Market Share Analysis Revisited as a Supply-Demand Model

Bill R. Miller[1], John C. Bullock[1] and Wan T. Huang[2]

Introduction

Shifte in the world supply and/or the world demand for a commodity are events that can alter the structure of international trade. Shifts in supply and demand might result from market development, an advance in technology, the influence of agricultural policy, or a fluctuation in exchange rates. Shane (1990), for example, presents evidence that "Exchange rates are now the single most important variable in determining the environment for agricultural trade."

A basic problem addressed by this paper is to define a model for studying the structure of international market shares of U.S. peanuts so that shifters of supply and demand, such as exchange rate, may be identified relative to endogenous market share effects.

According to Greene (1990), "the identification problem logically precedes estimation." Thus, we hope to show in this article the underlying supply and demand theory that is consistent with market share effects that are either: (1) endogenous share variables that are a function of supply shifters; (2) endogenous share variables that are a function of demand shifters; or (3) endogenous share variables that are a function of both supply and demand shifters. Miller and Huang (1992) have, for example, specified models of market shares without a basis

1.Professor of Agricultural and Applied Economics, University of Georgia, and former Graduate Assistant, Department of Agricultural and Applied Economics, University of Georgia, U.S.A.

2.Professor, Department of Agricultural Marketing, National Chung Hsing University, Taiwan, R.O.C.

for identification. This paper should address the identification problems of their analysis and provide a general framework for identifying models for other traded commodities.

Definition of Market Shares

Richardson (1971b, 300-304) was one of the first to rationalize that the structure of international trade effects a country's total export growth. For a single commodity, a country's total export growth was explained by Richardson as the sum of total growth or market size effect, market or distribution effect and competitive effect. This paper expands the Richardson model by showing that these effects may result from shifts in either supply or demand, or both, in one or more countries. Using Richardson's definitions of a market shares model (CMS):

s= the market share of the focus country;

q,Q= total exports of the focus country and the world, respectively;

c,C= "Competitiveness" of the focus country and the world, respectively.

Expressing market share of the focus country in period t as a function of its relative competitiveness:

$$(1.1)\quad s \equiv \frac{q}{Q} = f\left(\frac{c}{C}\right),\ f'()>0$$

$$(1.2)\quad s(t) = \frac{q(t)}{Q(t)} = f\left(\frac{c(t)}{C(t)}\right),\ f'()>0$$

Equation 1.2 can be Rewritten as:

$$(1.3)\quad q(t) = s(t)Q(t)$$

Differentiating 1.3 with respect to time yields

$$(1.4) \quad \frac{dq}{dt} = s\frac{dQ}{dt} + Q\frac{ds}{dt}$$

Letting the dotted variable denote that varriable's time derivative, equation 1.4 can be rewritten as:

$$(1.5) \quad \dot{q}_i = s\dot{Q} + \dot{Q}s \qquad i = 1$$

Export growth ($\dot{q}_i$) of the focus country, assuming one export ships to a world market (one importer), is explained by a market size or total growth effect ($s\dot{Q}$), and the competitive effect ($Q\dot{s}$) in equation 1.5. When there are j importers then effects must be summed. Summing over all the j importers will yield the amount of export growth for the ith exporter of interest, or focus country. This is denoted by equation 1.6:

$$(1.6) \quad \dot{q}_i = \sum_j s_j\dot{Q}_j + \sum_j \dot{s}_j Q_j \qquad i = 1' \; j = 1....J$$

Richardson's (1971a, 229) expansion of 1.6 by two additional terms specifies the multimarket case for the ith focus country (i.e., many exporters (i) and many importers (j)):

$$(1.7) \quad \dot{q}_i = s\dot{Q} + \sum_j s_j\dot{Q}_i - s\dot{Q} + \sum_j \dot{s}_j Q_j$$

When i is greater than one, the ith exporter (focus country) must share the total growth in markets with other exporters. Thus, the market growth effect measured by $\sum_j S_j\dot{Q}_j$ in equation 1.6 may be different from world growth $S\dot{Q}$ in equation 1.5. When there is only one exporter ($i = 1$) these terms are by definition equal. If, however, the j markets of exporter i are a subset of all world markets, then the j markets of the ith exporter may be growing at a differential rate from the world total. The difference is defined as the distribution ef-

fect. Because of space and time influences we should expect a distribution effect and add it to the effects of market size and competition as in equation 1.7.

