THE BALANCE OF TRADE BETWEEN MALAYSIA-U.S. AND MALAYSIA-JAPAN: A REGRESSION MODEL ESTIMATION

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Regresi 'step-wise' telah diguna untuk menganggar imbangan dagangan Malaysia-Jepun dan Malaysia-A.S.. Manakala minyak mentah adalah mengerti di dalam semua model yang dianggar, komiditi eksport utama yang lain didapati tidak mengerti dan tidak meningkatkan kekuasaan anggaran imbangan dagangan Malaysia dengan kedua negara tersebut. Selain daripada harga minyak mentah, hanya pertumbuhan ekonomi Malaysia sahaja yang di dapati mengerti secara konsisten di dalam semua model.

INTRODUCTION

The balance of trade between Malaysia-U.S. and Malaysia-Japan will be specifed by a single equation multiple regression model and will be estimated using step-wise regression. Apart from the estimation and ensuing analysis, the procedure also illustrates the use of step-wise regression, in identifying significant independent variables.

MODEL SPECIFICATION

The balance of trade between a country and any other country is the difference, in dollar value, of its exports to and imports from the other country. This balance can be positive, in favor of the exporting country, or negative, in favor of the importing country.

Hypothetically, we could see that an improvement in the balance of trade has a close relationship with a reduction in unemployment. Lower unemployment means that more labor is being employed, resulting in an increased GNP. Improvements in the GNP may indicate that more exports are being produced. Therefore, as a result of an increase in exports, the balance of trade will also increase. In this case, unemployment is said to be inversely related to the balance of trade.

The balance of trade will also improve with an increase in the exchange rate in favor of the importer. The fall of the ringgit against an importer currency would cause Malaysia's export to rise. For example, a United States buyer who has been purchasing a Malaysian commodity, e.g. tin, with an exchange rate of 2.4 Ringgit/US$1 would welcome any devaluation in Malay-

sian ringgit. If the rate is now 2.8 Ringgit/US$1 from the importer's view point, he is paying less in US$ for the same commodity. This 'fall' in price tends to increase his demand and thus enchances exports as suggested. Consequently, this increase in export would cause an improvement in the balance of trade. Therefore, a positive relationship develope between the exchange rate and the balance of trade.

Gross national product (GNP) is the dollar value at current market prices of all final goods and services produced annually by an economy. The final goods and services include those goods and services produced for export. Thus, an increase in the GNP can be an indicator for an increase in the production of goods and services for export, a favorable influence on the balance of trade. With this observation, Malaysia's balance of trade and GNP are said to be positively related. For the case of the USA and Japan, since these two countries depend on other countries for raw materials, an increase in GNP will lead these countries to import more and is hence positively related to the balance of trade of Malaysia.

Finally, the consumer price indices of all three countries, Japan, U.S. and Malaysia, are included to provide a measure of relative prices between them. A negative relationship is then postulated between the consumer price index ratios (of Malaysia vs USA or Japan) and Malaysia's balance of trade.

Knowledge of the relationship between Malaysia's balance of trade and its four major commodity exports is also important. Exports of rubber, tin, sawn logs and palm oil make up more than 50 per cent of Malaysia's export revenue. As such, export prices of these commodities will be incorporated in the model to see whether there will be improvements in explanatory powers. Any downward movement in prices will have favorable effect on Malaysia's balance of trade. This is especially true since Japan and the U.S. are mainly importers of primary commodities, as far as Malaysia is concerned.

Based on the above relationships, two different models are proposed. For the first model, Malaysia's balance of trade with each country, Japan or U.S., is given by

$$Y = f(XR, RP, GNPm, GNP^*, E, POP)$$

where

Y	=	Malaysia's Balance of trade in dollars
XR	=	exchange rate(ringgit/yen or ringgit/US$)
RP	=	ratio of CPI Malaysia/CPI Japan or US
GNPm	=	Malaysia's GNP
GNP*	=	Japan or U.S. GNP
E	=	Malaysia's unemployed labor force
POP	=	price of Malaysia's crude oil

For each country, both linear and log-linear versions of the above model will be estimated.

