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OPTIMAL TARIFFS AND SUBSIDIES AND CHANGES IN MARKETS STRUCTURE

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Abstract

We present a unified treatment of optimal trade policy for a small country. The well-known results for duopoly and competitive markets emerge as benchmark cases of our model. In addition, we show that changes in market structure have non-monotonic effects on optimal tariffs. Our results suggest that the recent reduction of tariffs in Eastern Europe is consistent with welfare maximizing trade policy in response to the substantial changes in the market structure of these countries.

Keywords: Market structure, strategic trade policy, rent shifting

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1 Introduction

The theory of trade policy for a small country consists of two subtheories. The first investigates trade policy for markets where many firms compete and market power is absent, the second investigates trade policy for oligopolistic markets. Bhagwati [1965] and Bhagwati, Ramaswami and Srinivasan [1969], who pioneered the first approach, consider a small home country with a monopolistic industry surrounded by a competitive world market, and show that an import tariff as well as a production subsidy is welfare reducing. Brander and Spencer [1981, 1985], Eaton and Grossman [1986], and Cheng [1988] investigate the situation of a home firm in competition with a foreign firm, either in a third market or in the home market. As they show, strategic trade policy enhances welfare by influencing the strategic game the two firms play. In this paper, we present a model that unifies the two strands of the literature.

Specifically, we model a situation in which a domestic monopoly faces competition from n foreign firms. For $n = 1$ we therefore are in the world of duopolistic competition, and for $n = \infty$ in the world of perfect competition. Furthermore, the model allows us to investigate the whole space between the two polar cases.

The model has the following main results:

1. Starting from a positive optimal tariff for $n = 1$, the optimal tariff first rises with the number of firms, then decreases to zero for n approaching infinity.

2. Starting from a positive optimal subsidy for $n = 1$, the optimal subsidy monotonically decreases to zero with the number of firms approaching infinity.

3. For the benchmark cases of complete competition and duopoly, the earlier results of the two literatures are replicated.

Strategic trade policy affects welfare through three channels: home firm profits, consumer surplus, and government revenue. In a highly concentrated market, the firms earn large profits. By engaging in strategic trade policy, the home government enables the home firm to gain a larger share of these profits. Obviously, this rent shifting effect decreases the more competitive the industry is, and vanishes in the extreme case of complete competition. However, tariffs and subsidies differ with respect to their effects on government revenue and consumer surplus. Through higher prices and a lower quantity, tariffs increase government revenue and decrease consumer surplus. Subsides have the reverse effect. Our results 1 and 2 show that the effect on consumer surplus is important if the number of firms is very small. If the market is already very concentrated, imposing a tariff thus amplifies the negative effect market concentration has on consumer surplus. Therefore the size of a tariff increases with the number of firms in a highly concentrated market and ultimately decreases as the number of firms goes to infinity and the rent shifting motive vanishes. The subsidy, on the other hand, benefits consumer surplus through lower prices and creates an

additional motive for strategic trade policy. It works as an anti-trust policy as well as a rent shifting instrument. The optimal subsidy is therefore the highest if there is only one foreign firm and decreases monotonously the more competitive the market is.

A similar argument is known from the literature on market access and anti trust policies. Dixit (1984) and Richardson (1998) show that there is a U-shaped domestic welfare with respect to the number of foreign firm entering the market. The driving elements of their results are the same effects on consumer and producer surplus as interpreted above. Our hump shaped tariff with respect to the number of firms may therefore be interpreted as a reflection of a U-shaped Welfare function found in previous studies.

The policy implication draw from a simple linear combination of the two well known benchmark cases would be that fewer firms lead to higher levels of protection - both, higher tariffs and higher subsidies. This paper has shown that this is not necessarily the case and can lead welfare reducing policy recommendations if the number of firms is very small. Rather than a linear combination of the benchmark cases, we find a hump shaped tariff with respect to the number of foreign firms entering the domestic market to be optimal. Markets which undergo substantial changes in market structure need to be particularly aware of this non-monotonous relationship. These include Eastern European countries, where the number of firms gradually increases and whose major trading partners - the industrialized economies in Western Europe - are characterized by mergers and take overs. The number of foreign firms therefore decreases from an Eastern European perspective.

Section two presents the model and a free trade example. In section three, optimal trade policy and the effect of the number of firms are analyzed. Section four concludes the paper.

2 The model

The world of this model consists of two countries. The home country is represented by uppercase letters, the second country, representing the rest of the world, by lowercase letters. Each country produces the same two goods. Good 1 is tradeable, good 2 is not. Each country is inhabited by a representative consumer. The utility functions of the two consumers are assumed to be quasilinear:

$$\begin{aligned} U(G_1, G_2) &= AG_1 - G_1^2/2 + G_2, \\ u(g_1, g_2) &= ag_1 - g_1^2/2 + g_2. \end{aligned}$$

G_1, G_2, g_1, and g_2 denote consumption of good 1 and 2 in the home and in the foreign country. On the consumers' side, the two countries differ only in the strength of their demand for good 1.

