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**Two models for illustrating the economics of media bias in introductory
economics**

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Abstract

Media bias is an important and underexplored feature of the economics of information. In this paper, I outline two models that can be used to illustrate media bias in an introductory economics course. The models rely on relatively simple and intuitive underlying assumptions, and draw on related empirical research. They do not require extensive mathematical derivations, although the models can easily be extended for more mathematically-inclined students. The models are useful in linking economic theory and empirical research, in a context that undergraduate students can relate to and often have direct experience of. The models can also be used to motivate a range of discussions on media and competition policy.

Keywords

Media bias
Economics teaching

JEL Classification

A22
L82

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1. Introduction

One goal of an introductory or survey course in economics is to introduce students to the sheer breadth of issues to which economic models and concepts can be applied. One feature of such courses is that the student body is incredibly diverse (Cameron and Lim, 2015). Some students have completed significant and relatively detailed studies of economics in high school, whereas others enter class with no background at all, or may have an aversion to or anxiety about studying economics. The latter is particularly a problem in compulsory introductory economics papers. Students also differ in their aspirations and motivations for studying economics. Some intend a future career in economics, or are intending to complete an economics major, whereas others are only completing the introductory economics paper because it is a compulsory component of their programme of study.

Teaching a class comprised of students with widely differing backgrounds and motivations is challenging (Cameron and Lim, 2015). In particular, teaching necessary basic economics concepts and models to students that are already familiar with them through prior study requires an approach that extends their understanding, while simultaneously engaging with students with no prior experience in economics. To achieve this, in my microeconomics survey class for social science students (which is separate from an introductory class for business students), I explicitly link concepts and theories to the work of past winners of the Nobel Memorial Prize in Economic Sciences and the John Bates Clark medal. This approach has the advantage of demonstrating to students the importance and relevance of the concepts and models they are learning, and how they relate to the most important work in economics. Thus, my survey class includes substantive topics on public choice theory (referencing Arrow and Buchanan), the economics of information (referencing Spence and Stiglitz), the economics of education (referencing Becker and Heckman), and the economics of social security (referencing Friedman, Tobin, and Sen), which are not the norm in introductory economics classes.

A key learning objective of the survey class for social science students is understanding how economics concepts and theories can be used to understand mainstream media stories. As part of that goal, I introduce students to the economics of media bias, drawing on the work of 2014 John Bates Clark Medal winner, Matthew Gentzkow. Examples of apparent media bias abound (e.g. see the collection of essays in Nelson, 2020). Almost any casual comparison of Fox News and MSNBC on major political or economic news stories will reveal a substantial difference in the elements that are emphasized, the tenor of reporting, the experts who are interviewed, and the conclusions that the experts and reporters arrive at.

As far as I am aware, no introductory-level economics textbook covers media bias. Thus, there are no extant graphical models available for instructors to use in teaching this material. However, Mullainathan and Shleifer (2005) outline a theoretical model of media bias that provides the inspiration for the models I describe in this paper.

Specifically, I describe two models that illustrate how the economist's toolkit can be used to understand how media bias may arise through the 'normal' operation of a media market. Both models start with a simple assumption that media consumers prefer to consume media stories that are aligned with their current beliefs. This 'confirmation bias' is well-established in the psychology literature (Nickerson, 1998; Oswald and Grosjean, 2004). Interestingly, both models are based on earlier models developed by Harold Hotelling for use in other contexts (1929; 1931). Hotelling's models are frequently used in introductory or intermediate microeconomics courses, and are readily understood by students. Their application to this new context represents a novel extension.

In our increasingly concentrated and polarized media landscape (Picard, 2014; Wilson et al., 2020), students are frequently confronted with accusations of media bias on social media or their everyday lives. For instance, President Donald Trump and other Republican politicians have repeatedly accused U.S. mainstream and social media organisations of exhibiting an anti-conservative bias (Bond, 2020). Moreover, the media have faced accusations of bias from both right-wing and left-wing advocates and industry insiders (Alterman, 2003; Goldberg, 2001). The prominence of these claims and counter-claims makes media bias a particularly salient topic for students. Including consideration of media bias within an introductory economics paper serves as a useful 'touch point' for students, connecting the theory and concepts from class with the real world that they observe around them. That some of the seminal work on this topic was recognized by Matthew Gentzkow's John Bates Clark Medal in 2014 further illustrates its importance and relevance to students of economics.

