's economy. It provides job opportunities for 31 thousand persons employed in the industry including estate workers, smallholder, grinders and chocolate manufacturing (including entrepreneurs). The industry contributes to the economy as a foreign exchange earner. In 2012, cocoa beans and cocoa products accounted for 4% of the total value of Malaysia's exports of the major commodities and their products. Moreover, the industry contributes about 0.02% of the country's total GDP.

Previously, Malaysia sustained an upward trend in cocoa-planted area, to hit its highest level of over 414 thousand ha in 1989. Consequently, the production of cocoa increased to achieve its maximum level of over 247 thousand tonnes in1990. That spectacular expansion was motivated by a successful marketing organization and rather low production costs of cocoa beans and consequently, its production in Malaysia was, then, a lucrative venture. This trend, however, have changed due to many factors that led to an increase in the relative competitiveness of competing crops (mainly, palm oil). These factors include waning world cocoa beans prices, increasing labour costs and loss of production due to pests and diseases. In 2012, only about 21.7 thousand ha were under cocoa with a total production of about 3.6 thousand tonnes. The Malaysian cocoa grindings and downstream industry has however, expanded dramatically in line with the objectives of the Industrial Master Plans 2 and 3 (NAP2 and NAP3) which encourage value added activities of local production and shifting the focus from upstream activities downstream ones. Currently, Malaysia, with a total grindings of 299,000 tonnes, is occupying the fifth position among the largest cocoa grinders in the world and the largest in the South East Asia (Fig. 1). To meet the rising demand by the grinding industry that cannot be fulfilled by the local production of cocoa beans, Malaysia increased its imports of this commodity.

The export patterns of cocoa bean and cocoa products over the period 1980-2012 are displayed in Fig. 2. During the period 1980-1988 the export volume of the Malaysian cocoa beans increased at a compound annual rate of 21% to reach a peak of 189 thousand tonnes, up from about 31 thousand tonnes at the beginning of the period. Meanwhile, the exports of cocoa products were

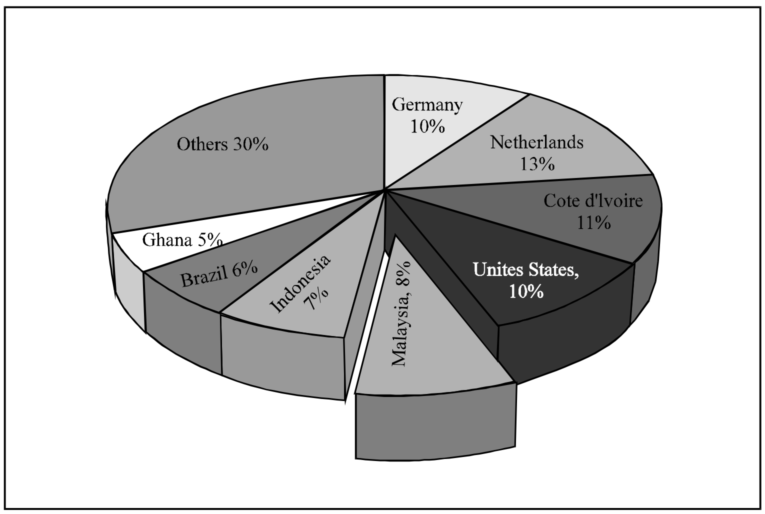

Fig. 1: World cocoa bean grinding shares (2010/11), Source: ICCO (2013)

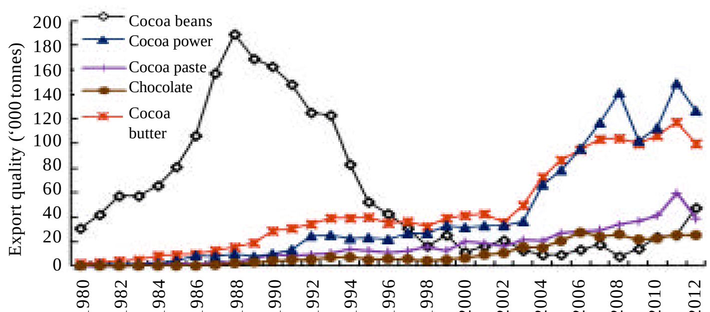

Fig. 2: Export quantities of cocoa bean and cocoa products of Malaysia (1980-2012) (Thousand Tonnes), Source: Malaysian Cocoa Board (2010, 2013)

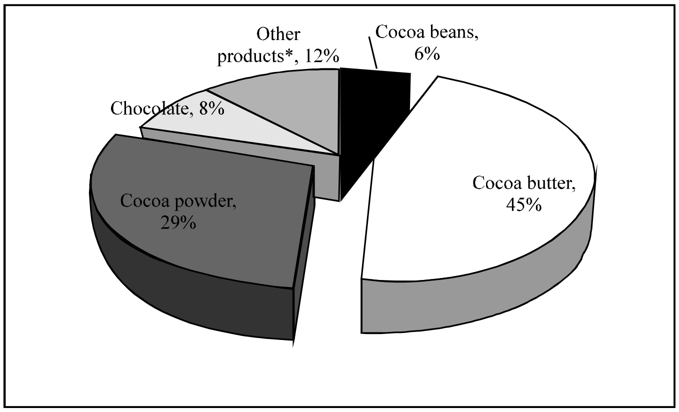

Fig. 3: Average percentage export earnings of cocoa bean and cocoa products of Malaysia, 2008-2012, *other products include cocoa paste, wholly, partly or not defatted, cocoa shell, husks, raw or roasted, source: Malaysian Cocoa Board (2013)

increasing at a very low rate. However, the exports of cocoa beans started a steep declining trend since 1989 while the exports of the cocoa products continued increasing. In 2012, Malaysia exported about 48 thousand tonnes of cocoa beans, around 39 thousand tonnes cocoa paste, 100 thousand tonnes of cocoa butter, 127 thousand tonnes of cocoa powder and 26 thousand tonnes of chocolate (Fig. 3).

