NBER WORKING PAPER SERIES

TRADE-POLICY AND IMPORT COMPETITION UNDER FLUCTUATING PRICES

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Working Paper No. 628

NATIONAL BUREAU OF ECONOMIC RESEARCH
1050 Massachusetts Avenue
Cambridge MA 02138

February 1981

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NBER Working Paper #628
February 1981

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ABSTRACT

When subsidies and tariffs are applied to imports with fluctuating prices, it is shown that the output response of domestic producers depends on market structure and their attitude toward risk. The domestic industry response is contrasted under two types of market structure, a monopoly and a competitive industry. Some unanticipated results suggest caution in the implementation of trade policy.

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1. Introduction

Tariffs are usually advocated as a means of expanding domestic output in import competing industries. The conventional wisdom is that tariffs generally induce an expansion of output, no matter what the structure of the import competing industry, provided import prices are fixed and certain.[1] This paper examines the impact of fluctuating import prices on the import competing industry under two polar market structures, single monopoly and a perfectly competitive industry. In the case of stable import prices, both the monopoly and the competitive industry behave similarly. This follows, because the domestic market is small relative to the international market, and hence the import price forces the monopoly to behave competitively. When tariffs are levied on imports [1] domestic producers react unambiguously by increasing domestic production and hence a decline in imports results.

Under fluctuating import prices, however, different reaction patterns are obtained, which depend mainly on the underlying type of domestic market organization and the firm's attitude towards risk. Hence in the more realistic context of random import prices, trade policy prescriptions based on theoretical fundations which assume deterministic prices may fail to attain the stated objectives, namely, increasing domestic production, and decreasing imports.

In section 2, we provide a model which captures the two polar cases of perfect competition and monopoly in the import-competing industry. In addition random import prices and attitudes toward risk are explicitly incorporated. Then optimality conditions, and their implications are examined. Section 3 and 4 examine the impact of risk aversion and a marginal increase in price uncertainty, while sections 5 and 6 analyze the industry response to various tariffs. The rationale for the choice of a particular trade policy instrument in a welfare context is not considered in this paper.[2] The final section provides a brief summary.

2. The Model

The domestic demand for the commodity produced by the industry is given by $P = P\ (Q)$ where P and Q stand for price and quantity demanded respectively. The fluctuating import prices are represented by a non-negative random variable P_w, which has a known distribution, $f(P_w)$. The mean of the price distribution is $\bar{P}_w = \int_0^\infty P_w f(P_w) dP_w$. Even though P_w may occasionally exceed the domestic price, P_d, it is assumed that exports are precluded by transaction costs. In order to illustrate the relationship between domestic prices and the price of imports, we can use the graphical representation in Figure 1.

The graph depicts the domestic demand, $P(Q)$, the marginal revenue, MR, the marginal cost, MC, and the mean value of the random import price, $\bar{P}_w$, and its corresponding distribution $f(P_w)$. For discussion purposes let the optimal decision(s) of the firm(s) in the industry result in a level of industry output Q_d. The production decisions are made ex-ante, prior to the realization of the value that the random import price takes. In the absence of exports, P_d becomes the highest price which can be charged if the market is to clear. In other words, P_d is the relevant price charged to domestic consumers if the import price happens to be above it. Otherwise, P_w (the particular value of the import price) becomes the relevant price that the firm can charge domestic consumers. We observe on the vertical axis of the graph, that P_d becomes the point of truncation on the higher side of the import price distribution. The area under the density function below P_d, which is given by $F(P_d) = \int_0^{P_d} f(P_w)dP_w$, represents the probability that $P_w \leq P_d$.

