Economics Bulletin

Volume 38, Issue 2

A Simple Extension to the Dixit-Stiglitz Framework to Allow for Strategic Interaction

Niroth Chhy
Graduate School of Economics, Kobe University

Abstract

This paper considers a simple extension to the Dixit-Stiglitz framework to allow for strategic interaction. We show that the markup under Bertrand competition is strictly lower than that under Cournot competition and is strictly higher than that under monopolistic competition. We also show that there are two opposing forces: the love for variety and price distortion. Under monopolistic competition, these forces offset one another, and the equilibrium is the second-best optimum. Under oligopolistic competition, price distortion dominates and, because of a lower markup, the social welfare under Bertrand competition is strictly higher than that under Cournot competition.

Citation: Niroth Chhy, (2018) "A Simple Extension to the Dixit-Stiglitz Framework to Allow for Strategic Interaction", *Economics Bulletin*, Volume 38, Issue 2, pages 1187-1197
Contact: Niroth Chhy - niroth.chhy@gmail.com
Submitted: February 25, 2018. **Published:** June 21, 2018.

1. Introduction

The Dixit and Stiglitz (1977, henceforth DS) framework of monopolistic competition (henceforth MC)—in which firms are infinitesimal in scale and are not involved in strategic interaction—has been widely used in various fields. As Neary (2010) suggests, however, one will find with casual empiricism that large firms are important in real-world markets. Neary demonstrates that 92.2 (87.3) percent of the value of exports in the United States (France) belongs to the top exporters, which dominate only 11.9 (23.3) percent of total exporting firms. Also, there exists empirical evidence (Campbell and Hopenhayn 2005, Manuszak 2002, Manuszak and Moul 2008), suggesting that the competition among firms drives the variations in markups. Therefore, oligopolistic competition (henceforth OC), which allows for strategic interaction among (large) firms, is conceivably crucial.

Neary (2010) indicates that introducing OC into general equilibrium models generates technical difficulty, which limits the range of applications. For instance, Yang and Heijdra (1993)—who attempt to introduce OC into the DS framework—have to resort to a Cobb-Douglas utility function to solve the model. There are, in fact, some works (e.g., Bertoletti and Epifani 2014, Bertoletti and Etro 2016, Parenti et al. 2017), which can solve the models under OC. An important distinction is that these works consider one-sector economies while, in DS, there is an outside good which is traded in a perfectly competitive market. This fact seems to suggest that technical difficulty arises from inter-industry strategic interaction. Hence, we can expect that, by ignoring inter-industry strategic interaction, it is possible to introduce intra-industry strategic interaction into the DS framework without generating severe technical difficulty. The objective of this paper is to make this extension and make a comparison with MC, which ignores both intra-industry and inter-industry strategic interaction.

The assumption that firms ignore inter-industry strategic interaction is similar to Neary's (2003) "large-in-small-but-small-in-large" assumption, which states that if there are sufficiently many sectors, each firm is small in the whole economy but needs not be small in its own sector. Hence, the inter-industry effect of each firm can be ignored. This assumption has been used to explore the implication of OC in applications (see, for example, Etro and Colciago 2010, Faia 2012, and Jaimovich and Floetotto 2008).

By allowing only for intra-industry strategic interaction, it is possible to incorporate different types of competition, namely Bertrand competition and Cournot competition. The main finding in this paper is consistent with that in Parenti et al. (2017). Concretely, under both Bertrand competition and Cournot competition, the markup is strictly decreasing with the number of firms. The markup under Bertrand competition is strictly lower than that under Cournot competition but is strictly higher than that under MC. Also, because the higher the markup, the higher the incentive to enter to market, the equilibrium number of firms under Bertrand competition is strictly lower than that under Cournot competition but is strictly higher than that under MC.

Parenti et al. (2017) use a separable preference—which is more general than the CES preference—in a one-sector economy, in which inter-industry strategic interaction does not exist. This paper instead uses a CES preference in a multi-sector economy.[1] The advantage

[1] The same idea applies to more general preferences.

of a CES preference is the welfare analysis, which is not fully explored in Parenti et al. (2017). This paper shows that, in the market equilibrium, there are two opposing forces, namely the love for variety and price distortion. These forces are in balance under MC, and hence, as shown by DS, MC produces the second-best optimum. Under OC, price distortion dominates, and the social welfare under Bertrand competition (because of a lower markup) is strictly higher than that under Cournot competition.