Malaysian cocoa butter has unique characteristic of the high melting point. This character is favourable for chocolate products in warm countries. Therefore, Malaysian cocoa butter gets best price in the world market for this product. Consequently, despite not being highest contributor to the total export volume of cocoa products, it was the highest contributor to the export earnings of this category. During the period from the mid 1990s until 2010, it accounted for an average of 55% of them. However, its share decreased to 32 and 26% in 2011 and 2012, respectively. However, the share of cocoa powder export value increased to 37 and 40% of the total cocoa products exports by the country in 2011and 2012, respectively. This drop in the cocoa butter export value was mainly due the decrease in the cocoa butter price following the fall in its world price due to the debt crisis in the euro zone. In addition, the slowdown in the United States economy influenced consumer expenditure, consequently reducing the buying interest of semi-finished products. Particularly, market reports point towards a decrease in the price ratio of cocoa butter resulting from the large stocks of cocoa butter in Europe and the United States (ICCO, 2011a). Meanwhile, the cocoa powder prices were not significantly affected because the demand for cocoa powder remained strong, due to the growth in the utilization of its products in developing South American and Asian countries (ICCO, 2011b). Figure 3 shows a five years average percentage shares of cocoa products.

Malaysian cocoa industry is of growing importance to the world-market of cocoa products. In 1980, the industry's share in the world exports of each of cocoa butter and cocoa powder was 0.5%. These shares increased to 8 and 5%, respectively, in 1990 and in 2010 they increased more, to about 15% of the world exports of cocoa butter and about 13% of cocoa powder. Moreover, from a negligible share in1980, its share in the global exports of cocoa paste increased to 1% in 1990 and to 4% in 2010. However, it decreased its share in the global exports of cocoa beans from about

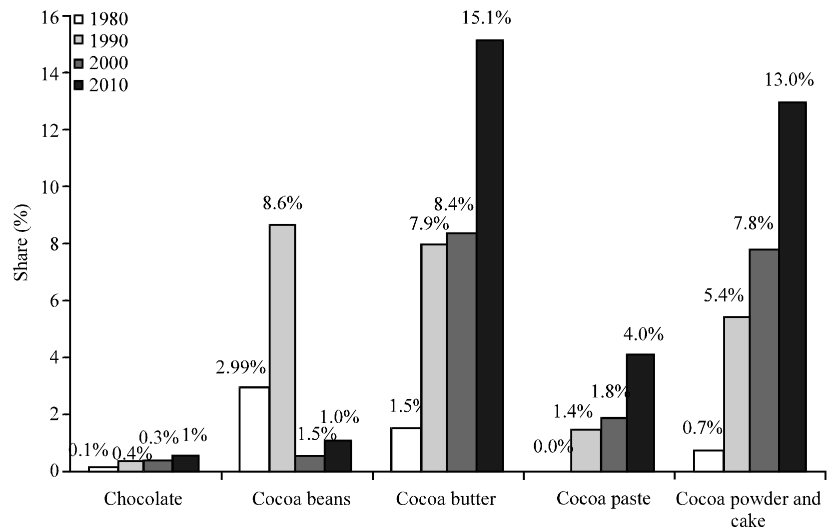

Fig. 4: Percentage shares of Malaysia in the world exports of cocoa products in 1980,1990, 2000 and 2010, Source: FAOSTAT (2013)

8.6% in 1990 to about 1% in 2010 mainly due to the significant reduction in the production of this crop and benefit from the value added resulting from manufacturing its downstream products (Fig. 4).

Cocoa products have high economic importance to the Malaysian economy and the global cocoa industry. Therefore, policy makers and other market participants are required to find tools that will provide timely and intelligible answers for questions concerning the major factors affecting the export demand for those products. That can be useful for them in formulating long-term targets and strategies for modifying their supply plans to sustain their competitiveness in the world market.

Thus, the objective of this study is to examine the export demand for two major Malaysian cocoa products, namely, cocoa powder and cocoa butter and attempts to draw some projections for the future demand.

This study contributes to the economics literature in two ways. First, it adds the first systematic quantitative analysis of the factors shaping the demand for the Malaysian cocoa products as all the previous studies (Alias *et al*., 2001; Rosdi, 1991; Shamsudin *et al*., 1993; Yusoff *et al*., 1998; Abdel Hameed *et al*., 2009, 2010) focused on the demand for cocoa beans. Second, this study uses the Bounds Test procedure (BT), a recent estimation econometric method that has not been applied in the existing studies on cocoa economics.

MATERIALS AND METHODS

Model specification: Prior to building the model answering the questions raised by this study, there are some key points that must be considered. First, as the cocoa is not a close substitute for domestically traded goods in the importing countries, the study will be conducted under the criterion of the imperfect substitute's model. Second, since the exports of individual countries (including Malaysia) compose a small share of cocoa products trade each of them can be treated as a small country. Under the small country assumption, the supply prices of different cocoa products faced by Malaysia are assumed to be exogenous. As price takers the importing countries face highly elastic supply function for those products. Thus, a single equation model can be appropriate in this case. The determinants of cocoa export demand product (Q) were modelled with a common set of explanatory variables. The main explanatory variables suggested by economic theory. Specifically, they are income (I), cocoa product price (P) and the price of a substitute (P_{st}):

$$Q_t = f(P_{pt}, P_{st}, I_t) \text{ or } Q_t = \alpha_0+\alpha_1 P_{pt}+\alpha_2 P_{st}+\alpha_3 I_t+u_t \quad (1)$$

where, α_0 is the intercept, α_1, α_2 and are the coefficients of own and cross prices variables, α_3 is the coefficient of income variable, Q_t is the quantity of cocoa product demanded at time t. P_t is the price of cocoa product at time t, P_{st} is the prices of some relevant substitutes at time t, I_t is the income level at importing country at time t (world GDP), u_t is the disturbance term.

