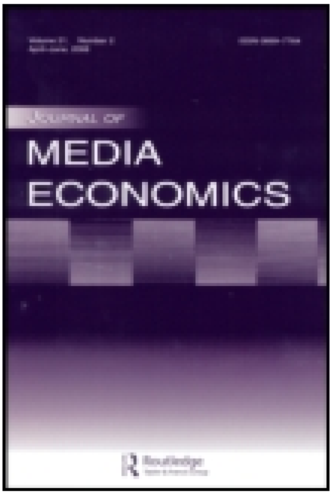

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Media Bias When Advertisers Have Bargaining Power

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This article establishes a 2-sided media market in which readers have heterogeneous beliefs, media outlets choose their reporting biases, and advertisement prices are determined by bargaining between media outlets and advertisers. The authors have shown that the presence of advertisers strengthens the reporting bias. The bias is increasing in the advertisers' bargaining power and is generally stronger if the advertisers can advertise in multiple outlets. Finally, the authors present an extension of the model on the formation of joint operating agreements for advertising sales among competing newspapers and show that the media bias will be mitigated.

Media bias can be analyzed from the supply side to reflect the preference of media outlets, as has been done by Besley and Prat (2006), Gentzkow and Shapiro (2006), Bovitz, Druckman, and Lupia (2002), and Baron (2006), whereas Mullainathan and Shleifer (2005), as a pure demand-side analysis, use the framework of Hotelling (1929) to analyze media slanting of news, showing that media slant the news toward extreme positions when reader beliefs are diverse. However, the revenue ratio from the reader side may not be the major source, because

[1]Mullainathan and Shleifer (2005) emphasized that competition between media outlets helps to reduce media prices, but deteriorates media bias, showing that the equilibrium slants in a duopoly will be more serious than those in the monopoly case when readers are heterogeneous in their beliefs. A detailed survey on both supply-side and demand-side literature on media markets is provided in Gentzkow and Shapiro (2008).

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most media outlets rely on both the advertisement revenue as well as the sales of newspapers. For instance, according to the 2010 Annual Report of the New York Times Company, advertising contributes 1.3 billion (54.3% of total revenue), while the circulation yields 0.93 billion (38.9% of total revenue). This article will extend the demand-side framework of media bias to include the role of advertisers who have bargaining power in determining advertisement prices. A theoretical framework of the two-sided market is suitable to analyze the slant behaviors of the media, because media outlets can be seen as intermediate platforms between readers and advertisers.

Two-sided markets are those industries in which platforms provide interaction channels to two (or more) kinds of users who affect each other, especially via cross-side externalities. Credit cards, video games, newspapers, software, and dating websites are some examples of two-sided markets. For instance, a credit card with more holders will attract more stores to accept this card, whereas more stores accepting one credit card will attract more people to be willing to hold this card. Therefore, a platform should determine pricing strategies to attract users from both sides. There are numerous studies discussing the two-sided markets issue such as Rochet and Tirole (2003, 2006, 2008), Caillaud and Jullien (2003), Hagiu (2006), Reisinger, Ressner, and Schmidtke (2009), Armstrong (2006), Armstrong and Wright (2007), and Jeon and Rochet (2010),[2] and recently, Rysman (2009) provided a detailed survey on this issue. The purpose of this article is to analyze the behavior of media bias from the perspective of a two-sided market with duopoly advertisers who have bargaining power in the setting of the advertisement prices. We focus on the interactions among media outlets, readers, and advertisers and analyze the influence of bargaining power on media bias and the equilibrium prices on both sides. Advertisers can make more revenues from posting their advertisements to a media outlet with more readership.

Our model is close to those in several recent studies. Manduchi and Picard (2009) developed a price competition model with two newspapers competing with each other for differentiated readers and advertising new products such that per reader cost decreases as the circulation increases. Given exogenous asymmetric locations of two newspapers, they focus on explaining the observed empirical fact that the revenues from advertising and the profits of the newspapers increase more than proportionally with the circulation. Ellman and Germano (2009) constructed a vertical differentiation framework to analyze how advertisers affect the accuracy of media reports, especially when they have the ability to withdraw their advertising contracts. However, all readers have neutral preferences in their model, although readers have their own biased beliefs in our model. Reisinger (2012) analyzed a two-sided model in which platforms compete for advertisers and users. His focus is different from ours in that platforms do not charge users for access, and make all profits from a mass of N advertisers. However, our major focus, media bias, is not analyzed in his model. Gal-Or, Geylani, and Yildirim (2012) discussed the impact of advertising on media bias. They showed that when the heterogeneity among advertisers with

[2]Among these studies, Rochet and Tirole (2003) constructed a model of platform competition with two-sided markets. They pointed out that a successful platform must "get both sides of the market on board." Hagiu (2006) focused on the case where sellers arrive before buyers and showed that a monopoly platform may prefer not to commit to the buyers' price when it announces its seller price. Jeon and Rochet (2010) explained why more and more academic journals are adopting an open access policy from a two-sided market perspective. It is shown that, for an electronic journal maximizing social welfare, the socially optimal policy is open access, because the marginal cost of reaching readers is zero.

respect to consumers' political preferences is significant, the equilibrium media bias will be more polarized. When this heterogeneity is small, a more moderate bias emerges. However, they assume a mass of advertisers who have no bargaining power in determining the advertising fees.

This study is motivated by a real-world observation that many media outlets regularly negotiate the advertising prices with advertiser agencies for the upcoming TV season, for instance, based on the A.C. Nielsen ratings of recent seasons. Therefore, advertisers may have some bargaining power, in general. Intuitively, when media outlets charge a higher price on the advertisers' side, they may thus lower subscription fees for readers to compete with other outlets. The more readers of a newspaper there are, the higher the advertisers' willingness to pay. The Nash bargaining mechanism will be used to decide the advertisement price in our model.

