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Measures of the Degree and Cost of Economic Protection of Agriculture in Selected Countries

by

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INTRODUCTION

The expansion of agricultural protection in many industrially developed countries is one of the main problems facing agricultural trade today. The isolation of agriculture from free trade and competition is in sharp contrast with developments in industrial sectors where the trend toward trade expansion and removal of trade restrictions was encouraged by the formation of the General Agreement on Tariffs and Trade (GATT) in 1948.

The exemption of trade in agricultural products from international trading rules reflects a basic conflict between domestic agricultural and trade expansion policies. This conflict has always existed but it has been heightened in recent years by the inability of agricultural workers to achieve comparable income increases with workers in the industrial sector. This has been due to a combination of many factors including an extremely rapid rate of technological advance and a failure of farm resources, particularly labor, to adjust adequately so that those resources remaining in agriculture might achieve the full benefits of increases in productivity. The resulting disparity, for social and political reasons, has led to government action designed to correct this imbalance.

The most common method of raising farm income was a system of price supports which maintained domestic prices above world prices (prices for which the commodities were available on the world market). Trade restrictions were then necessary to preserve the domestic price level and to ensure a market for higher priced domestic production. The situation was aggravated by the creation of surpluses in many countries due in part to response of domestic production to higher price levels. The accumulation of stocks resulting from production in excess of effective demand produced

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a downward pressure on world prices, intensifying the divergence between them and domestic prices. The continuance of trade barriers and the growing problem of surpluses led to the institution in 1961 of international discussions to determine conditions of access for agricultural products in international trade. Such discussions are still in progress (1). [3]

Two problems are of interest in any discussion of agricultural protection. These are measurement of the degree of protection and measurement of the welfare cost of protection. The first problem was discussed by Haberler and his group (2) in 1958. They concluded that some measure which would incorporate the results of all existing methods of protection was necessary. Tariff reductions had ceased to have much significance due to the employment, by the protecting countries, of quantitative restrictions, administrative barriers, sanitary regulations, and numerous other devices--all calculated to inhibit, if not directly prevent, trade in agricultural products. The recommendations of the Haberler report were acted upon by the United Nations (UN) in 1961 and a method of measuring the degree of protection was devised (3).

While such a measure is useful and is superior to one based on ad valorem tariffs or the mere enumeration of controls in existence, it still leaves the more important question unanswered--the welfare cost of protection. This cost may be defined as the cost incurred by the protecting country due to distortions in patterns of production and consumption. To the protecting country, the results of protection in terms of welfare cost are more significant than an index of protection, while to the exporting country market accessibility is the predominant consideration. These concepts are closely related.

The present study is concerned with both the degree and cost of protection. In the first section, the degree of protection is estimated for temperate zone agricultural commodities for 1959-61 for the following countries: Canada, Denmark, France, Italy, Netherlands, the United Kingdom, the United States, and West Germany. Changes in the degree of protection for the decade ending in 1961 are also examined. In the second part of the study, a model which can be used to measure the welfare cost of agricultural protection is developed. The model has general applicability and may be employed for both importing and exporting countries. Two applications of the model are made and the welfare effects of different methods of support for agriculture are analyzed.

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[3] Underscored numbers in parentheses refer to Literature cited, p. 61

DEGREE OF PROTECTION

Agricultural Protection in Industrially Developed Countries

Haberler and his panel (4) decided that most national devices for the protection of agriculture could be viewed as a combination of the following three categories: (1) devices which directly discourage imports (import duties, quantitative restrictions, state trading, multiple exchange rates); (2) devices which directly encourage exports (export subsidies, multiple exchange rates); (3) devices which directly encourage domestic production (price supports, deficiency payments).

In the first two cases the domestic producer and consumer face a higher price than that ruling in the world market. Under the deficiency payments system, however, the price to consumers is the free market price, while domestic producers receive a payment--deficiency payment--from the government to compensate for the difference between the free market price and an administratively determined producer price. Thus, the domestic producer price is higher than that with which either the domestic consumer or foreign trader is confronted.

There have been several studies by international organizations of national policies for supporting farm income. Special working parties were established by the Food and Agriculture Organization of the United Nations (FAO) in 1956 and 1959 and reports were published in 1960 (5). These reports describe in detail the price and income policies of various countries and the effects of these policies on production, consumption, and trade in agricultural products. The Organization for European Economic Cooperation (OEEC) and its successor, the Organization for Economic Cooperation and Development (OECD), have also discussed national policies of member and associate countries (6, 7).

The use of nontariff barriers to trade in agricultural products has been studied by Committee II of GATT, which was established as part of a trade expansion program in 1958. The Committee concluded that the use of such devices had seriously affected trade in dairy products, meat, and cereals (8). The comprehensiveness of the devices employed may make it necessary to consider an equivalent rather than an actual tariff when a measurement of the degree of protection is required.

Actual Tariff

The concept of the height of a given tariff and attempts to translate this concept into numerical terms encounter many difficulties.

The most important obstacle is the ambiguity of the concept itself since the tariff height may vary with the different methods used to measure it. Haberler (9) in his discussion of this problem mentioned the following ways of measuring the tariff height and their disadvantages: (1) protected imports as a percentage of total imports; (2) import duties as a percentage of total value of protected imports; (3) import duty as a percentage of the value of the protected good (ad valorem tariff).

The first two methods fail to take the prohibitive effect of tariffs into consideration. Thus a small value may reflect either a low degree of protection or the prohibitive nature of some import duties. The third approach avoids this disadvantage but it still is not entirely satisfactory. If a general index of protection is required, a weighted average must be constructed and this in turn raises the question of weight assignments. In addition, the price of the commodity (in either the importing or exporting country) which forms the basis for the tariff computation cannot be regarded as constant since the duty may have influenced its price. The conversion of specific to ad valorem rates may also present some problems due to quality differences and lack of adequate information. Haberler considered the third method to be the most reliable but emphasized that the height of the tariff wall was only one aspect of protection.

The use of nontariff barriers to trade in agricultural products, which has already been mentioned, means that tariffs are often less important than other methods of agricultural protection such as import quotas and subsidies. Recognition of this fact has led to the omission of most agricultural products from the comprehensive list of duties compiled by Political and Economic Planning (10). A similar study by the European Economic Community (EEC) of tariff levels of various trading blocs also disregarded agricultural and food products (11).

The U.S. Department of Agriculture presented a quantitative estimate of the degree of protection afforded by nontariff trade barriers in 1963 (12). The report compared the value of all major commodities produced in a country with the value of protected production where protected production was assumed to be all production covered by nontariff trade restrictions. It was pointed out that such an index might be inadequate in view of possible divergences between the existence and application of controls. The index thus served to reflect potential rather than actual protection.

Equivalent Tariff

The Haberler report in discussing the prevalence of nontariff trade barriers stated that (2):

"In principle the best way of measuring the degree of total protection given to any line of agricultural production in any country

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by the combination of protective devices used in that country would be to measure the percentage change by which the price (including any subsidy) received by the domestic producer exceeded the price at which the product was available from foreign suppliers or could be sold to foreign consumers."

This concept is similar in many respects to the equivalent tariff of Harberger (13), which is the tariff with the same effect on the volume of imports as existing trade restrictions.

In 1961, the United Nations implemented the recommendations of the Haberler report and published the results of a study of protective margins for temperate zone agricultural commodities for Western European countries for two 3-year periods in the 1950's (3). Import and export unit values were employed as approximations to the free market price enabling the margin of protection to be estimated for both importing and exporting countries. Transport costs and the ability of large importers to obtain favorable terms of trade were thus included in this measure.

In the following section the degree of protection, based on the United Nations method, is estimated for grain, livestock, and dairy products for 1959-61 for the following, countries: Canada, Denmark, France, Italy, Netherlands, the United Kingdom, the United States, and West Germany. A 3-year period was selected to avoid distortions due to fluctuations in the variables in any 1 year. As in the case of actual tariffs, the height of the tariff wall rather than its effectiveness is under consideration.

ESTIMATION OF THE DEGREE OF PROTECTION

Methodology

The equivalent tariff may be defined as the difference between producer and world market prices where the latter represent prices for which the commodity is traded on the world market. Price comparisons are made at the same marketing level necessitating an allowance for marketing margins for all commodities except wheat, barley, and oats. Marketing margins for these three commodities are omitted because of their relative unimportance and the lack of adequate data.

Derivation of the degree of protection is based on the equivalent tariff. The method may be summarized as follows. Let

P = average price received by producer for all types of sales

M = marketing margin = dollars per quintal (100 kilograms)

P' = adjusted producer price = P + M

T = import or export unit value (total value of imports or exports/total quantity of imports or exports).

Then degree of protection = $\frac{(P-T)}{P}100$ = percentage tariff (grain)

$$=\frac{(P'-T)100}{P'} = \text{percentage tariff (livestock and dairy products)}.$$

The difference between producer and trade prices may also be conceived as a percentage of the trade price resulting in the following formula:

Degree of protection = $\frac{(P-T)}{T}100$ = ad valorem tariff (grain)

$$=\frac{(P'-T)}{T}100 = \begin{array}{l}\text{ad valorem tariff (livestock}\\ \text{and dairy products).}\end{array}$$

The difference between percentage and ad valorem tariffs is shown in the following example. Let

P = producer price = \$20.00

M = marketing margin = \$10.00

P' = adjusted producer price = \$30.00

T = import or export price = \$15.00.

Then percentage tariff = 50 percent and ad valorem tariff = 100 percent.

Unless indicated otherwise the percentage tariff will be used in this study as a measure of the degree of protection.

Several qualifications concerning the reliability of the above method must be made because of quality differences, distribution costs and conversion factors, reality of world market prices, and transport costs.

QUALITY

For some commodities (eggs, bacon, butter) quality differences between domestic and foreign production may not be great (14). In this case the degree of protection is not changed greatly if the assumption of uniform quality is made. For cereals and beef, however, the price differential may be considerable and its impact on the degree of protection must be noted. For example, if domestic production is of inferior quality, the degree of protection has been underestimated while the converse holds if domestic production is of superior quality. No adjustments for quality differences were made in the present study so that some reservations must be made concerning results for these products (cereals and beef).

DISTRIBUTION COSTS

The particular marketing margin used is important since the higher the margin in any country the greater the degree of protection. It is conceivable that in countries with high distribution costs, free trade might result in the domestic producer receiving a lower than world price (at the farm level). Whether uniform or selected margins are used depends a good deal on what is being measured. The use of uniform margins implies that the measure is concerned solely with protection afforded to the domestic producer while the use of selected margins includes protection of distributors also. In this study, uniform margins were used for all livestock and dairy products; in addition, a separate analysis using individual margins for each country was made for beef, pork, eggs, and milk. In the latter analysis, some error was introduced due to lack of adequate data concerning actual marketing margins.

Another source of error lies in the conversion factors used for livestock and dairy products.[4] Such conversion factors may be considered only as approximations to actual conditions.

WORLD PRICES

The use of existing trade prices to measure the degree of protection assumes that such prices will remain relatively constant when protection is discontinued. Current trade prices may, however, be artificially low or high due to agricultural protection. Increased imports will also be required to replace high cost production, and there is no guarantee that these can be obtained at existing price levels. A great deal depends on the elasticity of supply and the extent to which production controls and surplus disposal policies have affected quantities placed on the world market. The direction of change is thus uncertain for many commodities. One study concluded price increases were more likely and placed them in the neighborhood of 10 percent for dairy products and 5 percent (a relatively minor change) for most other products (14). It can also be argued that potential changes in world prices face all countries equally, so that while some alterations in the degree of protection may occur the rankings of the individual countries will remain unchanged.

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[4] For livestock, domestic prices received by farmers, which were given in live weight, have been converted to carcass weight to permit comparison between unit values of imports or exports. Standard conversion factors were used for all countries. In the case of milk, variable conversion factors for the different countries were employed to convert producer prices for milk to producer prices for butter.

Price quotations for imports and exports are generally given as of the country's border. This means that imports are valued c.i.f. (cost, insurance, and freight) while exports are valued f.o.b. (free on board). Import and export values, therefore, include external transport costs for imports and internal transport costs for exports.[5] For Canada and the United States, certain adjustments had to be made because foreign trade values were compiled by a different method. Canadian exports are valued from within the country's border so that an allowance for internal transport costs must be made. These costs were assumed to amount to 4.5 percent of the value of exports for all commodities and export values were accordingly increased by this amount. This assumption is based on the fact that the inland freight on exports from Canada was equal to 4.6 percent of the value of exports in the period 1946-50 (15), while export duties and inland freight amounted to 4.5 percent of export values in the period 1949-53 (16).

Trade statistics for the United States are valued f.o.b. for both imports and exports, requiring a conversion from f.o.b. to c.i.f. values for imports from nonbordering nations. Import values were increased by 10 percent to obtain the necessary c.i.f. valuation. The assumption that 10 percent of the c.i.f. value of an import is accounted for by insurance and transport costs has been frequently employed in international trade studies (16,17,18). In both instances, transport cost adjustments undoubtedly introduced a margin of error but it was felt that such adjustments were not likely to have modified the resulting estimates to any great extent.

One final qualification must be made. The present method of obtaining the degree of protection ignores subsidies on agricultural inputs such as fertilizers and direct income payments to farmers other than deficiency payments as in the British system. The United Nations study concluded that such payments rarely exceeded more than 5 percent of the value of agricultural output and hence that it was unlikely to influence the degree of protection to any great extent (14). Other aid to agriculture such as irrigation, education, and research was considered as aid to the entire economy rather than to a particular sector.

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[5] It should be pointed out that while import values exclude tariffs on imports, export values reflect the deduction of subsidies from exports by the protecting countries. In both cases, export and import values represent the selling price of the commodity.

Results: Uniform Marketing Margins (1959-61)

The degree of protection which the various countries provided for grain, livestock, and dairy products for 1959-61 is given in tables 1 to 8. Two measures of protection were calculated for countries which were both importers and exporters of a particular commodity. A negative degree of protection indicates that producer prices were less than trade prices for the period under review. This implies the absence of protection although quality differences may have influenced the result.

For livestock and dairy products, marketing margins were based on the results of various marketing studies in North America and Europe. The marketing margins employed were similar to those employed by the United Nations study (3) for live cattle and pigs ($3 per quintal); eggs (10 percent of producer price); and milk ($16 per quintal of butter for processing costs). Marketing margins for beef and pork ($7 per quintal) were $2 per quintal higher than those employed by the UN study. It was felt that the higher figure approximated more closely actual marketing margins in the various countries in the period under review.

WHEAT (table 1)

Degree of protection ranged from -27 to 45 percent of producer price. No adjustments were made for quality differences between domestic and imported wheat.

In the second part of the study, the higher quality of imported wheat was accounted for by decreasing its price 12 percent for Denmark, Italy, Netherlands, the United Kingdom, and West Germany. The degree of protection was underestimated for these countries in the first part of the study since import prices of wheat were not reduced to compensate for quality differences.

Table 1.--Wheat. Degree of protection, 1959-61

Country	Producer price P	Import or export price T	Degree of protection $\left(\frac{P-T}{P}\right)100$
	--------Dollars per quintal--------		Percent
Importers:			
Denmark........................	7.23	6.58	9
Italy..........................	11.05	7.01	37
Netherlands....................	8.01	6.35	21
United Kingdom.................	7.37	7.12	3
West Germany...................	10.02	6.95	31
Exporters:			
Canada........................	5.33	[1] 6.75	-27
Denmark........................	7.23	7.66	-6
France........................	7.53	6.23	17
Italy..........................	11.05	6.11	45
United States.................	6.48	6.36	2

[1] Export price increased by 4.5 percent.

BARLEY (table 2)

The principal type of barley imported into most West European countries is feed barley. Import prices were compared with producer prices for feed barley for Italy, Netherlands, and West Germany. The degree of protection for barley (all forms of utilization) was also obtained for all countries and ranged from -37 to 38 percent of producer price.

MAIZE (table 3)

Maize (corn) is not an important crop in many European countries and France and Italy were the only two European countries considered in this analysis. Degree of protection ranged from -21 to 32 percent of producer price.

Table 2.--Barley: Degree of protection, 1959-61

Country	Producer price all barley P1	Producer price feed barley P2	Import or export price all barley T	Degree of protection all barley $\left(\frac{P1-T}{P1}\right)100$	Degree of protection feed barley $\left(\frac{P2-T}{P2}\right)100$
	--------- Dollars per quintal ---------			Percent	Percent
Importers:					
Denmark.........	6.16	--	5.73	7	--
France..........	6.21	--	6.38	-3	--
Italy...........	7.65	7.64	5.53	28	28
Netherlands.....	7.44	6.71	5.49	26	18
United Kingdom..	7.56	--	5.67	25	--
West Germany....	10.18	9.01	6.28	38	30
Exporters:					
Canada..........	3.77	--	[1] 5.18	-37	--
France..........	6.21	--	4.91	21	--
United States...	4.04	--	4.96	-23	--

[1] Export price increased by 4.5 percent.

