

Hungernomics: explaining food trade sustainability

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Abstract

This study explores the relationship between the total exports and total imports of the food industry in Sarawak from 1961 through 2007. We examined the sample period of the pre-1997 crisis (1961-1996) and the full sample period (1961-2007) to investigate disparities for pre-crisis sample. Analysis was carried out using standard econometric procedure and Dynamic OLS estimation for the annual observations of the two sample period. This study's major findings are: (1) long run relationships were detected in the full sample period whereas they were absent in the pre-crisis period; (2) imbalances in food were found to be weakly sustainable for the full sample; (3) for every ringgit increase in imports, exports rose by RM0.803 for the full sample, revealing that imports grew at a rate faster than exports. This finding suggests that reducing the size of imports may improve imbalances in Sarawak's food industry.

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Introduction

Famine and food riots are phenomena with long genealogies. Food, unlike any other economic goods, is a basic need; humans must eat at any cost. Famines epitomise the last stage of an extended process of deepening vulnerability and fracturing of social reproduction contrivances (George, 1977). Ultimately, the recent food "crisis" can be seen as a by-product of a long-term social reproduction crisis, which colonialism initiated and was later exacerbated by neoliberal capitalist development. In an article explaining the imperial conjuncture of famines, Davis (2001) argued that the late Victorian Holocaust continuance from India through northern China to Brazil was intensified by empire and the greediness of political powers to exchange natural resources for monetary rewards.

After the Second World War, reconstructing the world economy created the neoliberal conjuncture in which bilateral economic power overshadowed multilateralism. Regimes of liberalization and privatization that worked to integrate transnational agribusiness and food markets witnessed countries denied strategies of food self-sufficiency, a low proportion of market access, exposure to artificial world prices, and the failure of small producers to survive. These prolonged negative externalities of agribusiness trade liberalization resulted in the 2008

agflation crisis, which caused a significant increase in commodity prices. In 2008, the world was shocked with the facts that the price for maize doubled, the price of wheat increased by 50%, rice increased by up to 70%, and total food prices rose 75% from 2005 prices (McMichael, 2009). Such increases dragged the world into a "post-food-surplus era" (Vidal, 2007).

The drought of the food crisis still fills the air adding to hunger phobias and new waves of social unrest in poor countries. The first alarm on the global food price crisis in 2007–2008 were the indicators showing that the world is facing tremendous food insecurity, which can cause starvation and diminish entire societies. The crisis hung on and continued for years to the point that recent statistics from the United Nation's Food and Agricultural Organization shows that monthly price changes for a basket of cereals, oilseeds, dairy, meat, and sugar averaged 216 points in March 2012 compared to 215.6 in February of the same year. Throughout 2012, the price index was on average of 213 while recent index shows a decrease to 210 in February 2013 (FAO, 2013). Increasing food prices on a relative basis represent increasing import bills for countries that do not produce enough food domestically. Research or policy initiatives to overcome such crises, however, are given little attention, and any attempts to overcome hunger and deprivation usually only portray temporary effect.

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Motivated by the concern that self-sufficiency is the utmost important defence against food crisis, the present study analyses the current conditions of Sarawak food trade and future prospects for long-term sustainability to ascertain that enough food are produced for the population of the country as a whole. Increases in food production would bring Malaysia to self-sufficiency, which would require substantial investments in Sarawak and Sabah due to the availability of vast land and resources. Efforts to become self-sufficient in commodities production are in line with the Malaysian National Food Security policy to decrease trade imbalances (Tey, 2010) which also focus on producing enough for the nation. Sarawak is used in the present study because of the nature of the country's agricultural sectors, which play a vital role in the Malaysian economy. Sarawak is also blessed with an abundance of natural resources and a body named the State Farmers' Organization helps farmers export and commercialize their agricultural food products. According to a report from the Department of Statistics–Malaysia (2011), 12% of Sarawak's gross domestic product (GDP) is contributed through agricultural, livestock and fishery sector.