The major findings in this article are as follows. First, the media bias is in general more serious than that without advertising either under single-homing or multi-homing. This is because media outlets can raise their profits by more biased reports to avoid price competition, and this report deviation is also preferred by advertisers because their product differentiation is also enlarged. Moreover, when advertisers can place advertisements in both media outlets (multi-homing), they have more market revenues, and the equilibrium slant should be more serious than that under single-homing, because advertisers prefer more product differentiation for the image of their products to consumers. Second, the bargaining power of advertisers enhances the reporting bias, because the competition effect between media outlets is thus mitigated, and this power helps to raise media prices and decrease advertising prices. A greater bargaining power for the newspapers vis-à-vis the advertisers increases competition for readers, via increased margins on the advertisements sold, and thus leads to lower prices for the readers. This property of opposite effects on prices on two sides is consistent with previous theories of two-sided markets in Rochet and Tirole (2013) and Choi (2010). Third, the higher the disutility of bias, the higher the price to readers, but the lower prices to advertisers. This is because of the reduction in competition when readers have higher disutility of media bias. Fourth, if media outlets can collect more revenues from advertisements, they thus charge lower prices to readers, and higher prices to advertisers. This result is consistent with the practical observation of free online news, which may be financially supported by advertisements.

Finally, our model can be applied to a real-world example of a joint operating agreement. Media outlets may reach an agreement to run their advertising business jointly, using a shared independent agent and sharing the revenue by an ex ante negotiation, whereas their news gathering and editorial operations are totally separated. This mode of competition with cooperation is authorized by law and is working in some small or medium-sized cities such as Charleston, West Virginia and Salt Lake City, Utah. Intuitively, the advertising rate should be higher under this mode, and thus the media bias might be different from previous situations.

THE BASIC MODEL

We follow the standard demand-side model of media bias to construct a two-sided framework with media outlets as the platforms, and the two-sided users as readers and advertisers. Suppose there are two media outlets (1 and 2) which announce slanting strategies $s(d)$ simultaneously in the first stage, where $d = h + \varepsilon \sim N(0, v_d)$ is the data received by media i, $i = 1, 2$, h is the unobserved true state variable, which is distributed $N(0, v_n)$, ε is the noise, where

$\varepsilon \sim N(0, v_\varepsilon)$, and $v_d = v_n + v_\varepsilon$ is the variance of data. The distributions of h and ε are common knowledge for all readers, but readers are not allowed to identify ε. Potential readers are interested in this state variable h, and buy the newspaper from a platform that provides readers the maximal net expected utility. Suppose there is a uniform distribution of readers' beliefs (b) between $[b_1, b_2]$,[3] where $b_1 < 0$ and $b_2 > 0$, representing the fact that readers have some biased subjective beliefs.[4] Normalize $b_1 = -b_2$ for simplicity.[5] The size of the population of readers is normalized as one. The overall utility of the reader $b \in [b_1, b_2]$ from the service of outlet $i \in [1, 2]$ is

$$U^i = \left(\overline{u}_m - \chi s^2 - \phi(n_i - b)^2 - p_i\right) + \left(\overline{u}_a - (v - t|z_i - \beta_i|) - c_a\right), \tag{1}$$

where the first bracket in (1) is the net utility from reading newspapers, in which $\overline{u}_m$ is the reservation price for reading newspapers, $\chi > 0$ is the disutility of slanting, $\phi > 0$ is the disutility of inconsistency with his belief,[6] p_i is the subscription fee charged by outlet i, and $n_i = d + s_i$ is the reported news. The second bracket in (1) is the net utility from advertisement where parameters are defined as follows. We follow Mullainathan and Shleifer (2005) to define a slant strategy s_i to represent a newspaper's biases, $i = 1, 2$. Define $z_i = s_i \frac{\chi+\phi}{\phi} + d$ as the reporting "location" or "position" of media i to simplify calculations. Assume that consumers have a probability of buying a product from an advertiser who is also a producer with an exogenous ideological position $\beta_i \in [b_1, b_2]$. For example, fashionable clothing, electronic watches, or rock music could be seen as more liberal, whereas formal suits, mechanical watches, or classical music may be seen as more conservative. We simplify this probability as one, and $\beta_2 = -\beta_1 > 0$ for symmetric solutions.[7] Let $\overline{u}_a$ be the reservation price for purchasing the product from advertisers, t denote the effectiveness of ideological difference between media outlets and advertisers, and c_a be the nuisance cost from advertisements. Suppose that $v - t|\beta_i - z_i|$ is the price that the advertiser i can charge consumers, where v is the maximal price when the product and media have the same ideological position ($\beta_i = z_i$). Assume the reservation price $\overline{u}_a$ is large enough to ensure that all readers will purchase the product from advertisers. This setting provides a linkage among media outlets, advertisers, and readers.[8]

[3] We follow Mullainathan and Shleifer (2005), Manduchi and Picard (2009), and Reisinger (2012), and assumed that the market is fully covered. If the market is not fully covered, then each outlet enjoys a local monopoly position.

[4] We adopt these settings similar to the one-sided framework in Mullainathan and Shleifer (2005). Although Mullainathan and Shleifer discussed many cases, such as a monopoly outlet and rational readers, we only focus on the model with biased readers, which is the most interesting framework in their paper. In fact, readers with different prior beliefs may be perpetual, and even learning is allowed. For instance, Suen (2004) showed that conflicting beliefs can persist under Bayesian updating if information is costly.

[5] Our results rely on the symmetry assumption for simplicity. The case in which readers have a preference for reports biased in one direction might be explored in an extension of Lai (2001).

[6] In other words, "$\phi > 0$ calibrates his preference for hearing confirming news" (see Mullainathan & Shleifer, 2005, p. 1034).

[7] Our model can be extended to a general case when the probability $\lambda < 1$ of buying a product from advertisers is considered.

[8] Gal-Or et al. (2012) considered a different setting in which the product price that advertisers charge consumers is implicitly assumed as unity, and the prices of advertisement are subscription fees, in contrast to unit advertisement prices in our setting. Alternatively, Anderson and Gabszewicz (2006) considered advertisement to be a nuisance for consumers and emphasized that media platforms should balance the advertising revenue from a given advertising demand and this nuisance cost to readers.

For a reader's belief at $x \in [b_1, b_2]$, he buys the newspaper from outlet i, and his expected utility (see the appendix for details) is

$$E_d(U^i) = \left(\overline{u}_m - \frac{\chi\phi\,(v_d + x^2)}{\chi + \phi} - \frac{\phi^2(z_i - x)^2}{\chi + \phi} - p_i\right) + (\overline{u}_a - (v - t|z_i - \beta_i|) - c_a), \quad i = 1, 2. \tag{2}$$

We thus have a Hotelling-like equation as shown in the right hand side of (2), and the indifferent reader $\hat{x}$ can be derived. The case of single-homing advertisers is analyzed in the next section.

