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International Trade Under Oligopoly Conditions*

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RRH: TRADE UNDER OLIGOPOLY
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Abstract

This paper gives a simple representation of how oligopoly affects the general theory of international trade. Three points are emphasized: the simplicity of trade under oligopoly in the Ricardian model; the equations describing the general equilibrium of a world economy with any number of goods, countries, and factors under oligopolistic conditions and an integrated world market; and a complete description of the solution of a Mill-Ricardo-Cournot model with oligopoly in one sector and perfect competition in the other.

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“National industries and national trade react and react on one another, but the dominant force is that of the industry. The main courses of trade are governed by the relations between the surrounding industries, in the same way as watercourses are governed by the contours of the hill.... But the water reacts on the hills and trade reacts on the industry; but the industrial history of any country would have been different if her opportunities for foreign trade had been different.” Alfred Marshall, *Industry and Trade*, p. 4.

1. Introduction

What is the role of oligopoly in international trade? There has been a great deal of research on that topic to date, but the work is not complete because of the emphasis on partial equilibrium.¹ But partial equilibrium cannot fully answer the questions of what and how much is traded or for whom the gains or losses from trade accrue (Ruffin, 2003).

This paper describes a simple approach to general equilibrium under oligopoly. I do not depart from any standard assumptions except for the existence of product market oligopoly. Thus there are the usual assumptions of an integrated world market with zero tariffs and transport costs, perfectly competitive factor markets, identical and homothetic tastes, and constant returns to scale. I hope to accomplish three objectives: First, by way of introduction and to develop intuition I show that by some simple symmetry assumptions the existence of equal degrees of oligopoly across industries for all countries can be easily incorporated in the standard Ricardian demonstration of the pattern and gains from trade. The level of analysis is no more difficult than the standard Ricardian model of trade found in elementary textbooks. Second, when the degree of competition is specific to each industry and country, to show how Cournot oligopoly affects the general equations of equilibrium with any number of countries, goods, or factors. The only difference oligopoly makes to the

Walrasian equations is that the usual price equals cost of production equations for each good and location are simply replaced by supply equations for each good and location. Third, to solve the model for the special case in which one industry is oligopolistic and the other perfectly competitive under Mill-Graham preferences (equal expenditures on each good) and Ricardian costs. The solution tracks the commodity and double-factoral terms of trade as oligopoly power increases, and shows how it is possible for workers not to gain in the country with a comparative advantage in the oligopoly. Such a solution is also interesting because it enables us to examine, for example, the benefits of a perfectly executed antitrust policy when oligopolies do or do not face international competition.

2. Ricardian Trade with Oligopoly: The Intuition

Ricardian trade theory under perfect competition shows that an economy gains from trade because it can purchase the imported good at a lower price while the exported good sells for the same price when measured in wage units. The main difference the existence of ubiquitous oligopoly in both the import and export sectors makes to this story is that the price of the export may also fall. Therefore, with oligopoly the gains from trade for the economy are often smaller and for workers are often larger than under perfect competition.

Under oligopoly the firm chooses a quantity that results in a price of a good that exceeds marginal costs. In this setting it is best to take the wage rate in one of the countries as the numeraire rather than one of the traded goods, as is usual in the perfect competition case. Thus, we need only concentrate on the oligopoly pricing of each of the goods in the numeraire wage.

Since under oligopoly the price is dictated by elasticity and the number of firms, it is easy to see what happens when trade is opened. Suppose for example that there are two countries, home and foreign. Choose the wage rate in the home country as numeraire, say \$1. In the home country airplane (trips) cost 4 labor units per trip and bread 5 labor units per loaf. In the foreign country, airplane trips cost 5 labor units and bread 4 labor units. If the two

countries are the same size and face symmetrical demands for airplanes and bread, then if the degree of oligopoly power is the same in both sectors both countries will experience the same wage rates so that given the numeraire assumption wages in both countries will be \$1.

Table 1 shows the dollar costs of airplane trips and bread in the two countries. With perfect competition, trade would simply lower the price of bread in the home country to \$4 and the price of airplane trips in the foreign country to \$4. The gain from trade would be the fall in the cost of living due to a 20% reduction in the price of the importable, which would be about 10% with Mill-Graham preferences so that half of all income devoted to each good.

