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A Market Model of Peninsular Malaysian Sawntimber Industry

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ABSTRAK

Satu model pasaran kayu gergaji yang mengandungi persamaan penawaran, permintaan eksport dan permintaan domestik dan identiti lebihan penawaran dan harga telah dibentuk. Model ini boleh digunakan untuk menganalisis kesan perubahan pembolehubah eksogen seperti cukai eksport, harga barang pengganti, pembukaan hutan dan pertumbuhan ekonomi ke atas penawaran, permintaan dan harga kayu gergaji.

ABSTRACT

A market model of sawntimber consisting of supply, export demand and domestic demand equations, and excess supply and price as identities was developed. The model can be used to analyse the effect of changes in exogenous variables such as export duty, substitute product prices, forest opening and economic growth on the supply, demand and price of sawntimber.

INTRODUCTION

Malaysian sawntimber production has grown by more than three times during the last two decades, from 2.6 million cubic metres in 1971 to 8.9 million cubic metres in 1991. The bulk of the production was initially from Peninsular Malaysia. However, this trend has changed. In the 1970s, the production from Peninsular Malaysia accounted for about 96% of the nation's production. In the late 1980s, the proportion dropped to around 63%, even though there was no decline in absolute production.

Many factors account for the slower growth of sawntimber production in Peninsular Malaysia. An important factor is the inadequate availability of raw material inputs for allocation to individual mills. Although log production in the peninsula expanded by 1.7 times during the past two decades, the number of mills also increased by about the same rate. This log input insecurity has discouraged further capital improvements among millers.

In the international sawntimber trade, Malaysia plays a dominant role. She is the world's biggest exporter of hardwood sawntimber with a volume of 4.9 million cubic metres in 1991. Of these, 2.2 million cubic metres were from the peninsula. Export earnings from sawntimber were RM2.93 billion in 1991. The export volume from the peninsula is not expected to increase significantly in the coming years following a shift in policy towards further domestic processing. Export levies on selected species of sawntimber were introduced in June 1990, and by April 1991 some 22 species were affected.

Domestic demand for sawntimber might have triggered the export levies imposed. In the peninsula, the domestic consumption of sawntimber increased from 1.1 million cubic metres to 2.2 million cubic metres during the last two decades. These figures represented 43.6% and 39.9% of production respectively.

In view of the economic importance, a study on the relationship of the major variables of the sawntimber industry is certainly useful for it will provide a framework for policy effect analysis. The major variables of the industry are (i) economic growth, (ii) price of substitutes, (iii) production, (iv) exports and export tax, (v) domestic utilization, (vi) price, and (vii) forest opening. This paper proposes to develop a Peninsular Malaysia sawntimber market model in order to provide a basic framework for policy simulation. It is hoped that this model will contribute to the much sought-after information on the behavioural relationships of the industry and explain the role and effects of certain policy instruments.

Previous studies on the sawntimber market have generally concentrated on the formulation and estimation of the export and domestic demand relationship using a single equation approach (Radzuan 1975; Luqman 1978; Kumar 1982; Mohd. Shahwahid 1991). The estimated elasticity obtained by Radzuan was not statistically significant. Luqman's model was similar to that of Radzuan but he tried both the linear and log linear specifications. The price variable was not significant in both specifications. The results obtained by Kumar were generally not consistent with *a priori* expectations. Nevertheless, Mohd. Shahwahid obtained statistically significant elasticity estimates of the world demand for sawntimber.

The above-mentioned studies assumed that the export supply is infinitely elastic. Robinson (1967) argued that this assumption is legitimate only if the product and factor markets are perfectly competitive. Thus simultaneity bias can be ignored if the small country assumption is satisfied. If otherwise, a simultaneous equation model approach should be employed. A study by Yusoff and Salleh (1987) on eleven primary commodity exports including sawntimber indicates that export supply is inelastic. This study therefore employs a simultaneous equation model in estimating the sawntimber industry.

MODEL SPECIFICATIONS

The sawntimber market model for Peninsular Malaysia consists of three behavioural equations describing the supply, domestic demand and export demand. The model also consists of three identities defining the excess supply, the price received by the producers, and the closing identity.