SINGLE-HOMING ADVERTISERS

Suppose there are two advertisers who can get revenues (profits) with zero production costs from product sales via placing advertisements in media outlets such as

$$R_1 = (v - t|z_1 - \beta_1| - q_1)(\hat{x} - b_1), \tag{3}$$

$$R_2 = (v - t|z_2 - \beta_2| - q_2)(b_2 - \hat{x}), \tag{4}$$

where $v - t|z_i - \beta_i|$ is the unit product price mentioned before and q_i is the advertisement price paid to outlet i, $i = 1, 2$.[9] In other words, advertisers' profits are the product of the unit profit margin $(v - t|z_i - \beta_i|)$, $i \in \{1, 2\}$ and the volume of sales. Consider the case of single-homing advertisers in which advertiser i only places its advertisement in media i, $i = 1, 2$. Conditional on the assumption of single-homing advertisers, the setting of the unit profit margin induces Advertiser 1 to choose Media 1, instead of Media 2, for its targeted readers and vice versa for Advertiser 2. Now we have a two-sided market structure as shown in Figure 1. The profit functions of media outlets are

$$\pi_1 = (p_1 + q_1) \cdot (\hat{x} - b_1), \tag{5}$$

$$\pi_2 = (p_2 + q_2) \cdot (b_2 - \hat{x}). \tag{6}$$

Suppose the advertisement prices are determined by the Nash bargaining between these media outlets and advertisers. Specifically, the advertising price q_i is determined by the maximization of the Nash product of two profits. Let the threat point of bargaining be zero. The Nash bargaining solution is the argument that maximizes $\Pi_i = \pi_i^{\alpha} R_i^{(1-\alpha)}$, $i = 1, 2$, where α is the relative bargaining power for the media i. We use a standard Nash bargaining solution which is the argument to maximize the Nash product (see the details in Nash, 1953, Roth, 1979, Binmore, Rubinstein, and Wolinsky, 1986 and Zhou, 1997). The equilibrium reporting positions and prices are summarized as the following proposition.

[9]Gal-Or et al. (2012) provided an alternative framework in which there exist a mass of passive advertisers, and advertising is designed to increase consumers' purchase probabilities. In contrast, advertisers are active in determining advertisement prices. Moreover, we ignore the probability of purchase and focus on the ideological difference between media outlets and advertisers.

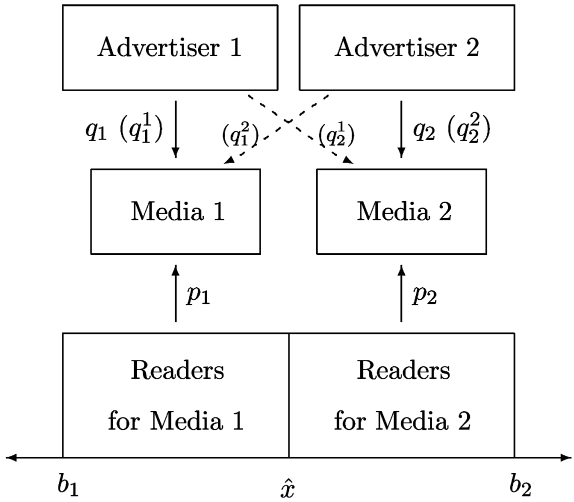

FIGURE 1 The map of a two-sided market under single-homing (multi-homing).

Proposition 1: There exists a unique subgame perfect equilibrium of media bias and prices. The equilibrium reporting positions are $[z_1^*, z_2^*] = [-\frac{3b_2(3-\alpha)}{2(\alpha+1)}, \frac{3b_2(3-\alpha)}{2(\alpha+1)}]$, and $z_2^* > \frac{3}{2}b_2$ when $\alpha < 1$. Furthermore, the equilibrium media prices and the advertising prices are

$$p_1^* = p_2^* = \frac{24\phi^2(2-\alpha)(3-\alpha)b_2^2 + 3t(\alpha+1)(3-\alpha)(\chi+\phi)b_2 - 2(\alpha+1)^2(t\beta_2+v)(\chi+\phi)}{2(\alpha+1)^2(\chi+\phi)},$$

$$q_1^* = q_2^* = \frac{6b_2^2\phi^2(3-\alpha)}{(\chi+\phi)(\alpha+1)} - p_1^*.$$

The equilibrium media prices charged to readers will become lower than those without advertising when the media outlets have larger bargaining power (α is large enough).

Proposition 1 implies that the media bias is in general more serious than that without advertising. Unless media outlets have full bargaining power over the advertisers ($\alpha = 1$), the equilibrium reporting positions, (z_i^*) as well as expected equilibrium slants ($E(S_i^*)$), will be more diversified (serious) than those in the one-sided market case predicted by Mullainathan and Shleifer (2005). When advertising is introduced, there are two effects on reporting locations. The first effect is the *readership effect*, which means that media outlets have stronger incentive to move closer to the median reader in order to have a larger readership, and get more revenue from advertisers. In contrast, the second effect is the *advertisement competition effect*, which induces more diverse reporting to avoid competition in the advertisement market. In our model, the second effect dominates the first effect in general. When media outlets have full bargaining power in the advertisement market ($\alpha = 1$), the first effect reaches the maximal level and cancels out with the second effect in our setting. In addition, our equilibrium reporting positions can also be compared with Gal-Or et al. (2012), in which the effective advertising and the size of the advertising market relative to the subscription market are emphasized. When either the size of the advertising market converges to zero ($T = 0$ in their notation), or the basic effectiveness of advertising converges to zero ($h_0 = 0$), the equilibrium reporting positions are approaching the case without advertising.

