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Biased-Manager Hiring in a Market with Network Externalities and Product Compatibility

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Abstract: This paper studies biased-manager hiring in a market with network externalities and product compatibility. We show that the aggressivity of a biased manager has a non-linear relationship with product compatibility; however, since both owners want to hire aggressive managers, product compatibility is irrelevant to the type of manager the owner hires. In Cournot competition, product compatibility is crucial in alleviating the "prisoner's dilemma" due to the net network effect of network externalities with product compatibility. In Bertrand competition, the "prisoner's dilemma" is resolved when the augmented net network effect of product compatibility is large.

Keywords: network externalities; product compatibility; biased manager; Bertrand; Cournot

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1. Introduction

Empirical studies have analyzed the impact of manager characteristics (narcissism, overconfidence, and others) on corporate performance (Kaplan et al., 2022; Donker et al., 2023), while the theoretical exploration is scanty.

Predicting the market size has become a critical aspect of a manager's role as a strategic decision maker. However, overconfidence (underconfidence) of a manager often occurs in marketing management predictions. Englmaier and Reisinger (2014) first provided theoretical support for manager bias in the context of strategic delegation. They argued that owners always hire aggressive managers irrespective of competition modes due to the biased managers acting as a strategic commitment device to grab a higher market share. Several papers extended Englmaier and Reisinger's (2014) framework considering vertically related markets in Meccheri (2021), relative-performance and endogenous market structure in Nakamura (2014, 2019), network externalities in Choi et al. (2023), and tax pass-through and incidence in Wang et al. (2025).

The presence of network externalities in the product market will affect the consumers' willingness to pay due to network effects, and firms' competition and cooperative behaviors (Katz & Shapiro, 1985). Choi et al. (2023) showed that if the strength of the network externalities is larger than a critical value, the well-known "prisoner's dilemma" result of strategic delegation does not apply under Cournot and Bertrand competition when firms commit themselves by hiring biased managers.[1] In their analysis, the subtle role of product compatibility in resolving the "prisoner' dilemma" was not considered. Product compatibility choice refers to decisions made by managers regarding which products, technologies, or standards to use within their network systems. For example, if two units of hardware can utilize identical units of software, they are said to be compatible (Katz & Shapiro, 1986). Several theoretical analyses have delved into the effect of product compatibility (See Shrivastav, 2021; Buccella et al., 2022, 2023). Product compatibility plays an important role in affecting the strategic choice, governance, and performance of firms.

In this paper, we provide a strategic analysis of biased-manager hiring by considering the degree of product compatibility and exploring the prisoner's dilemma under managerial delegation. We show that the aggressivity of biased managers has a non-linear relationship with product compatibility, and product compatibility is irrelevant to the type of manager the owner hires. In Cournot competition, both owners want to hire aggressive managers; furthermore, owners will hire more aggressive managers with higher product compatibility if network externalities are sufficiently large. The higher the network compatibility, the greater the critical value of product differentiation, which is helpful in alleviating the "prisoner's dilemma" due to a larger net network effect of network externalities with product compatibility. In Bertrand competition, we confirm the robustness of Englmaier and Reisinger (2014) and Choi et al. (2023), in which if firms compete in prices, the owners will hire more aggressive managers, even if the products are fully compatible. The "prisoner's dilemma" will be resolved if network externalities are small with an appropriate degree of product compatibility.

The rest of this paper is structured as follows. In Section 2, we present the basic model. Section 3 studies the scenario of Cournot competition, while Section 4 studies the same issue under Bertrand competition. Section 5 presents the concluding remarks.

2. The Model

Consider the utility function of the representative consumer in the network goods market with product compatibility as in Shrivastav (2021):

$$U = a(q_1 + q_2) - \frac{{q_1}^2 + {q_2}^2 + 2\gamma q_1 q_2}{2} + n\left((y_1 + \eta y_2)q_1 + (y_2 + \eta y_1)q_2 - \frac{{y_1}^2 + {y_2}^2 + 2\eta y_1 y_2}{2}\right) \quad (1)$$

The linear inverse demand is given by

$$p_i = a - q_i - \gamma q_j + n\left(y_i + \eta y_j\right) \;\; i,j = 1,2 \quad (2)$$

where $a > 0$ is the demand intercept; q_i denotes the quantity of firm i's production; and y_i denotes the consumer's expectation regarding firm i's total sales. $\gamma \in (0,\ 1)$ measures the product differentiation, where the smaller γ is, the lower the substitutability of products, resulting in less competition; parameter $n \in [0,\ 1]$ measures the effect of network externalities, where the larger n is, the higher the consumers' willingness to pay; and $\eta \in [0,\ 1]$ measures the product compatibility of firm i's network with firm j's network. When $\eta = 1$, the products are fully compatible, and $\eta = 0$ means that the product is fully incompatible. The augmented net network effect of product compatibility leads to a rise in demand.