Supply of Sawntimber

The supply of sawntimber is specified as

$$PRST_t^* = a_1 + a_2\,PR_t + a_3\,FOP_{t-1} + e_1 \qquad (1)$$

where

$PRST_t^*$ = desired supply of sawntimber
PR_t = price of sawntimber
FOP_t = forest opening
e_1 = error term

Equation (1) postulates that the supply of sawntimber is positively related to the price of sawntimber, and the forest opening. Since $PRST^*$ is an unknown quantity, it is assumed to follow the adjustment process

$$PRST_t - PRST_{t-1} = \lambda_1\,(PRST_t^* - PRST_{t-1}) \qquad (2)$$
$$0 < \lambda_1 < 1$$

where

$PRST_t$ = actual quantity of sawntimber supplied

Substituting (1) into (2) for $PRST^*$, yield

$$PRST_t = \lambda_1 a_1 + \lambda_1 a_2\,PR_t + \lambda_1 a_3\,FOP_{t-1} + (1 - \lambda_1)\,PRST_{t-1} + \lambda_1 e_1 \qquad (3)$$

Equation (3) is the estimating equation for the supply of sawntimber.

Demand for Sawntimber

Demand for sawntimber is a derived demand as it is used as an input in the production of final products. The demand equation is based on the theory of the firm. Following Silberberg (1978), the export demand equation can be specified as

$$EXDST_t^* = b_1 + b_2\,PR_t + b_3\,SWP_t + b_4\,WIPI_t + e_2 \qquad (4)$$

$$EXDST_t - EXDST_{t-1} = \lambda_2\,(EXDST_t^* - EXDST_{t-1})$$
$$0 < \lambda_2 < 1 \qquad (5)$$

where

$EXDST_t^*$ = desired export demand for sawntimber
$EXDST_t$ = actual export demand for sawntimber
SWP_t = price of softwood
$WIPI_t$ = world industrial production index
e_2 = error term

The price of final products is proxied by the industrial production index as in Tan (1984), Yusoff (1988) and Mohd. Shahwahid (1991). Since sawntimber is an intermediate raw material, it can be expected that if industrial activities are higher, the demand for sawntimber will increase. Softwood is assumed to be a substitute input for sawntimber in some uses, thus its cross price elasticity coefficient is anticipated to be positive.

Substituting (4) into (5) for $EXDST_t$, we obtain

$$EXDST_t = \lambda_2 b_1 + \lambda_2 b_2 PR_t + \lambda_2 b_3 SWP_t + \lambda_2 b_4 WIPI_t + (1-\lambda_2) EXDST_{t-1} + \lambda_2 e_2 \quad (6)$$

In the case of domestic demand for sawntimber, its specification is similar to that of the export demand, and may be specified as follows,

$$DDST_t^* = c_1 + c_2 PR_t + c_3 MIPI_t + e_3 \quad (7)$$

$$DDST_t - DDST_{t-1} = \lambda_3 (DDST_t^* - DDST_{t-1}) \quad (8)$$
$$0 < \lambda_3 < 1$$

where

$DDST_t^*$ = desired domestic demand for sawntimber

$DDST_t$ = actual domestic demand for sawntimber

$MIPI_t$ = Malaysian industrial production index

e_3 = error term

Substituting (7) into (8) for $DDST_t$, we obtain,

$$DDST_t = \lambda_3 c_1 + \lambda_3 c_2 PR_t + \lambda_3 c_3 MIPI_t + (1-\lambda_3) DDST_{t-1} + \lambda_3 e_3 \quad (9)$$

Equation (9) is the estimating domestic demand equation.