The term $(s\dot{Q})$ in equation 1.7 is the total growth or market size effect. This effect measures what the ith country's export would be, provided there are no changes in the ith shares of total world exports and may be either positive or negative depending upon whether positive or negative growth occurs. The distribution effect is $\sum_j s_j\dot{Q}_j - s\dot{Q}$. This effect measures how the focus country's exports to specific importing markets might differ in relation to world exports of the commodity. If, for example, there is only one exporter, this effect is zero. See equations 1.5 and 1.6. Finally, the competitive effect $\sum_j \dot{s}_j Q_j$. The competitive effect accounts for all export growth which arises from a change in market shares. If no change in market share occures, there is no competitive effect.

Shaub, Ames, Rigaux and Sprott, for example, have demonstrated applications and the computational aspects of the theory. Their studies of market shares have tended to be descriptive, as the theory indicates, but have not provided desired links with supply-demand theory. Such links, however, might prove useful in identifying and estimating econometric models of the basic structure of change. These links may be presented in a set of supply-demand diagrams that define each of the market size, distribution and competitive effects as positive while the other two effects are zero. The diagrams are presented in the classical interregional trade scenario and thus may be applicable to commodities other than peanuts. Shaub's computational technique may be applied to show the consistency of the diagrams with Richardson's definitions.

CMS in a Supply-Demand Framework

Variables denoting an exporter, an importer, or the world are:

A= Exporter A; Y= Importer Y; B= Exporter B; Z= Importer Z; and W= World

The first subscript of a supply or demand curve (S or D) denotes a location, either an exporter or an importer. The second subscript denotes a time period. To denote a total for a market, a dot is used in lieu of the first subscript.