With oligopoly the prices before trade would be higher than costs. Suppose that before trade the oligopolies were powerful and charged a price twice as high as marginal costs. Then Table 2 shows the autarkic prices before trade. Low cost airplane trips at home and bread abroad would sell for \$8. High cost bread at home and airplane trips abroad would sell for \$10. In this situation, workers and oligopolists would share equally in national income. I will assume that there are 1000 workers, so that autarkic national income is \$2000 in each country with \$1000 earned by each income class.

Now let trade be opened. Since the airplane industry in the home country and the bread industry in the foreign country would now face competition from their high cost counterparts, the price of both airplanes and bread would drop below \$8. Assume this price is \$6. At a price of \$6 for airplanes and \$6 for bread, both the high cost bread industry in the home country and the high cost airplane industry in the foreign country could compete because their costs are only \$5. Table 3 describes the free trade prices (profit margins) with strong oligopolies. Under free trade, workers would still earn \$1000, but oligopolists would earn much less. The home and foreign countries are symmetrical so we can concentrate on the home country. The profit margin in airplanes is now \$2 and in bread it is \$1. As will be shown later, under Cournot oligopoly we can suppose that the ratio of airplane trips to bread output (facing the same price and demand) will also be 2 to 1. Thus, since the labor constraint

is $4Q_a + 5Q_b = 1000$ and $Q_a = 2Q_b$, it must be that $Q_a = 154$ while $Q_b = 77$ (approximately). Thus the profits of the oligopolists must be \$308 and \$77, respectively, or \$385. Oligopoly profits have fallen over 60% from \$1000 to \$385 while prices have fallen, on the average, by only 33%. Workers, with the same wages, experience a 33% increase in real income; oligopolists are hurt badly. Even the oligopolists in the export industries are hurt since their profits fall by more than 33% from \$500 to \$308. The economy does not gain as much as with perfect competition because the high cost industry is protected by the strong oligopoly abroad! But workers gain more than under perfect competition (about three times as much) and oligopolists, as argued, lose.

The above describes what happens when oligopolists are strong and charge prices much higher than marginal costs. Suppose the oligopolists are weak so that prices are only 25% higher than marginal costs. With labor income before trade of \$1000, oligopoly profits would be \$250, with \$125 in each sector. Then autarkic prices are as in Table 4. Airplane trips in the home country and bread in the foreign country both sell for \$5. We have assumed just enough competition to drive the price of airplanes in the home country down to the cost in the foreign country and the same for bread.

What happens now when trade opens? The high cost foreign airplane or home bread industries will be unable to operate. For example, as a Cournot oligopolist the foreign airplane industry will assume that if it produces airplanes, the price will drop below \$5 so that marginal costs could not be covered. The same will be true of the home country's bread industry. What prices will prevail in free trade? With the same number of firms operating and since oligopolists price according to elasticity of demand rather than total demand, the free trade prices would be as in Table 5: all goods sell for \$5! Now the price of the export stays the same, but the price of bread falls by 20%, precisely what happened under perfect competition. Thus, the gains from trade for workers, the economy, and oligopolists will all be the same as under perfect competition. Workers gain the same since prices fall as much and

we are keeping wages the same. The economy gains the same because there is complete specialization. And oligopolists as a whole gain the same because their income is exactly the same after trade is established. Why? The markup over costs is 25%. This was true before trade as well as after trade. Thus, with labor income of \$1000, oligopoly profits are \$250 before and after trade.² Of course, the oligopolists in the export sector now earn the entire \$250 so that with a doubling of their profits their gains are the greatest.

Summarizing, if oligopolies are strong, there is a tendency for workers to gain more from trade and the economy to gain less from trade than under perfect competition; capitalists tend to lose. If oligopolies are weak, workers, capitalists, and the economy gain about as much as with perfect competition. Note that the Stolper-Samuelson conundrum that workers gain in one country and lose in the other is absent.

3. The General Model

I will now show that it is very easy to formulate the theory of international trade under oligopoly under conditions as general as the Heckscher-Ohlin-Samuelson model of trade. The quote from Alfred Marshall at the beginning of this essay provides the initial insight: the dominant force is the industry (Marshall, 1920). This fact can be elevated to the level of theory by simply supposing that firms in an industry act as if the prices of all goods and services other than the good in question are to be held constant. Once this assumption is made as well as the other assumptions of the Heckscher-Ohlin-Samuelson model, the general theory of trade under oligopoly is easy to represent (but difficult to analyze!).