The rest of this paper is organized as follow. Section 2 provides the setup. Section 3 provides the discussion of market outcomes. Section 4 concludes.

2. The Setup

The structure of the economy is the same as that in DS. The economy is inhabited by a continuum of identical individuals of measure one. There are $n > 1$ differentiated goods and one numeraire. Each individual is endowed with one unit of numeraire, which can be either consumed or used as an input in the production of differentiated goods. The market for numeraire is competitive, and the price is normalized to one.

2.1. Preferences and Demand Functions

The utility function of the representative individual is given by

$$U = u\left(x_0, \left(\sum_{i=1}^{n} x_i^{(\gamma-1)/\gamma}\right)^{\gamma/(\gamma-1)}\right),$$

where x_0 and x_i are consumption levels of numeraire and good i, respectively, and $\gamma > 1$ is the elasticity of substitution. The utility function u satisfies the following standard assumptions.

Assumption:

- A1: $u_0 > 0$ and $u_1 > 0$, where u_0 and u_1 are the first-order derivatives of the function u with respect to the first and second arguments respectively.
- A2: The function u is quasi-concave.
- A3: The function u is homothetic.

The budget constraint of the representative individual is given by

$$x_0 + \sum_{i=1}^{n} p_i x_i = 1 + \sum_{j=1}^{n} \pi_j \equiv I, \tag{1}$$

where p_i is the price of good i, π_j is the dividend paid by firm j, and I is the total income. By convention, define the consumption index y and the price index q as follows

$$y = \left(\sum_{i=1}^{n} x_i^{(\gamma-1)/\gamma}\right)^{\gamma/(\gamma-1)}, \qquad q = \left(\sum_{i=1}^{n} p_i^{1-\gamma}\right)^{1/(1-\gamma)}. \tag{2}$$

Assuming interior solution, we can write necessary conditions for utility maximization as

$$x_i = (p_i/q)^{-\gamma} y, \qquad \forall i, \tag{3}$$
$$u_1 = qu_0. \tag{4}$$

A natural way to allow for imperfect markets is to assume that firms use the actual demand function, $x_i(p_i, q, I)$, for profit maximization. With equations (1)-(4), we can write the total differentiations of (inverse) demand functions as follows:

$$\frac{dx_i}{x_i} = -\gamma\frac{dp_i}{p_i} + \left[\gamma y + \frac{u_1u_0 + qy(u_{10}u_0 - u_{00}u_1)}{(u_{11}u_0 - u_{10}u_1) - q(u_{10}u_0 - u_{00}u_1)}\right]\frac{dq}{qy}, \tag{5}$$
$$\frac{dp_i}{p_i} = -\frac{dx_i}{\gamma x_i} + \left[1 + \gamma y\frac{(u_{11}u_0 - u_{10}u_1) - q(u_{10}u_0 - u_{00}u_1)}{u_1u_0 + qy(u_{10}u_0 - u_{00}u_1)}\right]\frac{dy}{\gamma y}, \tag{6}$$

where u_{11}, u_{10}, and u_{00} are the second-order derivatives of the utility function, and we have implicitly assumed that there is no Ford effect; i.e., firms treat the total income I parametrically (see d'Aspremont et al. 1996 for the model with the Ford effect). Firm behavior under equations (5)-(6) is obviously complicated and, in general, is insolvable. In MC, with the assumption that firms are infinitesimal in scale, the impact of each firm on consumption and price indices is zero (i.e., $dq = dy = 0$). This assumption simplifies firm behavior considerably. As mentioned in the introduction, it is possible to relax this assumption and use a weaker assumption. That is, we can simply assume that firms do not take the inter-industry strategic interaction into account.