World Market Equilibrium Defined for all Effects Equal Zero

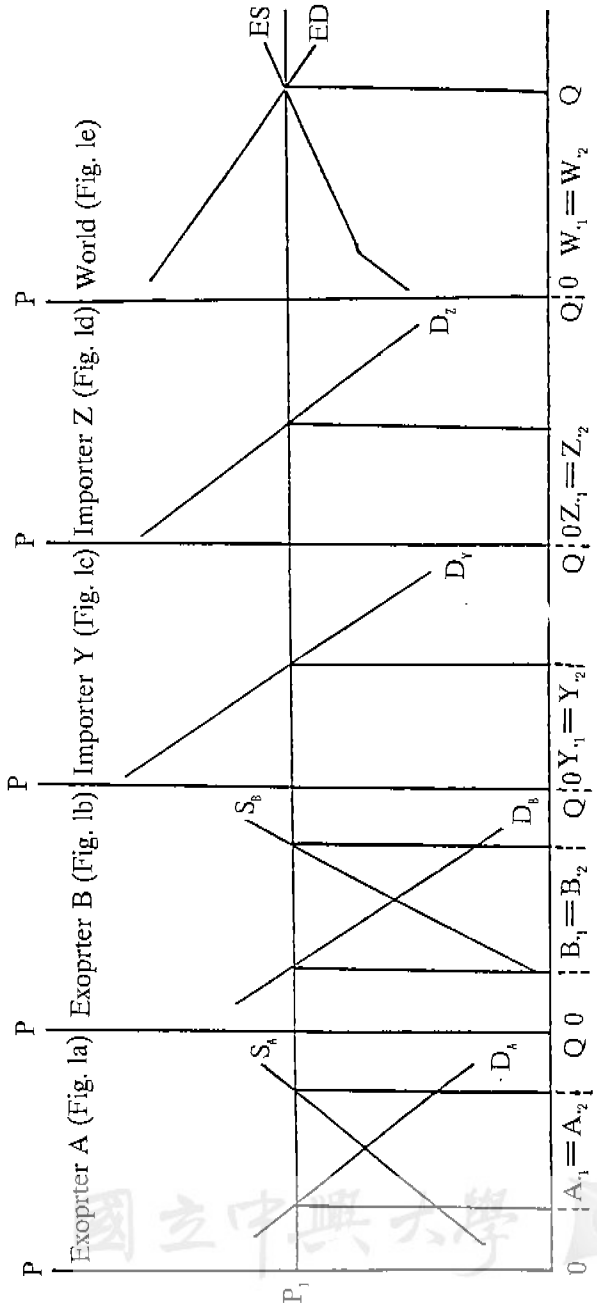


Figure 1. Market Equilibrium: No Changes in Volume of Trade

The initial scenario begins with no chages in the volume of trade from period one to period two (figure 1).

Figure la depicts supply and demand of peanuts in Exporter A which has excess supply. For a given world price P_1, excess supply in Exporter A equals A_{Y1} plus A_{Z1} where A_{Y1} and A_{Z1} are the excess supplies of peanuts shipped from Exporter A to Importers Y and Z, respectively, in period one. Similar logic applies to Exporter B.

The importing countries are assumed not to be peanut producers. This assumption is in fact representative of world peanut trade. The supply for Importer Y and Importer Z is assumed to intersect the price axis at zero quantity. Thus, the demand curve for peanuts in Importer Z is denoted by D_z ,which is also the excess demand curve for the example case.

Figure le depicts world market equilibrium of aggregate excess supply and demand (horizontal summations). The distance between the zero axis and the solid vertical line represents the equilibrium amount of peanuts shipped from all exporters to all importers. Equilibrium is denoted by $W._1$, which means that $A._1$ plus $B._1$ equals $Y._1$ plus $Z._1$,in period one. Also $W._2$ means that $A._2$ plus $B._2$ equals $Y._2$,in period two. That is, excess quantity supplied equals excess quantity demanded at constant world equilibrium price (P_1) in both periods (i.e., $W._1$ equals $W._2$).

If no change in the volume of trade by any country occurs from period one to period two, none of Richardson's CMS effects have any value; hence, there is no export growth.

The Market Size Effect

The CMS market size effect measures the impact on an exporting country of a change in the volume of world trade if that country maintains its share of the aggreagate market. An important assumption is that the market size effect might result from an increase or decrease in the global demand for a commodity.

Graphic Example of a Market Size Effect

The impact of the market size effect, when the distribution and competitive effects are zero, is illustrated in Figure 2. Supply and demand for Exporter A is depicted in figure 2a.

If excess demand for world peanuts shifts to the right, world price P_1 increases to P_2. The increased price encourages Exporter A and Exporter B to ship more peanuts to Importer Y and Importer Z. Total export shipments from Exporer A increases from $A._1$, in period one, to $A._2$, in period two. Peanut shipments owuld also increase from $B._1$, in period one, to $B._2$, in period two. The new quantity demanded of peanut shipments (excess quantity demanded at world price) for Importer Y is $Y._2$.

The additional volume of trade that results from an increase in excess demand ($W._2$ minus $W._1$) is the amount of export growth. A numerical example of the market size effect computed by applying Schaub's technique will show a positive market size effect and zero effects for distribution and competitive effect.

The Distribution Effect

The distribution effect measures an overall increase or decrease in export growth by analyzing gains or losses in a focus country's exports resulting from changes in relative sizes of export markets (Schaub 1987).

Graphic Example of a Distribution Effect

An example of the distribution effect acting alone can be illustrated by a rightward shift in the demand of peanuts in one importing country, accompanied by a leftward shift in the demand of peanuts in the other importing country. Thus, as the relative sizes of markets change, shippers who capture the expanding demand will gain a distribution effect relative to shippers who trade in the declining market. However, opposite shifts in the supplies of peanuts in the exporting countries must occur to keep the competitive effect at zero and thus isolate the distribution effect (figure 3).