Proposition 1 also reveals the impact of bargaining power on equilibrium media prices and the advertising prices. Intuitively, when the bargaining power of media outlets is reduced, they must charge lower advertisement prices. Thus outlets should expect to earn more profits from readers by increasing the reporting differentiation with their rivals, enabling them to avoid price competition as well as raise their subscription fees. In fact, our results are degenerated to the case without advertising when the media outlets have full bargaining power ($\alpha = 1$), where the equilibrium slant is reduced to the benchmark case of a one-sided market ($z_1^* = -\frac{3b_2}{2}$, $z_2^* = \frac{3b_2}{2}$), and the equilibrium expected slants become $E(s_i) = \frac{3\phi b_2}{2(\chi+\phi)} - d$. In other words, Mullainathan and Shleifer (2005) is equivalent to one case of the current model in that the media outlets have full power in determining the price of advertisement. If the advertisers have full bargaining power ($\alpha = 0$), then the equilibrium reporting positions are $z_1^* = -\frac{9b_2}{2}$, $z_2^* = \frac{9b_2}{2}$. In other words, the advertisers benefit from a more dispersed slant of media when they have the full bargaining power. This is because the media outlets can thus charge higher prices to the readers, and from a two-sided market view, the advertisement prices will thus fall.[10]

The equilibrium prices in Proposition 1 additionally shows that an increase in the maximal per capita revenue of advertisement (v) will cause decreases (increases) in p_1 and p_2 (q_1 and q_2). Intuitively, when advertisers can make more profits from advertisements, the outlets can also charge a higher advertisement price and thus provide a lower price to readers. This result is consistent with Kaiser and Wright (2006), where they found that higher demand on the advertising side decreases the cover prices in the German magazine industry. Note that when $\alpha = 0$, the equilibrium prices $p_1^* = p_2^* = \frac{72\phi^2}{\chi+\phi} b_2^2 - v$, which can be either greater or less than those in one-sided markets (denoted by p_i^{MS}, $i = 1, 2$). In the case of small per capita revenue of advertisement ($v - t|z_i - \beta_i|$), the media outlets will charge higher prices to the readers, even when advertisement revenue has been taken into account. In contrast, when $v - t|z_i - \beta_i|$ is large, it is possible that $p_i^* < p_i^{MS}$, $i = 1, 2$. This result is consistent with the observation that when media outlets have relatively strong bargaining power, because they can get more revenue from the advertisers' side and thus charge a lower price on the readers' side. Our equilibrium media prices can be compared with those in Gal-Or et al. (2012). When basic effectiveness of advertising (h_0 in their notation) is zero, the equilibrium media prices are $\frac{6\phi^2 b_2^2}{\chi+\phi}$ in Gal-Or et al. (2012). In our case, when $\alpha = 1$ and $t = 0$, the equilibrium media prices are smaller as

[10]The optimal reporting positions should be $z_1^0 = z_2^0 = 0$ if unbiased reporting is the only goal of a society. In such a case, it will be degenerated to Bertrand competition and yield zero profits as well as prices. If we consider the standard social welfare function such that $W = \pi_1 + \pi_2 + R_1 + R_2 + \int_{-b_2}^{b_2} E_d(U^i)dx$, then the socially desirable reporting position should be $z_1^W = -z_2^W = -\frac{b_2}{2}$, which is the typical optimal position of a Hotelling-like model (Lambertini, 1997; Braid, 19961 Mai and Peng, 1999). Henceforth, the case when media outlets have maximal bargaining power ($\alpha = 1$) is the second-best solution. Intuitively, an increase of α causes less dispersed reporting positions, and thus they are much closer to socially desirable reporting positions. However, we should be cautious on this property, since advertisement level is not a decision variable in our model.

$\frac{6\phi^2 b_2^2}{\chi+\phi} - v$. This difference may result from different setting of the influence of advertising on consumers and the determinant of advertising prices.

From the above equilibrium slants, we can derive the influence of bargaining power on the equilibrium in the following proposition.

> Proposition 2: As the bargaining power of media increases, (a) the equilibrium reporting positions are less dispersed ($\partial z_1^*/\partial\alpha > 0$, $\partial z_2^*/\partial\alpha < 0$); (b) the equilibrium prices to readers fall ($\partial p_i^*/\partial\alpha < 0$); (c) they can charge higher prices to the advertisers ($\partial q_i^*/\partial\alpha > 0$).

Our model shows that the bargaining power of media outlets affects media slants and prices on both sides as well. Proposition 2(a) suggests that more powerful advertisers will choose more biased reporting. Moreover, the results of Proposition 2(b) and 2(c) can be explained by a view of a two-sided market such that when the price increases on one (advertisements) side, it must accompany a price decrease on the other (readers) side. As the bargaining power of media outlets increases, reporting positions are less dispersed and competition between media outlets increases, resulting in lower prices for readers. However, the effect of increased bargaining power of media outlets dominates the effect of increased competition, and so the advertising prices increase. This result is consistent with the previous studies on two-sided markets, which suggest that as the price on one side is raised by a platform, it will generally lower the price on the other side (see Rochet and Tirole, 2003; and Choi, 2010). In contrast, with asymmetric locations of two newspapers, Manduchi and Picard (2009) showed that the media prices are also reduced but advertising prices are unchanged as the bargaining power of newspapers increases.

> Proposition 3: (a) The higher the disutility of bias (slant) is, the higher (lower) the price to readers, but the lower (higher) the prices to advertisers. That is, $\partial p_i^*/\partial\phi > 0$, $\partial q_i^*/\partial\phi < 0$ ($\partial p_i^*/\partial\chi < 0$, $\partial q_i^*/\partial\chi > 0$), $i = 1, 2$. (b) The more dispersed beliefs of readers are, the higher prices will be to readers, and the lower prices will be to advertisers. That is, $\partial p_i^*/\partial b_2 > 0$, $\partial q_i^*/\partial b_2 < 0$, $i = 1, 2$. (c) The more revenue collected from advertisements (v is large, β is large or t is small), the lower the price to the reader, and the higher the prices to the advertisers are.

The results of Proposition 3 can be explained by a common argument in spatial models. Observing (2), $\phi^2/(\chi+\phi)$ is similar to the transportation rate in the Hotelling (1929) model, and we can derive that $\frac{\partial\phi^2/(\chi+\phi)}{\partial\phi} > 0$, $\frac{\partial\phi^2/(\chi+\phi)}{\partial\chi} < 0$. Therefore, as ϕ increases, the "transportation rate" also increases, and the degree of competition falls. Intuitively, a larger ϕ means that readers give more weight on conformity, and thus readers are less likely to change to another outlet. In contrast, a larger χ means that readers are more averse to slant, and thus the expected slant $E(s_i) = \frac{3\phi b_2}{2(\chi+\phi)}$ of media outlets decreases, meaning more intensive competition between outlets. Moreover, a larger b_2 means a larger space for biased reporting. Therefore, the competition between outlets falls. Since the increases of ϕ or b_2 (χ) represent the decrease (increase) of competition between these two outlets, they will charge higher (lower) prices to readers and thus lower (higher) prices on the advertisement side in a two-sided market structure. Similarly, a larger v or a small t represents more revenues that media outlets can collect from advertisements; therefore, they will charge lower (higher) prices to readers (advertisers).

