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EXPORT COMPETITION AMONG
CHINA AND ASEAN IN THE
US MARKET: APPLICATION OF
MARKET SHARE MODELS

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**Export Competition Among China and ASEAN in the US Market: Application of
Market Share Models**

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ABSTRACT

In this paper, market share models were estimated using the panel data regression technique. The relative price variable was adjusted by movement in exchange rate and a quality index (indicated by the ratio of high quality proportion of the products to lower quality one) is incorporated into the model. The models were used for evaluating the level of competition among China and ASEAN in the US market. The empirical results showed that the panel data estimations provided a better goodness-of-fit than the separate country regressions. The analysis of export share elasticities with respect to relative prices suggests a reasonably strong competition for export share in the US import market among China, Malaysia and Singapore. In contrast, the level of competition within the same market niche was either small in magnitude, as in the case of Indonesia, or insignificant, as in the case of Thailand. Quality or product composition was shown to be a significant determinant of changes in country *i*'s export share.

Export Competition Among China and ASEAN in the US Market: Application of Market Share Models

I Introduction

Market share models are widely used to evaluate export competition for a country's traded commodities¹. The theory of using market share analysis was first presented by Armington (1969). Specifically, Armington developed a theory for products differentiated by location of production in world markets. Subsequent to Armington's seminal work, many empirical models were extended to apply the market share approach in international trade analysis (e.g. Sirhan and Johnson 1971; Reddy 1980; Durham and Lee 1985; Shalaby et al 1991; Voon 1994).

Among the frameworks used for assessing export market share, the distributed-lag regression model was the most commonly used (e.g. Saghafi 1987; Tellis 1989; Voon 1994)². In those models, market share was commonly specified as a function of lagged share and one explanatory variable (i.e. relative prices). In this paper, we extend the previous analysis by incorporating some changes into the model. First, changes in relative prices will be adjusted by movements in exchange rates. A rationale for this is that export prices of internationally-traded goods are normally affected by fluctuations in exchange rates. Second, a quality index (indicated by the ratio of high quality proportion of the products to lower quality one) is incorporated into the model. According to a priori expectation, quality/composition is deemed to be important in determining export market share (Weiss 1968; Cooper and Nakasishi 1988). In addition to the above extensions, the panel-data estimation methods will be used for the empirical analysis.

¹ In what follows, competitiveness is defined as country i's ability to gain market share in a common export destination (such as the US import market). Competition, however, measures the intensity with which countries compete for market share of similar goods on a common import market (Voon 1996).

² The distributed-lag models were normally applied for assessing agricultural commodities which exhibit long production period. Since our analysis involves manufactured goods with relatively short production intervals, the model with a lag of one year (as in previous studies) may no longer be appropriate for our empirical analysis. The results computed from the distributed-lag model are compared with those estimated using a simple regression model.

Unlike the conventional single market share equation approach, the problem with low degree of freedom arising from short time series could be tackled by using the panel data estimation methodology.

In this paper, market share elasticities computed from our extended framework will be compared across the countries exporting to the common import market. Market share elasticities may be used to indicate the degree of rivalry among the competing countries. For example, where the market is relatively competitive, the market shares of the competitor are expected to be sensitive to changes in relative prices/competitiveness³. Otherwise, small changes in market share resulting from a change in relative prices indicates a low degree of rivalry.

In the following section, the basic model and the various panel-data estimation methods are presented. In section III, the models are applied for assessing export competition among China and the Association of South East Asian Nations (ASEAN) in the US market. There are many possible factors contributing to the changing level of competition for China and ASEAN. In this paper, we confine our analysis to evaluating how important relative movements in export prices, real exchange rate and product composition are in influencing export competitiveness of China and ASEAN in the US import market. The conclusions and implications are presented in section IV.