We consider two types of industry structure, a monopoly and a competitive industry. Q_d and P_d depend on the industry structure. From Figure 1, the import competing firm in a given industry faces the following truncated price distribution:

$$P=\begin{cases} P_d & \text{if } P_w \geq P_d \\ P_w & \text{if } P_w < P_d \end{cases} \tag{1}$$

If q_m is any output which the monopoly firm may choose, q_c any output a single competitive firm may choose and N is the number of firms in the competitive industry, and C(q) is the total cost function for both industries, the firm's profits are

$$\Pi = \begin{cases} \Pi_1 = P_d \cdot q - C(q) \text{ with probability } 1 - F(P_d) \\ \Pi_2 = P_w \cdot q - C(q) \text{ with probability } f(P_w) \end{cases}$$

where

$$P_d = \begin{cases} P_m(q_m) & \text{in the monopoly case} \\ P_c & \text{in the competitive case} \end{cases} \tag{2}$$

and

$$q = \begin{cases} q_m = Q_d & \text{in the monopoly case} \\ q_c \text{ and } Nq_c = Q_d & \text{in the competitive case} \end{cases}$$

Both types of firms select an optimal output which maximizes the expected utility of their profits, $Eu(\Pi)$ where

$$Eu(\Pi) = [1-F(P_d)]\ u(\Pi_1) + \int_0^{P_d} u(\Pi_2)\ f(P_w)dP_w \qquad (3)$$

In selecting q_m, the monopolist determines the truncation point on the industry price distribution, $P_m(q_m)$, the maximum price which it can charge on the industry demand curve. We assume that goods cannot be carried forward, that is, there are no inventories, so $P(q_m)$ is the maximum price the monopoly can charge and still clear the market. In long run equilibrium, the output q_c selected by the competitive firm, times the number of firms in the industry, yields the total competitive industry output Q_c; given the demand curve, Q_c, determines the maximum price P_c which the competitive firm can charge. Each firm is aware of P_c in long run equilibrium, because if firms charged $P_w > P_c$, competition would force $P_w \rightarrow P_c$ to clear the market. Although q_c and P_c are related in the long run, in the short run, by contrast, firms take P_c as given, so that short run charges in q_c do not affect the perceived P_c. For the monopoly, of course, q_m and P_m are directly related in both the long and short run.

The first order condition for the monopolist is

$$[\partial Eu(\Pi)^m/\partial q] = -f(P_m)(\frac{\partial P}{\partial q})\ u(\Pi_1) + f(P_m)(\frac{\partial P}{\partial q})u(\Pi_2)$$
$$+ [1-F(P_m)]\ u'(\Pi_1)(MR-MC) + \int_0^{P_m} u'\ (\Pi_2)(P_w-MC)f(P_w)dP_w=0 \qquad (4)$$

Since both the first two terms are evaluated at the truncation point $P_w = P_m$, they are equal in magnitude and cancel out. For an optimum to occur, the third and fourth terms must be opposite in sign. There are only two possibilities, either the third term is negative and the fourth positive, or vice versa. We shall concentrate on the former case which corresponds to $\bar{P}_w$ above the intersection between MR and MC, because this case generates the more interesting contrasts with the competitive industry. There is nothing which excludes the other possibility apriori. However, the output response of the monopolist in the latter case is in the same direction as that of the competitive firm.

With MR < MC, the third term in (4) is negative, because $F(P_m) < 1$ and $U(\Pi_1) > 0$. At the optimal output, therefore, the fourth term is positive. At this optimum, the probability weighted negative marginal utility of profits with respect to output associated with the domestic price P_m is equal in magnitude to the probability weighted positive marginal utility of profits with respect to output associated with the import prices, P_w. Note that the firm will never select an output on the price inelastic portion of the demand curve, because such a choice would decrease both the domestic and the import price related marginal revenue. MR is negative and the range of P_w smaller, so that both the third and the fourth terms in (4) are smaller on the price inelastic part of the demand curve.

Given equation (4), let us examine the impact of the monopolistic attitude towards risk on its output. To facilitate the comparison between the risk averse and risk neutral cases we rewrite (4) as follows:

$$[1-F(P_m)](MR-MC) + \int_0^{P_m} \frac{u'(\Pi_2^m)}{u'(\Pi_1^m)} (P_w-MC)f(P_w)dP_w = 0 \qquad (5)$$

The solution of (5), q_m^a, denotes the optimal output chosen by the risk averse monopoly. Since the import prices are less than domestic prices,

$\Pi_2^m(P_w) \leq \Pi_1^m(P_m)$ and by concavity of the utility functions, it follows that $u'(\Pi_2^m) \geq u'(\Pi_1^m)$ for all $P_w \in [0,P_m]$. Risk neutrality, on the other hand, implies $u'(\Pi_2) = u'(\Pi_1) = u'(\Pi)$. The ratio of the marginal utilities is greater for the risk averse than for the risk neutral monopolist. At the optimal output of the risk averse firm q_m^a, the expected marginal profit of the risk neutral monopolist may be either positive or negative. Hence, the optimal output chosen by a risk neutral monopolist $q_m^n \gtrless q_m^a$. The interesting result is that risk aversion may induce the monopolist to expand output.

