ABSTRACT

BRADY, GORDON LEONARD Jr. A Survey of Protectionism from Import Quotas. (1973) Directed by: Dr. Paul G. Althaus.

It is the purpose of this paper to analyze the contributions to the theory of protectionism from import quotas and to compare quota protection with tariff protection. Partial and general equilibrium analysis are used to compare the effects of quotas on consumption, production, and income distribution with tariffs and free trade. Edgeworth boxes are used to determine the effects of quotas on trade in a pure exchange model.

Tariffs and quotas are found 'equivalent' in the static context of both partial and general equilibrium analysis. By 'equivalent' we mean both can be used to produce identical results with respect to prices, production, consumption and income distribution. The 'equivalence' breaks down in the dynamic context due to the different adjustment mechanisms of the two systems. Quotas are shown to adjust to shifting markets through changes in relative prices while adjustment under the tariff takes place through changes in the quantities traded. In the dynamic partial equilibrium model we find the quota more protective than the tariff in the 'tightening' market and less protective in the 'softening' market. Our findings in the 'tightening' market contradict the historical reliance on tariffs in markets with inelastic demand. In the 'softening' market context the use of tariffs is found valid.

In the dynamic general equilibrium model we demonstrate the importance of initial endowments in determining the willingness to trade

A SURVEY OF PROTECTIONISM FROM IMPORT QUOTAS

by

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A Thesis Submitted to
the Faculty of the Graduate School at
The University of North Carolina at Greensboro
in Partial Fulfillment
of the Requirements for the Degree
Master of Arts

Greensboro
1973

Approved by

Thesis Adviser

APPROVAL PAGE

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ACKNOWLEDGEMENTS

With gratitude to my thesis adviser,
Paul G. Althaus, and my wife, Mary

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CHAPTER I

THE INTRODUCTION

The purpose of this paper is to compare and contrast the protection afforded by tariffs and import quotas. Using partial and general equilibrium analysis in static and dynamic contexts, we will compare and contrast the two means of protection. The quota concept will be introduced by sketching the historical context in which it was first used with tariffs introduced as alternative means of protection. The effect of protection on prices, consumption, and trade will be given and related to the concepts of social cost and social benefit, transfers of consumer's and producer's surplus, and revenue effects or 'quota profits'. The social cost-benefit approach provides the analytical tools with which to clarify and contrast the operational characteristics of the two systems. The 'static equivalence' of tariffs and quotas will be demonstrated and the break-down of 'equivalence' under dynamic conditions will be shown. Dynamic analysis of three market conditions will be used to show the differences in adjustment to shifting market conditions. We begin with a historical sketch of the conditions in which quotas were first used and why tariffs were considered risky.

Section One: The Situation Surrounding the Introduction of Import Quotas into France

According to Kindleberger,[1] the French were the first to use import quotas. In the face of an inelastic supply of Australian wheat

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[1] Kindleberger, C. P., International Economics, Homewood, Illinois: Richard D. Irwin, Inc., 1963, pp. 130-134.

in 1930, the French were not sure that a tariff rate could be devised which would allow some Australian wheat to be imported, yet prevent a drastic decline in domestic wheat prices resulting from an oversupply situation. A decrease in domestic wheat prices, they felt, would threaten the political stability of their country by forcing the peasants off the farm. Because the French felt it politically desirable to have a peasant class, they decided a new course of action was necessary. Their goal was to allow enough wheat importation to maintain trade relations with the Australians, but not so much that domestic wheat prices would decrease the standard of living of the peasants, and possibly force them out of the agricultural sector. With this in mind, the government determined that price stability could best be accomplished by setting an absolute quantitative limitation on the imports of Australian wheat. The importation of wheat was then limited to a quantity which they felt was low enough to maintain a level of domestic wheat prices high enough to sustain the peasants. Now let us see how present-day protectionists rationalize the use of quotas in the United States.

Section Two: The Use of Import Quotas in the United States

The history of United States' quotas goes back to the Long-term Cotton Arrangement set up under President Kennedy, and the voluntary steel quotas of the Johnson Administration. The rationale for protection has been varied. Textile quota supporters maintain this type of protection is essential for a basic industry employing a type of non-competitive worker not readily absorbed elsewhere in the economy. The supporters of protection for the steel industry justify quotas because steel is a

capital-intensive industry that is often faced with surges of imports, as foreign producers attempt to substitute export sales for domestic sales during times of slack demand in their own economies. The steel industry maintains that due to its capital-intensive nature it is unable to compete by cutting prices or production without seriously impairing its financial health. Presenting still another side is the justification of petroleum import quotas on the basis of national security. The petroleum industry advocates limiting imports of foreign crude in order to maintain high domestic prices, which they say is necessary to encourage domestic exploration. Unique capital- and labor-intensive situations and national security are representative of the justifications used by producers. In the past quotas have been used to place absolute limitations on the 'flood' of cheaper foreign products. When faced with a foreign supply which is completely unresponsive to price changes, quotas may be the only viable solution.

Until recently, quotas could be characterized as unilateral and permanent. Unilateral, in that negotiations were not held to make the terms agreeable to both sides; and permanent, as they were indefinite with respect to time and made no provision for re-evaluation. There is a trend toward negotiating a type of bilateral quota called 'temporary voluntary agreements'. Although these are, in effect, agreements not to compete or to restrict competition in certain areas, they have been justified as a means of heading off protectionist sentiment by providing adjustment time and in some cases government incentives for threatened industries. Quotas enable the response to be short term rather than long term. Supporters maintain quotas can be used more effectively in

restricting imports and with less long-run distortion of resource allocation because the psychological impact of changing the quantity of imports differs from that of changing the rate of divergence between foreign and domestic prices. In most cases, 'temporary voluntary agreements' are tied to commitments to shrink ailing domestic industries in exchange for agreements from foreign countries to temporarily moderate the growth of some exports. The time gained may be used to sort out potentially profitable companies in the industry that might receive tax credits, while those with no discernible prospects might receive job training for their employees, or other types of adjustment assistance. Depending on the circumstances, incentives in the form of accelerated depreciation, technical assistance, or possible exemption from anti-trust action might also be used. Although it has been estimated that permanent quotas cost from ten to fifteen billion dollars for items on the consumer price index, proponents maintain this type of temporary protection has lower social cost than permanent protection.[2] The quota should be removed and competition reinstated when the 'threatened' industry has had time to adjust, even if it is not off the 'critical' list.

While a justification for tariffs has been the protection of 'infant' industries, the use of quotas marks the extension of protection from 'infant' to 'mature' industries. The use of the term 'mature' requires some explanation. We make the distinction between 'infant' and 'mature' industries in terms of the degree of stability present in the production

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[2]Beman, Lewis, "How To Tell Where We're Competitive," Fortune, Vol. LXXXVI, No. 1, July 1972, p. 54.

process. A 'mature' industry may be described as having stabilized in terms of growth, expanding at a rate near that of the economy, and able to achieve economies of scale. On the other hand, an 'infant' industry is in the process of expanding at a rate greater or less than the rate of growth of the economy and is unable to achieve economies of scale. Historically, tariffs have been used to protect 'infant' industries by raising the foreign price equal to or higher than the domestic price. This is meant to encourage expansion to optimum size and production at the least cost combination of inputs in order to permit competition between domestic and foreign producers. It may also provide the stimulation for a potential monopoly to become a monopoly. When an 'infant' industry becomes a 'mature' industry, the justification for tariffs is no longer valid, and should also be removed. Quotas, on the other hand, control access to domestic markets in order to provide adjustment time for 'mature' industries threatened by foreign competition and prevent imports from taking over the domestic market. Aside from protecting 'infant' or 'mature' industries, tariffs and quotas may have other uses.

Tariff and quota protection may also be used to maintain the status quo, correct balance of payments or other such disequilibria, or as a bargaining tool against similar regulations by other countries. Quotas provide absolute limitation of imports in markets in which foreign supply is unresponsive to changes in price resulting from the imposition of tariffs. Quotas are superior to tariffs in such markets because the effect of tariffs is less certain due to the effect of the elasticities of demand and supply on price changes. Recent quotas have been used as a 'stop-gap' measure, while the use of tariffs has tended to entail long-term objectives, such as the development of an industry. Short-run tariffs

might conceivably be used to accomplish the same objectives. Although based on the most scientifically verified observations of inelastic foreign supply, the use of quotas introduces a more arbitrary dimension into international trade than tariffs.

Section Three: Quotas Are More Arbitrary

We know protection in any form opposes the forces which cause countries to trade, and prevents production and consumption according to the 'comparative advantage' of a country. The introduction of protection alters trading patterns by causing variations in the set of relative prices facing producers and consumers for reasons other than transportation cost differentials. The administrators of quota systems are granted a greater degree of explicit arbitrariness than tariff administrators.[3] While it is true that a tariff rate may be set arbitrarily, the administrators of a tariff system are unable to determine the final outcome of their actions in terms of a specified import level and individual importers as under a quota. With a quota, the free market determination of prices as a rationing device is replaced by the decisions of bureaucrats sometimes guided by considerations other than efficiency and maximization. The outcome of a tariff may be described as distorting, but not replacing the market mechanism. A quota allows administrators to evaluate fairness, equity and justice, in arriving at a decision as to what is to be imported and by whom, as well as the prices and quantities at which the transactions are to take place. The administrative flexibility inherent to the use of

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[3]Kindleberger, C. P., International Economics, Homewood, Illinois: Richard D. Irwin, Inc., 1963, p. 131.

quotas may encourage unsystematic change and price volatility at the expense of the consumer. The point we wish to emphasize is that quotas permit the administrator to be more arbitrary, and more considerate of 'special' interests, though not necessarily 'vested' interests, than tariffs, due to their ability to determine a priori the quantity as well as the importers, and those who may reap the increase in import values resulting from the restriction of trade. The operational characteristics of quotas need not produce greater movement from free trade equilibria than tariffs, but when coupled with political motivations of 'special' and 'vested' interests, the resulting trade diversion may have significant social cost.

Section Four: The Distortions Caused by Commercial Policy

By social cost we mean the loss of production in non-protected industries resulting from resource shifts to protected industries, and the decrease in consumption resulting from protection-induced price increases. Under perfect competition, price equals the marginal social value of the commodity. Under protection, price may not be reflective of social value. The equilibrium price may be greater or less than the marginal social value. Ultimately, protection may lead to artificial stimulation and channeling of resources into non-optimal uses. By non-optimal we mean resource shifts away from areas of greatest social benefit.

Natural gas is an example of the misallocation of resources resulting from commercial policy. Because the rate structure of electric utilities is based on generating capacity, the expansion of facilities has been

encouraged to the point where it is feasible from a cost standpoint to generate electricity by burning natural gas. Some of this electricity is then put to uses competitive with natural gas. This paradox has resulted from domestic policy aimed at holding the price of natural gas artificially low in order to stimulate its consumption. The low price of natural gas encouraged excessive demand and tended to exclude more expensive foreign gas, while at the same time discouraging domestic development of natural gas resources. The rate structure of the electric utilities is equally blame-worthy, as it has in many cases encouraged the unwarranted expansion of utilities in order to lower their unit cost, but, at the same time, maintained or increased their price per kilowatt hour. Commercial policy may stimulate or retard the growth of an industry. In this case, commercial policy encouraged the expansion of the electric utilities, which created excess demand in the natural gas industry. Natural gas producers were at the same time discouraged from developing domestic sources due to price regulation.

Having provided an example of the distortions caused by commercial policy, let us proceed to develop graphically the analysis of tariffs and quotas. In Section Five we will begin by using the definition of a tariff to develop the social cost-benefit analysis and the concepts of consumer's and producer's surplus.

Section Five: Social Cost-Benefit Analysis and the Concept of Surplus[4]

A tariff is a tax, and in many respects, a quota has the same effect as a tax. In Figure 1 (page 9) the effect of a tax on a single

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[4]See Vickrey, William S., Microstatics, New York: Harcourt, Brace, and World, Inc., 1964, p. 262.

product with a rising supply curve is demonstrated. It is necessary to describe the model and define the concepts of social cost and social benefit before proceeding with the tax analysis. Under perfect competition,

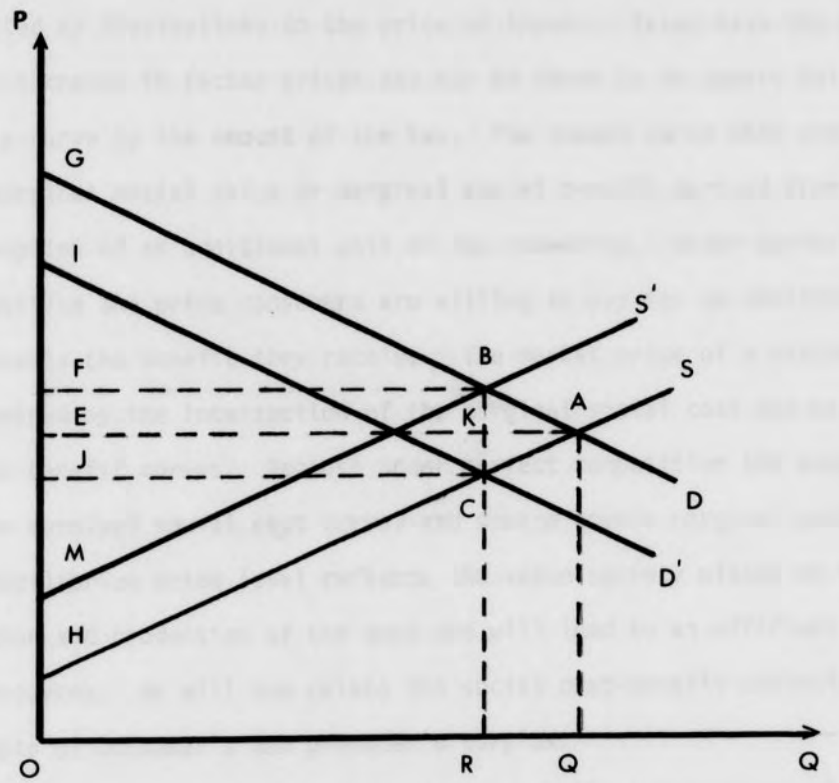

Figure 1: Social Surplus

the supply curve HCAS corresponds to the marginal social cost curve which is obtained by summing horizontally the marginal cost curves of competing producers. Social cost may be defined in two ways. First, social cost is the resource sacrifice in terms of one commodity in a two-commodity world, which consumers are willing to undergo in order to obtain an additional unit of the other commodity. Secondly, it may be defined as

the amount of money required to compensate individuals adversely affected by a given step. For example, restricting production to a certain level gives rise to gainers and losers which become policy considerations. Because social cost is the supply curve under perfect competition, it will be affected by fluctuations in the price of inputs. Taxes have the same effect as an increase in factor prices and may be shown by an upward shift of the supply curve by the amount of the tax. The demand curve GBAD represents the marginal social value or marginal social benefit derived from the consumption of an additional unit of the commodity. Under perfect competition the price consumers are willing to pay for an additional unit represents the benefit they receive. The market price of a factor is determined by the intersection of the marginal social cost and marginal social benefit curves. Because under perfect competition the supply curve is the marginal social cost curve, and demand equals marginal social benefit, the equilibrium price level reflects the value society places on the consumption and production of the good and will lead to an efficient allocation of resources. We will now relate the social cost-benefit analysis to the concepts of consumer's and producer's surplus.

Consumer's surplus is defined by Marshall as the money value of marginal utility above what the consumer would have been willing to pay rather than go without the commodity. Hicks defines it as the compensation which would have to be paid consumers if they were prevented from spending their money in a certain way, and yet were to be enabled to make themselves as well off as before.[5] Producer's surplus is the Marshallian counterpart

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[5]Hicks, John R., 'The Rehabilitation of Consumer's Surplus', Review of Economics Studies, February 1941, Vol. 8, p. 111.

representing the economic rent attributable to the excess of productivity in the next best alternative use. Hicks defines it as the compensation which would have to be paid to factor owners used in an industry, if they were to be denied opportunity to produce in this industry, and though compelled to transfer themselves to other less advantageous occupations, were yet to be as well off as before.[6] In Figure 1, the initial equilibrium is located at point A with production OQ and price QA. GBAKE represents the consumer's surplus, while HAE is its counterpart, producer's surplus. AHG, the total net social surplus, is the sum of consumer's and producer's surplus and represents the benefit received by society due to the existence of this industry with production at level OQ, as compared with their economic status if production was restricted or prohibited. The total net social surplus remains unchanged until equilibrium is disturbed by shifts in demand or supply. In the absence of shifting, no matter how much prices may change, the absolute value of the social surplus will remain constant.

In the tax analysis we may assume the tax is paid either by the producer or consumer. If the producer pays the tax, the supply curve is shifted backward or upward, indicating a decrease in the quantity supplied at each price level. Tax BC has the same effect as an addition to production costs and is indicated by the new supply curve MBS'. Given a constant demand function, a production tax will increase the equilibrium price level and decrease production. In effect, the tax discourages the producer and leads to a reduction in supply. The subsequent scarcity

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[6] Ibid. p. 111.

causes consumers to offer higher prices and is shown by a movement along the demand curve. The reduction in quantity demanded drives out the less efficient producers and leaves the survivors to supply the remaining output at a somewhat lower price. Production will decrease until the price offered by consumers has so risen, and the commodity price needed by producers to cover their factor costs has so fallen that the margin between the higher price paid by consumers and the lower price received by producers is sufficient to cover the tax. The new equilibrium is located at output OR and price RB, which includes the tax.

