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## **The Effects of Entry under the Coexistence of Oligopolistic and Monopolistic Competition**

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# The Effects of Entry under the Coexistence of Oligopolistic and Monopolistic Competition

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## Abstract

This paper proposes a model of a continuum of industries in which some industries are monopolistically competitive, the others are oligopolistic, and they interact in a labor market. We use this model to examine the effects of an increase in the number of oligopolistic firms. We first show that this raises the equilibrium wage and induces exit of monopolistically competitive firms. Then, we find that the profits of each oligopolistic firm and the whole oligopolistic industry decrease. Finally, we establish that if the elasticity of substitution is the same in all industries, welfare improves as a result of an increase in the oligopolistic firms.

*Keywords:* Monopolistic competition, oligopoly, general equilibrium, entry, welfare

*JEL classification:* D43, L13, L40

# 1 Introduction

Are increased entry and/or competition beneficial? This is a classical question in economics, but the answer is mixed. For instance, in Cournot competition with identical firms, ‘when the number of firms becomes very large, the market price tends to the competitive price,’ (Tirole, 1988, p. 220) and hence increased competition is desirable in terms of welfare.<sup>1</sup> While this result has provided a theoretical rationale for competition policy, it rests on a partial equilibrium analysis and ignores the effects on the other industries.

This paper examines the effect of entry in a general equilibrium model where oligopolistic and monopolistic competition coexists. For this purpose, we incorporate monopolistic competition into Neary’s (2003, 2016) general oligopolistic equilibrium (GOLE) model. Concretely, we suppose a continuum of industries on a unit interval, some of which are oligopolistic and the others of which are monopolistically competitive. And, these industries use a common factor of production, labor. Thus, entry modeled by an exogenous increase in the number of oligopolistic firms has an effect on income distribution and welfare through a change in the wage rate that clears the labor market. While Neary (2003, 2016) assumes that all industries are oligopolistic, we relax this assumption and allow some industries to be monopolistically competitive, which seems more realistic.

In this model, we first show that an increase in the number of oligopolistic firms raises the equilibrium wage. Due to this rise in the wage rate, the number of varieties increases, and the product price rises in the monopolistically competitive industries. Meanwhile, the product price falls, and the profits of each individual firm and the whole sector increase in the oligopolistic sectors. That is, an increase in the number of firms has a pro-competitive effect on the oligopolistic industries, but an anti-competitive effect on the monopolistically competitive industries. Due to these mixed effects on each industry, it is generally ambiguous whether welfare improves. However, in the case with

the same elasticity of substitution in all industries, welfare is shown to rise as a result of entry in the oligopolistic industries.

This paper is closely related to two strands of literature. The first concerns the coexistence of oligopolistic and monopolistic competition. To our knowledge, Shimomura and Thisse (2012) first formalize the coexistence of monopolistic competition and oligopoly. Incorporating monopolistically competitive and oligopolistic firms into the Dixit-Stiglitz (1977) model with a CES utility function, they show that an increase in the number of oligopolistic firms lowers the number of monopolistically competitive goods, but raises welfare. Parenti (2018) also derives the same finding in a quadratic utility model that allows for multi-product oligopolistic firms. While these papers assume that oligopolistic and monopolistically competitive *firms* coexist in the same industry, we consider a different situation in which oligopolistic and monopolistically competitive *industries* coexist.

The second related literature is about the GOLE model of Neary (2003, 2016).<sup>2</sup> As briefly mentioned above, Neary (2003) develops a baseline model in which Cournot competition prevails in a continuum of industries, and the factor price is endogenously determined so that the factor market clears. Neary (2003) shows that an increase in the oligopolistic firms improves welfare, and Neary (2016) extends the model to a two-country world to examine the patterns of and gains from trade. We use a variant of this model for at least two reasons. For one thing, this approach resolves the difficulties arising in general equilibrium analysis with imperfect competition, e.g. non-existence of equilibrium. For another thing, because all the endogenous variables can be explicitly solved, comparative statics is easier than the model of Shimomura and Thisse (2012). We do not claim that the GOLE model is superior to the models of Shimomura and Thisse (2012), but our model hopefully provides a supplementary framework that examines the effects of entry under the coexistence of oligopolistic and monopolistic competition.