MULTI-HOMING ADVERTISERS

In the previous section, we have assumed that each advertiser can only place her advertisement in the media outlet closer to her ideological position. Now we consider the multi-homing case in which advertisers are allowed to post their advertisements in both media outlets. Assume that readers are still single-homing.[11] Under advertisers' multi-homing setting, (2) should be changed to

$$E_d(u^i) = \left(\overline{u}_m - \frac{\chi\phi\,(v_d + x^2)}{\chi+\phi} - \frac{\phi^2(z_i - x)^2}{\chi+\phi} - p_i\right)$$

$$+ (\overline{u}_a - (v - t|z_i - \beta_1|)) + (\overline{u}_a - (v - t|z_i - \beta_2|)) - c_a, \quad i = 1, 2.$$

Suppose there are two advertisers, who are also producers, and who receive benefits from placing advertisements in both media outlets by selling products to readers such as

$$R_j = \left[(v - t|z_1 - \beta_j| - q_1^j)(\hat{x} - b_1) + (v - t|z_2 - \beta_j| - q_2^j)(b_2 - \hat{x})\right], \quad j = 1, 2, \tag{7}$$

where q_i^j, $i = 1, 2$, $j = 1, 2$, is the unit advertisement price for media i and advertiser j, which has also been described in Figure 1. The profit functions of media outlets are

$$\pi_1 = (p_1 + q_1^1 + q_1^2) \cdot (\hat{x} - b_1), \tag{8}$$

$$\pi_2 = (p_2 + q_2^1 + q_2^2) \cdot (b_2 - \hat{x}). \tag{9}$$

Suppose the advertisement prices are determined by Nash bargaining between the media outlets and advertisers. The advertising price q_1^j, $j = 1, 2$ for media outlet 1 is determined by the product of two profits. That is $q_1^j = \arg\max \pi_1^\alpha[(v - t|z_1 - \beta_1| - q_1^j)(\hat{x} - b_1)]^{1-\alpha}$. Similarly, the advertising price q_2^j for media outlet 2 is $q_2^j = \arg\max \pi_2^\alpha[(v - t|z_2 - \beta_2| - q_2^j)(b_2 - \hat{x})]^{1-\alpha}$.

Similarly to Proposition 1, we have the equilibrium reporting positions under multi-homing (denoted by a superscript "m").

Proposition 4: With multi-homing advertisers, the subgame perfect equilibrium of reporting positions is $[z_1^{m*}, z_2^{m*}] = [-\frac{3(5-3\alpha)b_2}{2(\alpha+1)}, \frac{3(5-3\alpha)b_2}{2(\alpha+1)}]$, which are more diverse than that under single-

[11]The assumption of single-homing readers is relatively frequent, for example, Anderson and Gabszewicz (2006), Ellman and Germano (2009), Gal-Or et al. (2012), and Reisinger (2012). It can be justified by invoking a small amount of time available to each reader. Therefore, our model only deals with multi-homing on the advertisers' side. In a different framework, Duggan and Martinelli (2011) also showed that "if the private benefit of information is small enough for a majority of citizens, then there is an equilibrium in which only a minority of citizens read both newspapers" (p. 19).

homing ($z_1^{m*} < z_1^*$, $z_2^{m*} > z_2^*$). The equilibrium media and advertising prices are

$$p_1^{m*} = p_2^{m*} = \frac{6b_2^2\phi^2(7-5\alpha)(5-3\alpha)}{(\chi+\phi)(1+\alpha)^2} - \frac{2v(\alpha+1)-tb_2(15-9\alpha)}{1+\alpha}, \tag{10}$$

$$q_1^{1*} = q_2^{2*} = \frac{1}{2}\left(\frac{6b_2^2\phi^2(5-3\alpha)}{(1+\alpha)(\chi+\phi)} + 2t\beta_2 - p_1^{m*}\right), \tag{11}$$

$$q_1^{2*} = q_2^{1*} = q_1^{1*} - 2t\beta_2. \tag{12}$$

The equilibrium slants are in general more diverse than those under single-homing. In an extreme case $\alpha = 1$, the equilibrium reporting positions are reduced to $z_1^{m*} = -\frac{3b_2}{2}$, and $z_2^{m*} = \frac{3b_2}{2}$, which is identical to the single-homing case. Note that when $\alpha < 1$, $z_2^{m*} = -z_1^{m*} > \frac{3}{2}b_2$, meaning more dispersed slants. In other words, unless both outlets have full bargaining power over the advertisers, the equilibrium slants will be more diversified (serious) compared with that in a one-sided market. In this multi-homing case, advertisers place their advertisements in both media outlets, and thus the readership effect is no longer observed. Therefore, the advertisement competition effect dominates the readership effect, and thus the reporting positions are more diversed than those under single-homing. In Gal-Or et al. (2012), when there is no heterogeneity among advertisers or the size of the advertising market converges to zero, the equilibrium reporting positions are reduced to those in a one-sided market. In our framework, the equilibrium slant converges to the case of a one-sided market when the media outlets have full bargaining power. Under multi-homing, Proposition 4 also suggests that with advertisers' multi-homing, the equilibrium media price is lower than those prices (p_i^{MS}) in a one-sided market when the per capita revenue from advertisement is large (v is large and t is small), because

$$p_i^{m*} - p_i^{MS} = \frac{6b_2^2\phi^2(1-\alpha)(17-7\alpha)}{(\chi+\phi)(1+\alpha)^2} - \frac{2v(\alpha+1)-tb_2(15-9\alpha)}{1+\alpha},$$

which is negative if v is large and t is small. Specifically, in the case $\alpha = 1$, $p_1^{m*} < p_1^{MS}$ when $v > \frac{3}{2}tb_2$. However, the price difference could be reversed such that $p_1^{m*} > p_1^{MS}$ when $v < \frac{(15-9\alpha)tb_2}{2(\alpha+1)}$. Intuitively, when media outlets have full bargaining power, they can charge a lower media price than that of the one-sided framework when they can get a large advertisement revenue. In contrast, when the possible revenue from advertisement is low, the media outlets will charge higher media prices. Our results can be compared with that in Gal-Or et al. (2012), in which when the size of the advertising market converges to zero, the equilibrium media prices converge to the case of a one-sided market. In our setting, however, the media prices are reduced to the one-sided market case when media outlets have full bargaining power and $v = \frac{3}{2}tb_2$. The next result extends Proposition 2 for the influences of bargaining power in the multi-homing case.