Source: See appendix A.

Table 3.--Maize: Degree of protection, 1959-61

Country	Producer price P .	Import or export Price T	Degree of protection $\left(\frac{P-T}{P}\right)100$
	------ Dollars per quintal ------		Percent
Importers:			
Canada.....................	4.88	4.79	2
France.....................	7.56	5.92	22
Italy......................	6.72	5.70	14
Exporters:			
France.....................	7.56	5.16	32
United States..............	4.12	4.99	-21

Source: See appendix A.

CATTLE AND BEEF (table 4)

Degree of protection was estimated for both cattle and beef. For cattle, trade data were converted from number of head to quintals using the following conversion factors: (19, 20)

	Quintals per head
Canada	3.00
Denmark	4.76
France	3.48
Italy	3.79
Netherlands (imports)	5.90
Netherlands (exports)	2.82
United Kingdom	5.19
United States	2.21
West Germany	5.00

Producer price for cattle was increased by $3 per quintal to allow for transport costs from farm to market place. Degree of protection for cattle ranged from −39 to 31 percent of producer price.

Producer price for cattle was converted to producer price for beef by means of a standard conversion factor of 1 quintal live weight per 55 kilograms carcass weight and a uniform marketing margin of $7 per quintal was then added.

An allowance for the hill cattle and cow subsidy in the United Kingdom resulted in price increases of $3.54 per quintal for cattle and $6.44 per quintal for beef. These figures were obtained by dividing the value of the subsidy by cattle production for the relevant period (21).

Chilled and frozen beef account for a large part of United Kingdom beef imports and are also important for Italy and West Germany (22). Since fresh beef commands a premium over chilled or frozen beef in the United Kingdom market, it can be concluded that for these countries imports are of lower quality than domestic production and hence that the degree of protection has been overestimated. Degree of protection for beef ranged from −12 to 41 percent of producer price.

Table 4.--Cattle and beef: Degree of protection, 1959-61

Country	Cattle				
	Producer price[1] P	Transport costs M	Adjusted producer price P' = P+M	Import or export price T	Degree of protection $\left(\frac{P'-T}{P'}\right)100$
	----------Dollars per quintal-----------				Percent
Importers:					
Italy......................	52.81	3.00	55.81	44.28	21
Netherlands...............	45.78	3.00	48.78	33.47	31
United Kingdom............	39.39	3.00	[2] 45.93	32.82	29
United States.............	46.45	3.00	49.45	48.30	2
West Germany..............	47.48	3.00	50.48	40.45	20
Exporters:					
Canada....................	43.83	3.00	46.83	[3] 48.16	-3
Denmark...................	35.14	3.00	38.14	39.85	-4
France....................	40.90	3.00	43.90	45.46	-4
Netherlands...............	45.78	3.00	48.78	67.96	-39

Country	Beef				
	Producer price[4] P	Marketing margin M	Adjusted producer price P' = P+M	Import or export price T	Degree of protection $\left(\frac{P'-T}{P'}\right)100$
	----------Dollars per quintal-----------				Percent
Importers:					
Italy......................	96.02	7.00	103.02	60.96	41
Netherlands...............	--	--	--	--	--
United Kingdom............	71.62	7.00	[5] 85.06	54.60	36
United States.............	84.45	7.00	91.45	[6] 86.28	6
West Germany..............	86.33	7.00	93.33	54.99	41
Exporters:					
Canada....................	79.69	7.00	86.69	[3] 87.91	-1
Denmark...................	63.89	7.00	70.89	72.99	-3
France....................	74.36	7.00	81.36	57.62	29
Netherlands...............	83.24	7.00	90.24	100.65	-12

[1] Live weight. [2] Includes subsidy of $3.54 per quintal. [3] Export price increased by 4.5 percent. [4] Carcass weight. [5] Includes subsidy of $6.44 per quintal. [6] Import price increased by 10 percent.

Sources: See appendix A.

PIGS AND PIG-MEAT (table 5)

Price comparisons were made for pigs, pork, and bacon. As in the case of cattle, the producer price for pigs was increased by $3 per quintal to take transport costs into consideration while import values were obtained by converting number of head to quintals (23). Producer price for pigs was converted to producer price for pork using a standard conversion factor of 1 quintal live weight per 80 kilograms carcass weight except for the United Kingdom where 73 kilograms were used. The adjusted producer price for pork was then obtained by adding $7 per quintal for marketing margins.

Table 5.--Pigs and pig-meat: Degree of protection, 1959-61

Country	Producer price F	Marketing margin M	Adjusted producer price P' = P+M	Import or export price T	Degree of protection $\left(\frac{P'-T}{P'}\right)100$
	----------Dollars per quintal----------				Percent
Importers:					
France[1].....................	62.38	7.00	69.38	75.69	-9
Italy:					
Pigs, liveweight........	53.03	3.00	56.03	38.68	31
Pork, carcass weight.....	66.29	7.00	73.29	56.53	23
United Kingdom:					
Pork, carcass weight.....	69.00	7.00	76.00	63.29	17
Bacon	---	---	98.80	67.60	32
United States[1].............	42.25	7.00	49.25	78.50	-60
West Germany:					
Pigs, liveweight........	57.34	3.00	60.34	48.13	20
Pork, carcass weight.....	71.68	7.00	78.68	59.45	24
Exporters:					
Canada[1].....................	52.53	7.00	59.53	79.15	-33
Denmark[1]:					
Pork, carcass weight.....	58.23	7.00	65.23	63.02	3
Bacon[2]...................	---	---	71.75	67.06	7
France[4]....................	62.38	7.00	69.38	66.97	3
Netherlands[1]:					
Pork, carcass weight.....	57.26	7.00	64.26	68.68	-7
Bacon[2]....................	---	---	83.54	62.22	26
United States[1].............	42.25	7.00	49.25	55.73	-13

[1] Pork, carcass weight.

Sources: See Appendix A.

For bacon, an allowance had to be made for weight loss and cost of curing. It was assumed that a 10 percent price increase for Denmark and a 30 percent price increase for the Netherlands and the United Kingdom would be sufficient to take both these factors into account (24). It is possible that this allowance was excessive for the Netherlands in which case the producer price for bacon may be too high. Degree of protection for pigs and pig-meat varied from -60 to 32 percent of producer price.

POULTRY (table 6)

Degree of protection ranged from -10 to 62 percent of producer price. A conversion factor of 1 quintal live weight per 73 kilograms carcass weight was used. Lack of data concerning marketing margins for most European countries necessitated the use of United States data. In some cases, producer prices of poultry were only available for certain years (e.g., the price for the Netherlands pertains to 1961-62 only).

EGGS (table 7)

Eggs may be regarded as a fairly homogeneous commodity so that quality differences are relatively unimportant. An allowance of

Table 6.--Poultry: Degree of protection, 1959-61

Country	Producer price[1] P	Marketing margin M	Adjusted producer price P'=P+M	Import or export price T	Degree of protection $\left(\frac{P'-T}{P'}\right)100$
	Dollars per quintal				Percent
Importers:					
Canada..................	63.62	22.00	85.62	65.34	24
Italy...................	145.74	22.00	167.74	63.39	62
United Kingdom........	66.95	22.00	88.95	82.81	7
West Germany..........	58.63	22.00	80.63	62.45	23
Exporters:					
Denmark................	42.69	22.00	64.69	71.10	-10
France.................	100.08	22.00	122.08	92.52	24
Netherlands...........	62.81	22.00	84.81	62.53	26
United States.........	47.22	22.00	69.22	61.12	12

[1] Carcass wgt.

Sources: See appendix A.

Table 7.--Eggs: Degree of protection, 1959-61

Country	Producer price P	Marketing margin (percentage of producer price) M	Adjusted producer price P' = P+M	Import or export price T	Degree of protection $\left(\frac{P'-T}{P'}\right)100$
	Dollars per quintal				Percent
Importers:					
France.........	65.45	10	72.00	58.32	19
Italy..........	77.93	10	85.72	52.68	39
United Kingdom.	76.43	10	84.07	53.90	36
West Germany...	76.25	10	83.88	52.15	38
Exporters:					
Canada.........	51.84	10	57.02	[1] 52.41	8
Denmark........	47.42	10	52.16	54.21	-4
Netherlands....	50.28	10	55.31	55.25	0
United States..	51.45	10	56.60	57.13	-1

[1] Export price increased by 4.5 percent.

Sources: See appendix A.

10 percent was made for costs of packing and transportation. Degree of protection ranged from -4 to 39 percent of producer price.

MILK (table 8)

Degree of protection ranged from 31 to 62 percent of producer price. Due to transportation costs, most low-cost milk producers export milk in the form of butter. Producer prices for milk were, therefore, converted to producer prices for butter using variable

Table 8.—Milk: Degree of protection, 1959-61

Country	Producer price (milk)	Quintals of milk per quintal[1] of butter	Producer price (butter) f	Marketing margin (butter) M	Adjusted producer price (butter) $P' = P+M$	Import or export price (butter) T	Degree of protection $(\frac{P'-T}{P'})100$
	----------------------Dollars per quintal--------------------						Percent
Importers:							
France.........	6.74	21.9	147.61	16.00	163.61	112.67	31
Italy..........	7.60	23.4	177.84	16.00	193.84	72.88	62
United Kingdom.	9.09	21.8	198.16	16.00	214.16	81.33	62
West Germany...	8.16	22.0	179.52	16.00	195.52	119.45	39
Exporters:							
Canada.........	7.78	23.4	182.05	16.00	198.05	[2] 134.93	32
Denmark........	5.92	19.5	115.44	16.00	131.44	85.54	35
France.........	6.74	21.9	147.61	16.00	163.61	88.06	46
Netherlands....	7.11	22.2	157.84	16.00	173.84	95.20	45
United States..	9.26	21.8	201.87	16.00	217.87	104.89	52

[1] Based on percentage of fat in milk and 82 kg. of butterfat =1 quintal of butter. See: OECD, Agricultural and Food Statistics (OECD, Paris, 1962); ECE/FAO, Prices of Agricultural Products and Fertilizers in Europe 1961/62 (UN, Geneva, 1963); USDA, Agricultural Statistics 1963 (Government Printing Office, Washington, 1963); CDA, Weights and Conversion Factors for Canadian Agricultural Products, Publication 1155 (The Queen's Printer, Ottawa, 1962).

[2] Export prices increased by 4.5 percent.

Sources: See appendix A.

conversion factors for the different countries. It was assumed that 82 kilograms of butterfat were necessary to produce 1 quintal of butter. A standard allowance of $16 per quintal for processing costs was then added to obtain adjusted producer price for butter. It should be mentioned that this method permitted dual pricing (two different price levels for milk sold for direct consumption and for processing) to be taken into consideration. Since milk sold for direct consumption receives a higher price than manufacturing milk a comparison between domestic and trade butter prices would underestimate seriously the degree of protection.

SUMMARY OF RESULTS

A summary of these results is given in table 9 for importing countries and in table 10 for exporting countries. Milk appears to be the most heavily protected of all commodities for all countries, with the degree of protection ranging from 31 to 62 percent. Some idea of the magnitude of the protection afforded to milk producers may be obtained from the fact that a percentage tariff of 60 percent is equivalent to an ad valorem tariff of 150 percent which implies that domestic prices are two and a half times trade prices. The theoretical relationship between percentage and ad valorem tariffs is obtained by the following formula: $v = t/(1-t)$, where v = ad valorem tariff and t = percentage tariff.

The degree of protection for the principal importing countries (Italy, United Kingdom, West Germany) is relatively similar for

Table 9.--Importing countries: Degree of protection, 1959-61

Commodity	Canada	Denmark	France	Italy	Nether-lands	United Kingdom	United States	West Germany
Wheat......		9		37	21	3		31
Barley.....		7	-3	-22	¹ 10	25		¹ 30
Maize......	2		22	14				
Cattle.....				21	31	29	2	20
Beef.......				-1		36	6	41
Pigs.......				31				20
Pork.......			-9	23		17	-60	24
Bacon......						32		
Poultry....	24			62		7		23
Eggs.......		19		39		36		38
Milk.......		31		62		62		39

¹ Feed barley.

Table 10.--Exporting countries: Degree of protection, 1959-61

Commodity	Canada	Denmark	France	Italy	Netherlands	United States
Wheat..............	-27	-6	17	-5		2
Barley all.......	-37		-1			-23
Maize.............			32			-21
Cattle............	-3	-4	-4		-39	
Beef..............	-1	-3	29		-12	
Pork..............	-2	3	3		-7	-13
Bacon.............		7			26	
Poultry...........		-13	24		26	12
Eggs..............	8	-4			0	-1
Milk..............	32	35	-6		-5	52

barley, pork, and eggs. It varies from 23 to 38 percent, provided bacon rather than pork is selected for the United Kingdom. These results confirm the conclusions of the United Nations study that protective margins tend to be the same for these three commodities since barley is an important input in the production of pork and eggs (25).

Most of the exporting countries such as Canada, Denmark, Netherlands, and the United States had either negative or low margins of protection for exports except for milk, and in the case of the Netherlands, bacon and poultry. A positive margin for an exporting country indicates subsidization of exports as long as quality differences can be disregarded. France (grain, poultry, milk) and the Netherlands (bacon, poultry, milk) appear to be the two countries where export subsidization is the most frequent, though Canada, Denmark, and the United States also subsidize milk exports.

On the whole it seems that the degree of protection tends to be higher for the importing than for the exporting countries. There is, however, no reason to suppose that this situation will necessarily

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continue in the future. The growth of agricultural protection in many industrially developed countries and the resulting accumulation of unwanted stocks may provide a strong incentive for increased export subsidization.

COMPARISON OF ACTUAL AND EQUIVALENT TARIFFS

In view of the abandonment of actual tariffs as a measure of protection afforded to agricultural commodities, it is of interest to compare actual and equivalent tariffs. This comparison is given in table 11 for the three major importing countries: Italy, the United Kingdom, and West Germany. The contrast between the results of the two methods is considerable, especially for dairy products. The fact that Italy and the United Kingdom have slightly different ad valorem tariffs for milk (166 and 163) and the same percentage tariff (62) is due to rounding errors.

Table 11.--Comparison of actual and equivalent ad valorem tariffs, 1959-61

Commodity	Italy	United Kingdom	West Germany
Barley:			
Actual[1].........................	10	10	0
Equivalent[2]......................	[3] 38	33	[3] 43
Wheat:			
Actual[1].........................	27	0	0
Equivalent[2]......................	58	4	44
Beef:			
Actual[1].........................	29	3	20
Equivalent[2]......................	69	56	70
Pork:			
Actual[1].........................	18	10	16
Equivalent[2]......................	30	20	32
Eggs:			
Actual[1].........................	0	6	5
Equivalent[2]......................	63	56	61
Milk:			
Actual[1].........................	30	5	24
Equivalent[2]......................	166	163	64

[1] As of Jan. 1, 1961.

[2] $\left(\frac{P-T}{T}\right)100$, where P = producer price (including marketing margin), and T = import price.

[3] Feed barley.

Sources: Commonwealth Economic Committee: Grain Crops (Her Majesty's Stationery Office, London, 1961); Dairy Produce (Her Majesty's Stationery Office, London, 1961); Meat (Her Majesty's Stationery Office, London, 1961).

Results: Selected Marketing Margins (1959-61)

Selected marketing margins were used for beef, pork, eggs, and milk. In some instances, specific marketing margins for each country were not available so either United States margins or average European margins were used. The results are given in tables 12 to 15. For purposes of comparison, the degree of protection based on uniform marketing margins is also included. It is interesting to note that in most instances there is a difference of only a few percentage points between the two measures. The conclusions of the United Nations that the error introduced by the use of uniform marketing margins was likely to be small is thus substantiated (14).