Cocoa butter substitutes (coconut and palm kernel oils) are mainly used in combination with low-fat cocoa powder (8-10% fat content). The main application of cocoa butter substitutes is in products where chocolate taste does not play an essential part like coatings for cookies, ice cream and candy bars. These substitutes are most likely to be used in developing country markets than in quality-sensitive, OECD-markets, as they reduce the cost of these products (Kox, 2000). It is worth mentioning that the price of palm kernel oil was included in the initial running of the model but it was removed from the model for being, statistically, insignificant. Many other factors are suitable for insertion in demand equation for food. Changing tastes, living patterns, concern about health, habit formation, population etc may be important, either individually or collectively. Several different specifications of the general model were tried and the results from each model were tested for statistical significance of the estimated coefficients as well as for consistency with the cointegration methods. Consistency with economic theory is another important criterion for selecting the models. After discarding the model specifications that do not meet all these preconditions, the following model specifications have been selected as the final models for the two cocoa products (the time subscripts in both Eq. 2 and 3 are suppressed for notational convenience):

$$\ln Q_B = \beta_0 + \beta_1 \ln BP + \beta_2 \ln CP + \beta_3 \ln GDP + \beta_4 \ln POPW + \varepsilon_{1t} \quad (2)$$

$$\ln Qp = \gamma_0 - \gamma_1 \ln PP + \gamma_2 \ln GDP + \varepsilon_{2t} \quad (3)$$

where, Q_B is the export quantity of cocoa butter in tonnes. BP is the cocoa butter price in USD/tonne. CP = Coconut oil price in USD/tonne. PP = Cocoa powder price in USD/tonne. GDP = World gross domestic product at current prices USD billions as proxy of income. QP = Export quantity of cocoa powder in tonnes. POPW= World population.

β_0 and γ_0 are intercepts and ε_1 and ε_2 are disturbance terms. The cocoa powder model is similar to that specified by Kox (2000).

Expected signs:

$$\beta_1 < 0, \beta_2 > 0, \beta_3 > 0, \beta_4 > 0, \gamma_1 < 0, \gamma_2 > 0$$

Model estimation method: Cointegration approaches are adopted to model these relationships to avoid the problem of spurious regression. First, it is necessary to determine which of the explanatory variables in the general model should be included in the final cointegrating regressions. Second, given the existence of a cointegrating or long-run equilibrium relationship, it is always possible to build an error correction model (ECM) (Engle and Granger, 1987) to specify the nature of the short-run disequilibrium relationship between the variables. The literature on co integration estimation is very extensive and a number of estimation methods have been recommended, including the Engle and Granger (1987) procedure, Johansen (1996) full information maximum likelihood procedure, Phillips and Hansen (1990) fully modified OLS procedure. Pesaran *et al.* (2001) proposed a procedure known as the bounds testing (BT), for investigating the long-run equilibrium relationship among time-series variables for running Autoregressive Distributed Lag (ARDL) approach to cointegration. Recent studies have indicated that the (ARDL) is preferable to other conventional cointegration approaches[1]. One of the reasons for preferring the ARDL is that it is applicable irrespective of whether the underlying regressors are purely I(1), purely I(0)or mutually cointegrated. Thus, the pre-testing problems associated with standard cointegration analysis which requires the classification of the variables into I(0) and I(1) has been avoided. Another reason for using the ARDL approach is that it is more robust and performs better for small sample sizes (such as in this study) than other cointegration techniques. Romilly *et al.* (2001) claimed the superiority of the forecasting performance of the ARDL model over other co integration methods. They used this finding to support the view that choosing the ARDL lag order by model selection criteria, rather than by testing down from a general to a specific model, may grant a better model specification. Thus, the ARDL approach proposed by Pesaran and Shin (1995) was used. Their procedure involves two stages. In the first stage, the existence of the long-run relation between the variables under investigation is tested using the bounds test proposed by Pesaran *et al.* (2001). If a stable long-run relationship is verified, then in the second stage, a further two-step procedure to estimate the model is carried out. In the first step of the second stage, the lag order of the ARDL model is selected by Akaike or Schwartz information criteria. In the second step, the parameters of the long-run relationship and the associated short-run dynamic Error Correction Model (ECM) areestimated. To illustrate the (BT), let us consider the error correction version of the ARDL model pertaining to the variables in Eq. 1 as follows:

$$\Delta Q_{it} = \delta_0 + \pi_{QQ} Q_{t-1} + \pi_{Q,x} x_{t-1} + \sum_{i=1}^{p-1} \varphi_i' \Delta z_{t-1} + \omega' \Delta x_t + u_t \quad (4)$$

where, x represents the regressors ($\ln Pp_t$, $\ln Ps_t$... etc), z represent all the variables used in the specified model. The symbols π_{QQ} and π_{Qx} are the long-run multipliers, φ_i and ω are the short-run dynamic coefficients, ρ is the order of the underlying model and the error term u_t is uncorrelated with Δx_t and the lagged values of x_t and Q_t. The BT approach tests for the absence of any level relationship between y_t and x_t through the exclusion of the lagged level variables, y_{t-1} and X_{t-1} in Eq. 4. In other words, the absence of a level relationship between Q_t and x_t is a test of the joint null hypothesis $\pi_{QQ} = 0$ and $\pi_{Qx} = 0$ in the equation. This hypothesis can be examined by the standard Wald or F-statistics. Nevertheless, the asymptotic distributions of these statistics are non-standard under the null hypothesis. Pesaran *et al.* (2001) provide two sets of asymptotic critical values to the two extreme cases: All regressors are purely I(0) or purely I(1). These two sets of critical values provide a band that covers all possible classifications of the variables into I(0), I(1) or fractionally integrated. If the computed F-statistic falls outside the critical bounds, a conclusive inference can be drawn irrespective of the order of the integration of the variables. If, however, the computed

F-statistic falls within these bounds, inference depends on whether the underlined variables are I(0), I(1) or fractionally integrated. Narayan (2005) argued that these critical values are inappropriate in small samples which are the usual case with annual macroeconomic variables. Therefore, he provides a set of critical values for samples ranging from 30 to 80 observations for the usual levels of significance. If the test statistic exceeds the respective upper critical value obtained from Narayan (2005) tables, it may be argued that there is evidence of a long-run equilibrium relationship. If the test statistic falls below the lower critical value, the null hypothesis of no cointegration cannot be rejected. Finally, if the test statistic lies between the two bounds, then the test becomes inconclusive. Thus, the rejection of the null hypothesis will allow us to draw a conclusion that there exists a long-run level relationship between Q and x. To ensure the robustness of the estimated models, Lagrange multiplier test of residual serial correlation, Ramsey's RESET test for functional form misspecification and White's test for heteroskedasticity were used. Additionally, test of skewness and kurtosis of residuals has been utilized to check for Normality. Moreover, Pesaran and Pesaran (1997) argued that it is extremely important to confirm the constancy of the long-run multipliers by testing the above error-correction models for the stability of its parameters. Tomek (1994) emphasized the importance of stability of parameters, particularly, for economic forecasting in agriculture. To ensure the stability of the long-run parameters of the econometric specification, the cumulative sum (CUSUM) and the cumulative sum of squares (CUSUMQ) tests introduced by Brown *et al*. (1975) were applied.