The direct demand is expressed as

$$q_i = \frac{a - p_i + (a - p_j)\gamma + n\left(y_i(1 - \gamma\eta) - y_j(\gamma - \eta)\right)}{1 - \gamma^2} \; i,j = 1,2 \quad (3)$$

The firms' profits are

$$\pi_i = (p_i - c)q_i \; i,j = 1,2 \quad (4)$$

where c is the marginal production cost, and we assume $c = 0$; without loss of generality, we assume $a = 1$. Following Katz and Shapiro (1985) and Hoernig (2012), the consumer's expectations satisfy 'rational expectations', and for a given consumption bundle (q_1, q_2), utilities reach their highest level if consumers' expectations are correct (i.e., if $q_1 = y_1,\ q_2 = y_2$).

In particular, if the firm i hires a manager of type k_i, from (2) and (3), and replace a with k_i, the direct and inverse demand functions perceived by managers are as follows:

$$\hat{q}_i = \frac{k_i - p_i - (k_j - p_j)\gamma + n\big(y_i(1-\gamma\eta) - y_j(\gamma-\eta)\big)}{1-\gamma^2}\hat{p}_i = k_i - q_i - \gamma q_j + n\big(y_i + \eta y_j\big)\ i, j = 1, 2 \tag{5}$$

where k_i is the demand intercept recognized by the biased managers. According to Englmaier and Reisinger (2014), a manager is aggressive when they produce a larger quantity or sets a lower price than the one justified by the market demand; that is, a conservative manager is therefore associated with $k_i < 1$ (the market is too small) in Cournot competition and $k_i > 1$ (the market is too large) in Bertrand competition. Hiring an aggressive manager under Bertrand competition implies hiring a manager with $k_i < 1$, because a manager who believes that the demand intercept is lower than the actual market size will then set a lower price. Under Cournot competition, a manager who believes that the demand intercept is higher than the actual market size will then set a higher output, that is, $k_i > 1$.

There is a two-stage game as follows. In the first stage, each owner of the firm decides the type of manager to maximize its own profit. In the second stage, each manager of the firm maximizes its own profit given the demand function that they believe the firm faces.

3. Cournot Competition

Backward induction is employed to solve the subgame perfect Nash equilibrium. In the second stage, each manager chooses outputs to maximize the profit. From the first-order condition, $\frac{\partial\hat{\pi}_i}{\partial q_i} = 0$, with rational expectation $(q_1 = y_1,\ q_2 = y_2)$, we have

$$q_i = \frac{k_i(2-n) - k_j(\gamma - n\eta)}{(2-n-\gamma+n\eta)(2-n+\gamma-n\eta)}\ i, j = 1,\ 2 \tag{6}$$

Substituting q_i into π_i obtains

$$\pi_i = \frac{\big(k_i(2-n) - k_j(\gamma-n\eta)\big)\begin{pmatrix} 4 - \gamma(k_j+\gamma) - n\big(4 - n - k_j\eta - 2\gamma\eta + n\eta^2\big) \\ -k_i\big(2-\gamma^2 - n\big(3 - 2\gamma\eta - n(1-\eta^2)\big)\big) \end{pmatrix}}{(2-n-\gamma+n\eta)^2\big(2+\gamma-n(1+\eta)\big)^2} \tag{7}$$

In the first stage, each owner decides the type of manager to maximize profit. From the first-order condition, $\frac{\partial\pi_i}{\partial k_i} = 0$, we have

$$k^{CB} = 1 + \frac{\gamma^2 + n\big(2 - 2\gamma\eta - n(1-\eta^2)\big)}{4 + (2-\gamma)\gamma + n^2(2-\eta)(1+\eta) - n(6+\gamma+2\eta-2\gamma\eta)} \tag{8}$$

where the superscript "CB" denotes Cournot competition with the biased manager.

We find $k^{CB} > 1$ and have Lemma 1.

Lemma 1. *In Cournot competition with network externalities and product compatibility, both owners want to hire aggressive managers, that is,* $k^{CB} > 1$ *with* $1 \geq n \geq 0$ *and* $1 \geq \eta \geq 0$.