In a two-sector economy, since the link between the two industries, from consumers' perspectives, is governed by income allocation (i.e., equations (1) and (4)), the assumption that firms do not take inter-industry interaction into account is equivalent to the assumption that firms take the total spending on differentiated goods $E = qy$ as given. Then, the demand and inverse demand functions, that each firm $i = 1, ..., n$ faces, can be written as

$$x_i = \left(\frac{p_i}{q}\right)^{-\gamma}\frac{E}{q}, \tag{7}$$
$$p_i = \left(\frac{x_i}{y}\right)^{-1/\gamma}\frac{E}{y}. \tag{8}$$

It should be noted here that the assumption that firms treat E parametrically holds trivially when there is no Ford effect, and yu_1/u_0 depends only upon the consumption of numeraire x_0. Thus, this paper encompasses the works ignoring the Ford effect and using either Cobb-Douglas utility function (e.g., Yang and Heijdra 1993) or a separable utility function $u = v(x_0) + \log y$.

Under equations (7)-(8), the elasticities of each variety i satisfy

$$\frac{p_i}{x_i}\frac{\partial x_i}{\partial p_i} = -\gamma + (\gamma - 1)\frac{p_ix_i}{E}, \tag{9}$$
$$\frac{x_i}{p_i}\frac{\partial p_i}{\partial x_i} = -\frac{1}{\gamma} - \frac{\gamma - 1}{\gamma}\frac{p_ix_i}{E}. \tag{10}$$

We can tell from equations (9)-(10) that each firm faces a less elastic demand under Cournot competition:

$$\left|\frac{p_i}{x_i}\frac{\partial x_i}{\partial p_i}\right| > \left|\frac{x_i}{p_i}\frac{\partial p_i}{\partial x_i}\right|^{-1}.$$

Singh and Vives (1984, p. 549), who consider Bertrand competition and Cournot competition in a differentiated duopoly, state that the above condition implies that 'Cournot competition is more "monopolistic" than Bertrand competition.' As a result, the markup is higher under Cournot competition (see Proposition 1 in the sequel).

2.2. Firm Behaviors

Firms face an identical linear cost function, $C(x) = cx + f$, where $c > 0$ and $f > 0$ are the marginal cost and fixed cost, respectively. From profit maximization, we obtain

$$\left[1 - \frac{p_i x_i}{E}\left(1 - \frac{c}{p_i}\right)\right] p_i = \frac{\gamma c}{\gamma - 1}, \tag{11}$$

$$\left(1 - \frac{p_i x_i}{E}\right) p_i = \frac{\gamma c}{\gamma - 1}, \tag{12}$$

where equations (11)-(12) are derived under, respectively, Bertrand competition and Cournot competition.

Consider a symmetric case, in which $p_i = p$ and $x_i = x$ for all i. In such case, we can rewrite equation (2) as

$$y = x n^{\gamma/(\gamma-1)}, \qquad q = p n^{1/(1-\gamma)}. \tag{13}$$

Using equations (11)-(13), we can write the markup under Bertrand competition $\mu_b(n)$ and that under Cournot competition $\mu_c(n)$ as

$$\mu_b(n) = \frac{n\mu_{mc} - 1}{n - 1}, \tag{14}$$

$$\mu_c(n) = \frac{n\mu_{mc}}{n - 1}, \tag{15}$$

where $\mu_{mc} = \gamma/(\gamma - 1)$ is the markup under MC.

Proposition 1: Assuming A1-A2, we must have

(i) $\mu_c'(n) < 0$ and $\mu_b'(n) < 0$,

(ii) $\mu_c(n) > \mu_b(n) > \mu_{mc}$ for a given number of firms $n > 1$, and

(iii) $\lim_{n\to\infty} \mu_c = \lim_{n\to\infty} \mu_b = \mu_{mc}$.

The proof follows immediately from equations (14)-(15). (i) states that strategic interaction gives rise to the pro-competition effect; that is, the markups are strictly decreasing with the number of firms. In (ii), as already noted in the previous subsection, the first inequality arises from the fact that demand is more elastic under Bertrand competition. The second inequality, along with (iii), states that each firm under MC sets the lowest possible markup as if the number of firms is infinite and hence a rise in the number of firms makes no difference.

3. Market Outcomes

This section considers market outcomes in both short run and long run. In the short run, there is neither entry nor exit, and the number of firms is fixed. In the long run free entry drives the profit of each firm to zero, and the number of firms is endogenously determined.