Forecasting method: The rising importance of forecasting in a wide range of planning or decision-making situations and the need for better forecasts gave rise to many forecasting methods. Forecasting situations vary widely in their time horizons, factors determining actual outcomes, types of data patterns and many other features. Long term forecasts are required mostly for capital escalating plans, choosing R and D projects, introducing new products and formulating long-term targets and strategies (Makridakis *et al*., 1998). Scenario analysis presents, purposely, several alternative future developments, rather than trying to show one exact depiction of the future. Therefore, a range of possible future outcomes is perceptible.

In order to project export demand for the Malaysian cocoa butter and cocoa powder during the next ten years, The FAO analysts projection methodology, illustrated in Ferris (1998) and utilised in the works of Web and Shamsudin (2000) and Mohayidin and Samdin (2001); has been employed in this study as follows:

$$Q_{fit} = Q_{ib*}((1+POPGi+(IG_i*IEL_i))^{NOYRS}) \quad (5)$$

where, Q_{fit} is the projected export demand of product i in time t. Q_{bit} is the import demand in product i in base year (2011). POPG is the world population growth. IG_i is the world income growth. IEL_i is the income elasticity for product i. NOYRS is the number of years between projection year and basic year.

The estimated income elasticities obtained by estimating the different long-run models has been incorporated into the above displayed projection framework based on income and population growth assumptions to the base year (2012). It is worth mentioning that this study departs from most of the previous studies in estimating the elasticities used in the projection as it consider the time series properties of the variables. Projections have been based on the following scenarios: Low growth, moderate growth and high growth rates of income. The projections are calculated as follows: First, the assumed moderate income growth rate for the importers equals the real income growth rate for them during the last five years of the study period (2008-2012). Second, the standard deviation of the annual income growth rate during the same period have been subtracted from and added to the importers moderate income growth rates to obtain the assumed low and high income growth rates respectively for them. The population growth rates are somewhat constant over a five to ten years period (Web and Shamsudin, 2000), thus the population growth rates in the base year, has been utilised. Since all the estimated models do not embody time trend variable, the time trend has not been included the export demand projections.

Data sources and description: The data used for analysis are based on annual observations. The quarterly or monthly data are unavailable for the products under study. However, the use of annual data is defensible by the following works: Hakkio and Rush (1991) argued that increasing the number of observations by using monthly or quarterly data do not add any robustness to the results in tests of cointegration; the time span is essential. This argument was used by Sinha (1997) for estimating Thailand's export demand function using annual data for 1953 to1990. Moreover, Davidson and MacKinnon (1993) stressed that the use of annual data can avoid the bias of using seasonally adjusted quarterly or monthly data in analysis. In addition, Mohammad and Tang (2000) declared that the measurement errors might be more critical when constructed data are used. For the appropriate specification the theory does not provide any specific suggestion on the best functional form and the most pertinent measures of variables involved in the analysis. An appropriate model was defined as one which generate unbiased (or at least consistent) and efficient elasticity estimates (Thursby and Thursby, 1984). In the current study the linear form has been rejected against the log-linear form. Therefore, all variables are converted into the natural logarithmic form. The time spans of data for the two models extend over the period 1978-2012. Data on cocoa products and their prices were obtained from the Malaysian Cocoa Board (2010, 2013). Coconut oil prices were available from Oil World (Malaysian Palm Oil Board, 2013). Annual data on GDP were available from the IMF (2013).

RESULTS AND DISCUSSION

Pre-estimation tests results

Unit root tests results: The augmented Dickey-Fuller (ADF) test was used to determine the order of integration of the time series in the models. The findings of the conducted tests displayed in Table 1 reveal that each of the specified models includes a mixture of I(0) and I(1) variables. With such a combination of I(1) and I(0) variables it was found that the appropriate procedure to analyse the long-run and the short-run behaviour of the export demand of the products under study was the BT.

Bounds test results: The choice of correct lag structure of the model specification before performing the test for the existence of cointegrations is a crucial issue for this test. Therefore, both SBC and AIC criteria for lag selection are used in this study to choose an appropriate lag order (the results of these tests are available from the authors). Thus, according to these criteria both models were estimated with a lag of one.

Table 2 summarises the results of the bounds test across the two models. In both cases the obtained F-statistics exceed the upper bounds suggested by Pesaran *et al.* (2001) and Narayan (2005). The conclusion drawn from these results is that the presence of a cointegrating relationship

Table 1: Results of the augmented dickey-fuller unit root tests for the variable in level and first difference

	Augmented dickey-fuller test statistic	
Variable	Level	1st difference
lnQB	-2.496628(6)	-4.042245***(6)
lnBP	-2.347755 (6)	-4.730064***(6)
lnCP	-3.98453***(6)	-5.660765***(6)
lnGDP	-3.028672(1)	-2.565238* (1)
lnQP	-1.646130(6)	-5.832249***6)
lnPP	-2.520581(6)	-3.981866***(6)

Null Hypothesis: LCBP has a unit root; Figures in parentheses show the lag length, Asterisks *, **, *** denote 10, 5 and 1% significance level, respectively, The critical values for the case with No Trend are -3.626784, -2.945842 and -2.611531for 1, 5 and 10% significance levels, respectively, Variable definitions are given in the methodology section