Suppose that there are n countries, m goods, and r factors of production. Let $i =$ country ($i = 1, \dots, n$), and $j =$ good ($j = 1, \dots, m$), and $k =$ factor ($k = 1, \dots, r$). Let c_{ij} denote the unit cost function. Let $\mathbf{w}_i = (w_{i1}, \dots, w_{ir})$, $\mathbf{p} = (p_1, \dots, p_m)$, $\epsilon_j =$ price elasticity of world demand D_j . V_{ik} is the supply of factor k to country i . Q_{ij} is country i 's supply of good j . N_{ij} is the number of firms in country i producing good j .

Assumption 1. Production functions are homogeneous of degree one and are the same for every firm in the same industry in the same country. In country i , c_{ij} is the unit cost of a firm in country i producing good j and, since there are constant returns to scale, $c_{ij} = c_{ij}(w_i)$.³

Assumption 2. Utility functions for all income recipients in all countries are identical and homothetic.

Assumption 3. Integrated world market for goods.

Assumption 4. Every firm is a member of an industry and treats the prices of all other goods and factors as constant.

Assumption 5. Every firm is a Cournot oligopolist. The firm's profit is distributed lump sum to consumers.

Assumption 6. Firms ignore the impact of changes in the price of their good on own utility.

Assumption 7. The number of potential firms is fixed for each industry and country.

The key assumptions are 4, 5, 6, and 7. Assumption 4 captures two stylized facts. First, product markets are generally more oligopolistic than factor markets since the latter compete in more than one industry. Second, industries are important in the sense that the setting of prices in, say, the automobile industry likely does not involve the firm in making any assumption about what happens to the prices of personal computers or software. Assumption 5 is just the familiar Cournot assumption that implies that any equilibrium is also a Nash equilibrium so that any deviation is everywhere regarded as unprofitable. Assumption 6 captures the stylized fact that the owners of an industry probably consume an insignificant amount of their own good compared to other goods and services. Assumption 7, while unrealistic in a partial equilibrium setting, in general equilibrium allows us to characterize the empirical fact that the degree of competition differs across industries (Wilcox, 1950).

In general equilibrium, it is better to work with the direct demand function rather than the indirect one that is typical of presentations of Cournot oligopoly. If D_j is the world demand for good j and a firm in country i produces x_{ij} at the unit cost c_{ij} , then the firm maximizes $(p_j - c_{ij})x_{ij}$ by simply calculating $\partial D_j / \partial p_j = \partial x_{ij} / \partial p_j$ so that profits are maximized when:

$$(\partial D_j / \partial p_j)(p_j - c_{ij}) + x_{ij} = 0. \quad (1)$$

Using the numerical price elasticity, $e_j = -(\partial D_j / \partial p_j)(D_j / p_j)$, equation (1) can be rewritten as:

$$x_{ij} = (p_j - c_{ij})e_j D_j / p_j. \quad (2)$$

Since N_{ij} is the number of firms in country i producing good j , the total supply of good j in country i is:⁴

$$Q_{ij} = N_{ij}(p_j - c_{ij}(\mathbf{w}_i))e_j D_j / p_j \quad nm \text{ equations} \quad (3)$$

Factor market clearing requires:

$$\hat{\mathbf{a}}_j (\partial c_{ij} / \partial \mathbf{w}_{ik}) Q_{ij} = V_{ik} \quad nr \text{ equations} \quad (4)$$

Market clearing requires:

$$\mathbf{S}_i Q_{ij} = D_j(\mathbf{p}, \hat{\mathbf{a}}_j (p_j \hat{\mathbf{a}}_j Q_{ij})) \quad m \text{ equations} \quad (5)$$

One of the equations in (5) is redundant by Walras Law. Any commodity or factor price can be chosen as numeraire. Equations (3) are just the aggregate Cournot first order conditions for each industry in each country. Equations (4) employ Shepherd's lemma and the factor market clearing conditions. The N_{ij} 's are a bit tricky since there are exogenous up to a corner solution. We can of course take account of corner solutions by adding the obvious inequalities, $N_{ij}(p_j - c_{ij}(\mathbf{w}_i)) \geq 0$, which forces $N_{ij} = 0$ whenever the profit margin is negative.