Figure 1 illustrates that the levels of both imports and exports are adjacent, although in some years they drifted apart. Such a divide can be seen in the period between the years 1980-2006. Visually inspecting the plot suggests that exports and imports of food increased from 1961 to 2007 and are expected to grow further in the future as imports of food items continue to grow at the faster rate than exports¹ (¹Concern on such were also made by earlier researchers such as Ismail and Radam (2004), in which they argued that increasing demand for food items has risen mainly from high population growth and improved living standards. This provides a clear motivation for taking Sarawak as the case study). These conditions are causing the deficit to widen, especially in recent years. The plot raises two possible questions (1) are food trade deficits due to the fundamental of short run phenomenon? and (2) will imports and exports in Sarawak converge to long run equilibrium?

The contribution of this paper comes at least in two important ways. First, with implementation of the Malaysian National Food Security policy which aims to decrease trade imbalances, this study provide an empirical investigation on Sarawak trade in food industry. This empirical analysis was first of its kind especially focusing on Sarawak and food exports and imports. Second, the policy implication of the findings is obviously important before satisfactory policy options can be offered. Identifying national

self-sufficiency as the important defense against food crisis, it is very much important to understand the degree of sustainability of present food trade in Sarawak to formulate new or divert existing policies to boost the local food productions.

The remainder of the present paper is organized as follows. The next section presents the related literature on the connection between exports and imports. The subsequent section provides a theoretical model, and the last section concludes the overall findings with policy implications outlined.

Literature review

Broadly speaking, a sustainable system is one that can be maintained at a certain state or quality over a long-term time horizon and can be evaluated by following trends in indicators of interest (in this case, import and export of food). Correcting a trade imbalance by implementing macroeconomic policies occurs due to the presence of long run relationship (Bahmani-Oskooee and Rhee, 1997). Vast theoretical and empirical literatures have investigated such relationships in order to seek possible links between exports and imports. The trade imbalance currently investigated in numerous studies has concentrated mostly on aggregate trade imbalances. Thus, in the present study the trade imbalances focus on disaggregated areas, specifically investigating the cointegration properties between food export and import in Sarawak. Most of the pioneering work on trade imbalances has emphasized aggregate trade imbalances between exports and imports for particular countries during a particular time period. The present study, on the contrary, focuses on the trade imbalances on the food industry in Sarawak. Economists have stated that trade account deficits are self-correcting instruments and involve shorter time periods (Wijeweera and Deskins, 2010).

Bahmani-Oskooee (1994) used a cointegration technique to examine the long run relationship between Australian exports and imports and indeed found the presence of cointegration between exports and imports in Australia. They found that the Australian trade will converge in the long-run. Similarly, Bahmani-Oskooee and Rhee (1997) investigated Korean imports and exports and found that the hypothesis of cointegration of trade could not be rejected. Evidence of cointegration shows that government intervention in macroeconomic policies is efficient in producing import and exports for long run equilibrium (Bahmani-Oskooee and Rhee, 1997). While examining exports and imports for Fiji and Papua New Guinea, Narayan and Narayan (2004)

found the existence of long-run relationships in the countries examined. Fiji in particular showed a strong sustainability relationship between its import and export in the long-run compared to Papua New Guinea because the coefficient for Fiji was found to be equal to one.

Baharumshah *et al.* (2003) analysed the sustainability of the current account imbalance for Indonesia, Malaysia, the Philippines, and Thailand during pre 1997 crisis and post 1997 crisis periods. They found that all the countries studied except Malaysia currently have unsustainable deficits that can serve as the leading indicator of the 1997-1998 financial crises. Analysing data from the post 1997 crisis period revealed the sustainable path, which could be largely explained by the macroeconomic performance changes in these countries after the financial crisis period. A cointegration analysis conducted for selected industrial countries revealed that temporary phenomenon or short-term trade imbalances exist in all countries except the UK (Irandoost and Ericsson, 2004). The study showed that effective macroeconomic policies in Germany, Sweden, and the United States have contributed to the sustainability of the trade imbalances in the long-run. Moreover, using a sample of 27 Organization of Islamic Countries OIC members, the long run between the import and export relationship is investigated revealed that imports and exports for Benin, Burkina Faso, Cameroon, and Guyana are cointegrated compared to remaining sample countries (Tang and Alias, 2005).