The second model incorporates Malaysia's four major non-oil commodity prices; palm oil, rubber, tin and timber and the squared value of each commodity prices so that Malaysia's balance of trade with each country, Japan or U.S., is given by

$$Y = g(XR, RP, GNPm, GNP^* E, POP, POL, RUB, TIN, LOG, POL2, RUB2, TIN2, LOG2)$$

where POL, RUB, TIN and LOG are export prices of palm oil, rubber, tin and timber, respectively. POL2, RUB2, TIN2 and LOG2 are the squared values of the respective commodity prices. As for the first model, both linear and log-linear versions will be estimated.

DATA

The estimation was based on 21 annual observations covering the period from 1960 to 1980. The data were obtained from the five sources indicated below.

Export and import data and the prices of the four main export commodities were obtained from the *Quarterly Economic Bulletin of the Central Bank of Malaysia (Dec. 1983)* annually. The exports and imports data represent the gross exports and imports of all commodities (excluding military imports and imports of offshore installations of the petroleum industry) and are expressed in millions of Malaysian ringgits. The prices of rubber, tin, sawn logs and palm oil are given in Malaysian cent per kg, Ringgit per metric ton, Ringgit per cubic metre, and Ringgit per metric ton, respectively.

From the given exports and imports, the balance of trade is obtained. It is calculated as exports minus imports and is also expressed in millions of Malaysian ringgits. The data for unemployment are obtained from the *United Nations Statistical Bulletin* and *The World Statistics*. The figure shown in the table are expressed in thousands of people.

GNP is the dollar value at current market prices of all final goods and services produced annually. Malaysia's GNP figure are obtained from *The World Statistics* and were given in millions of ringgit. The values for Japan and U.S. were taken from *The World Tables (1976, 1980)-World Bank Publication* and the were given in millions of Japanese Yen and US dollars respectively.

Consumer price indices (with 1970 as the base year) and exchange rates were also obtained from the same publication. The data on crude oil prices were taken from the *Handbook of Economic Statistics* and are expressed is US$ per barrel.

ESTIMATION RESULTS

As indicated earlier, step-wise regression was used in estimating the models. There are altogether six equations estimated. In the first stage, all independent variables are included. The results for the first stage are given in Tables 1-a,b & c. Insignificant variables were eliminated and the models re-estimated. Results for the second stage are given by Tables 2-a, b & c.

Linear Models: Equations 1 & 2

Both the U.S. and Japan's GNP figures came out insignificant in both equations, indicating their lack of influence on the balance of trade with Malaysia. While Malaysia's balance of trade with Japan is price sensitive as indicated by the signifinance of the relative price variable(RP), the same cannot be said for the balance of trade with th U.S. All other independent variables are significant for both equations except for Malaysia's unemployment which is only significant for the case with Japan. The signs of all significant independent variables concurs with prior expectations.

Both models exhibited high values of R^2, 0.92243 and 0.91693 for the U.S. and Japan models, respectively. Tests for autocorrelation using the Durbin-Watson statistics are however inconclusive for both equations, discounting somewhat the high coefficients of determination stated earlier.

Log-linear models: Equations 3 & 4

The goodness of fit of the above two models, as measured by the coefficient of determination did not improve by regressing the log-linear versions of the earlier two models (equations 1 & 2). In fact, there was a slight drop in the R^2 values for both models, from 0.92243 to 0.87121 and from 0.91693 to 0.81051 for U.S. and Japan respectively. As the variable in both models, linear and log-linear, is identical, this drop in R^2 seemed to suggest that taking logarithm will not improve the estimation result.

Except for the exchange rate, the estimated equations for balance of trade for both U.S. and Japan showed the same pattern. The ringgit/US$ exchange rate was significant for the U.S. model but the ringgit/yen exchange rate was insignificant for the Japan model. This would suggest that Malaysia-U.S. balance of trade is more sensitive to currency fluctuations than Malaysia-Japan's.

As for the earlier two equations, tests for autocorrelation were again inconclusive.