Table 2: F-statistics for testing the existence of long-run relationships between the variables in the cocoa butter and cocoa powder export demand models (bounds test)

Product	Variables	ρ	F- statistics
Cocoa butter	LnQB/lnBP, lnCP, lnGDP, lnPOPW, Intercept	1	13.2846***
Cocoa powder	lnQP/ lnPP, lnGDP, Intercept	1	12.0951***

Asterisks *** denote 1% significance level, ρ denotes the lag order, Referring to Table CI (iii): Unrestricted intercept and no trend (Pesaran *et al.*, 2001), with 5 regressors the lower and upper bounds test are 3.41 and 4.68 respectively, at 1% significance level. The lower and upper limits of the bounds test, with 3 regressors are 4.29 and 5.61, respectively, at 1% significance level. Referring to Narayan (2005), critical values for the bounds test, case III, unrestricted intercept and no trend with 35 observations are used. With 5 regressors, the lower and upper limits of the bounds test are 4.257 and 6.040 respectively, at 1% significance level. The lower and upper limits of the bounds test, in the same table with 3 regressors and 35 observations, are 5.198 and 6.845 respectively, at 1% significance

among the variables included in the two models was established. This finding permits the application of the ARDL technique for the estimation of the parameters in the long-run relationship and the associated short-run dynamic error correction models.

MODELS ESTIMATION RESULTS

Robustness of the empirical model: Having found a long-run relationship, the specified model for each country is estimated using the SBC and AIC criteria for model selection. The Schwarz Bayesian Criterion selected ARDL (1, 0, 0, 0, 0) and (1, 0, 0) for cocoa butter and cocoa powder respectively. The results of the diagnostic of the selected ARDL models are shown in Table 3. The high value of adjusted R^2 (98%) suggests that both models have high explanatory power. These results of model specification tests suggest that the estimated models are free from specification problems.

Moreover, the Fig. 5-8 display the results of CUSUM and CUSUMQ tests for the estimated models. The plots of CUSUM and CUSUMQ of the estimated cocoa butter export demand model are illustrated in Fig. 5 and 6, respectively. Likewise, Fig. 7 and 8 illustrate the Cumulative Sum and Cumulative Sum of Squares of Recursive Residuals, respectively, of the respective model for cocoa powder. In all the graphs, the straight lines stand for the critical upper and lower bounds at the 5% level of significance. The visual inspection of graphs reveals that there is no evidence of parameters instability in both models, since the CUSUM and CUSUMQ related to them move within the critical bounds.

Almost all the estimated coefficients are statistically significant and their signs are consistent with theory. Those findings suggest that the export demand functions used in this study are properly specified and verified their stability throughout the sample period and, accordingly; estimations of the long and short-run dynamics based on those models are also reliable.

Table 3: Results of model specification diagnostic tests for the estimated cocoa butter and cocoa powder export demand models

Product	Cocoa butter		Cocoa powder	
$\bar{R}_2$	98%		98%	
Diagnostic tests	LM version	F version	LM version	F version
Serial correlation[A]	3.0805[0.099]	2.5904[0.120]	0.47115[0.492]	0.35496[0.557]
Functional form[B]	1.0628[0.303]	0.83895[0.368]	1.0362[0.309]	0.99917[0.327]
Normality[C]	0.31250[0.855]	Not applicable	0.15488[0.925]	Not applicable
Heteroscedasticity[D]	0.037832[0.846]	0.035647[0.851]	2.2566[0.133]	1.7532[0.200]

LM denotes Lagrange Multiplier version which has a χ^2 distribution, A: Lagrange multiplier test of residual serial correlation. B: Ramsey's RESET test using the square of the fitted values to verify the functional form. C: Based on a test of skewness and kurtosis of residuals. D: Based on the regression of squared residuals on squared fitted values. Figures in square brackets are the p-values

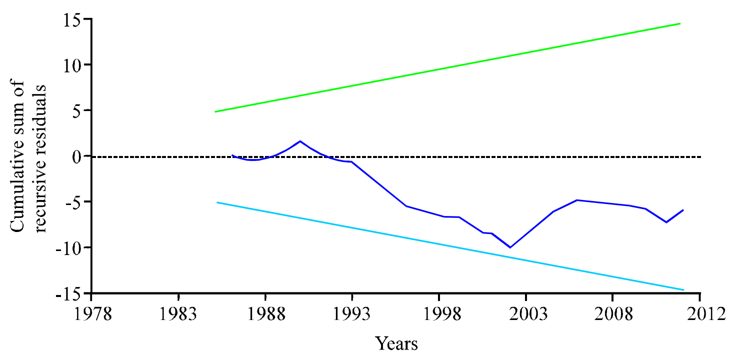

Fig. 5: Plot of cumulative sum of of recursive residuals of the estimated cocoa butter export, the straight lines represent the critical bounds at 5% significance level

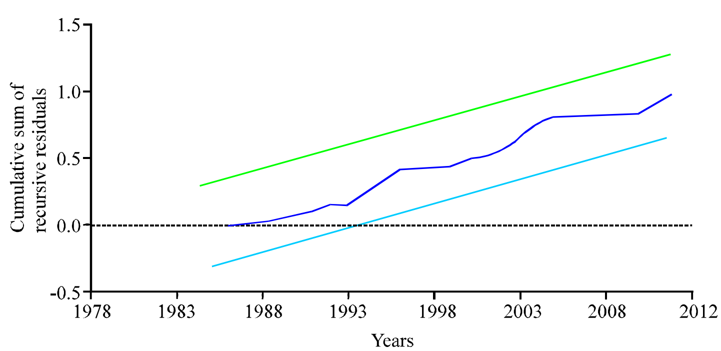

Fig. 6: Plot of cumulative sum of squares of recursive residuals of the estimated cocoa butter export demand model, the straight lines represent the critical bounds at 5% significance level