Solving (3) and (5) we can state the Cournot pricing equations:

$$p_j = \mathbf{S}_i N_{ij} c_{ij}(\mathbf{w}_i) / (\mathbf{S}_i N_{ij} - 1 / e_j). \quad (6)$$

This is an extremely useful equation and played a prominent role in Ruffin (2003). Indeed, the equation shows how the \$6 prices in Table 3 were determined. If the cost of airplanes was

\$4 in one country and \$5 in the other, with 2 firms in each country and $e_j = 1$, $p_a = 2(4 + 5)/3 = \$6$.

It should be noted that in general one cannot go from (5) and (6) back to (3) since equations (6) are only m in number for any $n \geq 1$. Thus, (3), (4), and (5) are necessary for a solution in a multicountry setting.

The only difference with standard trade theory is that instead of equations (3) we would have mn Walrasian pricing equations: the price of each good equals cost of production in each country. We could, of course, have a subset of industries be perfectly competitive, as in the next section. But equations (3) make factor price equalization a near impossibility even in the Heckscher-Ohlin production model with identical technologies. Helpman and Krugman (1985, Ch. 5) consider factor price equalization only on the assumption that there are enough perfectly competitive industries and do not contradict the above remark.

Since factor price equalization does not in general take place in the above model, it should be obvious that the main effect of oligopoly on international trade is to reduce the volume of trade, just as we discovered above in the case of a Ricardian world with strong oligopolies allowing the high cost industry to operate. The failure of tariffs and trade costs to explain the low volume of international trade (see Davis and Weinstein, 2001) may be in part be a reflection of oligopoly.

Now that we have the general equilibrium equations for oligopoly it is possible to solve the model in particular instances, such as for example in a computable general equilibrium model (Shoven and Whalley, 1984). In the next section, I propose to solve them for a simple but interesting case.

4. Oligopoly in One Sector

Clair Wilcox (1950) presented persuasive evidence that oligopoly is not ubiquitous. Thus, it is really necessary to examine a situation in which one industry is oligopolistic and the other competitive. Thus, going back to airplanes and bread imagine the airplane industry is always

oligopolistic and bread is always competitive.⁵ Suppose the home country has a Ricardian comparative advantage in an oligopoly and the foreign country a comparative advantage in a perfectly competitive industry. What can we now conclude?

Let good 1 be airplanes and good 2 bread. To simplify let us begin by supposing equal labor supplies, $L = L^*$, with unit labor cost coefficients, $a_1 < a_1^*$, and $a_2^* < a_2$, so both countries have an absolute advantage in their good and must be capable of producing more of that good and less of the other good. To further simplify I will assume that the first industry, airplanes, has the same number of firms (N) in both countries in autarky. Finally, assume that the utility function is $u = (D_1 D_2)^{1/2}$ for everyone so that $p_1 D_1 = p_2 D_2$. Since the price elasticity of demand is unity, the price of good 1 will simply be (if good 1 is viable in both countries):

$$p_1 = N(w a_1 + w^* a_1^*) / (2N - 1). \quad (7)$$

However, if $N w a_1 / (N - 1) \leq w^* a_1^*$, then industry 1 in the foreign country will shut down and the price of good 1 will be:

$$p_1 = N w a_1 / (N - 1). \quad (8)$$

The equations of general equilibrium are then:

$$p_2 = w^* a_2^* \quad (9)$$

$$Q_1 = N(p_1 - w a_1)(Q_1 + Q_1^*) / p_1 \quad (10)$$

$$Q_1^* = N(p_1 - w^* a_1^*)(Q_1 + Q_1^*) / p_1. \quad (11)$$

$$\sum a_i Q_i = L \quad (12)$$

$$\sum a_i^* Q_i^* = L^* \quad (13)$$

$$(Q_1 + Q_1^*) p_1 = p_2 (Q_2 + Q_2^*) \quad (14)$$

Equation (7) can be derived from (10) and (11) so that there are 6 equations in the unknowns (setting $w = 1$): w^* , p_2 , Q_i , and Q_i^* ($i = 1, 2$). If $N w a_1 / (N - 1) \leq w^* a_1^*$, then $Q_1^* = 0$.

