Ranking Ad Valorem and Specific Tariffs under Imperfect Competition

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Abstract

In a setting of imperfect competition, this paper shows that realizing a given level of imports via a specific tariff generates more consumer utility than an equivalent restriction with an ad valorem tariff. Yet, in terms of tariff revenue this ranking is reversed.

Keywords: Trade policy; ad valorem tariff; specific tariff; consumer utility

JEL classification: F12

1. Introduction

Krugman (1992) comments that even though new trade theory has been a major success in the economics profession, its impact on trade policy has been limited. Moreover, the differences between distinct forms of tariff regimes, namely, ad

valorem versus specific tariffs and their respective impacts on the involved countries' welfare, have received little attention in new trade theory. Also, GATT and later WTO, have traditionally focussed on ad valorem tariffs, ignoring specific tariffs. Though ad valorem tariffs may be preferable from an administrative point of view, their impact on industry profits and hence industry structure has to be addressed. The present paper builds on the seminal work of Krugman (1980) and finds that obtaining a certain import volume with a specific tariff generates more consumer utility than obtaining the same restriction with an ad valorem tariff. This result is driven by the larger number of product variants in the case of a specific tariff. However, in terms of tariff revenue (say the government's point of view) an ad valorem tariff is preferable. Hence, a trade-off emerges between increased tariff revenue to the government and decreased consumer utility.

A related point of non-equivalence of ad valorem versus specific tariffs is made by Lockwood and Wong (2000). In a dynamic two-country game of setting optimal tariffs with retaliation, they show that the move from specific tariffs to ad valorem tariffs improves welfare in at least one country, via the increased tariff revenue. The issue of ranking ad valorem and specific tariffs has also been addressed in Kowalczyk and Skeath (1994). Their setting models one country facing one foreign monopolist, and deals thus again - contrary to the present paper - with the issue of profit extraction. The approach closest to the present model comes from Gros (1987). Gros builds a two-country single industry model based on Krugman (1980) and studies a series of trade policies in this framework. The main result concerns welfare effects of retaliation in tariff wars. However, Gros (1987) considers ad valorem tariffs only, and does not proceed towards addressing the divergent impact of specific tariffs.

2. The model

The starting point of this model is the application of Chamberlinian monopolistic competition to international trade, developed by Krugman (1980, 1981). In particular, it is assumed that the world consists of two symmetric countries, each with M industries. Market conditions are described by monopolistic competition, increasing returns to scale in production and differentiated goods. Each industry, k, has a large number of potential variants, N_k, which enter symmetrical into demand. For simplicity it is assumed that M-1 industries are non-traded industries while the Mth industry is a pure export industry, i.e. the Mth industry in the home country exports its entire output to the foreign country and vice versa. Extending the utility function of Krugman (1981) to M industries, and applying the specific functional form introduced in Krugman (1980), one gets the following utility function, identical for all individuals:

$$U = \sum_{k=1}^{M-1}\left(\ln \sum_{j=1}^{N_k} c_{k,j}^{\theta}\right) + \ln\left(\sum_{i=1}^{N_M} c_{M,i}^{\theta}\right) \qquad (1)$$

where $0<\theta<1$ and $c_{M,i}$ is consumption of the ith variant of the import industry and $c_{k,j}$ is consumption of the jth variant of the non-traded home industry k; $k = 1, \ldots, M\text{-}1$. The number of variants actually produced (n_M and n_k) is assumed to be large, although smaller than N_M and N_k. Utility maximisation implies that the share of income spent on each industry is identical, and equals $1/M$. Also, with a large number of variants being produced in each industry, the pricing decision of each producer in the industry will have a negligible effect on marginal utility of income. Hence, every

firm faces a demand curve with an elasticity of 1/(1-θ).

For the moment we examine the properties of the export industry alone, bearing in mind that the free-trade equilibrium of the export industry is identical to the equilibrium of the non-tradable industries *k*; *k* = 1, ... , *M*-1. On the supply side it is assumed that all variants will be produced with the same cost function given by:

$$l_{M,i} = \alpha + \beta x_{M,i} \qquad i = 1,\ldots n_M \tag{2}$$

where $l_{M,i}$ is labour used in the production of the *i*th variant in the *M*th industry and x_{Mi} is output of that variant. This specification includes fixed costs α and constant marginal costs β. Hence, average costs decline at a diminishing rate, and thus each variant is produced by only one firm. Since by assumption one firm only produces one variant the number of variants equals the number of firms. Furthermore, (2) implies that all variants will behave identically, hence, in the reminder of the paper the subscript i can be omitted.