Linear models with 4 major export commodities-Equations 5 & 6

The inclussion of Malaysia's four major export commodities prices and their squared values diminishes the significane of most independent variables

specified in earliear models and resulted in the four commodity prices themselves being insignificant. Only crude oil price(POP) is significant for both equations, and the only significant independent variable for the balance of trade with Japan. For the U.S. equation, apart from crude oil price, Malaysia's unemployment and the squared value of sawn timber price(LOG) are the only other two significant independent variables.

The goodness of fit dropped rather significantly compared with the previous models, more for the equation with Japan than with the U.S. In fact, the value of R^2 for Japan is low at 0.64679. This is however compensated with the conclusive rejection of autocorrelation for the model. A similiar test on the U.S model is, however, inconclusive.

CONCLUSION

Several conclusions can be derived from the above results. First, the log-linear versions are not an improvement over the linear version. This is clearly indicated by the results for equations 1 & 2 and equations 3 & 4. Second, while it makes theoretical sense to include Malaysia's major export commoditv prices in the estimation, as done for equations 5 & 6, their inclusion weakens estimation results. In addition, the incorporation of these commodity prices in the equations render the other specified independent variables insignificant, except for crude oil prices. There are only two consistently significant independent variables throughout the whole exercise, Malaysia's GNP (GNPm) and crude oil prices(POP). As this is true for both Malaysia-U.S. and Malaysia-Japan balances of trade, a final conclusion is that Malaysia's balance of trade with both countries are influenced by the same set of variables.

Admittedly, the model specifications can be further improved to obtain more illustrative results to enable more coherent economic interpretations. Different estimation techniques may also be used.

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Table 1-a: First Stage Result Of Models

	MODEL 1 (M'sia-USA)			MODEL 2 (M'sia-Japan)		
	COEFF.	S.E	T-VALUE	COEFF	S.E	T-VALUE
1. INDEP. VARIABLES						
Exchange Rate	1557.4	1252.1	1.244	−624231	324918	−1.921
GNP*	−0.005	0.004	−1.333	−0.02	0.02	−1.053
Pr. Crude oil	−370.3	84.62	−4.376	−330.9	82.0	−4.033
Unemployment	−11.1	6.70	−1.653	−10.88	12.06	−0.902
GNPm	0.595	0.185	3.220	0.408	0.092	4.435
RP	−4985.4	4424.7	−1.127	−780.0	4236.6	−0.184
Constant	1750.2	8667.0	0.202	5884.9	7110.4	0.828
2. R^2		0.93267			0.92384	
3. F-Value		32.323			28.305	
4. Durbin-Watson		2.15954			1.60905	

Table 1-b: First Stage Result Of Linear Models

	MODEL 3 (M'sia-USA)			MODEL 4 (M'sia-Japan)		
	COEFF	S.E	T-VALUE	COEFF	S.E	T-VALUE
1. INDEP. VARIABLES						
Exchange Rate	8.459	3.046	2.777	−3.455	2.390	−1.446
GNP*	2.444	3.507	0.697	−0.959	1.627	−0.589
Pr. Crude oil	−2.435	0.734	−3.318	−3.112	0.815	−3.818
Unemployment	−2.465	0.564	−4.372	−2.677	0.783	−3.419
GNPm	5.170	2.775	1.863	4.017	1.5692	2.561
RP	3.095	3.4527	0.896	8.980	5.618	−1.598
Constant	−70.05	28.30	−2.475	−19.916	18.147	−1.097
2. R^2		0.87860			0.85122	
3. F-Value		16.874			13.346	
4. Durbin-Watson		1.81357			1.11952	

Table 1-c: First Stage Result Of Linear Models (with 4 major export commodity prices)