3.1. Short-Run Equilibrium

Throughout this section, assume A3; i.e., the utility function u is homothetic in its arguments. Then, from equations (1) and (4), we can obtain the following equations:

$$y = Is(q)/q, \tag{16}$$

$$x_0 = I\left(1 - s(q)\right), \tag{17}$$

where $s(q)$ is the share of spending on differentiated goods. The elasticity of the function $s(\cdot)$, defined by $\theta \equiv s'q/s$, satisfies $\theta = (1-\sigma)(1-s)$, where $\sigma > 0$ is the elasticity of substitution between x_0 and y (see DS, as well as Chang 2012).

In the symmetric equilibrium, we have $I = 1 + (\mu - 1)ncx - fn$ and $qy = npx$. Then, use these equations and equation (16) to obtain

$$I = \frac{(1 - fn)\mu}{(1 - s(q))\mu + s(q)}. \tag{18}$$

Equation (13) and equations (16)-(18) hold in all market structures, including perfect competition, MC, and OC. For comparison, we can use these equations to write the social welfare as a function of (n, μ): $W(n, \mu) \equiv u\left(I\left(1 - s(q)\right), Is(q)/q\right)$, where q and I are given by equations (13) and (18), respectively. Then, we can show that (see Appendix)

$$\text{sign}\left\{\partial W(n, \mu)/\partial \mu\right\} = \text{sign}\left\{1 - \mu\right\}. \tag{19}$$

Consistent with DS, it is clear that the markup under perfect competition is the first-best optimum. We can also tell that the social welfare is strictly decreasing with the markup for $\mu > 1$; that is, the higher the markup, the stronger the price distortion and the lower the social welfare. Then, since we have $\mu_c > \mu_b > \mu_{mc} > 1$, we obtain the following proposition.

Proposition 2: Assuming A1-A3, for a given number of firms $n > 1$, we have

(i) $W(n, 1) \geq W(n, \mu)$ for all $\mu > 0$; and

(ii) $W\left(n, \mu_c(n)\right) < W\left(n, \mu_b(n)\right) < W\left(n, \mu_{mc}\right) < W(n, 1)$.

3.2. Long-Run Equilibrium

Since DS already provide the discussion of the first-best optimum, this subsection only considers the second-best optimum or the constrained optimum.

Each firm under both MC and OC earns zero profit in the long run and, thus, the total income I must equal one. With equation (18), it is straightforward to show that the equilibrium numbers of firms and markups must satisfy the following zero-profit condition

$$\frac{\mu}{\mu-1}=\frac{s\left(c\mu n^{1/(1-\gamma)}\right)}{fn}. \tag{ZPC}$$

Proposition 3: Assuming A1-A3, we have

(i) the long-run equilibrium exists under MC if $\lim_{n\to 1} s\left(c\mu_{mc}\right)>\gamma f$ and exists under OC if $\lim_{n\to 1} s\left(c\mu_{c}\right)>f$ and $\lim_{n\to 1} s\left(c\mu_{b}\right)>f$; and,

(ii) the long-run equilibrium is unique if $\theta(\mu-1)+1>0$.

Proof: With conditions in (i), under both MC and OC, when $n\to 1$, the left-hand side of (ZPC) is strictly lower than the right-hand side. At the same time, as $n\to\infty$, the left-hand side converges to $\gamma>1$, while the right-hand side converges to zero (because s must be lower than one). Thus, there exists at least one equilibrium number of firms $n\in(1,\infty)$.

For the uniqueness, the condition in (ii) guarantees that, for a given μ, the slope of the right-hand side of (ZPC) is strictly lower than that of the left-hand side. Thus, there is a unique number of firms satisfies (ZPC) for a given markup. ■

Conditions in (i) guarantee that when there is only one variety, the monopolist of that variety earns a strictly positive profit in the long run. Thus, the equilibrium number of firms must be strictly higher than one. The condition in (ii), as in DS, states that the Chamberlinian dd curve is more elastic than the Chamberlinian DD curve.[2] This condition ensures a one-to-one relationship between the markup and the number of firms, satisfying (ZPC):

$$\frac{d\mu}{dn}=\left(\theta+\frac{1}{\mu-1}\right)^{-1}\frac{(\theta+\gamma-1)\mu}{(\gamma-1)n}>0.$$

It is noteworthy that although both θ and μ are endogenous variables, the condition in (ii) always holds when θ is nonnegative; i.e., the elasticity of substitution σ is smaller than one. This assumption holds trivially under Cobb-Douglas utility function because $\sigma=1$.