Estimated Degree of Protection for Grain in the European Economic Community (1967)

Estimation of the degree of protection for grain in the EEC for 1967 is given in table 16. Announced target prices for grain for 1967 were used as estimates of producer prices in the EEC. Trade prices were represented by 1964 import prices in Rotterdam. It should be emphasized that the degree of protection thus obtained is based on two important assumptions: that the average producer price in 1967 will equal the announced target price, and that trade prices will remain relatively constant from 1964 to 1967. A rise in trade prices would produce an overestimate. In the more likely event of a price fall, the measure provides a lower limit on the degree of

Table 12.--Beef: Degree of protection--selected marketing margins, 1959-61

Country	Producer price [1]	Selected marketing margins M*	Adjusted producer price P* = 1-M*	Import or export price T	Degree of protection (selected margins) $(\frac{P*-T}{P*})100$	Degree of protection (uniform margins)
			--Dollars per quintal--		Percent	Percent
Importers:						
Italy............	77.02	11.20	108.22	60.96	44	41
United Kingdom..	71.62	[2] 8.19	79.81	54.60	32	36
United States..	95.45	1.71	95.16	[3] 86.28	9	0
West Germany...	86.33	5.92	92.25	54.99	40	41
Exporters:						
Canada.........	79.69	9.48	89.17	[4] 87.91	1	-1
Denmark........	63.89	5.57	69.46	72.99	-5	-3
France.........	74.36	9.32	83.68	61.13	27	29
Netherlands....	83.24	7.94	91.18	100.65	-11	-12

[1] Carcass weight.
[2] Average of 5 European countries.
[3] Import price increased by 10 percent.
[4] Export price increased by 5.5 percent.

Sources: See appendix A.

Table 13.--Pork: Degree of protection--selected marketing margins, 1959-61

Country	Producer price[1] P	Selected marketing margins M*	Adjusted producer price P* = P+M*	Import or export price T	Degree of protection (selected margins) $(\frac{P*-T}{P*})100$	Degree of protection (uniform margins)
			Dollars per quintal		Percent	Percent
Importers:						
France...........	62.38	10.59	72.97	75.69	-4	-9
Italy...........	66.29	[2] 7.77	74.06	56.53	24	23
United Kingdom..	69.00	[2] 7.77	76.77	63.29	18	17
United States...	42.25	8.40	50.65	78.56	-55	-60
West Germany....	71.68	6.71	78.39	59.45	24	24
Exporters:						
Canada..........	52.53	[3] 8.40	60.93	[4] 79.15	-30	-33
Denmark.........	58.23	6.71	64.94	63.02	3	3
France..........	62.38	10.59	72.97	66.97	8	3
Netherlands.....	57.26	7.06	64.32	68.68	-7	-7
United States...	42.25	8.40	50.65	55.73	-10	-13

[1] Carcass weight.
[2] Average of 4 European countries.
[3] U.S. margin.
[4] Export price increased by 4.5 percent.

Sources: See appendix A.

Table 14.--Eggs: Degree of protection--selected marketing margins, 1959-61

Country	Producer price P	Selected marketing margins (percentage of producer price) M*	Adjusted producer price P* = P+M*	Import or export price T	Degree of protection (selected margins) $(\frac{t*-T}{P*})100$	Degree of protection (uniform margins)
			Dollars per quintal		Percent	Percent
Importers:						
France.........	65.45	[1] 14	74.61	58.32	22	19
Italy..........	77.93	15	89.62	52.68	41	39
United Kingdom.	76.43	11	84.84	53.90	36	36
West Germany...	76.25	20	91.50	52.15	43	38
Exporters:						
Canada.........	51.84	20	62.21	[2] 52.41	16	8
Denmark........	47.42	11	52.64	54.21	-3	-4
Netherlands....	50.28	13	56.82	55.25	3	0
United States..	51.45	27	65.34	57.13	13	-1

[1] Average of 5 European countries.
[2] Export price increased by 4.5 percent.

Sources: See appendix A.

Table 15.--Milk: Degree of protection--selected marketing margins, 1959-61

Country	Producer price (butter) P	Selected marketing margins (butter) M	Adjusted producer price (butter) P* = P+M*	Import or export price (butter) T	Degree of protection (selected margins) $(\frac{P*-T}{T})100$	Degree of protection (uniform margins)
			----Dollars per quintal----		Percent	Percent
Importers:						
France..........	147.61	[1] 20.00	167.61	-12.47	33	31
Italy..........	177.84	[1] 20.00	197.84	72.88	43	62
United Kingdom.	198.16	22.00	220.16	81.33	63	62
West Germany...	179.52	18.00	197.52	119.45	40	39
Exporters:						
Canada..........	182.05	21.00	203.05	[2] 134.93	31	32
Denmark........	115.44	18.00	133.44	85.54	36	35
France..........	147.61	20.00	167.61	88.06	47	46
Netherlands....	157.84	23.00	180.84	95.26	47	45
United States..	202.79	18.00	220.79	134.89	52	52

[1] Average of 4 European countries.
[2] Export price increased by 4.5 percent.

Sources: See appendix A.

Table 16.--Grain: Estimated degree of protection in European Economic Community, 1959-61 and 1967

Commodity	Target price, 1967	July 1, 1964, c.i.f. price, Netherlands[1]	Estimated degree of protection, EEC, 1967	Estimated degree of protection, 1959-61			
				France	Italy	Netherlands	West Germany
	Dollars per quintal		Percent	Percent	Percent	Percent	Percent
Wheat..........	[2] 10.625	[2] 6.175	42	[3] 17	37	21	3.
Rye..........	9.375	5.775	38	[1] 8	30	30	[3] 49
Barley..........	7.125	5.21	41	[3] 1	[4] 29	[4] 18	[4] 36
Maize..........	9.063	5.97.	34	[4] 32	14	--	--

[1] C.i.f. price for standard grades, as determined by the EEC Commission.
[2] Soft wheat.
[3] Export values.
[4] Feed barley.

Source: Hans G. Hirsch, The Uniform Grain Price in the European Economic Community (52).

protection (26, 27). The estimates for the 3-year period 1959-61 are also included in table 16 to indicate the magnitude of possible changes in the degree of protection for these countries. In nearly all cases the potential degree of protection has increased, and the increase is considerable for France, Netherlands (wheat, barley), and Italy (maize).

Two important consequences of the announced target prices must be noted. For countries such as France where expansion of the grain supply is possible these prices will undoubtedly serve as a strong stimulus to increased production, so the EEC will probably become increasingly self-sufficient in certain grains. The price increase for feed grains will also have repercussions in the livestock sector, since feed grains form an important part of the cost of livestock production. Countries such as the Netherlands and Italy may find themselves facing higher production costs for livestock. This has important implications for the relative cost of protection, as will be shown in the second part of this study.

Changes in the Degree of Protection (1950-61)

Changes in the degree of protection from 1950 to 1961 for grain, livestock, and dairy products are given in table 17. Data for earlier years were obtained from the United Nations study and for beef and pork these estimates were modified to permit the use of constant marketing margins for the entire period ($7 per quintal). Changes in the degree of protection are discussed with reference to commodities and countries.

COMMODITIES

The most striking change is the steady increase in milk protection. For Denmark this has grown from -3 to 35 percent, and for the Netherlands from -6 to 45 percent. The degree of protection has remained relatively constant for eggs except in France and West Germany, where it has widened. Degree of protection for grain has also increased steadily except for wheat in Denmark and the United Kingdom.

For livestock products, the exporting countries' margin of protection (except for France in 1959-61) has been either negative or relatively low, while for the importing countries the margin has been in the neighborhood of 20 to 40 percent. The generally higher margins for beef must be discounted somewhat since quality differences have not been taken into consideration.

The degree of protection has increased for France and West Germany for nearly all commodities, while for Denmark, Italy, and the Netherlands such increases have been confined mainly to grain and milk. There has not been much change in the overall degree of protection in the United Kingdom, where increases in one sector tend to be offset by decreases in another sector.

Denmark, which has maintained either low or negative margins of protection for all commodities, with the exception of milk, contrasts with the two other exporting countries, France and the Netherlands, where there has been a sizable increase in the degree of protection for grain. Since France is an exporter of grain (unlike the Netherlands), this implies that grain exports are being subsidized at an increasing rate.

The common agricultural policy of the EEC may effect further changes in the degree of protection, and, as we have seen, the potential margin has widened for grain. If the degree of protection for the EEC increases, the outlook for a reduction in the degree of protection in other countries is not promising, other things remaining equal. The market for suppliers willing to trade at world prices will be affected by increased production in EEC countries and the resulting decline in demand might lower world prices. If the decline in world prices is sufficiently great, the free trade countries may be obliged to resort to some protective measures. Increased protection in the dairy sector in the past 10 years is an example of this type of chain reaction.

Effectiveness of the Tariff

Haberler (9), as was mentioned earlier, noted that the height of the tariff wall was but one aspect of protection, and that it was inadequate as a measure of the effectiveness of the tariff (amount of divergence between situations under free trade and protection). This was the conclusion of Loveday (28) in 1929, when he remarked that a tariff index could not provide a measure of the amount of protection given by a particular government since "equal duties may have unequal effects" owing to the different economic structures of the various trading countries and the resulting differences in demand and supply elasticities.

In the second part of this study, this aspect of protection is considered and demand and supply elasticities as well as the height of the tariff (degree of protection) are considered. The effectiveness of a tariff is examined from the viewpoints of both the protecting and exporting countries and the similarity between the two measures--cost of protection and market accessibility--is shown.

WELFARE COST OF AGRICULTURAL PROTECTION

Theoretical Model

A partial equilibrium model, based on linear demand and supply functions, is used to estimate the welfare cost of agricultural protection. The employment of partial equilibrium analysis for problems of this kind is not new. Barone (29) was one of the first to use this method. He concluded that a definite welfare loss existed when trade was restricted by means of tariffs. Recent advocates of the partial equilibrium approach have been Corden, Harberger, and Johnson (30, 13, 31). Corden's analysis is similar in many respects to that of Barone. He deducts changes in revenue and in producers' surplus from changes in consumers' surplus to obtain a production and consumption cost of protection. Harberger, as was mentioned earlier, employed the concept of an equivalent tariff, which meant that the analysis could be applied to all types of trade restrictions. Johnson extended Corden's model to more than two goods and like Harberger was concerned with relative cost--cost as a percentage of national income--rather than with absolute cost of protection. The models derived in this study to measure the cost of protection are based mainly on work by Corden and Johnson.

An important assumption underlying the use of partial equilibrium analysis is that the indirect effects of the removal of trade restrictions may be neglected. These indirect effects are changes in total employment, changes in the terms of trade and balance of payments, and changes in the prices of commodities in other parts of the economy. The assumption may be justified if the following conditions hold for the agricultural sector.

(1) It is relatively unimportant in the total economy, that is, repercussions throughout the economy are relatively insignificant. The marginal utility of income may also be considered as constant.

(2) Expansion of trade in a commodity following the removal of trade restrictions would be low due to inelastic domestic demand and supply. Changes in the balance of payments may therefore be neglected even if foreign trade in this sector is a significant component of total foreign trade.

(3) The country's exports and imports form a relatively unimportant part of the world market so that world demand for its exports and world supply of its imports may be considered as perfectly elastic and no changes occur in its terms of trade as a result of removal of trade restrictions.

These conditions are met to a certain extent by the agricultural sector of industrially developed countries where the production and consumption of agricultural commodities are relatively unimportant. Demand and supply elasticities for these commodities

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may also be regarded as low. It is felt that neglect of these effects in the case of agricultural commodities in industrially developed countries is unlikely to distort the resulting estimates to any serious extent, since the relevant elasticities of demand and supply are low and since both the production and consumption of these commodities are relatively unimportant.

In the following discussion the word tariff will denote the difference between domestic and world market prices where domestic or producer prices refer to prices received by producers in the protecting country. The tariff is thus the equivalent tariff discussed in the first part of the report. Percentage tariff will express the tariff as a percentage of the domestic price and the ad valorem tariff will express the tariff as a percentage of world market price. By use of an equivalent tariff, cost of protection can be obtained for both importing and exporting countries.

TWO-GOOD MODEL

The two-good model relates to a country with one import good and one export good. Trade restrictions are applied to either the import or the export good and the unprotected good is excluded from the analysis since it is assumed that its price remains unchanged. This assumption permits the model to be used when the number of unprotected goods is greater than one.

Tariff on Import Good.--The domestic demand and supply curves of the country imposing the tariff are given in figure.1. These curves relate to the import good. They are drawn as straight lines, and may be regarded as either true representations of the demand and supply functions or as linear approximations in the case of curvilinear functions. The supply curve S is the sum of the marginal cost curves of the individual producers while the demand curve D is the compensated demand or constant utility curve.[6] The world supply of the import good WR is perfectly elastic assuming that the world price OW is unaffected by changes in quantities demanded by the importing country.

In the initial situation, a percentage tariff WW'/OW' is levied on imports resulting in production of Ob, consumption of Oc, and imports of bc. Removal of the tariff lowers the domestic price to OW,

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[6] The compensated demand curve which gives the quantities of a particular commodity which the consumer is willing to purchase at various prices, assumes that the income of the consumer is continuously adjusted after each price change so that he is kept on the same indifference level. The compensated demand curve thus differs from the ordinary demand curve in that the latter neglects the effect of a price change on the income of the consumer. If the ordinary demand curve is employed to measure the gain accruing to the consumer from a price decline (consumer's surplus) it is necessary to assume that the income effect of a price change may be neglected (32).

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production falls to Oa while consumption increases to Oe and imports increase to ae. The effect of the tariff reduction on welfare can now be analyzed in terms of producers' and consumers' surpluses.

The fall in price has produced a gain in consumers' surplus equal to W'WEG. Hicks' (33) compensating variation in income is used to measure the change in consumer's surplus arising from a price fall, and it is equal to the loss of income that would just compensate the consumer for this price change and leave him on the same indifference curve. The fall in price, however, has also produced a loss in producers' surplus and in tariff revenue which is given by the two areas W'WAF and BCGF. The final gain is given by the two shaded triangular areas in figure 1 (ABF and CEG) which represent the cost of protection. Replacing AB by dS, and CE by dD the cost can be written as follows:

Cost $= \frac{1}{2}dpdS + \frac{1}{2}dpdD = \frac{1}{2}mdS + \frac{1}{2}mdD$ where m $=$ dp.

This formula may be regarded as the sum of the production and consumption costs of protection. Under the tariff, the production of ab entailed the use of resources amounting to abFA while the same amount could have been imported for abBA. The production gain in terms of released resources is ABF, provided resources are everywhere employed so that the value of their marginal product is equal to their price. On the consumption side, the marginal valuation of ce under the tariff is given by ceEG, whereas with trade this

COST OF PROTECTION, TWO-GOOD MODEL: TARIFF ON IMPORT GOOD
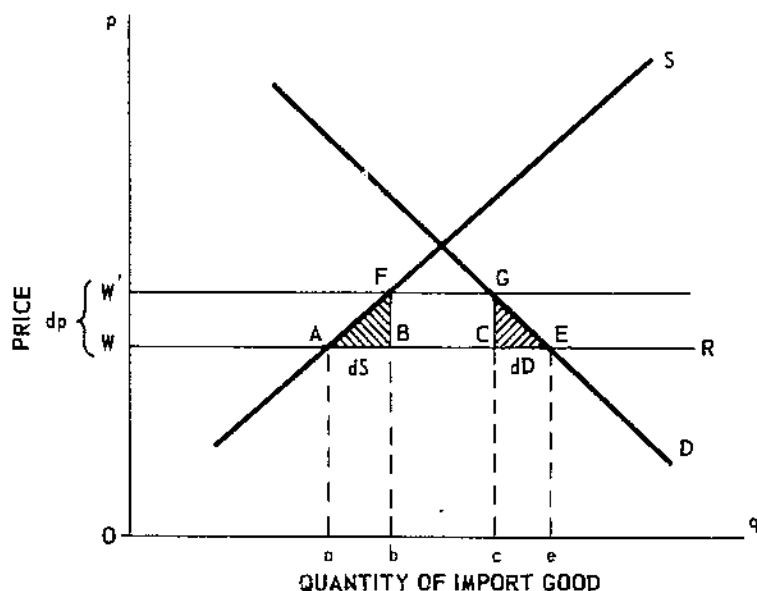
Figure 1

increase in consumption only costs the consumer ceEC. The difference CEG represents the gain to the consumer from the change in consumption ce resulting from lower prices.

Subsidy on Export Good.--In the case shown in figure 2, the loss in producers' surplus W'WCG must be subtracted from both the gain in consumers' surplus W'WBF and the gain in subsidization payments AEGF. (The country no longer has to subsidize exports). The resulting cost from maintaining producer and consumer prices above world market prices, as in the former case, consists of both a production and consumption cost of protection $\frac{1}{2}mdS + \frac{1}{2}mdD$.