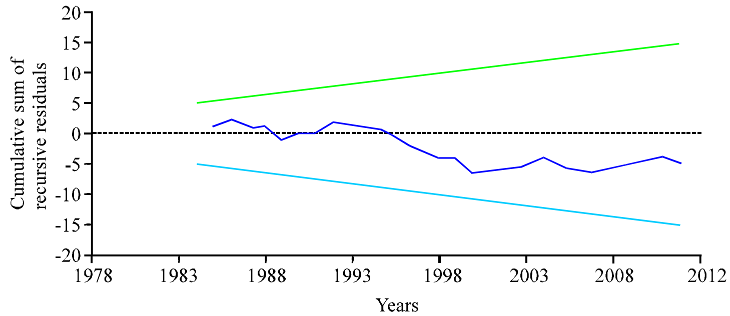

Fig. 7: Plot of cumulative sum of recursive residuals of the estimated cocoa powder export demand model, the straight lines represent the critical bounds at 5% significance level

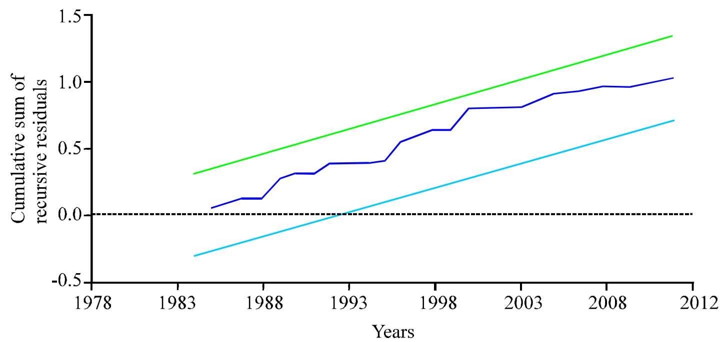

Fig. 8: Plot of cumulative sum of squares of recursive residuals of the estimated cocoa powder export demand model, the straight lines represent the critical bounds at 5% significance level

Estimating the long-run parameters: The estimated static long-run models corresponding to the export demand functions for the Malaysian cocoa products are displayed in Table 4. The estimated coefficients of the world income level carry the expected positive sign, they are statistically highly significant and their magnitudes are 1.074 and 2.55 for cocoa butter and cocoa powder. These figures compare favourably with the results obtained by Shamsudin *et al.* (1993) who found income elasticity of 1.7640 for cocoa beans. This result concurs with Kox (2000) proposition that cocoa powder isgenerally applied for luxury food commodities. Therefore, its demand is expected to react positively to an increase in income. Furthermore, it should go up faster at higher incomes as the consumer can afford to purchase more products in which cocoa powder is used.

The export demand for cocoa products is also significantly related to their own prices. The price of coconut oil, as a cocoa butter substitute, turned to be an important factor in shaping the export demand for the Malaysian cocoa butter. The cross price elasticity of the Malaysian cocoa butter export demand to coconut oil emerged to be very low, probably, because the majority of the Malaysian cocoa butter importers are from the quality-sensitive OECD-markets. Furthermore, the results show that the world population growth is an important factor boosting the export demand both in the long as well as in the short terms and it is very sensitive to this variable.

Table 4: Estimated long-run coefficients using the ARDL approach (dependent variable is LNQ)

Regressors	Cocoa butter coefficient (T-ratio)	Cocoa powder coefficient (T-ratio)
lnBP	-0.51669**	-
	(-2.6090)	-
lnCP	0.31661**	-
	(2.1627)	-
lnPP	-	-0.61055**
	-	(-2.6231)
lnGDP	1.0743**	2.5520***
	(5.9487)	(12.3070)
InPOPW	8.1926**	(2.6850)
C	-18.2339***	-11.7110***
	(-6.1931)	(-4.5561)

Figures in parentheses below the coefficient values are the T-ratio values. Asterisks *, **, *** denote 10, 5 and 1% significance level, respectively, C denotes "Intercept"

Short-run dynamics and the adjustment towards the long-run equilibrium: The results of the error correction representations for the selected ARDL models corresponding to cocoa products export demand functions are displayed in Table 5. The error correction terms were found to be statistically highly significant and they carry negative signs, giving additional evidence as to the existence of long term causal relationships between the variables of both equations. Furthermore, the relatively low magnitude of the lagged error correction term coefficient in the case of cocoa powder (-0.34916) implies a relatively low speed (about 35%) of adjustment of the demand to the variations in its determinants. Meanwhile, high magnitude of the lagged error correction term coefficients in the case of cocoa butter of approximately (-0.67754) with the expected negative sign indicates that deviations from equilibrium are restored at a fairly high annual rate of about 68%. The finding that the export demand function of cocoa butter adjusts at a higher speed than cocoa powder demand implies that the market of the former is more efficient than that of the latter.

Long and short-run elasticities: Table 6 summarises the estimated long-run and short-run export demand elasticities for the two products. All the long-run elasticities are greater in absolute value than their short-run counterparts, which is consistent with economic theory. The elasticities are interpreted as normally done in the previous studies. For instance, a 1% increase in the cocoa butter prices, other things equal, leads to a 0.52% decrease in the export demand of cocoa butter from Malaysia in the long run.

Overall, the results yield low price elasticities. Previous studies on the demand for cocoa beans have shown that the price elasticities, both in the short and long run were generally low and inelastic. Comparable results of the studies were obtained for cocoa bean by Bateman (1965), Behrman (1968), Melo (1972), Hwa (1979), Claessens (1984), Shamsudin *et al.* (1993) and Yusoff *et al.* (1998). However, the demand for both products is highly income elastic in the long run while the short run estimations of the elasticities fall in the inelastic range.