		MODEL 5 (M'sia-USA) (4 EXP. PRICES)		MODEL 6 (M'sia-Japan) (4 EXP. PRICES)		
	COEFF.	S.E	T-VALUE	COEFF	S.E	T-VALUE
1. INDEP. VARIABLES						
Exchange Rate	5284.0	814.9	6.486	−750774	781151	−0.961
GNP*	−0.003	0.003	−1.007	0.009	0.081	0.113
Pr. Crude oil	−376.1	60.12	−6.256	−303.2	166.09	−1.826
Unemployment	3.328	8.672	0.384	19.14	33.77	−0.567
GNPm	0.923	0.235	3.928	0.086	0.907	0.095
RP	1669.2	3358.2	0.492	−6218.1	9900.8	−0.628
Pr. rubber (RUB)	19.147	18.11	1.057	5.383	44.37	0.121
Pr. tin (TIN)	−0.092	0.179	−0.515	0.218	0.480	0.453
Pr. sawn log (Log)	−117.0	33.60	−3.482	−47.05	90.47	−0.520
Pr. palm oil (POL)	−3.742	2.265	−1.652	−0.976	5.960	−0.164
RUB^2	0.001	0.051	0.020	0.045	0.141	0.317
TIN^2	−0.00001	0.0000	−3.374	−0.0000	0.0000	−0.275
LOG^2	0.470	0.112	4.210	0.200	0.337	0.591
POL^2	0.003	0.001	−2.130	−0.001	0.005	−0.287
Constant	−17328.9	6673.5	−2.597	15693.0	15562.4	1.008
2. R^2		0.99550			0.96445	
3. F-Value		94.707			11.626	
4. Durbin-Watson		2.70260			2.17942	

Table 2-a: Final Stage Result Of Linear Models

	MODEL 1 (M'sia-USA)			MODEL 2 (M'sia-Japan)		
	COEFF.	S.E	T-VALUE	COEFF	S.E	T-VALUE
1. INDEP. VARIABLES						
Exchange Rate	2734.6	961.4	2.844	−684206	310673	−2.202
GNP*	–	–	–	–	–	–
Pr. Crude oil	−313.5	73.7	−4.253	−297.0	74.5	−3.987
Unemployment	−14.3	4.1	−3.509	–	–	–
GNPm	0.382	0.052	7.304	0.347	0.054	6.408
RP	–	–	–	−3591.1	1170.9	−3.067
Constant	−8961.6	3163.6	−2.833	−363.9	3454.7	−0.105
2. R^2		0.92243			0.91693	
3. F-Value		47.567			44.151	
4. Durbin-Watson		2.57038			1.69339	

Table 2-b: Final Stage Result Of Log-Linear Models

	MODEL 1 (M'sia-USA)			MODEL 2 (M'sia-Japan)		
	COEFF.	S.E	T-VALUE	COEFF	S.E	T-VALUE
1. INDEP. VARIABLES						
Exchange Rate	7.428	2.704	2.747	–	–	–
GNP*	–	–	–	–	–	–
Pr. Crude oil	−2.342	0.650	−3.603	−2.470	0.762	−3.240
Unemployment	−2.153	0.429	−5.023	−1.764	0.476	−3.707
GNPm	6.279	1.01	6.210	4.883	1.029	4.747
RP	–	–	–	–	–	–
Constant	−47.162	9.125	−5.169	−27.85	6.853	−4.064
1. R^2		*0.87121*			*0.81051*	
2. F-Value		27.042			24.233	
3. Durbin-Watson		1.56544			1.06150	

Table 2-c: Final Stage Result Of Linear Models (with 4 major export commodity prices)

	MODEL 5 (M'sia-USA) (4 EXP. PRICES)			MODEL 6 (M'sia-Japan) (4 EXP. PRICES)		
	COEFF.	S.E	T-VALUE	COEFF	S.E	T-VALUE
1. INDEP. VARIABLES						
Exchange Rate	–	–	–	–	–	–
GNP*	–	–	–	–	–	–
Pr. Crude oil	−183.16	80.99	−2.262	207.38	35.5	5.899
Unemployment	–	–	–	–	–	–
GNPm	0.172	0.047	3.652	–	–	–
RP	–	–	–	–	–	–
RUB	–	–	–	–	–	–
TIN	–	–	–	–	–	–
LOG	–	–	–	–	–	–
POL	–	–	–	–	–	–
RUB^2	–	–	–	–	–	–
TIN^2	–	–	–	–	–	–
LOG^2	0.106	0.048	2.185	–	–	–
POL^2	–	–	–	–	–	–
Constant	−1022.9	347.0	−2.947	7.128	359.6	0.020
2. R^2		0.86100			0.64679	
3. F-Value		35.101			34.793	
4. Durbin-Watson		1.03593			1.92402	