Formulas for Production and Consumption Costs of Protection.-- Production and consumption costs of protection may be expressed in terms of demand and supply elasticities. For convenience, the terms production cost and consumption cost will be used to replace the production cost of protection and the consumption cost of protection. Let

p = domestic price of the protected good

dp = fall in price of this good upon tariff removal = m

COST OF PROTECTION FOR TWO-GOOD MODEL: SUBSIDY ON EXPORT GOOD

QUANTITY OF EXPORT GOOD
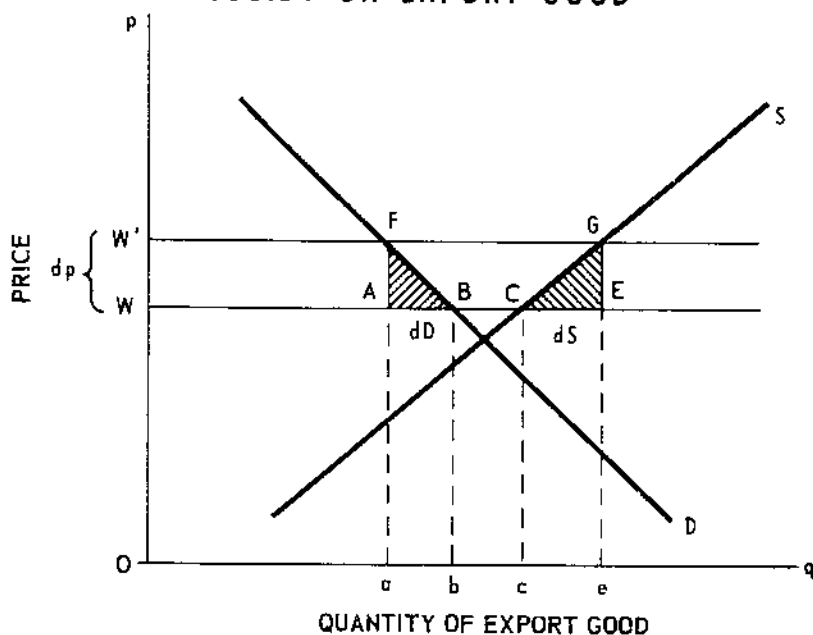
Figure 2

$S = S(p) =$ domestic supply function

$D = D(p,Y) =$ domestic demand function

where $Y =$ personal income.

Then Cost $(C) =$ Production Cost (PC) + Consumption Cost (CC)

$$= \tfrac{1}{2}mdS + \tfrac{1}{2}mdD \tag{1}$$

and $\qquad PC = \tfrac{1}{2}mdS = \tfrac{1}{2}m(dS/dp)dp = \tfrac{1}{2}t^2 \, \eta \, V^S \tag{2}$

where $\qquad \eta =$ elasticity of domestic supply $= \dfrac{dS/S}{dp/p}$

$\qquad t =$ percentage tariff $= m/p$

and $\qquad V^S =$ value of production under the tariff $= Sp.$

In a similar manner

$$CC = \tfrac{1}{2}mdD = \tfrac{1}{2}m \,(-dD/dp)\,dp = \tfrac{1}{2}m^2 k \tag{3}$$

where $\qquad k = (-dD/dp) =$ Slutksy substitution term.

By means of the Slutsky substitution theorem ($\underline{34}$):

$$k = - \frac{\partial D}{\partial p} - \frac{\partial D}{\partial Y}\frac{dY}{dp} = \frac{\epsilon \, V^D - y \, \dfrac{(V^D)^2}{Y}}{p^2}$$

where $\qquad \epsilon =$ elasticity of demand $= - \dfrac{\partial D/D}{\partial P/p}$

$\qquad y =$ income elasticity $= \dfrac{\partial D/D}{\partial Y/Y}$

and $\qquad V^D =$ value of domestic consumption under the tariff $= Dp.$

Substituting the above value for k in (3) we get

$$CC = \tfrac{1}{2}t^2 V^D \left(\epsilon - y \frac{V^D}{Y}\right). \tag{4}$$

Thus $\qquad C = \tfrac{1}{2}t^2 {}_\eta \, V^S + \tfrac{1}{2}t^2 V^D \left(\epsilon - y \frac{V^D}{Y}\right). \tag{5}$

This formula indicates that any increase in the percentage tariff--t--results in a more than proportionate increase in the cost of protection since t is raised to the power of 2. Thus, the welfare cost of a tariff imposition is influenced by the magnitude of existing tariff levels.

The consumption cost equation shows that the income effect of a price change may be neglected when the proportion of expenditure on a good (V^D/Y) is small. In such a case, the same result--$\frac{1}{2}t^2 V^D \epsilon$--is obtained as if the ordinary demand curve had been employed.

Relative Cost of Protection.--Cost of protection may be calculated also with reference to income redistributed to the protected sector. The change in producers' surplus in the protected sector may be used to represent the effects of a particular trade policy. In the two-good model, relative cost of protection is given by the following formula:

$$\text{Relative Cost} = \frac{\frac{1}{2}m(dS + dD)}{mS - \frac{1}{2}mdS}$$

$$= \frac{\frac{1}{2}t^2(\eta V^S + \epsilon V^D)}{tV^S(1 - \frac{1}{2}\eta t)} \quad \text{(assuming the income effect of a price change may be neglected)}$$

$$= \frac{\frac{1}{2}\eta t}{(1-\frac{1}{2}\eta t)} + \frac{\frac{1}{2}\epsilon t}{(1-\frac{1}{2}\eta t)} \frac{V^D}{V^S}.$$

Relative cost of protection is a function of domestic demand and supply elasticities, the percentage tariff, and the ratio of the value of domestic consumption to domestic production. The latter variable is particularly significant since it indicates the importance of a country's trade balance--whether it is a net exporter or importer. This fact will be demonstrated in a later application of the model which is concerned with the cost of wheat protection in selected countries.

Cost of Protection and Market Accessibility.--An alternative way of examining the effects of protection is to consider its impact on the world market for exports or market accessibility. The connection between market accessibility and the cost of protection may be shown as follows, assuming that the income effect of a price change may be neglected. Let

$M = M(p)$ = demand for imports

$S = S(p)$ = domestic supply function

$D = D(p)$ = domestic demand function

where p = domestic price of the protected good.

Then $M = D - S$

and $-dM = (-dD/dp)dp + (dS/dp)dp$.

Cost, however, may also be written as

$$\tfrac{1}{2}m(dS + dD) = \tfrac{1}{2}m((-dD/dp)dp + (dS/dp)dp)$$

$$= \tfrac{1}{2}m(-dM).$$

There is, therefore, a direct linear relationship between the cost of protection and the change in imports $(-dM)$ and for a given tariff (m) the cost of protection is a positive multiple of market accessibility. The higher the elasticities of demand and supply in the protecting countries, the higher the cost of protection and the greater the market dislocation and potential welfare losses to exporting countries.

GENERAL MODEL

If a country exports or imports more than one good, two methods may be used to estimate the welfare cost of protection.
1. Aggregate demand and supply curves for the group of commodities under review may be used. The commodities in question must be close substitutes in consumption and production.
2. Individual demand supply curves may be used and the cost of protection may be regarded as the sum of the costs of the individual goods with an allowance for the effects of cross elasticities in demand and supply.
The first method permits the use of the simple production and consumption cost formulas which have already been derived. The second method requires an extension of these formulas. Let

n = number of protected goods in the economy

p_i = domestic price of the protected good i $(i = 1,2,...n)$

dp_i = fall in price of good i when protection is removed $= m_i$

$S_i = S_i(p_1, p_2, ..., p_n)$ = domestic supply function

$D_i = D_i(p_1, p_2, ..., p_n, Y)$ = domestic demand function

Y = personal income.

In the case of many goods, summation of the individual costs of production and consumption results in

$$\text{Cost} = \text{PC} + \text{CC}$$

$$\text{PC} = \tfrac{1}{2} \sum_{i=1}^{n} dS_i\, dp_i = \tfrac{1}{2} \sum_{i=1}^{n} dS_i m_i \tag{1}$$

$$\text{CC} = \tfrac{1}{2} \sum_{i=1}^{n} dD_i\, dp_i = \tfrac{1}{2} \sum_{i=1}^{n} dD_i m_i . \tag{2}$$

Since dS_i is the result of all price changes

$$dS_i = \sum_{j=1}^{n} (dS_i/dp_j)\, dp_j = \sum_{j=1}^{n} (dS_i/dp_j) m_j = \sum_{j=1}^{n} h_{ij} m_j$$

where $h_{ij} = dS_i/dp_j \quad (j = 1, 2, \ldots n)$.

Substituting the above value for dS_i in (1) we obtain:

$$\text{PC} = \tfrac{1}{2} \sum_{i=1}^{n} \sum_{j=1}^{n} h_{ij} m_i m_j \tag{3}$$

$$= \tfrac{1}{2} \sum_{i=1}^{n} \sum_{j=1}^{n} t_i t_j\, \eta_{ij} V_i^S \tag{4}$$

where

$$\eta_{ij} = \text{elasticity of supply} = \frac{dS_i/S_i}{dp_j/p_j}$$

$$t_i = \text{percentage tariff} = m_i/p_i$$

and $V_i^S = $ value of domestic production of good i under protection.

Again in estimating the consumption cost, since dD_i is the result of all price and income changes

$$dD_i = \sum_{j=1}^{n} (-dD_i/dp_j)\, dp_j = \sum_{j=1}^{n} (-dD_i/dp_j) m_j = \sum_{j=1}^{n} k_{ij} m_j$$

where $k_{ij} = $ Slutsky substitution term.

Substituting the above value for dD_i in (2) we obtain

$$\text{CC} = \tfrac{1}{2} \sum_{i=1}^{n} \sum_{j=1}^{n} k_{ij} m_i m_j . \tag{5}$$

By means of the Slutsky substitution theorem:

$$k_{ij} = -\frac{\partial D_i}{\partial p_j} - \frac{\partial D_i/}{\partial Y}\left(\frac{dY}{\partial p_j}\right)$$

$$= \frac{\epsilon_{ij} V_i^D - y_i \left(\dfrac{V_i^D V_j^D}{Y}\right)}{p_i p_j}$$

where ϵ_{ij} = elasticity of demand = $-\dfrac{\partial D_i/D_i}{\partial p_j/p_j}$

y_i = income elasticity = $\dfrac{\partial D_i/D_i}{\partial Y/Y}$

and V_i^D = value of domestic consumption of good i under protection = $D_i p_i$.

Substituting the above value for k_{ij} in (5), we obtain:

$$CC = \tfrac{1}{2} \sum_{i=1}^{n} \sum_{j=1}^{n} t_i t_j V_i^D \left(\epsilon_{ij} - y_i \frac{V_j^D}{Y}\right). \tag{6}$$

Thus

$$C = \tfrac{1}{2} \sum_{i=1}^{n} \sum_{j=1}^{n} h_{ij} m_i m_j + \tfrac{1}{2} \sum_{i=1}^{n} \sum_{j=1}^{n} k_{ij} m_i m_j \tag{7}$$

or in terms of demand and supply elasticities

$$C = \tfrac{1}{2} \sum_{i=1}^{n} \sum_{j=1}^{n} t_i t_j \, \eta_{ij} V_i^S + \tfrac{1}{2} \sum_{i=1}^{n} \sum_{j=1}^{n} t_i t_j V_i^D \left(\epsilon_{ij} - y_i \frac{V_j^D}{Y}\right). \tag{8}$$

Formula (8) can be used to estimate the cost of protection provided the relevant demand, supply, and income elasticities are known, since the other terms in the equation may be obtained from foreign trade and national statistics. This formula also indicates that the cost of protection is less than the sum of the individual measures of protection in the case of goods which are substitutes in production and consumption. In such instances, the cross elasticities of demand and supply are both negative so that terms containing these particular parameters are deducted from the total cost of protection.

In certain circumstances some modifications in the model may be necessary. These modifications will be discussed now.

Modifications in Theoretical Model

MARKETING MARGINS

The traditional method of measuring the cost of protection assumes a uniform price level. The existence of marketing margins, however, ensures a divergence between prices at the farm, wholesale, and retail levels. Use of an equivalent tariff, which is more or less mandatory for agricultural commodities where nontariff trade barriers are widespread, means that production and consumption costs are measured at the wholesale level, instead of at the farm and retail levels, resulting in an overstatement or understatement of the cost of protection.

The domestic demand and supply curves at various levels of marketing are given in figure 3. The supply curves at the farm and wholesale level are given by S_f and S, D_r and D represent demand at the retail and wholesale levels. It is assumed that no changes occur in the quantity of a commodity as it is moved from the farm to the retail marketing level. Let

$W'F$ = domestic production at the wholesale level under protection

$W'G$ = domestic consumption at the wholesale level under protection

P_r = domestic price at retail level

p = domestic price at wholesale level

p_f = domestic price at the farm level

$g(p)$ = marketing margin between wholesale and retail level

$h(p_f)$ = marketing margin between farm and wholesale level.

Then

$$P_r = p + g(p) \tag{1}$$

$$p = p_f + h(p_f) \tag{2}$$

and $dp_r = dp\,(1 + g'(p)) \tag{3}$

$$dp = dp_f\,(1 + h'(p_f)) \tag{4}$$

where

$$g'(p) = \frac{\partial g(p)}{\partial p} \quad \text{and} \quad h'(p_f) = \frac{\partial h(p_f)}{\partial p_f}.$$

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COST OF PROTECTION AND MARKETING MARGINS

Change in consumers' surplus: Measured ($\equiv$) and actual ($\boxplus$)

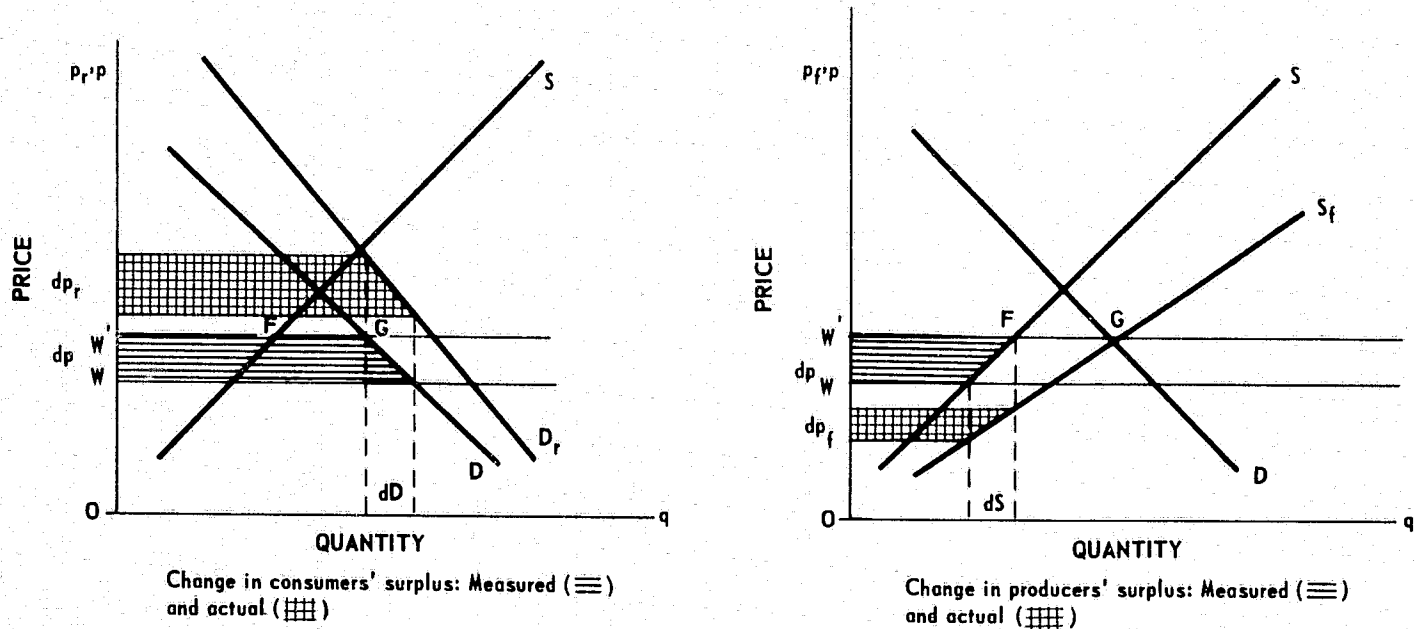Change in producers' surplus: Measured ($\equiv$) and actual ($\boxplus$)

Figure 3

Change in Consumers' Surplus.--It is necessary to compare the difference between the loss in consumers' surplus measured at the wholesale level and the actual loss in consumers' surplus.