Taking a partial differentiation on k^{CB} with respect to η, we have

$$\frac{\partial k^{CB}}{\partial \eta} = \frac{(n-2)n\left(\gamma(4+\gamma)+n^2(1+\eta)^2-2n(1+\gamma+(2+\gamma)\eta)\right)}{(4+(2-\gamma)\gamma+n^2(2-\eta)(1+\eta)-n(6+\gamma+2\eta-2\gamma\eta))^2} > 0, \quad \text{if } n > n_{CB} \equiv \frac{1+\gamma+2\eta+\gamma\eta-\sqrt{(1+2\eta)^2-2\gamma(1+\eta)}}{(1+\eta)^2} \tag{9}$$

The condition $\eta > \eta_{CB} \equiv \frac{n(2-n+\gamma)-\sqrt{2}\sqrt{(2-n)n^2}}{n^2}$ or $\gamma < \gamma_{CB} \equiv n(1+\eta) - 2 + \sqrt{4-2n}$ is equivalent for the validity of (9) to be positive.

Equation (9) is stated in Proposition 1.

Proposition 1. *In Cournot competition, the owners will hire more aggressive managers with higher product compatibility if the strength of network externalities is sufficiently large, that is,* $\frac{\partial k^{CB}}{\partial \eta} > 0$, *if* $\eta > \eta_{CB}$.

Both owners want to hire more aggressive managers when product compatibility is higher and the network externalities are sufficiently large. In this paper, two effects of product compatibility influence the competition between two firms. Product compatibility strengthens the network externality effect and increases consumers' willingness to pay. Product compatibility weakens product differentiation and intensifies the competition between two firms. But, since the effect of the previous one is smaller than the effect of the later one, the owners will hire more aggressive managers.

Choi et al. (2023) did not consider the implications of product compatibility in their analysis. The product is partially compatible, i.e., $\eta = \gamma$. We instead consider whether product compatibility affects the hiring of biased managers. Comparing the manager types between two extreme scenarios, partial compatibility ($\eta = \gamma$) and complete incompatibility ($\eta = 0$), for better understanding the impact of product compatibility,

$$\begin{aligned} k^{CB}(\eta = 0) > k^{CB}(\eta = \gamma) \quad \text{if} \quad 0 < n < \hat{n}_C \equiv \frac{2+\gamma(4+\gamma)-\sqrt{4+\gamma^3(4+\gamma)}}{2(1+\gamma)} \\ k^{CB}(\eta = 0) < k^{CB}(\eta = \gamma) \quad \text{if} \quad \hat{n}_C < n < 1 \end{aligned} \tag{10}$$

Proposition 1 points out that, in Cournot competition, if the products are completely incompatible ($\eta = 0$), the owners will hire more aggressive managers than when the products are partially compatible ($\eta = \gamma$) under a weak spillover effect of network externalities ($0 < n < \hat{n}_C$). From the utility function, we can see that products' incomplete compatibility weakens the network externalities, which affects the improvement in consumer utility. Hence, when the spillover effect of network externalities is weak, the spillover effect under complete incompatibility is sufficiently weaker, and the owner needs to hire more aggressive managers to increase its output. On the contrary, if network externalities are strong, owners may hire less aggressive managers under less market competition pressure.

The firms' profits are

$$\pi^{CB} = \frac{(2-n)\left(2-\gamma^2-n\left(3-2\gamma\eta-n\left(1-\eta^2\right)\right)\right)}{(4+(2-\gamma)\gamma+n^2(2-\eta)(1+\eta)-n(6+\gamma+2\eta-2\gamma\eta))^2} \tag{11}$$

We first investigate whether, if the owners do not hire the managers, the profits are $\pi^{CU} = \frac{1}{(2-n-\eta n+\gamma)^2}$. We obtain

$$\pi^{CB} > \pi^{CU}, \text{ if } \gamma < \hat{\gamma} \equiv \frac{\sqrt{2}\sqrt{(n-2)(n-1)} + (3-n)n(1+\eta) - 2}{3-n} \tag{12}$$

