RESOURCE MOBILITY, DIVERSIFICATION, AND THE COMPENSATION REQUIREMENTS OF TRADE REFORM

by

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1. INTRODUCTION

The agricultural sector has evaded the attempts of multilateral trade reform in the past several rounds of the GATT. The current round of negotiations of the General Agreement on Trade and Tariffs (GATT) represents another significant initiative in potential multilateral economic reform, and once again the highly protected agricultural sector appears to be a major obstacle for an agreement. Although several attempts have been made to explain this phenomena on the basis of political economic rent seeking, these models do not adequately explain why agriculture receives protection over and above the protection received in other sectors in virtually all developed countries. In this paper, we develop a thesis that we believe explains at least part of the inability to reform agricultural policy. We show that the degree of resource mobility and the diversification of ownership of assets both have significant impact on the compensation requirements of trade reform. In particular, we then argue that the compensation requirements for individuals in agriculture are likely to be very high due to the immobility of agricultural inputs and the undiversified, family farm structure of ownership in the sector.

With great frequency, interest groups seek and block reform of government policies that increase their wealth, often at the expense of society as a whole. This undesirable aspect of government policy has been described as government failure, and models of rent seeking have successfully been used to explain it (e.g., Becker, 1983, Bhagwati, 1982, Krueger, 1974, Mayer, 1984, Tullock, 1967). Within these models it is in the interest of groups to seek and promote government policies that increase their wealth at the expense of the size of the economy as a whole. Given that government failure decreases the size of the economy, if any one is to gain from the policy, the generated rents must go to a limited number of individuals in the society. In most models, limited access to policy-generated
rents is usually derived from the ownership of some fixed resource, but it could also come from a particular set of consumer preferences that differentiates one group from another in society.

In this paper we pursue an expanded framework. We argue that the policies that are pursued within a country, and the ability to achieve reform, are a function of the mobility of the resources within the economy and the distribution of ownership of those resources. Policies that affect the mobility of the resources and the distribution of ownership can permanently alter the political economic equilibrium path of development in the economy. In particular we show that resource ownership and mobility can play a major role in the effect of trade liberalization on interest groups who, in turn, will influence the likelihood of reform.

Not all citizens of a country moving toward free trade will benefit from the transition. For the policy change to be Pareto improving, compensation must be paid to the losers of reform. The amount of compensation that would bring about a Pareto improvement is a function of preferences, resource ownership of each person, and the mobility of those resources. We term this level of compensation Pareto fulfilling. A measure of Pareto-fulfilling compensation is relevant for several reasons. From a normative point of view, the Pareto-fulfilling levels would indicate whether or not a proposed change unambiguously increases individual citizen's welfare; and, if the change creates losers, the levels would indicate whether or not the distributional consequences of the change are practically important.

From a positive, political-economic perspective, an understanding of Pareto-fulfilling compensation would form the basis for assessing the likelihood of reform taking place. Given that losers from a policy change can delay, restrict, or even block the change, the Pareto-fulfilling compensation represents a real barrier for the trade reform process. For example, one important implication that emerges from this model, among others, is that, with any skewness in resource ownership, more and more groups will suffer as a country liberalizes its
trade restrictions. A measurement of the magnitude of the potential compensation required may provide the upper bound of the budgetary exposure of a contemplated change, which indirectly can effect the likelihood of successful reform. The compensation of losers to obtain trade liberalization is not merely a theoretical construct, but often a practical necessity. There are several examples where governments have made payments to individual persons or groups in compensation for moves toward free trade. For instance, the Canadian government made payments to Canadian wine producers in compensation for the removal of trade barriers brought about by the 1989 Canada-U.S. Free Trade Agreement (FTA). This compensation scheme promised wine producers the full value of their assets employed in wine production in the event the FTA was ratified. Other groups in Canada were less successful in receiving direct compensation for the FTA but did receive concessions in terms of lengthy phase-in periods for trade reform. Another example of compensation to gain acquiescence to trade reform is the case of Australian milk protection quotas, which artificially inflated domestic prices through production controls. Rather than simply do away with the protection, the government purchased the production quotas from producers and then eliminated the program.

In the remainder of the paper we examine the effects of diversification and resource mobility on the potential compensation requirements of trade reform. A general framework is presented for examining the interaction of diversification and resource mobility on the Pareto-fulfilling compensation associated with trade liberalization. Using this framework it is possible to identify a priori the conditions under which the potential compensation requirements of trade reform are likely to be large. In particular, if trade reform harms an industry employing much sector-specific capital and this capital is not widely held by interest groups, then Pareto-fulfilling compensation likely will be large. In contrast, complete diversification of resource ownership eliminates the need for compensation to politically support trade reform. Similarly, unencumbered mobility is a sufficient condition for trade
liberalization to be Pareto optimal. In essence, diversification substitutes for immobility, and vice versa, in the achievement of Pareto-efficient trade reform. Under either of the two conditions, complete diversification or unencumbered mobility, policies designed to enhance total social surplus will dominate policies of wealth redistribution. In fact, under either of these two conditions, there are no incentives for individuals to form coalitions to block moves from the status quo.

