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Exports, FDI and Infrastructure in Oligopoly

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Abstract: This paper extrapolates it to oligopolistic Cournot competition based on the main components of the Belt and Road - exports, FDI and infrastructure. The paper first establishes a basic linear demand duopoly model and extends the firm costs under-investment in transportation infrastructure by adding transportation costs to the base model. Third, the firm responses under other infrastructure investments are discussed, adjusting the original market size. Finally, conclusions are also drawn about how different investment approaches can affect each other as different investments in infrastructure lead to further cost reductions.

Keywords: Exports; FDI and Infrastructure; Oligopoly

1. Introduction

In 2013, China proposed the "One Belt, One Road" national strategy, and in 2015, the "Vision and Action for Promoting the Construction of the Silk Road Economic Belt and the 21st Century Maritime Silk Road" was officially released. "In 2015, Chinese companies made direct investments in 49 countries related to the Belt and Road, and the Chinese government also launched several projects in Southeast Europe, such as ports, roads, railways, power stations. In 2015, Chinese companies made direct investments in 49 countries related to the Belt and Road, while the Chinese government also carried out infrastructure construction in Southeast Europe, including ports, roads, railroads and power stations, and granted loans to related projects through Chinese commercial banks. According to the Vision and Action, investment and trade cooperation is the "main task" of the Belt and Road Initiative, infrastructure connectivity is the "priority area" of the Belt and Road Initiative, and financial integration is the "important support". The interaction between the three economic aspects of the initiative, namely investment and trade, finance and infrastructure, is an essential element of the Belt and Road. In addition, FDI is also a significant focus of the Belt and Road Initiative.

Infrastructure may affect the firm's costs and the market demand, and this paper assumes that starting from the simplest linear demand model, this infrastructure may affect costs. A firm producing the exact product has two choices, exporting or FDI, and the costs affected by the decision of the Chinese firm to invest in infrastructure under the Belt and Road policy are different, and subsequently, the firm's choice of exporting or FDI is also affected. In addition, the firm has to pay some fixed costs as resource costs, so this paper will also investigate some questions about the equilibrium, such as a better decision will depend on which threshold.

For the basic model, this paper will follow James Brander's (1995) "the third market" model in studying export subsidies, among other things. This literature extends the case of asymmetric countries, but the two firms assumed in this paper are symmetric. This paper assuming that Chinese firms compete with European firms in the third country market with the Cournot competition; the discussion proceeds to how different infrastructures affect Chinese firms. For firms that want to export or make FDI in the third country, the infrastructure may improve the size of the market and may also reduce the firm's costs. For example, if a firm wants to make FDI, it will have lower costs after setting up a factory within the third country. So, it will be modelled based on Cournot competition theory.

Suppose two firms are producing the same product, which is from China and Europe, and we have learnt the basic Cournot model with linear demand and the following formula:

2. Response of Chinese firm under transportation infrastructure investment

Suppose we have derived the following formula:

$$F = \frac{4}{9b}[\tau^2 + (a - c - 2\bar{t} + t_{EU})\tau]$$

When $\tau = 0$, $F = 0$.

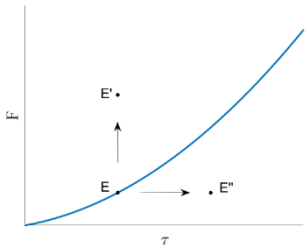

Figure 1

Take a point E on the curve. When τ is the same and F becomes larger, ΔW^c becomes smaller. Since the curve represents $\Delta W^c=0$, $\Delta W^c<0$ at ,E` which means the space above the curve is $\Delta W^c<0$ and the point falls in this region when it represents infrastructure is worth investing; when F is the same and τ becomes larger, ΔW^c becomes larger and $\Delta W^c>0$ at E``, then the curve The space below indicates that $\Delta W^c>0$, which means that the point falls in this region when it is not worth investing in infrastructure.

When the other parameters are kept constant and becomes larger, the curve changes as figure 2:

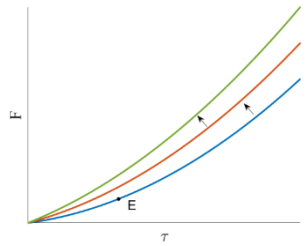

Figure 2

As can be seen from the Figure 2, with a increases, the curve moves towards the upper, but always passes through the point (0, 0). Due to the larger a, point E in Figure 1 is no longer on the new curve but falls into the region below the new curve, which, as mentioned in the previous content, represents a region where welfare is greater than 0. At the point where a is more extensive than before, point E changes from welfare being 0 to welfare being more significant than 0. In this case, point E has the same status as point E`` in Figure 1, it leads to an investment in infrastructure at point E that is more worthwhile than before.