By assumption the home country's productivity advantage in good 1 (a_1^*/a_1) exceeds its productivity advantage in good 2 (a_2^*/a_2), which in turn exceeds the ratio of the latter to the

Corollary (the gains from trade): *Workers cannot lose from trade in the home country, although their gains from trade are zero in region II; capitalists gain in the home country, and lose in the foreign country; workers in the foreign country benefit substantially from free trade; and the home country's gains from trade will exceed the foreign country's.*

Let us see why the workers cannot lose in the home country. Let $w = 1$. Then $p_1 = Na_1/(N-1)$ and $p_2 = w^*a_2^* \leq a_2$. What happens is this: as trade is opened, w^* rises in the foreign country as it shifts from the oligopoly (e. g. airplanes) to the competitive industry (e.g., bread). As long as the wage increase in the foreign country satisfies $w^*a_2^* \leq a_2$, workers in the home country cannot lose; the worse they can do is face the same price of good 2 as in autarky. This holds regardless of our demand assumption (Ruffin, 2003). The existence of a potential competitor in the home country to the foreign country's natural export good sets an upper limit to the improvement in the foreign country's double factorial terms of trade, and guarantees that the home worker will not lose from trade.

The economic intuition is simple. When trade is opened, in the home country labor is shifted from bread to airplanes and the opposite happens in the foreign country. Indeed, if the airplane industry faces a weak enough oligopoly, the airplane industry in the foreign country shuts down. Wages in the foreign country rise relative to wages in the home country where the bread industry shuts down. Let us take the home wage as given. Then the wage in the foreign country, w^* , is rising. Foreign workers are clearly a lot better off because their wages are rising and the price of the oligopolistic good is falling with the price of bread rising in proportion to wages. In the home country, the oligopoly price remains the same, but the price of bread falls, which shuts down the bread industry. Workers are better off with same wages, lower import prices, but not as well off as in the foreign country.

But the home country gains more from trade than the foreign country because it benefits from the favorable terms of trade arising from its oligopoly power in world markets whereas the foreign country's export industry is competitive. If the oligopoly power greater,

wages in the home country are depressed further compared to foreign wages, and this eventually makes the home country's bread industry competitive. If that is the case, home workers in will be no better off by trade.!

Make oligopoly power even greater, the wage in the foreign country cannot rise relative to home wages because both bread industries must be competitive, but the higher price of airplanes allows the foreign country's airplane industry to become competitive. Now trade would benefit workers in the home country as the price of airplanes would fall.

A further conclusion is of great interest: antitrust policy is generally regarded as more useful to a country if it does not face international competition.⁶ But the truth is exactly the opposite. If the country faces international competition, that means the oligopoly is so strong at home that it permits the high-cost foreign rival to operate. Greater competition will enable the home country to specialize more in the good in which it has a comparative advantage. If there is no international competition, antitrust policy in the home country backfires because it simply lowers the price of airplanes, which are exported, and worsens the terms of trade. The country is worse off, but workers are better off!

A worked out example based on the above theorem and equations (9)-(14) follows.

Let $L = L^* = 200$, $a_1 = a_2^* = 4$; and $a_2 = a_1^* = 5$. Let $w = 1$. If $N = 3$ or 4 , we are in stage II above. If $N = 2$, we are in stage III. In both stages, $w^* = a_2/a_2^* = 5/4 = 1.25$. Let u_y and u_w denote the utility levels of the economy and workers, respectively, and u_A , the utility of the economy at autarky. Under the assumptions, autarkic utility is the same in both countries. Table 6 shows the approximate solutions for the crucial variables for different levels of competition from $N = 2$ to $N = \mu$. Comparing columns (5) or (6) with (14) enables one to compute the gains from trade to the entire economy. Home exports can be deduced from columns (9) and (10).

Note it makes no difference that we assumed the same number of potential firms in industry 1 in both countries because when $N = 3$, industry 1 shuts down in the foreign country regardless of the number of firms in that country.

Notice that when the world economy is in stage I, an increase in competition in the home country will drive the industry abroad out of business as its output falls from 6.9 to 0. There is an improvement in both economies as well as workers in both countries. Although the terms of trade of the home country declines, the expansion of international trade is sufficiently beneficial to improve home real income. Prior to increase in competition, the home country exported 11.7 units of good 1. Now, when $N = 3$, the home country exports 20.8 units of good 1 (almost a doubling).