Under either MC or OC, we can write the zero-profit markup as a function of the number of firms, i.e., $\mu_0(n)$ which satisfies $\mu_0'(n)>0$ (see $d\mu/dn$ above). Figure 1 depicts $\mu_0(n)$ and

[2] The DD curve is the actual demand curve, given by $x(p)=Is\left(pn^{1/(1-\gamma)}\right)/pn$. The elasticity is given by (see also DS)

$$\varepsilon_D\equiv-\frac{p}{x}\frac{\partial x}{\partial p}=1-\theta.$$

The dd curve is the demand curve perceived by firms. The elasticity (equation (9)) is given by

$$\varepsilon_d\equiv-\frac{p}{x}\frac{\partial x}{\partial p}=\gamma-\frac{\gamma-1}{n}.$$

With equation (14), it is straightforward to show that condition (ii) in Proposition 3, i.e., $\left(\mu_b-1\right)\theta+1>0$, is equivalent to $\varepsilon_d>\varepsilon_D$.

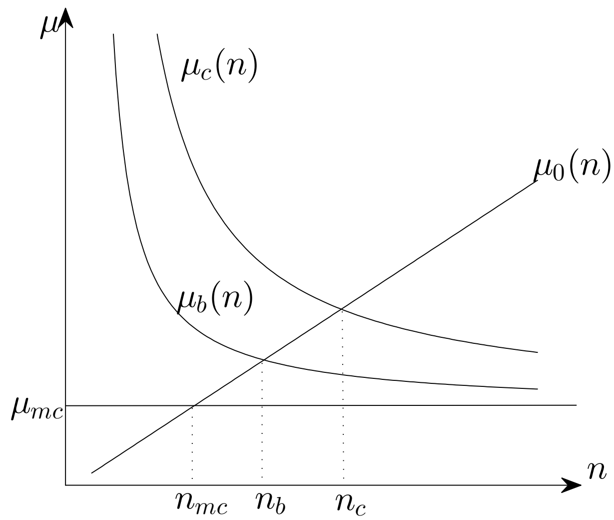

Figure 1: The Long Run Equilibrium.

$\{\mu_{mc}, \mu_b(n), \mu_c(n)\}$.[3] Since $\mu_0'(n) > 0$, as shown in Figure 1, the equilibrium number of firms and the markup under Bertrand competition are strictly lower than those under Cournot competition but are strictly higher than those under MC.

Proposition 4: Let n_c, n_b, and n_{mc} (μ_c^*, μ_b^*, and μ_{mc}^*) be the long-run equilibrium numbers of firms (the long-run equilibrium markups) under respectively Cournot competition, Bertrand competition, and MC. Then, assuming A1-A3, we have $n_c > n_b > n_{mc}$ and $\mu_c^* > \mu_b^* > \mu_{mc}^*$.

Loosely speaking, Proposition 4 states that the higher the markup, the higher the incentive to enter the market, and hence the higher the equilibrium number of firms.

For the welfare comparison, substituting $\mu_0(n)$ into the short-run social welfare function, we can write the long-run social welfare as a function of the number of firms, i.e., $\mathcal{W}(n) \equiv W(n, \mu_0(n))$. We can show that (see Appendix)

$$\text{sign}\{\mathcal{W}'(n)\} = \text{sign}\{\mu_{mc} - \mu_0\}. \tag{20}$$

Since μ_0 is strictly increasing in n and equals μ_{mc} at $n = n_{mc}$, the sign of $\mathcal{W}'(n)$ is identical to the sign of $n_{mc} - n$. This result, along with Proposition 4, immediately gives rise to the following proposition:

[3]Note that we have drawn the zero-profit markup as a straight line without any loss of generality.

Proposition 5: Assuming A1-A3, we have

(i) $\mathcal{W}(n_{mc}) \geq \mathcal{W}(n)$ for all $n > 1$; and,

(ii) $\mathcal{W}(n_c) < \mathcal{W}(n_b) < \mathcal{W}(n_{mc})$.