In this example, excess quantity supplied, excess quantity demanded and world price remain constant from period one to period two. This is due to offsetting shifts in the supplies from the exporters, and offsetting shifts in demand, by the importers. The increase in excess demand for peanuts in Importer Y is offset by the decrease in excess demand for peanuts in Importer Z. The increase in excess supply of peanuts in Exporter A is offset by the decrease

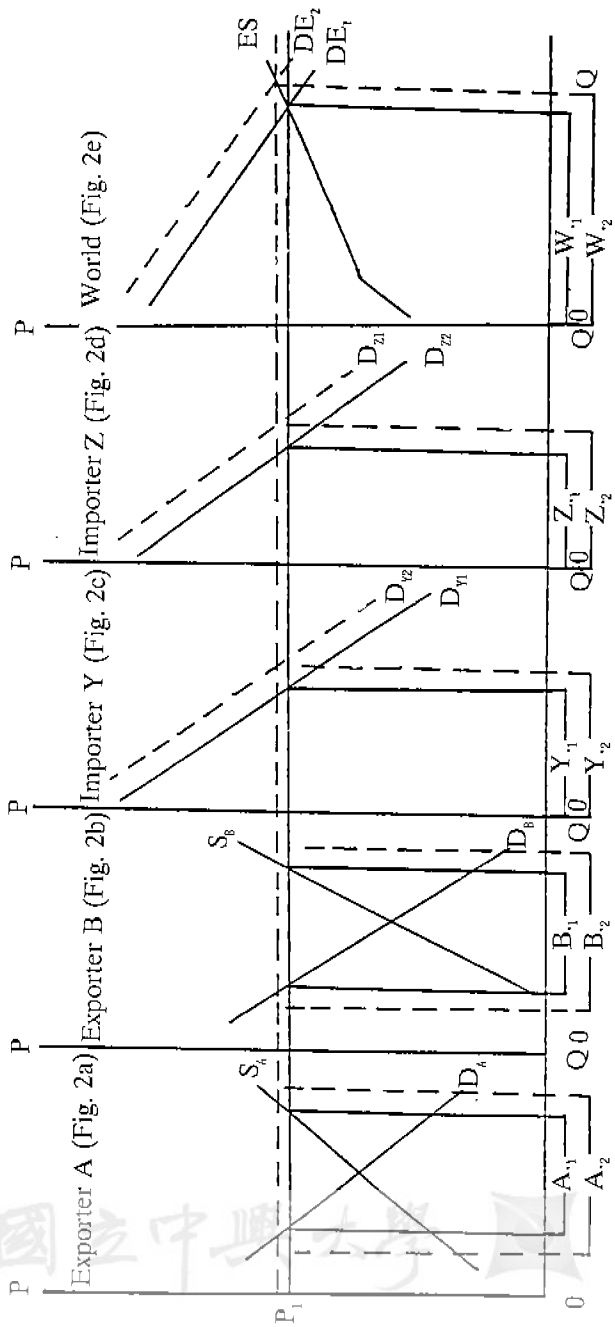


Figure 2. Market Size Effect : Global Change in Demand

inexcess supply for peanuts in Exporter B. However, no change in total world trade does not mean there were no chages in export growth. Exporter A experienced positive export growth because of trade in a growing market. Exporter B experienced negative export growth because of trade in a declining market. The particular supply and demand shifts were designed so the distribution effect could be computed as positive for the focus country A (by Schaub's technique), while making the market size and competitive effects equal zero for A.