Assuming the tax is paid by consumers is another approach to the tax analysis. In this case, the demand curve is lowered, or shifted down, by the amount of the tax. A new demand curve ICD' is generated, intersecting the supply curve at point C with equilibrium production level OR and price net of the tax RC. Total tax revenue is represented by rectangle BCJF. The increase in price BC resulting from the imposition of the tax reduces consumer's surplus to BFG. Because the tax has effectively decreased the net price of their product from OE to OJ, the producer's surplus is reduced to HJC.

The net effect of the tax is to reduce the social surplus by area ABC to HCI. The loss of social surplus resulting from a tax varies according to the elasticity of supply and demand. A tax would cause no loss of social surplus with an infinitely inelastic demand schedule because in this case the social surplus is infinite. Cigarettes and salt are examples of products for which the demand is apparently inelastic because the increased price resulting from heavy taxing does not strongly affect the level of consumption.

The same effects with respect to production and consumption can be achieved by imposing a quota restricting the producer's output to OR. Assuming the restriction does not initially affect demand, the equilibrium price changes from QA to RB. Restricting production to OR in effect reduces the supply curve to point B. Total net social surplus is reduced by area ABC as in the tariff case. The changes in domestic production caused by quotas in a two-commodity world may, in general, be assumed to have the same effect upon prices as equal changes in production brought about by a tariff. For this reason, we say they are 'equivalent' in a static partial equilibrium context. We must point out, however, that although 'equivalent' in terms of equilibria, they do not operate in the same way. In this respect a quota is the converse of a tariff. A tariff generates the import level by setting the rate of divergence between domestic and foreign prices, while a quota determines the level of imports a priori and allows the rate of divergence to be determined by the market. The limited value of comparative static analysis is demonstrated here because we are unable to point to any real static differences. Let us proceed with other types of analyses, which provide a better understanding of the fundamental differences between the two systems.

Conclusion: Chapter One

In Chapter One we have seen how import quotas were introduced in France to divert the inelastic supply of Australian wheat. We have also shown how recent United States' import quotas have been used as a 'stop-gap' measure to protect domestic industries threatened by foreign competition. The qualities inherent to the administration of import

quotas have made this type of protection the one preferred by the steel, textile, and petroleum industries. Import quotas are more arbitrary because administrators are able to determine a priori the quantities to be imported as well as those who will be allowed to import. Ultimately, protection may lead to artificial stimulation and channeling of resources into non-optimal uses because price may not be reflective of social value. We have shown that taxes and quantitative restrictions may be used to achieve the same results, since both ultimately limit the supply. It is clear that protection in any form causes a distortion between social cost and social benefit and leads to a reduction in the social surplus.

CHAPTER TWO

THE NON-EQUIVALENCE OF TARIFFS AND QUOTAS IN A DYNAMIC CONTEXT

Introduction

A dispute has developed between Bhagwati, Shibata, Kreinin, and Walter over the definition of 'equivalence' used by Kindleberger to describe quota and tariff protection. Kindleberger maintains that quotas generating the same domestic price divergence and import level are 'equivalent' to tariffs with respect to the protective, consumption, redistribution, and revenue effects if we are able to determine to whom the 'quota profits' will accrue.[7] Bhagwati defines 'equivalence' to mean the tariff rate will produce an identical discrepancy between foreign and domestic prices.[8] Shibata concentrates on a comparison between the domestic prices prevailing under tariffs and quotas.[9] They conclude the two yield 'equivalent' effects in competitive markets, while the 'equivalence' breaks down with the introduction of monopoly.

Kreinin and Walter maintain the definition of 'equivalence' is misleading and results from the preoccupation of partial equilibrium

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[7] Kindleberger, C. P., International Economics, Homewood, Illinois: Richard D. Irwin, 1968, Fourth Edition, pp. 130-34 and appendix E.

[8] Bhagwati, J., "On the Equivalence of Tariffs and Quotas," in R. E. Baldwin et al., Trade Growth and the Balance of Payments - Essays in Honor of G. Haberler, Chicago: Rand McNally & Co., 1965, pp. 53-67; and "More on the Equivalence of Tariffs and Quotas," in American Economic Review, March, 1968, pp. 142-46.

[9] Shibata, H., "A Note on the Equivalence of Tariffs and Quotas," in American Economic Review, March, 1968, pp. 137-42.

analysis with static phenomena.[10] They believe the comparison is more meaningful if placed in the context of market reactions to shifts in demand and supply under the tariff and quota system.[11] We will pursue the dynamic analysis introduced by Kreinin and Walter, and begin by demonstrating the 'static-equivalence' of tariffs and quotas.

Section One: 'Static Equivalence'

As previously stated, taxes and quantitative restrictions may have identical effects on prices, production, and consumption. Figure 2

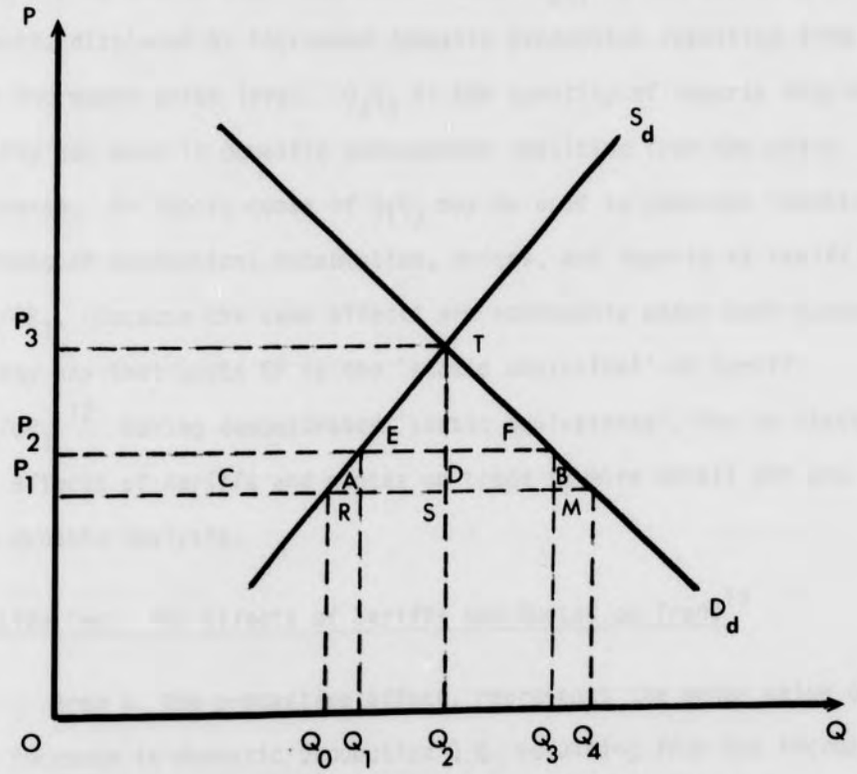

Figure 2: 'Static Equivalence' Tariffs and Quotas

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[10] Kreinin, M., "More on the Equivalence of Tariffs and Quotas," Kyklos, Vol. 23, 1970, pp. 75-78.

[11] Walter, Ingo, "On the Equivalence of Tariffs and Quotas," Kyklos, 1971, Vol. 24, pp. 111-13.

is used to tie in the effects of 'static equivalent' tariffs and quotas with the concepts of social cost and social benefit. The free trade price level is OP_1 with domestic production OQ_o and imports of Q_oQ_4. The imposition of tariff OP_2/OP_1 raises the price level to OP_2 and brings about an increase in domestic production to OQ_1 and a decrease in imports to Q_1Q_3 = EF. The total decrease in imports Q_oQ_4 less Q_1Q_3 may be broken down into components. Q_oQ_1 is the quantity of imports displaced by increased domestic production resulting from the increased price level. Q_3Q_4 is the quantity of imports displaced by the decrease in domestic consumption resulting from the price increase. An import quota of Q_1Q_3 may be used to generate identical effects on production, consumption, prices, and imports as tariff OP_2/OP_1. Because the same effects are achievable under both systems, we may say that quota EF is the 'static equivalent' of tariff OP_2/OP_1.[12] Having demonstrated 'static equivalence', let us discuss the effects of tariffs and quotas on trade in more detail for use in the dynamic analysis.

Section Two: The Effects of Tariffs and Quotas on Trade[13]

Area A, the protective effect, represents the money value of the increase in domestic production Q_oQ_1 resulting from the increased

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[12] Kindleberger, International Economics, p. 130.

[13] Ibid. pp. 105-13, 130-132.

price level P_1P_2. It refers only to production and represents the increase in production resulting from marginal producers entering the market due to the protection-induced increase in domestic price. The size of the protective effect varies directly with price and is dependent upon the elasticity of domestic supply. The greater the elasticity of supply, the larger the social benefit, and, conversely, the more inelastic the supply, the less society has to gain from protection. Since the protective effect represents the value of increased production made available to society, it may be called the social benefit. By designating the increase in production as the 'social benefit', we make no judgment as to the desirability of such increase, and use the term only in reference to what society 'gets' as a result of protection. For a price decrease, the protective effect becomes the social cost of protection because it represents the loss of production experienced by society due to the decrease in price. Although in static analysis these may seem irrelevant, they become useful tools of comparison in the dynamic analysis.

The consumption effect, area B, is the value of the consumption lost due to the price increase and is the counterpart of the protective effect. Just as the protective effect represents the marginal producers entering the market due to increased prices, the consumption effect represents the marginal consumers leaving the market. The size of the consumption effect is dependent upon the elasticity of demand and will be larger the greater the elasticity

of demand, and smaller the more inelastic the demand. Since it represents the loss of consumption of the protected item associated with an increase in price, it may be termed the social cost. We may describe the consumption effect as the price paid by consumers for the benefit received by producers. The increase in production comes at the expense of domestic consumers and foreign suppliers. Because it varies inversely with prices, the consumption effect is always negative for the increase in domestic prices associated with protection. For a price decrease the consumption effect is positive and becomes the social benefit. Again we make no judgment as to the desirability of such changes in consumption.

The protective and consumption effects constitute the 'dead weight' loss of import restrictions because these are not compensated by changes in other areas. While the protective effect may be favorable for an industry or region dominated by a single economic activity, it will not benefit the country as a whole. A region within an economic unit selling its product in unprotected markets may be adversely affected by not being able to pay the relatively higher prices of the protected item.

The redistribution effect, area C, represents the money value of the transfer of consumer's surplus to producer's surplus resulting from an increase in prices. For a price decrease it represents a transfer in the opposite direction and will become useful as a distinguishing characteristic of the quota in the dynamic

analysis. More specifically, it is the economic rent accruing to existing producers due to the elimination or restriction of foreign competition. Although protection is argued in terms of the marginal producer, it is, in fact, the existing producer who gains because under free trade the intensive marginal producer will not be driven out of business, but will make less 'rent' or profit. Although the income redistributions resulting from protection are important policy considerations, we will not be concerned with them in this paper. The redistribution effect is the last static similarity.

The basic difference between 'static equivalent' tariffs and quotas lies in who collects the increased value of the imports resulting from the protection-induced divergence between domestic and foreign price. Under a tariff, it automatically accrues to the government in the form of tariff revenue and is called the revenue effect (area D in Figure 2). In our analysis we will assume tariff revenue is distributed in the form of a lump-sum subsidy. Dispensing the value of commodities collected as import duty in this way prevents distortions on the demand side. Without such a distribution system the analysis would be diverted from the central issue of the paper. To prevent this diversion, in the tradition of Marshall, we assume away the possibility of its happening. In the quota case, the value of this price divergence is called the 'quota profits'. This will not automatically accrue to the government unless the import

rights are sold. Because the possibility of a price decrease is realized in subsequent analysis, we will define the decreased value of imports under the quota as the 'quota loss'.

'Quota profits' represents the increase in value of imports resulting from quota protection. It exists only at the time the quota is imposed or changed, thus making the method of allocating import rights a matter of great significance to importers and the general public as well. Only the initial possessor of the import rights will reap the windfall or 'quota profit' because this is later capitalized as ownership is transferred. Subsequent owners of the quota rights receive only profits normal to that industry with no economic 'rent' or 'quota profit' resulting from mere possession. Generally, the quota is divided among importers according to the market share each held prior to the introduction of the quota. Governments may attempt to capture the 'quota profits' by auctioning import licenses or permits. This method is unpopular with officials because it makes the extra cost conspicuous and may reduce their power. A lack of objectivity of those administering the program may become apparent in the choice of base periods for quota allocation and the weights allowed for growth. It is obvious that wealthier interests in an industry have an advantage due to their ability to make administrators aware of their views by channeling part of the 'quota profits' into lobbying. Compared to the tariff, the quota system is more prone

toward intense lobbying because importers as well as producers stand to gain. Importers have nothing to gain from tariffs because the increased value of the imports automatically accrues to the government. In fact, the importer may lose revenue due to the reduced volume of imports. Producers stand to gain from the price increase in either system and would, in most cases, be indifferent between tariffs and quotas, unless they thought the windfall would accrue to them. Importers would, in most cases, prefer the quota over the tariff due to the possibility that the 'quota profits' might accrue to them. Disregarding market power, the producer never loses from protection, while the importer might lose. Thus, without knowing to whom the 'quota profits' will accrue, we expect the producer to be indifferent between the means of protection, while the importer will always prefer quotas. In this paper we will not be concerned with the group to which the 'quota profits' accrue and mention this only as a factor distinguishing the two systems. Having discussed the static similarities and differences of the two systems, in the next section we use the dynamic analysis to bring out the fundamental differences between the two systems.

Section Three: Dynamic Analysis

Two market structures will be analyzed statically and dynamically with the objective of exposing the differing effects on prices, production,

consumption, and imports under tariffs and import quotas. 'Tightening' and 'softening' markets will be compared in the following two market structures:*

Case I: Elastic Demand and Supply

Case II: Infinitely Inelastic Demand and Elastic Supply

These two cases have been chosen to demonstrate the distinctive adjustment mechanisms of the two systems to changing market conditions. Admittedly, these represent only a fraction of the myriad possible market conditions which might be faced by those making the decision between tariff and quota protection, or no protection at all. We exclude cases which are obviously inapplicable, or at best represent unrealistic situations. For instance, almost perfectly elastic domestic demand (S_d) is excluded because this is not the type of market in which protection is normally used. Although perfect elasticity is conceivable for some price ranges, it is unrealistic for the entire demand curve to display this. In addition, we obtain the same direction of price and quantity changes from a demand function which is less than perfectly elastic. Differences occur only with respect to the extent of changes. Although severely restricted, we feel the cases demonstrate adequately the effect of varying degrees of responsiveness on the adjustment process to price changes.

In the exporting country we will assume elastic demand (D_f) and inelastic supply (S_f), although the foreign market could also conceivably

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*A third case - inelastic supply and elastic demand - was excluded because the result is the reversal of the social cost-benefit relationship in Case II. We feel the dynamic effects of protection can be adequately demonstrated with the two cases.

take any number of variations. A foreign supply totally unresponsive to price changes has been the condition under which quotas have been historically justified. Tariffs have been used in the opposite market situation of perfectly elastic foreign supply. The use of perfectly inelastic foreign supply in our model does not bias the analysis toward quotas because it is possible to monitor the adjustment process under perfectly elastic foreign supply by simply reading the quantity imported from the horizontal axis. This approach allows us to compare tariff and quota protection in the markets in which they have been considered superior. Inelastic domestic demand, the domestic market structure in which tariffs have been historically justified, is analyzed in Case II. The severe restrictions placed on the export market structure is in keeping with our objective of determining the validity of the historical reliance on tariffs and quotas in specific markets as well as observing the effects of protection on the exporting country.

The effects of tariffs and quotas will be compared in 'tightening' and 'softening' markets. A 'tightening' market is characterized by an increasing price level. A rising price level may result from increased demand (with constant supply) and/or decreased supply (with constant demand). In a 'softening' market, a decreasing price level results from decreasing demand (with constant supply) and/or increasing supply (with constant demand). In each case we will shift both supply and demand in order to obtain a clearer picture of the adjustment process under both systems. In the dynamic comparison a two-country closed model of international trade will be used. It is closed in the sense that imports of the country on the left must equal the exports of the

country on the right. Trade results from differing production functions and tastes, and is explained in our model by the presence of excess demand in the importing country and excess supply in the exporting country. The importing country is characterized by a free trade price level less than the equilibrium price level which would exist in the absence of trade. Excess demand at the free trade price level is also present. In the absence of trade the equilibrium price level in the importing country must be greater than the price level plus transportation costs in the exporting country, otherwise there would be no advantage for either country to trade. In the exporting country excess supply is present at the free trade price level which is greater than the equilibrium price level in the absence of trade. Free trade leads to increased prices in the exporting country and decreased prices in the importing country with trade ceasing when foreign prices plus transportation costs are equal to the domestic price. Having described the dynamic market conditions to be investigated, let us begin with the simplest market structure.

Case I: Elastic Supply and Demand

The two-country model with elastic supply and demand is the simplest model, and is used to expand the previous discussion, and to provide additional criteria for the analysis. We assume domestic supply and demand to be mirror-images to permit price-induced changes in production and consumption to have equal absolute value. Although in reality we do not expect supply and demand functions to have identical slopes and result in changes of equal absolute value, this is analytically

neater and provides an adequate representation of price and quantity movements.