II The Model and Estimation Methods

In what follows, two important independent variables having differential impacts on market share are constructed. First, where countries are competing for market share on a common import market, product prices and exchange rates are critical. Nothing can destroy the competitiveness of an exporter more quickly than a rigid exchange-rate policy (Fleissig and Grennes 1994). In our analysis, a relevant price competitiveness

³ The level of competition could be high or low depending on the number of substitutes, the elasticity of substitution, proximity of the trading nations, the presence of price policies, the existence of any implicit and explicit forms of trading arrangement and relationship between markets, among others. Our models cannot be used to identify the individual sources of competition.

index ($I=EPI/E$ where EPI is export price index and E represents real exchange rate) is constructed by adjusting product prices by exchange rates. Relative price competitiveness (P , which denotes the ratio of competitor i 's price index (I_i) to the sum of other competitors' (I_n)) constitute the appropriate independent variable. Where competitor i 's price index rises faster than that of all others', country i 's export share would decrease vis-à-vis its competitors' share.

Second, changes in product quality characteristics or composition constitute the non-price factor affecting market share. In our analysis, we examine if changes in relative product composition ratio ($C = (X_i/Y_i)/(X/Y)$ where X_i/Y_i represents the ratio of higher-quality to lower-quality portion of the production of country i , and X/Y denotes the average ratio for all other exporters) have any effects on country i 's competitiveness. Brakman and Japme (1987) reported that changes in product composition have a significant impact on total exports.

Traditionally, market share models for each individual country are estimated separately by the Ordinary Least Square (OLS) regression. This method will be adopted here as well, among other plausible approaches. Since we have a relatively short time series (15 years) for each individual country, the OLS estimation for each individual country is likely to be limited by the problem of low degree of freedom. This problem will be more tractable if we apply the panel data estimation technique and estimate the model by using the entire five-country data. Therefore, in addition to doing separate regressions for each individual country, we will also run regressions using the panel data as a whole.

More specifically, we first estimate the following equation for each individual country with the OLS technique.

$$M_{it} = \beta_{i0} + \beta_{i1}P_{it} + \beta_{i2}C_{it} + \mu_{it} \quad \begin{matrix} i=1,2,\dots,5 \\ t=1,2,\dots,15 \end{matrix} \quad (1)$$

where M denotes market share, β_{ik} ($k = 1, 2$) are individual country coefficients which are normally different for different countries, u is stochastic error, and other terms are

explained as before. This is the unrestricted model. But, as we mentioned above, it may suffer from the problem of low degree of freedom.

Next, we will impose various restrictions on the above model, and run regressions with the whole panel data. First, we set both β_{i1} and β_{i2} to be the same for all countries, and allow the intercept β_{i0} to vary across countries: the so-called fixed-effects model. We designate this as model 2. Second, we allow both β_{i0} and β_{i1} to vary across countries, but still keep β_{i2} as a constant (model 3). The F-test as well as other relevant test procedures (see for example Hsiao 1986) will enable us to select the best specification among these alternatives.

Moreover, we will also run a random-effects model (model 4) as below:

$$M_{it} = \beta_0 + \beta_{i1}P_{it} + \beta_2C_{it} + v_i + \mu_{it} \quad \begin{matrix} i=1,2,\dots,5 \\ t=1,2,\dots,15 \end{matrix} \quad (2)$$

where v_i is the individual country-specific random variable, and $E[v_i] = 0$, $\text{Var}[v_i] = \sigma_v^2$, $\text{Cov}[v_i, \mu_{it}] = 0$, $\text{Var}[v_i, \mu_{it}] = \sigma_v^2 + \sigma_{\mu^2}$.

Comparing to the fixed-effects model with one country-specific slope β_{i1} (models 2 and 3), this random-effects model imposes restriction on the mean of the intercept to be the same for all countries, but allows the intercept to have country-specific variances. The estimation will be run by the general least square (GLS) technique. The Hausman test of fixed versus random effects model (Greene, 1993) will be calculated to show which model gives the better fit.

III An Application, The Data and Results

The above models are used to assess export competition between China and ASEAN-4⁴. China and ASEAN-4 have been experiencing rapid economic growth over the last two decades or so. Aside from sharing similar rates of growth, there are some other common features between China and the ASEAN-4 countries. For example, in their initial stages of growth, China and ASEAN-4 were predominantly specializing in the production of primary-based and labour-intensive commodities (e.g. textiles, clothing and electrical goods), as in contrast to the NIE's and Japan's production of largely capital- and technology-intensive products. Another similarity is that both China and the ASEAN-4 countries are heavily dependent on the United States (US) and Japan as important destinations of their exports. By exporting similar products (e.g. labour-intensive goods) to the same markets, these economies might have faced a high degree of export competition or rivalry among themselves.