In the competitive case, the optimal output chosen by the risk averse firm is obtained from

$$\frac{\partial Eu(\Pi^c)}{\partial q_c} = [1-F(P_c)]u'(\Pi_1^c)(P_c-MC) + \int_0^{P_c} u'(\Pi_2^c)(P_w-MC)f(P_w)dP_w=0 \qquad (6)$$

Since the term $(P_c-MC) > 0$, the second term is necessarily negative. Contrasting the risk averse firm's output with the risk neutral, the result is that risk aversion induces a contraction in the competitive firm's output. This can be easily shown by rearranging (6):

$$[1-F(P_c)](P_c-MC) + \int_0^{P_c} \frac{u'(\Pi_2^c)}{u'(\Pi_1^c)} (P_w-MC)f(P_w)dP_w = 0 \qquad (7)$$

Let q_c^a denote the solution of (7). Evaluating the expected marginal profit of the risk neutral firm at q_c^a, we note that is positive, implying that its optimal output $q_c^n > q_c^a$.

The reason for the possible difference in the impact of risk aversion on output responses is the following: for both the competitive industry and the monopoly the utility evaluated marginal profit from random import prices is greater than that from domestic prices. Since the import related marginal profit may be positive for the monopoly and is negative for the competitive industry, risk aversion has a negative impact on the output of the latter and may have a positive impact on the output of the former.

Finally, comparing the above results for fluctuating prices to those obtained under deterministic import prices equal to $\bar{P}_w$, it is obvious that they imply a lower level of domestic output, and higher expected imports, irrespective of the industry structure.

3. Lump-Sum Subsidy (Tax)

It is well known from the standard theory of the monopoly and competitive firm, that a change in wealth has no effect on output. In the case of fluctuating import prices, however, the opposite impact of risk aversion on the output of the competitive and monopolistic industries is highlighted by changes in the firm's wealth. The latter may result from a change in fixed costs, or from the imposition of a positive (negative) lump sum subsidy, S.

We define the profit function of the monopolist and the competitive firm as follows:

$$\Pi^d = \begin{cases} P_d \cdot q_d - C(q_d) + S & \text{for } P_w \geq P_d \\ P_w \cdot q_d - C(q_d) + S & \text{for } P_w < P_d \text{ where } d = c,m \end{cases} \tag{8}$$

After substituting the new profit functions, in the first order conditions (6) and (7) and differentiating with respect to S one obtains:

$$\frac{\partial q_c}{\partial S} = - \frac{1}{\Delta_c} \{[1-F(P_c)](P_c-MC)u''(\Pi_1^c) + \int_0^{P_c} u''(\Pi_2^c)(P_w-MC)f(P_w)dP_w\} \tag{9}$$

$$\frac{\partial q_m}{\partial S} = -\frac{1}{\Delta_m}\{[1-F(P_m)](MR-MC)u''(\Pi_1^m) + \int_0^{P_m} u''(\Pi_2^m)(P_w-MC)f(P_w)dP_w\} \qquad (10)$$

Where Δ_c and Δ_m are the second order conditions for the competitive firm and the monopoly respectively. It will be shown that a lump sum subsidy increases (decreases) output in the competitive (monopoly) industry given non-increasing absolute risk aversion. To sign (9) and (10) we rewrite the first order conditions (6) and (7) as

$$[1-F(P_c)](P_c-MC)u'(\Pi_1^c) = -\int_0^{P_c} u'(\Pi_2^c)(P_w-MC)f(P_w)dP_w > 0$$

and $$-[1-F(P_c)](MR-MC)u'(\Pi_1^m) = \int_0^{P_m} u'(\Pi_2^m)(P_w-MC)f(P_w)dP_w > 0$$

Since the sign of (9) and (10) is the same as the sign of the brackets, we divide each term in the brackets by a positive number, chosen from the above expressions.

