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Tax Holiday or Advertising:

Which Signal is Most Effective in Attracting Foreign Investment?

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1. Introduction

Although attracting investment from abroad has become a central component of industrial policy for many countries, there are various obstacles to this strategy. One of these is informational asymmetry (Gordon and Bovenberg, 1996; Harding and Javorcik, 2013). Investors incur significant costs in gathering and analyzing information about potential host countries, and often make location decisions on the basis of their subjective informational pool (Charlton and Davis, 2007). Therefore, especially for developing countries that believe they are attractive investment locations but whose reputation is not well established, it is important to convey their attractiveness to foreign investors.

Bond and Samuelson (1986) argue that countries may use tax holidays (i.e., a temporary tax concession on corporate income) for that purpose. They construct a two-period model in which a firm is initially uncertain about the productivity type (high or low) of the country in which it might locate. Bond and Samuelson show that the high-productivity country may be able to distinguish its type and attract the firm by offering very low corporate tax rates or even subsidies in the first period. The high-productivity country can do this because it can recover the initially forgone tax revenues by imposing high taxes in the second period when the true productivity is revealed to the firm. The low-productivity country cannot imitate the high-productivity country because even if it attracts the firm by means of tax holidays, any attempt to recoup the lost revenue in the second period leads the firm, which has learned the country's true type, to leave the country.

A natural question that arises here is whether a tax holiday is really an effective means of signaling a country's attractiveness. Some authors (e.g., Musgrave, 1964) express a skeptical view about the general role of tax concessions granted by developing countries. In addition, in practice, many countries employ investment promotion agencies (IPAs), which engage in campaigns to attract foreign investment. These campaigns include communicating with foreign investors by means such as advertising in the financial media and conducting information seminars. If this communication is sufficiently effective, countries will feel no need to delegate such a signaling role to a tax holiday.

This paper extends the work of Bond and Samuelson (1986) in two ways. First, it considers two alternative signaling devices that the government of a country may use to communicate with investors: tax holidays (Case 1) and advertising (Case 2). The government is assumed to maximize its tax revenue (net of advertising costs). The paper compares the two signaling devices in terms of revenue received.

Second, while Bond and Samuelson consider a country attracting a *single firm*, this study considers a country attracting *divisible* capital because the aim is to focus on a delicate nuance in relation to the amount of investment that tax holidays and advertising may attract. As a by-product, this modified setup yields a sharper result than that of Bond and Samuelson. Their model yields three kinds of equilibria depending upon parametric assumptions: a separating equilibrium with distorted taxation (which is most interesting), a separating equilibrium without distortion, and a pooling equilibrium. The model developed here yields only a separating equilibrium with distortion whenever the country would like to signal its productivity.

Foreign direct investment (FDI) advertising is an issue that has been well covered in the international marketing literature. Some skeptical authors (e.g., Anholt, 2007) argue that advertising a country's image may be perceived as insincere and even as propaganda.[1] In addition, an analysis of the image of Canada recommends that countries should "avoid FDI advertising" on the grounds that investors are too rational to be influenced by it (Papadopoulos and Heslop, 2001).

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1 Wilson and Baack (2012) apply Dunning's (1998) location advantages framework to FDI advertising and show that advertising is not necessarily insincere in practice. They also provide a compact literature review on this area.

However, in another study, the same authors argue that FDI advertising can have a significant influence providing it is done properly (Papadopoulos and Heslop, 2002). Wells and Wint (2000, p. 126) compare the costs of promotional activities by IPAs with those of tax holidays and conclude that the trade-off seems to favor promotion:[2] promotion is cheaper and thus more effective than tax holidays for inviting a certain amount of investment.

Although the issue addressed in this paper (tax holidays vs advertising) is rather interdisciplinary, the analytical method used here is that of theoretical economics; a signaling model of game theory following Bond and Samuelson (1986) is used. The finding of this study, namely, that the trade-off favors tax holidays, does not conform to that of Wells and Wint (2000). An interpretation of this discrepancy is provided in Section 6.

This paper also considers a "no-signaling" case in which the government commits to a certain tax rate before it receives its private information, and does not engage in advertising at all (Case 3). The payoff for the government when it engages in an advertising campaign is compared with that when it does not engage in any signaling. This part of the finding conforms to that in Wells and Wint (2000): advertising dominates non-signaling when the country's *ex ante* reputation for attractiveness among investors is not good, but the country is actually very attractive. This is also discussed in Section 6.

Bond and Samuelson (1986) is not the only paper analyzing the signaling role of tax holidays. Wen (1997) develops a model in which a government signals its propensity for public expenditure through tax holidays. In addition, there are several signaling models in the context of international economics in which governments signal some information to foreign players (e.g., Collie and Hviid, 1993, 1994; Sawaki, 2007). None of these papers addresses the issue of the relative effectiveness of alternative signaling devices a government can use. However, in the context of attracting foreign investment, this is precisely the issue that governments and/or IPAs face on a daily basis.

The rest of this paper is organized as follows. Section 2 describes the setup of the model. Section 3 derives the Signal Sender's objective function and solves the

2 Here, the term "promotion" is narrowly defined: it excludes incentives such as tax holidays.

model under complete information for a benchmark case. Section 4 derives solutions for the tax-holiday case (Case 1), the advertising case (Case 2), and the no-signaling case (Case 3). Section 5 compares the tax revenues in Cases 1–3 and Section 6 presents a discussion of the results. Section 7 concludes. This paper does not examine the case in which the government uses both tax holidays and advertising for the reason explained in a footnote below.

2. Setup of the model

A two-period (t=1,2), two-country (home and foreign) model is considered. Each country has a government. A representative investor resides in the home country and is endowed with K units of divisible capital. The investor can invest abroad in quantity F_t or at home in quantity K-F_t in period t. The home country's reputation is well established, and thus the return R_d on domestic investment is common knowledge. The home government imposes a source-based unit tax τ_d on K-F_t. The home government is supposed to be inactive: τ_d is constant and the same in both periods. This information is also common knowledge.

The foreign country is endowed with zero capital and attracts investment from abroad (i.e., from the home country). The per-period return on F_t takes one of two possible values: R^i (i=H,L), where R^H>R^L. p is defined as the prior probability that the return is high, while 1-p is the probability that it is low.