Lau *et al.* (2009) examined the bilateral trade performance of Malaysia–China and Malaysia–India and found significant long run cointegration relationships for the bilateral trade performance, parallel with support for the strong form sustainability. In a similar study using the forest domain of Malaysia, Alias *et al.* (2009) found that the export and import of forestry domain are cointegrated, implying the authorities adopted good trade policies. Concerning the cross-border trade flows between Sarawak–West Kalimantan, Bariyah *et al.* (2012) found a significant long-run cointegration relationship for bilateral trade flows. The study also established a strong form of sustainability, suggesting that Sarawak–West Kalimantan bilateral trade is on a sustainable path in governing their trade flows performance.

Theoretical background: sustainability rule

With developments in econometrics, mainly the concept of cointegration, the concept of ‘sustainable’ balances (or imbalances) is somewhat empirical. In the present study, we adopted the theoretical model

from Hakkio and Rush (1991) and Husted (1992) to test for the sustainability of exporting and importing food for Sarawak. The same method was also applied by Bariyah *et al.* (2012) for trade sustainability, and Baharumshah *et al.* (2003) to test for current account sustainability while the cited papers in the previous sections do also adopt the same theoretical foundation in a similiar manner.

The model begins with the budget constraint of an individual who is able to borrow and lend freely in the international market. The current-period budget constraint of this representative household is;

$$C_0 = Y_0 + B_0 - I_0 - (1+ir_0) B_{-1} \quad (1)$$

where C_0 denotes current consumption; Y_0 is output; I_0 is investment; ir_0 is the world interest rate; B_0 is international borrowing (which could be positive or negative); and $(1+ir_0)B_{-1}$ is the initial debt of the representative household, corresponding to the country’s external debt.

Because Equation (1) must hold for every time period, the period-by-period budget constraints can be summed to form the economy’s intertemporal budget constraint, expressed as;

$$B_0 = \sum_{t=1}^{\infty} \delta_t TB_t + \lim_{n \rightarrow \infty} \delta_n B_n \quad (2)$$

where $TB_t = EX_t - MM_t = Y_t - C_t - I_t$ represents the trade balance of food in period t (income minus absorption); EX_t = total exports; MM_t = total imports; $\delta_t = \prod_{s=1}^t \beta_s$, where $\beta_s = 1/(1+ir_s)$; and δ_t is the discount factor. The crucial element in Equation (2) is the last term $\lim \delta_n B_n$, where the limit is taken as $n \rightarrow \infty$. When this limit term equals zero, the amount that a country borrows (lends) in international markets is equal to the present value of the future trade surpluses (deficits). If B_0 is positive, then the country is ‘bubble-financing’ its external debt. If B_0 is negative and the limit term is non-zero, then the country is making Pareto-inferior decisions: welfare could be increased by lending less (Husted, 1992).

Assuming that the world interest rate is stationary with unconditional mean ir , Equation (1) can be expressed as;

$$Z_t + (1 + ir)B_{t-1} = EX_t + B_t \quad (3)$$

where $Z_t = MM_t + (ir_t - ir)B_{t-1}$. Solving Equation (3) by forward substitution, Hakkio and Rush (1991) and Husted (1992) obtained the following relationship;

$$MM_t + ir_t B_{t-1} = EX_t + \sum_{j=0}^{\infty} \phi^{j-1} [\Delta EX_{t+j} - \Delta Z_{t+j}] + \lim_{j \rightarrow \infty} \phi^{t+j} B_{t+j} \quad (4)$$