2. THE WELFARE EFFECTS OF TRADE REFORM

The study of the welfare effects of trade reform has long been a part of international trade theory. Some studies focus on the effects at the industry level (Corden, 1969, Meade, 1955, Bhagwati, 1971), while others concentrate on the implications of reform on the distribution of return to resources employed in production (Heckscher, 1949, Jones, 1970, Stopler and Samuelson, 1941). The effects of resource mobility have been studied extensively and have become central to neoclassical trade theory. In more recent literature, the effects of resource mobility have been studied in a many good economy (Jones, 1975).

Resource mobility and ownership diversification are important factors in the distributional impact of trade reform. Resource mobility is determined in part by technical relationships but can be enhanced through the provision of unemployment insurance, social assistance, and retraining programs; and can be restricted, especially in the case of labor, by work and housing restrictions, licensing, and guild and union barriers. Diversification of the ownership in the economy is perhaps more frequently a function of the economic regulation and subject to political influence. Government promotion of diversification of resource ownership and the existence of markets for contingent claims may be vehicles for increasing the propensity for trade reform.

Generally, the motive for individuals to diversify the portfolio of assets they own is to reduce risk or the variability of returns. By owning a portfolio of risky assets an individual
can reduce and effectively manage risk. Yet we observe many resources or sector-specific assets that are not widely held in the economy. This lack of diversification may be explained by two economic forces. First, the existence of insurance, financial instruments, and government policies that stabilize income may reduce the underlying risk. Thus, the existence of government compensation schemes may impede a "natural" level of diversification. Second, high transaction costs associated with diverse ownership may make diversification prohibitively expensive. These high transaction costs may be the result of a market failure but are often the result of some underlying principal-agent problems that make efficient contracts prohibitively expensive to enforce. The classic example of such a case is the ownership and operation of farms. The vast majority of the world's grain production continues to be grown by largely undiversified owner-operator enterprises. This industry and similar industries with similarly high transaction costs may resist attempts to promote the diversification of ownership in these industries.

In order to examine the Pareto-fulfilling compensation levels under trade reform, we first consider the case of a small country. For a small country, free trade would be optimal based on the criterion of maximizing total social surplus but individual groups gain and lose disproportionately with reform. After we present the small country case, we turn to an alternative specification where the level of a country's imports affects the world price. The case of a large country with market power is similar in determining Pareto-fulfilling compensation, although free trade is no longer the optimal policy in order to maximize total social surplus.

The instrument of trade distortion examined is a quota on imports which controls the domestic price level relative to the given world price level. The rents generated by the quota are allocated to each factor in the import industry in proportion to the factor shares. In effect, the quota is equivalent to a tariff on imports and exports where the tariff revenue is returned to the effected sectors. This specification of income is consistent with the existence of an
import monopoly in which the profits are distributed to the owners of resources employed in the production of the import good.

The import monopoly could be a state organization, a state-sanctioned organization, or a private monopoly. In the case of a state organization, the quotas are set with the government objectives in mind. In the case of a private monopoly, the quota level will be set to maximize the sum of the return from production and the import quota rents. With the former, trade reform would entail the removal of the import quota; and, in the latter, it may require a change in the regulation of the monopoly. In either case, the move to free trade represents a potential Pareto improvement in the economy and the losers of the reform process may have to be compensated for the reform. In a two-sector open economy with a balance of payments constraint, it is irrelevant whether the trade policy is imposed on exports or imports.

As a further simplification, we have presumed that the economy is competitive with no other distortions. Without this assumption, the effect of removing one distortion may not be even potentially Pareto improving. This difficulty in determining the effects of piecemeal policy reform were pointed out in trade theory by Meade (1955) and Viner (1950) in the early 1950s.¹

3. THE MODEL

Conditions under which trade reform without compensation is Pareto improving and the conditions under which compensation to some individuals is required to meet the Pareto criterion are presented in this section. These conditions are derived using a simple two-sector trade model that emphasizes diversification of resource ownership and thus provides a different focus than previous models (Staiger and Tabellini, 1987, Mussa, 1982, Mayer, 1984, Eaton and Grossman, 1985).
The economy of $N$ persons is represented in a two-sector (goods A and B) open-economy model. The country produces $A_x$ and $B_x$, consumes $A_c$ and $B_c$, imports $A_c - A_x$, and exports $B_x - B_c$. Imports and exports are carried on with rest of the world at fixed world prices. Prices are determined in competitive markets, implying that the domestic and world prices of good $B$ will be equal in equilibrium, regardless of quota (or tariff) on good $A$. The wedge between the domestic price of $A$ and its world price will reflect the restrictions on trade. There exists a quota, $Q$, on the imports of good $A$; that is, $Q \geq A_c - A_x$. Prices are normalized such that the world and domestic price of good $B$ is equal to one; and $P_w$ and $P$ represent the world and domestic price of good $A$.