The foreign government imposes a source-based unit tax τ_t on F_t in period t. When the investor invests F_1 and F_2 in the foreign country with return R^i, the investor's payoffs U_t are:

$$U_1 = R^i F_1 - \tau_1 F_1 - (F_1)^2/2 + R_d \cdot (K - F_1) - \tau_d \cdot (K - F_1) \quad \text{and}$$

$$U_2 = R^i F_2 - \tau_2 F_2 - (F_2 - F_1)^2/2 + R_d \cdot (K - F_2) - \tau_d \cdot (K - F_2).$$

In the above expressions, $(F_1)^2/2$ and $(F_2$-$F_1)^2/2$ denote the mobility costs of capital. The assumption of a quadratic cost function is adopted following Persson and Tabellini (1990), Wen (1997, p. 134), and Bacchetta and Espinosa (1995, p. 113), and seems innocuous because the main argument below does not depend on it.[3]

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[3] In Persson and Tabellini (1990) and Bacchetta and Espinosa (1995), capital mobility cost functions take the form of $F^2/(2\mu)$-γF. The γF term is absorbed in $R^i F_t$ in the proposed model. In addition, assuming $(F_1)^2/(2\mu)$ and $(F_2$-$F_1)^2/(2\mu)$ instead of $(F_1)^2/2$ and $(F_2$-$F_1)^2/2$ in the present model does not alter the main results below. In Wen's (1997) two-period model, there are no mobility costs (or capital adjustment costs in his terminology) in the first period because savings are assumed to be initially liquid. In the current model, as well as in those of Persson and Tabellini (1990) and Bacchetta and Espinosa (1995), such costs are assumed to be incurred whenever capital crosses a national border.

Costs include those related to hiring new employees and adapting to different regulations. They correspond to the fixed costs of capital mobility associated with a sunk-cost explanation of tax holidays (e.g., Doyle and van Wijnbergen, 1994). Bond and Samuelson (1986) also use this fixed-cost setup, but they go further and offer a signaling explanation for tax holidays. The assumption of a continuously convex cost function (instead of fixed costs) is necessary to obtain interior solutions (i.e., $0<F_1, F_2<K$) in the present model.

To simplify the notation below, the *relative* return on foreign investment is defined as $r^i \equiv R^i - (R_d - \tau_d)$ $(i=H,L)$. Because R^i is a random variable while R_d and τ_d are constant, r^i is also a random variable and represents the foreign country's type in terms of productivity. A foreign country with a relative return of r^H (r^L) is a high (low)-productivity country. A country, or its government, with r^H (r^L) is referred to as simply "type H (L)." $\bar{r} \equiv pr^H + (1-p)r^L$ is the *ex ante* expectation about the country type.

Using the definition of r^i, the representative investor's overall payoff in a deterministic environment is expressed as

$$U=U_1+U_2, \tag{1}$$

where $U_1=(R_d-\tau_d)K+r^i F_1-\tau_1 F_1-(F_1)^2/2$ and

$$U_2=(R_d-\tau_d)K+r^i F_2-\tau_2 F_2-(F_2-F_1)^2/2.$$

The foreign government is supposed to be a tax-revenue maximizer. Its payoff is

$$g=g_1+g_2, \tag{2}$$

where $g_1=\tau_1 F_1-A$ and $g_2=\tau_2 F_2$. $A \geq 0$ is the advertising expense paid by the government in Case 2. The discount factor is assumed to be unity, as it does not affect the derivation of the main results. This point is touched on in Section 5.

The timing of the game in Case 1 (the tax-holiday case) is as follows. In period 1, Nature randomly chooses the foreign country's type, r^i $(i=H,L)$, which is the private information of the foreign government. The government selects τ_1, which can be a message about r^i. Observing τ_1, the investor updates their beliefs about r^i and chooses F_1. In period 2, r^i becomes common knowledge because the investor can now compare F_1 with the realized return $r^i F_1$. The foreign government selects τ_2. Then, the investor chooses F_2.

The above timing is summarized in Table 1. In Cases 2 and 3, the sequences of events in period 1 differ from those outlined above, and are explained below. The game in Case 1, as well as in Case 2, is a signaling game in which the foreign government is a Signal Sender and the investor is a Receiver. The solution concept is the Perfect Bayesian Equilibrium (PBE) refined by Cho and Kreps's (1987) intuitive criterion.

Table 1. Timing

	Case 1 (tax holiday)	Case 2 (advertising)	Case 3 (no signaling)
Period 1	▸ Nature picks r^i . ▸ Foreign government selects τ_1 . ▸ Investor chooses F_1 .	▸ Foreign government commits to τ_1 . ▸ Nature picks r^i . ▸ Foreign government selects A . ▸ Investor chooses F_1 .	▸ Foreign government commits to τ_1 . ▸ Nature picks r^i . ▸ Investor chooses F_1 .
Period 2	▸ r^i becomes common knowledge. ▸ Foreign government selects τ_2 . ▸ Investor chooses F_2 .	(The same as in Case 1)	(The same as in Case 1)

3. Derivation of the foreign government's objective

An important step in solving a signaling model is to derive the objective of the Signal Sender (here, the foreign government) as a function of the messages, the belief of the Receiver, and the true type. The analysis proceeds backwards from period 2.

Information is complete in period 2. The investor in this period maximizes U_2 in Eq. (1) with respect to F_2. The first-order condition yields

$$F_2 = r^i - \tau_2 + F_1. \tag{3}$$

F_1 positively affects F_2 because there is an inertia effect through the capital-mobility costs.