Table 1. Unit root and stationarity tests

	Test Statistics					
	t_m	t_t	t_m	t_t	h_m	h_t
Panel A: 1961-1996 (Pre 1997 crisis)						
Level						
EX	-1.814(1)	-2.602(1)	-0.040(1)	-1.797(1)	0.680(5)*	0.206(1)*
MM	0.078(5)	-0.729(3)	-0.559(1)	-2.454(1)	0.688(4)*	0.199(4)*
First Differences						
DEX	-3.615(3)*	-5.096(6)*	-3.857(1)*	-3.819(1)*	0.052(1)	0.062(2)
DMM	-5.605(1)*	-6.064(2)*	-4.766(1)*	-4.634(1)*	0.144(3)	0.077(3)
Panel B: 1961-2007 (Full sample)						
Level						
EX	-2.078 (1)	-2.824 (4)	0.396 (1)	-2.113 (1)	0.675(5)*	0.152 (4)*
MM	-0.717 (1)	-2.906 (1)	1.196 (2)	-0.662 (3)	0.824(5)*	0.231 (5)*
B: First Differences						
DEX	-4.595 (1)*	-4.847 (1)*	-4.675 (1)*	-4.847 (1)*	0.311(1)	0.128 (1)
DMM	-4.611 (1)*	-4.588 (1)*	-2.666 (2)*	-5.515 (1)*	0.247(1)	0.095 (2)

Notes: The t , τ , and η statistics are for ADF, DFGLS and KPSS respectively. The subscript μ in the model allows a drift term while τ allows for a drift and deterministic trend. Refer to the main text for the notations. Asterisks (*) indicate statistically significant at 5 percent level. Figures in parentheses are the lag lengths. The asymptotic and finite sample critical values for ADF are obtained from MacKinnon (1996) while the KPSS test critical values are obtained from Kwiatkowski *et al.* (1992, Table 1, pp. 166). The DFGLS for the drift term (μ) follows the MacKinnon (1996) critical values while the asymptotic distributions for the drift and deterministic trend (τ) are obtained from Elliott *et al.* (1996, Table 1, pp 825). Both the ADF and DFGLS test examine the null hypothesis of a unit root against the stationary alternative. KPSS tests the null hypothesis that the series is stationary against the alternative hypothesis of a unit root. Δ denotes first difference operator.

where $\phi = 1/(1 + ir)$ and Δ denote the first difference operator. The left-hand side of Equation (4) represents spending on total imports (food) and interest payments (receipts) on net foreign debt (assets). Furthermore, by assuming the limit term that appears in Equation (4) is to equal zero and adding the residual term to Equation (4), we obtain the following regression model

$$EX_t = \alpha + \beta MM_t^* + e_t \quad (5)$$

where $MM_t^* = (MM_t + ir_t B_{t-1})$ measures the total imports of food to Sarawak and EX measures the total exports of food to Sarawak. The necessary condition (weak form) for the economy to satisfy its intertemporal budget constraint is the existence of a stationary error structure; that is, e_t in Equation (5) should be an $I(0)$ process. In contrast, failure to detect comovements between exports (inflows) and imports (outflows) would indicate the industry/sector is not functioning properly and fails to satisfy its budget constraint (Hakkio and Rush, 1991). The necessary and sufficient condition (strong form) of sustainability if and only if $I(1)$ process of EX and MM are cointegrated with the cointegration vector $[1, -1]$ or with $\beta = 1$. The deficit is only weakly sustainable if the EX and MM are cointegrated with $0 < \beta < 1$ and is unsustainable if $\beta \leq 0$. Lastly, for the condition of $\beta > 1$, shows that it is not consistent with a deficit criterion.

Empirical results

Data Description

Annual observations (1961–2007) of the total food exports and imports were extracted from the

Department of Statistics, Sarawak² (The total food (exports and imports) were made available as such in the publication of Department of Statistics. The details especially the imports were such as meat, dairy products, cereals, vegetables and fruits while exports were mainly the raw resources for food processing industries. Among the major exports and imports market were Sabah, West Malaysia, Australia, China and Thailand). These nominal variables, which were expressed in domestic currency, were converted into logarithm format before the estimation process.

Unit root test

As the prelude to any cointegration and VAR testing procedure, the variables under investigation must be a stationary time series. For this purpose, we conduct one unit root (ADF; Said and Dickey, 1984) and one stationary test (KPSS; Kwiatkowski *et al.*, 1992) procedures on the series of EX and MM and their first differences in order to discriminate the conclusion of stationarity and non-stationarity of these series. Overwhelmingly, both testing procedures of ADF, DFGLS and KPSS suggest the existence of unit root or nonstationarity in level or $I(1)$. This is shown in Table 1. The finding that all the variables have the same order of integration allows us to proceed with Johansen and Juselius (1990) multivariate cointegration analysis.