Identities

The model consists of three identities, namely the excess supply function, the price received in the presence of export tax and the closing identity. The excess supply function is the horizontal difference between supply and domestic demand measuring the amount of sawntimber supply for export. The excess supply function can be defined as

$$EXST_t = PRST_t - DDST_t \quad (10)$$

where

$EXST_t$ = quantity of sawntimber exported

Following Tan (1984), the price received in the presense of export tax may be defined as follows,

$$PRR_t = PR_t - XTR_t \quad (11)$$

where

PRR_t = price received in the presense of export tax

XTR_t = sawntimber export tax

The model contains six endogenous variables. Thus one more equation or identity is needed to complete the system. In this case, the completion is achieved by introducing an identity as follows,

$$PRST_t = EXDST_t + DDST_t \quad (12)$$

The sample period for this study is from 1965 to 1988. The data applied in the analysis have been obtained from the Annual Forestry Reports, Department of Statistics' Import and Export Trade Statistics and Bank Negara's Annual Reports. The estimation technique applied to the specified model is the 2SLS.

RESULTS

The estimates of the sawntimber market model are presented in Table 1. The model as a whole appears to be consistent with *a priori* expectations, and has several significant explanatory variables.

All the estimated coefficients in the supply equation have the expected signs. The price and the forest opening variables are significant at the 5% level. The price elasticity of supply is 0.327. This inelastic supply is consistent with the finding by Yusoff and Salleh (1987). The coefficient on lagged supply is significant at the 1% level, and the adjustment coefficient is 0.471, indicating that adjustment to the equilibrium level is relatively alow, partly due to large fixed investment in sawntimber production.

The estimates obtained for the export demand equation are consistent with *a priori* expectations. The coefficients for substitute prices and industrial production index are significant at 5% level. The coefficient for the price of softwood suggests that it is a substitute for sawntimber in its utilization. The industrial production index influences the demand for many primary commodities such as palm oil (Mad Nasir *et al.* 1988), rubber (Yusoff 1988) and sawntimber and plywood (Mohd. Shahwahid

TABLE 1
Estimated structural equations

Supply

$PRST_t = 278.291 + 4.692\ PR_t + 2.095\ FOP_{t-1} + 0.529\ PRST_{t-1} - 699.724\ DUM$
(2.778) (2.837) (3.958) (-3.322)

$R^2 = 0.945$ $h = 0.971$

Export Demand

$EXDST_t = -1{,}819.033 - 15.691\ PR_t + 43.948\ SWP_t + 43.779\ WIPI_t + 0.0578\ EXDST_{t-1}$
(-2.812) (2.285) (2.959) (0.145)

$R^2 = 0.873$ $h = 0.073$

Domestic Demand

$DDST_t = 319.255 - 2.829\ PR_t + 19.734\ MIPI_t + 0.474\ DDST_{t-1}$
(-2.582) (4.775) (3.526)

$R^2 = 0.935$ $h = 0.403$

Identities

$EXST_t = PRST_t - DDST_t$
$PRST_t = EXDST_t + DDST_t$
$PRR_t = PR_t - XTR_t$

Note: Number in parentheses are t-values.
h - Durbin h statistics..

1991). The short-run price elasticity is 2.267. Thus 1% change in the price of sawntimber would change the export demand by 2.267%.

The results of the domestic demand equation indicates that own price and the Malaysian industrial production index are important determinants of the demand for sawntimber in the domestic market. The elasticities with respect to own price and industrial index are -0.382 and 0.759 respectively.

Simulation Analysis

The simulation analysis is basically to validate the model based on its predictive power. The model was simulated through the sample period to see how close it could track the path of the actual observations. It can be measured by the root mean square per cent error (RMSPE) and Theil's inequality coefficient (U).

The results of the simulation analysis are presented in Table 2. In general, the values of the RMSPE which are in the order of 8% are

TABLE 2
Historical simulation results

Statistics	PRST	DDST	EXDST
RMSPE	0.0844	0.0568	0.0934
U	0.0395	0.0282	0.0571
U^m	0	0.0002	0
U^s	0.0448	0.0025	0.0279
U^c	0.9552	0.9973	0.9721

RMSPE - root mean square percent error
U - Theil's inequality coefficient
U^m - fraction of error due to bias
U^s - fraction of error due to different variation
U^c - fraction of error due to different covariation