From (12), we find that the "prisoner's dilemma" will be resolved by the presence of network externalities with product compatibility when the degree of product differentiation is high (a small γ), and note that a large product differentiation reduces the output-substitution effect between firms. Taking a partial differentiation on $\hat{\gamma}$ with respect to η, we have $\frac{\partial \hat{\gamma}}{\partial \eta} = \frac{(3-n)n}{3-n} > 0$. That is, when the degree of product compatibility rises, the effect of augmented network externalities will increase under a given n. The higher the product compatibility, the greater the critical value of product differentiation, indicating that higher product compatibility will help alleviate the "prisoner's dilemma" due to a larger net network effect of network externalities with product compatibility. We then show that when the product is partially compatible ($\eta = \gamma$), $\pi^{CB}(\eta = \gamma) > \pi^{CU}(\eta = \gamma)$, if $\gamma < \hat{\gamma}(\eta = \gamma) \equiv \frac{\sqrt{2(2-n)(1-n)}+(3-n)n-2}{3-4n+n^2}$, which is consistent with Choi et al. (2023). However, if the product is fully incompatible ($\eta = 0$), $\pi^{CB}(\eta = 0) > \pi^{CU}(\eta = 0)$ only when $\gamma < \hat{\gamma}(\eta = 0) \equiv \frac{\sqrt{2(2-n)(1-n)}+(3-n)n-2}{3-n}$.

We have the following Proposition 2.

Proposition 2. *In Cournot competition, a higher product compatibility will be helpful in alleviating the "prisoner's dilemma", that is,* $\pi^{CB} > \pi^{CU}$*, if* $\gamma < \hat{\gamma}$ *and* $\frac{\partial \hat{\gamma}}{\partial \eta} > 0$.

4. Bertrand Competition

In stage 2, each manager chooses the prices. From the first-order condition, $\frac{\partial \hat{\pi}_i}{\partial p_i} = 0$, with rational expectation ($q_1 = y_1,\ q_2 = y_2$), we have

$$p_i = \frac{\begin{array}{c} n(1-\gamma)(1+\eta)\left(2-n-\gamma-\gamma^2+n\eta\right)+\left(2-3\gamma^2+\gamma^4-n\left(3-\gamma^2\right)(1-\gamma\eta)+n^2\left(1+\eta^2\right)\right)k_i \\ -\left((n-1)\gamma^3+n\eta+n\gamma^2\eta+\gamma\left(1-n\left(3-n+n\eta^2\right)\right)\right)k_j \end{array}}{(-2+n+\gamma+\gamma^2-n\eta)((-2+\gamma)(1+\gamma)+n(1+\eta))} \tag{13}$$

In stage 1, each owner decides the type of manager. Substituting p_i into π_i, from the first-order condition, $\frac{\partial \pi_i}{\partial k_i} = 0$, we have

$$k^{BB} = 1 + \frac{\gamma^2-\gamma^4+n\left(2-2\gamma\left(2-\gamma^2\right)\eta-n\left(1-\eta^2\right)\right)}{(-1+\gamma)(4+\gamma(2-3\gamma+\gamma^3)+n^2(1+\eta)(2+(-1+\gamma)\eta)+n(-2(3+\eta)-(1-\gamma)\gamma(1-(2+\gamma)\eta)))} \tag{14}$$

where the superscript "BB" denotes the Bertrand competition with the biased manager.

From (14), we have $k^{BB} > 1$, if $n > \overline{n}_{BB} \equiv \frac{1-2\gamma\eta+\gamma^3\eta-\sqrt{(1-\gamma\eta)\left(1+\gamma^2-\gamma^4-\gamma\left(3-3\gamma^2+\gamma^4\right)\eta\right)}}{1-\eta^2}$. Given $k = k^{BB}$, to ensure $p_i > 0$ in equilibrium, it requires that the network externalities are not too high, i.e., $n < \underline{n}_{BB} \equiv \frac{2(3+\eta)+(1-\gamma)\gamma(1-(2+\gamma)\eta) - \sqrt{(2(3+\eta)+(1-\gamma)\gamma(1-(2+\gamma)\eta))^2-4(4+\gamma(2-3\gamma+\gamma^3))(1+\eta)(2-(1-\gamma)\eta)}}{2(1+\eta)(2-(1-\gamma)\eta)}$. However, we have $\overline{n}_{BB} < \underline{n}_{BB}$, which points out that there does not exist an n to achieve $k^{BB} > 1$, that is, $k^{BB} < 1$.

We have Lemma 2.

Lemma 2. *In Bertrand competition with network externalities and product compatibility, both owners want to hire aggressive managers, that is,* $k^{BB} < 1$ *with* $1 \geq n \geq 0$ *and* $1 \geq \eta \geq 0$.