The Competitive Effect

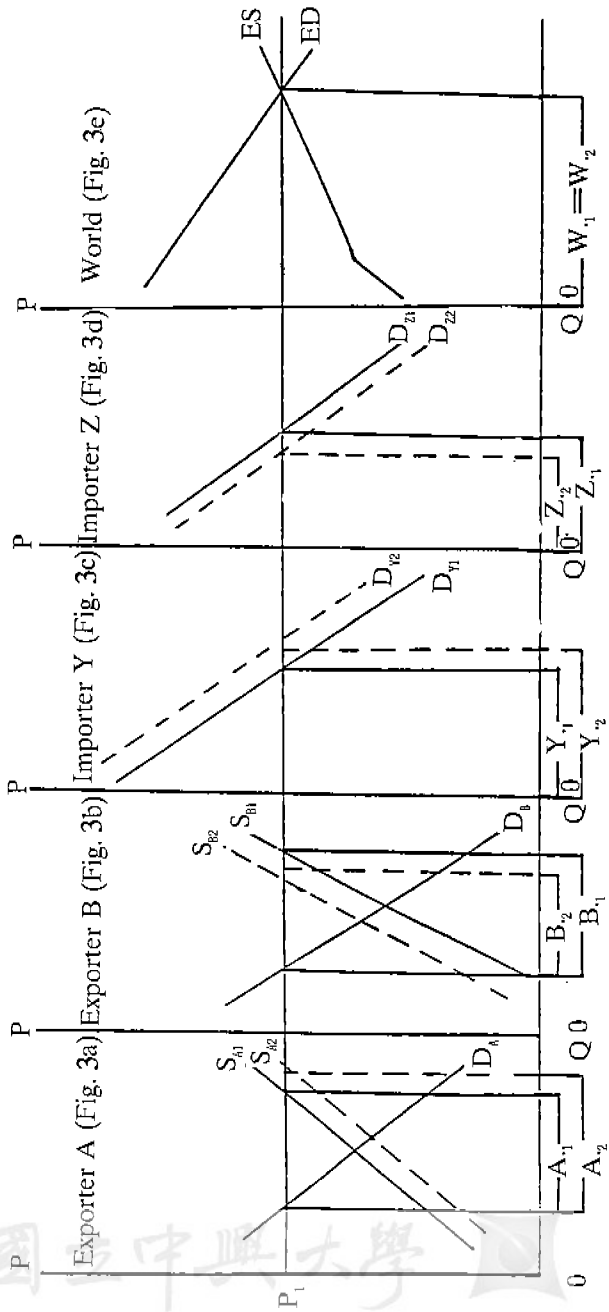
Richardson (1971, 236) defines a competitive effect simply as the export growth which arises from a chage in export market shares. The term "competitiveness" may be somewhat misleading in the context it is used. Economists use the word "competition" to describe acceptance of market forces and not aggressive "rivalry" among individuals (Binger and Hoffman). In the CMS model, the term competitiveness is said to include all factors, which the exporter may or may not control, that may result in a change of market shares. An exporter's competitiveness is said to arise not only from efficiencies and other advantages intrinsic to the exporter, but also from forces acting in importing countries and competing exporters alike (Schaub 1987).

Critics of the model suggest the term competitiveness should not be used. Instead, export growht attribtued to changes in market shares should be referred to as simply the residual. However, in the following example, the competitive effect can clearly be shown to result from a shift in supply.

Graphic Example of a Competitive Effect

The example presented here is that an advancement of technology in Exporter A, not yet obtained by Exporter B, would result in a competitive effect (figure 4). In Exporter A, this advancement in technology would cause a rightward shift in supply.

The competitive effect resulting from the shift will measure export growth due to a change in market shares. Other computed CMS effects (i.e. the market size and the distribution effect) in this example can be shown to be zero. According to the supply-demand exam-



Figrue 3. Distribution Effect : Changes in Supply and Demand

ple, an advance in technology shifts the supply curve thus allowing Exporter A to sell at a lower price. As a resutl, world price decreases from P_1 to P_2. Exporter A becomes a more efficient competitor because of the new technology and the supply shift.

Application

Market, distribution and competitive effects were computed each year to describe annual changes in the world peanut market over the period 1962-1987. A time series of endogenous variables were thus available for analysis. According to the theory, the market and distribution effects are ednogenous varialbes that result from shifts in demand. Thus, important demand shifters such as exchange rate, income and population were specified to explain these effects. The theory identifies compeititive effect as an endogenous variagle affected by supply shifts. Important supply shifters such as technology and government policy were specified to explain competitive effect.

So far, the econometric analysis of the models yields expected signs that are significant and consistant with theory and enables researchers (Miller and Huang) to isolate the relative impacts of important policy varialbes. For example, current models support the hypothesis that exchange rates have had important impacts on U.S. market shares, but these effects are not as important impacts on U.S. market shares, but these effects are not as important as U.S. supply shifters including drought and government policy. Various econometric models are being constructed using abundant secondary data that are available. Extension of the research to other commodities is planned.