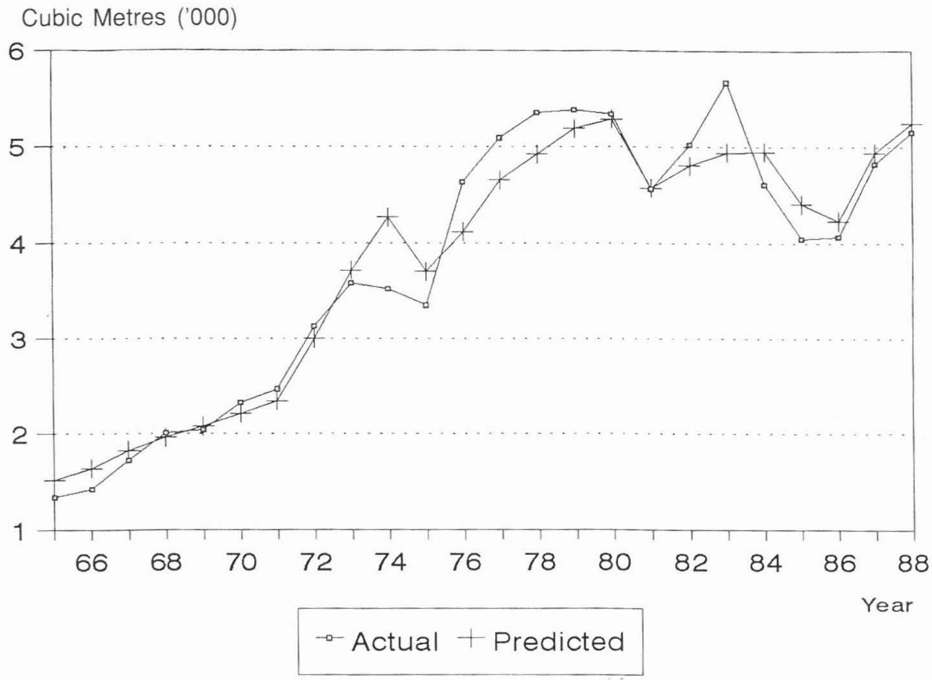

Fig. 1: Simulation of supply of sawntimber

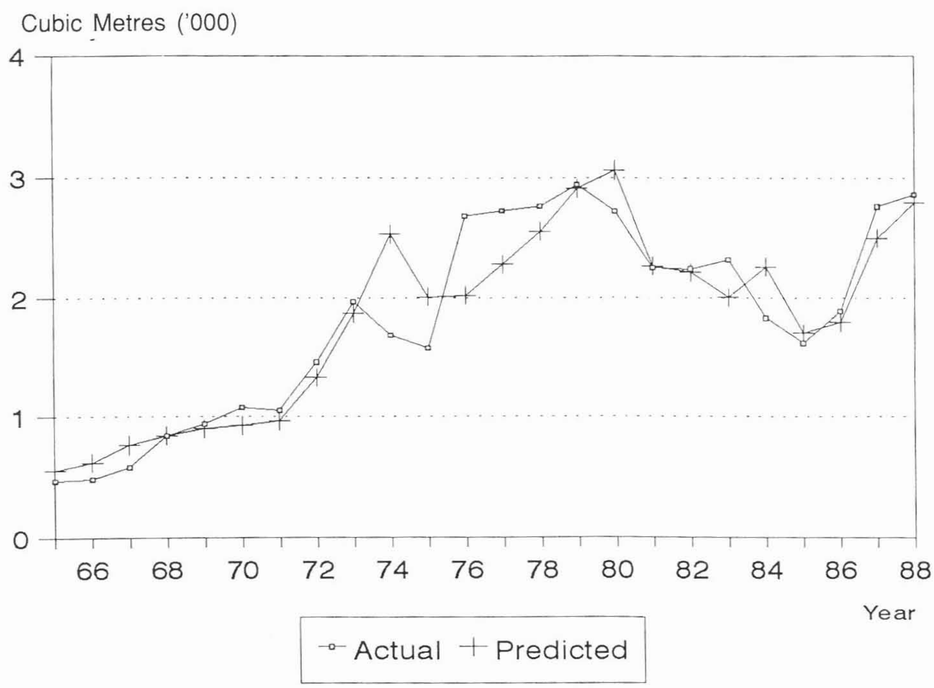

Fig. 2: Simulation of export demand for sawntimber

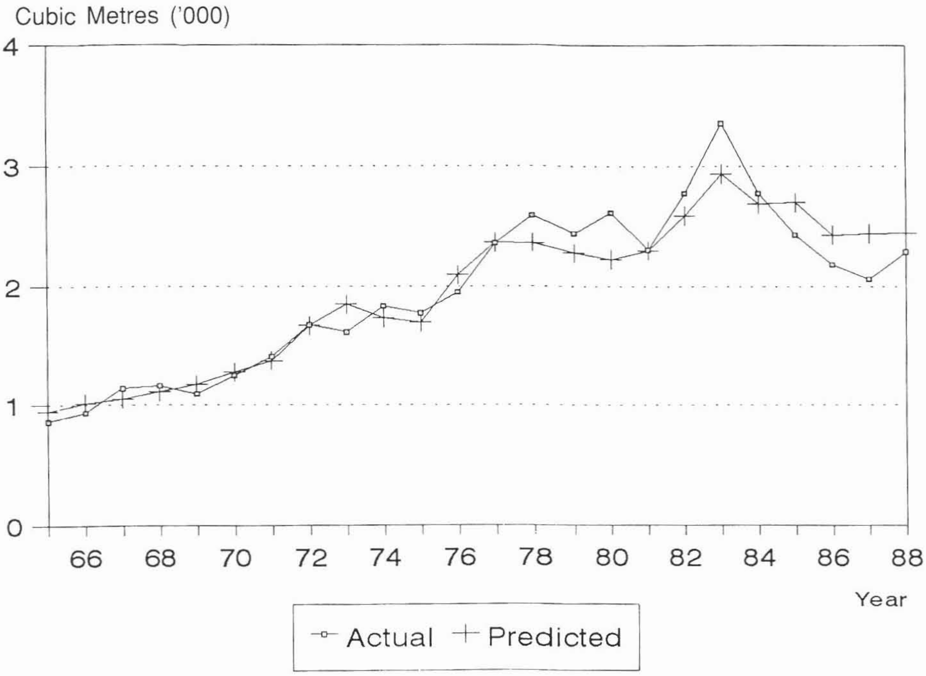

Fig. 3: Simulation of domestic demand for sawntimber

relatively small. The values of U of all endogenous variables are less than one, suggesting that the model is superior to the naive no change model. The values of U^m are all close to zero, indicating that a systematic bias is not present. The values of U^s are also very small, suggesting that the model is able to replicate the degree of variability in those particular variables of interest. The high values of U^c indicate that the predictive errors are basically unsystematic.

In order to examine the paths of the endogenous variables, their actual and simulated values are plotted as shown in *Figs. 1 - 3*. Generally, the model could trace the directions of the actual values quite well, besides capturing the turning points. The results, however, seem to indicate more dispersion during 1978-1988, than during 1966-1978. This could be due to the world recessionary period in the 1980s which created instability in the export demand and supply of sawntimber.

CONCLUSION

The central theme of this paper is to formulate a model of the Peninsular Malaysian sawntimber market. The model consists of supply, export demand and domestic demand equations, and excess supply and price received by producers as identities. The formulated model represents a major departure from the previous studies on sawntimber where a simultaneous equation model was employed.

It was found that the price elasticities of supply and domestic demand are less than unity. Thus, a large change in price would result in a small change in supply and domestic demand for sawntimber. On the export market, the price elasticity of export demand is elastic. This suggests that a small change in price would result in a large change in exports. Thus, the imposition of export taxes on sawntimber will raise the export price and suppress the price received by the producers, and the burden of the taxes will be shared by importers and producers as well. Further, world economic activities, as represented by the world industrial production index, and the price of substitute products seem to be important determinants of the export demand for sawntimber. However these variables are beyond Malaysia's influence. Thus in order to stabilize her export earnings from sawntimber, Malaysia should place more emphasis on supply management policy actions.

From the simulation exercise, it was found that the model generally has the ability to track the path of the actual observations. The model can therefore be used to forecast the effect of changes in exogenous variables.

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