In Lemma 2, even when the degree of product compatibility is high, the owners will hire aggressive managers ($k^{BB} < 1$), which is irrelevant to the degree of product compatibility.

Taking a partial differentiation on k^{BB} with respect to η, we have

$$\frac{\partial k^{BB}}{\partial \eta} = \frac{\begin{array}{c} n(1+\gamma)\Big(\gamma(-16+\gamma(1+\gamma)(10-\gamma(2+(3-\gamma)\gamma)))+n^3(1+\eta)^2 \\ -n^2\big(4+(4-3\gamma)\gamma+8\eta-2\gamma\eta+\big(2-\gamma^2(3-2\gamma)\big)\eta^2\big) \\ +n(4+8\eta+\gamma(4(4-\eta)-\gamma(11+\gamma(4-3\gamma+2(1-\gamma)\eta))))\Big)\end{array}}{(-1+\gamma)(4+\gamma(2-3\gamma+\gamma^3)+n^2(1+\eta)(2-(1-\gamma)\eta)-n(2(3+\eta)+(1-\gamma)\gamma(1-(2+\gamma)\eta)))^2} > 0, \quad (15)$$
$$\text{if } \eta > \eta_{BB} \equiv \frac{\sqrt{2}\sqrt{n^2(1-\gamma)^3(2-n-\gamma^2)^3 - n\big((2-n)^2-(2-n)\gamma-\gamma^3+\gamma^4\big)}}{n^2(n+(3-2\gamma)\gamma^2-2)}$$

Equation (15) is stated in Proposition 3.

Proposition 3. *In Bertrand competition, the owners will hire less aggressive managers with higher product compatibility if the degree of product compatibility is sufficiently large, that is,* $\frac{\partial k^{BB}}{\partial \eta} > 0$, *if* $\eta > \eta_{BB}$.

We find that from Proposition 3, both owners want to hire less aggressive managers when product compatibility is higher and the network externalities are sufficiently large. In addition to that, the aggressivity of biased managers has a non-linear relationship with product compatibility. The type of manager (degree of delegation) hired by the owner under Bertrand competition is irrelevant to the network externalities and product compatibility under a given degree of product differentiation.

Our findings confirm the robust result of Englmaier and Reisinger (2014) and Choi et al. (2023), who showed that if firms compete in prices, the owners will hire more aggressive managers, even if the products are fully compatible ($\eta = 1$) or fully incompatible ($\eta = 0$). Englmaier and Reisinger (2014) considered the market demand without network externalities, that is, $n = 0$, and obtained $k^{BB}(n = 0) < 1$. In particular, Choi et al. (2023) considered the market demand with network externalities and partial product compatibility, that is, $n > 0$ and $\eta = \gamma$, and obtained $k^{BB}(n > 0, \eta = \gamma) < 1$.

As mentioned above, product compatibility has two effects that affect the competition between two firms; on one hand, it increases consumers' willingness to pay, and on the other hand, it intensifies market competition. In Bertrand competition, the effect of the former is smaller than that of the latter. So, the owners will hire more aggressive managers with higher product compatibility when product compatibility is sufficiently large.

The firms' profits are

$$\pi^{BB} = \frac{(2-n-n\gamma\eta)\big(2-3\gamma^2+\gamma^4-n\big(3-\gamma^2\big)(1-\gamma\eta)+n^2\big(1-\eta^2\big)\big)}{\big(4+\gamma(2-3\gamma+\gamma^3)+n^2(1+\eta)(2-(1-\gamma)\eta)-n(2(3+\eta)+(1-\gamma)\gamma(1-(2+\gamma)\eta))\big)^2} \quad (16)$$

We explain whether a "prisoner's dilemma" still holds. We first consider that if the owners do not hire the managers, the profits are $\pi^{BU} = \frac{n(2-\gamma)(1-\gamma)(1+\eta)}{(n(1+\eta)-(2-\gamma)(1+\gamma))^2}$. We then show that if the product is partially compatible ($\eta = \gamma$), $\pi^{BB}(\eta = \gamma) > \pi^{BU}(\eta = \gamma)$ when $n < \frac{8-(3-\gamma)\gamma(1+\gamma)-\sqrt{16+\gamma(-8+\gamma(-23+\gamma(16+\gamma(10+(-8+\gamma)\gamma))))}}{2(3+(-1+\gamma)\gamma)}$; otherwise, $\pi^{BB}(\eta = \gamma) < \pi^{BU}(\eta = \gamma)$. In addition, if the product is fully incompatible ($\eta = 0$), $\pi^{BB}(\eta = 0) > \pi^{BU}(\eta = 0)$ only when $n < \frac{8-\gamma(5+(2-\gamma)\gamma)-\sqrt{16-\gamma(24-\gamma(49-\gamma(48+\gamma(6-\gamma(24-7\gamma)))))}}{6-4\gamma}$.