A. 'Tightening' Market

In Figure 3, the free trade level of prices is P_1 with domestic production OQ_0. The level of domestic consumption OQ_4 is the sum of

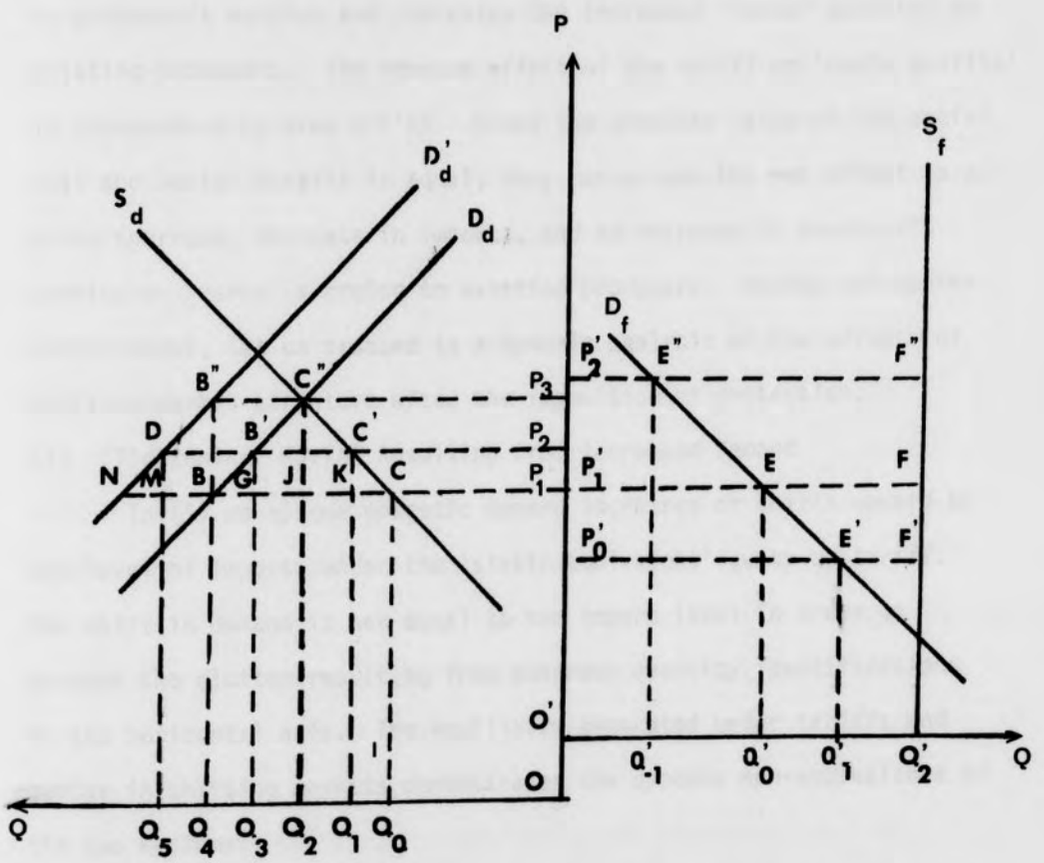

Figure 3: 'Tightening' Market Resulting from Increased Demand

domestic production OQ_0 and imports Q_0Q_4. Tariff OP_2/OP_1 and static equivalent quota B'C' cause an increase in price to P_2 with concomitant expansion of production to OQ_1 and contraction of to OQ_3. Imports

decrease to Q_3Q_1 or quota B'C'. Under the assumption of mirror-image demand and supply the protective and consumption effects are of equal absolute value. For a price increase the social benefit is the protective effect C'CK with the social cost or consumption effect B'GB. Because the tariff or quota results in a price increase, the redistribution effect $C'P_2P_1C$ is a direct transfer of consumer's surplus to producer's surplus and indicates the increased 'rents' accruing to existing producers. The revenue effect of the tariff or 'quota profits' is represented by area B'C'KG. Since the absolute value of the social cost and social benefit is equal, they cancel and the net effect is a price increase, decrease in imports, and an increase in producer's surplus or 'rents' accruing to existing producers. Having set up the static model, let us proceed to a dynamic analysis of the effects of shifting market structure after the imposition of protection.

(1) 'Tightening' Market Resulting from Increased Demand

In (1) we assume domestic demand increases or shifts upward by the level of imports under the 'static equivalent' quota or tariff. The shift in demand is set equal to the import level in order to prevent the clutter resulting from numerous quantity identifications on the horizontal axis. The equilibria generated under tariffs and quotas in shifting markets demonstrates the dynamic non-equivalence of the two systems.

Under tariff OP_2/OP_1 the level of domestic consumption increases by the full amount of the shift in demand to OQ_5. By holding the price constant the tariff allows the shift in demand to become effective with no change in the domestic production level. The difference between

domestic production and demand will be referred to as the 'gap'. For the increase in demand, a larger positive 'gap' is created indicating the presence of excess demand. Under the tariff, adjustment to the 'gap' is an expansion of imports from Q_1Q_3 to Q_1Q_5. The social cost DMN represents the loss of consumption resulting from the tariff-ridden price level. Although it shifts with the demand curve, it remains equal to the social benefit C'CK. The redistribution effect $C'P_2P_1C$ is not affected by the shift, while the revenue effect increases to DC'KM due to the expansion of imports. Because tariffs adjust to increased demand by expanding imports and maintaining the price level, the net effect of the shift is a larger revenue effect.

Under 'static equivalent' quota B'C' the effect of an ex post shift in demand is an expansion of production and contraction of consumption to fill the 'gap' created by increased demand. The adjustment to a shift in demand with the 'maximum' level of imports determined a priori by the quota is a price increase which expands domestic production and simultaneously contracts consumption. With the import level held constant, a price increase of P_2P_3 is necessary to expand production to OQ_2 and reduce consumption to OQ_4. The price increase acts to increase production and decrease consumption until the 'gap' created by the shift has decreased to the quantity of imports stipulated by the quota. Although demand has increased, we find consumption and imports remain constant at OQ_4 and B"C" respectively under the quota. In comparison to the tariff we find the social cost B"BN and social benefit C"CJ are larger. The redistribution effect $C"P_3P_1C$ represents a greater transfer of consumer's to producer's

surplus or increased 'rents' accruing to producers than under the tariff. Due to the greater price fluctuation 'quota profits' B"C"JB are larger than the revenue effect. The quota causes greater distortion from free trade equilibria because the fixed import level requires greater compensating changes in production, consumption, and price in the domestic market. As a consequence of the extent price changes under the quota, producers are made better off while consumers are made worse off. To continue the investigation of the adjustment process in the 'tightening' market, let us look at the effects of a decrease in domestic supply.

(2) 'Tightening' Market Resulting from Decreased Supply

In Figure 4 the free trade price level is P_1 with consumption OQ_6 which is composed of production level OQ_2 and imports Q_2Q_6.

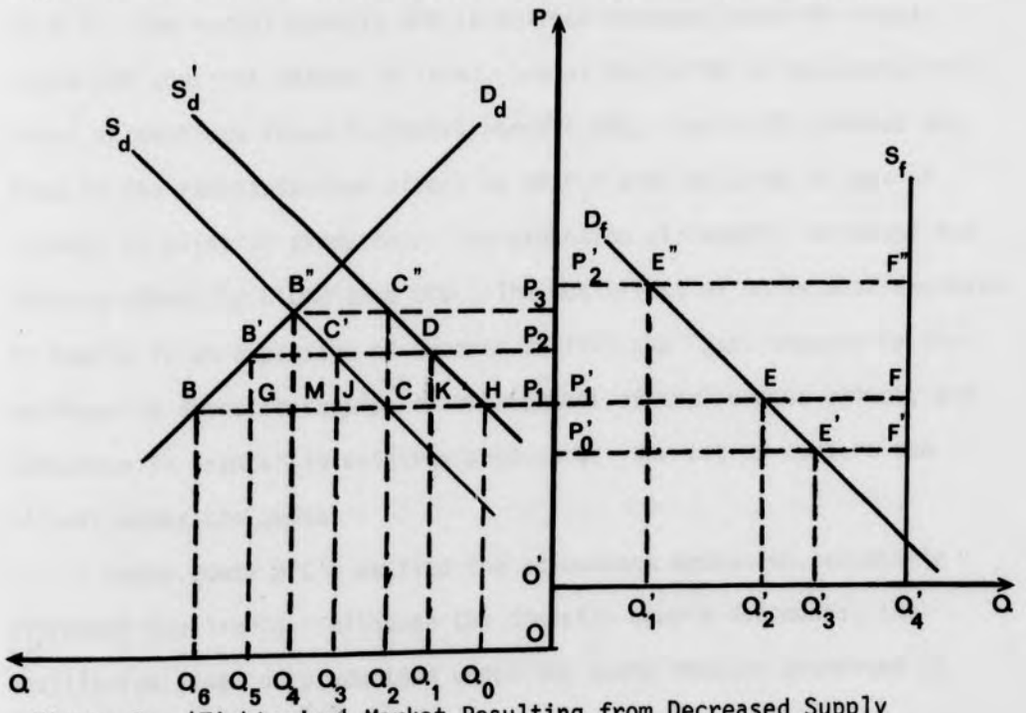

Figure 4: 'Tightening' Market Resulting from Decreased Supply

With the imposition of tariff OP_2/OP_1 or 'static equivalent' quota B'C' the price increases to P_2. The increase in price causes a subsequent increase in production to OQ_3 and decrease in consumption to OQ_5. Due to our assumption of mirror-image supply and demand curves, the absolute value of social benefit C'CJ equals social cost B'GB. The 'rents' accruing to producers resulting from the price increase is represented by the redistribution effect $C'P_2P_1C$. The revenue effect and 'quota profits' are B'CJG. Now let us consider the effect of shift in domestic supply.

Assume domestic supply decreases by the amount of the quota as indicated by a backward shift to S_d'. Under the tariff, domestic consumption and prices remain constant. The adjustment to the decrease in supply is made solely by an expansion of the import level from B'C' to B'D. The social benefit DHK is shifted backward with the supply curve but does not change in size. Social cost B'GB is unchanged and equal in absolute value to social benefit DHK. The shift reduces the size of the redistribution effect to DP_2P_1H and indicates a loss of 'rents' to existing producers. The expansion of imports increases the revenue effect by C'DKJ to B'DKG. The net effect of an ex post decrease in supply is an expansion of imports to fill the 'gap' created by the decrease in domestic supply, an enlargement of the revenue effect, and reduction in 'rents' to existing producers. Now let us compare the effects under the quota.

Under quota B'C', we find the adjustment mechanism results in different equilibria. Although the domestic supply decreases, the equilibrium level of production under the quota remains unchanged at

OQ_2. With the import level frozen at B'C' by the quota, a price increase of P_2P_3 is necessary to close the 'gap' created by the decrease in supply. The price increase acts to simultaneously increase production and decrease consumption. As in the case of an increase in demand, we see the price increase creates equal social benefit C"HC and social cost B"MB. These are larger than their tariff counterparts. 'Quota profits' B"C"CM is also larger than the revenue effect due to the larger price change. We also find the redistribution effect C"P_3P_1H is larger, thus indicating larger 'rents' under the quota. Because 'quota profits' and 'rents' are significantly larger we conclude producers are made better off while consumers are made worse off under the quota.

Conclusion: 'Tightening' Market

The adjustment to increased demand or decreased domestic production in the 'tightening' market has been demonstrated. Under the tariff, the adjustment is in the quantity imported with prices held constant, while under a quota the constant import level allows only price-induced adjustments in the levels of domestic production and consumption. In the 'tightening' market the quota magnifies the price increase because, in effect, the quota becomes a 'maximum' import restriction causing excess demand and upward price pressure. The excess demand and concomitant price increase draw marginal producers into the market while excluding marginal consumers.

We expect consumers in the importing country to prefer the tariff while producers would prefer the quota. Consumers are better off under the tariff because the price level is maintained with consumption increasing by the full amount of the shift in demand and

remaining constant for the decrease in supply. Quotas, on the other hand, prevent the full expansion of consumption by maintaining the import level and causing price-induced expansions of production and contractions of consumption. Quotas make producers better off because the rising price level increases both the quantity and value of protection and generates larger 'rents'. Because quotas make producers better off, they are more protective, although the tariff is obviously less distortionary with respect to the extent of price, consumption, and production changes, it does not provide the same degree of protection as the quota.

The effect of a 'tightening' market in the importing country is opposite to what happens in the exporting country. Since our model is based on the assumption that foreign supply is unresponsive to price, the adjustment to changing export demand is in the quantity consumed. With supply constant and an increase in export demand, a price adjustment is necessary to reduce consumption to close the 'gap' between what is produced and what may be exported. Under a tariff the adjustment to increased export demand E"F" is a price increase of $P'_2P'_1$ which is necessary to decrease consumption by $Q'_{-1}Q'_0$. With a quota the exporting country is completely insulated from changes in the importing country because the adjustment to 'tightening' domestic market conditions in the importing country take the form of a price increase to draw marginal producers into the market and exclude marginal consumers. The tariff, on the other hand, maintains prices in the importing country and makes the adjustment by expanding imports. In the 'tightening' market consumers in the exporting country would prefer the insulation of the quota while producers would prefer the price rise associated with tariffs. As previously stated, the two systems have opposite effects in

the import and export country the system causing the greatest distortion in one market causing no change in the other.

B. 'Softening' Market

In 'softening' markets we know price decreases result from decreases in demand or increases in supply and may be shown by downward shifts in supply and demand curves. The initial equilibrium levels of price, consumption, production, and imports in Figure 5 are identical to Figure 3. See the introductory paragraph for subtopic A on (pages 26-27) for the discussion of initial free trade and 'static equivalent'

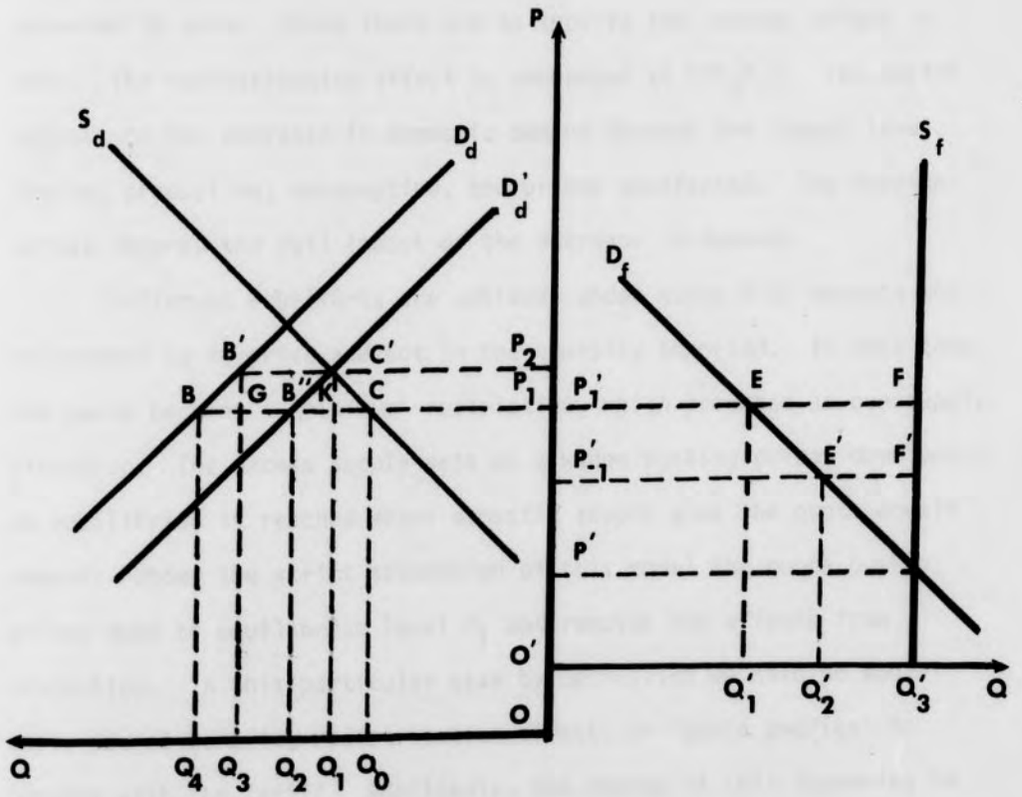

Figure 5: 'Softening' Market Resulting from Decreased Demand

tariff and quota equilibria. We will first consider the effect of a decrease in demand resulting after the imposition of protection.

(1) 'Softening' Market Resulting from Decreased Demand

In Figure 5 we assume domestic demand decreases by the amount of the quota to D_d'. Under tariff OP_2/OP_1 the level of domestic consumption decreases by the full amount of the shift. Prices and production are unaffected by the shift. In the 'softening' market a negative 'gap' is generated which, due to the constant price, may be closed only by reducing imports. With the shift equal to the import level B'C' the tariff becomes totally prohibitive and imports are squeezed to zero. Since there are no imports the revenue effect is zero. The redistribution effect is unchanged at $C'P_2P_1C$. The tariff adjusts to the decrease in domestic demand through the import level, leaving production, consumption, and prices unaffected. The foreign market absorbs the full impact of the decrease in demand.