This paper is organized as follows. Section 2 presents a model, and Section

3 examines the effects of entry of oligopolistic firms on the wage rate, product price, the number of monopolistically competitive goods, the profits in the oligopolistic industries, and welfare. Section 4 discusses a few closely related issues. Section 5 concludes.

## 2 Model

Suppose a continuum of goods on a unit interval  $[0, 1]$ . Good  $z$  is horizontally differentiated and supplied by monopolistically competitive firms if  $z \in [0, \tilde{z}]$ , and supplied by Cournot oligopolistic firms if  $z \in [\tilde{z}, 1]$ . All goods are produced from labor. The marginal labor requirement is denoted by  $c(z)$ , and the fixed labor requirement for each monopolistically competitive firm is given by  $f(z) > 0$ . We describe consumer behavior, and then proceed to firm behavior and general equilibrium.

### 2.1 Consumer Behavior

We assume a representative consumer whose utility function is given by

$$U = \int_0^{\tilde{z}} \ln X_1(z) dz + \int_{1-\tilde{z}}^1 \ln X_2(z) dz, \quad (1)$$

where  $U$  is utility, and  $X_i(z)$ ,  $i = 1, 2$  is the quantity index defined by

$$X_1(z) \equiv \left[ \int_0^{m(z)} x_i(z)^{\frac{\sigma_1-1}{\sigma_1}} di \right]^{\frac{\sigma_1}{\sigma_1-1}}, \quad X_2(z) \equiv \left[ \int_0^n x_j(z)^{\frac{\sigma_2-1}{\sigma_2}} dj \right]^{\frac{\sigma_2}{\sigma_2-1}}, \quad \sigma_1, \sigma_2 > 1.$$

Here,  $x_i(z)$  is consumption of variety  $i$  in monopolistically competitive industry  $z$ , and  $x_j(z)$  is consumption of variety  $j$  in oligopolistic industry  $z$ . Furthermore,  $\sigma_i$ ,  $i = 1, 2$  is the elasticity of substitution among varieties in each market structure,  $n \geq 2$  is the number of oligopolistic firms.<sup>3</sup> The consumer chooses consumption to maximize (1) under the budget constraint:

$$\int_0^{\tilde{z}} \left[ \int_0^{m(z)} p_i(z) x_i(z) di \right] dz + \int_{1-\tilde{z}}^1 \left[ \int_0^n p_j(z) x_j(z) dj \right] dz = I, \quad (2)$$

where  $p_i(z)$  and  $p_j(z)$  are the price of each variety, and  $I$  is national income. Denoting by  $\lambda$  the Lagrangean multiplier attached to the budget constraint, the first-order conditions for utility maximization are

$$\begin{aligned}\frac{x_i(z)^{-\frac{1}{\sigma_1}}}{\int_0^{m(z)} x_i(z)^{\frac{\sigma_1-1}{\sigma_1}}} - \lambda p_i(z) &= 0 \\ \frac{x_j(z)^{-\frac{1}{\sigma_2}}}{\int_0^n x_j(z)^{\frac{\sigma_2-1}{\sigma_2}}} - \lambda p_j(z) &= 0.\end{aligned}$$

Following Neary (2003, 2016), we choose marginal utility of income  $\lambda$  as a numeraire.<sup>4</sup> The justification for this price normalization is as follows. In the present general equilibrium model,  $\lambda$  is an endogenous variable and depends on the outputs that are the choice variables of imperfectly competitive firms. However, Neary (2003, 2016) and we assume that all firms have market power in their own product market while they treat  $\lambda$  parametrically due to the assumption of a continuum of industries. Then, it is no longer problematic to set  $\lambda = 1$ . Under this price normalization, the perceived inverse demand function of each firm is obtained as

$$p_i(z) = \frac{x_i(z)^{-\frac{1}{\sigma_1}}}{\int_0^{m(z)} x_i(z)^{\frac{\sigma_1-1}{\sigma_1}} di}, \quad p_j(z) = \frac{x_j(z)^{-\frac{1}{\sigma_2}}}{\int_0^{m(z)} x_j(z)^{\frac{\sigma_2-1}{\sigma_2}} dj}. \quad (3)$$

Using these inverse demand functions, we proceed to the description of firm behavior.