Substituting the definition of absolute risk aversion, $R_A(\Pi)=-u''(\Pi)/u'(\Pi)$ and rearranging terms, we obtain

$$\text{Sign}\ \frac{\partial q_c}{\partial S} = \text{Sign}\{\frac{\int_0^{P_c} [R_A(\Pi_2^c)-R_A(\Pi_1^c)]u'(\Pi_2^c)(P_w-MC)f(P_w)dP_w}{\int_0^{P_c} u'(\Pi_2^c)(P_w-MC)f(P_w)dP_w}\} \qquad (11)$$

$$\text{Sign}\ \frac{\partial q_m}{\partial S} = \text{Sign}\{\frac{\int_0^{P_m} [R_A(\Pi_1^m)-R_A(\Pi_2^m)]u'(\Pi_2^m)(P_w-MC)f(P_w)dP_w}{\int_0^{P_m} u'(\Pi_2^m)(P_w-MC)f(P_w)dP_w}\} \qquad (12)$$

Given decreasing absolute risk aversion, we note that $R_A(\Pi_2^c) > R_A(\Pi_1^c)$ for all $P_w \varepsilon[0,P_c]$ and $R_A(\Pi_1^m) < R_A(\Pi_2^m)$ for all $P_w \varepsilon[0,P_m]$. Previously it was shown that $\int_0^{P_c} u'(\Pi_2^c)(P_w-MC)f(P_w)dP_w < 0$, hence

$\int_0^{P_c} [R_A(\Pi_2^c)-R_A(\Pi_1^c)]\, u'(\Pi_2^c)(P_w-MC)f(P_w)dP_w$ is clearly negative. Hence the sign of (11) is positive. Moreover, $\int_0^{P_m} u'(\Pi_2^m)(P_w-MC)f(P_w)dP_w > 0$ and since $R_A(\Pi_1^m)-R_A(\Pi_2^m) < 0$ it follows that (12) is negative.

Heuristically, we can explain the positive impact of a lump sum subsidy on the competitive firm and the negative impact on the monopoly as follows: under non-increasing absolute risk aversion, the subsidy lowers the degree of risk aversion of both monopoly and competitive firm. This in turn encourages the undertaking of more risk, which for the competitive firm implies an increase in output. For the monopoly it implies a movement towards higher profits which obtain when his price rules in the domestic market. The monopoly accomplishes this by decreasing output.

4. Increasing Price Uncertainty

Since import competing industries face various degrees of price uncertainty overtime, it is interesting to examine their reaction to a marginal increase in price uncertainty. This case also illustrates the technical complexity which comparative static analysis of the model may generate.

A marginal increase in price uncertainty can be reflected by a stretch of the probability distribution of the import prices. Hence we redefine the random price by

$$P_w^* = P_w + k\,(P_w - \bar{P}_w)$$

Substituting P_w^* for P_w in (4) and (6) and differentiating with respect to k, and evaluating the derivatives at k=0 yields

$$\frac{\partial q_m}{\partial k} = - \frac{1}{\Delta_m} \{ +f(P_m)u'(\Pi_i)[\bar{P}_w - P_m] [P_m - MR] +$$

$$\int_0^{P_m} q_m \, u''(\Pi_2^m)[P_w - MC][P_w - \bar{P}_w] f(P_w) dP_w + \int_0^{P_m} u'(\Pi_2^m)[P_w - \bar{P}_w] f(P_w) dP_w \} \quad (13)$$

$$\frac{\partial q_c}{\partial k} = - \frac{1}{\Delta_c} \{ \int_0^{P_c} q_c \, u''(\Pi_2^c)[P_w - \bar{P}_w][P_w - MC] f(P_w) dP_w + \int_0^{P_c} u'(\Pi_2^c)[P_w - \bar{P}_w] f(P_w) dP_w \} \quad (14)$$

Δ_m and Δ_c stand for the second order conditions corresponding to the monopolist and the competitive firm which are definitely negative.

We shall show that an increase in price uncertainty reduces output of the domestic industry if preferences reflect low degree of risk aversion, or risk neutrality. To be more specific, non-increasing absolute risk aversion is a sufficient condition for the competitive industry, whereas for the monopoly, the conditions are more complex. The proof for the competitive case is provided in the following, while the monopoly case is examined in the appendix.

In (14), the sign of the expression on the right hand side is the same as the sign of the bracketed terms.

First we examine the second term. Choosing the range of import price $P_w > \bar{P}_w$, it follows that $\Pi_2^c\ (P_w) > \Pi_2^c\ (\bar{P}_w)$. The concavity of the utility function ensures that $u'(\Pi_2^c) \leq u'(\bar{\Pi}_2^c)$ where $\bar{\Pi}_2$ are the profits when $P_w = \bar{P}_w$. Multiplying both sides by $(P_w - \bar{P}_w)$, preserves the direction of the inequality in the above expression, i.e. $(P_w - \bar{P}_w)\ u'(\Pi_2^c) \leq u'(\bar{\Pi}_2^c)\ (P_w - \bar{P}_w)$. Furthermore it can be shown that the same holds for the price range $P_w < \bar{P}_w$. Hence integrating both sides of the inequality over the truncated distribution yields

$$\int_0^{P_c} u'(\Pi_2^c)\ (P_w-\bar{P}_w)f(P_w)dP_w \leq \int_0^{P_c} u'(\Pi_2^c)[P_w-\bar{P}_w]f(P_w)dP_w =$$

$$u'(\Pi_2^c) \int_0^{P_c} (P_w - \bar{P}_w)f(P_w)dP_w < 0$$

Next we shall show that the sign of the first term in (14) is negative, under the assumption of non-increasing absolute risk aversion.

$$\int_0^{P_c} q_c\ u''(\Pi_2^c)[P_w-\bar{P}_w][P_w-MC]f(P_w)dP_w = \int_0^{P_c} q_c\ u''(\Pi_2^c)(P_w-MC)^2 f(P_w)dP_w +$$

$$(MC-\bar{P}_w) \int_0^{P_c} q_c\ u''(\Pi_2^c)[P_w-MC]f(P_w)dP_w$$

Above we added and subtracted MC, and separated into two terms. The first term is definitely negative; the second term can be signed after using the definition of absolute risk aversion, $R_A\ (\Pi) = -\dfrac{u''\ (\Pi)}{u'\ (\Pi)}$

so that it becomes

$$-(MC-\bar{P}_w) \int_0^{P_c} R_A(\Pi_2)\ u'(\Pi_2^c)[P_w-MC]f(P_w)dP_w$$

This term is also negative since $(MC-\bar{P}_w) < 0$ by assumption, and the term under the integral is positive after noting its resemblence to the second term in (6) in conjnction with non-increasing absolute risk aversion.

In summary, the competitive firm (industry) decreases output in reaction to a marginal increase in price uncertainty given non-increasing absolute risk aversion. The monopoly response is negative given a low relative risk aversion measure or risk neutrality. However for a high relative risk aversion the monopoly response becomes ambiguous.

5. Specific Tariff

We turn now to a comparison of the responses of the competitive industry and monopoly to a specific tariff, τ. The specific tariff affects the import price distribution, $\hat{P}_w = P_w + \tau$, by increasing the mean, without affecting its spread. Substituting the tariff inclusive import price in (4) and (6), and differentiating with respect to τ, we get

$$\frac{\partial q_c}{\partial \tau} = -\frac{1}{\Delta_c}\left\{\int_0^{P_c} u''(\Pi_2^c)\;(P_w - MC)q_c \cdot f(P_w)dP_w + \int_0^{P_c} u'(\Pi_2^c)f(P_w)dP_w\right\} \tag{15}$$

$$\frac{\partial q_m}{\partial \tau} = -\frac{1}{\Delta_m}\left\{-f(P_m)(P_m - MR)u'(\Pi_1^m) + \int_0^{P_m} u''(\Pi_2^m)(P_w - MC)q_m f(P_w)dP_w + \int_0^{P_m} u'(\Pi_2^m)f(P_w)dP_w\right\} \tag{16}$$

Δ_c and Δ_m stand for the second order conditions which are definitely negative, hence, the sign of (15) and (16) is determined by the sign of the brackets.