Anticipating the above reaction from the investor, the foreign government maximizes $g_2=\tau_2 F_2$ with respect to τ_2. Substituting Eq. (3) into F_2 and solving the first-order condition gives

$$\tau_2=(F_1+r^i)/2. \quad (4)$$

It can be seen that if r^i and/or F_1 are higher, the foreign government can take advantage of this and set higher taxes. Substituting Eq. (4) into Eq. (3) yields

$$F_2=(F_1+r^i)/2. \quad (5)$$

Using Eq. (4) and (5) and conducting a straightforward but tedious calculation, U_2 can be expressed as

$$U_2 =(R_d - \tau_d)K + \frac{(r^i)^2}{8} + \frac{r^i F_1}{4} - \frac{3(F_1)^2}{8}.$$

In period 1, the investor does not know the true r^i. However, the investor updates their belief about it conditional upon the messages received in the previous stage and maximizes the following expectation of U with respect to F_1:

$$E(U)= E\left[(R_d - \tau_d)K + r^i F_1 - \tau_1 F_1 - \frac{(F_1)^2}{2} +(R_d - \tau_d)K + \frac{(r^i)^2}{8} + \frac{r^i F_1}{4} - \frac{3(F_1)^2}{8}\right].$$

The first-order condition yields

$$F_1^* = (5\hat{r} - 4\tau_1)/7, \quad (6)$$

where $\hat{r} \equiv E(r^i) = qr^H + (1-q)r^L$ is the posterior belief. Here, q is the posterior probability that the foreign country has high productivity, updated by the investor after receiving a message from the foreign government. The message is τ_1 in Case 1, A in Case 2, and none in Case 3. From the above calculations, the objective function for the foreign government in period 1 is expressed as follows:

$$g(\tau_1, A, \hat{r}, r^i) = \tau_1 F_1^* - A + \tau_2^* F_2^*, \quad (7)$$

where $F_1^* = \frac{5\hat{r}-4\tau_1}{7}$; $\tau_2^* = F_2^* = \frac{F_1^*+r^i}{2}$. This is the Sender's objective as a function of the messages (τ_1 or A), the belief ($\hat{r}$), and the true type (r^i).

Before proceeding to the Sender's strategy, let us consider the complete-information case as a benchmark in which r^i is common knowledge. In this case, the belief $\hat{r}$ in Eq. (7) is replaced by r^i. In addition, A is set to zero because advertising is meaningless. Thus, the foreign government maximizes $g(\tau_1, 0, r^i, r^i)$ with respect to τ_1. Solving the first-order condition leads to the solution $\tau_1^{i,Com} = (11/48)r^i$, where "Com" stands for complete information. Substituting this into Eq. (4) – (6) yields

$$F_1^{i,Com} = (7/12)r^i \text{ and } \tau_2^{i,Com} = F_2^{i,Com} = (19/24)r^i, \quad i = H, L.$$

To ensure interior solutions, the following assumption is made:

Assumption 1. $r^L > 0$; $r^H < (24/19)\,K$.

The lemma below follows directly from the above results and assumption.

Lemma 1. *Suppose that information is complete.*

(i) *In each period t, a foreign country of type H imposes higher tax rates and attracts larger amounts of investment than one of type L:*

$$\tau_1^{L,Com} < \tau_1^{H,Com};\quad \tau_2^{L,Com} < \tau_2^{H,Com};\quad F_1^{L,Com} < F_1^{H,Com};\quad F_2^{L,Com} < F_2^{H,Com}.$$

(ii) *Each type imposes higher taxes and attracts more investment in period 2 than in period 1:* $\tau_1^{i,Com} < \tau_2^{i,Com}$; $F_1^{i,Com} < F_2^{i,Com}$ $(i=H,L)$.

Using U_1 in Eq. (1) and g_1 in Eq. (2), it can be shown that if there is only one period, rather than two, the optimal tax rate is $r^i/2$. The above $\tau_1^{i,Com}$ is lower and $\tau_2^{i,Com}$ is higher than this rate. This tax profile is similar to those found in the sunk-cost explanation of tax holidays (Doyle and van Wijnbergen, 1994). Bond and Samuelson (1986, p. 824) and Wen (1997, p. 137) show similar results.[4] That is, when there are capital-mobility costs, the country exploits the inertia in terms of capital movement that such costs create and imposes lower taxes in period 1 and higher taxes in period 2.[5] Those two papers (Bond and Samuelson, 1986; Wen, 1997) go beyond this type of tax holiday. Similarly, the tax holiday focused on in this paper is more drastic: the introduction of incomplete information can make the tax profile steeper.

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4 Although the tax profile in Lemma 1(ii) is similar to that in Proposition 1 in Wen (1997, p. 137), the investment profile is different from that in his paper. In Wen's model, $F_1^{i,Com} > F_2^{i,Com}$ (in the notation of the present model) holds due to the assumption that there are no capital-mobility costs in period 1.

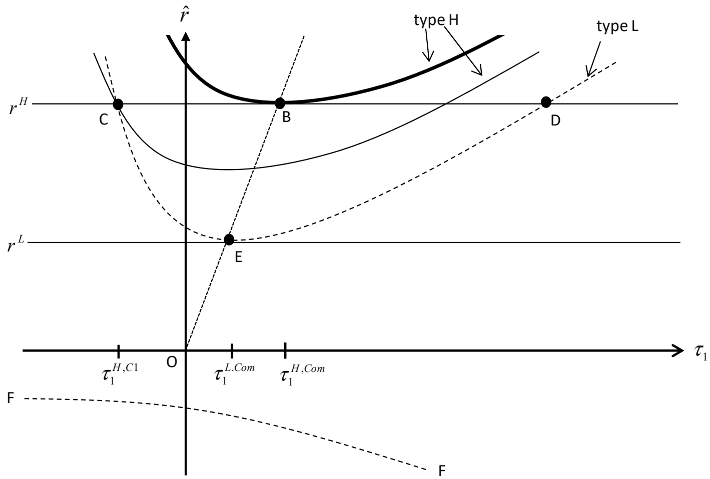
5 In this context, the capital-mobility costs in period 2 are critical. If the first- and second-period costs have functional forms of $(F_1)^2/(2\mu_1)$ and $(F_2 - F_1)^2/(2\mu_2)$ rather than just $(F_1)^2/2$ and $(F_2 - F_1)^2/2$, respectively, it can be shown that $\partial\tau_2^{i,Com}/\partial\mu_2 > 0$ and $\partial\tau_2^{i,Com}/\partial\mu_2 < 0$. That is, if the second-period mobility costs become higher (i.e., μ_2 is lower), the tax profile becomes steeper.

4. Solutions

(4.1. Case 1: tax holidays)

Returning to the incomplete-information case, this subsection considers the event sequence in Case 1, in which the government sets the period-1 tax rate *after* learning about the productivity (Table 1). Advertising A is set to zero, because I want to focus on tax holidays. A key in solving for a PBE is to pursue the Sender's incentive compatibility: neither type H nor type L deviates from sending the specified messages. For that purpose, a typical analytical method is to draw indifference curves for each type in a space with the messages on the horizontal axis and the beliefs (or responses) of the Receiver on the vertical axis. Figure 1 draws such curves using Eq. (7). Solid (dashed) lines represent type H's (L's) indifference curves. The bold line indicates a larger payoff than the thin line. As Appendix 1 shows, these curves satisfy the single-crossing property and therefore the intuitive criterion selects a unique separating outcome. The following proposition summarizes the result.