Proposition 5: Comparative statics demonstrate that (a) as the bargaining power of media increases, the reporting bias is less serious; (b) as the bargaining power of media increases, the equilibrium prices to readers fall; (c) the more bargaining power the media outlets have, the higher prices will be to the advertisers.

The intuition behind Proposition 5 is exactly the same as with Proposition 2. For the other comparative statics under multi-homing, we can summarize the following proposition.

Proposition 6: Under multi-homing: (a) the higher the disutility of slant (χ) is, the lower the price to readers is, but the higher the prices to advertisers. (b) The higher the disutility of inconsistency with readers' beliefs (ϕ), the higher the price to readers is, but the lower the prices to advertisers. (c) The more dispersed the beliefs of readers (b_2), the higher the price to readers, and the lower the prices to advertisers. (d) The more revenue collected from advertisements (v is large or t is small), the lower the prices to the readers, and the higher the prices to the advertisers. (e) The advertising prices will become lower when advertisers engage in multi-homing. (f) The media subscription fees will become lower when advertisers engage in multi-homing, as α is large, v is large, and t is small.

The intuition of Proposition 6(a) is straightforward: when readers dislike slanting of news more, media outlets should report less biased news, and thus price competition is more drastic. For Proposition 6(b–d), the intuition is similar to the explanation of Proposition 3. Proposition 6(e) and (f) compare the prices between single-homing and multi-homing. Intuitively, allowing multi-homing for advertisers reduces the market power of media outlets, and thus the advertising prices will become lower. However, the comparison between media prices under single-homing and multi-homing depends on the relative bargaining power. Namely, when media outlets have more bargaining power and the per capita revenue from advertisement is large, the media price under multi-homing is lower than that under single-homing.

AN EXTENSION: JOINT OPERATING AGREEMENT

This section presents an extension of the model motivated by a real-world case. Because drastic competition among newspapers in some small cities (or even medium-sized cities) may result in only one newspaper surviving, to avoid a monopoly newspaper viewpoint in the same city or geographic area, the Newspaper Preservation Act of 1970, signed by President Richard Nixon, authorized the formation of joint operating agreements (JOA) for advertising sales among competing newspapers in the same market area (although newsgathering and editorial policies are completely separated), and this behavior is exempted from certain provisions of antitrust laws. Although many JOAs have been terminated, there are still many examples nowadays, such as the *Charleston Gazette* and *Charleston Daily Mail* in Charleston, West Virginia, the *Detroit Free Press* and *Detroit News* in Detroit, Michigan, and the *Desert News* and *Salt Lake Tribune* in Salt Lake City, Utah. The distribution of advertising revenue can be any type, depending on their ex ante negotiations.

The scenario is similar to the multi-homing section, and Equations (7) and (9) can be applied directly. We here assume both advertisers have the same bargaining power $1-\alpha$. Since the media outlets now maximize their joint profits, the equilibrium advertising rates are

$$q_1^j = q_2^j$$
$$= \arg\max\ (\pi_1+\pi_2)^{\alpha}\left[\frac{(v-t|z_1-\beta_j|-q_1^j)(\hat{x}-b_1)+(v-t|z_2-\beta_j|-q_2^j)(b_2-\hat{x})}{(b_2-b_1)}\right]^{1-\alpha},$$
$$j=1,2. \tag{13}$$

where $\pi_1 + \pi_2$ is the joint profit and the second part is the profit of advertiser j. After some calculations, we obtain the maximal reservation price for advertisers $q_1^{j*} = q_2^{j*} = \min\{v - t|z_1 - \beta_j|, v - t|z_2 - \beta_j|\}$, which guarantees that the remote advertiser is willing to post its advertisements on the media outlet. For example, Advertiser 1 is the remote advertiser for media 2. If $q_2^1 > v - t|z_2 - \beta_1|$, then Advertiser 1 will get a negative surplus when it posts advertising on Media 2. Although the media outlets are united as a monosony in their advertising markets, they cannot fully exploit their monosony power since the remote advertiser can only be attracted by a lower advertising rate. In other words, the media outlets will charge a price less than the maximal reservation price for advertisers under JOAs. Finally, solving $\partial\pi_1/\partial z_1 = 0$ and $\partial\pi_2/\partial z_2 = 0$ yields $z_1^* = -\frac{3b_2}{2}$ and $z_2^* = \frac{3b_2}{2}$, which is identical to the case without advertising. Therefore, the media bias still exists under JOA, but it is not so serious as without JOA. Intuitively, the advertisement competition effect on reporting positions mentioned before is no longer observed under JOA.

The above results on JOA are based on the case of multi-homing advertisers. However, it is possible that advertisers only desire to advertise in one media outlet for some reasons mentioned by Romeo, Pittman, and Familant (2003). Consider the single-homing case, the media outlets maximize the following Nash products to solve the equilibrium advertising rates:

$$q_1^1 = \arg\max(\pi_1 + \pi_2)^\alpha \left[\frac{(v - t|z_1 - \beta_1| - q_1^1)(\hat{x} - b_1)}{(b_2 - b_1)}\right]^{1-\alpha},$$

$$q_2^2 = \arg\max(\pi_1 + \pi_2)^\alpha \left[\frac{(v - t|z_2 - \beta_2| - q_2^2)(b_2 - \hat{x})}{(b_2 - b_1)}\right]^{1-\alpha}.$$

Similar calculations lead to $q_1^{1*} = v - t|z_1 - \beta_1|$ and $q_2^{2*} = v - t|z_2 - \beta_2|$, which are the maximal reservation prices for advertisers. Consequently, the reporting positions are $z_1^* = -\frac{3b_2}{2}$ and $z_2^* = \frac{3b_2}{2}$.

Our results are consistent with the fact that the advertising prices will be higher under JOA.[12] Moreover, our results suggest several testable implications for future research. First, the advertising prices are higher under single-homing than that under multi-homing, which is implied by $v - t|z_2 - \beta_2| > v - t|z_2 - \beta_1|$. Second, the media bias will be mitigated under JOA, because the integration in the advertising market leads to less competition between media outlets. Finally, JOA will result in a lower media price, because of more intensive competition for closer reporting positions.