## 2.2 Monopolistic Competition

Given the inverse demand function in (3), a representative monopolistically competitive firm  $i$  maximizes its profit

$$\pi_i(z) \equiv p_i(z)x_i(z) - wc(z)x_i(z) - wf(z),$$

where  $\pi_i(z)$  is the profit of firm  $i$  in monopolistically competitive industry  $z$ , and  $w$  is the wage rate. Then, the price of all varieties is determined by the

markup pricing rule:

$$p_i(z) = \frac{\sigma_1 w c(z)}{\sigma_1 - 1}. \quad (4)$$

Making use of (4), the inverse demand function in (3) and the zero profit condition  $\pi_i(z) = 0$  jointly determine the equilibrium output and the number of varieties:

$$x_i(z) = \frac{(\sigma_1 - 1)f(z)}{c(z)}, \quad m(z) = \frac{1}{\sigma_z w f(z)}. \quad (5)$$

### 2.3 Oligopoly

The profit of each oligopolistic firm  $j$  is defined by

$$\pi_j(z) \equiv p_j(z)x_j(z) - w c(z)x_j(z),$$

where  $p_j(z)$  is given by (3). Solving the system of the first-order conditions for profit maximization, the equilibrium output and price in the symmetric equilibrium are derived as

$$x_j(z) = \frac{(\sigma_2 - 1)(n - 1)}{\sigma_2 n^2 w c(z)}, \quad p_j(z) = \frac{\sigma_2 n w c(z)}{(\sigma_2 - 1)(n - 1)}. \quad (6)$$

### 2.4 General Equilibrium

Having characterized the behavior of the consumer and firms, we close the model by introducing the labor market-clearing condition. Summarizing the results in the previous subsections, the labor market-clearing condition is

$$L = \int_0^{\tilde{z}} m(z)[c(z)x_i(z) + f(z)]dz + \int_{\tilde{z}}^1 n c(z)x_j(z)dz = \frac{\tilde{z}}{w} + \frac{(1 - \tilde{z})(\sigma_2 - 1)(n - 1)}{\sigma_2 n w},$$

where  $L > 0$  is a labor endowment. Solving this equation for  $w$  yields the equilibrium wage rate:

$$w = \frac{1}{L} \left[ \tilde{z} + \frac{(1 - \tilde{z})(\sigma_2 - 1)(n - 1)}{\sigma_2 n} \right] = \frac{(\sigma_2 + n - 1)\tilde{z} + (\sigma_2 - 1)(n - 1)}{\sigma_2 n L}. \quad (7)$$

Once the equilibrium wage is determined by (7), all the other endogenous variables are obtained as a function of primitive parameters such as  $n$ . What



is worth noting is that the existence and uniqueness of equilibrium is guaranteed because the equilibrium value of endogenous variables is explicitly solved.

### 3 The Effects of Entry

This section derives some comparative statics results with respect to an increase in  $n$ . We begin with the effect on the wage rate, and then address the effects on the goods prices, the number of monopolistically competitive goods, the profits in the oligopolistic sectors and welfare. It follows from Eq. (7) that

#### Proposition 1

As the number of oligopolistic firms increases, the equilibrium wage increases.

#### Proof

Differentiating (7) with respect to  $n$ , we have

$$\frac{\partial w}{\partial n} = \frac{(1 - \tilde{z})(\sigma_2 - 1)}{\sigma_2 n^2 L} > 0, \quad (8)$$

which leads to the proposition. Q.E.D.

When  $n$  increases, labor demand in the whole oligopolistic industry increases, and hence the equilibrium wage rate rises. Although this result itself is intuitively trivial, it has an important implication for the effects on the other endogenous variables.