Different equilibria are achieved under quota B'C' because the adjustment is in price and not in the quantity imported. In this case the quota becomes a 'minimum' restriction, which produces an oversupply situation. The excess supply acts as a wedge pushing prices down until an equilibrium is reached where domestic supply plus the quota equals demand. Under the strict assumption of this model the quota pushes prices down to equilibrium level P_1 and removes the effects from protection. In this particular case by definition we have no social cost, social benefit, redistribution effect, or 'quota profits' to compare with the tariff. Admittedly, the chance of this happening in the real world is rare, but it does demonstrate the fact that in a

'softening' market the producer may be adversely affected by the a priori determination of foreign supply. Producers would be better off under the tariff due to the insulation from price fluctuations while consumers would be better off under the quota due to the increased consumption resulting from the lower price.

(2) 'Softening' Market Resulting from Increased Supply

The initial free trade and static equivalent tariff and 'static-equivalent' quota equilibria in Figure 6 are identical to those of Figure 4. Refer to the discussion of initial equilibria on page 33.

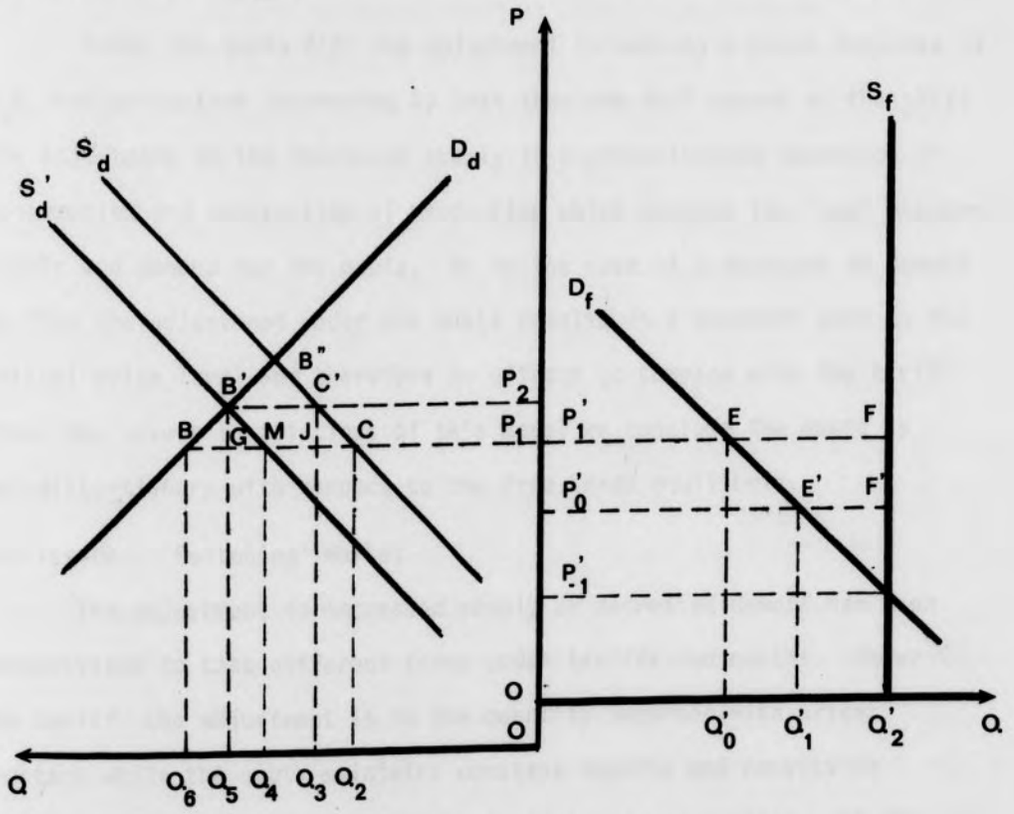

Figure 6: 'Softening' Market Resulting from Increased Supply

Assuming the supply increases or shifts out by the import level B'C' we find the outcome similar to the increase in demand although having different causes. Under a tariff the price remains constant at P_2 thus allowing an increase in production by the full amount of the shift. The adjustment to the shift is made by squeezing imports to zero. The revenue effect also goes to zero. Social benefit B'MG is shifted with the supply curve and remains equal to social cost C'CJ. The redistribution effect $C'P_2P_1C$ increases to $B'P_2P_1M$ representing larger 'rents' for existing producers. The net effect under the tariff is a decrease in imports and an increase in 'rents'.

Under the quota B'C' the adjustment is made by a price decrease of P_2P_1 and production increasing by less than the full amount of the shift. The adjustment to the increased supply is a price-induced expansion of consumption and contraction of production which creates the 'gap' between supply and demand for the quota. As in the case of a decrease in demand, we find the adjustment under the quota results in a movement back to the initial price level and therefore no effects to compare with the tariff. Under the severe restrictions of this model we conclude the quota is non-distortionary with respect to the free trade equilibria.

Conclusion: 'Softening' Market

The adjustment to increased supply or decreased demand has been demonstrated to take different forms under tariffs and quotas. Under the tariff, the adjustment is in the quantity imported with prices constant while the quota maintains constant imports and results in price-induced changes in domestic production and consumption. In the 'softening' market the quota causes a price decrease which increases

consumption and simultaneously decreases production in order to create the 'gap' between production and consumption which is required by the quota.

Consumers in the import country are better off under the quota while producers are better off under the tariff. Consumers are better off under the quota because the adjustment to 'softening' market conditions takes place in price-induced increases in consumption. Tariffs, on the other hand, maintain the existing price level and make the adjustment to shifting market conditions by varying the import level. In 'softening' markets producers benefit from the insulation from market conditions inherent to the use of quotas.

In the exporting country 'static equivalent' tariffs and quotas cause identical initial responses. With the introduction of 'softening' market conditions in the importing country differences with respect to the dynamic equilibria are generated under each form of protection. Under the tariff, the price level in the exporting country decreases due to excess supply resulting from the decreased demand for exports. In our highly restrictive model the tariff reduces trade to zero, results in a price decrease to P'_{-1} and a concomitant increase in consumption to $0Q'_2$. Under the quota, prices and consumption are unaffected due to insulation from changing export demand. Consumers in the exporting country would prefer the increased consumption resulting from the price decrease under the tariff while producers would be better off under the quota because it insulates them from the changing market conditions in the importing country and maintains the value of production. Conditions in the exporting country are opposite to those in the importing country.

In the importing country consumers are better off under the price decrease and concomitant increase in consumption under the quota while producers are better off under the tariff due to the price stability. As in the 'tightening' market we found the two systems produce opposite effects in the import and export countries with the least distortion in one country resulting in the greatest distortion in the other.

Conclusion: Case I

In the 'tightening' market we found tariffs maintained prices and allowed maximum consumption while quotas magnify the price increases and prevent maximum levels of consumption. Consumers are better off under the tariffs because price stability allowed consumption to increase by the full amount of the increase in demand and maintained the level of consumption despite the decrease in domestic production. Adjustment under the quota required a price increase in order to increase production to fill the 'gap' created by increased demand or decreased supply. In the 'tightening' market, quotas become the 'maximum' import level and cause price increases to draw marginal producers into the market while excluding marginal consumers. Producers are better off under quotas because the price adjustment increases the value of production and generates greater 'rents'. With respect to the extent of price, consumption, and production changes, the tariff is less distortionary in the import country and therefore, less protective than quotas.

In the 'softening' market the quota caused a price decrease which resulted from an excess supply situation. The quota acts as a 'minimum' import level which made domestic production plus the quota greater than demand. With the import level determined a priori, a price decrease was

necessary to simultaneously decrease production and increase demand to create the 'gap' between production and demand equal to the quota. Under the highly restrictive assumptions of our model the system was brought back to the initial free trade price level in the import country. Consumers benefit from the price decrease and concomitant increase in consumption. Tariffs, on the other hand, maintain prices and adjust by changing the import level. In the 'softening' market producers are better off under the quota due to the insulation from price decreases reducing both the quantity and value of production. The quota magnifies the effect of price changes in both dynamic markets, and makes producers better off in 'tightening' markets and consumers better off in 'softening' markets. In effect the adjustment mechanism of tariffs provides insulation from domestic price changes, making consumers better off in 'tightening' markets and producers in 'softening' markets.

Case II: Inelastic Demand and Elastic Supply

The two-country model with inelastic demand and elastic supply is the domestic market structure in which tariffs have been considered most effective. This case differs from Case I in that demand is completely unresponsive to price changes. By definition we know there is no social cost in terms of lost consumption from price increases and no social benefit or increased consumption from price decreases in this market structure. To simplify the geometry and provide a workable model we will set shifts in supply and demand equal to the import level under 'static equivalent' tariffs and quotas. By comparison to Case I we will develop the criteria under which tariffs and quotas achieve maximum usefulness and determine the validity of historical usage.

A. 'Tightening' Market

In Figure 7, the free trade level of prices is P_1 with production OQ_o. The level of domestic consumption OQ_2 is the sum of domestic production and imports Q_oQ_2. The imposition of tariff OP_2/OP_1 or static equivalent B'C' causes an increase in price to P_2 with concomitant expansion of production to OQ_1. Imports decrease to Q_1Q_2 with no effect

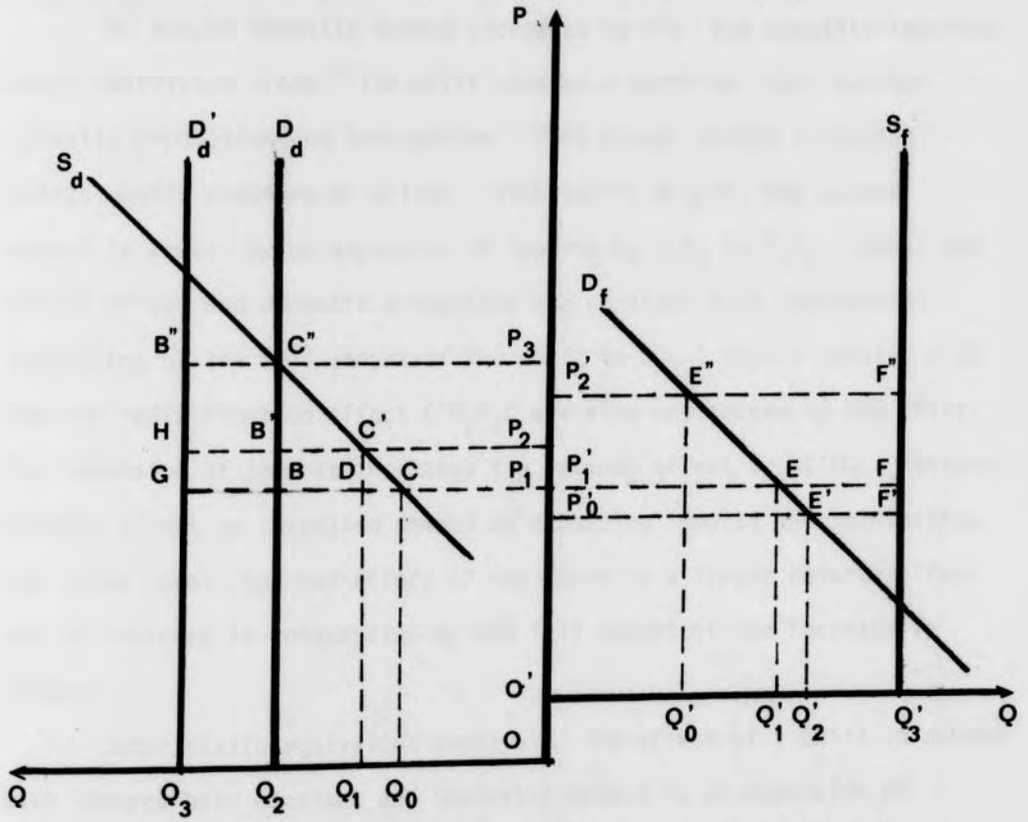

Figure 7: 'Tightening' Market Resulting from Increased Demand

on consumption due to the inelasticity of demand. The protective effect or social benefit C'CD is not offset by the consumption effect or social cost because there is no loss of consumption resulting from price changes. Protection produces a redistribution effect $C'P_2P_1C$ representing the

'rents' accruing to producers. The revenue effect and 'quota profits' is represented by area B'C'DB. The net effect of the restriction of trade is an increase in prices, production, and 'rents'. Having set up the static model let us proceed to a dynamic analysis of the effects of a shift in demand.

(1) 'Tightening' Market Resulting from Increased Demand

We assume domestic demand increases by B'C' the quantity imported under restricted trade. The shift creates a positive 'gap' between domestic production and consumption. This excess demand situation exerts upward pressure on prices. With tariff OP_2/OP_1 the excess demand is abated by an expansion of imports by Q_2Q_3 to Q_1Q_3. Under the tariff prices and domestic production are constant with consumption increasing by the full amount of the shift to OQ_3. Social benefit C'CD and the redistribution effect $C'P_2P_1C$ are also unaffected by the shift. The expansion of imports increases the revenue effect to HC'DG. Because tariffs adjust to increased demand by expanding imports and maintaining the price level, the net effect of the shift is a larger revenue effect and an increase in consumption by the full amount of the increase in demand.

Under static equivalent quota B'C' the effect of a shift in demand with imports held constant and inelastic demand is an expansion of production to fill the 'gap' created by the increase in demand. With the 'maximum' level of imports determined a priori by the quota, adjustment takes the form of a price increase which draws marginal producers into the market. Social benefit C"CD is larger than C'CD under the tariff and the redistribution effect $C"P_3P_1C$ is also greater. We

also find an increase in the size of 'quota profits' to B"C"BG. By placing an absolute limitation on the level of imports, the quota magnifies the effect of protection and causes greater compensating changes in the domestic market. Although the quota is more protective than the tariff, it is also more distortionary. To continue the comparison of tariffs and quotas in the 'tightening' market, let us look at the effects of a decrease in domestic production.

(2) 'Tightening' Market Resulting from Decreased Domestic Production

In Figure 8, the free trade price level is P_1 with consumption OQ_3 which is composed of production level OQ_1 and imports Q_1Q_3. The

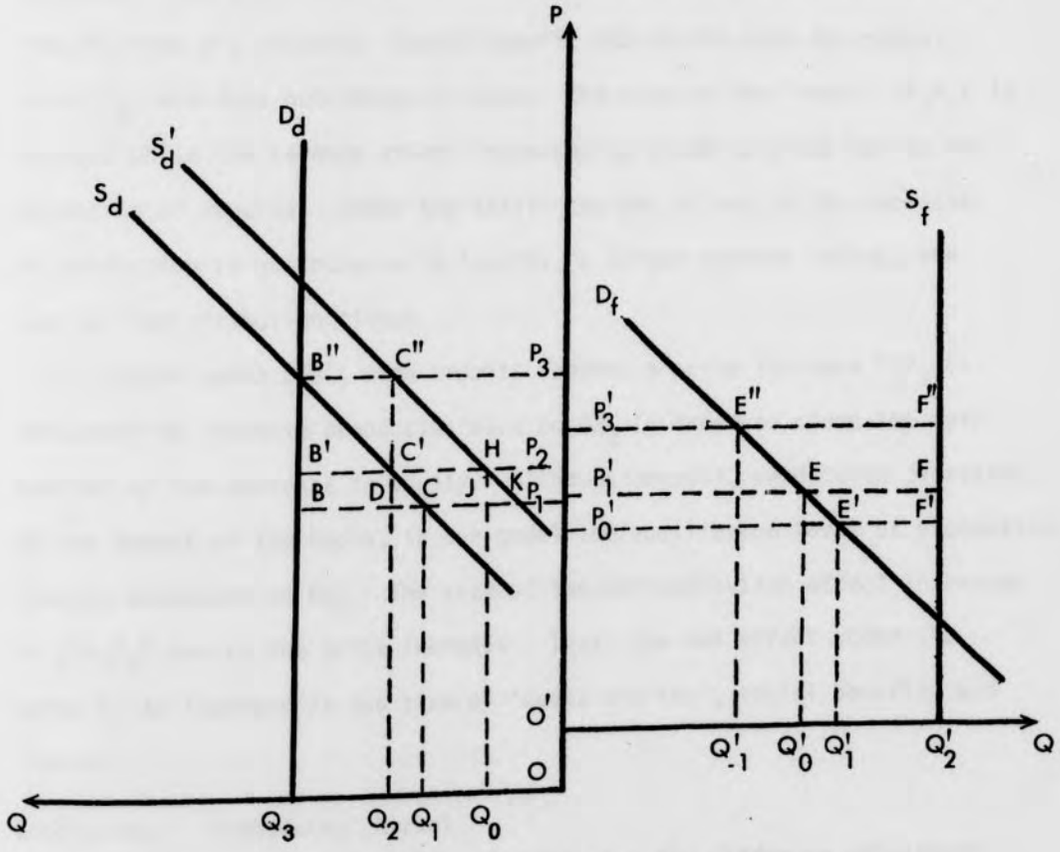

Figure 8: 'Tightening' Market Resulting from Decreased Domestic Supply

imposition of 'static equivalent' tariff OP_2/OP_1 or quota B'C' increases the price level to P_2. The increase in price causes an expansion of production to OQ_2. Due to inelastic demand there is no social cost or loss of consumption resulting from the price increase. The 'rents' accruing to existing producers is indicated by the redistribution effect $C'P_2P_1C$. The revenue effect and 'quota profits' are B'C'DB.