In our empirical analysis, total exports of China and ASEAN-4 to the US are segregated into 4 major product categories: (i) agricultural products (AP), which include food, livestock and beverages (SITC codes 0-2), (ii) primary products (PP), comprising minerals, crude materials, fuels and oils (SITC codes 3-4), (iii) relatively more-labour-intensive manufactures (MLIM) (SITC codes 6 and 8) and (iv) relatively less labour-intensive manufactures (LLIM) (SITC codes 5, 7 and 9)⁵. Following Garnaut and Anderson (1980), LLIM include textile, yarn and fabrics (under SITC 65), glass (SITC 664-666), clothing (SITC 84), footwear (SITC 85), travel goods and handbags (SITC 83), toys and sporting goods (SITC 894), plastic (SITC 893), office supplies (SITC 895), furniture (SITC 82), plumbing, heating and lighting equipment (SITC 81), and other manufactured goods (SITC 899). Notice that most of the LLIM are categorised under SITC single-digit codes 6 and 8. Goods that are grouped under single-digit SITC codes

⁴ The ASEAN economic grouping comprises Singapore, Malaysia, Thailand, Indonesia, Philippines, Vietnam and Brunei. In this paper, we confine our analysis to Singapore, Malaysia, Thailand and Indonesia (hereafter ASEAN-4). These four ASEAN countries share similar growth rates.

⁵ Of the total exports, manufactures constituted more than 80% of China's and ASEAN's exports to the US in 1994. Of the manufactured products, textiles and clothing are a major category, accounting for around half of total manufactured exports in China and ASEAN (especially Indonesia and Thailand).

5, 7 and 9 are considered to be more capital or technology intensive than those grouped under SITC 6 and 8.

Single-digit SITC trade data on US imports from the ASEAN-4 countries were obtained from the US Foreign Trade Highlights (1984, 1986 and 1994 volumes) available at the US consular office in Hong Kong. The exchange rate data were collected from the International Marketing Statistics published by Euromonitor and Statistical Year Book for Asia and the Pacific, United Nations. Consumer price index data for computing the appropriate real exchange rates for China and ASEAN-4 were taken from the World Trade Tables (1995) published by the International Bank for Reconstruction and Development. Our estimation uses annual observations covering the time span of 15 years (1980 -1994).

The empirical results obtained from estimating equations (1) and (2) with the different methods discussed in the last section are presented in Table 1. Since both the dependent and independent variables are in logarithm form, the estimated coefficients on the independent variables represent the elasticities. Table 1 shows that almost all the coefficients have got the signs as we expected: negative for the relative price and positive for the relative product composition ratio. In general, the panel data estimations have much better goodness-of-fit than the separate country regressions⁶.

The F statistics show that the hypothesis of homogeneous slopes and intercept for all countries should be rejected at 1% level. In other words, the simple fixed effects model (2) should be rejected compared with the model showing separated equations for each country (model 1). However, further tests affirmed that model (1) should be rejected in favour of model (3) - panel data model with country-specific intercepts and slopes on relative price. Using the Hausman test, model (3) was then compared with model (4) where the fixed-effects in model (3) was replaced by the random-effects. It was found

⁶ The R^2 for model (4) was not presented here, since it was negative. This could happen as the model was estimated with 2-stage General Least Square method. Consequently, the R^2 for that model does not carry the normal meaning for goodness-of-fit, and cannot not be used to compare with the R^2 of other models.

that model (3) should be rejected in favour of model (4). Hence, in the subsequent discussion of the estimated effects, we will concentrate on model (4)⁷.

Table 1 shows that the market share elasticities with respect to the relative price were the largest for China and Malaysia (price elastic) followed by Singapore and Indonesia (price inelastic). The coefficient for Thailand has got the wrong sign but was not significant. The high market share elasticities with respect to the relative price for China, Malaysia and Singapore may be explained by the fact that these countries have the largest market shares in the US market and their wide range of MLIM and LLIM exports to the US caused them to be in competition with one another. The coefficient for the relative product quality (C) was reported in model (4) to be significant at the 10 per cent level. The coefficient C exhibited a low elasticity value, implying that it was a weaker determinant of changes in market share than the relative prices.