Relating Proposition 1 to Eqs. (4) and (5), an increase in  $n$  affects the monopolistically competitive industries as follows.

#### Proposition 2

As the number of oligopolistic firms increases, the product price increases, the output of each firm is unchanged, and the number of varieties decreases in the monopolistically competitive industries.

Because the price of each monopolistically competitive good is proportional to the wage rate, it rises with  $n$  through the rise in the wage rate. In contrast, the rise in the wage rate induces exit of monopolistically competitive firms since their number  $m(z)$  negatively depends on the wage rate. Therefore, new entry in the oligopolistic industries has an anti-competitive effect on the monopolistically competitive industries, tending to reduce welfare.

While Proposition 2 concerns the effects on the monopolistically competitive industries, the effects on the oligopolistic industries are obtained as follows.

**Proposition 3**

As the number of oligopolistic firms increases, the product price decreases in the oligopolistic industries.

**Proof**

Substituting (7) into (6), the price of each oligopolistic goods is

$$p_j(z) = \frac{[(\sigma_2 + n - 1)\tilde{z} + (\sigma_2 - 1)(n - 1)] c(z)}{(\sigma_2 - 1)(n - 1)L}.$$

Thus, differentiating this with respect to  $n$  yields

$$\frac{dp_j(z)}{dn} = -\frac{\sigma_2 \tilde{z} c(z)}{(\sigma_2 - 1)(n - 1)^2 L} < 0,$$

which establishes the proposition. Q.E.D.

When  $n$  rises, there are two channels through which the good price changes. The first is a partial equilibrium effect according to which an in-

crease in  $n$  lowers the price by promoting competition. Besides, the rise in the wage rate reported in Proposition 1 tends to raise the product price. Proposition 3 states that the former effect dominates the latter effect, thereby leading to a reduction in the product price of oligopolistic goods. In other words, the entry in the oligopolistic sectors has a pro-competitive effect and a positive effect on welfare even though the general equilibrium feedback is taken into account.

Thus far, we have addressed the effects of entry of oligopolistic firms on the prices of labor and products, but now consider the effects on the profits in the oligopolistic industries. They are summarized in:

**Proposition 4**

As the number of oligopolistic firms increases, the profit of each oligopolistic firm and the whole industry decreases.

**Proof**

Substituting (7) into  $x_j(z)$  and  $p_j(z)$  in (6), and further substitution of the resulting expression into the definition of profit, we have

$$\pi_j(z) = \frac{\sigma_2 + n - 1}{\sigma_2 n^2}, \quad n\pi_j(z) = \frac{\sigma_2 + n - 1}{\sigma_2 n}.$$

Differentiating these with respect to  $n$  yields

$$\frac{d\pi_j(z)}{dn} = -\frac{2(\sigma_2 - 1) + n}{\sigma_2 n^3} < 0, \quad \frac{d[n\pi_j(z)]}{dn} = -\frac{\sigma_2 - 1}{\sigma_2 n^2} < 0.$$

Therefore, the profit of each individual firm and the oligopolistic industry decreases with  $n$ . Q.E.D.

The utility function assumed is quadratic and different from ours, Neary (2003, p. 492) obtains the same result as above. If  $n$  increases, each oligopolistic firm contracts output, but the industry-wide output expands. Recalling that the product price falls (Proposition 3), this implies that the

profit per-firm decreases as a result of an increase in  $n$ . What is seemingly counter-intuitive is that the industry-wide profit also decreases with  $n$ , which contrasts with the result in the partial equilibrium analysis. This is because the negative effect on each firm's profit through the rise in the wage rate plays a pivotal role. That is, the feedback effect in the general equilibrium is a key behind Proposition 4.