First we examine the response of the competitive firm (industry). The first term in the brackets reflects the risk aversion impact, and we shall show that it is positive. Utilizing the definition of absolute risk aversion and substituting $-R_A\, u'(\Pi_2)$ for $u''\,(\Pi_2)$ in the first term in (15), we get

$$-\int_0^{P_c} R_A\;(\Pi_2)u'(\Pi_2)(P_w - MC)q_c\; f(P_w)dP_w > 0 \tag{17}$$

for non-increasing absolute risk aversion, because $\int_0^{P_c} u'(\Pi_2)(P_w - MC)f(P_w)dP_w < 0$ from (6). The second term in (15) is definitely positive, so that the impact of a specific tariff on the competitive industry output is positive.

The monopolist response to a specific tariff is more complicated because of the appearance of the first term in (16), which was zero for the competitive firm. This term reflects a marginal change in profits resulting from a change in the cummulative probability functions, i.e., $u'(\Pi_1)f(P_m)(MR-MC)-u'(\Pi_1)f(P_m)(P_m-MC)=-f(P_m)u'(\Pi_1)(P_m-MR)<0$ The reason for this negative impact on output is that the tariff carries a substitution of an increased probability of the marginal loss $(MR-MC)<0$ for a decreased probability of the marginal profit (P_m-MC).

To sign the second and third terms in (16), we rearrange them as follows in terms of the firm's relative risk aversion:

$$\begin{aligned}&\int_0^{P_m} [u''(\Pi_2^m)\ (P_w-MC).q_m + u'(\Pi_2^m)]f(P_w)dP_w \\ &= \int_0^{P_m} u'(\Pi_2^m)[1-R_R\ (\Pi_2^m)]f(P_w)dP_w - \eta_1\ C \int_0^{P_m} u''(\Pi_2^m)f(P_w)dP_w\end{aligned} \tag{18}$$

Above we have used the definition of the elasticity of average cost with respect to output, $\eta_1 \equiv (\partial AC/\partial q)(q/AC)$ and the definition of relative risk aversion, $R_R(\Pi_2) \equiv -u''(\Pi_2).\Pi_2/u'(\Pi_2)$.

Clearly, if the monopolist is highly risk averse, $R_R > 1$, (18) is negative. Since the first term in (16) is negative, a specific tariff has a negative impact on the output of a highly risk averse monopolist. This impact is reinforced the further away from efficient capacity the firm is operating $(\eta_1 < 0)$.

However, the first term in (16) is a function of the price elasticity of demand in the industry: $-f(P_m)u'(\Pi_1)(P_m-MR)=f(P_m/\eta_2)$ where $\eta_2 = (\partial Q_d/\partial P_d)(P_d/Q_d)$. Hence, in the presence of highly price elastic demand, (large $|\eta_2|$), a monopolist with low risk aversion $R_R < 1$ operating close to efficient capacity $\eta_1 \to 0$, will increase output in response to a specific tariff. In contrast to the competitive industry which responds to a specific tariff by unambiguously increasing output, the response of the monopolist depends on the degree of risk aversion, as well as the operating efficiency and the price elasticity of demand. In brief, the import competing industry response to a specific tariff is to expand output, (for any degree of risk aversion) if the domestic industry is competitive, and negative or ambiguous if the industry is monopolized.

6. Ad Valorem Tariff

A tariff of t percentage is levied on imports, so that the tariff inclusive imports price is $\hat{P}_w = (1+t)P_w$. Substituting $\hat{P}_w$ for P_w in the first order conditions, (4) and (6) differentiating with respect to t and evaluating at t = 0 yields,

$$\frac{\partial q_c}{\partial t} = = -\frac{1}{\Delta}\left\{ \int_0^{P_c} u''(\Pi_2^c)(P_w - MC)P_w q_c f(P_w)dP_w + \int_0^{P_c} u'(\Pi_2^c)P_w f(P_w)dP_w \right\} \quad (19)$$

$$\frac{\partial q_m}{\partial t} = -\frac{1}{\Delta}\left\{ -f(P_m)P_m u'(\Pi_1)(P_m - MR) + \int_0^{P_m} u''(\Pi_2^m)(P_w - MC) \right. \quad (20)$$

$$\left. P_w \cdot q_m f(P_w)dP_w + \int_0^{P_m} u'(\Pi_2^m)P_w f(P_w)dP_w \right\}$$

A close examination of the competitive industry case, shows that a high degree of risk aversion is sufficient to ensure a negative impact of an ad-valorem tariff on output. To see this, we rearrange (20) in a manner similar to (18):

$$\int_0^{P_c} [u''(\Pi_2^c)\ (P_w-MC).q_c+u'(\Pi_2^c)]P_w f(P_w)dP_w = \int_0^{P_c} u'(\Pi_2)(1-R_R(\Pi_2))P_w f(P_w)dP_w$$
$$-\eta_1 C \int_0^{P_c} u''(\Pi_2^c)P_w f(P_w)dP_w \tag{21}$$

If the competitive firm is highly risk averse $R_R > 1$, an ad-valorem tariff has a negative impact on output. This impact is reinforced the farther away from efficient capacity the firm is operating.

A similar expression to (21) can be derived also for the monopoly case. This is:

$$\int_0^{P_m} u'(\Pi_2^m)(1-R_R(\Pi_2^m))P_w f(P_w)dP_w - \eta_1 C \int_0^{P_m} u''\ (\Pi_2^m)P_w f(P_w)dP_w - P_m f(P_m)u'(\Pi_1)(P_m-MR) \tag{22}$$

It is obvious that if the conditions mentioned above, for the competitive case, hold also for the monopoly, a similar negative impact on output results. On the other hand if firms exhibit a low degree of risk aversion, $R_R < 1$ and operate near efficient capacity utilization, $\eta_1 \rightarrow 0$ the impact of an ad-valorem tariff may affect competitive firm output, positively, and monopoly output negatively, especially when the latter operates at a level where the demand elasticity, $\eta_2 \rightarrow -1$. In brief, an ad-valorem tariff may have a positive (negative) impact on the output of both the competitive monopolized industries when the relative risk aversion is low (high).

7. Conclusion

In this paper, we have examined the output response of import competing industries to a subsidy, tariffs, and a marginal increase in price fluctuations. The analysis was carried out in the context of two market structures, a monopoly and perfect competition. The main results can be most conveniently summarized in the form of the following propositions:

(i) Given decreasing absolute risk aversion, a lump sum subsidy induces the competitive industry to expand output, thereby, reducing expected imports. By contrast, the monopoly contracts output, thereby, increasing expected imports.

(ii)

(a) Given non-increasing absolute risk aversion, a specific tariff increases the output of the competitive industry and reduces expected imports. By contrast, the monopoly response is negative, if the relative risk aversion measure is high ($R_R > 1$) and ambiguous otherwise.

(b) For a high degree of risk aversion ($R_R > 1$), an ad valorem tariff reduces output and increases expected imports for both the monopoly and the competitive industry. For a low degree of risk aversion ($R_R < 1$) the response is ambiguous in both cases.

(iii)

(a) Given non-increasing absolute risk aversion, a marginal increase in import price uncertainty reduces output and increases expected imports in the competitive industry case. The result is ambiguous in the monopoly case.

These results highlight the complexity of the interaction between market structure and risk aversion, which suggests caution in the implementation of trade policy.