Measured change in consumers'
surplus $\qquad = dp \ (W'G + \tfrac{1}{2}dD)$ (5)

actual change in consumers'
surplus $\qquad = dp_r \ (W'G + \tfrac{1}{2}dD)$ (6)

difference $\qquad = (dp - dp_r) \ (W'G + \tfrac{1}{2}dD).$

From (3), it is evident that if $g'(p)$ is greater than zero, implying that marketing margins increase as the wholesale price level increases, then dp_r is greater than dp and the actual loss of consumers' surplus is greater than the measured loss. An underestimate of the cost of protection has thus occurred. A constant marketing margin would mean $g'(p)$ was equal to zero, and it would be immaterial whether cost was measured at the wholesale or retail level. Given constant marketing margins, the elasticity of demand at wholesale (ϵ) may be obtained from the elasticity of demand at retail (ϵ_r) by means of equation (1) and we get:

$\epsilon = \epsilon_r \ (p/p_r).$

Change in Producers' Surplus.--As in the previous case we obtain:

Measured change in producers'
surplus $\qquad = dp \ (W'F - \tfrac{1}{2}dS)$ (7)

actual change in producers'
surplus $\qquad = dp_f \ (W'F - \tfrac{1}{2}dS)$ (8)

difference $\qquad = (dp - dp_f) \ (W'F - \tfrac{1}{2}dS).$

From (4), if $h'(p_f)$ is greater than zero an overstatement of the gain in producers' surplus has occurred and this, in turn, implies that the cost of protection has again been underestimated. A constant marketing margin likewise insures that no discrepancy exists between cost measured at the farm and wholesale level. From (2), assuming constant marketing margins the elasticity of supply at the wholesale level (η) may be obtained from the elasticity of supply at the farm level (η_f) and we get:

$\eta = \eta_f \ (p/p_f).$

As the above analysis shows, the neglect of marketing margins need not lead to any bias in the measurement of the cost of protection in the case of constant marketing margins. If a percentage markup system is in operation and marketing margins increase as the farm and wholesale prices increase, then an underestimate of

the cost of protection occurs. The converse is obtained if a decrease in marketing margins occurs.

The assumption of no quantity changes in the commodity as it is moved from farm to retail level may be modified. By means of equations (5) to (8) and assuming constant marketing margins, it can be shown that if the quantity declines at both stages of marketing the producers' surplus is undervalued and the consumers' surplus is overvalued. This occurs when W'F, which is now less than actual farm production, is used to measure changes in producers' surpluses, and W'G, which is now greater than retail consumption, is employed to measure changes in consumers' surpluses. In this case, an overestimate of the cost of protection takes place.

CHANGES IN THE TERMS OF TRADE (35)

Changes in the terms of trade as a result of protection may be discussed in a partial equilibrium context if it is assumed that demand for a country's exports of an unprotected good is perfectly elastic in the relevant price and quantity area. Changes in the world price of imports may be used then to represent changes in the terms of trade. Let

$S(p)$ = domestic supply function of the protected good

$D(p)$ = domestic demand function of the protected good

$S_w(p_w)$ = world supply of exports of the protected good

p = domestic price of the protected good

p_w = world price of the protected good

and τ = ad valorem tariff = $(p-p_w)/p_w$.

The equilibrium conditions $D(p) = S(p) + S_w(p_w)$ can be differentiated with respect to τ resulting in the following equation:

$$\frac{dD}{dp}\frac{dp}{d\tau} - \frac{dS}{dp}\frac{dp}{d\tau} - \frac{dS_w}{dp_w}\frac{dp_w}{d\tau} = 0. \tag{1}$$

Since $p = p_w(1+\tau)$ with τ equal to zero when the tariff is removed we obtain

$$dp = dp_w + d\tau p_w \tag{2}$$

and $$\frac{dp}{d\tau} = \frac{dp_w}{d\tau} + p_w. \tag{3}$$

Substituting from (3) in (1) we get:

$$\frac{dD}{dp}\frac{dp}{d\tau} - \frac{dS}{dp}\frac{dp}{d\tau} - \frac{dS_w}{dp_w}\left(\frac{dp}{d\tau} - p_w\right) = 0. \tag{4}$$

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Solving for $\frac{dp}{d\tau}$ and simplifying we obtain:

$$\frac{dp}{d\tau} = \frac{\eta_w S_w}{(\epsilon D + \eta S)/p + (\eta_w S_w)/p_w} = \frac{\eta_w S_w}{K} \tag{5}$$

where

$$K = (\epsilon D + \eta S)/p + (\eta_w S_w)/p_w$$

$$\eta_w = \text{elasticity of world supply} = \frac{dS_w/S_w}{dp_w/p_w}$$

$$\eta = \text{elasticity of domestic supply} = \frac{dS/S}{dp/p}$$

and $\epsilon = \text{elasticity of domestic demand} = -\frac{dD/D}{dp/p}$.

In the event of a tariff removal $d\tau$ is equal to $-\tau$ so that we can write

$$dp = -\tau\eta_w S_w/K.$$

If the supply curves are positively sloped and the domestic demand curve negatively sloped then K is greater than zero and a fall in the domestic price occurs. From (2) and substituting $d\tau = -\tau$ we obtain:

$$dp_w = dp + \tau p_w \tag{6}$$

$$= -\tau\eta_w S_w/K + \tau p_w. \tag{7}$$

This equation provides the necessary conditions for a rise in the world price of the import good when the tariff is discontinued. For dp_w is greater than zero if

$$\tau p_w > \tau\eta_w S_w/K$$

or

$$p_w K > \eta_w S_w \text{ for } K > 0.$$

As in the case of a fall in the domestic price, this inequality is satisfied when K is greater than zero.

If the world supply curve is horizontal then

$$dp_w = \lim_{\eta_w \to \infty} \frac{-\tau\eta_w S_w}{K} + \tau p_w = 0. \tag{8}$$

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In this case, from (6)

$$dp = dp_w - \tau p_w = -\tau p_w$$

which implies that the domestic price falls by the full amount of the tariff.

Thus under certain conditions $(K > 0)$, it is possible to place some limits on the change in the world price of the protected good when trade restrictions cease. This change can never be less than zero and its magnitude depends on the demand and supply elasticities and the height of the ad valorem tariff (τ). The assumption of unchanged world price is one that has been used in the partial equilibrium model. It is evident that unless this assumption is satisfied the world price will rise when free trade is permitted and an overstatement of the cost of protection will be made. The explanation lies in the neglect of changes in the terms of trade and the consequent gains from protection--gains which arise from the ability of the importer to exercise monopoly power in this particular market.

It is also possible to examine changes in the terms of trade of a country which subsidizes exports. The assumption of no price change in the unprotected good is still necessary, and in this case it applies to the country's imports. If the demand for a country's exports is perfectly elastic, no changes in the terms of trade occur and a situation analogous to the one previously discussed exists. A negatively sloping demand curve for its exports, however, produces a fall in world price when exports are subsidized due to increased supplies of this commodity. As a result the country suffers an adverse change in its terms of trade under protection which is corrected when the subsidies are discontinued. The traditional method of calculating the cost of protection has a downward bias.

NATURE OF TRADE RESTRICTIONS

One final qualification concerning the cost of protection is necessary when quotas rather than tariffs are used to protect the domestic industry. Quotas are identical to a tariff only if the government auctions import licenses to the highest bidder. In all other cases either the exporters or the importers gain the tariff revenue. Unless the exporters are organized it is generally concluded that the importers gain this revenue. In this case the cost of protection is unchanged though the redistributive effects are different. If the exporters are organized the world price of imports is maintained at the domestic price level so that the tariff revenue need not be deducted from the gain in consumers' surplus when trade restrictions are removed. The cost of protection has been underrated in this case.

MEASUREMENT OF WELFARE COST OF
AGRICULTURAL PROTECTION

Two applications of the model are made in this section. The first application concerns the cost of wheat protection for selected countries, and employs the simple two-good model. The second application is confined to the feed and livestock sectors of West Germany, and since more than one good is involved the formula for the general model is used. In both instances the cost of protection is calculated for a single year--1960.

Wheat: Selected Countries

WHEAT PROTECTION

Cost of protection was calculated for Canada, Denmark, France, Italy, Netherlands, the United Kingdom, the United States, and West Germany. The United Kingdom was the sole country under review where there was a divergence between producer and consumer prices (36). This was due to the system of deficiency payments under which consumer prices were similar to free market prices while the domestic producers received a payment from the government (deficiency payment) to compensate for the difference between free market prices and an administratively determined producer price. Therefore, the consumption cost of protection was not estimated for the United Kingdom.

For the remaining countries both a production and consumption cost were calculated whenever trade prices were lower than domestic prices. This was a result of the employment of trade restrictions such as tariffs and quotas by the importing countries (Denmark, Italy, the Netherlands, West Germany) and of export subsidization by the exporting countries (France, the United States).

THEORETICAL MODEL

Wheat is used mainly for food, but a certain amount is also consumed as feed. Costs in both sections must be estimated, therefore, if the total cost of wheat protection is to be obtained. For food wheat the ordinary uncompensated demand curve was employed since the value of wheat consumption constituted a small fraction of total expenditures.

The demand curve for feed wheat is a demand curve for a resource which is used in the production of final goods (livestock products). Assuming the price the livestock producer is willing to pay for this input or resource is equal to the value of its marginal product, the triangular area (in the case of linear demand curves) under the demand curve and above the price line represents profits

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accruing to the livestock producer at that particular price level. Changes in consumers' surplus are thus replaced by profit changes. The basic formula, however, remains unchanged.

In the present instance, it was assumed that the elasticity of demand for food wheat was equivalent to the elasticity of demand for feed wheat (0.5)[7] thus permitting the derivation of a consumption cost for all wheat. The effect of a tariff on wheat in changing relative costs of protection for livestock was ignored, since it was felt that this particular repercussion could be disregarded in view of the fact that the prices of other feed grains, such as barley and maize, were assumed to remain constant.

The formula for the cost of protection is given below and it is similar to the formula already derived for the two-good model with the income term omitted.

$$C = \tfrac{1}{2}t^2 \, (\eta V^S + \epsilon V^D)$$

where $\quad t = \dfrac{p-p_w}{p} = $ percentage tariff

$\quad p \quad = $ domestic price

$\quad p_w = $ trade price

$\quad \eta \quad = $ elasticity of domestic supply

$\quad \epsilon \quad = $ elasticity of domestic demand

$\quad V^S = $ value of domestic production

$\quad V^D = $ value of domestic consumption

and all prices, quantities, and elasticity values relate to the situation under the tariff. Cost as a percentage of the change in producers' surplus was calculated as follows:

$$\text{Relative cost} = \frac{m \, (dS + dD)}{2(mS - \tfrac{1}{2}mdS)} = \frac{t(\eta V^S + \epsilon V^D)}{2V^S(1 - \tfrac{1}{2}\eta t)}$$

where $m = p - p_w$

$\quad S \quad = $ domestic supply

and $\quad D = $ domestic demand.

---

[7] This assumption was made primarily for computational simplicity since it is recognized that the elasticity of demand for food wheat is undoubtedly less than the elasticity of demand for feed wheat. A better approximation of the cost of protection could be obtained by examining costs in each market (i.e. food wheat and feed wheat) in which case it would be necessary to ascertain the composition of wheat imports. It is probable that the consumption cost of protection has been overestimated in the present model.

Percentage Tariff.--Derivation of the percentage tariff was based on the method discussed in Part I though some allowance for quality differences was made. In the United Nations study it was concluded that imported wheat could generally be considered of higher quality than domestic wheat for most West European countries, and prices in the United Kingdom market were utilized to obtain some measure of the resulting price differential (37). In 1960, the price of No. 2 Red Winter was 12 percent higher than the price of domestic wheat in this market and import prices were reduced accordingly by this amount for Denmark, Italy (soft wheat and all wheat, but not for durum), the Netherlands, the United Kingdom, and West Germany (38, 39). The assumption of uniform quality for domestic wheat encounters some difficulties in certain instances. Although soft wheat is the predominant variety of wheat produced and traded in Western Europe, durum wheat is important in Italy. The production of durum in that country accounted for 17 percent of total wheat production in 1960 (40). In view of the price differential between durum and soft wheat in Italy separate estimates were obtained for both varieties of wheat as well as for all wheat. Derivation of the percentage tariff for durum wheat was based on the assumption that imported wheat was of the same quality as domestic wheat.

In the United States a low percentage tariff (3 percent) was obtained for all wheat though export subsidization undoubtedly occurs. It is probable that the quality of exported wheat (and hence its price) is higher than that for all wheat, so that a certain amount of export subsidization can occur before trade prices fall below domestic prices. The subsequent selection of hard winter wheat in place of all wheat raised both the degree and cost of protection and indicated the importance of quality differences in influencing these measures. For this reason little reliance should be placed on the estimates for all wheat for the United States.

Elasticity Values.--Lack of adequate data concerning demand and supply elasticities for the countries under review led to the selection of a single value (0.5) to represent the required elasticities. It is recognized that such a decision removes one of the chief reasons for preferring the cost of protection to other measures of protection since it prevents consideration of the relevant demand and supply conditions in each country. The resulting estimates are still useful, however, provided this limitation is borne in mind. Thus the estimates may be considered either as over-estimates or underestimates, depending on whether the actual elasticities are less than or greater than 0.5. Since both the elasticities of demand and supply are linearly related to the cost formula, changing these elasticities will result in an identical change

in the cost of protection. In the present model, for example, the substitution of 0.25 or 1 for the previous elasticity values of 0.5 would halve or double the cost of protection.

The assumption of elasticities equal to 0.5 for both demand and supply permitted the following simplification in the cost of protection formula:

$$\text{Cost} = .25t^2 \ (V^S + V^D) \ \text{where}$$

$$V^S + V^D = \text{Value of domestic production and consumption.}$$

Results.--The results are given in table 18. The cost of protection ranges from 0 to \$81 million with Canada, the United States, and Denmark at the lower end and Italy and West Germany at the upper end of the scale. There was no cost of protection for Canada since domestic prices were less than trade prices. When relative rather than absolute cost is examined, however, the rankings of the various countries undergo some change. Italy (soft) and West Germany, with relative costs of 25 percent and 26 percent respectively, are now joined by the Netherlands (27 percent) while the United States (all and hard winter) and France replace Denmark at the lower limit.

When cost of protection among several countries is under review, some basis for comparison must be formed. Cost can then be considered either with respect to the ability of the country to sustain it or to the results of the policy which incurred it. The former refers to cost as a percentage of national income while the latter refers to cost as a percentage of the change in producers' surplus.

Table 18.--Wheat: Cost of protection, 1962

country	Price of production	Export price	tariff	Percentage tariff	Value of domestic production and consumption		Change in producers' surplus	Cost as a percentage of change in producers' surplus	Change in imports
	per metric ton	per metric ton	per metric ton	Pct.	Mil. dol.	Mil. dol.	Mil. dol.	Pct.	1,000 metric tons
Belgium...	...	51.9	...	23	...	...	5....	...	76
France...	...	46.5	...	13	...	9.2	19.3	8	1,657
Italy (hard)...	...	...	...	43	1,778.	81.7	331..	24	3,343
Italy (soft)...	...	51.2	-3.2	41	...	0.2	241.7	25	2,833
Denmark...	133..	72.5	6...	46	364.5	19.3	7.2	27	631
Netherlands...	8.3	86.6	23.7	1.	...	2.2	1.8	27	275
United Kingdom...	54.6	64.9	11.8	16	248.	1.6	33.2	4	237
United States	54.3	54.4	4.4	3	...	.5	15.7	1	455
hard winter...	43..	54.7	1.8	16	...	22.6	217.8	0	2,136
West Germany...	57..	54..	...	--	...	44.5	171.4	26	2,219

Value of exports, production and products not for the United Kingdom.
Export value.
Import price including a percent.

Sources: See appendix B.

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In the case of a single agricultural good in industrially developed countries, cost as a percentage of national income is negligible and cannot be considered as imposing too great a burden on any country. The results of the second method are more interesting since they indicate clearly the cost, in terms of resource misallocation, of transferring income to the agricultural sector. The low absolute costs of Denmark ($0.6 million) and the Netherlands ($3.2 million), take on a new meaning when they are converted to relative costs. The Netherlands is seen to pay a far higher price for protection than examination of absolute costs alone might indicate. Relative cost amounted to 12 percent for Denmark and 27 percent for the Netherlands.

Figure 4 illustrates the divergence among the three measures of protection--degree of protection, absolute costs, and relative costs. The divergence is not as great as might be expected since uniform demand and supply elasticities were used for all countries. The use of actual elasticities would undoubtedly have produced far stronger contrasts because of the importance of elasticity values in the cost formula. The divergences that do exist are due primarily to differences between agricultural policies and domestic production in the various countries.

The United Kingdom emerges as the country with the lowest relative cost, which undoubtedly results from the absence of consumption cost. The system of deficiency payments is superior to other systems as far as relative costs are concerned. This arises from the obvious fact that it removes the consumption cost and leaves producers' surplus unchanged. The latter result demonstrates the dependence of relative cost of protection on the magnitude of domestic production since the greater this quantity the greater the ensuing change in producers' surplus for a given level of absolute costs and the lower the relative cost of protection. Thus, France and the United States (hard winter) have lower relative costs of protection than either Denmark or the Netherlands in spite of the fact that their absolute costs of protection are higher.