(i) in Proposition 5 states a well-known result, which has been shown in DS, that MC produces the second-best or constrained optimum. (ii) simply states that the social welfare under Bertrand competition is strictly higher than that under Cournot competition. To understand Proposition 5, note that by definition we have

$$\mathcal{W}'(n) = \frac{\partial W}{\partial n} + \frac{\partial W}{\partial \mu}\mu_0'(n),$$

where $\partial W/\partial \mu < 0$ (since, in the long run, $\mu > 1$). We can tell from the above equation that there are two opposing forces, namely the love for variety and price distortion. When the markup is close to the first-best optimal markup (which equals one) and is strictly smaller than that under MC, the love for variety must be stronger, since the equilibrium number of firms is far from the optimal value which is strictly higher than n_{mc} (see DS and recall that the lower the markup, the lower the equilibrium number of firms). In such case, a rise in the number of firms will raise the social welfare. In contrast, when the markup is strictly higher than that under MC and hence is far from one, price distortion is stronger and, hence, a fall in the markup will raise the social welfare. As it turns out, the love for variety and price distortion offset one another at the equilibrium under MC. Then, since we have $n_c > n_b > n_{mc}$, the social welfare under Bertrand competition must be strictly higher than that under Cournot competition but is strictly lower than that under MC.

To see the above discussion more clearly, we can borrow Benassy's (1996) concept of "taste for variety" (or love of variety) which,[4] with a CES utility function, is given by[5]

$$\nu = \frac{1}{\gamma - 1} = \mu_{mc} - 1.$$

Then, we can rewrite equation (20) as

$$\text{sign}\left\{\mathcal{W}'(n)\right\} = \text{sign}\left\{\nu - (\mu_0 - 1)\right\}.$$

The preceding equation confirms our argument above that the change in the social welfare depends on two opposing effects, namely taste for variety ν and price distortion $\mu_0 - 1$. This fact was demonstrated by Benassy (1996), who discusses the social optimum under monopolistic competition with a general utility function, which encompasses the CES utility function. Our result, applicable to both monopolistic and oligopolistic competition, complements the result of Benassy, who only considers monopolistic competition. Our result makes

[4] Thanks to an anonymous referee for making this suggestion.

[5] Define $V_n(x_1, ..., x_n) \equiv y$ and $v(n) \equiv V_n(x, ..., x)/V_1(nx) = V_n(1, ..., 1)/n$. Benassy (1996, p. 42) states that $v(n)$ "depicts the utility gain derived from spreading a certain amount of production between n differentiated products instead of concentrating it on a single variety." Taste for variety, defined by $\nu \equiv nv'(n)/v(n)$, is the marginal taste for additional variety.

it clear that, with a CES utility function, price distortion dominates the love for variety in any market structure, in which the long-run equilibrium markup is strictly higher than that under MC (see equation (20)). Recall from Proposition 1 that the markup under MC is the lowest possible markup. It follows that price distortion always dominates the love for variety. This explains why MC, with the lowest possible markup, produces the second-based optimum.

4. Concluding Remarks

In this paper, we consider an extension of the DS framework. By ignoring inter-industry strategic interaction, on the one hand, we can retain as much tractability as MC. By allowing for intra-industry strategic interaction, on the other hand, we can differentiate between Bertrand competition and Cournot competition, giving rise to an endogenous markup and the pro-competitive effect.

The idea that firms do not take inter-industry strategic interaction into account, which is in the spirit of Neary's (2003) large-in-small-and-small-in-large assumption, is supported by evidence. In the U.S., for example, Hottman et al. (2016) find that the largest firms sell only 3% of total sales in their sample. Also, although we use a CES preference, the idea in this paper applies to more general preferences.

One problem in this paper—which should be addressed in future works—is that all firms are involved in strategic interaction. In practice, the majority of firms in each sector have trivial market shares, and there are a few large firms with substantial market shares. In the sample of Hottman et al. (2016), for example, the market share of the ten largest firms is around two-thirds, while 98% of firms have the market shares of less than 2%. This evidence suggests that, in each sector, the majority of firms can be monopolistically competitive while a few large firms are oligopolistically competitive. This type of setting is ignored in the literature (one exception is Shimomura and Thisse 2012). The idea that the largest firms ignore inter-industry strategic interaction is arguably applicable in this setting and will also help simplify the analysis and help open the range of applications.