Forecasting the selected malaysian cocoa products export demand

Model validation tests: A simulation exercise was done to evaluate the predictive power of the specified models based on the results of the Theil's inequality coefficients (U) criteria. The

Table 5: Estimated coefficients of error correction representations for the selected ARDL models (dependent variable = dLNQ)

Regressors	Cocoa butter coefficient (T-ratio)	Cocoa powder coefficient (T-ratio)
dlnBP	-.35008**	-
	(-2.3222)	-
dlnCP	0.11259	-
	(1.0307)	-
dlnPP	-	-.21318*
	-	(-1.9102)
dlnGDP	0.72787*	0.89105**
	(1.8215)	(2.1558)
dlnPOPW	7.3002**	-
	(2.5172)	-
dC	-48.2635**	-4.0889*
	(-2.6495)	(-1.7688)
ect(-1)	-0.67754***	-0.34916**
	(-6.8767)	(-2.3371)

Product notations in the variable symbols are suppressed for writing convenience (i.e., Q, is exports quantity for the cocoa product of interest), Figures in parentheses below the coefficient values are the T-ratio values, Asterisks *, **, *** denote 10, 5 and 1% significance level, respectively, d: Denotes the first difference of the variables; ect(-1) is the lagged error correction term

Table 6: Short and long-run cocoa products export demand elasticities

	Long-run elasticities			Short-run elasticities		
Product	Own price	Cross price	Income	Own price	Cross price	Income
Cocoa butter	-0.51669	0.31661	1.0743	-0.35008	0.11259	0.72787
Cocoa powder	-0.61055	-	2.5520	-0.21318	-	0.89105

results of the historical simulations of different models (Table 7) reveal that the values of U are less than one, suggesting the superiority of the models over the naive no-change models. The values of U^m are all very close to zero, indicating the non-existence of a systematic bias. Thus, revision of the models is not necessary. The values of U_s are also very small, which indicate that the models are able to replicate the degree of variability in the variables of interest. All the values of U_C are large (close to one), suggesting the non-existence of unsystematic error in the models. The results of the stability tests discussed earlier, give further support of the adequacy of the estimated models for forecasting purposes.

Malaysian cocoa products export demand projections: Table 8 displays the projected Malaysian cocoa products export demand, under three economic growth scenarios namely; high, moderate and low income growth scenarios. The assumed high, medium and low income growth rates for the importing countries are 5, 3 and -1% per annum, respectively.

All the forecasts are sensitive to changes in the assumed income growth rates. The 'low growth' scenario that assumes an annual decrease in the world GDP, is projected to bring about 12 and 13% increments in the export demand of the cocoa butter and powder, respectively in 2022, compared with their levels in 2012. The Medium growth scenarios show that under this assumed level of income growth rate the volume of cocoa butter exports is expected to increase by 18%.

Table 7: Historical simulation results of selected malaysian cocoa products export demand

Product	U	U^M	U^S	U^C
Cocoa butter	0.013721	0.00000	0.00284	0.99716
Cocoa powder	0.012634	0.00000	0.01375	0.98625

U = Theil's inequality coefficient, U_M = Fraction of error due to bias, U_S = Fraction of error due to different variations, U_C = Fraction of error due to different covariations

Table 8: Malaysian cocoa products export demand during 2011-2021 (thousand tonnes)

Product	Income growth rate	Actual 2012	Projections 2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Cocoa butter	H		107	113	121	128	136	145	154	164	175	186
	M	100	102	104	105	107	109	110	112	114	116	118
	L		101	103	104	105	106	107	108	110	111	112
Cocoa powder	H		144	164	187	212	242	275	313	356	405	460
	M	127	130	134	138	142	146	150	154	158	163	167
	L		128	130	132	133	135	137	138	140	142	144

H, M and L denote high, moderate and low income growth scenarios, respectively

Under the same scenario, the exports of cocoa powder are expected to increase by about 32%, as compared with the base year. The high income growth rate scenario presumes that the exports of cocoa powder will almost triple in 2021 while those of the cocoa butter are expected to almost double.

CONCLUSION

The results of this study provide the following findings or conclusions. First, the cocoa product price variable in the two models was found to be significant. However, the export demand for both cocoa products turned to be slightly sensitive to this variable. Secondly, the price of coconut oil that turned to be an important substitute for the Malaysian cocoa butter but its long-run and short-run elasticity fall in the inelastic range. Thirdly, the most important factor shaping the export demand for both cocoa products is the world income level. Finally, the projections suggest that the export demand of the Malaysian cocoa products is expected to sustain its upward trend. From a policy point of view, these findings emphasize the need for reorientation of cocoa production policies to increase the excess supply of these products in a way that would make it possible to capture the ever- increasing market share of them. Moreover, the importance of the price levels of these products and the cocoa butter substitutes imply the importance of the price factor in shaping the export demand even though the response to changes in the price variables is slight. Monitoring the changes in the income levels of the importing countries is very crucial for formulating a successful marketing policy, as the demand is very sensitive to this factor.

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REFERENCES

Abdel Hameed, A.A., A. Hasanov, N. Idris, A.M. Abdullah, F.M. Arshad and M.N. Shamsudin, 2009. Supply and demand model for the Malaysian cocoa market. Proceedings of the Workshop on Agricultural Sector Modelling in Malaysia: Quantitative Models for Policy Analysis, October 26-28, 2009, Johor Bahru, Malaysia.

Abdel Hameed, A.A., S.D. Applanaidu, F.M. Arshad and M.N. Shamsudin, 2010. An Econometric Model of the Malaysian Cocoa Market, Proceedings of the International Conference on Business and Economic Research. Global Research Agency, Malaysia, ISBN-13: 9789675705007.

Alias, M.H., A.M. Ali and M. Abdul Rahman, 2001. The impact of government policy on the supply response of Malaysian palm oil, rubber and cocoa producers. Utara Manage. Rev., 21: 41-64.

Bateman, M.J., 1965. Aggregate and regional supply functions for Ghanaian cocoa, 1946-1962. Am. J. Agric. Econ., 47: 384-401.

Behrman, J.R., 1968. Monopolistic cocoa pricing. Am. J. Agric. Econ., 50: 702-719.

Brown, R.L., J. Durbin and J.M. Evans, 1975. Techniques for testing the constancy of regression relationships over time. J. Royal Stat. Soc. Ser. B Methodol., 37: 149-192.

Claessens, S.A., 1984. A prototype model of the world cocoa market. ELSA Technical Report 1, Institute of Developing Economics, University of Pensylvania, pp: 215-230.

Davidson, R. and J.G. MacKinnon, 1993. Estimation and Inference in Econometrics. 1st Edn., Oxford University Press, New York.