2. The Economics Literature on Media Bias

Media bias (or media slant) can be defined as "systematic differences in the mapping from facts to news reports – that is, differences which tend to sway naive readers to the right or left on political issues" (Gentzkow et al., 2015, p.). Essentially, news media firms, when presenting the same factual information, do so in ways that convey different normative interpretations of the facts (Scheufele & Tweksbury, 2007). The measurement of media bias can be operationalised as the difference between the average ideological stance (however measured) of the media (when considered collectively, or as individual firms) and the average ideological stance of the voting public, or the news consuming public.

The investigation of media bias by economists is a relatively recent development. Mullainathan and Shleifer (2005) were the first to outline a theoretical model of media bias that may arise where media firms cater to the preferences of their readers. In their model of two profit-maximising media firms, the two firms both report biased news to readers who are willing to pay for news that confirms their beliefs. Moreover, the two firms will present news with opposing biases. When there are three or more media firms, the firms segregate the

population to a greater extent, leading to greater bias in individual news firms. Gentzkow and Shapiro (2006) extended this model to consider news consumers' preferences for the accuracy of reporting. Unlike Mullainathan and Shleifer (2005), Gentzkow and Shapiro's (2006) model leads to less rather than more bias as competition and the number of media firms increases. This is because inaccurate reporting damages news media firms' reputations, leading them to prefer more accurate (and less biased) reporting in the long run.

In an early empirical contribution, Groseclose and Milyo (2004) computed 'ideological scores' for several major media news outlets (newspapers and television) in the U.S., based on a count the times that a media outlet cites various think tanks and other policy groups, compared with the number of times those groups are cited by members of Congress (see also Groseclose et al., 1999). They found a strong liberal bias overall, but substantial diversity, with some news outlets far to the left and others more centrist. Gentzkow and Shapiro (2010) took this methodology a step further, using text-based analysis to categorise newspapers based on the similarity of the language they used with the language used by members of Congress. They also showed substantial diversity in ideological positions of the newspapers. They then used data on newspaper circulation and voting patterns to show that a large proportion of the media bias in newspapers was explained by the underlying bias in voters. They also showed that, after controlling for newspaper audience, the identity of the newspaper owner did not affect bias. Somewhat in contrast to the theoretical implications of Gentzkow and Shapiro (2006), Gentzkow et al. (2014) find that competition drives diversity in ideological viewpoints, increasing the bias of individual media outlets. The motivation for ideological diversity is to reduce competition among media outlets for advertisers and readers. Their analysis was based on data on all US newspapers in presidential election years from 1872 to 2004.

In sum, the economics literature on media bias demonstrates that bias arises from the normal operation of media markets. For a useful summary, in particular highlighting the contributions of Matthew Gentzkow, see Shleifer (2015), which is a very accessible summary that I have assigned as an additional reading for my first year class in recent years.

3. Two economic models to illustrate media bias

In this section, I describe two economic models that I use to illustrate media bias in my introductory economics class for social science students. As noted previously, both models rely on the assumption of confirmation bias by media consumers. The models also assume that consumers' preferences for news items can be defined along a single dimension (e.g. liberal or conservative). Higher dimensionality could be considered as an extension of these simple models, but that would entail the loss of the simplicity apparent in the graphical representations of the models shown below.

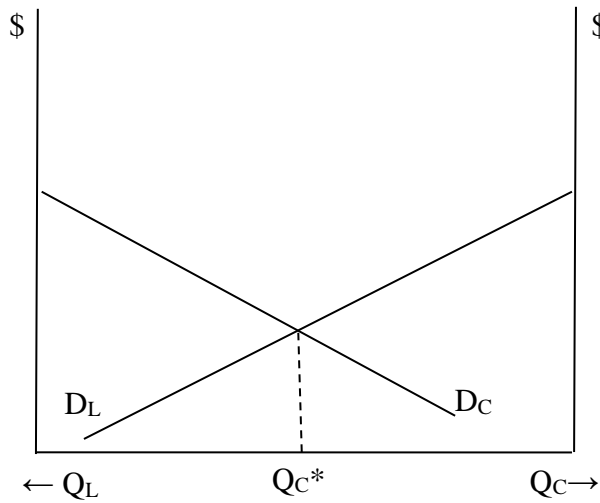
In the first model, we assume that there is a single profit-maximising firm serving the market for media stories, and only two types of content – liberal stories, and conservative