Appendix

Using equation (4), the total derivative of the social welfare function can be simplified to

$$dW(n, \mu) = u_0 \left(dI - Is(dq/q) \right). \tag{A1}$$

From equations (13) and (18), we know that $\partial q/\partial \mu = q/\mu$ and

$$\frac{\partial I}{\partial \mu} = \frac{Is}{\mu \left[(1-s)\mu + s \right]} \left[1 + (1-s)(1-\sigma)(\mu - 1) \right] > 0. \tag{A2}$$

Then, substituting these equations into (A1) yields

$$\frac{\partial W}{\partial \mu} = \frac{(1-s)Is\sigma u_0}{(1-s)\mu + s} \frac{1-\mu}{\mu}.$$

In the long run, because the total income I equals one, we have $dI = 0$. Then, using equation (13) and $\mu_0'(n)$ in the text, we obtain

$$\mathcal{W}'(n) = \left(\theta + \frac{1}{\mu_0 - 1}\right)^{-1} \frac{Isu_0}{n(\mu_0 - 1)} \left(\mu_{mc} - \mu_0\right).$$

Acknowledgments

I am greatly indebted to Kenichi Shimomura, Shigeto Kitano, Tamotsu Nakamura, and two anonymous referees for many valuable comments and suggestions. All errors are of course my own. This work was supported by JSPS KAKENHI Grant Number JP18J11491.

References

d'Aspremont, C., R.D.S. Ferreira, and L.A.Gérard-Varet (1996) "On the Dixit-Stiglitz Model of Monopolistic Competition" *American Economic Review* **86**, 623–629.

Benassy, J.P. (1996) "Taste for Variety and Optimum Production Patterns in Monopolistic Competition" *Economics Letters* **52**, 41–47.

Bertoletti, P. and P. Epifani (2014) "Monopolistic Competition: CES Redux?" *Journal of International Economics* **93**, 227–238.

Bertoletti, P. and F. Etro (2016) "Preferences, Entry, and Market Structure" *RAND Journal of Economics* **47**, 792–821.

Campbell, J. and H. Hopenhayn (2005) "Market Size Matters" *Journal of Industrial Economics* **53**, 1–25.

Chang, W.W. (2012) "Monopolistic Competition and Product Diversity: Review and Extension" *Journal of Economic Surveys* **26**, 879–910.

Dixit, A. and J.E. Stiglitz (1977) "Monopolistic Competition and Optimum Product Diversity" *American Economic Review* **67**, 297–308.

Etro, F. and A. Colciago (2010) "Endogenous Market Structure and Business Cycle" *Economic Journal* **120**, 1201–1233.

Faia, E. (2012) "Oligopolistic Competition and Optimal Monetary Policy" *Journal of Economic Dynamics & Control* **36**, 1760–1774.

Hottman, C.J., S.J. Redding, and D.E. Weinstein (2016) "Quantifying the Sources of Firm Heterogeneity" *Quarterly Journal of Economic* doi:10.1093/qje/qjw012.

Jaimovich, N. and M. Floetotto (2008) "Firm Dynamics, Markup Variations, and the Business Cycle" *Journal of Monetary Economics* **55**, 1238–1252.

Manuszak, M. (2002) "Endogenous Market Structure and Competition in the 19th Century American Brewing Industry" *International Journal of Industrial Organization* **20**, 673–932.

Manuszak, M. and C. Moul (2008) "Prices and Endogenous Market Structure in Office Supply Superstored" *Journal of Industrial Economics* **6**, 94–112.

Neary, J.P. (2003) "Globalization and Market Structure" *Journal of European Economic Association* **1**, 245–271.

Neary, J.P. (2010) "Two and a Half Theories of Trade" *World Economy* **33**, 1–19.

Parenti, M., A. V. Sidorov, J.F. Thisse, and E.V. Zhelobodko (2017) "Cournot, Bertrand or Chamberlin: Toward a Reconciliation" *International Journal of Economic Theory* doi: 10.1111/ijet.12116.

Shimomura, K.I. and J.F. Thisse (2012) "Competition among the Big and the Small" *RAND Journal of Economics* **43**, 329–347.

Singh, N. and X. Vives (1984) "Price and Quantity Competition in a Differentiated Duopoly" *RAND Journal of Economics* **15**, 546–554.

Yang, X. and B.J. Heijdra (1993) "Monopolistic Competition and Optimum Product Diversity: Comment" *American Economic Review* **83**, 295–301.