CONCLUSIONS

This article discusses the media bias from a two-sided market view when advertisers have bargaining power in determining advertisement prices. A media outlet is an intermediary

[12]Empirically, JOA outlets charge a price below the monopoly advertising rate (see Romeo et al., 2003). This is because the JOA outlets must consider some practice constraints in their operations. In addition, Chandra and Collard-Wexler (2009) used data of Canadian newspaper merges to test a theoretical model with exogenous reporting positions in which merges in two-sided markets lead to higher prices, and find that greater concentration did not lead to higher prices for either side of the markets.

between readers and advertisers. The revenue of a media outlet may come from the reader side or from the advertiser side. It is shown that the media bias will be more serious than those without advertisements. In general, comparative statics demonstrate that the higher the price is on one side, the lower the price must be on the other side. We have shown that the media bias in the one-sided market is equivalent to a particular case of our model such that the media outlets have full power in determining the price of advertisement. A greater bargaining power for the media outlets is associated with less media bias, lower media subscription fees, and higher advertising prices. When advertisers are allowed to choose multi-homing, the equilibrium slants will be more serious than that under single homing. Moreover, an extension of joint operating agreements is found to provide less media bias but higher advertising prices.

There are several issues left for future research. First, if there are more than two advertisers, it is expected that the bargaining power of advertisers will be weaker, and thus the advertisement prices should be increased and the subscription fees could be decreased. Second, a generalized model considering the optimal level of advertisement may provide implications for social welfare such as Anderson and Gabszewicz (2006) and Manduchi and Picard (2009). Third, allowing media outlets to adopt multi-ideology strategies such as Garcia Pires (2013) could be an appealing extension of the current model. Finally, the case in which readers have a preference for reports biased in only one direction might be an interesting issue.

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APPENDIX

Derivation of Equation 2

Following the setting in Mullainathan and Shleifer (2005), Equation (1) can be replaced by

$$U^i = \overline{u} - \chi \frac{\phi^2}{(\chi+\phi)^2}(z_i - d)^2 - \phi\left(d + \frac{\phi}{\chi+\phi}(z_i - d) - b\right)^2 - p_i$$
$$+ (\overline{u}_a - (v - t|z_i - \beta_i|) - c_a)\,.$$

The reader's expected utility is

$$E_d(U^i) = \left(-\phi\left(1-\frac{\phi}{\chi+\phi}\right)^2 - \frac{\chi\phi^2}{(\chi+\phi)^2}\right)E(d^2) + \overline{u} - p_i - \frac{\chi\phi^2 z_i^2}{(\chi+\phi)^2}$$
$$-\phi\left(\frac{\phi z_i}{\chi+\phi} - b\right)^2 + \left(\frac{2\chi\phi^2 z_i}{(\chi+\phi)^2} - 2\phi\left(\frac{\phi z_i}{\chi+\phi} - b\right)\left(1-\frac{\phi}{\chi+\phi}\right)\right)E(d)$$
$$+ (\overline{u}_a - (v - t|z_i - \beta_i|) - c_a).$$

Because $E(d) = 0$, $E(d^2) = v_d$ by definition, we have

$$E_d(U^i) = \left(-\phi\left(1-\frac{\phi}{\chi+\phi}\right)^2 - \frac{\chi\phi^2}{(\chi+\phi)^2}\right)v_d + \overline{u} - p_i - \frac{\chi\phi^2 z_i^2}{(\chi+\phi)^2} - \phi\left(\frac{\phi z_i}{\chi+\phi} - b\right)^2$$
$$= \overline{u} - \frac{\phi\chi}{\chi+\phi}(v_d + b^2) - \frac{\phi^2(z_i - b)^2}{\chi+\phi} - p_i + (\overline{u}_a - (v - t|z_i - \beta_i|) - c_a).$$

Without loss of generality, consider that $z_1 < \beta_1 < \beta_2 < z_2$. Solving $E_d(U^1) = E_d(U^2)$ yields the indifferent reader $\hat{x}$ such that

$$\hat{x} = \frac{\phi^2(z_1^2 - z_2^2) + (p_1 - p_2 + t(z_1 + z_2))(\chi+\phi)}{2\phi^2(z_1 - z_2)}.$$

Proof of Proposition 1

Solving profit maximization conditions $\partial\pi_1/\partial p_1 = 0$ and $\partial\pi_2/\partial p_2 = 0$ simultaneously, we have

$$p_1 = \frac{\phi^2\left(6b_2(z_2 - z_1) + (z_2^2 - z_1^2)\right) - (\chi+\phi)(2q_1 + q_2) + t(z_1 + z_2)}{3(\chi+\phi)},$$
$$p_2 = \frac{\phi^2\left(6b_2(z_2 - z_1) + (z_1^2 - z_2^2)\right) - (\chi+\phi)(2q_2 + q_1) - t(z_1 + z_2)}{3(\chi+\phi)}.$$

Plugging p_1 and p_2 into the Nash products Π_1 and Π_2, then we can solve $\partial\Pi_1/\partial q_1 = 0$ and $\partial\Pi_2/\partial q_2 = 0$ simultaneously for Nash bargaining solutions and get the equilibrium advertisement prices q_1^* and q_2^*. Plugging q_1^* and q_2^* into π_1 and π_2, and then solving $\partial\pi_1/\partial z_1 = 0$ and $\partial\pi_2/\partial z_2 = 0$ yields z_1^* and z_2^*. Plugging z_1^* and z_2^* into prices yields p_i^* and q_i^*, $i = 1, 2$. Note that $p_1^{MS} = p_2^{MS} = \frac{6\phi^2}{\chi+\phi}b_2^2$ is the equilibrium prices in Mullainathan and Shleifer (2005). Comparing p_i^* and p_i^{MS}, $i = 1, 2$. Because we have

$$\frac{\partial\left(p_1^* - p_1^{MS}\right)}{\partial\alpha} = -\frac{6b_2\left(b_2\phi^2(34 - 14\alpha) + t(\chi+\phi)(\alpha+1)\right)}{(\chi+\phi)(\alpha_1 + 1)^3} < 0,$$

plugging the minimal value of $p_1^* - p_1^{MS}$ when $\alpha = 1$ yields $p_1^* - p_1^{MS} = t(\frac{3}{2}b_2 - \beta_2) - v < 0$, because $z_2^* \geq \frac{3}{2}b_2$ and the unit price of product $v - t|z_2 - \beta_2| > 0$. Thus, $p_1^* < p_1^{MS}$ when α is large enough. A similar result is obtained for comparing p_2^* and p_2^{MS}.