Time series data on trade flows are easily constructed. The suggested methodology is to 1) compoute the market share effects; and 2) specify econometric models based on the idenfication properties of each effect. The identification properties of market share varialbes are clarified in the article by supply and demand theory. Each share effect is identified by either demand shifters (for market effects), supply shifter (for competitive effects) and a combination of demand shifters in importing countries and supply shifts in exporting countries identifies distribution effects.

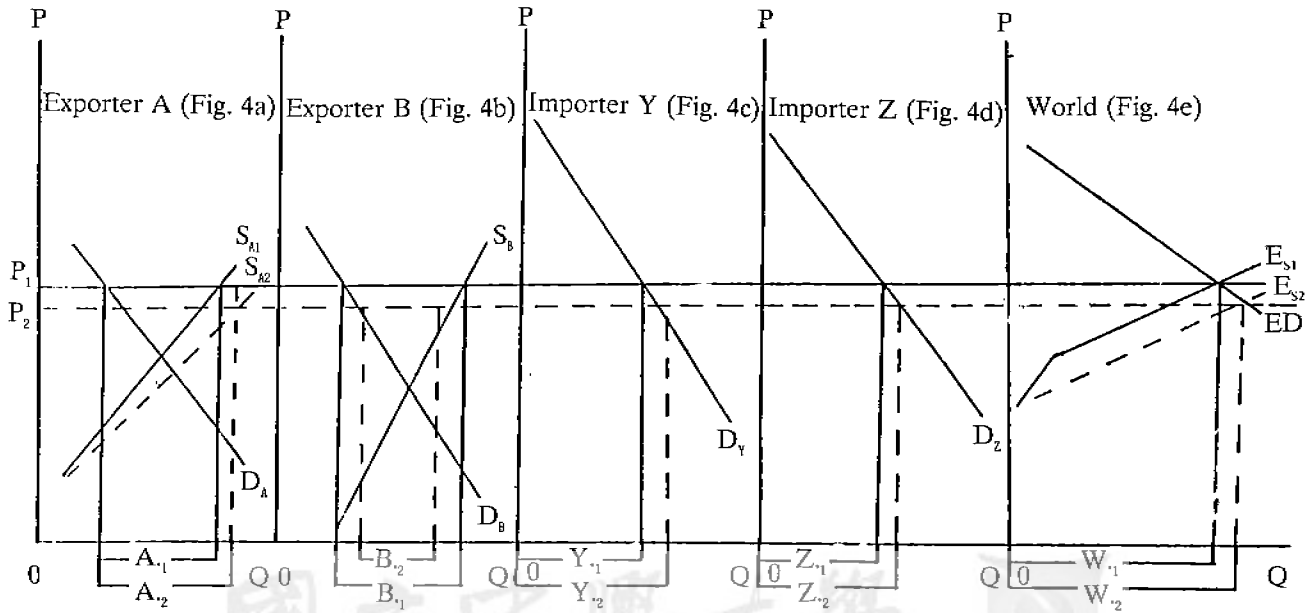


Figure 4. Competitive Effect : Shift n Supply One Exporter

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市場佔有率分析在供需模式之應用

米勒* 布拉克* 黃萬傳**

摘 要

本文旨在由理論說明供需理論與市場佔有率效果之一致性，即(1)佔有率變數爲供給移動函數之內生變數；或(2)其亦爲需求移動函數之內生變數；或(3)其同時爲供需移動函數之內生變數。于1992年，米勒和黃萬傳一文已設定美國花生外銷市場佔有率模式，但乏認定基礎；依此，本文即以上述三個觀點來闡明前文之認定基礎。

由文中理論之探討，發現市場效果和分配效果可做爲來自需求移動之內生變數，如匯率、所得和人口皆可用來解釋此等效果；另發現競爭效果可做爲供給移動之內生變數，如技移和政府政策可說明該效果。

*美國喬治亞大學農業與應用經濟系教授與前研究生助理。
**國立中興大學農產運銷研究所教授。