The high relative cost of protection for the Netherlands (27 percent) may have to be discounted somewhat since a more complicated system of protection is employed in that country than that envisaged by the present model. Under this system, the importer is reimbursed for duties paid on imports when these imports are used in the production of goods for exports. In the case of wheat used in the production of flour or livestock for export there is, therefore, no loss in consumers' surplus or gain in tariff revenue since wheat has been purchased at world market prices. This situation is analogous to that obtained under a deficiency payments system with the interesting exception that it is the foreign consumer who benefits instead of the domestic consumer. Wheat used to produce a domestic good receives no rebate so that both a production and

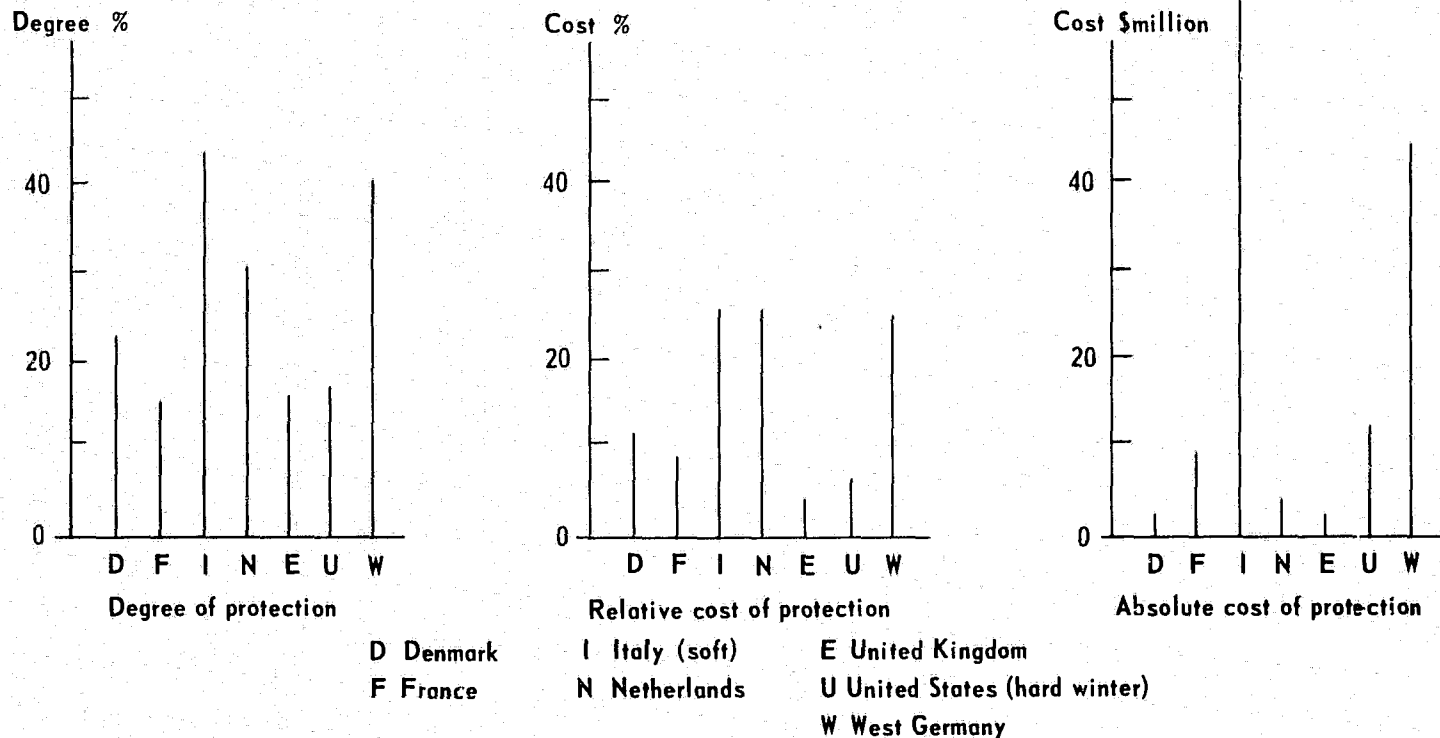# THREE MEASURES OF PROTECTION FOR WHEAT IN 8 COUNTRIES, 1960

Degree of protection

Relative cost of protection

Absolute cost of protection

D Denmark   I Italy (soft)   E United Kingdom

F France   N Netherlands   U United States (hard winter)

W West Germany

Figure 4

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consumption cost exist in this market. Combining costs in both markets we obtain:

Total Cost = Production Cost + Consumption Cost (Wheat used in domestic good production).

This is illustrated in figure 5 where S represents the domestic supply curve of all wheat, D_h is the domestic demand curve for wheat employed in domestic good production and D_x is the domestic demand curve for wheat employed in export good production. The domestic price is given by OW' and the free market price by OW. The cost of protection is derived as follows:

$$\text{Cost} = \tfrac{1}{2}mdS + \tfrac{1}{2}mdD_h$$

where $m = dp$ = fall in domestic price when protection is removed.

The absence of consumption cost in the case of wheat imported for production of an export good is explained by government reimbursement of duty paid on such wheat (dpW'A) to importers.

The existence of rebates is responsible for a divergence between estimated and actual cost of protection if, as in this study, the following formula is used to derive the consumption cost:

$$CC = \tfrac{1}{2}mdD$$

where D = domestic demand for all wheat.

This divergence or error is equal to

$$\tfrac{1}{2}mdD - \tfrac{1}{2}mdD_h = \tfrac{1}{2}t^2 \, (\epsilon V^D - \epsilon_h V_h^D)$$

where ϵ, t, and V^D represent elasticity of domestic demand, the percentage tariff, and the value of domestic production for all wheat, while the h subscripts pertain only to wheat employed in domestic good production. If we assume that

$$\epsilon = \epsilon_h$$

then the following simplification is obtained:

$$\text{Error} = \tfrac{1}{2}t^2 \, \epsilon (V^D - V_h^D) > 0$$

since $V^D > V_h^D$.

In this case the cost of protection has been overestimated.

The assumption that all wheat is employed in export good production ($D = D_x$) provides a lower limit on the cost of protection--a limit which is equivalent to the cost obtained under the deficiency payments system. In the case of the Netherlands, the lower limits on the absolute and relative costs of protection were $1.6 million and 14 percent of the change in producers' surplus.

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COST OF PROTECTION: IMPORTS FOR DOMESTIC USE
AND IMPORTS FOR REEXPORT
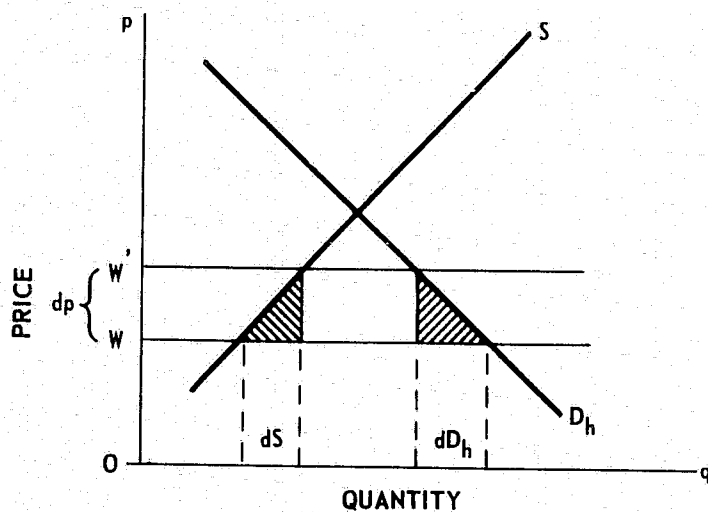
Demand for wheat employed in domestic good production
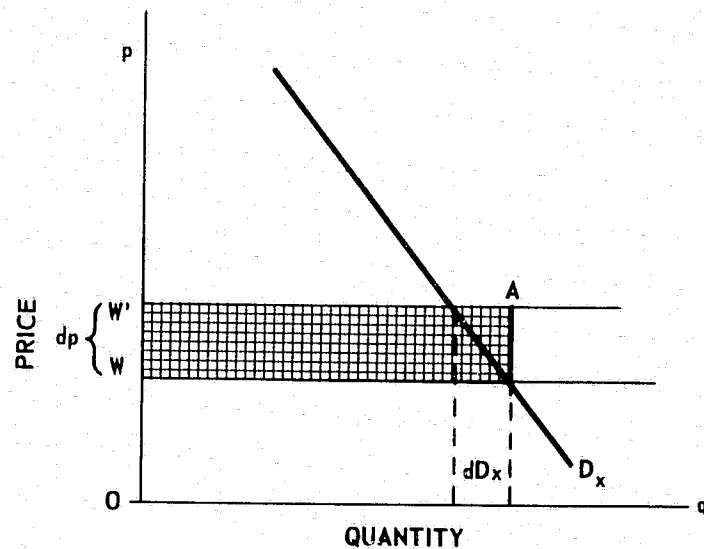
Demand for wheat employed in export good production

Figure 5

The last column in table 18 concerns the impact of protection on market accessibility where changes in imports are used to measure the latter. As we saw earlier, cost may be expressed in terms of the reduction in demand for imports (-dM) as follows:

$$\text{Cost} = \tfrac{1}{2}m((-dD/dp)dp + (dS/dp)dp)$$

$$= \tfrac{1}{2}m(-dM).$$

Solving for -dM we obtain:

$$-dM = 2C/m.$$

For exporting countries such as France and the United States, the change in exports due to subsidization of exports (dX) is equivalent to the change in imports (-dM) and the above formula still holds. Italy and West Germany are still among the leaders which might be expected in view of their dominance in the absolute cost of protection scale. The high values for France and the United States are of particular interest, however, since both of these countries had low relative costs of protection. This combination indicates that the correspondence between cost of protection and market accessibility (for a given tariff) may be changed when relative costs replace absolute costs.

Feed and Livestock Sectors: West Germany

The cost of protection for the feed and livestock sectors of West Germany was examined for the year 1960. Livestock products were represented by pork, poultry, and eggs. Feed grains were represented by barley, rye, and oats. Selection of the three livestock products was based on the fact that more than 50 percent of the cost of production for each of these products is accounted for by feed grains (41, 42). Beef was not included since feed grains amount to only a small proportion of total quantity of fodder fed to cattle in West Germany (41).

Demand and supply elasticities from studies of the United States were used as approximations to the relevant elasticities in West Germany (43, 44). The results of this analysis depend, as for wheat, on how closely the actual and assumed values agree. The ordinary uncompensated demand elasticities were used since expenditure on any livestock product accounted for only a small proportion of total expenditure.

AGRICULTURAL PROTECTION IN WEST GERMANY

West Germany uses a system of import regulations such as tariffs and quotas to support farm prices. This method is employed for feed grains and pork so that domestic prices are higher than

trade prices ($\underline{45}$, $\underline{21}$). In the case of eggs, direct subsidies are paid to the producers and consumer prices are virtually equivalent to trade prices ($\underline{46}$)--there is no consumption cost. A combination of direct subsidies to producers and tariffs on imports is employed for poultry so that a divergence exists between producer and consumer prices ($\underline{21}$, $\underline{46}$). Two different percentage tariffs were used to obtain the production and consumption cost of protection for poultry.

THEORETICAL MODEL

The feed and livestock sectors concern intermediate goods (feed grains) and final goods (livestock). Two methods were used to estimate the cost of protection. The first method was concerned with the final goods subsector only (final goods model) since it was assumed that protection of feed grains was reflected in the higher prices of livestock. In the second method costs incurred by each subsector were derived.

Final Goods Model.--The general model was used since more than one good was involved. The unavailability of cross elasticities of supply meant that terms containing these values were omitted from the production cost formula. The production and consumption cost formulas used in computing the cost of protection are given below:

$$PC = \tfrac{1}{2} \sum_{j=1}^{3} t_j^2 \, \eta_j V_j^S$$

$$CC = \tfrac{1}{2} \sum_{j=1}^{2} \sum_{k}^{2} t_j t_k \epsilon_{jk} \, V_j^D$$

where t_j = percentage tariff = $(p_j - p_{jw})/p_j$

   p_j = domestic price

   p_{jw} = trade price

   η_j = elasticity of domestic supply

   ϵ_{jk} = elasticity of domestic demand (own and cross)

   V_j^S = value of domestic production

   V_j^D = value of domestic consumption

and the j and k subscripts refer to the final goods--pork, poultry, and eggs.

Change in producers' surplus was obtained by the same method as used for wheat, and since there was more than one good, total change in producers' surplus was obtained by adding the change in producers' surplus for each commodity as follows:

$$\text{Change in producers' surplus} = \sum_{j=1}^{3} (m_j S_j - \tfrac{1}{2} m_j dS_j)$$

$$= \sum_{j=1}^{3} (t_j V_j^S (1 - \tfrac{1}{2} t_j \eta_j))$$

where m_j = gross tariff = $p_j - p_{jw}$

and S_j = domestic production.

Intermediate Goods Model.[8]--The simple addition of production and consumption costs in both subsectors produces an overestimate since the two are interdependent. Changes in profit in the feed grain subsector are essentially equivalent to changes in producers' surplus in the livestock sector, so both cannot be included in the same analysis. In addition, part of the tariff on livestock may be attributed to the existence of a tariff on feed grains which raises costs of production of livestock. Thus the removal of a tariff on feed grains could be accompanied by a certain reduction in livestock prices without changing producers' surplus in the livestock subsector. The concept of a compensatory tariff was employed to represent the component of the gross or actual tariff on livestock which could be attributed to the tariff on feed grains. A similar approach is employed by the European Economic Community where the tariff on final goods includes an allowance for higher prices of protected inputs used in the production of that good (47, 48).

For the sake of simplicity, the derivation of the cost of protection is based on the assumption that there is only one final good and one intermediate good and that the latter is used predominantly in the production of the final good. Modifications in this assumption will be considered later.

In order to obtain the separate effect of the tariffs on final and intermediate goods the following hypothetical situation is developed. In the initial situation a net tariff m_{rj} exists on the final good j raising its price from OW_j to Ow_j^*. This is illustrated in figure 6(I). The cost of protection in the livestock subsector due to the net tariff is given by
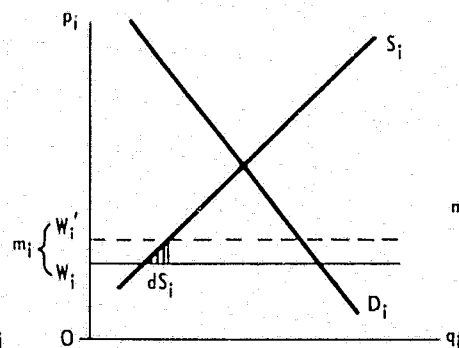
$$\tfrac{1}{2} m_{rj} dS_{rj} + \tfrac{1}{2} m_{rj} dD_{rj}.$$

[8] This model is discussed in greater detail in R. Dardis, "The Welfare Cost of Agricultural Protection." Unpublished Ph.D. Thesis (University of Minnesota, 1965).

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INTERMEDIATE GOOD MODEL: NET TARIFF ON FINAL GOOD FOLLOWED BY GROSS TARIFF ON INTERMEDIATE GOOD AND COMPENSATORY TARIFF ON FINAL GOOD
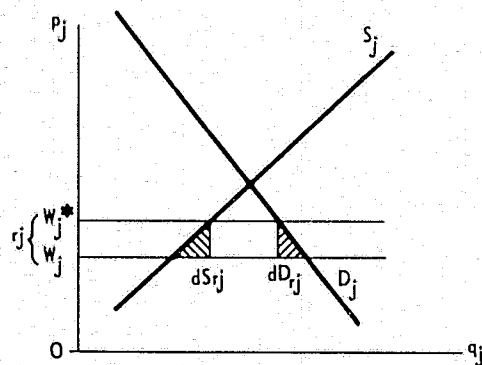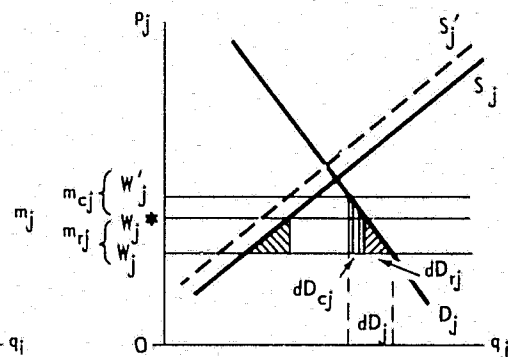
I. Net tariff on final good only

II. Gross tariff on intermediate good in conjunction with compensatory tariff on final good

(a) Intermediate good

(b) Final good

Figure 6

It is then assumed that a gross tariff m_i is levied on the intermediate good raising its price from OW_i to OW_i'. At the same time a compensatory tariff m_{cj} is levied on the final good raising its price from OW_j^* to OW_j'. The results of the second tariff round including the shift of S_j to S_j' as a result of higher input prices are illustrated in figure 6(II). It should be noted that the compensatory tariff is obtained by maintaining producers' surplus unchanged in the final good subsector.