We normalize the price of good 2 in each country to one and call the relative prices P and p. We assume that good 2 is costlessly traded in order to have one single market where we can isolate the effect of a tariff. The budgets of the households are assumed to be exogenous. The resulting inverse demand functions for good 1 are

$$P = A - G_1$$

for the home country and

$$p = a - g_1$$

for the foreign consumer. The consumer surplus for the home consumer from consumption of good 1 is

$$S = G_1^2/2.$$

There is one firm producing x units of good 1 in the home country, and n identical firms producing y_i $(i = 1...n)$ units of good 1 in the rest of the world. Production is characterized by quadratic costs $x^2/2$ and $y^2/2$.[1] In order to be in the world of the home country as an importer we would then assume the number of firms in the foreign country is larger than that of a home country. In order to have a model which incorporates both benchmark cases mentioned in the introduction as well as for simplicity, we continue the paper with the assumption that there is only one firm in the home market.

Besides producers and consumers in both of the countries, we also consider the home country's government. The government has two trade policy tools at its disposition, an import tariff t per imported unit, and a production subsidy s per unit produced at home. Active trade policy can also consist of the combination of a subsidy and a tariff. Complete protection and free trade can be seen as special cases where the values of the trade policy tools are set such that no trade occurs for the former case, or trade is not influenced at all for the latter case.

Since good 1 might be traded, consumption for the home consumer consists of the sum of home production and imports im from the foreign country: $G_1 = x + im$. Accordingly, $g_1 = ny - im$.

Different prices would lead to the possibility of arbitrage gains as the markets are not segmented. Thus $P \leq p + t$. The arbitrage condition determines imports:

$$im = \frac{A - x - (a - ny) - t}{2}.$$

[1] Qualitatively, the analysis is unchanged as long as costs are strictly convex.

Taking everything together allows us to define profits and welfare:

$$\begin{aligned}
\pi^h &= (p_h + s)x - x^2/2 \\
\pi_i^f &= p(y_i - \frac{im}{n}) + (P - t)\frac{im}{n} - y_i^2/2 \\
W &= \pi^h + (x + im)^2/2 - sx + t \cdot im
\end{aligned}$$

Following our assumption of symmetric firms, the foreign firms share the imports equally in equilibrium.

We investigate a two stage game, in which the government chooses optimal values of t and s in the first stage, and the firms compete à la Cournot in the second stage.

2.1 Free trade

From the import equation for $t = 0$, we can derive the overall demand function

$$P = p = \frac{A + a - X - nx}{2},$$

and the profit functions of the home firm and the foreign firms:

$$\begin{aligned}
\pi^h &= px - x^2 \\
\pi_i^f &= py_i - {y_i}^2.
\end{aligned}$$

Maximizing profits as usual leads as to the following equilibrium values:

$$\begin{aligned}
x &= \frac{A + a}{4 + n} \\
y_i &= \frac{A + a}{4 + n} \\
im &= \frac{A(3 + 2n) - 5a}{2(4 + n)}
\end{aligned}$$

where $\frac{A(3+2n)}{5} > a > 3\frac{A}{2n+5}$.

Every firm produces more when total market size $A + a$ increases. Imports grow with a growing home market and decrease with a growing foreign market. In case both markets increase simultaneously, imports grow for $n > 1$. For the special case of a duopoly, the imports are $(A - a)/2$. The additional restrictions on a are due to two reasons. First, the foreign market needs to be sufficiently small so the home country is an importer of the good. Secondly, imports need to be smaller than the total production of the good. The foreign market therefore needs to be large than a certain critical value. This ensures that the foreign firm produces enough to meet the

arbitrage condition $P = p + t$. The first restriction increases with n, the second one decreases with it. Therefore, the larger the number of firms, the easier the restrictions are satisfied to ensure that we are in the interesting case where the home country imports from the foreign market and the home government accompanies these imports with a strategic trade policy.

As the number of firms in the foreign country increases, the market structure moves towards perfect competition, production for each firm goes to zero, and overall production to $A + a$. In the limit, the entire production is carried out abroad, and the home country imports A.

$$\begin{aligned} \lim_{n\to\infty} x &= 0 \\ \lim_{n\to\infty} y_i &= 0 \\ \lim_{n\to\infty} n \cdot y_i &= A + a \\ \lim_{n\to\infty} im &= A \end{aligned}$$

This result is due to the assumption of quadratic cost and zero fixed cost.