Assuming equality between the numbers of workers, *L*, and consumers the market clearing condition demands:

$$x_M = L c_M \tag{3}$$

where c_M is the consumption of a representative consumer. Evoking i) free entry and exit of firms, ii) the zero-profit condition $\pi = px - (\alpha + \beta x)w = 0$ (where *w* is

the economy wide wage rate and *p* the price) and iii) labour market clearing at full employment $L = l_M nM$, the standard results, concerning firm output, price and number of variants, are obtained:

$$x = \frac{\theta\alpha}{(1-\theta)\beta}$$

$$p = \frac{\beta w}{\theta} \qquad (4)$$

$$n = \frac{L(1-\theta)}{\alpha M}$$

Equation (4) also characterises the conditions for the import industry and in fact the non-traded industries.

The trade volume in the free trade case is given by $\chi = nx = \frac{L\theta}{\beta M}$, accordingly a restriction on imports can be defined as:

$$\bar{\chi} = \gamma\chi = \frac{\gamma L\theta}{\beta M} \qquad 0 < \gamma < 1$$

The parameter γ measures how strict the import restriction is.

3. Tariff Regimes

An ad valorem tariff, *t*, affects firms similar to a tax. In particular, only the fraction $(1-t)$ of total sales enters the exporting firms' profit function. Assuming free entry and exit, the equilibrium under an ad valorem tariff that generates the import volume $\overline{\chi}$ is characterised by:

$$x^t = \frac{\theta\alpha}{(1-\theta)\beta}$$

$$p^t = \frac{\beta w}{(1-t)\theta} \qquad (5)$$

$$n^t = \frac{\gamma L(1-\theta)}{\alpha M}$$

Thus, compared to free-trade, an ad valorem tariff results in a reduced number of variants (firms), the same amount of output per firm and higher prices. This finding is in line with the results of Gros (1987). From the condition that total consumer expenditure on the *M*th industry must equal consumer expenditure on any industry, i.e. $p^t\overline{\chi} = \frac{w}{M}L$, the ad valorem tariff can be calculated as $t = 1-\gamma$.

When a specific tariff T is imposed in order to obtain the import volume $\overline{\chi}$, it enters the exporting firms' profit function like an increase in marginal cost. Defining the specific tariff in real terms by $\tau = \frac{\mathrm{T}}{w}$, and still assuming free entry and exit, the new equilibrium is:

$$x^{\tau} = \frac{\theta\alpha}{(1-\theta)(\beta+\tau)}$$

$$p^{\tau} = \frac{(\beta+\tau)w}{\theta} \qquad (6)$$

$$n^{\tau} = \frac{L(1-\theta)}{\alpha M}$$

The number of variants under a specific tariff is identical to the free trade case. This is so since marginal costs are irrelevant in the determination of the optimal number of variants (firms), even though each firm will produce less output under higher marginal costs. From the condition that total consumer expenditure on the *M*th industry must equal consumer expenditure on any industry, one can calculate the value of the specific tariff as $\tau = \beta(\frac{1}{\gamma} - 1)$.

Naturally, given the additional constraint of the tariffs, some other markets must be in disequilibrium. The residual market is the labour market, i.e. there is unemployment in the export sector. The economy wide unemployment after the implementation of an ad valorem tariff is $u^{t} = (1-\gamma)\frac{L}{M}$. On the other hand, in the case of a specific tariff the increased expenditures on fixed costs α (due to more variants) resulted in lower unemployment, namely $u^{\tau} = \theta(1-\gamma)\frac{L}{M}$. However, we disregard the effects from additional labour supply to the other industries. There are two justifying assumptions. First, one could assume that labour skills are industry specific and non-transferable, hence no labour force increase occurs in the non-tradable sector. Secondly, since the export industry only makes up a small part of the

entire economy, the cross industry supply effects are negligible.