Multivariate cointegration test

The Johansen and Juselius (1990) procedure employs two likelihood (LR) test statistics, the trace test and maximal eigenvalue test, to determine the number of cointegrating vectors (see Johansen, 1988 and Johansen and Juselius, 1990 for discussion). In Table 2, Panel A (pre-crisis sample period) shows

Table 2. Johansen cointegration test results

Panel A: 1961-1996 (Pre 1997 crisis)					
Null	Alternative	k=1 r=1			
		λ_{max}		Trace	
		Test statistics	95% C.V.	Test statistics	95% C.V.
r=0	r=1	6.638	14.265	6.976	15.495
r≤1	r=2	0.338	3.841	0.338	3.842
Panel B: 1961-2007 (Full sample)					
Null	Alternative	k=3 r=1			
		λ_{max}		Trace	
		Test statistics	95% C.V.	Test statistics	95% C.V.
r=0	r=1	18.739*	14.264	19.370*	15.495
r≤1	r=2	0.631	3.842	0.631	3.841

Notes: Asterik (*) denotes statistical significance at 5 percent level. k is the lag length and r is the number of cointegration vectors. Chosen r: number of cointegration vectors that are significant under both tests.

Table 3. Dynamic OLS estimation (DOLS)

1961-2007 (Full sample)				
Coefficient of b		0.803		
t-statistics		16.351 (0.000)		
$H_0: b = 1$		5.120 (0.030)		
Diagnostic Checking				
AR(4)	ARCH(4)	RESET(3)	J-B	White
0.811	2.064	1.887	2.262	0.702
(0.712)	(0.154)	(0.153)	(0.322)	(0.751)

Notes: Estimation of DOLS is based on both sampling periods with 1961 to 2007. AR(4) is a test of 4th order serial correlation using Breusch-Godfrey serial correlation LM test. ARCH(m) is an m-order test for autoregressive conditional heteroscedasticity. Ramsey's RESET (regression specification test) uses the square of the fitted values. J-B (Jarque-Bera) is the test of the normality of the residuals. The White general heteroscedasticity test is based on the regression of squared residuals on squared fitted values. Parenthesized values are the probability of rejection (p-value). Durbin-Watson statistics were not reported since the lagged dependent variables make it a misleading test (Portes and Winter, 1978).

evidence of no cointegration, whereas in Panel B (full sample period), the null hypothesis of no cointegration is rejected given that both λ_{max} and trace statistics are larger than critical values. The analysis suggests that exports and imports of food in Sarawak is cointegrated where long run relationship exists, indicating that Sarawak does not violate the self-correcting mechanism. Effective macroeconomic policies show that the variables do not drift apart from the long run equilibrium in the full sampling period. Although exports and imports of food in Sarawak may diverge in the short run, it will achieve the equilibrium conditions in the long run due to several macroeconomic adjustments and policies to ensure sustainability.

Long run equilibria estimation

In the next step, the Dynamic OLS (DOLS) procedure Saikkonen (1991) developed is applied to estimate the cointegration relation given by Equation 5. This method is considered a more robust procedure and generates unbiased and asymptotically efficient estimates for variables that cointegrate, even with endogenous regressors (Stock and Watson, 1993)³ (The method involves estimation of the long-run equilibrium relationship using the dynamic OLS (DOLS) method. They offer a parametric approach for estimating long-run equilibria in systems that

involve variables integrated of different orders but still cointegrated. The possibility of simultaneity bias and small-sample bias among the regressors is dealt with the inclusion of lagged and lead values of the first difference in the regressors. Moreover, Monte Carlo results show that the DOLS estimator has the lowest root mean square error (RMSE) and, therefore, performs well in finite samples relative to other asymptotically efficient estimators). Although it is a well-known practice to continue with VECM after evidence of cointegration was found, it may lead to biased results especially in the small samples (Dvořáková and Seidler, 2012) such as ours. Since only full sample period model proves the existence of cointegration, DOLS will only be estimated for the full sample period.