The production of $A_x$ and $B_x$ takes place in competitive sectors of the economy with identical and homogeneous degree-one production functions. Production takes place in both sectors using positive levels of two inputs; a mobile resource, $L$, the returns to which equilibrate across sectors; and an immobile resource, $K$. For example, the two types of resources may be thought of simply as labor and capital, or as capital (perhaps human capital) not specific to an industry, and capital specific to each industry. The inputs devoted to the import industry, $L_A$ and $K_A$, and those devoted to the export industry, $L_B$ and $K_B$, are constrained by the total resource available to the economy: $L_A + L_B \leq L$ and $K_A + K_B \leq K$.

To be explicit, the production relationships are given by

$$A_x = f(L_A, K_A) \quad \text{and} \quad B_x = f(L_B, K_B).$$

(1)

In equilibrium, decentralized income is a function of the general level of prices (which are functions of the level of quota employed) and the share of each resource in each sector. The gross income in sectors $A$ and $B$, respectively, are:

$$Y_A = PA_c - P_w (A_c - A_x)$$

(2a)

or
and

\[ Y_B = B_x. \tag{2c} \]

Note that, in this formulation, the quota value is attributed to income in the import-competing sector. Given a binding quota, national income is defined by

\[ Y = PA_x + (P - P_w)Q + B_x. \tag{3} \]

The per-unit wage earned by the mobile resource, \( w \), is common across industries; and firm managers use the input until its marginal product equals the wage: \( P \partial A_x/\partial L_A = w = \partial B_l/\partial L_B. \)

Using the Euler equations, factor shares of \( L_A, K_A, L_B, \) and \( K_B, \) are:

\[ \alpha_L = \frac{wL_A}{PA_x}, \quad \alpha_K = \frac{r_AK_A}{PA_x}. \tag{4a} \]

\[ \beta_L = \frac{wL_B}{Y_B}, \quad \beta_K = \frac{r_BK_B}{Y_B}. \tag{4b} \]

The quota value is attributed to income in the import sector and divided among the inputs according to factor shares. This is equivalent to an import tariff or an export tariff where the tariff is returned to the resource owners in the import sector in proportion to their share of domestic revenues.

In this economy, the consumption and the utility of individuals is determined by their preferences, the prices they face, and their incomes. In a general-equilibrium setting, their incomes will be determined by the resources each individual owns and the aggregate output and trade of the general economy. The output of the economy will, in turn, be a function of prices that is a function of the level of import quota. Using these linkages it is possible to determine the effect trade policy has on individual utility. The primary tool of analysis will be
the indirect utility function of individuals. Let $V_j$ represent the indirect utility function of individual $j$:

$$V_j = \int [P(Q), Y_j(Q)].$$

(5)

The effect of an incremental change in the quota level on $V_j$ is found by using the chain rule:

$$\frac{dV_j}{dQ} = \left[-A_{cj} \frac{\partial P}{\partial Q} + \frac{\partial Y_j}{\partial Q}\right] \cdot \frac{\partial V_j}{\partial Y_j}$$

(6)

where the individual demand for the import good, $A_{cj} = \frac{-\partial V_j/\partial P}{(\partial V_j/\partial Y_j)}$.

The standard gains-to-trade argument for a competitive economy holds—that total income is maximized where $P = P_w$, that is, when the quota is nonbinding. If a quota is in place and removal of the quota constraint is Pareto improving (i.e., all individuals are at least as well off), then reform will certainly take place. If, on the other hand, reform decreases any individual's welfare, the government may be forced either to retain the trade restriction in order to prevent the change in terms of trade or to compensate the losers to attain acquiescence to the reform. The potential compensation requirement can be derived in the following manner. Suppose there is a change in the quota level from $Q_0$ to $Q_1$ resulting in a change in the price-income pair from $(P_0, Y_{j0})$ to the pair $(P_1, Y_{j1})$. The level of compensation necessary to make the $j^{th}$ individual just as well off as without the policy change is the familiar compensating variation measure, $CV_j$:

$$V_j(P_1, Y_{j1}, + CV_j) = V_j(P_0, Y_{j0})$$

(7)

For incremental changes in $Q$, the change in the level of $CV_j$, represented by $C_j$, is given by

$$C_j = A_{cj} \frac{\partial P}{\partial Q} - \frac{\partial Y_j}{\partial Q}.$$  

(8)

This simple framework will be used to derive propositions that describe the relationship between preferences, resource ownership, and resource mobility on the Pareto-fulfilling
compensation associated with reform. First, consider the usual case that demonstrates the potential gains from free trade. In a two-sector economy, individuals with identical preferences and equal resource ownership are sufficient to show that moves to free trade are Pareto improving. As a result, the potential compensation requirement is zero for all individuals.