However, in stage II the home industry does not face international competition. If the number of firms increases to $N = 4$, due to a perfectly executed antitrust policy, home welfare falls from 26.4 to 25.6. Workers in the home country gain substantially, so antitrust policy is in effect a policy intended to improve income distribution.

5. Conclusions

Oligopoly does not materially affect the law of comparative advantage. Indeed, the Ricardian specialization story can be easily modified to explain how strong oligopoly simply causes both countries to produce both goods. If there is equal but strong oligopoly power in both sectors in both countries, the gains from trade are smaller under oligopoly but the gains to workers larger than under perfect competition.

There is no difficulty in writing out the equations of general equilibrium under the assumptions of constant returns to scale, identical and homothetic utility functions, and each firm acts as a Cournot oligopolist and assumes the prices of all other goods and factors to be constant. All that changes from perfect competition is that instead of price equals the cost of production for each good in each location, there is a supply equation for each good and

location that simply reflects the Cournot addition over the first order conditions in each location and industry.

When there is oligopoly in one sector and perfect competition in the other, the country with a comparative advantage in the oligopoly will gain more from trade than the other country, but workers in that country gain less and may not gain anything. Perfectly executed antitrust policy will benefit the country with a comparative advantage in the oligopoly if the oligopoly faces international competition. If there is no international competition, increased competition will simply reduce the terms of trade, hurt the country as a whole, but benefit workers. Because of its intuitive appeal, this result would probably hold in a more general model (with different demand conditions), but it is an open question. The country that has a comparative advantage in the oligopoly will have a lower double factorial terms of trade and, as a consequence, tend to be more diversified.

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Notes

¹ For early contributions see Brander (1981) and Eaton and Grossman (1986). See Dixit (1984), Helpman and Krugman (1985), and Chang and Katayama (1995) for reviews of the literature. Neary (2002) and Ruffin (2002) emphasize general equilibrium. Helpman and Krugman (1985) consider general equilibrium for oligopoly in the special case in which there is factor price equalization and a sufficient number of competitive industries.

² In Ruffin (2002) I examine in detail the preceding Ricardian case allowing for different degrees of oligopoly power across industries.

³ The production structure is the same as Samuelson (1954).

⁴ Equation (3) suggests our previous calculation that with airplane trips and bread selling for \$6 and selling the same number of units in world markets (due to symmetry), the ratio of outputs would have to just equal the ratio of the profit margins.

⁵ Markusen (1981) examines a situation in which neither country has a comparative advantage in order to focus on the impact of single-sector monopoly when one country is larger than the other.

⁶ See Dixit (1984) for a discussion in a partial equilibrium setting.

<u>Country/Goods</u>	<u>Airplanes</u>	<u>Bread</u>
Home	\$4	\$5
Foreign	\$5	\$4

Table 1: dollar costs of production with wage equal to \$1 in both countries

<u>Country/Goods</u>	<u>Airplanes</u>	<u>Bread</u>
Home	\$8	\$10
Foreign	\$10	\$8

Table 2: Autarky prices: strong oligopolies

<u>Country/Goods</u>	<u>Airplanes</u>	<u>Bread</u>
Home	\$6 (\$2)	\$6 (\$1)
Foreign	\$6 (\$1)	\$6 (\$2)

Table 3: Free trade prices (profit margins): strong oligopolies

<u>Country/Goods</u>	<u>Airplanes</u>	<u>Bread</u>
Home	\$5	\$6.25
Foreign	\$6.25	\$5

Table 4: Autarky prices: weak oligopolies

<u>Country/Goods</u>	<u>Airplanes</u>	<u>Bread</u>
Home	\$5	\$5
Foreign	\$5	\$5

Table 5: Free trade prices: weak oligopolies

N	P_1	P_2	w^*	u_y	u_{y^*}	u_w	u_{w^*}	D_1	Q_1	Q_2	Q_1^*	Q_2^*	$u_A = u_A^*$
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
2	6.83	5	1.25	25.2	21.7	17.1	21.3	21.6	33.3	13.4	6.9	41.4	21.1
3	6	5	1.25	26.4	22.8	18.2	22.8	24.2	45	4	0	50	21.9
4	5.33	5	1.25	25.6	24.2	19.4	24.2	24.8	48.2	1.4	0	50	22.1
μ	4	4	1	25	25				25	20	20	25	22.4

Table 6: The impact of increased competition