The results of the DOLS (Table 3) appear in the full sample period from 1961 to 2007, showing the estimated b is 0.803, which not close to 1. The null hypothesis of $b = 1$ is rejected at significant levels ($\chi^2 = 5.121$). These empirical results imply that exports (EX) and (IM) are cointegrated with the cointegrating coefficient of less than 1. It is acknowledged that the value 0.803 is a form of weak sustainability however, the results found is robust when estimated for various diagnostic checking conducted in terms of residual correlation, autoregressive conditional heteroscedasticity (ARCH), misspecification of functional form, non-normality, and heteroscedasticity of residuals.

We also conducted the CUSUM squares stability tests for the full sample model. If the plot of the CUSUM squares sample path moves outside the critical region, in this case at the 5% significance level, the null hypothesis of stability over time of the intercept and slope parameters is rejected (assuming the model is correctly specified). The plots of CUSUM squares in Figure 1 reveals the null hypothesis of parameter stability cannot be rejected at the 5% level of significance, implying that the estimated results obtained earlier are stable over time. This is consistent

with the view that relevant authorities are efficiently generating macroeconomics policies to sustain trade deficits in the food industry.

Concluding remarks

Based on the analysis, we can draw the following conclusions. First, the cointegration relationship is not present in the pre-crisis period. This may be attributed to the trade activities that diverted our focus from agricultural industries to manufacturing industries relatively made the agricultural products to be somehow neglected. Not long after the 1997 crisis that the government implemented policies (Third National Agricultural Policy, 1998 - 2010) to encourage agricultural trade business realizing that Malaysia's agricultural products are declining in the world market and the importance of self-sufficiency to curb food crisis. The results supporting the existence of long run relationship in the full sample (1961 - 2007) period can be best described as the improvements in policies related to agricultural industries. Second, we found support for the weak form of sustainability condition in the full sample, suggesting that the exports and imports of food in Sarawak are cointegrated when the coefficient is less than one. For every Malaysia ringgit increase in the import of food, exports of food increase by \$0.803. This evidence also implies that imports of food were growing at a faster rate compared to exports of food in Sarawak. Indeed, this was detected earlier while visually inspecting the plot. This is caused by the decade of deficits in food trade patterns of Sarawak.

Recent evidence of famine found that while infecting Southeast Asia in 2008, East Asia has been free from the virus (McMichael, 2009). In China for example, the prices for rice are lower than before the recent food crisis, whereas Japan is not affected and South Korea has started to open its grain reserves to keep prices down. Some lessons can be drawn from these countries. First, all three of the East Asian economies have their own domestic production, which they supplemented with domestic grain reserves. In this sense, the Malaysian government should be able to establish an efficient food policy and regulations that would cater to a self-sufficient economy. Recently, the 10-year National Agro-Food Policy (2011 to 2020) was implemented to safeguard these initiatives and address the issue of food supply in Malaysia. Furthermore, Sarawak was also turned into a new 'rice bowl' for the nation, meaning that heavy investments on an enormous scale are made in growing rice on a massive scale for the purpose of creating self-sufficiency in Sarawak (Khor, 2008).

These policy initiatives is required especially for Sarawak food trade while prevent the state against the food crisis.

Second, Sarawak relevant authorities should be pro-active in improving the imbalance conditions of food trade in Sarawak in the long-run. Some measure like negotiating in international trade agreements and regulations in subsidies, protections, and grain reserves would be feasible to ensure such imbalances could be reduced. It is also evident that imports in Sarawak are growing faster than exports, which in the future will cause food trade imbalances in the economy. With this policy in place, the country will have a sufficient amount of food that will be safe for consumption in Sarawak and Malaysia. This situation will increase revenue for farmers and agro-entrepreneurs. This, in turn, will allow the agro-sector to develop into a steady and resilient industry. These efforts, despite being ambitious, may contribute toward reducing Sarawak's enormous dependence on imported foods and help avoid future food crises, which are the roots of hunger and famine.

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