When other parameters are held constant and b becomes larger:

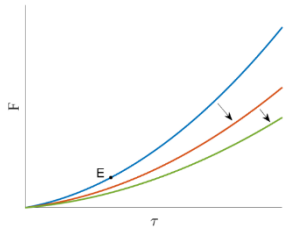

Figure 3

As can be seen from the Figure 3, with b increases, the curve moves towards the lower, but always passes through the point (0, 0). Due to the larger b, point E in Figure 3 is no longer on the new curve but falls into the region above the new curve, which, as mentioned in the previous, represents a region where welfare is lower than 0. At this point where b is more significant than before, point E changes from welfare being 0 to welfare being less than 0. In this case, point E has the same status as point E` in Figure 1, it leads to an investment in infrastructure at point E that is not worthwhile.

When other parameters are held constant and t_{EU} becomes larger:

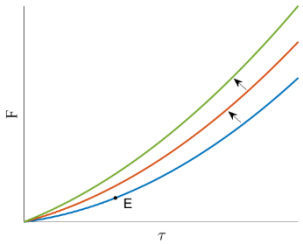

Figure 4

As can be seen from the Figure 4, with t_{EU} increases, the curve moves towards the upper, but always passes through the point (0, 0). The curve direction is similar to Figure 2. Due to the larger t_{EU}, point E in Figure 1 is no longer on the new curve but falls into the region below the new curve, which is similar to the case when a increases. In this case, point E has the same status as point E'' in Figure 1, it leads to an investment in infrastructure at point E that is more worthwhile than before.

When two firms have different marginal costs and different transport costs, suppose we have derived the following formula:

$$F = \frac{4}{9b}[\tau^2 + (a - 2c_{CN} + c_{EU} - 2\bar{t} + t_{EU})\tau]$$

When $\tau = 0, F = 0$.

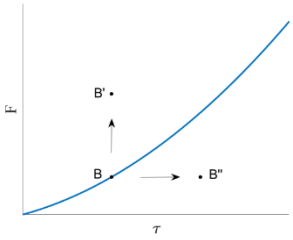

Figure 5

Take a point B on the curve. When τ is the same and F becomes larger, ΔW^c becomes smaller. Since the curve represents $\Delta W_c=0$, $\Delta W^c<0$ at B`, which means the space above the curve is $\Delta W^c<0$ and the point falls in this region when it represents infrastructure is worth investing; when F is the same and τ becomes larger, ΔW^c becomes larger and $\Delta W^c>0$ at B``, then the curve The space below indicates that $\Delta W^c>0$, which means that the point falls in this region when it is not worth investing in infrastructure. The situation here is significantly similar to that in Figure 1.

When other parameters are kept constant and c_{CN} becomes larger:

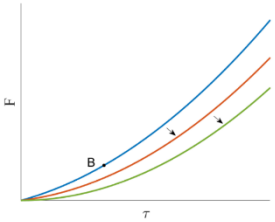

Figure 6

As can be seen from the figure 6, due to the larger c_{CN}, point B in Figure 5 is no longer on the new curve but falls into the region above the new curve, which, as mentioned in the previous content, represents a region where welfare is smaller than 0. In the case where c_{CN} is more extensive than before, point B changes from welfare being 0 to welfare being lower than 0. Due to the situation of $\Delta W^c<0$, it would be unwise to invest in infrastructure now.

When other parameters are kept constant and c_{CN} becomes larger:

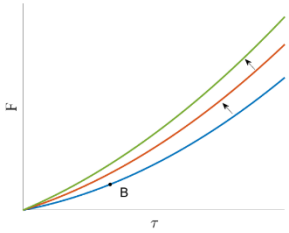

Figure 7

As can be seen from the figure 7, due to the larger c_{EU}, point B in Figure 5 is no longer on the new curve but falls into the region below the new curve, which represents a region where the welfare is greater than 0. In the case where c_{EU} is more prominent than before, point B changes from the welfare equal to 0 to welfare being more significant than 0. Therefore, investing in infrastructure is a right choice.

2. Response of Chinese firm under the third country domestic infrastructure investment

Assuming that there is some infrastructure investment within the third country due to the benefit of the Belt and Road policy, which leads to the expansion of the market size of the third country, suppose we have derived the following formula:

$$A = \frac{1}{9b}[\alpha^2 + (2a - 2c + 2t)\alpha]$$

When $\alpha = 0$, $A = 0$.

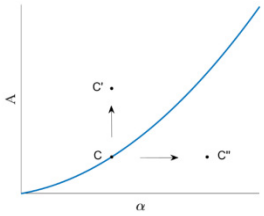

Figure 8

Take a point C on the curve $\Delta W^c=0$. When α is constant and A becomes larger, welfare decreases and point C moves to point C`, since the curve is welfare equal to zero, this region (above the curve) represents welfare less than 0. Similarly, when A is constant and α becomes larger, welfare increases and point C moves to point C``, this region (below the curve) represents welfare greater than 0. Therefore, the point falls above the curve when the infrastructure investment is not worthwhile and falls below the curve when it is worthwhile investment.