Figure 1. Case 1 (tax holiday).



Proposition 1 (Case 1: tax holiday). *In the unique intuitive outcome, type L chooses the same tax rate as that under complete information* $\tau_1^{L,C1} = \tau_1^{L,Com}$ *, while type H chooses a lower tax rate than that under complete information* $\tau_1^{H,C1} < \tau_1^{H,Com}$*. This* $\tau_1^{H,C1}$ *is even lower than* $\tau_1^{L,Com}$*.*

The proof and the exact functional form of $\tau_1^{H,C1}$ are given in Appendix 1. The superscript "C1" denotes Case 1.

If information is complete, type H (L) chooses the tax rate corresponding to point B (E) in Figure 1. With incomplete information, type H can no longer choose point B in a separating equilibrium, because type L would then have an incentive to mimic type H by deviating from point E to point B. To prevent such mimicry, type H runs away from type L by lowering its tax rate from $\tau_1^{H,Com}$ (point B) to $\tau_1^{H,C1}$ (point C). I call this difference $\tau_1^{H,Com} - \tau_1^{H,C1}$ a "distortion" in tax.

Type H attracts a large amount of investment in period 1, not only because it signals the true type, but also because of the downwardly distorted tax rate. In particular, this latter feature attracts $F_1^{H,C1} > F_1^{H,Com}$. Combined with the inertia effect of capital, this leads to higher taxes and larger investment for type H in period 2 than under complete information: $\tau_2^{H,C1} = F_2^{H,C1} > F_2^{H,Com} = \tau_2^{H,Com}$. Comparing the taxes in periods 1 and 2, incomplete information gives rise to a steep tax profile for type H:

$$\tau_1^{H,C1} < \tau_1^{H,Com} < \tau_2^{H,Com} < \tau_2^{H,C1}.$$

I identify this steep profile as a tax holiday in this model.

$\tau_1^{H,C1}$ even becomes negative (i.e., subsidies) in many cases. Using Eq. (A2) in Appendix 1, it can be shown that $\tau_1^{H,C1}<0$ as long as $r^H>1.0416r^L$. Thus, in many cases the high-productivity country adopts what Bond and Samuelson call a "stricter" form of tax holiday (i.e., one with a negative period-1 tax).

While the above explanation for tax holidays is similar to that in Bond and Samuelson (1986), there are at least two differences from their results. These differences both stem from the difference in terms of the target the foreign government has in mind: a single firm or divisible capital. The first difference is that in their model, the introduction of incomplete information does not alter the period-2 tax rate. Because the government in their model deals with a single firm, the government sets the period-2 tax that makes the firm indifferent between staying and leaving ($\bar{t}_{2i}$ in their notation). This rate is independent of the informational structure. By contrast, in the present model, $\tau_2^{H,C1} > \tau_2^{H,Com}$ holds because $F_1^{H,C1} > F_1^{H,Com}$, as seen above.

Second, Bond and Samuelson (1986) present three kinds of outcomes depending on the parameters: pooling, separating with distortion (which is most interesting), and separating without distortion. Because the government targets a single firm in their model, there is a limited number of period-1 taxes the government can choose from, even though the tax rate is a continuous variable: the tax rate that makes the firm indifferent between entering or not ($\bar{t}_{1i}$ in their notation), and the lowest tax rate that makes the foreign government participate in the game ($\hat{t}_{1i}$ in their notation). If type L has a strong incentive to mimic type H, this coarseness of the Sender's message space can lead to a situation in which H *cannot* run away from L any longer and give rise to a pooling equilibrium.[6] At the other end of the spectrum, if the incentive to mimic is weak, there can emerge a "no-envy" case, to use Gibbons' (1992, pp. 194–205) terminology, in which type H *does not want to* run away from L at all. Then, a separating outcome without distortion (i.e., an outcome that replicates the complete-information outcome) occurs. In the present model, by contrast, the government targets divisible capital, and hence the message space is continuous in both the nominal and the virtual sense. The Sender's objective function exhibits the single-crossing property, always allowing the intuitive criterion to select the most efficient separating outcome. In addition, because point B falls between points C and D in Figure 1, an "envy" case always takes place, creating a distortion in tax.

For later use, the *ex ante* foreign tax revenue is derived as follows:

$$Eg^{C1} \equiv p \cdot [\tau_1^{H,C1} F_1^{H,C1} + \tau_2^{H,C1} F_2^{H,C1}] + (1-p)[\tau_1^{L,C1} F_1^{L,C1} + \tau_2^{L,C1} F_2^{L,C1}], \tag{8}$$

where $\tau_1^{H,C1}$ is given in Eq. (A2) in Appendix 1 and is negative in many cases. When the type is L, the tax rate becomes $\tau_1^{L,C1} = \tau_1^{L,Com} = (11/48)r^L$. The period-1 investment is $F_1^{H,C1} = (5r^H - 4\tau_1^{H,C1})/7$ or $F_1^{L,C1} = (5r^L - 4\tau_1^{L,C1})/7 = (7/12)r^L$. The period-2 tax and investment are $\tau_2^{i,C1} = F_2^{i,C1} = (F_1^{i,C1} + r^i)/2$ for *i=H,L.*

The next subsection considers the case in which the foreign government signals its type through advertising instead of tax holidays.[7]

6 Even if the message space is not coarse, it is possible in general that a signaling game does not have separating equilibrium and have only pooling or semi-pooling equilibria. See, for instance, Cho and Sobel (1990, Section 5). In this case, the reason is the message space has an upper limit.

7 I have also analyzed the case in which the government can use *both* signaling devices (tax holidays and advertising) simultaneously. This analysis is conducted following Milgrom and Roberts's (1986) multi-dimensional signaling model. However, the result is the same as in Case 1: the government selects tax holidays and does not use advertising. Hence, the analysis is omitted here, and is available from the author on request. This no-advertising result arises from the configuration of the Sender's objective function. Roughly, a case similar to that shown in Figure 4 in Milgrom and Roberts (1986, p. 809) occurs. This has nothing to do with payoff comparisons. Thus, the no-advertising result outlined above does not lessen the importance of the analyses in Subsection 4.2 and Sections 5 and 6 of this paper.