The compensatory tariff has increased the consumption cost in the final good subsector which is now given by $\frac{1}{2}m_j dD_j$. Production cost, however, remains unchanged since the compensatory tariff only reflects increased production costs in that subsector resulting from the tariff on intermediate goods. In the intermediate good subsector, the production cost amounts to $\frac{1}{2}m_i dS_i$. Since producers' surplus has been taken into account in the final good sector, profit changes in the intermediate good subsector need not be considered. Total cost of protection (from the two tariff rounds) is given by:

$$\tfrac{1}{2}m_j dD_j + \tfrac{1}{2}m_{rj}\, dS_{rj} + \tfrac{1}{2}m_i dS_i$$

which is the gross consumption cost and net production cost in the final good subsector and gross production cost in the intermediate good subsector. This total cost could be considered also as the result of one tariff round--a gross tariff on $j(m_j)$ and a gross tariff on $i(m_i)$. The reason for employing two hypothetical tariff rounds is to take the interdependence of the two subsectors into account and to allocate costs between subsectors.

Cost of protection in the intermediate good model may be summarized as follows:

1. Net production and consumption costs in the final good subsector based on the net tariff m_{rj}.
2. Gross production costs in the intermediate good subsector based on the gross tariff m_i.
3. Additional consumption cost in the final good subsector based on the compensatory tariff m_{cj}.

Net and gross costs refer to costs obtained by means of the net and gross tariffs, respectively. The first cost component is the result of the first tariff round while the second and third cost components are the result of the second tariff round and represent the gain from removing the gross tariff on the intermediate good and the compensatory tariff on the final good.

The intermediate good model may be employed to calculate the cost of protection when there is more than one final good. If the intermediate good is used mainly in the production of the final goods under review then the modification consists of substituting the general model formula for the two-good formula. In the case of the feed-livestock sector, the general model was employed to calculate

net production and net consumption costs in the livestock sector utilizing net percentage tariffs (m_{rj}/p_j). The additional consumption cost in the livestock sector was obtained by subtracting net consumption costs from the gross consumption costs already obtained in the final goods model.

A change in the producers' surplus in this sector was obtained in the same manner as in the final goods model except that net tariffs replaced gross tariffs. Feed grains were treated as a single commodity and the formula for the two-good model was used to estimate absolute and relative costs. (See Appendix C.)

COST OF PROTECTION

Percentage Tariff.--Derivation of the gross percentage tariff according to the method outlined in Part I is given in Appendix C. The net percentage tariff for livestock was obtained by subtracting the compensatory percentage tariff from the gross percentage tariff. It was assumed that a 10 percent reduction in the price of feed grains would induce a 5 percent reduction in the price of livestock so that the compensatory percentage tariff could be written as follows:

$$t_{cj} = .5 \, t_i$$

where t_{cj} = compensatory percentage tariff on livestock

t_i = gross percentage tariff on feed grains.

Results.--The results of applying the two models are given in tables 19 and 20. In the final goods model, absolute cost amounts to $50 million and accounts for 10 percent of the change in producers' surplus while in the intermediate goods model absolute cost amounts to $49 million and accounts for 11 percent of the change in producers' surplus. Both estimates are in close agreement.

Table 19. Cost of protection, feed and livestock sectors, West Germany: Final goods model, 1960

Sector	Change in producers' surplus	Type of cost	Cost	Cost as a percentage of change in producers' surplus
	Mil. Dol.		Mil. Dol.	Pct.
Livestock	480.8	Gross production (pork, poultry, eggs)	16.8	3.5
		Gross consumption (pork, poultry)	33.0	6.9
Total	480.8		49.8	10.4

Table 20. Allocation of costs between feed and livestock sectors, West Germany: Intermediate goods model, 1960

Sector	Change in producers' surplus	Type of cost	Cost	Cost as a percentage of change in producers' surplus
	Mil. Dol.		Mil. Dol.	Pct.
Livestock	276.6	Net production (pork, poultry, eggs	6.7	2.5
		Net consumption (pork)	8.2	3.0
Total, livestock sector	276.6		14.9	5.5
Feed grain	161.0	Gross production (feed grain)	8.9	5.5
		Additional consumption cost (pork, poultry)	24.8	15.4
Total, feed grain subsector	161.0		33.7	20.9
Total, livestock and feed grain sectors	431.6		48.6	11.3

The importance of consumption costs in increasing the cost of protection is clearly demonstrated. In the final goods model consumption costs are more than double production costs, so that the adoption of a system of deficiency payments would serve to reduce costs to a considerable extent.

The intermediate goods model, which gives the results of two hypothetical tariff rounds, indicates the importance of a tariff on intermediate goods in raising the relative cost of protection. The cost of protection amounts to $15 million in the livestock sector when there is no tariff on feed grains and this accounts for 6 percent of the extra income accruing to livestock producers. The second tariff round produces an additional cost of $34 million and this now accounts for 21 percent of the change in producers' surplus in the feed grain sector. Most of the increase in absolute cost is the result of the existence of tariffs from the first tariff round in the livestock sector. Any tariff augmentation, irrespective of its cause, would produce this result. The sharp increase in relative costs, however, is a consequence of the tariff on feed grains since that tariff raises costs of production and lowers producers' surplus in the livestock sector. The employment of a compensatory tariff corrects this effect but only at the expense of increased consumption cost. This result is particularly significant for countries such as Italy and the Netherlands which face a sharp increase in feed grain prices by 1967 if the announced EEC target prices become effective. The gain to grain producers will be counteracted by losses in the livestock sector, and the more important livestock production relative to grain production the greater this counteraction will be. If prices in the livestock sector are assumed to remain unchanged, relative costs in that sector will certainly rise since consumption and production costs of protection are unchanged. The alternative is the employment of a compensatory tariff, which can lead to a sharp increase in the relative cost of protection.

When the degree of protection was in question a 3-year average tariff (based on average prices) was examined to avoid distortions caused by extreme fluctuations in the variables in any 1 year. Such distortions, however, are important when the cost of protection is considered since any increase in tariff levels leads to a more than proportionate increase in the cost of protection. The use of average prices in this case produces an underestimate of the cost of protection, so that the cost should be computed for each year and the average then obtained.

If the variables in the cost formula do not fluctuate greatly within the period under review, average prices and quantities may be used to calculate elasticities, tariffs, and values of domestic production and consumption which can be inserted in the cost formula to obtain an average cost of protection. This method was employed for the feed-livestock sector for West Germany for 1959-61. The results are given in tables 21 and 22. It can be seen that absolute cost has changed to a much greater extent than relative cost, which remains in the vicinity of 10 to 11 percent. It can be concluded that relative cost of protection tends to remain fairly stable provided there are no extreme fluctuations in any of the price or quantity variables in the relevant period.

SUMMARY AND CONCLUSIONS

Protection of agriculture in industrially developed countries is one of the main problems facing agricultural trade today. In this study, estimates of the degree of protection were obtained for selected commodities and countries for the period 1959-61. A general model which could be used to measure the welfare cost of protection was developed and two applications of the model were made.

Measurement of the degree of protection was based on the method suggested by the Haberler report (2) and employed later by the United Nations (3). In this method an equivalent tariff, which is equal to the difference between producer prices (adjusted for marketing margins) and trade prices, was used to obtain the degree of protection. Among the advantages of this approach are its inclusion of transport costs, export subsidies, and the ability of large countries to obtain favorable terms of trade. It also ensures that the effect of nontariff barriers to trade, which are important for many agricultural commodities, are taken into consideration.

Some qualifications regarding this method of obtaining the degree of protection must be made with respect to quality differences, distribution costs, and the present level of world prices. All price comparisons ought to be made for goods of the same quality. If producer prices are not so adjusted, the resulting estimates will be biased. An assumption of uniform quality will lead, therefore, to an exaggeration of the degree of protection if the domestic product is superior to the imported product. In the case of distribution costs, it is possible to use either an individual margin for each country or a single uniform margin for all countries. The use of an individual margin for each country includes protection of the distributor as well as of the producer since the greater the distribution cost the greater the degree of protection. The employment of uniform margins removes this effect, so the resulting measure is concerned solely with the protection afforded to the domestic producer. Both types of margins were tested for certain commodities and it was found that the degree of protection was changed by only a few percentage points. The application of uniform margins avoids the unreliability of individual margins and, even if the uniform margins are incorrect, their application will not change the relative position of the various countries in a producer degree-of-protection index. A similar argument is valid for the use of existing trade prices as approximations to world market prices since even if such prices are artificially depressed or raised, all countries will be affected equally.

The degree of protection was estimated for grain, livestock, and dairy products for 1959-61 for Canada, Denmark, France, Italy, the Netherlands, the United Kingdom, the United States, and West Germany. The difference between adjusted producer price and

trade price (equivalent tariff), expressed as a percentage of the former, was used to measure the degree of protection. All prices were averaged for the 3-year period to avoid distortions due to fluctuations in any of the variables in any 1 year.

Milk was the most heavily protected of all commodities in all countries, the degree of protection ranging from 31 to 62 percent. Except for milk, the margin of protection was generally higher for the importing countries than for the exporting countries. Most of the exporting countries had either negative or low margins of protection while the range for importing countries, with some exceptions, was 20 to 40 percent. Canada and Denmark had the lowest overall degree of protection; France and the Netherlands were the two exporting countries with the greatest amount of export subsidization. Barley, pork, and eggs had somewhat similar margins of protection in the three main importing countries--Italy, the United Kingdom, and West Germany--which might be expected since barley is an important input in the production of pork and eggs.

Changes in the degree of protection from 1950 to 1961 for grain, livestock, and dairy products were also examined for Denmark, France, Italy, the Netherlands, the United Kingdom, and West Germany. Data for earlier years were obtained from the results of the United Nations study (3). The most striking changes were noted for milk. In Denmark the degree of protection changed from -3 to 35 percent and in the Netherlands it changed from -6 to 45 percent. Developments in this sector are an interesting example of how protection in some countries may eventually induce its adoption in free trade countries. The chain reaction is initiated by increased domestic production in the protecting countries, which reduces the market for suppliers willing to trade at world prices. If the resulting price decline is sufficiently great, free trade countries may find themselves obliged, in turn, to take some measures to support farm income.

The degree of protection has increased in France and West Germany for nearly all commodities, while in Denmark, Italy, and the Netherlands such increases have been confined to grain and milk. There has not been much change in the overall degree of protection in the United Kingdom, where increases in one sector tended to be offset by decreases in another sector. On the whole the degree of protection appears to have increased for grain and milk and to have remained relatively constant or decreased for livestock and eggs, though France and West Germany are exceptions to the latter.

In the second part of the study a partial equilibrium model, based on linear demand and supply functions, was employed to estimate the welfare cost of agricultural protection. Changes in producers' surplus and in tariff revenue were deducted from changes in consumers' surplus to provide a consumption and production cost of

protection. This cost was a function of the height of the tariff, demand and supply elasticities, and values of domestic consumption and production. Use of an equivalent tariff meant that cost could be obtained for both importing and exporting countries.

All price comparisons were made at the same level of marketing. This raises the problem of marketing margins, since their existence means that producers' and consumers' surpluses are measured at the wholesale level rather than at the farm and retail level. It was concluded that cost measurement at the wholesale level would not affect the final result for constant dollar marketing margins but that an underestimate of the cost of protection would occur with a percentage markup system.

The use of individual or uniform marketing margins depends again on what one wished to measure--the cost of protecting the agricultural sector alone or the cost of protecting both distributors and producers. Accurate measurement of the cost of protecting both distributors and producers depends in part on the accuracy of the marketing margins used. Furthermore, in cases where existing world prices are depressed artificially as a result of protection, both the degree and cost of protection are overestimated in the method used here. This factor is more serious when cost rather than degree of protection is under consideration. First, cost itself is an absolute measure, unlike the degree of protection which serves primarily as an index to rank the various countries. Second, the degree of protection is squared when it is employed in the cost formula, thus magnifying the original overestimate.

An important assumption underlying the use of partial equilibrium analysis in the model is that the indirect effects of the removal of trade restrictions can be neglected. These indirect effects are changes in the terms of trade and balance of payments; changes in employment, and changes in the prices of commodities in other parts of the economy. It was thought that the neglect of these effects in the case of agricultural commodities in industrially developed countries was unlikely to distort the resulting estimates to any serious extent because of the relatively low elasticities of demand and supply and the relative unimportance of the production and consumption of these commodities.

However, in view of the importance of changes in the terms of trade in determining whether a country gains or loses from a tariff in a general equilibrium model, some attempt was made to estimate these changes in a partial equilibrium context. The simple two-good model was used. In the first instance the effect of protection on the world price of the import good was examined, on the assumption that no changes occurred in the price of the country's export good. Protection was found to turn the terms of trade in favor of the protecting country provided the relevant demand and supply functions had the conventional slopes. No change in the terms of trade

was found when the world supply of exports (the country's imports) was perfectly elastic. This had been the traditional assumption of the partial equilibrium model. The analysis indicated that the cost of protection was likely to be exaggerated if the country could effect ..ome changes in its terms of trade.

The second instance was concerned with an export subsidy. The results were similar to the previous case when demand for a country's exports was considered to be perfectly elastic. Removal of this assumption, however, produced an improvement in the country's terms of trade when export subsidies were discontinued, indicating that neglect of this particular effect might provide an underestimate of the cost of protection.

Both of these results rest on a rather restrictive set of assumptions, notably the assumption that no change occurs in the world price of the unprotected good. The possibility of tariff retaliation also means that the overall effect of protection on the terms of trade may be quite inconclusive (49). For this reason no attempt was made to obtain a quantitative estimate of the effect of changes in the terms of trade.

It must be emphasized also that the model is concerned with short-run changes and neglects the dynamic effects of trade restrictions. It is possible that the long-run effects might be in the opposite direction. A great deal depends on the nature of the supply functions in the protected and unprotected industries. It has been argued frequently by the proponents of protection that the existence of increasing returns to scale in the protected industry would mean that a country gains rather than loses from protection. Haberler (50), however, has pointed out that increasing returns to scale are by no means confined to the protected industries and that their existence in the unprotected industries increases the argument in favor of free trade.

When cost of protection among several countries is under review, some basis for comparison must be formed. Cost can then be considered either as a percentage of national income or as a percentage of the change in producers' surplus. The latter comparison is of interest because most agricultural trade restraints and price support programs are instituted mainly to raise farm income. Cost as a percentage of the change in producers' surplus is thus the cost, in terms of resource misallocation, of transferring income to the agricultural sector.

Two applications of the model were made. The first concerned the cost of wheat protection in 1960 in Canada, Denmark, France, Italy, the Netherlands, the United Kingdom, the United States, and West Germany. Several modifications in the degree of protection were made to take quality differences into account. The price of

imported wheat was lowered 12 percent for the importing countries. For Italy and the United States, the cost of protection was obtained for different classes of wheat as well as for all wheat. Lack of adequate data led to the selection c' single value (0.5) to represent the required elasticities of demand and supply. This approach may introduce an appreciable error in the resulting estimates since the elasticity values enter the cost equation in a multiplicative aspect.

Absolute cost of protection ranged from $0 to $81 million with Italy and West Germany at the upper end of the scale and Canada at the lower end. Some changes in the relative position of countries occurred when relative cost replaced absolute cost. Relative cost, or cost as a percentage of income redistributed to farmers, varied from 0 to 27 percent and was highest for the Netherlands, Italy, and West Germany. The divergence between the three measures of protection--degree of protection, absolute cost, and relative cost-- was limited by the assumption of uniform elasticities but some interesting results emerged. One result demonstrated the importance of various agricultural policies in changing the relative cost of protection. The low relative costs in the United Kingdom (4 percent) are due primarily to the absence of a consumption cost which is a characteristic of the system of deficiency payments in operation in that country. Another result illustrated the dependence of relative cost of protection on the magnitude of domestic production. The greater this quantity, the greater the change in producers' surplus for a given level of absolute costs and hence the lower the relative cost of protection. This effect is of particular importance for the two major exporting countries, France and the United States, since it means that the correspondence between cost and market accessibility may be destroyed when relative costs replace absolute costs. The reconcilement of trading interests is thus made more difficult since the damage inflicted on the free trade countries may not be proportional to the cost incurred by the protecting countries.