APPENDIX

In this appendix we examine in detail the impact of an increase in the spread of the import prices on the monopoly. For convenience we reproduce a part of the right hand side of equation (13) in the text.

$$\int_0^{P_m} [q_m\, u''(\Pi_2^m)(P_w - MC) + u'(\Pi_2^m)](P_w - \bar{P}_w) f(P_w) dP_w =$$

$$\int_0^{P_m} [u''\,(\Pi_2^m)(P_w q_m - q_m AC(q)(1+\eta_1) + u'(\Pi_2^m)](P_w - \bar{P}_w) f(P_w) dP_w \qquad \text{(i)}$$

$$= \int_0^{P_m} [1 - R_R(\Pi_2^m)] u'(\Pi_2^m)(P_w - P_w) f(P_w) dP_w \quad \eta_1\, C \int_0^{P_m} u''(\Pi_2^m)(P_w - \bar{P}_w) f(P_w) dP_w \qquad \text{(ii)}$$

In the rewriting of (i) as (ii) we have utilized the definition of relative risk aversion $R_R(\Pi_2) = -\dfrac{u''(\Pi_2).\Pi_2}{u'(\Pi_2)}$ and substituted $AC(1+\eta_1)$ for MC. The sign of (ii) becomes negative of $R_R < 1$ and $\eta_1 \to 0$. That means, a low degree of risk aversion in conjunction with efficient capacity utilization ensure a negative impact of a mean preserving spread increase on monopolist output. Otherwise we obtain an ambiguous impact on monopolist output.

FOOTNOTES

1. The issue of tariffs and their consequences is extensively examined in Corden (1971 ch. 2) and Corden (1974 ch. 8). For an examination of the redundancy of tariff protection, see Fishelson and Hillman (1979).

2. For a comparative analysis of tariffs and quotas given perfect competition under uncertainty see Fishelson and Flatters (1975), and Shibata (1968), Bhagwati (1968) for domestic monopoly.

3. A more general discussion of various aspects of protection in a general equilibrium model under uncertainty see Helpman and Razin (1980).

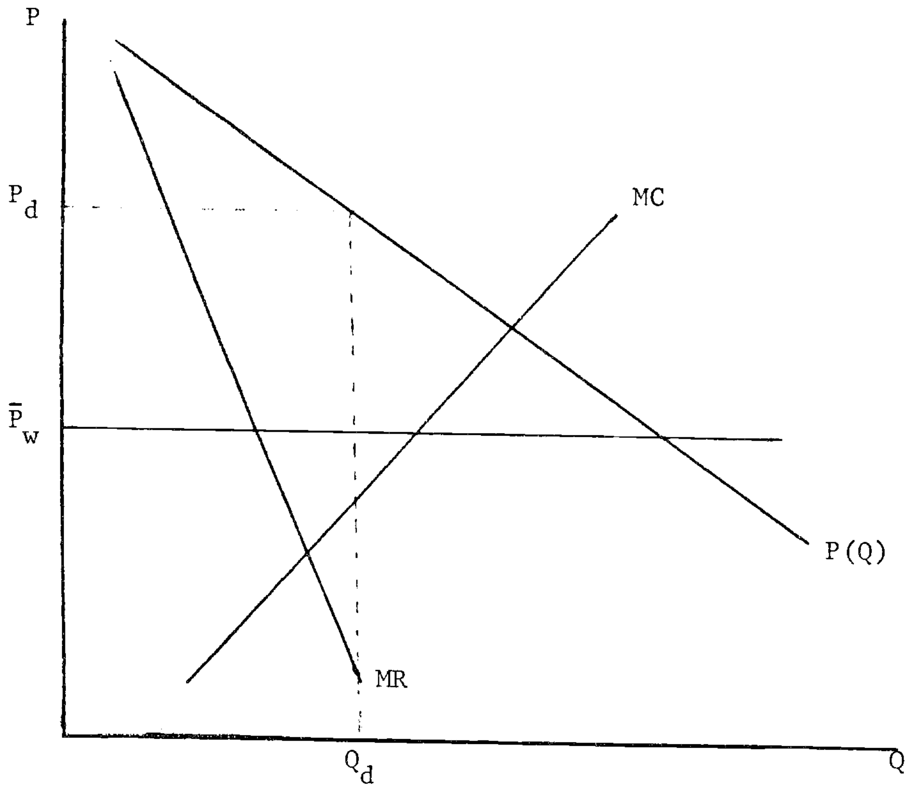

Fig. 1

TRADE POLICY AND IMPORT COMPETITION
UNDER FLUCTUATING PRICES

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