The condition of equal resource ownership, however, is not necessary. Take a representative individual with consumption levels of $A$ and $B$ equal to some fraction of total consumption: $A_i = \gamma A_i A_c$ and $B_i = \gamma B_i B_c$. The individual consumer's assets are diversified in the sense that the consumer has a claim to a share of national income that is invariant to changes in the quota or prices. That is, the individual's income is some fraction of national income:

$$Y_j = \omega [PA_x + (P - P_w)Q + B_x].$$  \hspace{1cm} (9)

For homothetic preferences, identical across consumers, $\omega_j = \gamma A_j = \gamma B_j$. The effect of relaxing the quota on an individual's welfare can be examined using the effect on the individual $j$'s indirect utility, $V_j$. From expression (9), the effect of a change in quota on national income is given by

$$\frac{dY}{dQ} = A_x \frac{\partial P}{\partial Q} + P \frac{\partial A_x}{\partial Q} + Q \frac{\partial P}{\partial Q} + \frac{\partial B_x}{\partial Q} + (P - P_w).$$  \hspace{1cm} (10)

Given that a change in the quota only affects use of the mobile resource in each sector, and that the total amount of the resource is unaffected by the change, we note that

$$P \frac{\partial A_x}{\partial Q} + \frac{\partial B_x}{\partial Q} = P \frac{\partial A_x}{\partial L_A} \frac{\partial L_A}{\partial Q} + \frac{\partial B_x}{\partial L_B} \frac{\partial L_B}{\partial Q} = w \frac{\partial L_A}{\partial Q} - w \frac{\partial L_A}{\partial Q} = 0.$$  \hspace{1cm} (11)

Therefore, noting that $A_c = Q + A_X$, the change in the $j^{th}$ consumer's income is given by

$$\frac{dY_j}{dQ} = \omega_j [A_c \frac{\partial P}{\partial Q} + (P - P_w)].$$  \hspace{1cm} (12)
Using (6) and (12), the effect on the $j$th consumer's welfare is given by

$$\frac{dV_j}{dQ} = [(1 - \gamma_{Aj} / \omega_j) A_j \frac{\partial P}{\partial Q} + (P - P_w)] \cdot \omega_j \frac{\partial V_j}{\partial Y_j}. \quad (13)$$

This leads to the following proposition.

**Proposition 1:** Under identical, homothetic preferences, complete diversification of all individuals in ownership of resources assures the Pareto optimality of trade liberalization.

**Proof:** With identical homothetic preferences, the first item in the square brackets vanishes and $dV_j/dQ > 0$ when $P > P_w$ or utility increases with increases in quota until $dV_j/dQ = 0$ when $P = P_w$, that is, when the quota is nonbinding.

Note complete diversification is implied by the invariance of $\omega_j$ with respect to quota and prices; it does not imply that all persons are identically endowed. Identical endowments are those such that $\omega_j = 1/N$ for all resource owners. Also note, diversification is not sufficient for relaxed quotas to be Pareto improving when preferences are not homothetic. When a consumer has a lower share of consumption of the imported good than of the national income, then the Pareto-fulfilling compensation level may be positive. In fact, as can be seen in equation (13), $(P - P_w)$ approaches zero as the import quota, $Q$, approaches the free-trade level, and the compensation level becomes positive for anyone who spends less than average share of his income on the import good—i.e., $(1 - \gamma_{Aj} / \omega_j) > 0$. Although national income will increase, the real income of these citizens will decrease.

This proposition indicates that in economies where the portfolio of all individuals is identical, trade reform is Pareto improving. In developed economies, where the investment markets are fully developed, complete with pension and mutual funds, a nearly balanced portfolio may be representative of many individuals. In lesser developed countries (LDCs) the portfolio of individuals of nearly all individuals is likely to much less diversified. This lack
of diversification can in turn influence the compensation requirements of reform. Thus, all other factors being similar, the lack of capital markets may in itself create an obstacle for economic reform in the LDC's.

4. RESOURCE MOBILITY AND THE EFFECTS OF DIVERSIFICATION

In order to illustrate the combined effects of resource mobility and diversification, further structure must be added to the model. We begin with mobility assumptions employed by Jones (1970). The input, L, is perfectly mobile between sectors while the inputs, KA and KB, are not. The assumption of perfect mobility of one input is not unduly restrictive. If one wished to introduce imperfect mobility of a factor, such as has been often done with labor (Mussa, 1982), the input, L, could represent fully transferrable skills and the immobile component could include human capital as well as other immobile assets. Diversification is introduced into the model by assuming that each individual in society holds a portfolio made of the mobile input and the sector specific inputs in each of the two sectors. The income of each individual is a function of the assets he holds and the returns accruing to each of those assets.

We assume the factor share of labor in the two sectors are identical such that \( \alpha_L \) equals \( \beta_L \)—that is, \( \alpha_L = \beta_L = \alpha. \) Without loss of generality, we make several notational simplifications and normalizations to clarify the relationship between diversification and resource mobility: The units of measure are chosen such that the total endowment to society is one unit of the mobile resource \( (L = 1) \), one unit of the immobile resource in the import-competing industry \( (K_A = 1) \), and one unit of the immobile resource in the export-oriented industry \( (K_B = 1) \).