Let us finally consider the welfare effect of an increase in  $n$ . To this end, we now define welfare  $W$ . Substituting the results in (5) and (6) into (1) and rearranging terms, welfare depends on the primitive parameters as follows.

$$W = \int_0^{\tilde{z}} \ln X_1(z) dz + \int_{\tilde{z}}^1 \ln X_2(z) dz, \quad (9)$$

where the two terms in the right-hand side are

$$\begin{aligned} \ln X_1(z) &= \frac{\sigma_1}{\sigma_1 - 1} \ln \left[ \frac{n}{\tilde{z}\sigma_2 n + (1 - \tilde{z})(\sigma_2 - 1)(n - 1)} \right] \\ &\quad + \frac{\sigma_1}{\sigma_1 - 1} \ln \left[ \frac{\sigma_2 L}{\sigma_1 f(z)} \right] + \ln \left[ \frac{(\sigma_1 - 1)f(z)}{c(z)} \right] \\ \ln X_2(z) &= \frac{1}{\sigma_2 - 1} \ln n + \ln \left[ \frac{n - 1}{\tilde{z}\sigma_2 n + (1 - \tilde{z})(\sigma_2 - 1)(n - 1)} \right] \\ &\quad + \ln \left[ \frac{(\sigma_2 - 1)L}{c(z)} \right]. \end{aligned}$$

Therefore, differentiating these terms with respect to  $n$ , the welfare effect is obtained as follows.

$$\begin{aligned} \frac{dW}{dn} &= \int_0^{\tilde{z}} \frac{d \ln X_1(z)}{dn} dz + \int_{\tilde{z}}^1 \frac{d \ln X_2(z)}{dn} dz \\ &= -\frac{\tilde{z}(1 - \tilde{z})\sigma_1(\sigma_2 - 1)}{n(\sigma_1 - 1)[(\sigma_2 + n - 1)\tilde{z} + (\sigma_2 - 1)(n - 1)]} \\ &\quad + \frac{1 - \tilde{z}}{n(\sigma_2 - 1)} + \frac{\tilde{z}(1 - \tilde{z})\sigma_2}{(n - 1)[(\sigma_2 + n - 1)\tilde{z} + (\sigma_2 - 1)(n - 1)]}. \quad (10) \end{aligned}$$

Since the first line in the right-hand side of (10) is negative and the second line is positive, the total effect is ambiguous. The biggest reason is that  $\sigma_1$  and  $\sigma_2$  are allowed to be arbitrary in (10).

If the elasticity of substitution is the same across oligopolistic and monopolistically competitive goods, we have

**Proposition 5**

As the number of oligopolistic firms increases, welfare increases if  $\sigma_1 = \sigma_2$ .

**Proof**

If  $\sigma_1 = \sigma_2 = \sigma$ , (10) simplifies to

$$\frac{dW}{dn} = \frac{\tilde{z}(1 - \tilde{z})\sigma}{n(n-1)[(\sigma + n - 1)\tilde{z} + (\sigma - 1)(n - 1)]} > 0,$$

and hence the above proposition follows. Q.E.D.

The intuition behind this proposition is as follows. As noted earlier in Propositions 2 and 3, entry in the oligopolistic industries has the opposite effect on each industry. In the monopolistically competitive industries, the goods price rises, and the number of varieties falls, both of which tend to reduce welfare. In the oligopolistic industries, the goods price falls, which tends to raise welfare. Thus, the total effect depends on which of these effects is stronger. Proposition 5 states that in the special case with  $\sigma_1 = \sigma_2$ , the latter effect is stronger and hence welfare necessarily improves. That is, the pro-competitive effect and variety-expanding effect in the oligopolistic play a dominant role in the whole effect on welfare.

However, the same is no longer valid in another case. One noteworthy case is the situation with  $\sigma_2 \rightarrow \infty$  in which the oligopolistic goods are homogeneous (perfect substitutes). Then, Eq. (10) becomes

$$\frac{dW}{dn} = \frac{\tilde{z}(1 - \tilde{z})(\sigma_1 - n)}{(\sigma_1 - 1)n(n - 1)(n - 1 + \tilde{z})},$$

the sign of which is positive if and only if  $\sigma > n$ . If this inequality is satisfied, the positive effect on the oligopolistic industries becomes stronger than the negative effect on the monopolistically competitive industries. It is beyond

the scope of this paper, but quite interesting to investigate whether the above inequality is supported by empirical evidence.