3 Optimal trade policy

We now derive the optimal trade policy of the home government. We follow the approach by Eaton and Grossman [1986] and Cheng [1988], who suggest that a policy mix of tariffs and subsidies is welfare maximizing in an oligopolistic setting. One key difference, which makes the literature on strategic trade incompatible with the earlier literature of perfect competition is that the strategic trade literature does not model a foreign market. The foreign price, whose difference from the home price is driving the results in Bhagwati's model, can therefore not be determined. Our paper thus differs from standard strategic trade models by considering the situation of two countries and n firms in the foreign market. This reduces the difference between the two literatures to the type of market structure, namely the number of firms. We show below that we can generate the results of both literatures as benchmark cases of our model for $n = 1$ and $n = \infty$.

From the import equation we can derive the demand function

$$P = \frac{A + a - x - ny + t}{2}.$$

Maximizing profits by the firms and national welfare by the government as usual leads to Proposition 1.

Proposition 1 *(i) The size of the optimal subsidy decreases monotonously with the number of firms in the foreign market.*

(ii) The size of the optimal tariff first increases and then decreases with the number of firms in the foreign market.

Proof: $s^* = \frac{6A+3a}{2(2n+15)}; t^* = \frac{A(6n+9)-18a}{4n^2+36n+45}; \frac{\partial^2 W}{\partial s^2} = -\frac{63+36n+4n^2}{9(4+n)^2} < 0;$ $\frac{\partial^2 W}{\partial t^2} = -\frac{52n^2+456n+567}{36(4+n)^2} < 0$; this confirms that s^* and t^* lead to a welfare maximum. The home country is an importer of good 1 if the size of the foreign market is relatively small, which leads to $a < A(3+2n)/6$. The optimal tariff is not a protective tariff as long as $a > \frac{3A(3+2n)}{4n^2+30n+18}$, which leads to the same restriction as $ny_i > im$. ■

The same intuition for the restrictions on a as well as for the effects of parameter values on the equilibrium outcome apply as given in the free trade case.

Corollary 2 *As the number of firms goes to infinity, free trade is welfare maximizing.*

Proof: $\lim_{n\to\infty} s^* = 0, \lim_{n\to\infty} t^* = 0$.

The effects of various parameters on the optimally chosen policy tools, particularly the number of firms in the market are interesting. The optimal subsidy increases with the strength of demand and decreases with the number of firms. In the limit, the subsidy goes to zero. On the other hand, the optimal tariff increases with the size of the home market and decreases with the size of the foreign market. This shows that if the opportunity to sell the product elsewhere is good for the foreign firm, the tariff does not work well as a rent shifting instrument. Figure 1 shows the effect of the number of firms on the optimal tariff (parameters for this illustration are set to A=1 and a=0.8). If the number of firms in the foreign market is small, the tariff increases with the number of firms. If the number of firms in the foreign market is large, the optimal tariff decreases with the number of firms and ultimately approaches zero as the number of firms goes to infinity.

The intuition for the behavior of the tariff follows from the different effects trade policy has on the three components of welfare which are illustrated in figure 2. While both, tariffs and subsidies, have a positive effect on profits, their effects on government revenue and consumer surplus are exactly opposite. Our result shows that the consumer effect is important when the number of firms is very small and thus the tariff increases with the number of firms in a highly concentrated market, while a subsidy does not.

For the benchmark cases $n = 1$ and $n = \infty$, the model replicates the results of the literature of trade policy under imperfect and perfect competition. For $n = 1$, both the tariff and the subsidy are positive, whereas for $n = \infty$, the home country looses by pursuing an active trade policy.[2]

[2]One of the assumptions in Bagwathi's model is that the foreign market is infinitely elastic and can absorb any amount of the good at the world market price. The results of our model are qualitatively not affected by our simplifying assumption that the slope of the foreign demand curve is equal to -1. Introducing e as slope of the foreign demand curve and letting e go to zero replicates Bagwathi's free trade result as well.

It is important to note that the foreign firms become more efficient, as the number of firms increases. This is due to our assumption of quadratic costs. Implicit in our convex production function is therefore that firms become more competitive as well as more efficient, as n increases, since foreign firms are operating closer to their minimum cost. The effects of efficiency on optimal tariffs has been analyzed by Ono and Lahini (1988). However the efficiency change is not driving our main result - the hump shaped tariff -, because the optimal tariff changes monotonously with respect to changes in costs, if they were introduced to the model as a separate parameter. For simplicity this has been omitted from the analysis.

4 Conclusion

This paper present a model of trade policy where well known policies emerge as benchmark cases. In a duopoly a strategic trade policy is optimal and under perfect competition optimal policies go to zero and free trade dominates all other options in terms of welfare. Interestingly the optimal policies for the cases in between is not a trivial combination of the two polar cases. While the subsidy decreases monotonously with the number of firms in the foreign market, tariff first increases and then decreases as the market structure moves towards perfect competition.