Define \( \lambda_j \) as the \( j^{th} \) person's share of the labor resource: \( \lambda_j = L_j / L \). From the Euler equations (1) and (2), the \( j^{th} \) person's income from the mobile resource is given by \( \lambda_j \alpha Y \). The income from the immobile resource is given by

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\[
(1 - \alpha) \cdot (\frac{K_{Aj}}{K_A} Y_A + \frac{K_{Bj}}{K_B} Y_B) = \theta_j 2(1 - \alpha)[\mu_j Y_A + (1 - \mu_j) Y_B].
\]  

(14)

where \( \mu_j = \frac{K_{Aj}}{(K_{Aj} + K_{Bj})} \), the share of the \( j^{th} \) person's immobile resources in the \( A \) industry, and \( \theta_j = (K_{Aj} + K_{Bj}) / (K_A + K_B) \) is the \( j^{th} \) person's share of the total amount of the immobile resource. The \( j^{th} \) person's total income is given by

\[
Y_j = \lambda_j \alpha Y + \theta_j 2(1 - \alpha)[\mu_j Y_A + (1 - \mu_j) Y_B].
\]

(15)

Complete diversification of the individual's ownership of immobile resources across industries \( A \) and \( B \) occurs where \( \mu_j = 1/2 \).

**Proposition 2:** Complete diversification of all individuals in the ownership of immobile resources, assures the Pareto optimality of trade liberalization.

**Proof:** Expression (15) can be rewritten in terms of the total incomes of the two industries, \( Y_A \) and \( Y_B \):

\[
Y_j = [\lambda_j \alpha + \theta_j 2(1 - \alpha)] \cdot Y_A + [\lambda_j \alpha + \theta_j 2(1 - \alpha)](1 - \mu_j) \cdot Y_B.
\]

(16)

Setting \( \mu_j = 1/2 \) with complete diversification of ownership of the immobile resource between import-competing and export-oriented industries, the individual's income is proportional to national income; and the proportion will not vary with the quota level:

\[
Y_j = [\lambda_j \alpha + \theta_j 2(1 - \alpha)] \cdot Y.
\]

(17)

Thus, by the argument used in Proposition 1, this ensures the Pareto optimality of trade reform.

This result indicates that it is not necessary to own a diversified portfolio of all resources to ensure the Pareto optimality of trade reform. Rather, the diversification is required only in the immobile inputs. For example, an individual could be heavily concentrated in the ownership of unskilled labor in the import sector, but because of the
mobility of the labor he may favor free trade. Thus, mobility is a substitute for ownership diversification.

The substitution of mobility and diversification of is further illustrated, where $\mu_j \neq 1/2$, the change in income with respect to a change in the quota is equal to

$$ \frac{dY_j}{dQ} = \left[ \lambda_j \alpha + \theta_j \right] \cdot \left[ A_x \frac{\partial P}{\partial Q} + P \frac{\partial A_x}{\partial Q} + (P - P_w) \right] + \left[ \lambda_j \alpha + \theta_j \right] \cdot \left[ A_y \frac{\partial B_y}{\partial Q} \right]. $$

(18)

Define the $j^{th}$ person's shares of total income from the two industries: $\omega_j^A = [\lambda_j \alpha + \theta_j \delta (1 - \alpha) \mu_j]$ and $\omega_j^B = [\lambda_j \alpha + \theta_j \delta (1 - \alpha)(1 - \mu_j)]$. The effect on the individual's utility due to an incremental increase in the quota without compensation is given by

$$ \frac{dV_j}{dQ} = \left[ (P - P_w) + (1 - \gamma_{A_j}) A_x \frac{\partial P}{\partial Q} + P \frac{\partial A_x}{\partial Q} + \frac{\omega_j^B \partial B_x}{\omega_j^A \partial Q} \cdot \frac{\partial V_j}{\partial Q} \cdot \omega_j^A \right]. $$

(19)

The three terms in equation (19) represent three channels by which individual welfare is altered by a change in the quota level. First, there is an increase in revenue due to importing a unit for less than its domestic sale price. This is represented by the term $(P - P_w)$ and this gain would eventually vanish as the quota becomes nonbinding. Second, there is a change in real purchasing power due to change in the import price that benefits the person as consumer differently than it harms the person as resource owner. This purchasing-power effect, represented by the first term in the square brackets, may be either positive or negative:

$$ (1 - \frac{\gamma_{A_j}}{\omega_j^A}) A_x \frac{\partial P}{\partial Q} \geq 0 \quad \text{as} \quad \gamma_{A_j} \geq \omega_j^A. $$

(20)

This purchasing-power effect is positive as the person consumes a greater share of the import good and earns a lesser share of the revenues produced by the import industry. Although the person has fewer dollars from the import industry, the purchasing power of those dollars has increased.

The third way in which individual welfare is affected by the change in quota is through the effect on income produced from changes in the domestic production of the two goods, apart
from changes in relative prices. Income from the domestic production of the good A decreases
as quota increases and allows more imports to substitute for domestically produced goods.
On the other hand, income from the export-oriented production increases. If the person is
completely diversified, \( \omega_j^A = \omega_j^B \), and the loss of income from domestic production of the
import-competing good balances with the gain of income from production in the export­
oriented industry. As the person's assets are more concentrated in the import-competing
industry, the less his gain from trade liberalization, or the greater his loss:

\[
P \frac{\partial A_x}{\partial Q} + \frac{\partial B_x}{\partial Q} = 0 \quad \text{as} \quad \frac{\partial B_x}{\partial Q} > 0.
\]

(21)

To illustrate the relationship between the diversification of a person's portfolio and the
degree of compensation necessary to make that person indifferent to a relaxation of the quota,
consider the compensation required to balance an incremental change in \( Q \), as defined in
equation (8). To focus on the effects of resource ownership, as opposed to questions of the
individual's consumption bundle, assume that one's share of total consumption of the imported
good is equal to one's share of the total revenue generated by the import-competing industry
\( \gamma_{N_j} = \omega_j^A \). In general, the degree of compensation to the \( j^{th} \) individual for an incremental
increase in quota is given by utilizing equations (8) and (19):

\[
C_j = \left[ -(P - P_w) \left( P \frac{\partial A_x}{\partial Q} + \frac{\partial B_x}{\partial Q} \right) \right] \omega_j^A.
\]

(22)

From equation (21), for \( \omega_j^A = \omega_j^B \), or \( \mu_j = 1/2 \) the value the compensation requirement, \( C_j \), is
negative \( [C_j = - \omega_j^A (P - P_w)] \), for any combination of mobile and immobile resources. As the
person's portfolio of immobile resources relies more heavily on the import-competing
industry, the degree of diversification between mobile and immobile resources becomes
important. Measuring the concentration of an individual's assets in the mobile resource by
\( \tilde{\lambda}_j = \lambda_j / (\lambda_j + \theta_j) \) allows the representation of the ratio \( \omega_j^b / \omega_j^A \) in terms of mobility, \( \tilde{\lambda}_j \) and diversification, \( \mu_j \); namely,

\[
\frac{\omega_j^b}{\omega_j^A} = \frac{\tilde{\lambda}_j \alpha + (1 - \tilde{\lambda}_j)2(1 - \alpha)(1 - \mu_j)}{\tilde{\lambda}_j \alpha + (1 - \tilde{\lambda}_j)2(1 - \alpha)\mu_j}.
\] (23)

For an incremental increase from a given level of quota, \( Q \), one can therefore write the level of Pareto-fulfilling compensation as a function of the concentration of assets in the mobile resource, \( \tilde{\lambda}_j \), and the concentration of the immobile resources in the import-competing industry, \( \mu_j \). Substituting (23) into (22), one can derive a potential compensation-requirement function in terms of \( \tilde{\lambda}_j \) and \( \mu_j \),

\[
C_j = C(\tilde{\lambda}_j, \mu_j).
\] (24)

This Pareto-fulfilling compensation function has three properties that may be be formalized as follows:

**Proposition 3:** (a) For any given level of endowment of resource ownership, the greater the individual's concentration of immobile resource in the import-competing industry, the greater the Pareto-fulfilling compensation associated with an increase in the quota: \( \partial C_j / \partial \mu_j > 0 \); and furthermore, (b) The more mobile are the individual's assets, the less the Pareto-fulfilling compensation: \( \partial C_j / \partial \tilde{\lambda}_j < 0 \).

**Proof:** To demonstrate properties (a) and (b), note that (22) is affected by \( \tilde{\lambda}_j \) and \( \mu_j \) only through the ratio \( \omega_j^b / \omega_j^A \). Finally, note that the signs of the derivatives of \( C_j \) with respect to \( \tilde{\lambda}_j \) and \( \mu_j \) are opposite of the signs of the derivatives of (23).

The relationship between compensation and diversification is graphically illustrated in Figure 1. Levels of compensation over values of \( \mu_j \) in the domain \([1/2, 1]\) are shown given a level of the mobility measure, \( \tilde{\lambda}_j \). Note that the person may be unevenly diversified between
Figure 1:
Levels of Pareto-fulfilling compensation as a function of the proportion of ownership of fixed resources in the import competing sector, $\mu_j$, conditioned on the degree of mobility, $\tilde{\lambda}_j$, and an initial quota, $Q$.
industries (i.e., \( \mu_j > 1/2 \)) and still require no positive level of compensation to remain at least indifferent to freer trade. There are levels of concentration of one's portfolio in mobile assets such that the degree of diversification of immobile assets is irrelevant for positively compensating a person for an incremental increase in quota.

Indeed, there are levels of concentration of one's portfolio in mobile assets such that the degree of diversification of immobile assets is irrelevant for positively compensating a person for an incremental increase in quota. Setting \( C(\tilde{\lambda}_j^*, \mu_j = 1) = 0 \), the share of one's total assets in mobile resources that assures no loss due to the relaxation of the quota, even when \( \mu_j = 1 \), is given by using (23) and solving for \( \tilde{\lambda}_j^* \) in (22):

\[
\tilde{\lambda}_j^* \geq \tilde{\lambda}_j^* = \frac{2\alpha(1-\alpha)a(Q)}{\alpha - [\alpha - 2(1-\alpha)]a(Q)}
\]  

(25)

where \( a(Q) \) is a measure of the restrictiveness of the quota,

\[
a \equiv 1 - (P - P_w) / (\partial B_x / \partial Q).
\]  

(26)

There is a tradeoff between the degree of concentration of assets in immobile resources and the degree of diversification of those resources between the import-competing and export-oriented industries. Simply put, diversification is a substitute for immobility. For any two individuals with a common Pareto-fulfilling compensation, the individual with a greater concentration of ownership in the import sector will also have a greater degree of immobility.