We now assume supply decreases by the import level B'C'. The decrease in production creates a positive 'gap' between demand and production which indicates the presence of excess demand. Under the tariff OP_2/OP_1 the level of domestic consumption and prices remain constant. The adjustment to the decrease in supply is made by expanding imports from B'C' to B'H. Social benefit HKJ shifts with the supply curve S_d, but does not change in size. The size of the 'rents' HP_2P_1K is reduced while the revenue effect increases by C'HJD to B'HJB due to the expansion of imports. Under the tariff the net effect of the decrease in production is an increase in imports, a larger revenue effect, and smaller redistribution effect.

Under quota B'C', with imports frozen, a price increase P_2P_3 is necessary to increase production back to OQ_2 in order to close the 'gap' created by the decrease in supply. Although domestic production decreases by the amount of the quota, in our model the equilibrium level of production remains unchanged at OQ_2. The size of the redistribution effect increases to $C''P_3P_2H$ due to the price increase. Thus, the net effect under the quota is an increase in the size of 'quota profits', social benefit, and 'rents'.

Conclusion: 'Tightening' Market

In Figures 7 and 8 we have demonstrated the differing adjustment mechanism of tariffs and quotas. Adjustment under the tariff is in the

quantity imported with prices constant, while under the quota the import level is held constant and a price adjustment takes place. In effect the quota becomes a 'maximum' import restriction which causes excess demand. The upward pressure on prices exerted by the excess demand draws marginal producers into the market. The price rise is greater than in Case I due to the unresponsiveness of demand to price changes. The tariff allows the shift to become effective and places the burden of adjustment on the foreign producers.

Consumers in the importing country are better off under the tariff although they have the same level of consumption under both systems. Consumers are better off under the tariff because the price level is lower than under the quota. The quota provides greater protection for producers due to the price increase which expands production and increases 'rents'. The greater protection afforded by the quota contradicts the validity of historical reliance on tariffs in cases of inelastic demand.

The effect of 'tightening' markets in the importing country is opposite to what happens in the exporting country. As in Case I, the most distortionary means of protection in the one country produces the least distortion in the other country. In the importing country tariffs maintain the price level and have smaller effects on trade than the quota. In the exporting country tariffs create excess export demand, which raises prices and decreases consumption. Quotas, on the other hand, are more distortionary in the importing country while completely insulating the exporting country from shifting.

B. 'Softening' Market

In 'softening' markets price decreases may result from decreases in demand and increases in supply. The initial equilibrium levels of price, consumption, production, and imports of Figures 9 and 10 are identical to Figures 7 and 8 respectively. See the introductory paragraph for Subtopic A, Section One, Case II (page 40) for the discussion of initial free trade and tariff and 'static equivalent' quota equilibria for Figure 9. We first consider the market reaction to a decrease in demand.

(1) 'Softening' Market Resulting from Decreased Demand

In Figure 9 we will assume domestic demand decreases by the amount of the import level to D_d'. Under tariff OP_2/OP_1 (Figure 9)

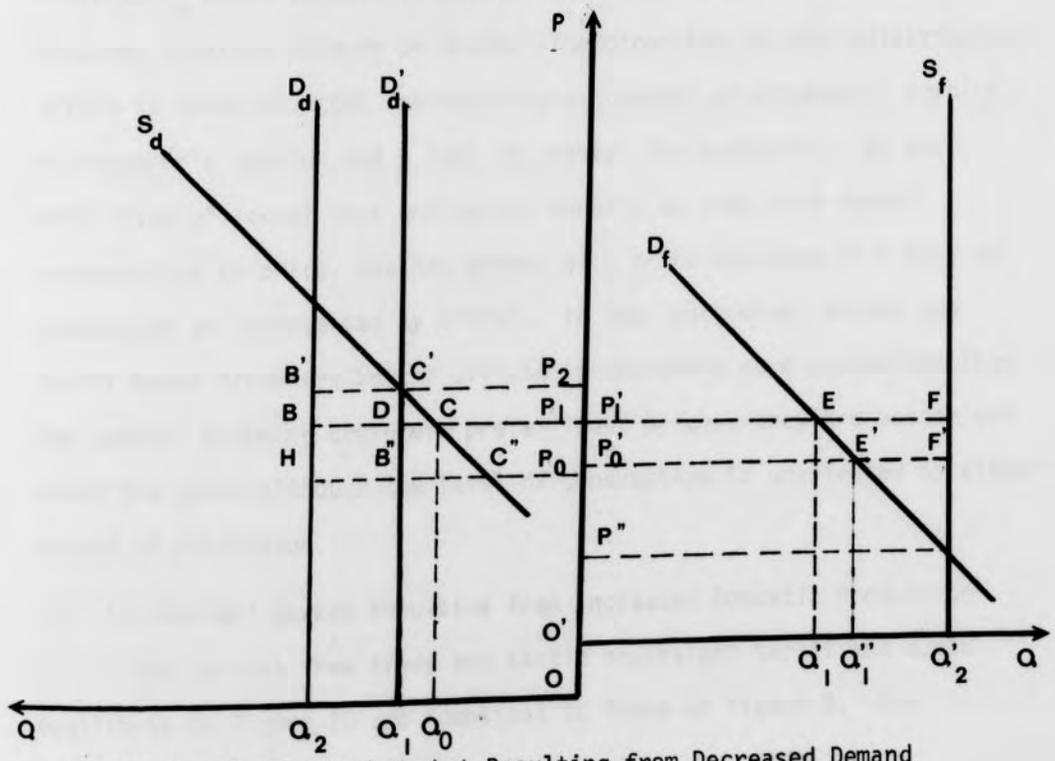

Figure 9: 'Softening' Market Resulting from Decreased Demand

the level of consumption contracts by the full amount of the shift. In the 'softening' market a negative 'gap' between demand and domestic production is generated which, due to the constant price, may be closed only by reducing imports. The tariff becomes totally prohibitive and squeezes imports to zero while maintaining domestic price and production levels. Since there are no imports, the revenue effect is zero. The redistribution effect is unchanged at $C'P_2P_1C$ with the full impact of the decrease in domestic demand transmitted to the exporting country.

In this case quota B'C' becomes a 'minimum' restriction producing an excess supply situation. The excess supply causes downward pressure on prices until the level of prices is reached where the level of domestic production plus the quota equals demand. In this case price falls to P_o which is below the initial free trade equilibrium and produces negative effects on trade. The direction of the redistribution effect is reversed, thus representing a transfer of producer's surplus to consumer's surplus and a loss of 'rents' for producers. By our definition of social cost and social benefit we know with demand unresponsive to price, the net effect of a price decrease is a loss of production as represented by C'C"B". In the 'softening' market the tariff makes producers better off and is therefore more protective than the quota. Assuming consumers prefer lower prices, they are better off under the quota although the level of consumption is unaffected by either method of protection.

(2) 'Softening' Market Resulting from Increased Domestic Production

The initial free trade and static equivalent tariff and quota equilibria in Figure 10 are identical to those of Figure 8. See

Subtopic A, Section 2 (page 42) for the discussion of equilibria in Figure 8. Assuming the domestic supply curve shifts out by the import

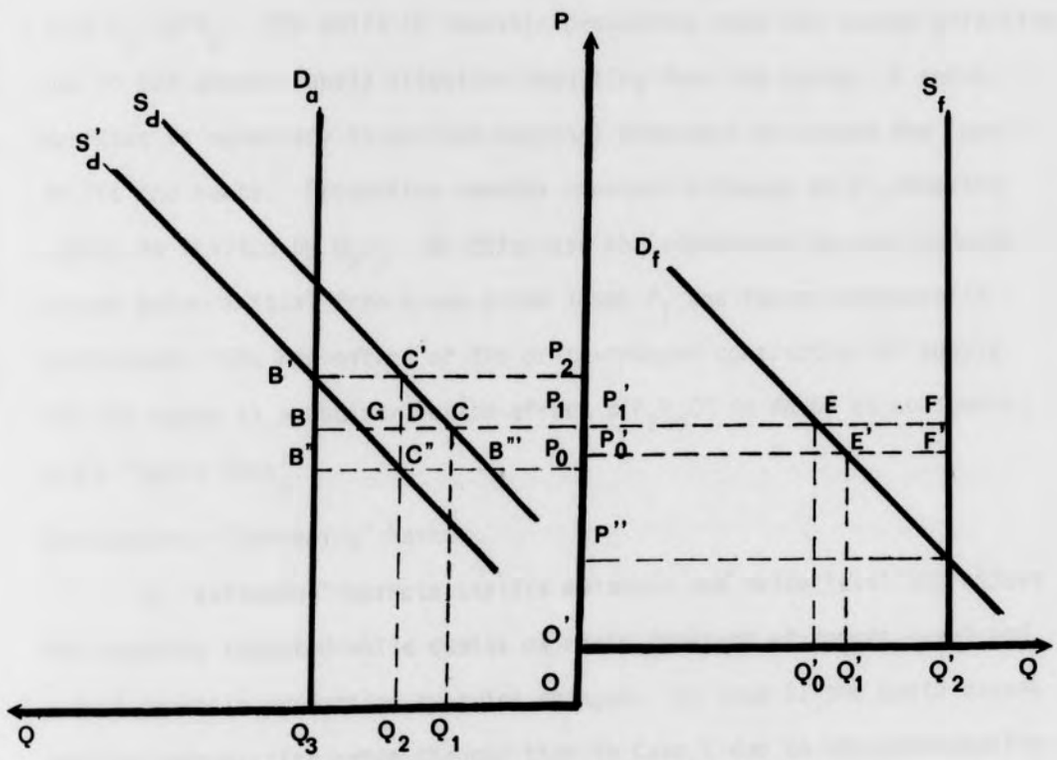

Figure 10: 'Softening' Market Resulting from Increased Domestic Supply

level B'C' we find the outcome is similar to the increase in demand.

Under the tariff, the price level remains constant at P_2 and production expands by the full amount of the shift. The adjustment to the shift is made by squeezing imports from B'C' to zero. The revenue effect becomes zero while the social benefit C'CD is shifted with S_d' and becomes B'GB. The redistribution effect $C'P_2P_1C$ is expanded to $B'P_2P_1G$ due to the shift. The net effect under the tariff is a decrease in imports,

an increase in 'rents', a zero revenue effect, and full expansion of production by the amount of the shift.

Under the quota B'C', the adjustment is made by a price decrease from P_2 to P_o. The shift in domestic production does not become effective due to the excess supply situation resulting from the quota. A price decrease is necessary to exclude marginal producers to expand the 'gap' to fit the quota. Production remains constant although at P_2 domestic supply is shifted by Q_2Q_3. In this case the adjustment process reduces prices below initial free trade price level P_1 and leaves consumption unaffected. The net effect of the price-induced contraction of supply and the quota is a redistribution effect $B'P_2P_oC''$ in favor of consumers, and a 'quota loss'.

Conclusion: 'Softening' Market

In 'softening' markets tariffs maintain the price level and adjust the quantity imported while quotas maintain constant at import level and reduce domestic production by price changes. In Case II the quota causes greater compensating price changes than in Case I due to the unresponsiveness of demand to price changes. With inelastic demand and elastic supply, adjustments are permitted only with respect to the level of domestic production. The extent of price changes under the quota depends on the elasticity of supply with less elastic curves requiring larger price changes while smaller compensating changes are associated with greater elasticity. Although consumption is not affected by either method, due to the lower prices the consumers are better off under the quota. Tariffs are more protective because they maintain price and allow the full expansion of supply. Our findings in 'softening' markets are in agreement with the historical justification of tariffs in cases of inelastic demand.

In the exporting country the adjustment to decreased export demand under the tariff is a price decrease to P''. The decrease in price is caused by excess supply resulting from the decreased export demand. In our highly restrictive model the adjustment to 'softening' market conditions reduces trade to zero. The net effect is increased consumption at lower prices for consumers and less 'rents' for producers. The quota guarantees a share of the domestic market to the exporting country and therefore insulates them from changes. In this case producers in the exporting country receive greater protection from the quota due to the constant production and price stability.

Conclusion: Case II

In 'tightening' markets we found tariffs maintained prices and allowed the market shifts to become effective while quotas magnified the increase in prices and maintained or increased production. It was demonstrated that quotas become a 'maximum' import restriction, which creates excess demand. The excess demand causes a rising price level until enough marginal producers have been drawn into the market. The price rise is greater than in Case I due to the unresponsiveness of demand to price changes.

As in Case I, we expect the consumers to prefer the constant prices under the tariff, although consumption was unaffected by either system. Quotas make producers better off because the price increases expand production and increase 'rents'. Thus, in 'tightening' markets quotas are more protective than tariffs due to the increase in the quantity and value of production. This is contradictory to the

historical justification of tariffs in cases of inelastic demand. Tariffs are, however, less distortionary.

In the 'softening' market tariffs are less distortionary and more protective than quotas. With imports determined a priori the quota becomes a wedge exerting downward pressure on prices to create a 'gap' the size of the quota. Quotas result in a price decrease below the initial free trade equilibrium. In the 'softening' market the tariff provides greater protection for producers by insulating them from price changes which reduce the quantity and value of production. Thus, in Case II the use of tariffs in 'softening' markets is valid.

In the exporting country tariffs are more distortionary in 'tightening' markets while quotas are more distortionary in the importing country. Tariffs result in increased demand for exports, which pushes up prices and excludes marginal consumers. Producers in the exporting country are better off under tariffs due to the increased 'rents' while consumers would prefer the insulation from price increases.

Conclusion: Chapter Two

In Chapter Two we have demonstrated the dynamic non-equivalence of tariffs and quotas resulting from the different adjustment mechanisms: tariffs places the burden of adjustment on the exporting country while quotas leave the adjustment to domestic producers and consumers. We also demonstrated that changes in domestic prices and prices in the export country depend on the elasticity of supply and demand. The quota was shown to provide greater protection in the 'tightening' market due to the magnification of price changes which increase both the value and

quantity produced. This was especially true in Case II because price increases had no social cost in terms of lost consumption and caused greater expansions of production. Our findings in the 'tightening' market contradict the conventional justification of tariffs in markets with inelastic demand.

In the 'softening' market tariffs were shown to make producers better off. Adjustment under the tariff is an expansion or contraction of imports to fill the 'gap' between domestic production and demand. In our model the tariff becomes totally prohibitive in the face of increases in supply and decreases in demand. Producers were not as well off under quotas due to the price decrease which reduced both the value and quantity produced. Thus we have shown the historical reliance on tariffs in markets with inelastic demand is justified only in the 'softening' market, while quotas are more protective in 'tightening' markets.

CHAPTER THREE

GENERAL EQUILIBRIUM ANALYSIS

Introduction

The purposes of the general equilibrium chapter are to show, first, that quotas establish a market relationship fundamentally different from that which underlies the conventional tariff; second, that in a comparative static context, tariffs and quotas may be used to generate identical results; third, that in a dynamic contest, the 'equivalence' breaks down. To distinguish the two systems as simply as possible, we will approach the question as a general equilibrium problem of exchange between two groups entering the market with fixed endowments of two goods. General equilibrium analysis is used due to our concern with the interrelationships of decision-making units and commodity markets. In the pure exchange model we exclude production in order to isolate the factors giving rise to trade and consumption. The pure exchange model permits a clear picture of market relationships and consumer reactions to changes in income distribution and prices without distorting the central theoretical issues involved. The use of the Edgeworth box analysis enables us to investigate the Pareto-optimality of income distributions resulting from protection. In Section One we will consider three static cases: competitive equilibrium, 'static equivalent' tariffs and quotas, and the all-or-nothing quota. In Section Two we extend the analysis to a dynamic context and demonstrate how the different adjustment mechanisms may be used for maximum

exploitation by the imposers. We begin the general equilibrium analysis by setting up the basic model and defining the competitive case.

Section One: Static General Equilibrium Analysis

The model is based on the following assumptions:

1. Two 'goods' X and Y are traded.
2. Trade takes place between two countries A and B.
3. Countries A and B are composed of identical individuals with respective utility functions:

   $U_a = f(X - X_b, Y - Y_b)$

   $U_b = f(X_b, Y_b)$
4. The A's and B's operate in a perfectly competitive world.
5. The A's and B's are rational consumers.
6. The indifference curves of both traders are homothetic.

The assumption that X and Y are 'goods' means there is a direct relationship between endowments and welfare. Increased endowments result in movement to higher utility levels while decreased endowments reduce welfare. We also know each country is composed of individuals with identical tastes, preferences, and resource endowments. Because each individual in A or B has the same income and consumes the same bundle of X and Y, we can represent the position of the country by the position of any one individual. The assumptions of perfect competition and rationality tell us the individuals are incapable of affecting prices and choose allocations providing the highest utility level. Rational behavior implies that each trader attempts to move to the highest utility level consistent with the preference map of his adversary. This in turn implies

that individual utility maximization is consistent with minimization of the adversary's utility. The homotheticity assumption will be important in the dynamic analysis. By definition we know a ray from the origin will intersect all homothetic indifference curves at the same angle. This is not the same as vertically parallel indifference curves which arise by assuming constant marginal utility of income. Having described the basic model we now move to the competitive case.