The second application of the model dealt with the feed and livestock sector in West Germany in 1960 and was selected primarily to illustrate the interdependence of the final and intermediate goods sectors. Individual rather than uniform marketing margins were used to obtain the degree of protection so that the cost includes protection of distributors as well as of producers. Demand and supply elasticities from studies of the United States were employed.

Two models were employed for West Germany--the final goods and intermediate goods model. The former method examined costs in the final goods sector only, since it was assumed that the tariff on intermediate goods was reflected in the higher prices of livestock. The second method obtained costs incurred by each sector.

Both methods were in close agreement and cost of protection ranged from $49 to $50 million, accounting for 11 and 10 percent, respectively, of the change in producers' surplus. The advantages

of the intermediate good model were that it permitted cost allocation between the two sectors and took their interdependence into account.

The importance of consumption costs in West Germany was demonstrated by the fact that production costs in either the livestock or feed grains sector accounted for only 3 to 6 percent of redistributed income. It is obvious that the avoidance of consumption costs will increase welfare, yet this result has important policy implications. The comparison between two systems of agricultural protection such as deficiency payments and price supports is similar in many respects to a comparison between direct and indirect taxation. In certain circumstances, it can be shown that direct taxation is more efficient than indirect taxation since it avoids distortions in consumption patterns. The same conclusions hold for the deficiency payments system.

The second result of the West Germany cost calculation stresses the importance of a tariff in the intermediate goods sector in raising the relative cost of protection. Net production and consumption costs in the final good or livestock sector amounted to $15 million and accounted for 6 percent of the change in producers' surplus. This result was obtained by assuming that a net tariff existed on the final good (livestock) only. The imposition of a tariff on feed grains occasioned production costs in that sector of $9 million while the imposition of a compensatory tariff on livestock raised consumption costs in the livestock sector by $25 million. Thus the additional gain to the farm community of $161 million (change in producers' surplus in the feed grain sector) cost the economy $34 million, or more than one fifth of the redistributed income. This result indicates how much a tariff in the intermediate good sector may raise the relative cost of protection.

In view of the high consumption cost in the livestock sector of West Germany, the adoption of a system of deficiency payments or a reduction in tariffs on feed grains (with a corresponding reduction in the compensatory tariffs on livestock) are both methods which might be used to lower the relative cost of protection.

It must be emphasized that the reliability of these estimates for West Germany depends a good deal on how closely the assumed and actual elasticities of demand and supply agree. This is true of the consumption cost in particular, which accounts for a large part of the cost of protection. Another possible source of error lies in the measurement of the degree of protection since it is affected by the particular marketing margins used.

The absolute cost of protection for any of the countries examined was not great. Neither was it negligible. The farm sector might receive greater benefits if some other method of income redistribution were adopted. The high relative costs obtained for some countries are particularly noteworthy in this respect. Relative costs

of 25 percent mean that each dollar that is transferred to the agricultural sector incurs a transfer cost of 25 cents. If a more efficient method of income redistribution could be devised, the resulting gain from cost reduction would increase the welfare of the economy irrespective of how this gain was redistributed. The present situation in most of the countries examined could thus be classified as Pareto nonoptimal (51) since the adoption of a system of deficiency payments would remove the consumption cost and thereby lower both the relative and absolute costs of protection. Production costs could also be lowered if other methods of supporting farm income, such as direct income payments or production grants, replaced support prices.

The cost formula demonstrates the importance of demand and supply elasticities in influencing the cost of protection so that the same absolute cost can be obtained from a combination of high tariffs and low elasticities or low tariffs and high elasticities. Thus, the degree of protection, which had replaced actual tariffs as a measure of protection, is supplanted by the cost of protection, though it remains as one of the terms in the cost formula. One reason why cost of protection has not been considered so far in trade negotiations is undoubtedly the lack of adequate data concerning the relevant elasticities. But an examination of costs for a certain range of elasticity values would still be helpful. In particular, agricultural products with relatively low elasticities of demand and supply may be able to sustain higher degrees of protection than industrial goods so that it is by no means certain that the attainment of equal tariff levels for groups of dissimilar commodities is an ideal situation.

The use of guaranteed prices and trade restraints threatens trade expansion in general since it demands exemption of agricultural products from international trading rules. It is not likely that the main exporting countries of unsubsidized agricultural products will permit such a system to continue indefinitely. While some protective measures may be necessary in the short run, the principal danger of such a policy lies in its continuance and in the perpetuation of unnecessary trade restrictions. The continued protection of many aged "infant industries" testifies to this possibility.

In view of the close connection between absolute cost of protection and market accessibility, there is no reason to suppose that the interests of the protecting countries and the free trade exporting countries are necessarily in conflict. As we have seen, the cost of protection is directly related to market accessibility. If the absolute cost of protection is high the market loss for the exporting country is also high and both countries have a mutual interest in reducing it. The correspondence of interests may be destroyed when relative cost replaces absolute cost as a consideration. This is particularly true of many exporting countries where

changes in producers' surplus may be of sufficient magnitude to permit a high absolute cost and a high increase in exports or reduction in market accessibility to accompany a low relative cost of protection. If the exporting country is dedicated to maintaining farm income at a certain level by means of trade restraints, it will be more likely to concentrate on relative rather than on absolute cost of protection since the latter provides an incomplete picture of its agricultural policy. This result may serve, in part, to explain the increase in export subsidization in recent years.

In conclusion, though the degree of protection is an incomplete measure of protection, a knowledge of it is essential in computing the cost of protection. The cost of protection, unlike the degree of protection, varies with the particular demand and supply elasticities of the protecting country and thus reflects the economic consequences of protection. For this reason, any discussion of the importance of trade restraints in international trade should be concerned with both the cost and degree of protection.

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ABBREVIATIONS

CDA   Canadian Department of Agriculture
CEC   Commonwealth Economic Committee
DBS   Dominion Bureau of Statistics
ECE   Economic Commission for Europe
EEC   European Economic Community
EPA   European Productivity Agency
FAO   Food and Agriculture Organization of the United Nations
GATT General Agreement on Tariffs and Trade
IMF   Internatonal Monetary Fund
IWC   International Wheat Council
MAFF Ministry of Agriculture, Fisheries, and Food
OECD Organization for Economic Cooperation and Development
OEEC Organization for European Economic Cooperation
PEP   Political and Economic Planning
UN   United Nations
USDA United States Department of Agriculture

APPENDIX A. SOURCES OF DATA USED IN OBTAINING DEGREE OF PROTECTION

Country	Commodity	References
PRODUCER PRICES[1]		
Denmark, France, Italy, Netherlands, United Kingdom, West Germany	All commodities except poultry and pork (France)	ECE/FAO, Prices of Agricultural Products and Fertilizers in Europe, UN, Geneva (Annual).
France	Pork	FAO, Production Yearbook 1962, FAO, Rome (1963).
Denmark	Poultry	FAO, Production Yearbook 1962, FAO, Rome (1963).
France, Italy, West Germany	Poultry	Stat. Off. of Eur. Communities, Agr. Stat., Brussels, (1962, No. 8 and 1963, - No. 4)
Netherlands, United Kingdom	Poultry	ECE/FAO, Prices of Agricultural Products and Fertilizers in Europe 1962/63, UN, Geneva (1964).
Canada	All commodities	Private communication from W.A. Morris, Chief, Farm Finance Section, Agr. Div., DBS, Ottawa, Canada
United States	All commodities	USDA, Agricultural Prices; 1963 Annual Summary, Government Printing Office, Washington (1964).
TRADE PRICES		
All countries	Wheat, barley, maize, beef, pork, and butter	FAO, Trade Yearbook 1963, FAO, Rome (1964).
All countries except the United States	Cattle, eggs	FAO, Trade Yearbook 1963, FAO, Rome (1964).
United States	Cattle, eggs	USDA, Foreign Agricultural Trade of the United States: Statistical Report for the Calendar Year, Government Printing Office, Washington (Annual).
MARKETING MARGINS[1]		
Denmark, France, Italy, Netherlands, United Kingdom, West Germany	Beef, pork	OEEC/EPA, Marketing and Distribution Margins for Livestock and Meat in OEEC Countries, OEEC, Paris (1959).
Denmark, France, Italy, Netherlands, United Kingdom, West Germany	Eggs	OEEC/EPA, Marketing and Distribution Margins for Eggs in OEEC Countries, OEEC, Paris (1959).
Denmark, France, Italy, Netherlands, United Kingdom, West Germany	Milk	OEEC/EPA, Marketing and Distribution Margins for Milk and Milk Products in OEEC Countries, OEEC, Paris (1960).
All countries	Poultry	USDA, Marketing and Transportation Situation, MTS-124, Government Printing Office, Washington, p. 22 (January 1957).
United States	Beef, pork	USDA, Marketing Costs and Margins for Livestock and Meats, Mktg. Res. Rept. No. 418, Government Printing Office, Washington, pp. 60-61 (1960).
		USDA, Marketing and Transportation Situation, MTS-142, Government Printing Office, Washington, p. 41 (July 1961).

[1] Exchange rates for conversion of foreign currencies to U.S. dollars were obtained in IMF, International Financial Statistics, IMF, Washington (monthly).

Country	Commodity	References
United States	Eggs	USDA, Prices and Price Spreads for Beef, Eggs, and Fluid Milk in Selected Markets of the United States and Europe, ERS-37, Government Printing Office, Washington, p. 14 (1961).
United States	Milk	USDA, Farm-Retail Spreads for Food Products, AMS, Misc. Pub. No. 741, Government Printing Office, Washington, p. 28 (1957).
Canada	All commodities except pork	Report of the Royal Commission on Price Spreads of Food Products, Vol. III, the Queen's Printer, Ottawa (1960).

APPENDIX B. SOURCES OF DATA USED IN OBTAINING COST OF PROTECTION OF WHEAT

Country	Prices and Quantities	References
All countries except Canada, Italy (soft, hard), and United States	Domestic prices	ECE/FAO, Prices of Agricultural Products, and Fertilizers in Europe 1961/62, UN, Geneva (1963).
Canada	Domestic prices	Private communication from W.G. Morris, Chief, Farm Finance Section, Agr. Div. DBS, Ottawa, Canada
Italy (soft, durum)	Domestic prices	Repubblica Italiana, Istituto Centrale di Statistica, Annuario di Statistica Agraria 1963, Roma pp. 211, 254 (1963).
United States	Domestic prices	USDA, Agricultural Prices: 1963 Annual Summary, Government Printing Office, Washington, (1964). USDA, The Wheat Situation, WS-189, Government Printing Office, Washington, p. 29 (July 1964).
All countries except United States (hard winter)	Trade prices	FAO, Trade Yearbook 1963, FAO, Rome (1964).
United States (hard winter)	Trade prices	USDA, The Wheat Situation, WS-189, Government Printing Office, Washington, p. 30 (July 1964).
All countries except Italy (soft, durum) and the United States	Production and consumption (disappearance)	FAO, Production Yearbook 1962, FAO, Rome (1963). FAO, Trade Yearbook 1962, FAO, Rome (1964). IWC, World Wheat Statistics, IWC, London, p. 46 (1963). CEC, Grain Crops;(1963); Her Majesty's Stationery Office, London, p. 66 (1963).
Italy (soft, durum)	Production and consumption (disappearance)	Repubblica Italiana, Istituto Centrale de Statistica, Annuario di Statistica Agraria 1963, Roma, p. 5 (1963).
United States	Production and consumption (disappearance)	USDA, Agricultural Statistics 1963, Government Printing Office, Washington, p. 12 (1963).

[1] Consumption of durum and soft wheat was obtained from the consumption of all wheat using the ratio of durum to soft wheat in production.

APPENDIX C. DATA USED IN OBTAINING COST OF PROTECTION OF THE FEED AND LIVESTOCK SECTORS IN WEST GERMANY

Derivation of Gross Percentage Tariff, and Producers' Surplus, Feed Grain Sector

Commodity	Producer price[1]	Import price[2]	Domestic production[3]
	------- Dollars per quintal -------		1,000 metric tons
Barley:			
1960...................	8.94	6.87	2,416
1959-61...............	9.01	6.28	2,196
Rye:			
1960...................	8.91	6.02	3,036
1959-61...............	9.04	6.17	2,699
Oats:			
1960...................	8.19	6.88	2,456
1959-61...............	8.28	6.17	2,295

[1] ECE/FAO, Prices of Agricultural Products and Fertilizers in Europe 1961/62 (United Nations, Geneva, 1963).
[2] FAO, Trade Yearbook, 1963 (FAO, Rome, 1964).
[3] OECD, Agricultural and Food Statistics (OECD, Paris, 1962). It was assumed that 75% of each grain produced was used as feed grain.

Then:

$$\text{Percentage tariff } (t_i) = \frac{\sum_{k=1}^{3} p_k q_k - \sum_{k=1}^{3} p_{kw} q_k}{\sum_{k=1}^{3} p_k q_k} \qquad (k = \text{wheat, barley, oats})$$

$$\text{Change in producers' surplus} = m_i S_i - \tfrac{1}{2} m_i dS_i$$

$$= m_i S_i - \tfrac{1}{2} t_i^2 \eta_i V_i^S$$

Where:

$$m_i S_i = \sum_{k=1}^{3} p_k q_k \quad \sum_{k=1}^{3} p_{kw} q_k$$

p_k = producer price of good k

p_{kw} = import price of good k

q_k = domestic production of good k

η_i = elasticity of domestic grain supply

V_i^S = value of domestic grain productions

Derivation of gross and net tariffs for livestock

Commodity	A Producer price[1]	B Marketing margin[2]	C Adjusted producer price	D Import price[3]	E Gross tariff	F Gross percentage tariff[4]	G Net percentage tariff
	------------------ Dollars per quintal -----------------					---- Percent ----	
Pork:							
1960...	71.25	$6.71	77.96	57.50	20.46	26	13
1959-61	71.68	6.71	78.39	59.45	18.94	24	9
Poultry:							
1960...	56.94	22.00	78.94	64.06	14.88	19 13[5]	6
1959-61	58.63	22.00	80.63	62.45	18.18	23 13	8
Eggs:		Percent					
1960...	76.05	20	91.25	52.86	38.39	42	29
1959-61	76.25	20	91.50	52.15	39.35	43	28

[1] Pork, eggs - ECE/FAO, Prices of Agricultural Products and Fertilizers in Europe 1961/62 (UN, Geneva, 1963). Poultry - Statistical Office of the European Communities, Agricultural Statistics, Brussels. (1960. No. 8, and 1963, No. 4).
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[3] FAO, Trade Yearbook 1963 (FAO, Rome, 1964).
[4] Gross percentage tariff is similar to the degree of protection derived in the first part of this study.
[5] Gross percentage tariff for estimation of consumption cost. A divergence exists between the producer and consumer price due to subsidies paid to producers. It was assumed that this divergence would continue when the compensatory tariff was removed, so that no net consumption costs existed for poultry.

NOTE: C = A + B
       E = C - D
       F = (E/C) 100
       G = F - (.5) (X%) where X% = gross percentage tariff on feed grains
                                  = 25% (1960)
                                  = 29% (1959-1961)

Quantity and Elasticity Values

Commodity	Domestic production[1]	Domestic consumption[2]	Elasticity of supply[3]	Elasticity of demand[4]	Cross elasticity of demand[4]
	---- 1,000 metric tons ----		-------------- Coefficient ---------------		
Pork:					
1960.......	1,515	1,636	0.130	-0.750	0.066(poultry)
1959-61....	1,520	1,631	0.130	-0.750	0.066(poultry)
Poultry:					
1960.......	100	232	0.678	-1.160	0.157(pork)
1959-61....	100	233	0.678	-1.160	0.157(pork)
Eggs:					
1960.......	450		0.298		
1959-61....	447		0.298		
Feed grains:					
1960.......	7,908		0.430		
1959-61....	7,190		0.430		

[1] Pork - FAO, Production Yearbook 1963 (FAO, Rome, 1964). Poultry - CEC, Meat 1963 (Her Majesty's Stationery Office, London, 1964). Eggs - FAO, Production Yearbook 1962 (FAO, Rome. 1963). Feed grains - OECD, Agricultural and Food Statistics (OECD, Paris 1962).
[2] CEC, op. cit.
[3] W.A. Cromarty, "An Econometric Model for United States Agriculture, " Jour. of Amer. Stat. Assoc., 54:573 (September 1959).
[4] G.E. Brandow, Interrelations among Demands for Farm Products and Implications for Control of Market Supply (Penn. State Univ. Agric. Exper. Station Bull. 680, Univ. Park, Penn., 1961), p. 17.

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