(4.2. Case 2: advertising)

What happens if the foreign country uses advertising rather than tax holidays? To address this question, I assume that the foreign government commits to a period-1 tax rate *before* learning its own type (H or L).[8] After Nature has revealed the type to the government, the government selects the advertising level (A) and then the investor chooses F_1. The event sequence in period 2 is the same as in Case 1 (see Table 1).

As in the signaling literature focusing on advertising (e.g., Milgrom and Roberts, 1986), the investor (i.e., the Receiver) pays attention to the level of A, not its content. This is because the foreign country (i.e., the Sender) always has an incentive to exaggerate its productivity, and thus the content does not transmit any useful information to the investor.

At the advertising stage, the foreign government maximizes $g(\tau_1, A, \hat{r}, r^i)$ in Eq. (7) by choosing A. It is convenient to note here that τ_1, which should be derived after this process, can be specified in advance. This is possible because A is additively separable from the rest of $g(\cdot)$, and hence τ_1 can be determined independently from A. The optimal tax becomes

$$\bar{\tau}_1 \equiv p\tau_1^{H,Com} + (1-p)\tau_1^{L,Com} = (11/48)\bar{r}. \tag{9}$$

To prove this, suppose that $\tau_1 = \bar{\tau}_1$. It is shown below that the advertising stage generates a separating equilibrium in which different types choose different advertising (call them $A^{H,C2}$ and $A^{L,C2}$). Then, it can be shown that $\tau_1 = \bar{\tau}_1$ actually maximizes $Eg = p \cdot g(\tau_1, A^{H,C2}, r^H, r^H) + (1-p) \cdot g(\tau_1, A^{L,C2}, r^L, r^L)$.[9] I set the tax to $\bar{\tau}_1$ in advance, because doing so greatly simplifies the analysis below.

Proceeding to the advertising stage, each type of foreign government chooses $A \geq 0$ to maximize $g(\bar{\tau}_1, A, \hat{r}, r^i)$. Again, indifference curves for each type are drawn in the message-belief diagram, this time with A on the horizontal axis (see Figure 2). Bold (thin) lines indicate that the payoffs are large (small). The payoff becomes larger when A is smaller and/or $\hat{r}$ is larger.[10] Under complete information, type H (L)

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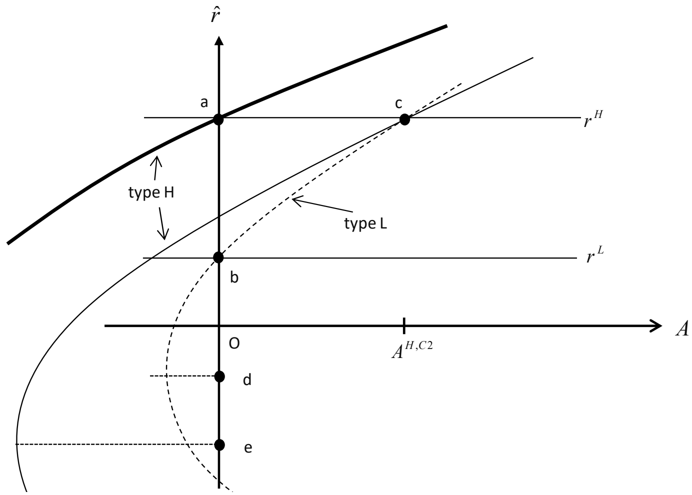
8 If the government were to select taxes *after* learning its type, investors would inevitably expect the tax to reflect that information. Then, the result would be the same as that in Case 1. Alternatively, if taxes were totally abstracted away, the raison d'etre of the government would disappear in this model.

9 It is theoretically possible that assuming some τ_1 different from $\bar{\tau}_1$ generates another type of equilibrium (i.e., pooling or hybrid). However, it can be shown that the optimal tax becomes $\bar{\tau}_1$ irrespective of the equilibrium type.

10 Note that these curves are concave downward, rather than concave upward, in the relevant area of Figure 2. This is because $g(\cdot)$ is quadratic in $\hat{r}$ but linear in A. Related to this, it is noticeable that the optimal advertising under complete information (i.e., zero) is a corner solution.

would choose point a (b) in Figure 2: both types would choose zero advertising.

Figure 2. Case 2 (advertising).



However, if information is incomplete, type H cannot choose point a because that would cause type L to deviate from point b to point a. The following proposition depicts the unique outcome selected by the intuitive criterion.

Proposition 2 (Case 2: advertising). *In the unique intuitive outcome, type L does not engage in an advertising campaign, hence* $A^{L,C2}=0$, *while type H chooses* $A^{H,C2}>0$.

The proof and the functional form of $A^{H,C2}$ are provided in Appendix 2.

The *ex ante* payoff for the foreign government in Case 2 is as follows:

$$Eg^{C2} \equiv p \cdot [\bar{\tau}_1 F_1^{H,C2} + \tau_2^{H,C2} F_2^{H,C2} - A^{H,C2}] + (1-p)[\bar{\tau}_1 F_1^{L,C2} + \tau_2^{L,C2} F_2^{L,C2}], \qquad (10)$$

where $\bar{\tau}_1$ is given in Eq. (9) and $A^{H,C2}$ is given in Eq. (A4) in Appendix 2. The first-period investment is $F_1^{i,C2} = (5r^i - 4\bar{\tau}_1)/7$ and the second-period tax and investment are $\tau_2^{i,C2} = F_2^{i,C2} = (F_1^{i,C2} + r^i)/2$ for *i=H,L.*

Note that the true type is revealed through advertising in period 1, and hence this makes a difference in investment attraction between the types: $F_1^{H,C2} > F_1^{L,C2}$. However, this difference is smaller than in Case 1: $F_1^{H,C2} - F_1^{L,C2} < F_1^{H,C1} - F_1^{L,C1}$. This is because both types commit to the same first-period tax in Case 2, while type H attracts large investment with tax holidays in Case 1.

(4.3. Case 3: no signaling)

Finally, I consider Case 3, in which the foreign government commits to *not* engaging in an advertising campaign by, for example, not creating a promotion agency. Furthermore, the government is supposed to commit to a first-period tax rate before learning its own type (see Table 1). Then, in period 1 the investor will lose the opportunity to infer the foreign country's productivity and must determine their first-period investment based on *ex ante* expectations. By backward induction, it is shown that the period-1 tax rate becomes $\bar{\tau}_1$ in Eq. (9).