## 4 Discussion

This section provides a few discussions that are relevant but not addressed in the previous sections.

### 4.1 Variable Markup

The preceding analysis has used the CES sub-utility function, which yields the constant markup. However, reflecting the recent evidence suggesting variable markups, there is a growing literature in theoretical industrial organization and international trade that produces variable markups. To our knowledge, two approaches have progressed. The first approach assumes an oligopoly instead of monopolistic competition, but keeps the assumption of the CES function.<sup>5</sup> Under this specification, the perceived elasticity of demand depends not only on  $\sigma_i$  in our notation but also on the share of each firm. Accordingly, the markup becomes variable. The second approach replaces the assumption of the CES function, but the market structure continues to be monopolistically competitive. Ottaviano et al. (2002), Melitz and Ottaviano (2008), Behrens and Murata (2007), Zhelobodko et al. (2012), d'Aspremont and Ferreira (2016), Parenti et al. (2017), Bertolotti and Etro (2017) and Mrazova and Neary (2017), Feenstra (2018) and Arkolakis et al. (2018) are the important contributions of this field.<sup>6</sup>

Even if the markup is allowed to be variable, it is conjectured that most of the foregoing arguments are valid. An increase in the number of oligopolistic firms leads some firms to exit and the incumbents to charge a higher product price due to the increased wage rate. In contrast, because the familiar pro-competitive effect is stronger than the effect on the wage rate, the product price of oligopolistic goods will fall. As a result of these competing effects,

it is generally ambiguous whether entry in the oligopolistic industries raises welfare. Though these arguments are expected to survive other formulations, it is quite difficult to do it as the next subsection shows.

## 4.2 Quadratic Sub-utility Model

As is just mentioned, some papers have introduced a non-CES preference in order to produce variable markups. This direction of research is promising, but we now briefly show that it is quite difficult even if the simplest model of quadratic sub-utility is used. Concretely, let us consider the following utility function.<sup>7</sup>

$$U = \int_0^{\tilde{z}} u_1(z) dz + \int_{\tilde{z}}^1 u_2(z) dz,$$

where  $u_i(z)$ ,  $i = 1, 2$  is sub-utility from consuming the monopolistically competitive goods and oligopolistic goods, respectively, and defined by

$$\begin{aligned} u_1(z) &\equiv \alpha \int_0^{m(z)} x_i(z) di - \frac{\beta}{2} \int_0^{m(z)} x_i(z)^2 di - \frac{\gamma}{2} \left[ \int_0^{m(z)} x_i(z) di \right]^2 \\ u_2(z) &\equiv \alpha \int_0^n x_j(z) dj - \frac{\beta}{2} \int_0^n x_j(z)^2 dj - \frac{\gamma}{2} \left[ \int_0^n x_j(z) dj \right]^2, \end{aligned}$$

where  $\alpha$ ,  $\beta$  and  $\gamma$  are positive constants. This model offers a useful alternative to the CES sub-utility model in the sense that demand functions are linear and markups are variable. However, the equilibrium wage rate can not be explicitly solved, and hence comparative statics becomes drastically difficult.

## 4.3 Different Numbers of Oligopolistic Firms

We have made an extreme assumption that the number of firms is the same in all oligopolistic industries. Then, it is natural to ask what can be said if the number of firms differs within the oligopolistic industries. One way to address this question is to split the whole oligopolistic sector into a subsector with  $n_2$  firms and a subsector with  $n_3$  firms. And, assume that  $n_2$  firms compete in  $\alpha \in [0, 1]$  fraction of the whole oligopolistic sector, and that