Engle, R.F. and C.W.J. Granger, 1987. Co-Integration and error correction: Representation estimation and testing. Econometrica, 55: 251-276.

FAOSTAT, 2013. Online database of the Food and Agriculture Organization of the United Nations. Food and Agriculture Organization, Rome, Italy.

Ferris, J.N., 1998. Agricultural Prices and Commodity Market Aanalysis. WCB McGraw-Hill, Boston.

Hakkio, C.S. and M. Rush, 1991. Cointegration: How short is the long run? J. Int. Money Finance, 10: 571-581.

Hwa, E.C., 1979. Price determination in several international primary commodity markets: A structural analysis. Staff Papers Int. Monetary Fund, 26: 157-188.

ICCO, 2011a. Cocoa market review. International Cocoa Organization, October 2011. http://www.icco.org/about-us/international-cocoa-agreements/cat_view/41-monthly-review-of-the-market-2011.html.

ICCO, 2011b. Monthly review of the cocoa market situation. International Cocoa Organization. http://www.icco.org/about-us/international-cocoa-agreements/cat_view/41-monthly-review-of-the-market-2011.html.

ICCO, 2013. ICCO Quarterly Bulletin of Cocoa Statistics. Vol. 38, International Cocoa Organization. http://www.icco.org/about-us/icco-news/229-may-2013-quarterly-bulletin-of-cocoa-statistics.html.

IMF, 2013. World economic outlook database. World Economic and Financial Surveys, International Monetary Fund. http://www.imf.org/external/pubs/ft/ weo/2013/01/ weodata/ index.aspx.

Johansen, S., 1996. Likelihood-Based Inference in Cointegrated Vector-Autoregressive Models. 2nd Edn., Oxford University Press, Oxford, UK., ISBN-13: 978-0198774501, Pages: 280.

Kox, H.M.L., 2000. The market for cocoa powder. Modeling and Forecasting the Market for Cocoa and Chocolate, Ministry of Foreign Affairs, The Netherlands. http://econpapers.repec.org/paper/wpawuwpio/0412002.htm.

Makridakis, S., S.C. Wheelwright and R.J. Hyndman, 1998. Forecasting: Methods and Applications. 3rd Edn., John Wiley and Sons Inc., New York, ISBN: 0471532339.

Malaysian Cocoa Board, 2010. Statistics: Export of cocoa beans and cocoa products. Department of Statistics Malaysia. http://www.koko.gov.my/lkm/industry/statistic/export.cfm.

Malaysian Cocoa Board, 2013. Statistics: Export of cocoa beans and cocoa products. Department of Statistics Malaysia. http://www.koko.gov.my/lkm/industry/statistic/export.cfm.

Malaysian Palm Oil Board, 2013. Malaysian oil palm statistics, 2012. Malaysian Palm Oil Board, Ministry of Plantation Industries and Commodities, Malaysia, pp. 1176-1177.

Melo, H.D., 1972. An analysis of world cocoa economy in 1980. Ph.D. Thesis, North Carolina State University.

Mohammad, H.A. and T.C. Tang, 2000. Aggregate imports and expenditure components in malaysia: A cointegration and error correction analysis. ASEAN Econ. Bull., 17: 257-269.

Mohayidin, M.G. and Z. Samdin, 2001. Food Availability and Consumption Pattern in Malaysia. In: Repositioning of the Agriculture Industry in the Next Millenium, Radam, A. and F.M. Arshad (Eds.). Universiti Putra Malaysia, Serdang, pp: 115-147.

Narayan, P.K., 2005. The saving and investment nexus for China: Evidence from cointegration tests. Applied Econ., 37: 1979-1990.

Pesaran, H.M. and Y. Shin, 1995. An Autoregressive Distributed Lag Modelling Approach to Cointegration Analysis. In: Chapter 11 in Econometrics and Economic Theory in the 20th Century: The Ragnar Frisch Centennial Symposium, Strom, S. (Ed.). Cambridge University Press, Cambridge, UK.

Pesaran, M.H. and B. Pesaran, 1997. Working with Microfit 4.0: Interactive Econometric Analysis. Oxford University Press, Oxford, UK, pp: 483-492.

Pesaran, M.H., Y. Shin and R.J. Smith, 2001. Bounds testing approaches to the analysis of level relationships. J. Applied Econometrics, 16: 289-326.

Phillips, P.C.B. and B.E. Hansen, 1990. Statistical inference in instrumental variables regression with I(1) processes. Rev. Econ. Stud., 57: 99-125.

Romilly, P., H. Song and X. Liu, 2001. Car Ownership and use in Britain: A comparison of the empirical results of alternative cointegration estimation methods and forecasts. Applied Econ., 33: 1803-1818.

Rosdi, M.L., 1991. An econometric analysis of the Malaysian cocoa prices: A structural approach. M.Sc. Thesis, Universiti Putra Malaysia.

Shamsudin, M.N., M.L. Rosdi and C.T. Ann, 1993. Malaysian Cocoa Market Model. In: Malaysian Agricultural Commodity Forecasting and Policy Modelling, Arshad, F.M., M.N. Shamsudin and M.S. Othman (Eds.). Center for Agricultural Policy Studies, UPM, USA.

Sinha, D., 1997. Determinants of import demand in Thailand. Int. Econ. J., 11: 73-873.

Thursby, J.G. and M.C. Thursby, 1984. How reliable are simple, single equation specifications of import demand? Rev. Econ. Stat., 66: 120-128.

Tomek, W.G., 1994. Economic forecasting in agriculture: Comment. Int. J. Forecasting, 10: 143-145.

Web, A.J. and M.N. Shamsudin, 2000. Forces Shaping Asia's Demand for Vegetable Oils and Protein Meals. In: Food Security in Asia: Economics and Policies, Chern, W.S., C.A. Carter and S.Y. Shei (Eds.). Edward Elgar Publishing, UK., ISBN: 9781782543343, pp: 229-256.

Yusoff, R., M. Chee and Z. Senteri, 1998. Supply and demand model of the Malaysian cocoa industry. Borneo Rev., 9: 67-86.