Case One: Competitive Equilibrium

In Figure 11 the initial equilibrium is located at point P. The B's are on B_8 with income Y_1, X_4, while the A's are located on A_7

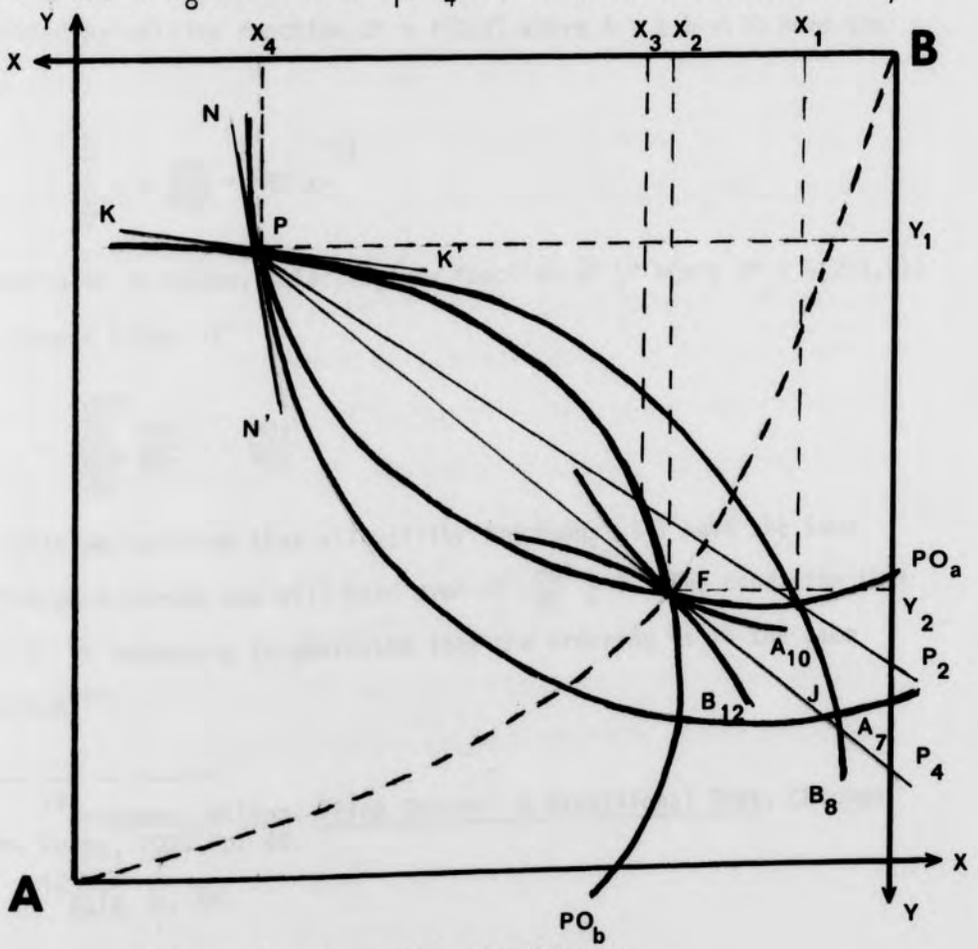

Figure 11: Competitive Equilibrium

with $Y - Y_1$, $X - X_4$. The ellipse PJ forms the relevant area within which trade is possible. Trade is restricted within this area because the A's will prefer the income distribution in the absence of trade at point P on initial indifference curve A_7 over distributions, placing them on lower indifference curves. Likewise, the B's will not accept trades moving them to indifference curves below their initial utility level Bg. The initial income distribution at point P and the fact that this is an intersection and not a point of tangency determines both the commodities which will be traded and the willingness to trade. Although the analysis is not dependent upon this, we will mention that indifference curves generated by utility function Ui = f(X,Y) where i = a,b will have the slope

$$-\frac{\frac{\partial U}{\partial X}}{\frac{\partial U}{\partial Y}} = -\frac{MUx}{MUy} = MRS\ xy$$ [14]

According to Friedman, selecting any function of U* where U* = G(U(X,Y)) will have a slope of

$$-\frac{\frac{dU^*}{dU}}{\frac{dU^*}{dU}}\frac{MUx}{MUy} = -\frac{MUx}{MUy}.$$

From this we conclude that all utility functions will have the same indifference curves and will hold even if $\frac{dU^*}{dU} \leqq 0$. The condition that $\frac{dU^*}{dU} > 0$ is necessary to guarantee that the ordering is in the same direction.[15]

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[14] Friedman, Milton, Price Theory: A Provisional Text, Chicago: Aldine Press, 1971, p. 46.

[15] Ibid. p. 46.

At point P the marginal rate of substitution of X for Y (MRS xy) is different for the A's and B's as indicated by the differing slopes of NN' and KK'. Because the slope of NN' is greater than KK' we know the A's have a higher MRS xy than the B's. This means that in comparison with the B's, the A's are willing to give up proportionately more Y for additional units of X. The relatively less steep slope of KK' reflects a lower MRS xy for the B's and indicates their willingness to give up proportionately greater quantities of X for additional units of Y. From the initial endowment point and the differing MRS xy we conclude the A's will trade for X and supply Y while the B's will supply X and trade for Y. Since the slopes of the indifference curves of the A's and B's differ, the marginal conditions for exchange are not satisfied, the income distribution is non-Pareto optimal, and trade is possible. Having described the model, let us discuss the method by which free trade leads to a Pareto-optimal income distribution.

In our model we make use of the Walrasian umpire. According to Friedman, the Walrasian method is a useful concept to bring out the 'logic of the interrelation of the price system' but cannot be used to analyze a concrete problem.[16] The use of the Walrasian umpire results in a determinant solution because a market clearing price must be found before trade is allowed to take place. The umpire begins by calling different relative prices (Px/Py), denoted in Figure 11 by PP_n where n = 1 ... n. Traders are allowed to select optimum or preferred quantities at each relative price. Optimal positions are determined by points of tangency

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[16] Ibid. p. 27.

of indifference curves and price vectors. The collection of these optima form the price-offer locus. Along the price-offer loci the following relationship holds for each trader:

$$MRS\ xy = -\frac{MUx}{MUy} = -\frac{Px}{Py} = PP_n$$

POa is the locus of such points for the A's with POb the equivalent locus for the B's. Because points along the price-offer loci represent optimal allocations, they will be chosen over non-optimal points located off the curve. Trade is possible only at the market clearing price, determined by the intersection of POa and POb. At prices other than the market clearing price, the indifference curves of the two traders are tangent to the same price vector but not tangent to each other, and excess supply or demand conditions are present. When excess supply is present the umpire is prompted to lower the price, while excess demand is a signal to raise prices. Excess demand is indicated in Figure 12. At PP_2 the

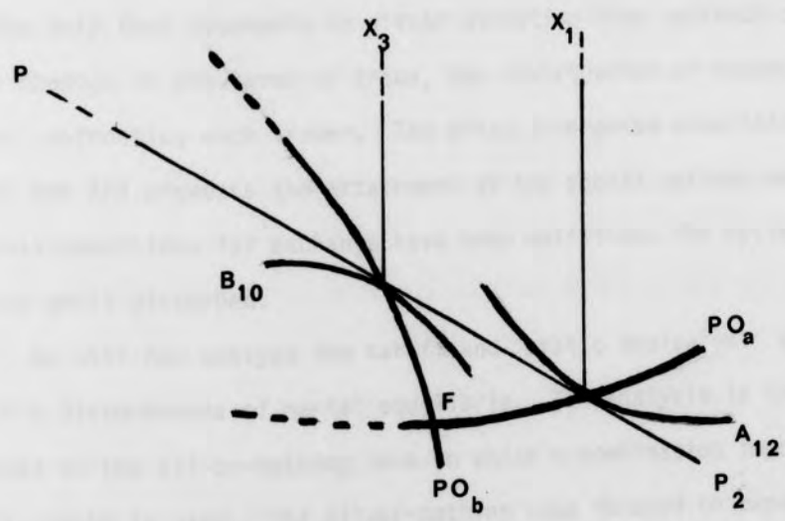

Figure 12: Excess Demand

A's demand quantity X_1 as indicated by the tangency of A_{12} to the price vector. At this price the B's are willing to supply only quantity X_3. The presence of excess demand prompts the umpire to call a higher price. The umpire submits higher prices until the market clearing price PP_4 is found. Once the indifference curves of both traders are tangent to each other at point F, the umpire allows the quantities of X and Y determined by the intersection of POa and POb to be exchanged at the price indicated by the slope of the tangency. At point F the marginal conditions for exchange are satisfied, and the following relationship holds:

$$\text{MRS xy (A's)} = \text{MRS xy (B's)} = PP_4.$$

The satisfaction of the marginal conditions precludes further trade, makes F a point on the contract locus AFB, and represents a Pareto-optimal income distribution. We are not permitted to make statements as to what may happen after a market-clearing price is reached, since non-quantifiable factors such as bargaining strength may become the determining factors. We know only that movements in either direction from contract curve AFB cause changes in the terms of trade, the distribution of income, and the prices confronting each trader. The price divergence associated with points off AFB prevents the attainment of the social optimum and once the marginal conditions for exchange have been satisfied, the system will remain at rest until disturbed.

We will now analyze the tariff and 'static equivalent' quota as possible disturbances of market equilibria. The analysis is then extended to the all-or-nothing case in which a combination import- and export- quota is used. The all-or-nothing case is used to expose the conditions for maximum exploitation by the B's. Although in our analysis

we will confine attention solely to tariffs and quotas, we may also note that in a static context a subsidy for consumers may be used to generate a market equilibrium identical to the tariff or quota.

Case Two: The Tariff and 'Static Equivalent' Quota

In case two we will alter the assumptions made in the competitive case to the extent that:

1. The B's have perfect knowledge of the preference map of the A's.
2. The B's are monopolists and are able to control the terms of trade.
3. The B's impose a tariff or quota.
4. Tariff revenue collected by the B's is distributed to individuals within the country in the form of a lump-sum subsidy.

In Figure 13, the ellipse TH forms the boundaries within which the B's will operate. As utility maximizers the A's will prefer to remain at point P rather than accept distributions placing them on indifference curves below A_7, while the B's will not offer distributions placing them on indifference curves below B_8. As monopolists, the B's will use their perfect knowledge of the A's preference map to find the maximum exploitable price in the tariff case, and the utility maximizing quantity of Y or X to be imported or exported in the quota case.

Because POa represents the optimum allocations of the A's, the B's will select a point on POa which places them on their highest indifference curve and therefore leading to maximum utility. Utility maximization for the B's is attained by imposing a tariff on Y imports. A tariff set at rate λ generates the necessary divergence between competitive price PP_4 and PP_6 to move equilibrium from point F to T. The slope of cord TF is the change in the competitive price ratio necessary for the movement of

equilibrium to point T and is therefore the rate at which the tariff is set. We will refer to this rate of divergence as λ. At point T the slopes of the indifference curves differ by λ and the following

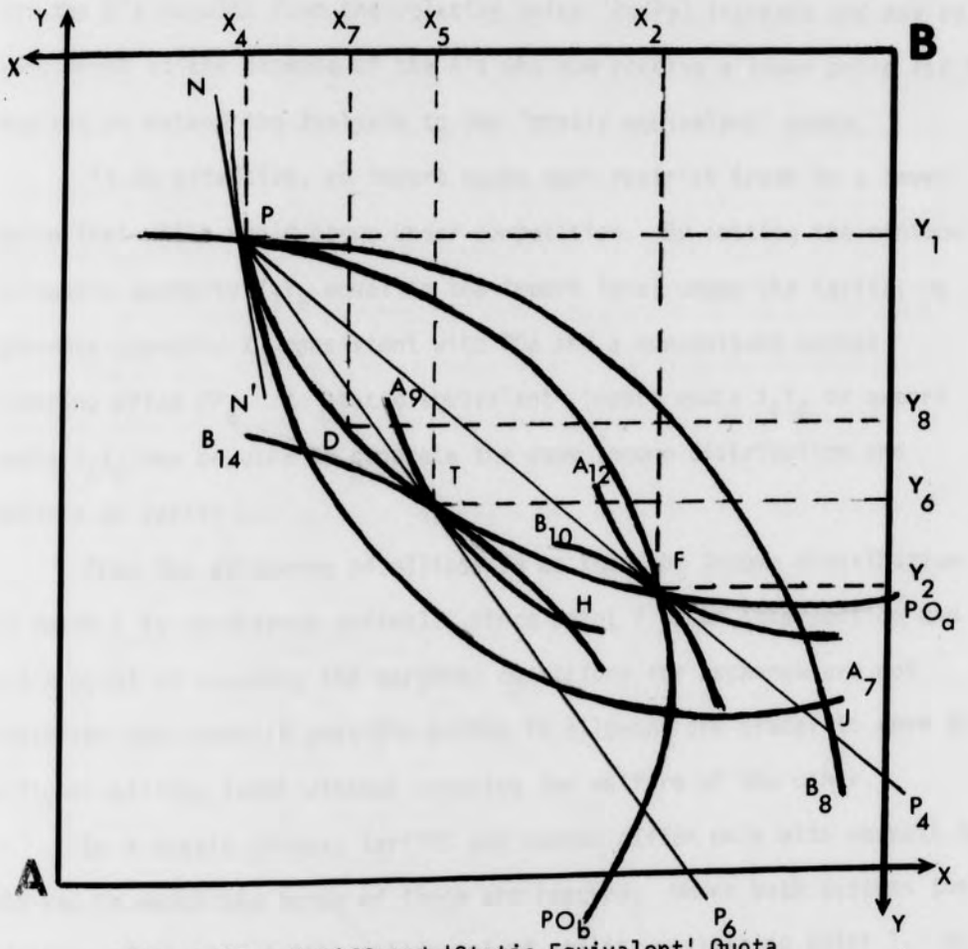

Figure 13: Tariff and 'Static Equivalent' Quota

relationship holds:

$$\text{MRS xy (B's)} + \lambda = \frac{MUy}{Py}\text{ (B's)} + \lambda = \frac{MUx}{Px}\text{ (B's)} = \frac{MUx}{MUy}\text{ (B's)} + \lambda$$

$$= \frac{Px}{Py}\text{ (B's)} + \lambda = PP_4 + \lambda = PP_6 = \text{MRS xy (A's)}.$$

The tariff results in an increased share of world income for the B's while the A's share diminishes. With the imposition of tariff λ the B's move from B_{10} to B_{14} while the A's move from A_{12} to A_9. The increased welfare for the B's results from the relative price (Px/Py) increase and may be considered at the expense of the A's who now receive a lower price for Y. Now let us extend the analysis to the 'static equivalent' quota.

To be effective, an import quota must restrict trade to a level below that which would occur under competition. By setting the minimum allowable quantity Y_1Y_6 equal to the import level under the tariff, we generate quantity X_5 consistent with POa and a concomitant market clearing price PP_6. A 'static equivalent' import quota Y_1Y_6 or export quota X_2X_5 may be used to generate the same income distribution and welfare as tariff λ.

From the existence of ellipse TH we know the income distribution at point T is non-Pareto optimal. Since point T is an intersection and not a point of tangency the marginal conditions for exchange are not satisfied and trade is possible within TH allowing one trader to move to a higher utility level without reducing the welfare of the other.

In a static context tariffs and quotas differ only with respect to the way in which the terms of trade are reached. Under both systems the strategy of the B's is the attainment of utility maximizing point T. In the tariff case the price is determined a priori by creating the divergence necessary to move from point F to T. With a quota it is the level of Y imports which is determined a priori, while the market is allowed to generate a set of relative prices consistent with the quantity of X preferred by the A's. Once the quantity of X consistent with POa is

determined we also have the market clearing price ratio. Because the marginal conditions of exchange are not satisfied at point T, the outcome of both forms of protection is non-Pareto optimal. The tariff and quota have in this instance been used to produce the same 'static' equilibria, thus allowing the description 'static equivalent'. In case three we will use a combination of quotas to generate a case which is not possible using any combination of tariffs.