IV Concluding Comments

The analysis of export share elasticities with respect to relative prices adjusted by the real exchange rate suggests a reasonably strong competition for exports share in the US import market among China, Malaysia and Singapore. In contrast, the level of competition for Indonesia and Thailand within the same market niche was either small in magnitude, as in the case of Indonesia, or insignificant, as in the case of Thailand. The emergence of the Chinese market since 1979 was considered to be the major force contributing to the competition. China was observed to be gaining export share in the US market at the expense of all the other ASEAN-4 competitors. This is attributed not only its low wage rate vis-a-vis Singapore and Malaysia, but also the fact that China has succeeded in lowering its artificially high exchange rate since 1979.

Quality or product composition was shown to be a significant determinant of changes in country *i*'s export share. This implies that country *i* has the potential to raise its

⁷ It is of interest to note that the statistical quality of our results was not improved by applying the distributed-lag models (see footnote 2).

competitive edge in terms of gaining export market share if it could increase its product varieties or the capital intensity of its export output. Malaysia, for instance, should be commended in light of the present study for its success in pursuing the policy of increasing the proportion of its exports with high technology and human-capital contents over the last decade or so. Such a structural transformation would be facilitated by the higher per capita income and higher average educational attainment in Malaysia than in China which would render the transition from MLIM exports to human capital-intensive exports sooner in Malaysia than China.

The analytical results above may be improved by incorporating a substitution variable between the exporters and the importer into the model. In previous market share models, changes in market share among exporters on a common import market were assumed to be the result of substitution between exporters only. This may not be reasonable because substitution which occurs between an exporter and the common importer will also change the export shares among the exporters. Where the export price of country i relative to the average of other competitors rose faster than the importer's domestic prices (CPI), we expect exports of country i to be substituted by the importer's own domestic production. The test for such a hypothesis constitutes a topic for more research.

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Table 1. The Estimation Results of the Market Share Model with Both the Individual Country and Panel Data Estimation Procedures

Variables	Individual Country	Panel Data Estimation		
	Estimation Model (1)	Model (2)	Model (3)	Model (4)
Relative price:		-0.59 (5.89)*		
China	-1.24 (4.58)*		-1.27 (5.68)*	-1.19 (5.48)*
Indonesia	-0.09 (0.61)		-0.17 (1.16)	-0.22 (1.54)****
Malaysia	-1.12 (3.37)*		-1.27 (4.53)*	-1.19 (4.44)*
Singapore	-0.63 (2.93)**		-0.75 (5.07)*	-0.75 (5.13)*
Thailand	0.03 (0.12)		0.34 (1.66)****	0.25 (1.25)
Relative product composition ratio:		0.26 (4.91)*	0.08 (1.47)****	0.10 (1.93)***
China	0.12 (0.83)			
Indonesia	0.03 (0.45)			
Malaysia	0.21 (1.20)			
Singapore	-0.18 (0.62)			
Thailand	0.25 (1.98)***			
Constant/fixed effects:				4.37 (4.07)*
China	7.05 (8.51)*	5.08 (17.62)*	7.17 (10.80)*	
Indonesia	2.00 (4.47)*	3.51 (11.23)*	2.24 (4.96)*	
Malaysia	5.38 (3.77)*	3.68 (13.81)*	6.28 (7.21)*	
Singapore	5.97 (6.59)*	4.12 (14.95)*	5.29 (11.74)*	
Thailand	1.80 (2.75)*	3.61 (13.27)*	1.15 (2.03)**	
R-square:		0.93	0.96	
China	0.71			
Indonesia	0.03			
Malaysia	0.70			
Singapore	0.60			
Thailand	0.56			
F-test of model specification ^a		(2) vs (1) F(8,60)=4.81*	(3) vs (1) F(4,60)=0.77	
Hausman test of Fixed vs Random Effects model ^b				(3) vs (4) $\chi^2(6)=0.0001$

Note: Numbers in brackets are t-statistics. * denotes significant at 1% level or better; ** denotes significant at 5% level; *** denotes significant at 10% level and **** denotes significant at 15% level.

a. When the F-test is significant, model (1) should be accepted.

b. When the χ^2 is insignificant model (4) should be accepted.