stories. The firm has limited ‘space’ available for content – this could be interpreted as a limited number of newspaper pages or columns, a limited amount of time within a news programme on radio or television, or a limited amount of consumer attention in the case of news websites or social media. The quantity of liberal content is Q_L , the quantity of conservative content is Q_C , and for simplicity we set $Q_L + Q_C = 1$, so that Q_L and Q_C represent the proportions of the media content that is devoted to each type. The space for these stories is represented as the x-axis in Figure 1, where Q_C is measured from left-to-right, and Q_L is measured from right-to-left, and the axis is of width equal to one.

Next, we assume that the firm must use all of the available space in each time period (or news cycle), and that the costs of news stories of the two types are the same. That ensures that the profit-maximising firm will maximise profits by maximising revenue, which also involves maximising the total benefits for news consumers of their news consumption. The demand curve for conservative news content represents the marginal benefits that news consumers with conservative news preferences receive from consuming conservative news stories. It is downward sloping from left-to-right, representing diminishing marginal utility from consuming additional conservative news stories. Symmetrically, the demand curve for liberal news content represents the marginal benefit that news consumers with liberal news preferences receive from consuming liberal news stories, and is downward sloping from right-to-left.

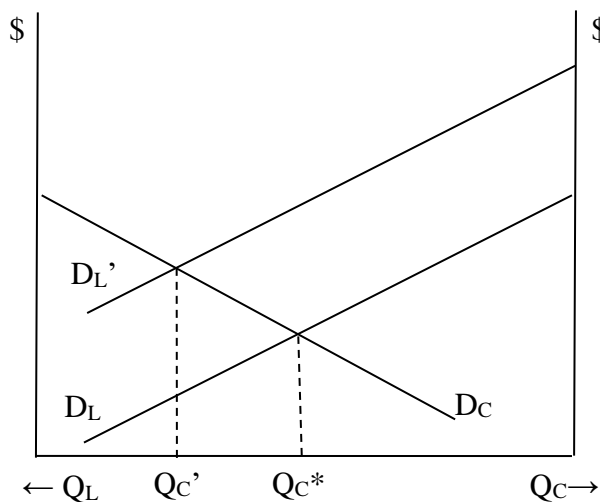
The optimal share of news content of each type is determined by the intersection of the two demand curves (Q_C^* in Figure 1). At this point, Q_C^* of the available media space is devoted to conservative content, and $1-Q_C^*$ is devoted to liberal content. The optimality of this solution can be established intuitively by reference to the marginal benefit and marginal cost of each type of content. As there are only two types of content, the opportunity cost of an item of one type of content is the marginal benefit foregone from an item of the other type of content. Thus, the demand curve for liberal content is also the marginal cost curve for conservative content. The quantity of conservative content that equates marginal benefit and marginal cost of conservative content is therefore Q_C^* . Symmetrically the same result holds for liberal content, where the demand curve for conservative content is simultaneously the marginal cost curve for liberal content. It is relatively straightforward to demonstrate this optimality result mathematically, if desired.

Figure 1: A model of media bias, with no apparent bias



Now consider an alternative market, where the number of liberal news consumers exceeds the number of conservative news consumers, such that the demand for liberal content, D_L' is greater than that shown in Figure 1. This situation is illustrated in Figure 2. In Figure 2, the optimal distribution of news content (Q_C') lies further to the left. The profit-maximising media firm responds to greater demand from liberal news consumers by providing more liberal news content. Thus, in this model news media bias arises through the 'normal' operation of the market for news content, and is a result of an underlying bias in the distribution of preferences of the news consuming public.

Figure 2: A model of media bias, with some liberal bias



This first model illustrates key results from the media bias literature, notably Gentzkow and Shapiro's (2010) finding that demand is much more influential in shaping content than supply. That is, media bias reflects underlying bias in the news consuming public, more so than reflecting bias in the journalists, editors, or news media owners. Note that this model closely

resembles Hotelling's (1931) two-period model of intertemporal exploitation of a non-renewable resource, and can be developed mathematically in a similar fashion, if desired (e.g. see Pindyck and Rubinfeld (2018) for a textbook treatment of Hotelling's two-period model).