Case Three: The All-or-Nothing Quota

The all-or-nothing quota is shown in Figure 14. With perfect knowledge of the A's preference map the B's are able to drive a harder bargain with an import quota setting the minimum quantity Y_1Y_7 and an

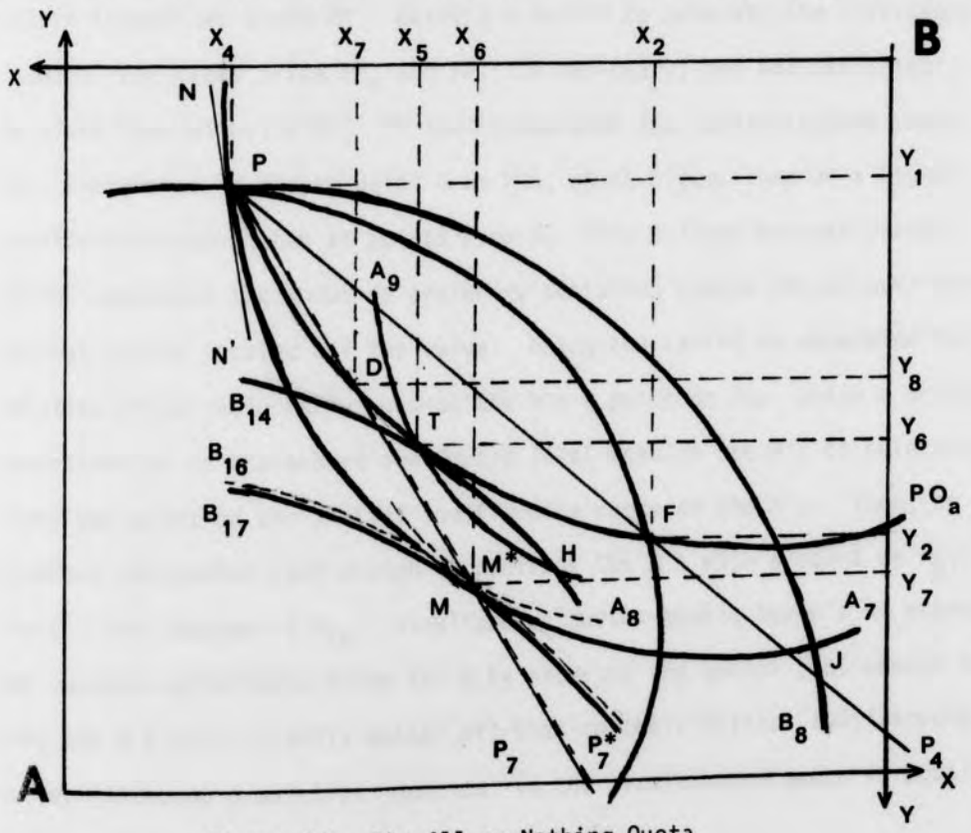

Figure 14: The All-or-Nothing Quota

and an export quota setting the minimum quantity X_6X_4. The optimal restriction for the B's is determined by finding the point on the initial indifference curve A_7 which places the B's on their highest attainable indifference curve. Point M on B_{17} is the highest attainable utility level for the B's. Now let us discuss the strategy used by the B's.

The B's use the utility maximizing behavior of the A's to assure a position near the super max point M. As utility maximizers the A's always select points on their highest attainable indifference curve. For points along A_7 the A's are indifferent between initial equilibrium at point P and trade at point M. By altering the quotas to generate a point just above point M on A_8 at PP_7*, just less than PP_7, the B's assure themselves point M*. Setting a tariff to generate the divergence between free trade price PP_4 and PP_7* is necessary, but not sufficient, to place them at point M*. If confronted with the tariff-induced price PP_7, the A's would choose point D on POa, which places them on a higher indifference curve than at points P or M. This follows because points on POa represent the locus of preferred positions always chosen over non-optimal points located off the curve. Using the tariff to determine the relative price ratio Px/Py assures the B's a point on POa, while a priori determination of the export and import level enables the B's to select a super max point on the initial indifference curve of the A's. Then, by altering the quotas just enough to confront the A's with a point on A_8, the B's are assured of B_{16}. Simultaneous quotas enable the B's to extract the maximum exploitable price for X by altering the quotas just enough to make the A's only slightly better off than on their initial indifference curve. Although a solution identical to the simultaneous quota is possible

by using a subsidy-tariff combination, the result is not strictly achievable by tariffs alone. Having demonstrated the general equilibrium 'static equivalence' of tariffs and quotas, and the All-or-Nothing case, let us define the conditions under which 'equivalence' breaks down.

Section Two: Dynamic General Equilibrium Models

The purpose of this section is to contrast the behavior of tariffs and quotas in a dynamic context. We will be concerned with two dynamic market structures: 'tightening' markets and 'softening' markets. From Chapter I we know 'tightening' markets are characterized by an increasing price level Px/Py, which may result from four sources:

1. Px may increase given Py is constant.
2. Py may decrease given Px is constant.
3. A combination Px increase and Py decrease.
4. An increase in both Px and Py if the increase in Px is greater than the increase in Py.

'Softening' markets are characterized by a decreasing price level Px/Py which may result from four sources:

1. Px may decrease given Py is constant.
2. Py may increase given Px is constant.
3. A combination Px decrease and Py increase.
4. A decrease in both Px and Py if the decrease in Px is greater than the decrease in Py.

Aside from changes in things which are held constant, relative prices may fluctuate due to shifting market conditions which change the marginal valuations of the goods. Increased endowments decrease the value

at the margin while decreased endowments increase marginal values. Although varying, the endowments of either 'good' may be used to achieve the same effect on relative prices, for simplicity we will vary only the A's endowment of Y since the B's objective as monopolist is securing Y at the lowest relative price Px/Py. Conversely, this may be explained as exchanging X at the highest relative price Px/Py, consistent with utility maximization and the price-offer locus of the A's. The locus POb is unique to the competitive case and with the introduction of monopoly POb becomes the point on the A's price-offer locus at which the B's achieve maximum utility. Furthermore, altering the B's endowment would change only the number of the B's utility maximizing indifference curve, whereas changing the A's endowment will result in a new price-offer locus and a new utility maximizing point for the B's. We begin the dynamic analysis by proving that welfare and income vary directly.

In Figure 15, we show that an increased endowment of Y is sufficient to move the A's to a higher indifference curve regardless of the new equilibrium price vector. For the A's to be better off it is sufficient to show that POa* does not intersect POa, and that any point on POa* represents the tangency of higher indifference curves. From initial income distribution at point P, we increase the endowment of Y vertically by PP'. The intersection of POa* and POb' determine the new equilibrium at point F'. POb' represents the same locus of tangencies of the B's indifference curves to price vectors and differs only with respect to the vertical distance PP'. POa is no longer the relevant locus for the A's and is replaced by POa* which represents the new locus

of tangencies of price vectors and higher indifference curves. At the new equilibrium point F, the A's are on A_2 which is greater than A_1 at

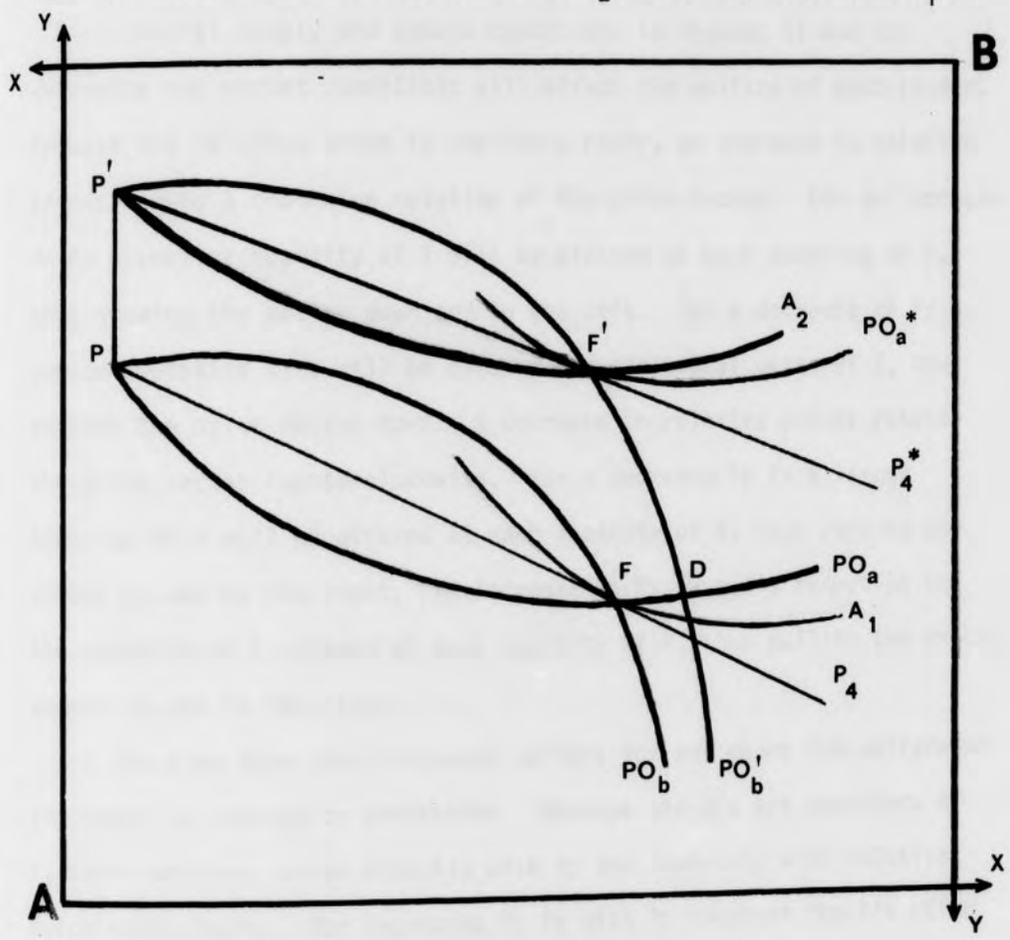

Figure 15: Increased Endowment of Y Increases the Welfare of the A's

point F. For the A's to be worse off, POa* would have to intersect POb' on the segment F'D. We conclude the A's are better off as a result of the increased endowment of Y since POa* does not intersect POa and points on POa* represent higher utility levels than POa. Conversely, it is true that a decrease in the endowment of Y leads to a reduction of the A's

welfare. Having demonstrated the A's welfare varies directly with good Y, let us proceed to the comparison of trade restrictions.

Initial supply and demand conditions in Figures 11 and 13 determine how market conditions will affect the welfare of each trader. Because the relative price is the ratio Px/Py, an increase in relative prices causes a clockwise rotation of the price vector. For an increase in Px a smaller quantity of X will be offered at each quantity of Y, thus drawing the vector down and to the left. For a decrease in Py a greater quantity of Y will be offered for additional units of X, thus pushing the price vector down. A decrease in relative prices rotates the price vector counterclockwise. For a decrease in Px a larger quantity of X will be offered at each quantity of Y, thus pushing the vector up and to the right. An increase in Py causes a reduction in the quantity of Y offered at each quantity of X, thus pulling the price vector up and to the right.

We also know that increased welfare for one means the welfare of the other is reduced or unaffected. Because the A's are suppliers of Y, their welfare varies directly with Py and inversely with relative price ratio Px/Py. For increases in Py with Px constant the A's offer less Y at each optimum or preferred position on the price-offer locus. A decrease in the relative price ratio Px/Py causes a counter-clockwise rotation of the price vector, which places the A's on a higher indifference curve. The B's welfare is directly related to relative prices and Px since they are suppliers of X. Markets in which the value of X increases with Py constant rotates the price vector clockwise and moves the B's to a higher indifference curve. In summary, clockwise

rotation increases the welfare of the B's while decreasing the welfare of the A's. The A's gain from relative price decreases and lose from increases, while the B's gain from relative price increases and lose from decreases. We now extend the analysis from the competitive equilibrium to the 'tightening' market.

Case I: 'Tightening' Market

A 'tightening' market is characterized by increasing relative prices. This is achieved analytically by increasing the A's allocation of Y by AY' thus reducing Py. In Figure 15 we proved the A's must benefit from an increased endowment of Y by vertically shifting the price-offer locus of the A's. In Figure 16 we show the increased endowment of Y by shifting the origin of the A's preference map down by AY'. This moves the A's to a higher utility level A_8. By assuming homothetic indifference curves we know the downward shift of the A's origin leads to a different slope of the A's indifference curve at the intersection at point P'. The slope of MM' in Figure 16 is greater than the slope of NN' in Figure 13, thus indicating the willingness of the A's to trade greater quantities of Y for additional units of X. The offering of greater quantities of Y in trade for X reflects the decrease in Py. The change in marginal valuation generates a new price-offer locus POa* which is located to the right and below POa.

Competitive equilibrium, determined by the intersection of POa* and POb, is moved from point F to F'. The new equilibrium price level $P'P_5$ is less than $P'P_4$. Income distribution for the B's shifts from X_2, Y_2 to X_{13}, Y_{12} while the A's have $X - X_{13}$, $Y - [Y_{12} + AY']$. The B's move to a higher utility level B_{12} due to the increase in relative

prices. Now let us see what happens if the shift occurs after the imposition of protection.

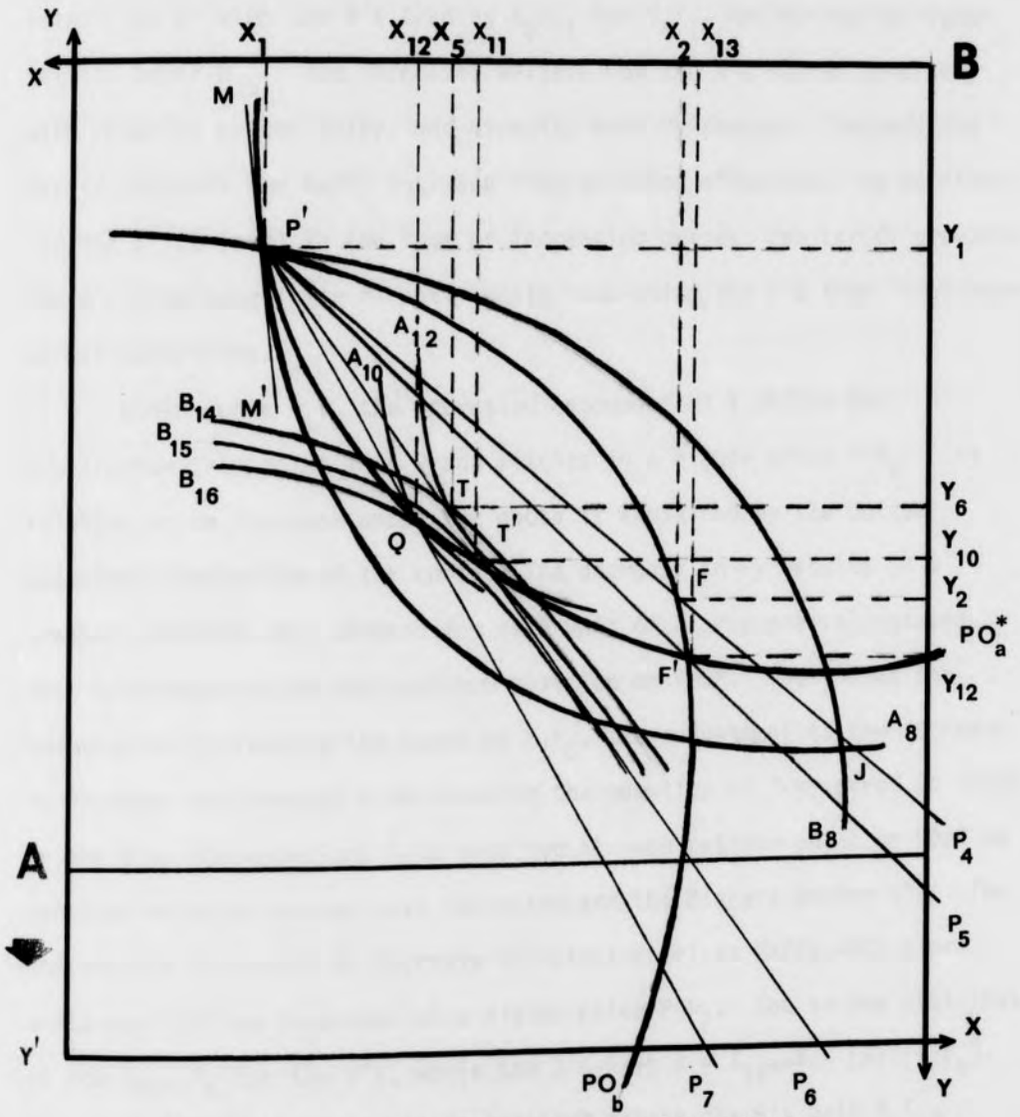

Figure 16: 'Tightening' Market Resulting from an Increased Endowment of Y

Under tariff λ trade is restricted to movements along $P'P_6$ with adjustments taking place in the quantities traded. Because trade is

restricted to $P'P_6$, the decrease in Py which increases relative prices Px/Py does not become effective. The tariff equilibrium shifts from point T to T' with the B's trading X_5X_{11} for Y_6Y_{10} and moving to higher utility level B_{15}. The increased welfare for the A's varies inversely with relative prices Px/Py, and directly with Py changes. Second, the tariff prevents the Px/Py increase from becoming effective. By maintaining the price level in the face of increasing prices, the tariff prevents the B's from benefiting directly while insulating the A's from 'tightening' market conditions.

Under quota Y_1Y_6 the increased endowment of Y shifts the equilibrium from point T to Q and results in a higher price $P'P_7$. The relative price increase under the quota is explained by the unique adjustment mechanism of the quota. The decrease in Py results in a greater quantity of Y offered for each unit of X or conversely stated, less X is required at each optimum position on POa*. Thus, with the quantity of Y fixed by the quota at Y_1Y_6, the adjustment to the decrease in Py takes the form of a decrease in the quantity of X required in trade by the A's. Because less X is required at each optimum point on POa* we conclude relative prices have increased and the B's are better off. The increase in Px causes an increase in relative prices Px/Py with a new quota equilibrium generated at a higher price $P'P_7$. The income distribution is now X_{12}, Y_6 for the B's, while the A's have $X - X_{12}$, $Y - [AY' + Y_6]$. Due to the shift and increase in relative prices the B's gain X_5X_{12} without trading additional Y.

At point Q the A's are on a lower indifference curve than at T' due to the decrease in Py and effective increase in relative prices.