The trade-off between diversification and mobility is illustrated in Figure 2. The portfolio that makes the individual indifferent to an incremental increase in quota is conditional on the initial level of quota. Setting \( \alpha = 1/2 \) for ease of presentation, the pairs, \( \tilde{\lambda}_j \) and \( \mu_j \), that make the individual indifferent to a change are given by

\[
\tilde{\lambda}_j = L[\mu_j; a(Q)] = \frac{\mu_j(1+a)-1}{(\mu_j-1/2)(1+a)}.
\]  

(27)
The trade off between resource mobility, $\tilde{\lambda}_j$, and the proportion of fixed factors owned in the import sector, $\mu_j$, in determining the region where Pareto fulfilling compensation is positive ($C_j > 0$) for an incremental increase in import quota, $Q$.

Note: $a = 1 - \frac{(P(Q) - P_w)}{\partial B_x / \partial Q}$.
**Proposition 4:** As effective quota approaches the nonbinding level, any resource ownership skewed toward the import-competing industry relative to the export-oriented industry will have a positive Pareto-fulfilling compensation.

**Proof:** As $Q$ approaches the level where it is nonbinding (i.e., $P \to P^*$), the region vanishes where no compensation is required to make indifferent those persons with an unbalanced mix of immobile resources. Also note that, as $P \to P^*$, $a(Q) \to 1$. This implies the next proposition.

This rather strong result comes from the fact that the gains from trade are second-order small and the income effects are first-order. Those individuals whose portfolio of assets is characterized by $\tilde{\lambda}_j$ and $\mu_j$ such that $0 \leq \tilde{\lambda}_j \leq 1$ and $1/2 \leq \mu_j \leq 1$ are those for whom there exists a potential for required compensation for some level of $Q$. Of course, for an effective quota (i.e., for a finite difference between domestic and world prices of good A), some persons with certain pairs $(\tilde{\lambda}_j, \mu_j)$ will be indifferent to, or gain from, the relaxation of the quota. The shaded area in Figure 2 represents those combinations of mobility and diversification that have a Pareto-fulfilling compensation for an incremental change in the quota. Thus, this shaded area represents a measure of the likelihood that a randomly selected individual will oppose freer trade without compensation.3

Suppose a country moves in incremental steps toward free trade, and compensates those who suffer losses at each stage. For each successive step, the number of persons requiring compensation grows. This may at first appear paradoxical: As a country moves closer to free trade, the extent of persons harmed increases. The intuitive explanation of this result may be expressed as follows. As the quota becomes proportionately less restrictive, additional gains to national income become less for further relaxations. Gains in income from all sources decrease to an individual, but at the same time the losses to income from domestic production in the import-competing industry becomes relatively more
important. Income per unit from sales of the imported goods, \( P - P_w \), falls as the quota increases, and falls at a faster rate than income from domestic production [i.e.,
\[
\frac{dY}{dQ} = P \frac{\partial A_y}{\partial Q} + (\omega^g_i/\omega^f_i)(\partial B_i/\partial Q)].
\]

This last point has implications for voting models of tariff formation (e.g., Mayer, 1984, and Mayer and Riezman, 1989). In the Mayer model, an individual's relative wealth in terms of capital ownership, along with the relative capital intensity of the import-competing industry, determines a person's gains or losses from freer trade. There is an endogenously determined equilibrium quota that meets a majority-rule criterion (if each person's relative vote weight is not equal to his relative gains or losses from quota imposition). The distribution of capital ownership thus determines the tariff (in Mayer's case) chosen by majority rule. In the present model, the distribution of persons over the space defined by mobility, \( \tilde{\lambda}_j \), and diversification, \( \mu_j \), would determine the quota in a majority-rule voting model. If the government embarks towards freer trade, potential voter resistance would tend to grow as a continually greater number of persons would be harmed without compensation. At initial stages of relaxing trade barriers, those harmed may suffer a great deal, but their numbers may be too small to compel compensation, as liberalization precedes, the political pressure for compensation would increase. If compensation carries with it additional costs (e.g., due to technical and administrative barriers) then exogenous pressures to relax trade restrictions may only be partially successful. Without a mechanism for compensation, a government would relax the quota just up to—but not beyond—the point where a successful voting block would prove obstructionist. Further trade liberalization would require some level of compensation.
5. The Compensation Requirements for Trade Reform in a Large Country

To extend the above analysis to the case of a large country requires very little modification to the existing framework. In a large-country case, the country faces decreasing terms of trade with an increase in trade. Thus the world price, rather than an exogenous parameter, is an endogenous variable which is an increasing function of the level of imports (i.e., $dP_w/dQ > 0$) when the import quota is binding and is equal to zero when it is not. The national income is equal to:

$$ Y = PA_x + (P - P_w)Q + B_x. $$

The change in income to the import sector for a small change in quota is equal to

$$ \frac{dY}{dQ} = A_x \frac{\partial P}{\partial Q} + P \frac{\partial A_x}{\partial Q} + Q \frac{\partial P}{\partial Q} - Q \frac{\partial P_w}{\partial Q} + \frac{\partial B_x}{\partial Q} + (P - P_w); \quad (28a) $$

or,

$$ \frac{dY}{dQ} = \frac{dY^s}{dQ} - Q \frac{\partial P_w}{\partial Q}; \quad (28b) $$

where $dY^s/dQ$ is equal to the change in income for the import sector in the small country case.