Proof of Proposition 2

This is because $\frac{\partial z_1^*}{\partial \alpha} = \frac{6b_2}{(\alpha+1)^2} > 0$, $\frac{\partial z_2^*}{\partial \alpha} = -\frac{6b_2}{(\alpha+1)^2} < 0$, and we have

$$\frac{\partial p_1^*}{\partial \alpha} = -\frac{6b_2(b_2\phi^2(34 - 14\alpha) + t(\chi + \phi)(\alpha + 1))}{(\chi + \phi)(\alpha + 1)^3} < 0,$$

$$\frac{\partial q_1^*}{\partial \alpha} = \frac{6b_2(b_2\phi^2(30 - 18\alpha) + t(\chi + \phi)(\alpha + 1))}{(\chi + \phi)(\alpha + 1)^3} > 0.$$

Proof of Proposition 3

(1) This is because

$$\frac{\partial p_i^*}{\partial \phi} = \frac{12\phi b_2^2(2 - \alpha)(3 - \alpha)(2\chi + \phi)}{(\alpha + 1)^2(\chi + \phi)^2} > 0, \quad i = 1, 2,$$

and similarly, $\partial q_i^*/\partial \phi < 0$, $\partial p_i^*/\partial \chi < 0$, $\partial q_i^*/\partial \chi > 0$.

(2) Comparative statics shows that

$$\frac{\partial p_i^*}{\partial b_2} = \frac{3(3 - \alpha)(b_2\phi^2(32 - 16\alpha) + t(\chi + \phi)(\alpha + 1))}{2(\alpha + 1)^2(\chi + \phi)} > 0,$$

and similarly, $\partial q_i^*/\partial b_2 < 0$, $i = 1, 2$.

(3) Clearly, $\frac{\partial p_i^*}{\partial t} = \frac{(9-3\alpha)b_2 - 2(\alpha+1)\beta_2}{2(\alpha+1)} > 0$, since $\beta_2 \leq b_2$, and $\frac{\partial p_i^*}{\partial v} = -1 < 0$, $\frac{\partial p_i^*}{\partial \beta_2} < 0$. Similarly, $\partial q_i^*/\partial t < 0$, and $\partial q_i^*/\partial v = 1 > 0$.

Proof of Proposition 4

Solving $\partial \pi_1/\partial p_1 = 0$ and $\partial \pi_2/\partial p_2 = 0$ simultaneously, we have

$$p_1 = \frac{\phi^2\left(6b_2(z_2 - z_1) + (z_2^2 - z_1^2)\right)}{3(\chi + \phi)} - \frac{2(q_1^1 + q_1^2) + q_2^1 + q_2^2 + 2t(z_1 + z_2)}{3},$$

$$p_2 = \frac{\phi^2\left(6b_2(z_2 - z_1) + (z_1^2 - z_2^2)\right)}{3(\chi + \phi)} - \frac{2(q_2^1 + q_2^2) + q_1^1 + q_1^2 + 2t(z_1 + z_2)}{3}.$$

Using p_1 and p_2 in the above, we can thus solve the Nash bargaining solutions simultaneously and obtain the equilibrium advertisement prices q_i^{j*}, $i = 1, 2$, $j = 1, 2$. Plugging q_i^{j*} into $\partial \pi_1/\partial z_1 = 0$ and $\partial \pi_2/\partial z_2 = 0$ yields equilibrium reporting positions such that $z_1^{m*} < z_1^*$ and $z_2^{m*} > z_2^*$. Substituting reporting positions into p_1 and p_2 yields the equilibrium media prices, and yields advertising prices similarly.

Proof of Proposition 5

(1) This is because $\frac{\partial z_2^{m*}}{\partial \alpha} = \frac{-12b_2}{(\alpha+1)^2} < 0$.
(2) Comparative statics yields

$$\frac{\partial p_1^{m*}}{\partial \alpha} = \frac{24b_2(b_2\phi^2(19\alpha - 29) - t(\chi + \phi)(\alpha + 1))}{(\chi + \phi)(\alpha + 1)^3} < 0.$$

(3) Clearly,

$$\frac{\partial q_1^{1*}}{\partial \alpha} = \frac{\partial q_1^{2*}}{\partial \alpha} = \frac{12b_2(b_2\phi^2(27 - 21\alpha) + t(\chi + \phi)(\alpha + 1))}{(\chi + \phi)(\alpha + 1)^3} > 0.$$

Proof of Proposition 6

(1) We have $\frac{\partial p_i^{m*}}{\partial \chi} < 0$, and $\frac{\partial q_i^{j*}}{\partial \chi} > 0$, $i = 1, 2$, $j = 1, 2$, since $\partial(\frac{\phi^2}{\chi+\phi})/\partial\chi < 0$.
(2) Since $\partial\left(\frac{\phi^2}{\chi+\phi}\right)/\partial\phi > 0$, it is obvious $\partial p_i^{m*}/\partial\phi > 0$ and $\partial q_i^{j*}/\partial\phi < 0$ from (10), (11) and (12).
(3) Moreover, it is clear $\partial p_1^{m*}/\partial b_2 > 0$, and $\partial q_i^{j*}/\partial b_2 < 0$.
(4) Obviously, $\partial p_1^{m*}/\partial v < 0$, $\partial p_1^{m*}/\partial t > 0$, and $\partial q_i^{j*}/\partial v > 0$, $\partial q_i^{j*}/\partial t < 0$.
(5) Since

$$q_1^{1*} - q_1^* = \frac{3(1-\alpha)b_2\left(12\phi^2 b_2^2(\alpha - 1) - (\chi + \phi)\alpha(t + 1)\right)}{(\chi + \phi)(1 + \alpha)^2} < 0.$$

Similarly, $q_2^{2*} - q_2^* < 0$.
(6) Moreover,

$$p_1^{m*} - p_1^* = \frac{12b_2\phi^2(1-\alpha)(23 - 13\alpha)}{2(\chi + \phi)(1 + \alpha)^2} + \frac{(21 - 15\alpha)tb_2}{2(1 + \alpha)} - (v - t\beta_2) < 0,$$

if v is large, t is small, and α is large.