Conclusion: 'Tightening' Market Relative Price

Since the B's welfare varies directly with relative prices Px/Py, and inversely with Py, we know that in a 'tightening' market they are better off under a quota because the relative price increase becomes effective. In a 'tightening' market the quota adjustment to the decrease in Py takes place in terms of a clockwise rotation of the price vector, which increases the B's allocation of X and moves them to a higher utility level. Because both X and Y are 'goods' we know a change in relative prices will make one trader better off. We also know the A's welfare undergoes the greatest reduction under the system in which the B's gain is greatest. Now let us contrast the results in 'softening' markets.

Case II: 'Softening' Market

In 'softening' markets we explain the decrease in relative prices by an increase in Py resulting from a reduction of the A's allocation of Y. In this case also we assume the reduction of the total Y endowment affects only that portion of Y owned by the A's and has no affect on the B's valuation of Y. Given a constant X endowment, the decrease in the Y leads to an increased marginal valuation of Y by the A's and a concomitant decrease in relative price ratio Px/Py. In Figure 15 we proved that an increased endowment of Y makes the A's better off and conversely, a decrease in Y makes the A's worse off. In Figure 17 we decrease the A's initial allocation by AY', shifting the origin of the A's upward by the amount of the decrease. The upward shift of the A's origin moves the A's to lower indifference curve A_3. Under the assumption of homothetic indifference curves the result of the upward shift of the

A's origin is a different slope of the A's indifference curves at the intersection of A_3 and B_8 at point P'. The differing slopes of NN' in

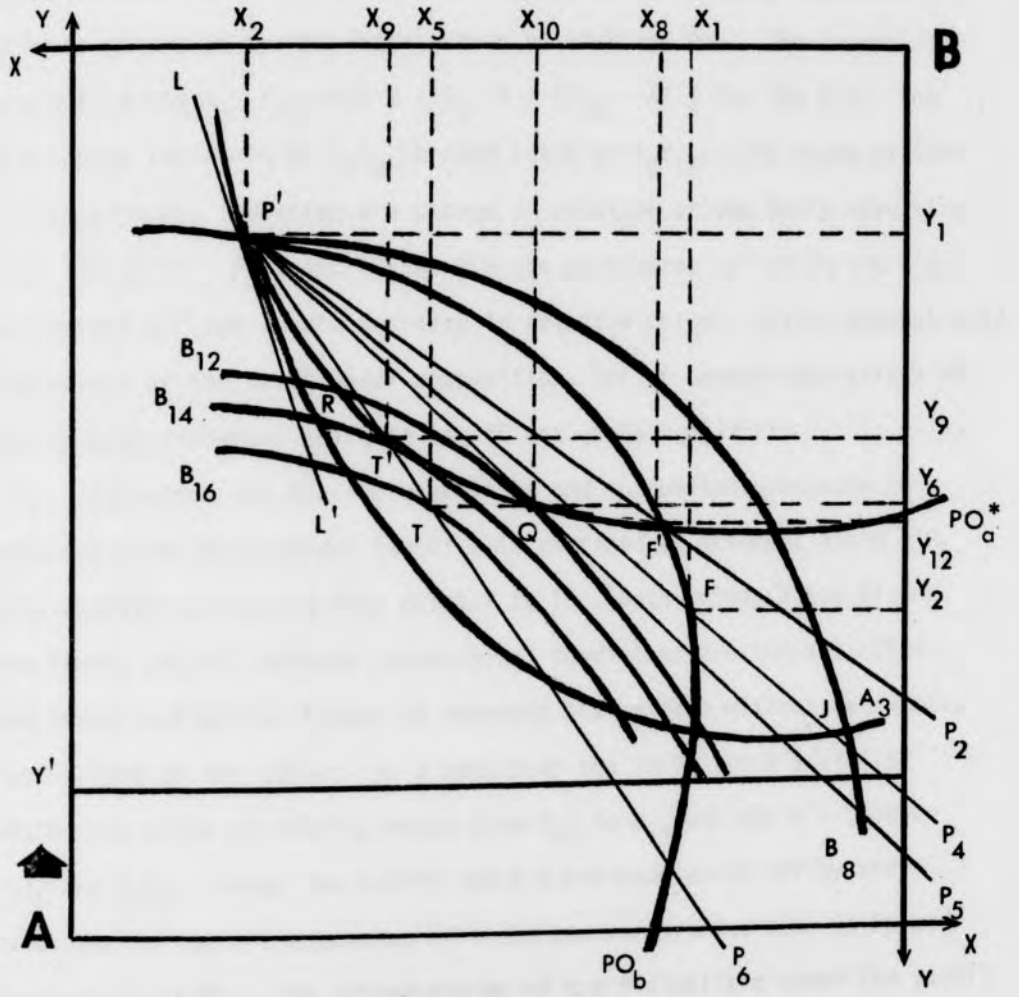

Figure 17: 'Softening' Market Resulting from Decreased Y Endowment for the A's

Figure 13 and LL' in Figure 17 reflect the higher Py. The slope of NN' is steeper than LL' because less Y is offered for each unit of X. Under competition the higher marginal valuation of Y in Figure 17 indicates the A's reluctance to offer the same amount of Y at each price. A new price-

offer locus POa* is located to the left and above the old locus POa. Along POa*, reflecting the higher Py, a smaller quantity of Y is offered for each quantity of X. A new equilibrium point F' and price level $P'P_2$ is generated by the intersection of POa* and POb. The income of the B's is now X_8, Y_{12} with X - X_8, Y - [Y_{12} - AY'] for the A's. The B's income increases by X_1X_8 through trade of Y_2Y_{12}. The slope of cord FF' (not shown) indicates the change in relative prices Px/Py resulting from the shift. At point F' the B's are made worse off while the A's are better off due to the decrease in relative price. Having demonstrated the effect of the ex post endowment shift on tariff and quota equilibria.

Adjustment to the increase in Py and concomitant decrease in relative price Px/Py under tariff λ is confined to movement along $P'P_6$ with equilibrium moving from point T to T'. Both points T and T' are non-Pareto optimal because the marginal conditions are not satisfied and trade enables one trader to increase his welfare without decreasing the welfare of the other. As a result of the shift the B's utility maximizing point on POa* is moved from B_{16} to B_{14} and the B's give up Y_9Y_6 and X_9X_5. Under the tariff the B's are made worse off by the reduction in the A's endowment of Y and concomitant increase in Py and decrease in Px/Py. The deterioration of the B's welfare under the tariff is the result of the movement of POa*.

The new equilibrium under quota Y_1Y_6 becomes point Q on $P'P_5$. Because the price $P'P_5$ is less than $P'P_6$ we know the B's are worse off under the quota. The B's are better off under the tariff because the 'softening' market is not allowed to become effective. The existence of

the ellipse QR makes the income distribution under the quota non-Pareto optimal. Since the marginal conditions for exchange are not satisfied at points Q or T', trade is possible in X although Y is frozen by the quota.

Conclusion: Case II

Because the B's welfare varies directly with relative prices Px/Py and inversely with Py, in 'softening' markets the B's attain higher utility levels by using the tariff. The B's are better off under the tariff in the 'softening' market due to the insulation from relative price decreases. The tariff prevents the price decrease from becoming effective and therefore prevents a welfare loss for the B's. Quotas, on the other hand, allow the decrease in relative prices to become effective thus making the A's better off and the B's worse off. In a 'softening' market maximum exploitation is achieved under the tariff.

Conclusion: Chapter Three

With perfect market knowledge and costless adjustment to changing market conditions by varying quantities and prices instantaneously, we have found quotas may be used interchangeably with tariffs to produce the same equilibria. However, in the absence of such perfect knowledge and costless adjustment, the adjustment mechanism of tariff or quota systems may be used to generate superior welfare for the imposer. Due to initial market conditions we found the B's welfare to vary directly with relative prices Px/Py and inversely with Py. In the 'tightening' market characterized by increasing relative prices and a clockwise rotation of the price vector, we found the B's are better off under the quota. The

B's are better off because the quota holds the quantity of Y constant permitting only a price adjustment, through changes in the quantity of X required on POa*.

In 'softening' markets a decrease in relative prices is shown by a counter-clockwise rotation of the price vector. Tariffs make the B's better off because the decrease in relative prices is not allowed to become effective. Under the tariff relative prices are held constant and the quantity traded is allowed to change in adjustment to the changing market conditions. The B's are made better off under the tariff in the 'softening' market because the tariff adjusts through the quantity traded and does not allow the decrease in relative prices and the concomitant decrease in welfare.

The results of our analysis may be generalized. Traders whose welfare varies directly with relative prices Px/Py, are better off by virtue of the tariff in the 'softening' market and by the quota in the 'tightening' market. They are better off with a tariff in 'softening' markets because the decrease in relative prices does not become effective. Conversely, they are better off with a quota in 'tightening' markets because the increase in relative prices becomes effective. Because tariffs maintain relative prices, traders are insulated from market shifts. Quotas, on the other hand, allow the price changes resulting from market shifts to become effective. The adjustment mechanism of the quota would appear more like the free market if not for the fact that trade in one commodity is frozen.

Reversing the supply and demand conditions resulting from initial endowments would reverse the conclusions. Because the imposing country may lose as well as gain, it is essential that it have adequate information about both market conditions and trading partners before selecting the type of protection to achieve maximum exploitation of its rival. The use of the wrong method may reduce the welfare of the imposing country and make its adversary better off.

SUMMARY

In Chapter I we discussed the historical context in which quotas were first used and the reasons why they came into being. The French used import quotas to divert the inelastic supply of Australian wheat while recent United States import quotas have been used as a 'stop-gap' measure to protect 'mature' domestic industries threatened by foreign competition. Arguments for the protection by quotas of 'mature' industries are fundamentally different from the 'infant' industry arguments made by supporters of tariffs. Import quotas were shown to be more arbitrary than tariffs due to the administrative flexibility which allows a priori determination of the quantities to be imported as well as those who will be allowed to import. The artificial stimulation and misallocation of resources resulting from protection cause a distortion of social cost and social benefit. In static partial equilibrium analysis, taxes and quantitative restrictions may be used to achieve the same results, since both ultimately limit the supply.

In Chapter II the 'static equivalence' and dynamic 'non-equivalence' of tariffs and quotas was demonstrated in a partial equilibrium model. Quotas make producers better off in the 'tightening' market by virtue of their adjustment mechanism. Producers are better off in the 'softening' market under tariffs because the relative price is maintained while changes take place in the quantities traded. In Case Two, a market characterized by inelastic demand, we found producers were better off under the quota in the 'tightening' market. This contradicts the

historical reliance on tariffs in this market structure. Tariffs were found to provide greater protection in the 'softening' market.

In Chapter III we used a dynamic general equilibrium model to contrast the two forms of protection. The importance of initial endowments in determining the willingness to trade and the equilibrium price level was demonstrated. We found traders whose welfare varies directly with relative prices are better off under the tariff in the 'softening' market and under the quota in the 'tightening' market. Tariffs make this trader better off in the 'softening' market by preventing the decrease in relative prices from becoming effective. On the other hand, quotas make him better off in 'tightening' markets because it allows the increase in relative prices to become effective. The reverse is true for traders whose welfare varies inversely with relative prices. Because the imposing country may be adversely affected by shifting market conditions, it is important that adequate knowledge be available concerning the trading partner and the market in which he is operating.

BIBLIOGRAPHY

Baldwin, Robert E., "Equilibrium in International Trade: A Dramatic Analysis," Quarterly Journal of Economics, Vol. 62, November, 1948.

Baldwin, Robert E., "The Effects of Tariffs on International and Domestic Prices," Quarterly Journal of Economics, Vol. 74, February, 1960.

Baldwin, Robert E., "The New Welfare Economics and Gains in International Trade," Quarterly Journal of Economics, Vol. LXVI, February, 1952.

Bator, Francis M., "The Simple Analytics of Welfare Maximization," American Economic Review, Vol. XLVII, March, 1957.

Beman, Lewis, "How to Tell Where We're Competitive," Fortune, Vol. LXXXVI, No. 1, July, 1972.

Bhagwati, J., "A Note on the Equivalence of Tariffs and Quotas," American Economic Review, Vol. 58, March, 1968.

Bhagwati, J., "The Pure Theory of International Trade: A Survey," Economic Journal, Vol. XXIV, No. 296, March, 1964.

Corden, W. W., "Monopoly, Tariffs, and Subsidies," Economica, Vol. 34, February, 1967.

Edgeworth, F. Y., "On A Point in the Pure Theory of International Trade," Economic Journal, Vol. IX, No. 1, March, 1889.

Ellis, Howard S., and Metzler, Lloyd A., Readings in the Theory of International Trade, Philadelphia: Blakiston Company, 1949.

Flanders, June M., "Measuring Protectionism and Predicting Trade Diversion," Journal of Political Economics, Vol. LXXIII, April, 1965.

Fleming, J. Marcus, "On Making the Best of Balance of Payments Restrictions on Imports," Economic Journal, Vol. LXI, No. 241, March, 1951.

Friedman, Milton, Price Theory: A Provisional Text, Chicago: Aldine Press, 1971.

Gehrels, Franz, "Optimal Restrictions on Foreign Trade and Investment," American Economic Review, Vol. 61, March, 1971.

Graaf, J. deV., "On Optimum Tariff Structure," Review of Economic Studies, Vol. XVII, No. 42, 1949-50.

Grubel, H. G., "Anatomy of Classical and Modern Infant Industry Arguments," Weltivirtschaft Archiv, December, 1966, Band 98.

Haberler, Gottfried, "Some Problems in the Pure Theory of International Trade," Economic Journal, Vol. 80, June, 1970.

Hicks, John R., "The Rehabilitation of Consumer's Surplus," The Review of Economic Studies, Vol. 8, February, 1941.

Johnson, H. G. and Bhagwati, J., "Notes on Some Controversies in the Theory of International Trade," Economic Journal, Vol. 70, 1960.

Johnson, H. G., "The Cost of Protection and the Scientific Tariff," Journal of Political Economics, Vol. 68, August, 1960.

Kaldor, N., "A Note on Tariffs and the Terms of Trade," Economica, Vol. 7, November, 1940.

Kemp, M. C., The Pure Theory of International Trade, Inglewood Cliffs, New Jersey: Prentice Hall, 1964.

Kindleberger, C. P., International Economics, Homewood, Illinois: R. D. Irwin Inc., 1963.

Krause, Lawrence B., "Import Discipline: The Case of the United States Steel Industry," Journal of Industrial Economics, Vol. XI, No. 1, 1962.

Kreinin, Mordechai, "More on the Equivalence of Tariffs and Quotas," Kyklos, Vol. 23, 1970.

Leith, J. C., "The Effect of Tariffs on Production, Consumption, and Trade: A Revised Analysis," American Economic Review, Vol. 80, March, 1971.

Leontief, Wassily, Essays in Economics, Theories and Theorizing, New York: Oxford University Press, 1966.

Leontief, Wassily, "The Pure Theory of the Guaranteed Annual Wage Contract," The Journal of Political Economy, Vol. LIV, No. 1, February, 1946.

Lerner, A. P., "The Diagramatic Representation of Demand Conditions in International Trade," Economica, Vol. I, August, 1934.

Lerner, A. P., "The Symmetry Between Import and Export Taxes," Economica, Vol. III, August, 1936.

Magee, Stephen P., "Factor Market Distortions, Production, Distribution, and the Pure Theory of International Trade," Quarterly Journal of Economics, Vol. LXXXV, November, 1971.

Meade, James Edward, A Geometry of International Trade, London: Allen and Unwin, 1961.

Meade, James Edward, Trade and Welfare, New York: Oxford University Press, 1961.

Miezkowski, P. M., "The Comparative Efficiency of Tariffs as a Means of Obtaining Revenue or Protecting Domestic Production," Journal of Political Economics, Vol. 74, December, 1966.

Mishan, E. J., "A Survey of Welfare Economics - 1939-1959," Economic Journal, Vol. LXX, No. 278, June, 1960.

Mosak, Jacob L., General Equilibrium Theory of International Trade, Bloomington, Indiana: Principia Press, 1944.

Patinkin, Don, "Demand Curves and Consumer Surplus," Measurement in Economics: Studies in Mathematical Economics and Econometrics, Stanford, California: Stanford University Press, 1963.

Quirk, James, and Saposnik, Rukin, Introduction to General Equilibrium and Welfare Economics, New York: McGraw-Hill Book Company, 1968.

Rybczynski, T. M., "Factor Endowment and Relative Commodity Prices," Economica, Vol. XXII, No. 84, November, 1955.

Samuelson, Paul A., "Welfare Economics and International Trade," American Economic Review, Vol. XXVIII, No. 2, June, 1938.

Shibata, H., "A Note on the Equivalence of Tariffs and Quotas," American Economic Review, March, Vol. 58, 1968.

Travis, W. P., The Theory of Trade and Protection, Cambridge, Mass.: Harvard University Press, 1964.

Vanek, Jaroslav, General Equilibrium of International Discrimination, Homewood, Illinois: Richard D. Irwin Inc., 1960.

Vickrey, William S., Microstatics, New York: Harcourt, Brace and World, Inc., 1964.

Viner, Jacob, International Economics Studies, Glencoe, Illinois: Free Press, 1951.

Walter, Ingo, "On Equivalence of Tariffs and Quotas," Kyklos, Vol. 24, 1971.

Wemelsfelder, "The Short Run Effects of the Lowering of Import Duties in Germany," Economic Journal, Vol. 27, March, 1960.

Winch, David M., "Consumer's Surplus and the Compensation Principle," American Economic Review, Vol. 75, June, 1965.