When other parameters are held constant and t becomes larger:

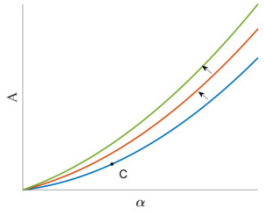

Figure 9

From the Figure 9, it can be seen that as the transportation costs of the two firms increase, the curve shifts upward. The point C on the original curve is no longer on the new curve and becomes falls in the area below the new curve. As mentioned before the area below the curve represents welfare greater than zero, so the previous point C becomes more worthy of infrastructure investment than before.

When other parameters are held constant and t becomes larger:

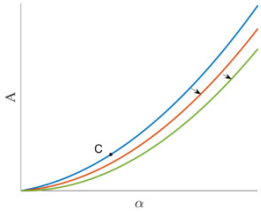

Figure 10

As Figure 10 shows, the curve shifts downward as the marginal cost increases. Point C`s position after the new curve is formed is equivalent to point C` in Figure 8, where the welfare is less than zero. It is not a wise choice to invest in infrastructure at this point.

When two firms have identical marginal costs and different transport costs, for Chinese firm, suppose we have derived the following formula:

$$A = \frac{1}{9b}[\alpha^2 + (2a - 2c - 4t_{CN} + 2t_{EU})\alpha]$$

When $\tau = 0$, $A = 0$.

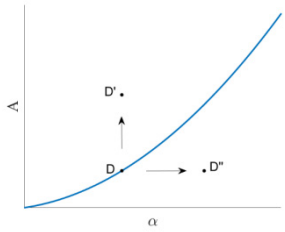

Figure 11

Take a point D on the curve ΔW^c=0. When α is constant and A becomes larger, welfare decreases and point D moves to point D', since the curve is welfare equal to zero, this region (above the curve) represents welfare less than 0. Similarly, when A is constant and α becomes larger, welfare increases and point D moves to point D``, this region (below the curve) represents welfare greater than 0. Therefore, the point falls above the curve when the infrastructure investment is not worthwhile and falls below the curve when it is worthwhile investment.

When other parameters are held constant and t_{CN} becomes larger:

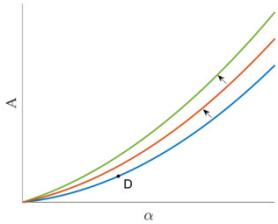

Figure 12

As Figure 12 shows, the curve shifts downward as the EU firm's transport cost increases. Point D`s position after the new curve is formed is equivalent to point D` in Figure 11, where the welfare is less than zero. It is not a wise choice to invest in infrastructure at this point. It also shows that the reduction in transportation costs for Chinese firm helps Chinese firm to invest in domestic infrastructure in third country.

When other parameters are held constant and t_{EU} becomes larger:

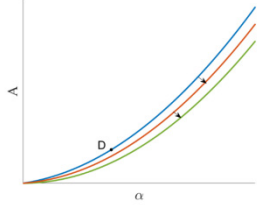

Figure 13

From the Figure 13, it can be seen that as the transportation cost of the Chinese firm increase, the curve shifts upward. The point D on the original curve is no longer on the new curve and becomes falls in the area below the new curve. As mentioned before the area below the curve represents welfare greater than zero, so the previous point D becomes more worthy of infrastructure investment than before, which suggests that the increased transportation costs for EU firm favor Chinese firm's investments in third country domestic infrastructure.

3.Conclusion

The Belt and Road Initiative affects many regions and firms, and this paper builds a third country Gounod competition model by linking oligopoly and exports, FDI and infrastructure with the background hypothesis of Belt and Road. The presence of infrastructure may affect two aspects, one is to reduce the firm's cost, and the other is to improve the size of the market. In this paper, infrastructure is divided into transportation infrastructure and infrastructure within the third country. The assumptions made in the model for investments in transportation infrastructure and infrastructure within the third country, and the changes in welfare before and after the investment corresponding to a series of Chinese firms and European firms seeking to maximize profits, are derived.

Also, by observing this paper, it is found that the two types of infrastructure investments have a catalytic effect on each other, i.e., one investment makes the other more profitable. Expanding the market size when making transportation infrastructure investments is found by the change in the curve that facilitates the reduction of transportation costs while reducing transportation costs for Chinese companies when investing in domestic infrastructure in third countries also facilitates the expansion of the market size. Both types of infrastructure investments are beneficial to each other.

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