As a check on consistency, it is possible to show that some binding level of quota, and not free trade, is Pareto optimal in the case of a large country. Using the identical consumer model in section 3, the change in utility for a change in the level of import quota becomes:

$$ \frac{dY}{dQ} = (P - P_w) - Q \frac{\partial P_w}{\partial Q}. \quad (29) $$

At a zero level of quota, the term is unambiguously positive; and, as the level of quota approaches the free trade level, $P - P_w$ approaches zero and the change becomes negative. If this derivative is continuous, then it follows that there exists some level of binding quota, $Q^*$, at which, $dY/dQ = 0$ and the gains from trade are maximized. If the country is making a unilateral move from $Q^*$ to free trade, this will unambiguously reduce the gains from trade.
There are two qualifications to this statement. First, if the reform is part a multilateral move of this country and its partners are moving to free trade, then a gain is possible. Second, if the existing level of quota is more restrictive than the optimal level, then the move to free trade can be potentially Pareto improving even though it is not Pareto optimal.

The Pareto-fulfilling compensations of a large country moving to free trade will differ from a small-country case in two ways: An individual's Pareto-fulfilling compensation in the small-country case will increase, and the number of persons requiring such compensation will be larger. This can be seen by examining the difference in the change of the utility of an individual in the large-country versus the small-country case.

**Proposition 5:** In the large-country case (for \( Q < Q^* \)), an individual requiring compensation to remain indifferent to an increase in \( Q \) suffers an additional income loss equal to his share of the quota rents which were being extracted from foreign countries. This loss of foreign quota rents, \( R_j \), is equal to

\[
R_j = -\omega_j^Q \frac{\partial P_w}{\partial Q}.
\]  

**Proof:** This proposition is demonstrated by taking the derivative of (16) with respect to \( Q \), allowing \( P_w \) to be influenced by \( Q \). If an individual has a positive Pareto-fulfilling compensation in a small-country case, his compensation level would increase by the amount given by equation (30).

If the individual had a zero compensation level in the small-country case, it is possible that in a large-country case this level would be positive. It should be noted, however, that even in a large country either complete diversification or complete mobility provide sufficient conditions for an individual to gain when the trade reform represents a potential Pareto improvement for the country.
In this paper we have analyzed the role of resource mobility and portfolio diversification in determining the distributional implications of trade reform. The four primary implications of the analysis are:

(i) The degree of compensation required for a person to remain indifferent to trade liberalization increases as an individual's share of consumption of the imported good decreases.

(ii) The Pareto-fulfilling compensation level increases as the person's immobile assets are concentrated in the import-competing industry. In other words, the greater the deviation of the individual's portfolio from one of complete diversification of immobile asset toward concentration in the import-competing industry, the greater the compensation.

(iii) For an unbalanced portfolio of immobile assets that concentrates ownership in the import-competing industry, as the proportion of the person's total wealth in immobile assets relative to mobile asset increases, the greater grows the Pareto-fulfilling compensation associated with freer trade.

(iv) There exist levels of effective quota sufficiently close to the nonbinding level that, for a given level of mobility, if an individual is even somewhat skewed toward ownership of resources in the import-competing industry, then compensation will be required to make the individual indifferent to further quota relaxation. Thus, as the trade restriction approaches the free trade level, a greater number of persons require such compensation in order to remain indifferent to the change.

These conclusions have some important policy implications. Trade reform in general is not Pareto improving. If interest groups have the power to block changes that make them
worse off, then compensation may be a necessary part of the trade reform. Resource ownership diversification and resource mobility reduce the potential compensation requirements of trade reform. *Ceteris paribus* then, a government should promote ownership diversification and mobility in order to facilitate trade reform without costly compensation. For many resources this may require the removal of an existing institutional barrier, or the correction of a market failure. In some sectors where the transaction costs of diversified ownership are very large, such as agriculture, promoting diversification and mobility may be a more formidable task.

The dynamic considerations are even more difficult. The act of compensating losers to bring about reform will decrease the private incentive for the diversification of ownership. Thus, the process of reform and the accompanying compensation may, in fact, make future reform more costly. If trade reform takes place in a series of piecewise moves, each accompanied by compensation, *ceteris paribus* the compensation should be paid in such a way as to enhance diversification and mobility. A government could pay an industry cash to accept free trade, or alternatively, the compensation payment could be tied to some action that improves the mobility of the resource or diversification of the ownership within the sector. For example, the government could subsidize re-education of an employee or provide an investment tax credit that would stimulate the owners in the sector to invest outside the sector.
Footnotes

1 These arguments were formalized in a "General Theory of Second Best" by Lipsey and Lancaster (1957).

2 This effectively removes the Stopler-Samuelson effects, which would otherwise complicate the presentation and confuse the distinction between diversification and resource mobility, adding little insight to the analysis.

3 One would need to specify a distribution function for $\tilde{\lambda}_j$ and $\mu_j$ over persons in society.
References