4. Results

It is assumed that tariff revenue occurs to the government and is not redistributed to the population. Given the two forms of tariff policy, it is straightforward to calculate the gains and losses in welfare of a representative consumer. Plugging (4) into (1) gives utility, *U*, under free trade:

$$U = M \ln\left(\frac{L}{M}(1-\theta)^{1-\theta}\alpha^{\theta-1}\theta^{\theta}\beta^{-\theta}\right) = M \ln \Omega \tag{7}$$

Utility depends positively on the size of the economy, is diminished for a larger degree of product differentiation $\left(\frac{\partial U}{\partial \theta} > 0\right)$, and falls for an increase of the fixed cost α and variable cost β.

Imposing an import restriction γ, utility under an ad valorem and specific tariff is given by,

$$\begin{aligned} U^{t} &= (M-1)\ln \Omega + \ln(\gamma\Omega) \\ U^{\tau} &= (M-1)\ln \Omega + \ln(\gamma^{\theta}\Omega) \end{aligned} \tag{8}$$

This gives rise to the following ranking:

Proposition 1. *The representative consumer strictly prefers a specific tariff to an ad valorem tariff. In particular,*

$$U > U^{\tau} > U^{t} \tag{9}$$

Proposition 1 follows from (7) and (8). Further, one can calculate the tariff revenue to the government . From the tariff rates τ and *t*, and from the respective price and quantity values the government revenue under the two tariff regimes can be calculated as:

$$R^{t} = (1-\gamma)\frac{Lw}{M}$$

$$R^{\tau} = \theta(1-\gamma)\frac{Lw}{M} \tag{10}$$

This results in the following ranking in terms of revenue to the government.

Proposition 2. *In terms of tariff revenue, the government strictly prefers an ad valorem tariff to a specific tariff. In particular,*

$$R^{t} > R^{\tau} > R \tag{11}$$

From proposition 1 and 2 a potential conflict emerges between the interests of the government and the interests of consumers.

Theorem 1. *The ranking of specific and ad valorem tariffs in terms of government revenue is inverse to the ranking in terms of consumer utility.*

Theorem 1 follows from proposition 1 and 2. Also note that the consumers' utility and the tariff revenue depend on γ, i.e. how severe the protection level is.

Corollary 1. *If social welfare puts significant weights on both consumers' utility and government tariff revenue, then there exist a protection level, γ^* ($0 < \gamma^* < 1$), where social welfare with an ad valorem tariff equals that with a specific tariff.*

This corollary implies that given some fixed import volume, for a low level of protection, in the sense that $\gamma > \gamma^*$, a country should choose an equivalent specific tariff to maximize welfare, as the higher consumer utility outweighs the lower tariff revenue. The contrary result emerges for a high degree of protectionism ($\gamma < \gamma^*$).

5. Conclusion

The present paper argues that, in a world of imperfect competition, ad valorem versus specific tariffs feature a non-trivial difference in terms of consumer welfare and government tariff revenue. What drives the results of this paper is the number of variants in the export/import industry. The model of the paper builds on Krugman (1980), and extends work by Gros (1987). It is found that enforcing a restriction on total imports via a specific tariff results in higher prices, less output per firm, but the same number of firms as under free trade. On the other hand, an equivalent ad valorem tariff results in fewer firms, more output per firm and higher prices than under a specific tariff.

In terms of the effect on the representative consumers utility, it is established that

utility under a specific tariff is higher than under an ad valorem tariff, though less than under free trade. However, government revenue will be larger in the ad valorem case. From this reverse ranking, the paper concludes that there is a potential conflict of interests between the governments interest (revenue) and consumers interest (number of variants).

The results of this paper have a clear policy implication in terms of tariff policies. In stead of advocating ad valorem tariffs across the board, tariff tools should be designed more carefully taking account of industry characteristics. In particular, in respect to the recent tariffication waves promoted by GATT and later WTO (see Carbaugh (1997) and Nguyen et al. (1993)), an unduly reliance on ad valorem tariffs might have a potential opportunity cost in terms of the lost number of variants, resulting in lower global consumer utility.

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