Two obvious limitations of the first model are that it relies on an assumption that there is a single media-producing firm, and that consumers have dichotomous preferences (liberal or conservative). In the second model, we instead assume that consumers' preferences lie along a continuum from hardcore conservative (C0) to hardcore liberal (L0), as shown in Figure 3. For simplicity, assume that news consumers are uniformly distributed along the continuum from L0 to C0, but the remainder of the key results are not contingent on this assumption. Each news media firm also locates on the continuum. A particular news media firm's location on the continuum reflects the mix of stories (liberal or conservative, whether at the extremes or somewhere in between), that in turn may be determined by the editorial and ideological preferences of the media firm owners, editorial staff, and journalists (although, see the earlier point on the primacy of demand-side factors in determining the balance of content).

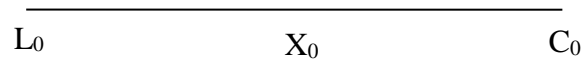
Next, assume that consumers will prefer to consume news stories from a news media firm that is most closely aligned with their preferences, and that consumers will consume news stories from a single news media firm. In the model, the consumer will choose to consume news content from the news media firm that is closest to their location, minimising the straight-line distance along the continuum between the location of the consumer and location of their preferred news media firm.

This model is of course a traditional Hotelling location choice model (Hotelling, 1929). If there was a single media firm, it could locate anywhere along the continuum, and all news consumers would consume from that media firm. With the additional assumption that there are only two types of news content, the firm's optimal location would be determined by the share of news stories, as shown in the first model above. However, that assumption is unnecessary here and therefore the location choice of a single firm is not constrained in that way. When there are two news media firms, the sole Nash equilibrium is for both firms to locate in the centre of the continuum (i.e. at X0). If either firm were located away from the centre, then they would be better off moving slightly closer to the centre, capturing more of the total market of news consumers.

In contrast, when there are three news media firms, as shown by Lerner and Singer (1937) there is no pure-strategy Nash equilibrium (see also Eaton and Lipsey, 1975; and Shaked, 1982). If all three firms located in the centre, they would split the market of news consumers equally. However, any of the firms could move a slight amount to the left (or right) along the continuum and capture nearly one half of the market, rather than one third. Each firm, then, initially has an incentive to move slightly outside the firm that is nearest to the centre, thereby capturing more of the market. The model also has no Nash equilibrium for four or more

media firms. A useful illustration of this model is to apply a classroom experiment (e.g. Anderson et al., 2007).

Figure 3: A location-based model of media bias



This second model also illustrates key results from the media bias literature, notably Gentzkow and Shapiro's (2010) finding that many newspapers exhibit partisan bias, but that there are newspapers on both sides of the political spectrum. As noted earlier, Groseclose and Milyo (2004) found similar results for both newspapers and television news, as did Gentzkow et al. (2014). This model makes clear that media bias arises in the normal operation of a media market where there are three or more firms, because each firm does best by differentiating themselves (even if only slightly) from the other firms, in terms of their location along the continuum. In other words, individual media firms would appear biased to a neutral observer, with some firms biased towards conservative content, and others biased towards liberal content. Still other firms may be more centrist in their content. Additional extensions of the Hotelling location model can also be applied to this case (e.g. see Nicholson and Snyder (2010) for a textbook treatment of the Hotelling location model).

4. Conclusion

Media bias is a real-world phenomenon of which almost all students will be aware. Many of them will have seen claims of bias in the mainstream media, or on social media. The models outlined in this paper demonstrate how economic theory and concepts can be used to illustrate how media bias may arise from the 'normal' operation of a media market. In my experience, having taught this topic using these models for more than ten years, the realisation that it is almost natural for some bias to be apparent in media markets leads many students to first examine their normative views of media bias. In some classes, this has led to interesting discussions of how optimal societal outcomes might best be achieved in the presence of persistent media bias. What sorts of policy tools are available to government, and does applying those tools lead to perverse outcomes. For instance, policies that limit media concentration or encourage the formation of a large number of small media firms, would actually lead to more biased media organisations, based on the second model. By connecting students with these real-world questions, we can open students' eyes to the importance of economic models for understanding important issues that matter to them, encouraging highly-motivated and reluctant economics students alike.

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