The *ex ante* payoff for the foreign government in Case 3 becomes

$$Eg^{C3} \equiv p \cdot [\bar{\tau}_1 \bar{F}_1 + \tau_2^{H,C3} F_2^{H,C3}] + (1-p)[\bar{\tau}_1 \bar{F}_1 + \tau_2^{L,C3} F_2^{L,C3}], \qquad (11)$$

where $\bar{F}_1 \equiv (5\bar{r} - 4\bar{\tau}_1)/7 = (7/12)\bar{r}$; $\tau_2^{i,C3} = F_2^{i,C3} = (\bar{F}_1 + r^i)/2$ for *i=H,L*. Note that the period-1 tax revenue $\bar{\tau}_1 \bar{F}_1$ is the same for both types. The period-2 tax revenue is larger for type H (i.e., $\tau_2^{H,C3} F_2^{H,C3} > \tau_2^{L,C3} F_2^{L,C3}$) because the true type is revealed in period 2. However, this difference is smaller than those in Cases 1 and 2 because $\bar{F}_1$ is common. The advantage of no signaling is that there is no need to pay the cost of distortion, while the disadvantage is that it is impossible for type H to signal its true type in period 1.

5. Comparison of *ex ante* payoffs

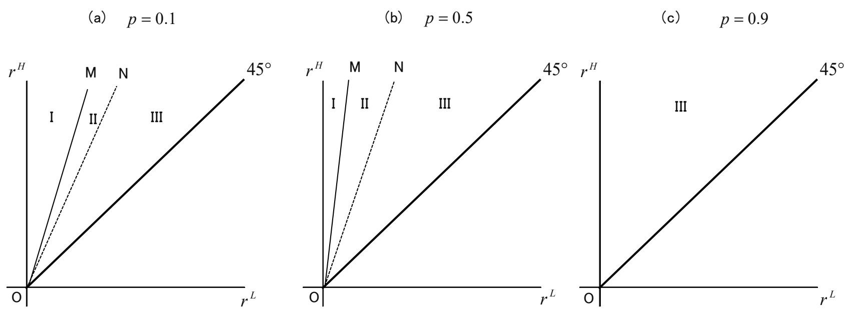
Which case generates the highest payoff for the foreign government? A comparison of Eq. (8) and (10) yields the following proposition. The proof is in Appendix 3.

Proposition 3. $Eg^{C1} > Eg^{C2}, \qquad \forall p, r^H, r^L.$

That is, tax holidays are always superior to advertising. In Case 1, both types set low taxes in period 1. Type H does so by distorting its tax downward (or even by providing subsidies in many cases). Type L also sets a lower tax rate in Case 1 than it does in Case 2.[11] While these low tax rates imply a large cost for the government in period 1, they have the benefit of attracting a larger amount of capital. The latter raises *both* the second-period tax and investment with the help of the capital-inertia effect, and increases the period-2 revenue in a quadratic order.[12]

What happens if some discount factor δ<1 is introduced to the foreign government's objective in Eq. (2)? Is the relationship between the magnitude of Eg^{C1} and Eg^{C2} altered if δ is small? This analysis produces results *not* qualitatively different from those presented above: even if δ is small, tax holidays dominate advertising. Certainly, a small δ lessens the importance of the second-period payoff and reduces the benefit of tax holidays compared with advertising. However, it also reduces the incentive for type L to mimic type H. In Case 1, the distance between points B and C narrows in Figure 1, and hence the distortion in taxes is reduced. This effect on $\tau_1^{H,C1}$ is greater than the effect on $A^{H,C2}$. As a result, the cost–benefit balance of signaling in Cases 1 and 2 is not significantly affected by the introduction of δ, and Proposition 3 remains intact.

Figure 3. Payoff comparisons.



Next, I take Case 3 (no-signaling case) into consideration. Figure 3 divides the (r^L, r^H) space into areas according to the relationship between the magnitude

11 Note that $\bar{\tau}_1$ falls somewhere between points E and B in Figure 1, with its exact location being determined by p.

12 This result is also attributable to the implicit assumption of interior solutions: $g^i = g_1^i + g_2^i > 0$. That is, the parameters are restricted so that they induce the government's participation in the game. If fictitious cases of $g^i < 0$ are allowed, it is possible to have $Eg^{C1} < Eg^{C2}$.

of the *ex ante* payoffs. Because $0<r^L<r^H$, the space above the 45°line in the first quadrant is relevant. Because Proposition 3 indicates that there is no possibility of $Eg^{C1} < Eg^{C2}$, the relevant space can be divided into the following three areas:

Area I: $Eg^{C1} > Eg^{C2} > Eg^{C3}$

Area II: $Eg^{C1} > Eg^{C3} > Eg^{C2}$

Area III: $Eg^{C3} > Eg^{C1} > Eg^{C2}$.

In the above, Eg^{C3} rises by one position in the ranking with each step from Area I to Area III. Using these areas, the following proposition outlines the payoff result (see Figure 3). The proof is in Appendix 4.

Proposition 4.

(i) *When p is low, Area III occupies a relatively small space in Figure 3 compared with when p is high.*

(ii) *When p rises, the border lines OM and ON shift in a counterclockwise direction.*

(iii) *When p>0.82, Area III covers all of the space.*

A low p implies that the country's *ex ante* reputation among investors is not good. It makes $\bar{r}$ low, and decreases the investment attraction $\bar{F}_1$, which depends proportionally on $\bar{r}$. Combined with a large weight (1−p) on type L's payoff, it follows that Eg^{C3} in Eq. (11) becomes small. That is why Area III is relatively small compared with when p is large.

When p rises, $\bar{r}$, and thus $\bar{F}_1$, becomes larger. This raises both $\tau_2^{i,C3}$ and $F_2^{i,C3}$ through the inertia effect, and hence increases the second-period revenue in a quadratic order. In addition, type H's payoff receives a higher weight in Eq. (11). Therefore, Eg^{C3} becomes larger. Conversely, the impact of an increase in p on Eg^{C1} or Eg^{C2} is relatively mild. In Case 1, its impact is only through the change in the weights (p and 1−p) in Eq. (8). In Case 2, a rise in p even serves to decrease, rather than increase, $F_1^{i,C2}$ through a higher $\bar{\tau}_1$, albeit by a small amount. Therefore, when p is higher, Area III becomes larger. That is, when the country's *ex ante* reputation among investors improves, the no-signaling strategy is more likely to become the best choice.

6. Discussion

This section compares the above results with results from previous empirical studies. Regarding whether reducing corporate income taxes is effective in attracting foreign investment, mixed empirical results are obtained. While some authors argue that low taxes are critical for that purpose, others say that taxes are only of second-order importance (e.g., Markusen, 2002).[13] A lesson from the present paper may be that it is important to distinguish between the signaling and post-signaling phases. The relationship between taxes and investment attraction is non-monotonic in this model. In Case 1, the high-productivity country attracts considerable investment with a very low tax rate in the signaling phase, while the same country attracts even more investment with a *higher* tax rate in the post-signaling phase.[14]

Regarding the promotional activities of IPAs, as opposed to tax holidays, Wells and Wint (2000) and Morisset and Andrews-Johnson (2004) stress their effectiveness in terms of attracting investment. Morisset and Andrews-Johnson's empirical analysis presents two key findings. First, promotional expenditure by IPAs is positively associated with attracting foreign investment. Second, investment promotion is more likely to be useful in a country with a better business environment. These results are supported by the present model, but in a rather extreme way. As shown in Case 2, only the high-productivity country engages in an advertising campaign and attracts more investment than the low-productivity country.

Louis T. Wells states that image-building activities by IPAs provide a lower return for large countries that are already well known and regularly tracked by investors (Morisset and Andrews-Johnson, 2004, Foreword, p. iv). At first glance, this statement may seem to contradict the second result of Morisset and Andrews-Johnson noted above, but it does not, because it is about the *ex ante* image of the country, not the actual business environment. Indeed, Morisset and Andrews-Johnson (2004, p. 35) clarify the distinction between these notions, stating that "to be effective, image-building activities should be pursued only if the image of a country is actually worse than the real conditions on the ground…." A similar result is obtained in the present model. Recall that a certain space is covered by Area I, in

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13 See, for instance, Voget (2015) for a recent literature survey.

14 In this respect, it is noticeable that Klemm (2009) empirically find that longer tax holidays are effective in attracting foreign investment.

which $Eg^{C2} > Eg^{C3}$, when p is small. As seen in Figure 3(a), the space covered by Area I represents the space in which r^H is much larger than r^L. That is, advertising is likely to dominate non-signaling when productivity is very high (i.e., $r^H >> r^L$) but the country's *ex ante* reputation is bad (i.e., p is low).

Although it has been shown that there are several similarities between the results in previous empirical studies and the present model, there is also a critical discrepancy. Wells and Wint (2000, pp. 126–129) compare promotion by IPAs with tax holidays and conclude that the trade-off seems to favor promotion. They conduct a simulation that estimates the costs of promotion and tax holidays per job created using data from several countries. They compare these costs and show that promotion is more cost-effective. This seems to contradict the result of Proposition 3 in the present paper.

There are at least two reasons for this discrepancy. First, Wells and Wint (2000) regard the tax concessions in tax holidays as pure costs in their simulation. In a similar vein, if $\bar{\tau}_1 - \tau_1^{H,C1}$ and $A^{H,C2}/F_1^{H,C2}$ (i.e., the first-period costs of signaling per attracted investment) are compared in this model, it can be shown that the former dominates the latter. However, from a longer-term perspective, tax holidays more than pay off: they attract more investment and thereby increase revenue in the post-signaling period.

Second, there is a difference in the scope of promotional activities under consideration. Wells argues that the empirical analysis by Morisset and Andrews-Johnson provides further evidence of the dominance of promotion over tax holidays (Morisset and Andrews-Johnson, 2004, Foreword, p. xi). However, the investment promotion that Morisset and Andrews-Johnson consider comprises four types of activities: (1) image building, including advertising; (2) investment generation, including direct mail and industry-specific seminars; (3) investment servicing, including counseling; and (4) policy advocacy, including participation in policy task forces.[15] Indeed, Morisset and Andrews-Johnson find that policy advocacy is the most cost-effective means of attracting investment.[16] By contrast, the activity this model analyzes is mainly focused on image building.

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15 This classification was originally proposed by Wells and Wint (2000).

16 This finding is somewhat surprising, because it is natural to expect a long period of time and various difficulties before such efforts are rewarded.

7. Conclusion

What strategy should a country pursue to attract investment from abroad when its image among investors is not well established? To address this question, this paper compared the *ex ante* payoffs when a country signals its productivity through either tax holidays or advertising, or sends no signal. A few results consistent with previous empirical findings were obtained. In particular, advertising dominates non-signaling when the ex ante image of a country among investors is not good but its productivity is high. However, the comparison between tax holidays and advertising generates a somewhat controversial result: the trade-off favors tax holidays. Although this result may seem to contradict the previous discussion stressing the importance of activities by IPAs, it should be taken with a grain of salt. This paper has focused on a very limited aspect of investment promotion: image building through advertising. Establishing a formal theory explaining other aspects might be a promising area for future research.

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Appendix 1. The proof of Proposition 1.

The indifference curves for each Sender type are expressed as

$$g(\tau_1, 0, \hat{r}, r^i) = G, \quad i = H, L, \tag{A1}$$

where the functional form of the LHS is given in Eq. (7), and the RHS is some constant value. This equation represents hyperbolic curves in the (τ_1, $\hat{r}$) space. Solving Eq. (A1) for $\hat{r}$ yields

$$\hat{r} = \frac{-10\tau_1 - 7r^i \pm 14\sqrt{(\tau_1)^2 + r^i\tau_1 + G}}{5}.$$

The lower solution has a shape like the line segment FF in Figure 1 and is neglected; only the higher solution is relevant.

In a separating equilibrium, type L chooses the same period-1 tax as under complete information $\tau_1^{L,Com}$ (point E in Figure 1) because no type wants to mimic L. Hence, the equilibrium payoff for type L is the same as that under complete information:

$g(\tau_1^{L,Com}, 0, r^L, r^L) = (73/96)(r^L)^2.$

Next, I derive the taxes corresponding to points C and D in Figure 1. Solving $g(\tau_1, 0, r^H, r^L) = (73/96)(r^L)^2$ for τ_1 yields

$$\tau_1 = \frac{25r^H - 14r^L \pm 7\sqrt{5(r^H - r^L)(5r^H + 9r^L)}}{48}. \quad \text{(A2)}$$

The lower (higher) solution corresponds to point C (D). By simple subtraction, it is shown that the tax selected by type H under complete information, $\tau_1^{H,Com}(= (11/48)r^H)$, falls between these two solutions. Thus, point B always comes between points C and D, giving rise to the "envy" case: if type H were to select $\tau_1^{H,Com}$, type L would envy type H. Note that if $r^H \to r^L$, the taxes corresponding to points B, C, D, and E all converge to $(11/48)r^L$.

Next, I check whether the single-crossing property is satisfied or not. Totally differentiating Eq. (A1) yields the slope of each indifference curve:

$$\frac{d\hat{r}}{d\tau_1} = -\frac{\partial g/\partial \tau_1}{\partial g/\partial \hat{r}}.$$

Taking a derivative of the slope with respect to r^i gives

$$\partial\left(\frac{d\hat{r}}{d\tau_1}\right)/\partial r^i = \left(\frac{5}{14}\right)F_1^*/\left(\frac{\partial g}{\partial \hat{r}}\right)^2 > 0.$$

Hence, the single-crossing property is satisfied with a positive sign. This sign implies that when the payoff for type H is gradually reduced from the complete-information level, its indifference curve reaches point C *before* it reaches point D, as in Figure 1. Because this model has only two types and satisfies the single-crossing property, the intuitive criterion selects the unique separating outcome, in which type H levies $\tau_1^{H,C1}$, defined as the lower solution in Eq. (A2).

Appendix 2. The proof of Proposition 2.

The indifference curves for each Sender type are expressed as

$$g(\bar{\tau}_1, A, \hat{r}, r^i) = G, \quad i = H, L, \quad \text{(A3)}$$

where the LHS comes from Eq. (7) and the RHS is some constant payoff. Solving Eq. (A3) for $\hat{r}$ yields

$$\hat{r} = \frac{-10\bar{\tau}_1 - 7r^i \pm 14\sqrt{(\bar{\tau}_1)^2 + r^i\bar{\tau}_1 + A + G}}{5}, \quad i = H, L.$$

Of the two solutions, only the higher one is relevant, because the lower one is negative. $\hat{r} = \frac{-10\bar{\tau}_1 - 7r^i}{5}$, which is a part of the above solutions, corresponds to points d and e in Figure 2.

In a separating equilibrium, type L chooses $A^{L,C2}$=0 as under complete information (point b in Figure 2), because no type wants to mimic L. However, type H cannot choose an advertising level between points a and c in Figure 2, because doing so induces type L's deviation. The advertising level corresponding to point c is derived by solving the following equation for A:

$$g(\bar{\tau}_1, A, r^H, r^L) = g(\bar{\tau}_1, 0, r^L, r^L),$$

where the RHS is the equilibrium payoff for type L. The solution is

$$A^{H,C2} = \frac{5}{49}(r^H - r^L)\left(5\bar{\tau}_1 + \frac{5}{4}r^H + \frac{19}{4}r^L\right). \quad \text{(A4)}$$

Note that if $r^H \rightarrow r^L$, $A^{H,C2}$ converges to zero.

Next, I check the single-crossing property. Totally differentiating Eq. (A3) yields the slope of each indifference curve:

$$\frac{d\hat{r}}{dA} = -\frac{\partial g/\partial A}{\partial g/\partial \hat{r}}.$$

Taking a derivative of the slope with respect to r^i leads to

$$\partial\left(\frac{d\hat{r}}{dA}\right)/\partial r^i = \left(-\frac{5}{14}\right)/\left(\frac{\partial g}{\partial \hat{r}}\right)^2 < 0.$$

It follows that the intuitive criterion selects the most efficient separating outcome, in which type H chooses $A^{H,C2}$ in Eq. (A4) (point c in Figure 2).

Appendix 3. The proof of Proposition 3.

Equating Eg^{C1} in Eq. (8) with Eg^{C2} in Eq. (10) and solving this equation for r^H yield two solutions: $r^H = r^L$ and $r^H = k(p)r^L$, where

$$k(p) \equiv \frac{184041p^2 - 600600p + 2218720}{184041p^2 - 600600p - 470400}.$$

I have confirmed this calculation using the computational software *Mathematica*. The former solution corresponds to the 45°line in Figure 3. It can be shown that $k(p) < 0$, $\forall p \in [0,1]$. Hence, the straight line $r^H = k(p)r^L$ does not cross the relevant area in Figure 3 (i.e., the area above the 45°line in the first quadrant). The fact that $\left.\frac{\partial(Eg^{C1} - Eg^{C2})}{\partial r^L}\right|_{r^H = k(p)r^L} > 0$ and the continuity of the functions prove Proposition 3.

Appendix 4. The proof of Proposition 4.

Solving $Eg^{C2} = Eg^{C3}$ for r^H yields the following two solutions:

$r^H = r^L$ and $r^H = m(p)r^L$, where $m(p) \equiv \frac{511-283p}{168-283p}$.

The latter solution corresponds to line OM in Figure 3.

Solving $Eg^{C1} = Eg^{C3}$ for r^H yields the following three solutions:

$r^H = r^L$, $r^H = \frac{n_2(p)-n_3(p)}{n_1(p)} r^L$, and $r^H = \frac{n_2(p)+n_3(p)}{n_1(p)} r^L \equiv n(p)r^L$, where $n_1(p) \equiv 40_p - 49_p{}^2$, $n_2(p) \equiv -49p^2 + 110p - 40$, and $n_3(p) \equiv 40\sqrt{1-p}$.

The second solution has a negative coefficient for any $p \in [0,1]$, and hence the corresponding straight line does not cross the relevant area in Figure 3. The third solution corresponds to line ON. If p rises from zero, both $m(p)$ and $n(p)$ increase, maintaining the relationship $m(p) > n(p)$. If $p \to 168/283 \approx 0.59$, $m(p) \to \infty$, and hence Area I disappears. If $p \to 40/49 \approx 0.82$, $n(p) \to \infty$, and hence Area II disappears.

Finally, $\left.\frac{\partial(Eg^{C3}-Eg^{C2})}{\partial r^L}\right|_{r^H=m(p)r^L} > 0$ and $\left.\frac{\partial(Eg^{C3}-Eg^{C1})}{\partial r^L}\right|_{r^H=n(p)r^L} > 0$ complete the proof.

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