$n_3$  firms compete in the  $(1 - \alpha)$  fraction. Then, our model above is given by a special case with  $\alpha = 1$ .<sup>8</sup> Then, making the manipulations parallel with those in the previous sections, we have

$$\begin{aligned} \frac{dW}{dn_2} &= \int_0^{\tilde{z}} \frac{d \ln X_1(z)}{dn_2} dz + \int_{\tilde{z}}^{\tilde{z} + \alpha(1 - \tilde{z})} \frac{d \ln X_2(z)}{dn_2} dz + \int_{\tilde{z} + \alpha(1 - \tilde{z})}^1 \frac{d \ln X_3(z)}{dn_2} dz \\ &= - \frac{\tilde{z}(1 - \tilde{z})\sigma_1(\sigma_2 - 1)\alpha n_3}{(\sigma_1 - 1)n_2\Delta} \\ &\quad + (1 - \tilde{z})\alpha \left[ \frac{1}{(\sigma_2 - 1)n_2} + \frac{\tilde{z}\sigma_2 n_3 + (1 - \tilde{z})(\sigma_2 - 1)(1 - \alpha)(n_3 - 1)}{(n_2 - 1)\Delta} \right] \\ &\quad - \frac{(1 - \tilde{z})^2(\sigma_2 - 1)\alpha(1 - \alpha)n_3}{n_2\Delta}, \end{aligned}$$

where

$$\Delta \equiv \tilde{z}\sigma_2 n_2 n_3 + (1 - \tilde{z})(\sigma_2 - 1)[\alpha n_3(n_2 - 1) + (1 - \alpha)n_2(n_3 - 1)] > 0.$$

In this case, an increase in  $n_2$  (the number of firms in  $\alpha$  fraction of the whole oligopolistic industry) has an anti-competitive effect on the  $(1 - \alpha)$  fraction of the whole oligopolistic industry as well as the monopolistically competitive industries. Consequently, the effect on welfare becomes more complicated. More seriously, it is unclear whether entry modeled above raises welfare even if the elasticity of substitution is the same in all industries.

## 5 Conclusion

Constructing a general equilibrium model with monopolistically competitive and oligopolistic industries coexisting, we have investigated the effects of entry in the oligopolistic industries. We have shown that the market-clearing wage rate rises with the number of oligopolistic firms, and that this effect significantly affects the endogenous variables in the monopolistically competitive industries, income distribution and welfare. Concretely, the goods price rises and the number of varieties falls in the monopolistically competitive industries, which tends to have a negative effect on welfare. On the other hand,



the goods price falls in the oligopolistic industries, which tends to raise welfare. The total effect on welfare is therefore ambiguous, depending on which of these effects is stronger. We have demonstrated that welfare necessarily improves in the case with the same elasticity of substitution across oligopolistic and monopolistically competitive industries. Furthermore, we have shown that the profit of each oligopolistic firm and the whole oligopolistic industry decreases as a result of entry.

We hopefully think that this paper contributes to literature in two respects. First, we have established a few new results. Particularly, we have shown that the welfare effect of entry in the oligopolistic industries is not always positive. Second, we have provided a tractable model that has many potential applications. As mentioned earlier, it is novel that the existence and uniqueness of equilibrium is ensured, and that all the endogenous variables are given by a function of primitive parameters. One direction is to apply our model to international trade to address whether trade liberalization raises welfare. However, we admittedly recognize the limitations. While three of them (variability of markups, other types of models and the different numbers of firms) are commented in Section 4, we must improve our analysis further. For example, it is challenging but fruitful to endogenize  $\tilde{z}$  by embedding the argument of Melitz' (2003) type. And, it is important to examine our theoretical prediction with empirical research.

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## Notes

1. However, we note that there is a counter-example. For example, Lahiri and Ono (1988) demonstrate that when efficient and inefficient firms coexist, entry of inefficient firms can reduce welfare.
2. The first working paper version of Neary (2016) was released in 2002. Colacicco (2015) is a comprehensive survey.
3. For the time being, we assume that  $n$  is the same in all oligopolistic industries. The case with different numbers of firms is commented in Section 4.
4. This choice of numeraire is familiar in the literature of the GOLE; see Colacicco (2015).
5. See, for instance, Atkeson and Burstein (2008) and Edmond et al. (2015).
6. See Thisse and Ushchev (2018) for an up-to-date survey.
7. See Ottaviano et al. (2002), Melitz and Ottaviano (2008) and Parenti (2018) for the applications of this utility function.
8. An alternative way is to assume a more general situation in which the number of firms is  $n(z)$ .

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