In short, a smaller degree of network externalities enables the owners to hire more aggressive managers (a small k^{BB}), which relieves price competition and increases the profit of both firms. However, if the degree of product compatibility rises, the net effect of network externalities will increase (under a given n) when product compatibility is sufficiently large. Hence, owners want to hire less aggressive managers (a large k^{BB}), causing a moderated price competition. The prisoner's dilemma will be resolved when the augmented net effect of product compatibility is sufficiently large (a larger $n\eta$) with less aggressive managers.

We have the following Proposition 4.

Proposition 4. *In Bertrand competition, the "prisoner's dilemma" will be resolved if the spillover effect of network externalities is large with a sufficiently higher product compatibility.*

5. Concluding Remarks

In this paper, we showed that the aggressivity of biased managers has a non-linear relationship with product compatibility; both owners will want to hire aggressive managers not only in Cournot competition but also in Bertrand competition when product compatibility is higher and the network externalities are sufficiently smaller.

In Cournot competition, the owners will hire more aggressive biased managers with higher product compatibility, in essence, if the spillover effect of network externalities is sufficiently large. The higher the product compatibility, the more helpful it is to alleviate the "prisoner's dilemma" problem due to a larger net network effect of network externalities with product compatibility. In Bertrand competition, however, the owners will hire less aggressive managers when product compatibility is higher and the network externalities are sufficiently large. The result of the "prisoner's dilemma" will be resolved when the augmented net network effect of product compatibility is large.

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Note

[1] Hoernig (2012) showed earlier that the "prisoner's dilemma" is resolved in the network goods market with managerial delegation and price competition. The prisoner's dilemma means that both owners individually prefer to hire an aggressive manager, but they would jointly be better off when committing to hire an unbiased manager (Englmaier & Reisinger, 2014).

References

Buccella, D., Fanti, L., & Gori, L. (2022). Network externalities, product compatibility and process innovation. *Economics of Innovation and New Technology*, *32*(8), 1156–1189. [CrossRef]

Buccella, D., Fanti, L., & Gori, L. (2023). Strategic product compatibility in network industries. *Journal of Economics*, *140*(2), 141–168.

Choi, K., Lee, D., & Lee, K.-D. (2023). Biased managers with network externalities. *Scottish Journal of Political Economy*, *70*(3), 201–216. [CrossRef]

Donker, H., Nofsinger, J., & Shank, C. A. (2023). CEO narcissism and corporate misconduct. *Economics Letters*, *228*, 111178.

Englmaier, F., & Reisinger, M. (2014). Biased managers as strategic commitment. *Managerial and Decision Economics*, *35*, 350–356.

Hoernig, S. (2012). Strategic delegation under price competition and network effects. *Economics Letters*, *117*(2), 487–489. [CrossRef]

Kaplan, S. N., Sørensen, M., & Zakolyukina, A. A. (2022). What is CEO overconfidence? Evidence from executive assessments. *Journal of Financial Economics*, *145*(2), 409–425.

Katz, M., & Shapiro, C. (1985). Network externalities, competition and compatibility. *American Economic Review*, *75*(3), 424–440.

Katz, M., & Shapiro, C. (1986). Product compatibility choice in a market with technological progress. *Oxford Economic Papers*, *38*, 146–165.

Meccheri, N. (2021). Biased managers in vertically related markets. *Managerial and Decision Economics*, *42*, 724–736. [CrossRef]

Nakamura, Y. (2014). Biased managers as strategic commitment: The relative profit approach. *Research in Economics*, *68*, 230–238. [CrossRef]

Nakamura, Y. (2019). The impact of the presence of biased managers as strategic commitment on endogenous market structures. *Managerial and Decision Economics*, *40*, 84–96.

Shrivastav, S. (2021). Network compatibility, intensity of competition and process R&D: A generalization. *Mathematical Social Sciences*, *109*, 152–163.

Wang, L. F. S., Wu, D., & Ramani, V. (2025). Biased manager aggressiveness, understated profits, tax pass-through and tax incidence in a differentiated duopoly. *International Journal of Economic Theory*, *21*(1), 121–137. [CrossRef]