Recently markets in Eastern and Western Europe have undergone substantial changes in market structure. In Eastern Europe, a variety of new firms have replaced the old monopolies which have been the intended outcome of central planning. In Western Europe, the reverse pattern emerges. Mergers of firms and take-overs are the predominant feature of the advanced market economies. Both developments give rise to the policy questions addressed in this paper. Our results suggest for instance that the recent reduction of tariffs in Eastern European countries (World Trade Organization, 1996 and 1998) as well as the continued protection of the European Union in particular industries (World Trade Organization, 1997) are consistent with welfare maximizing trade policy in response to changes in market structure in the trading partners country.

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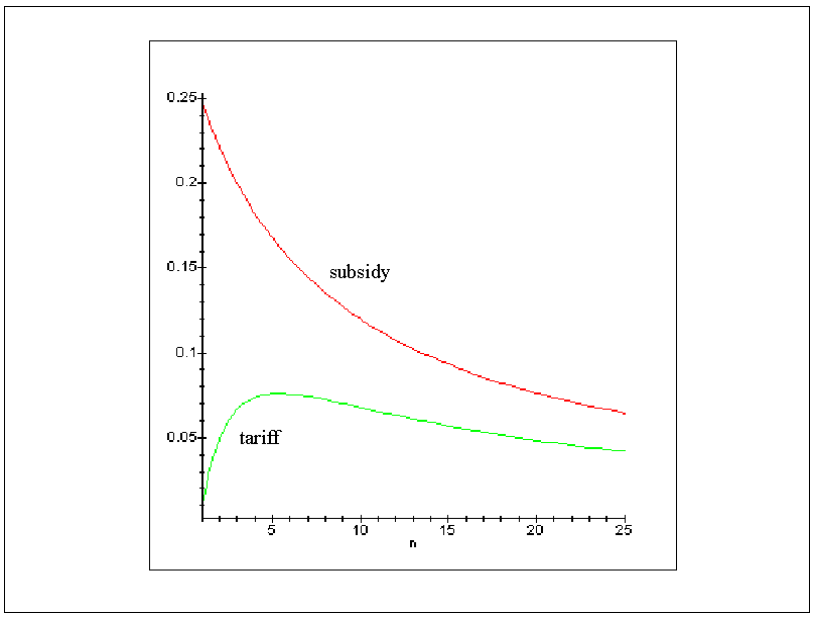

Figure 1:

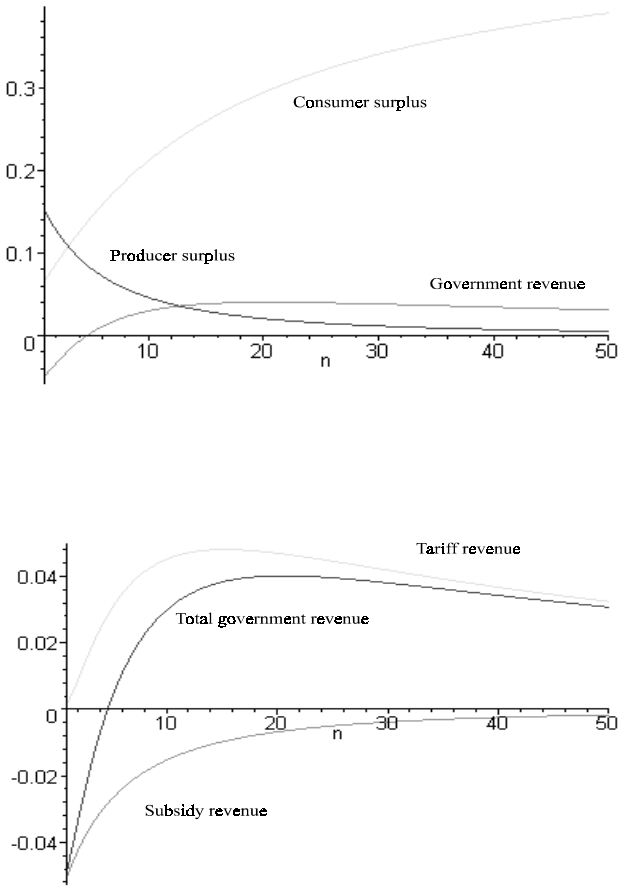
0.3
0.2
0.1
0
Consumer surplus
Producer surplus
Government revenue
10
20
30
40
50
n
0.04
0.02
0
-0.02
-0.04
Tariff revenue
Total government revenue
Subsidy revenue
10
20
30
40
50
n

Figure 2: