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The curse of anxiety-pleasure: Terrorism, the media, and advertising in a two-sided market framework

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THE CURSE OF ANXIETY-PLEASURE:
TERRORISM, THE MEDIA, AND ADVERTISING
IN A TWO-SIDED MARKET FRAMEWORK

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The curse of anxiety-pleasure: Terrorism, the media, and advertising in a two-sided market framework

CHRISTOPH P. PFEIFFER

Zusammenfassung/ Abstract

In theoretical analyses on terrorism and the media, the structure of the media market has thus far been neglected. The present paper adopts a multi-sided market framework in order to explore the ways in which the markets for terrorism, advertising, and the media influence each other. Although the markets for terrorism and the media do not constitute a two-sided market, they are linked by externalities, the degrees of which can be determined by the media. Further, advertisers play a crucial role in determining the content of a media product because they (i) usually contribute to a large share of a media firm's profit and (ii) value media violence for its juvenescent effect on the age structure of consumers. The model presented herein predicts that the probability of a 'circulation-advertising-terrorism spiral' usually decreases with increasing average age of the population, given that the media firm derives part of its profit from advertisements. The results underline the importance of financially independent news coverage.

JEL-Klassifikation / JEL-Classification: C72, D62, H52

Schlagworte / Keywords: terrorism, media, advertisements, multi-sided markets, game theory

1 Introduction

In a letter discovered at his hideout in Abbottabad, Pakistan Osama Bin Laden emphasized the importance of centralizing the media strategy of Al-Qaeda in order to “reclaim, God willing, the trust of a large segment of those who lost their trust in the jihadis” (Lahoud et al., 2012, p. 4) as a result of the excessive violence used by affiliated terrorist groups. Bin Laden believed that the media occupy “the greater portion of the battle today” (ibid., p. 14).

The foregoing statement indicates the degree to which media attention serves the tactical aims of terrorist organizations, which Schelling (1991) defined as threefold, namely to gain public attention, to destabilize existing policy, and to damage the economies of targeted countries. In fact, almost all scholars agree that terrorism and the media share a symbiotic relationship (Hoffman, 2006).¹ Not only do acts of terrorism shape news coverage, but the act of reporting on terrorism may influence media attention seeking terrorists, if this leads to terrorists updating their beliefs about the probability that their attacks will be covered in the news.

Contributions to the body of knowledge on terrorism derived from an economic perspective have often relied on game theory, which captures many aspects of the strategic interaction between terrorists and other groups such as targeted governments, the media, or the public (Sandler & Arce, 2007).² Game theory has been applied to the study of terrorism and the media by Frey and Rohner (2007), Pfeiffer (2011), and Scott (2001), none of whom, however, has taken into account the two-sided structure of the media market. The present paper thus aims to fill this gap by applying the theory of multi-sided markets to the relationship between terrorism and the media including the role of advertisers in the analysis. Advertisements often generate a large share of the profit for media firms (Picard, 2011) and are inseparably linked to most media products, or as Collins pointedly argued: “A magazine is simply a device to induce people to read advertising” (cited in Blanke, 2002, p. 52).

A point of departure when introducing the theory of multi-sided markets is to note that firms seem to over- or undercharge for certain products when the markets for these products are assessed in isolation. For instance, credit card users pay low (or no) fees, women often pay lower fees for entry into nightclubs compared with men, and

¹ For an opposing viewpoint, see Gowing (1994).

² For an extensive review of previous economic studies of terrorism, see Schneider, Brück, and Meierieks (2010a, 2010b). For a discussion on the suitability of rational choice models for the study of terrorism, see Caplan (2006).

technical platforms such as PlayStations are sold for prices that are too low to cover their costs. Viewed in relation to other markets, however, a seemingly irrational pricing strategy can actually be optimal.

Rochet and Tirole (2006) argued that the theory of multi-sided markets could be seen as a synthesis of the theory of network externalities with the theory of multi-product pricing: “From the former [...] it borrows the notion that there are noninternalized externalities among end-users. From the latter, it borrows the focus on price structure and the idea that price structures are less likely to be distorted by market power than price levels” (p. 646). They define a market as multi-sided if “the volume of transactions between end-users depends on the structure and not only on the overall level of the fees charged by the platform” (ibid., p. 646).

The theory of multi-sided markets has specifically been applied to media markets in order to model the relations of a media firm with its advertisers and consumers. Assuming homogeneity of consumers, advertisers would clearly prefer a media product that is consumed by more individuals to one that has fewer consumers. Further, although aversion to advertising is assumed in most theoretical models (e.g. Ambrus & Reisinger, 2005; Anderson & Gabszewicz, 2005; Choi, 2006), empirical research has suggested that individuals appreciate advertisements – at least in magazines (Kaiser & Song, 2009; Kaiser & Wright, 2006). Hence, consumers have a positive externality on advertisers, whereas advertisements can have either a positive or a negative externality on consumers. It seems plausible that the ease with which advertisements can be avoided determines the degree of the externality on consumers. This might explain why advertisements printed in newspapers or magazines result in a positive externality, whereas those seen on television or at the cinema can be expected to imply a negative externality (Anderson & Gabszewicz, 2005).

The remainder of the paper proceeds as follows: The basic model of a multi-sided media market that contains a media firm that sells a media product and space for advertisements is formulated in Section 2. This model is similar to that presented by Dewenter (2006). In Section 3, the proposed model is extended to include the market for terrorism. Results are discussed in the corresponding sections. Some conclusion are set out in Section 4.

Since the price for a terrorist attack and the price for a media product are set independently, the markets for terrorism and for media products are distinct markets linked by externalities. Further, although terrorism can have an externality on

advertisers, terrorists are assumed to be indifferent to the amount of advertising in the media product. The media firm can decide on the degree to which it covers terrorist attacks and thereby determine the magnitude of the externality on terrorists and advertisers. While media violence is considered to be a nuisance to most consumers, it tends to be appreciated by younger individuals (Hamilton, 2000; Hansen & Hansen, 1990). Moreover, because advertisers appreciate young adults as potential new customers, they value the ability of media violence to draw them in. However, the degree to which media violence can decrease the average age of media consumers is a function of the age distribution of a country. The model presented herein thus predicts that the propensity to report on terrorism will be higher when the average age of the population is low and when the media depend on advertising as a source of income.

2 A two-sided market: the media and advertising

The model development in this section assumes the existence of a two-sided media market with a monopolistic media firm. The basic model described herein is similar to that proposed by Dewenter (2006) and represents a two-sided market in a simple form. The media firm sells a media product to consumers and space or time to advertisers. To illustrate the impact of the two-sidedness of the market, first the model is developed for two single-sided markets that encompass only either the market for the media product or the market for advertising.

Let the price of the media product p_X be a linear function of its quantity X :

$$p_X = \xi_X - \alpha X, \quad (1)$$

with ξ_X representing autonomous demand and $\alpha > 0$ determining the marginal effect of a change in quantity on price. Variable costs in media markets tend to be relatively small (Picard, 2011), hence production is assumed to involve only a fixed cost F , yielding a net surplus of

$$\pi_X = p_X X - F. \quad (2)$$

After the substitution of equation (1) into equation (2), profit maximization leads to the following optimal quantity and price combination:

$$X_{1s} = \frac{\xi_X}{2\alpha}; p_{X,1s} = \frac{\xi_X}{2}, \quad (3)$$

implying a surplus of $\pi_{1s} = \frac{\xi_X^2}{4\alpha}$. This analysis does not take into account advertising, which is an essential source of income for most media firms. Without accounting for externalities, the advertising price-demand function can be written as

$$p_A = \xi_A - \beta A, \quad (4)$$

where A is the quantity of advertisements, ξ_A determines autonomous demand, and β represents the marginal effect of a price change on demand for advertisements. With the profit function $\pi_A = p_A A - F$, optimization leads to the single-sided market equilibrium:

$$A_{1s} = \frac{\xi_A}{2\beta}; \quad p_{A,1s} = \frac{\xi_A}{2}. \quad (5)$$

It is, however, reasonable to assume the existence of externalities between the two markets. Firstly, advertisers prefer to place their advertisements in media products that are consumed, *ceteris paribus*, by more individuals. The attitudes of consumers toward advertisements, by contrast, are less clear. As stated in the Introduction, although advertisement aversion is assumed in most economic models, empirical research has highlighted that individuals appreciate publicity—at least in magazines—with the positive externality increasing in the amount of information contained within the advertisements (Kaiser & Wright, 2006; Kaiser & Song, 2009). Taking into account the externalities from the media product on advertisers, the price-demand function for advertising can thus be written as

$$p_A = \xi_A - \beta A + \lambda X, \quad (6)$$

with $\lambda > 0$ determining how a change in the consumption of the media product influences advertising prices. The more people buy the media product, the higher the potential impact of advertising. Hence, λ is unambiguously positive for homogeneous consumers. By contrast, advertising has an externality on consumers, which is captured in the following price-demand function:

$$p_X = \xi_X - \alpha X + \theta A, \quad (7)$$

where $-1 < \theta < 1$ specifies the degree of the externality.

Anderson and Gabszewicz (2005) argued that the degree of this externality is a function of the ease with which advertisements can be avoided. For example, it is recognized that while cinema advertising is difficult to avoid (θ_C), individuals listening to the radio (θ_R) or watching television (θ_{TV}) can easily switch to another channel. Moreover, newspaper or magazine readers can skip advertisements with no perceivable loss of time and/or only read the advertisements that they are interested in (θ_N), which

implies the lowest ($\theta_C < \theta_{TV} < \theta_R < \theta_N < 0$) or even a positive externality ($\theta_C < \theta_{TV} < \theta_R < 0 < \theta_N$).³ If the media firm takes into account both markets, the profit maximization condition then becomes

$$\max_{X,A}\{p_A A + p_X X - F\}. \quad (8)$$

Using the price functions from equations (1) and (4), the first-order conditions lead to

$$X^* = \frac{\xi_X + A(\theta + \lambda)}{2\alpha}, \quad (9)$$

$$A^* = \frac{\xi_A + X(\theta + \lambda)}{2\beta}. \quad (10)$$

Thus, the optimal quantities for X and A can be calculated to equal

$$X_{2s} = \frac{2\beta\xi_X + \xi_A(\theta + \lambda)}{4\alpha\beta - (\theta + \lambda)^2}, \quad A_{2s} = \frac{2\alpha\xi_A + \xi_X(\theta + \lambda)}{4\alpha\beta - (\theta + \lambda)^2}, \quad (11)$$

$4\alpha\beta > (\theta + \lambda)^2$ ensuring the existence of positive values for both X and A .

How does this equilibrium compare to the single-sided market equilibrium? Note that the difference between the single- and the two-sided market equilibrium depends mainly on the sum of the externalities, $\theta + \lambda$. Therefore, three cases can be distinguished depending on the relative magnitudes of the externalities:

1. If both externalities are equal to zero or if they cancel each other out ($\theta + \lambda = 0$), the quantities of the two-sided market equilibrium are the same as those of the single-sided market equilibrium ($X_{2s}^I = X_{1s}, A_{2s}^I = A_{1s}$).⁴ However, when the quantities and externalities are non-zero, prices are affected. Specifically, the price of the media product is lowered by the negative externality from advertisements ($p_{X,2s}^I < p_{X,1s}$), whereas the price of advertisements is increased by the positive externality of the media product, $p_{A,2s}^I > p_{A,1s}$ (see Appendix A).
2. If the sum of the externalities is positive ($\theta + \lambda > 0$), more units of the media product and more advertisements will be sold ($X_{2s}^{II} > X_{1s}, A_{2s}^{II} > A_{1s}$). The increase in the quantity of a media product lowers its price. The increased amount of advertising further lowers this price if the media product has a negative externality on consumers ($p_{X,2s}^{II} < p_{X,2s}^I < p_{X,1s}$). The price of advertising is then lowered by rising advertising volume. However, a relatively strong externality from media product sales increases the advertising price. The overall effect depends on the relative magnitudes of the parameters. For

³ On a related matter, Ariel (2010) pointed out that commercials that interrupt an enjoyable movie may be suitable to counter hedonic adaptation and enhance the positive experience.

⁴ The Roman superscripts denote the different cases for the relative degrees of the externalities.

instance, if the sum of the externalities is high enough, the effect of the positive externality can offset the quantity effect, leading to an increased advertising price ($p_{A,2s}^I > p_{A,2s}^{II}$). This occurs if $\frac{\xi_A \alpha (\lambda - \theta)}{\xi_X (2\alpha\beta - \lambda(\theta + \lambda))} > 1$. Compared with the one-sided market model, the advertising price is always higher, $p_{A,2s}^{II} > p_{A,1s}$ (see Appendix A). This relationship can explain the ‘circulation-advertising spiral’. However, although the basic idea can be captured, a static model may be ill suited to explaining such an inherently dynamic process (Caillaud & Jullien, 2001).

3. The sum of externalities has a negative value ($\theta + \lambda < 0$) if (i) consumers have a strong aversion to advertisements or (ii) advertisers do not value additional consumers for the media product in question ($\frac{\lambda}{\theta} > -1$). Under certain conditions, a downward circulation-advertising spiral can thus emerge (see Appendix A).

Case 2 seems to be the most likely outcome, with either both externalities being positive ($\theta > 0 \wedge \lambda > 0$) or the negative externality from advertising assuming a smaller absolute value compared with the positive externality from consumers ($|\theta| < \lambda$). For example, both externalities have been shown to be positive in the market for magazines (Kaiser & Wright, 2006), which implies high advertising prices, low prices for the media product, and thus an advertising-circulation spiral over time. For the remainder of this paper $\theta + \lambda > 0$ is assumed.

3 Terrorism, the media, and advertising

This section introduces terrorism into the model. I define the market for terrorism as consisting of a group of active terrorists that offers to carry out attacks on the supply side and sponsors that have political goals on the demand side. For analytical simplicity, the complex of sponsors and active terrorists is hereinafter referred to as a terrorist organization.

The value a particular terrorist organization places on gaining public attention varies. For instance, while *Nationalsozialistischer Untergrund (NSU)*⁵ committed 10

⁵ *NSU*, a far-right German terrorist group, murdered nine immigrants and a police officer and injured 22 people on different occasions from 2000 to 2007 while maintaining complete secrecy. The police attributed the murders to the specific circumstances of the victims until the suicides of two of the cell’s three active members in 2011 led to the real reasons being revealed.

murders over the course of approximately 7 years, it intentionally remained unknown to the wider public. By contrast, the leadership of Al Qaeda in Afghanistan and Pakistan is reported to be very keen on maximizing the news impact of its attacks (Lahoud et al., 2012; Lynch, 2006). Walsh (2010) pointed out that media attention may be less important for terrorist organizations whose messages are intended only for specific groups. In the same vein, Minkmar (2011) suspected that the messages concealed within the attacks by *NSU* were directed toward like-minded individuals, who, unlike the authorities, might have known about the true perpetrators of the crimes, as some far-right music bands claimed in lyrics that were published in 2009 (ibid.). Similarly, Walsh (2010) argued that terrorist groups in Colombia mainly aim at intimidating law enforcement and judicial officials and thus receive little additional value from media attention. Nonetheless, for the purpose of the present paper, I focus on those terrorist organizations that seek media attention and, hence, assume terrorists to receive positive utility from media attention.

The economic costs of terrorism can be categorized into direct costs which include the loss of human lives and physical destruction, the costs of counter-terrorism, and the costs of distorted individual choices (Krugman, 2004; for a summary, see Frey, Luechinger & Stutzer, 2004a). Becker and Rubinstein (2011) acknowledged that a large proportion of the disutility created by terrorism stems from its ability to create irrational fear⁶:

Although the likelihood of being harmed by terrorism is negligible, the fear created by terrorism has huge and enduring effects on human behavior. Beyond the direct losses from terrorist acts, the resultant ‘terror’—the intense and prolonged fear of imagined dangers—has other long-term repercussions, such as the costs of increased security measures and changes in individuals choices (p. 1).

Using a life satisfaction approach, Frey, Luechinger, and Stutzer (2004b) found that the degree of terrorism has a significantly negative influence on happiness. Since most individuals are not directly exposed to terrorism, it is thus reasonable to attribute a share of this utility loss to the media coverage of terrorist attacks. Moreover, Slone (2000) adopted an experimental analysis in order to show that participants who are exposed to videos of terrorism have higher anxiety levels compared with those shown videos unrelated to national danger.

⁶ The degree of the fear induced by the media coverage of terrorism may depend on how the news is presented. For example, research has shown narrative communication has a stronger ability to influence behavior than statistics (Frey & Ronan, 2004).

The finding that exposure to the media coverage of terrorist attacks reduces utility seems to contrast with the observation that spectacular terrorist attacks lead to increases in media consumption (e.g. Frey & Rohner, 2007; Glaab, 2007; Hoffman, 2006). However, happiness-diminishing behavior has been found to be a persistent phenomenon; high television consumption is a good example (Layard, 2005). Although a reduction in the consumption of negative news would probably lead to higher overall life satisfaction, attention is still drawn to events that are perceived to be potentially dangerous. There are a number of reasons why individuals consume material that reduces their utility. Firstly, from an evolutionary perspective, a threat attention bias increased Darwinian fitness and is therefore ingrained into human biology (Fox et al., 2001; Marks & Nesse, 1994). Secondly, anxiety may be perceived as pleasurable, especially by young individuals (Hamilton, 2000), as from an evolutionary perspective, anxiety-pleasure in younger individuals can be seen as to encourage a playful preparation for the challenges of real life (Marks & Nesse, 1994). These points help to explain why younger individuals are particularly attracted by media violence. Thus, with terrorism per definition containing violence or at least the threat of violence, it seems reasonable to assume that younger consumers tend to value extensive news coverage of terrorism more than older customers for whom the externality may take negative values.⁷

The news coverage of terrorism also influences the decision-making of advertisers. I follow Hamilton (2000) assuming that the propensity for a media firm to display acts of violence such as terrorism tends to be appreciated by advertisers for its juvenescent effect on the age structure of media consumers.⁸

In contrast to the markets for the media product and advertising, the media firm does not directly control the quantities or the prices for terrorism. Thus, the media market and the market for terrorism are not considered to be two-sided markets. However, because the media firm determines the topics on which to report, it controls the magnitude of the externality from terrorism on advertisers and from media consumers on terrorists. The utility of the terrorist organization thus depends on the degree to which terrorism is covered by the news and on the number of people that

⁷ While Slone (2000) finds no difference in participants' levels of anxiety after exposure to news on terrorism across age-groups, the study does not address how individual *responses* to anxiety may differ depending on the age.

⁸ Bushman (2005) cautioned that violent or sexual television content can lower both the memory retention of the shown advertisements and purchase intention. Further, depending on the products they intend to promote, advertisers may wish to avoid being associated with certain negative events. For example, an airline might avoid placing advertisements after an airplane crash.

consume the news. Hence, the price-demand function in a monopolistic market for terrorism can be expressed as

$$p_T = \vartheta QX - \rho T, \quad (12)$$

$\rho > 0$ being the parameter to which additional terrorism lowers the price of terrorism, while Q is the probability of a media firm covering a terrorist incident and $\vartheta > 0$ represents the preference of a terrorist organization for public attention. Moreover, autonomous demand is set to be equal to zero in order to capture the idea that without media attention ($Q = 0$) terrorism would cease to have any utility for the terrorist organization and thus demand would drop to zero (see Appendix B). With c representing the marginal costs and F_T the fixed costs for terrorism, the profit maximization condition for the terrorist organization can be written as

$$\max_T \{p_T T - cT - F_T\}. \quad (13)$$

After substituting equation (12) into equation (13), maximization yields the following reaction function of the terrorist organization:

$$T^* = \frac{\vartheta QX - c}{2\rho}. \quad (14)$$

The media firm derives its profit in both markets; hence, it needs to take into account the different ways in which its news coverage influences terrorists and advertisers. The price-demand function for the media product then becomes

$$p_X = \xi_X - \alpha X + \theta A + \mu QT, \quad (15)$$

where $-1 < \mu < 1$ specifies how additional acts of terrorism affect media prices. The price-demand function for advertising can be written as

$$p_A = \xi_A - \beta A + \lambda X + \phi QT, \quad (16)$$

where $\phi > 0$ captures how news reports on terrorism influence the price of advertising. The media firm determines its reporting propensity for terrorist attacks, hence it controls the degree of terrorism's externality on consumers and advertisers; therefore, it needs to balance these different externalities in order to maximize its profit. The profit-maximizing condition is thus given by

$$\max_{X,Q,A} \{p_X X + p_A A - F_X\}. \quad (17)$$

The ensuing interaction between the media firm, advertisers and terrorists is formulated as a two-stage game in which the media firm is able to commit to a certain reporting propensity in advance.⁹ All players have common knowledge of rationality.

⁹ A media firm derives its power to commit to a certain reporting propensity from the expectations of consumers. As such, the style of a media product does not usually drastically change because customers come to expect events to be selected and framed in a certain way. For example, readers of a tabloid

The respective amounts of terrorism, advertisements, and the media product (in units) are chosen in the second stage of the game based on the previously determined reporting propensity.

The media firm anticipates and decides upon its reporting propensity based on the following Q -dependent best response functions¹⁰, which can be obtained by substituting equations (12), (15), and (16) into equation (17), optimizing with respect to X , A , and T , and solving the respective variable (see Appendix C):

$$X^*(Q) = \frac{2\rho((\theta + \lambda)\xi_A + 2\beta\xi_X)}{2\rho(4\alpha\beta - (\theta + \lambda)^2) - \vartheta Q^2(2\beta\mu + (\theta + \lambda)\phi)}, \quad (18)$$

$$A^*(Q) = \frac{4\rho\alpha\xi_A + 2\rho(\theta + \lambda)\xi_A + \vartheta Q^2(\phi\xi_X - \mu\xi_A)}{2\rho(4\alpha\beta - (\theta + \lambda)^2) - \vartheta Q^2(2\beta\mu + (\theta + \lambda)\phi)}, \quad (19)$$

$$T^*(Q) = \frac{\vartheta Q((\theta + \lambda)\xi_A + 2\beta\xi_X)}{2\rho(4\alpha\beta - (\theta + \lambda)^2) - \vartheta Q^2(2\beta\mu + (\theta + \lambda)\phi)}. \quad (20)$$

That there are positive real values of the response functions $\vartheta < \frac{4\alpha\beta - (\theta + \lambda)^2}{Q^2(2\beta\mu + (\theta + \lambda)\phi)}$ with $2\beta\mu + (\theta + \lambda)\phi > 0$ is assumed. Hence, for $2\beta\mu + (\theta + \lambda)\phi > 0$ and $(\theta + \lambda) > 0$, media sales, terrorism, and advertisements all monotonically increase alongside reporting propensity on terrorism, with terrorism and advertising increasing more rapidly compared with sales in Q ($\frac{\delta T}{\delta Q} > \frac{\delta A}{\delta Q} > \frac{\delta X}{\delta Q} > 0$). This result somewhat counterintuitively implies a ‘terrorism-advertising-circulation spiral’, even when media consumers find terrorism coverage to be a nuisance. Rearranging the conditions leads to

$$\phi > \frac{-2\beta\mu}{\theta + \lambda}. \quad (21)$$

Hence, a terrorism-circulation-advertising spiral is more likely to emerge under one or more of the following three conditions: (i) advertisers place a high value on changes in the age structure of consumers due to higher news coverage of terrorism, (ii) the influence of terrorism on consumers is either negative and small or positive, or (iii) the added externalities between advertisers and consumers are high.

newspaper would be surprised to find lengthy, in-depth analyses, while regular readers of a broadsheet would be irritated by huge, provocative headlines. As it is often the case in game theory, a weakness can become a strength.

¹⁰ For analytical convenience, the marginal costs of terrorism are assumed to be zero, $c = 0$.

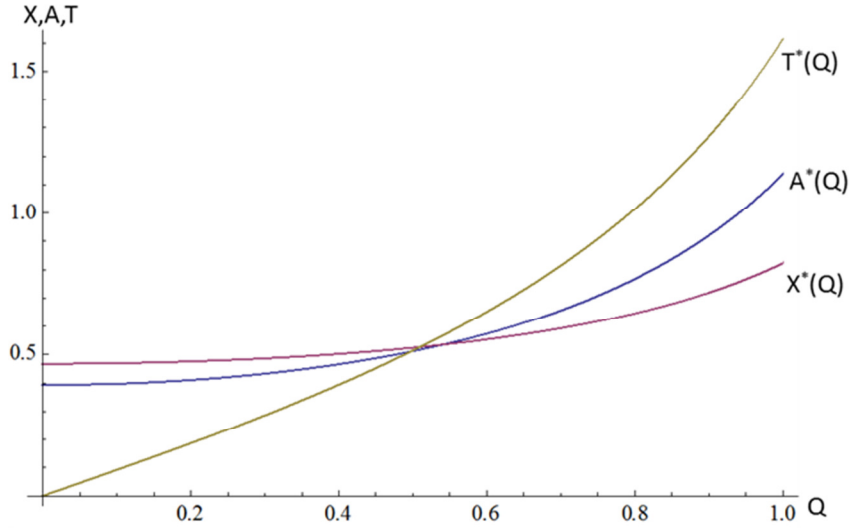


Figure 1: This graph represents the characteristics of a younger population. Advertisers value existing customers ($\lambda = 1.6$) and receive a strong positive externality from reporting on terrorism ($\phi = 1.5$), while customers slightly value advertising ($\theta = 0.1$) and receive a low negative externality from exposure to media violence ($\mu = -0.1$). The other parameters are specified as follows: $\xi_X = 0.8, \xi_A = 0.8, \beta = 2, \alpha = 1.5, \rho = 0.2, \vartheta = 0.7$. A terrorism-advertising-circulation spiral thus emerges in which the media firm optimally reports on all terrorist events.

Despite the possible negative externality from terrorism on consumers, the revenue increases with reporting propensity because the increased price that advertisers are willing to pay owing to the change in the consumer population leads to a lower unit price for the media product. Hence, contrary to the model without advertisers presented in Appendix B, terrorism and media attention may spiral to high values, even when news on terrorism overall constitute a nuisance to consumers. This finding emphasizes the importance of financially independent news coverage. With X, A and T all increasing in Q , the media firm thus maximizes its profit by reporting on *all* terrorist events – as exemplified in Figure 1.

As stated earlier, the juvenescent effect that an increase in media violence has on the average age of consumers depends on the age distribution, D , of the underlying population, $\phi = \phi(D)$. Young adults are the main consumers of media violence and the average age is relatively high in most industrialized countries, hence the externality from the media coverage of terrorism on advertisers can be expected to decrease with increases in the average age of the population, $\frac{\delta\phi}{\delta\phi(D)} < 0$ where $\phi(\cdot)$ indicates the arithmetic mean.

The way in which the news coverage of terrorism influences media consumption also depends on the age structure of the underlying population, $\mu = \mu(D)$. With a larger reservoir of younger individuals, μ is expected to decrease, $\frac{\delta\mu}{\delta\phi(D)} < 0$. Therefore, as

illustrated in equation (21) above, a terrorism-circulation-advertising spiral is more likely to emerge when ϕ and μ are high. This case is illustrated in Figure 2.

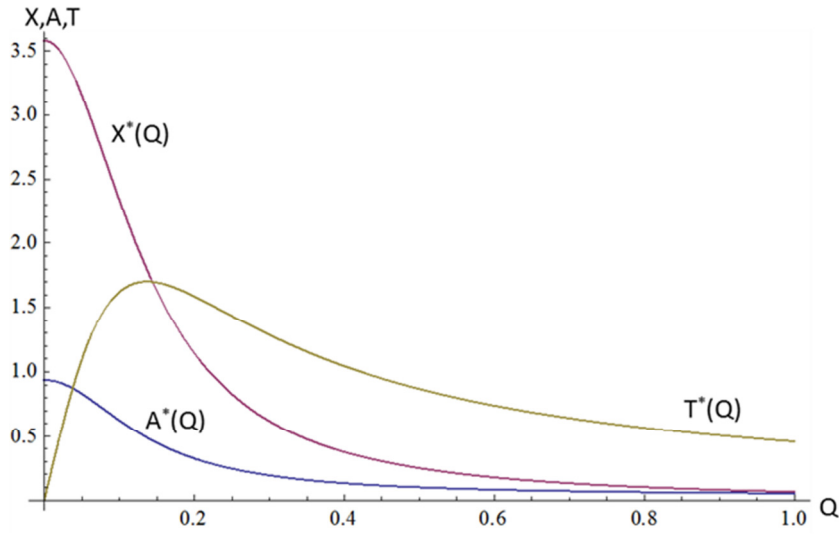


Figure 2: This graph represents a country that has a relatively old population, in which consumers receive a strong negative externality from terrorism ($\mu = -1.6$), advertisers only receive a small additional benefit from the media coverage of terrorism ($\phi = 0.3$), consumers slightly dislike advertising ($\theta = -0.3$), and advertisers value existing customers ($\lambda = 1.2$). The other parameters are specified as follows: $\xi_x = 0.7, \xi_A = 0.1, \beta = 1.8, \alpha = 0.2, \rho = 0.1, \vartheta = 0.7$. Terrorism has a maximum at $Q \approx 0.14$, because the higher overall coverage of terrorism strongly reduces media consumption and thus the potential impact of terrorism. In this setting, the media optimally do not report on terrorism because both A and X are declining in Q .

In light of the foregoing, the presented model predicts that countries that have a younger population are more likely to experience high rates of terrorism, a high reporting propensity of terrorist incidents, and high sales of media products and advertisements (see Figure 1). A relatively mature population, by contrast, tends to experience fewer terrorism events and less advertising, but relatively high sales of the media product (see Figure 2). A model that explicitly differentiates between different age segments leads to similar results (see Appendix D).

4 Conclusions

Although a threat-attention bias and anxiety-pleasure increase Darwinian fitness, they may leave contemporary individuals ill equipped to handle the increases in the availability of information that can be perceived as threatening. While the actual danger of terrorism is negligible, it causes large-scale disutility and changes in personal choices, with the media typically responsible for spreading the fear that terrorists intend to create by their actions.

Just as the media and terrorism share a symbiotic relationship, the media largely depend on advertising. When taking into account the two-sidedness of media markets, it becomes apparent that the choice and presentation of news events influence the

composition of media consumers, which in turn affects advertisers, because they value certain customer segments over others. In the case of younger individuals, a valuable customer segment, traditionally more attracted by media violence, advertisers appreciate how the portrayal of violence, for example of terrorist acts, tends to lower the average age of media consumers. However, the degree to which the average age of media consumers can be changed by increased coverage of terrorism clearly depends on the age structure of the underlying population. The model presented herein thus predicts that a terrorism-circulation-advertising spiral is more likely to emerge in a country that has a large number of young adults. That said, even when older individuals constitute the majority, this group may effectively be driven out of the market if advertisers value young customers highly enough.

Without advertising, the propensity to report on terrorism depends only on the degree of the externality of terrorism on consumers, implying an extensive coverage of terrorism when the externality is positive, and no coverage when the externality is negative. However, when advertisers are a source of income for a media firm, a terrorism-circulation-advertising spiral may emerge even when media consumers dislike news about terrorism. This finding underlines the importance of financially independent news coverage.

Further research could be directed towards the experimental exploration of individual, age-specific reactions to media coverage of terrorism. Empirical investigations into the perception of terrorism by the media have thus far been limited to newspaper content; an approach that relies on broader measures in order to quantify public or media attention therefore seems promising. The role of competition among media firms and the resulting changes in response to the coverage of terrorist incidents is another area that would benefit from further empirical as well as theoretical research.

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Appendices

A The media product and advertising

Case I

When the sums of the externalities between advertisers and consumers are both equal to zero ($\theta = 0 \wedge \lambda = 0$), the two-sided market collapses into a single-sided market in terms of quantities and prices. When the externalities cancel each other out, but both are non-zero ($\theta + \lambda = 0 \wedge \theta \neq 0 \wedge \lambda \neq 0$), the quantities are the same as those in the single-sided equilibrium:

$$X_{2s}^I = X_{1s} = \frac{\zeta_X}{2\alpha}, \quad (\text{A1})$$

$$A_{2s}^I = A_{1s} = \frac{\zeta_A}{2\beta}. \quad (\text{A2})$$

However, the prices change. The price for the media product will be lower (higher) than that in the single-sided equilibrium if the externality from advertising is negative (positive):

$$p_{X,2s}^I = \frac{\beta\xi_X + \theta\xi_A}{2\beta} < \frac{\xi_X}{2} = p_{X,1s} \text{ for } \theta < 0, \quad (\text{A3})$$

$$p_{X,2s}^I = \frac{\beta\xi_X + \theta\xi_A}{2\beta} > \frac{\xi_X}{2} = p_{X,1s} \text{ for } \theta > 0$$

Further, the price for advertising will be higher than that in the single-sided market equilibrium because the externality from consumers on advertisers is assumed to be positive:

$$p_{A,2s}^I = \frac{\alpha\xi_A + \lambda\xi_X}{2\alpha} > \frac{\xi_A}{2} = p_{A,1s} \quad (\text{A4})$$

Case II

When the sum of externalities is positive ($\theta + \lambda > 0$), both quantities are higher than that in the single-sided market equilibrium. In this case, it is not important whether consumers dislike advertising as long as the sum of externalities is positive:

$$X_{2s}^{II} = \frac{2\beta\xi_X + \xi_A(\theta + \lambda)}{4\alpha\beta - (\theta + \lambda)^2} > \frac{\xi_X}{2} = X_{1s}, \quad (\text{A5})$$

$$A_{2s}^{II} = \frac{2\alpha\xi_A + \xi_X(\theta + \lambda)}{4\alpha\beta - (\theta + \lambda)^2} > \frac{\xi_A}{2} = A_{1s}. \quad (\text{A6})$$

The price of the media product will be lower than that in Case I and thus lower than that in the single-sided market equilibrium:

$$p_{X,2s}^{II} = \frac{\alpha\xi_A(\theta - \lambda) + \xi_X(2\alpha\beta - \lambda(\theta + \lambda))}{4\alpha\beta - (\theta + \lambda)^2} < \frac{\beta\xi_X + \theta\xi_A}{2\beta} = p_{X,2s}^I, \quad (\text{A7})$$

for $\theta < 0$ or $\xi_X\beta(\theta - \lambda) + \xi_A(\theta(\theta + \lambda) - 2\alpha\beta) < 0$.

The price for advertisements is higher than that in Case I:

$$p_{A,2s}^{II} = \frac{\beta\xi_X(\lambda - \theta) + \xi_A(2\alpha\beta - \theta(\theta + \lambda))}{4\alpha\beta - (\theta + \lambda)^2} > \frac{\alpha\xi_A + \lambda\xi_X}{2\alpha} = p_{A,2s}^I \quad (\text{A8})$$

for $\xi_A\alpha(\lambda - \theta) > \xi_X(2\alpha\beta - \lambda(\theta + \lambda))$. However, $p_{A,2s}^{II} > p_{1s}$ because $2\xi_X\beta + \xi_A(\theta + \lambda) > 0$.

Case III

The sum of externalities can assume negative values ($\theta + \lambda < 0$) if consumers have a strong advertisement aversion or if advertisers do not value additional consumers of the media product ($\frac{\lambda}{\theta} > -1$). It is, however, difficult to conceive of a situation in which advertisers would not value additional customers without changes in consumer structure. The quantity of the media product is lower than that in the single-sided market case:

$$X_{2s}^{III} = \frac{2\beta\xi_X + \xi_A(\theta + \lambda)}{4\alpha\beta - (\theta + \lambda)^2} < \frac{\xi_X}{2} = X_{1s}, \quad (\text{A9})$$

for $(\theta + \lambda) \left(4\frac{\xi_A}{\xi_X} + (\theta + \lambda) \right) < 4\beta(\alpha - 1)$. Similarly,

$$A_{2s}^{III} = \frac{2\alpha\xi_A + \xi_X(\theta + \lambda)}{4\alpha\beta - (\theta + \lambda)^2} < \frac{\xi_A}{2} = A_{1s}. \quad (\text{A10})$$

for $(\theta + \lambda) \left(4\frac{\xi_X}{\xi_A} + (\theta + \lambda) \right) < 4\alpha(\beta - 1)$. In this case, the circulation-advertising spiral moves in a downward direction.

B Terrorism and the media without advertising

The price-demand function for X —without taking into account the externalities from advertising—is:

$$p_X = \xi_X - \alpha X + \mu QT. \quad (\text{B1})$$

With the profit maximization condition $\max_{X,Q} \{p_X X - F\}$, the substitution of equation (B1) leads to

$$X^* = \frac{\xi_X + Q\mu T}{2\alpha}. \quad (\text{B2})$$

With $\mu > 0$ profit is monotonically increasing in Q , with $\mu < 0$, profit is monotonically decreasing in Q . In this setup, the media firm's reporting propensity depends only on the extent of the externality of terrorism, μ .

Terrorism, the media, and advertising

Using the price-demand functions from equations (12), (15), and (16) and the profit functions for the media firm (equation 13) and for the terrorist organization (equation 17), optimization with respect to the quantities A, X and T leads to the following best response functions:

$$X = \frac{\xi_X + A(\theta + \lambda) + \mu QT}{2\alpha}, \quad (\text{C1})$$

$$A = \frac{\xi_A + X(\theta + \lambda) + \phi QT}{2\beta}, \quad (\text{C2})$$

$$T = \frac{\vartheta QX - c}{2\rho}. \quad (\text{C3})$$

Analytically, the substitution of equations (18), (19), and (20) into the profit maximization condition in equation (17) and optimizing with respect to Q yields

$$Q = \sqrt{\frac{4\rho \left(\xi_A(\theta\mu + \lambda\mu + 2\alpha\phi) + \xi_X(2\beta\mu + \phi(\theta + \lambda)) \right)}{\phi(\mu\xi_A - \phi\xi_X)}}. \quad (\text{C4})$$

for $\xi_X\phi \neq \mu\xi_A$ and $p((\theta + \lambda)\xi_A + 2\beta\xi_X)(\beta\mu^2 + \phi((\theta + \lambda)\mu + \alpha\phi)) \neq 0$. The negative solution for Q is not considered.

D A population with two age segments

In order to take into account explicitly the distribution of the underlying population, let there be a population of size 1 that can be divided into two age segments, namely a group of older individuals (O) and a group of younger individuals (Y), $Y + O = 1$. To older individuals, terrorism is considered to be a nuisance ($\mu_O < 0$). This group is less appreciated by advertisers compared with the group of younger customers ($\lambda_O < \lambda_Y$), which is attracted by media violence and thus by the news coverage of terrorism ($\mu_Y > 0$). It is further assumed that $\theta + \lambda_Y > \theta + \lambda_O > 0$.

Assuming that the media firm can effectively price discriminate between these two segments, the characteristic equations can be written as follows:

$$p_A = \xi_A - \beta A + \lambda_O X_O + \lambda_Y X_Y, \quad (D1)$$

$$p_{X_Y} = \xi_X - \alpha \frac{X_Y}{Y} + \theta A + \mu_Y QT, \quad (D2)$$

$$p_{X_O} = \xi_X - \alpha \frac{X_O}{1-Y} + \theta A + \mu_O QT, \quad (D3)$$

$$p_T = \vartheta Q(X_Y + X_O) - \rho T, \quad (D4)$$

$$\max_{X_Y, X_O, Q, A} \{p_{X_Y} X_Y + p_{X_O} X_O + p_A A - F_X\}. \quad (D5)$$

Optimization with respect to quantities yields the following best response functions: $X_Y = \frac{Y(\xi_X + A(\theta + \lambda_Y) + \mu_Y QT)}{2\alpha}$, $X_O = \frac{(1-Y)(\xi_X + A(\theta + \lambda_O) + \mu_O QT)}{2\alpha}$, and

$$A = \frac{\xi_A + X_Y(\theta + \lambda_Y) + X_O(\theta + \lambda_O)}{2\beta}.$$

Assuming that the media firm has the power to commit to a certain reporting propensity in advance (as described in Section 3), the equations based on which the media firm determines its reporting propensity for $c = 0$ are

$$X_Y = \frac{Y(2\rho(\xi_X(4\alpha\beta + (-1+Y)(\theta + \lambda_O)(\lambda_O - \lambda_Y)) + 2\xi_A\alpha(\theta + \lambda_Y)) + Q^2(-1+Y)(\xi_A(\theta + \lambda_Y)\mu_O + 2\xi_X\beta(\mu_O - \mu_Y) - \xi_A(\theta + \lambda_O)\mu_Y)\vartheta)}{4\alpha\rho(4\alpha\beta - \theta^2 + 2(-1+Y)\theta\lambda_O + (-1+Y)\lambda_O^2 - 2Y\theta\lambda_Y - Y\lambda_Y^2) + Q^2(4\alpha\beta((-1+Y)\mu_O - Y\mu_Y) + (-1+Y)Y(\lambda_O - \lambda_Y)((\theta + \lambda_Y)\mu_O - (\theta + \lambda_O)\mu_Y))\vartheta}, \quad (D6)$$

$$X_O = \frac{(1-Y)(2\rho(2\xi_A\alpha(\theta + \lambda_O) + \xi_X(4\alpha\beta + Y(\lambda_O - \lambda_Y)(\theta + \lambda_Y))) + Q^2Y(\xi_A(\theta + \lambda_Y)\mu_O + 2\xi_X\beta(\mu_O - \mu_Y) - \xi_A(\theta + \lambda_O)\mu_Y)\vartheta)}{4\alpha\rho(4\alpha\beta - \theta^2 + 2(-1+Y)\theta\lambda_O + (-1+Y)\lambda_O^2 - 2Y\theta\lambda_Y - Y\lambda_Y^2) + Q^2(4\alpha\beta((-1+Y)\mu_O - Y\mu_Y) + (-1+Y)Y(\lambda_O - \lambda_Y)((\theta + \lambda_Y)\mu_O - (\theta + \lambda_O)\mu_Y))\vartheta}, \quad (D7)$$

$$A = \frac{4\alpha\rho(2\xi_A\alpha + \xi_X(\theta + \lambda_O - Y\lambda_O + Y\lambda_Y)) + Q^2(\xi_X(-1 + Y)Y(\lambda_O - \lambda_Y)(-\mu_O + \mu_Y) + 2\xi_A\alpha((-1 + Y)\mu_O - Y\mu_Y))\vartheta}{4\alpha\rho(4\alpha\beta - \theta^2 + 2(-1 + Y)\theta\lambda_O + (-1 + Y)\lambda_O^2 - 2Y\theta\lambda_Y - Y\lambda_Y^2) + Q^2(4\alpha\beta((-1 + Y)\mu_O - Y\mu_Y) + (-1 + Y)Y(\lambda_O - \lambda_Y)((\theta + \lambda_Y)\mu_O - (\theta + \lambda_O)\mu_Y))\vartheta}, \quad (D8)$$

$$T = \frac{Q(\xi_X(4\alpha\beta + (-1 + Y)Y(\lambda_O - \mu_Y)^2) + 2\xi_A\alpha(\theta + \lambda_O - Y\lambda_O + Y\lambda_Y))\vartheta}{4\alpha\rho(4\alpha\beta - \theta^2 + 2(-1 + Y)\theta\lambda_O + (-1 + Y)\lambda_O^2 - 2Y\theta\lambda_Y - Y\lambda_Y^2) + Q^2(4\alpha\beta((-1 + Y)\mu_O - Y\mu_Y) + (-1 + Y)Y(\lambda_O - \lambda_Y)((\theta + \lambda_Y)\mu_O - (\theta + \lambda_O)\mu_Y))\vartheta}. \quad (D9)$$

With $4\alpha\rho(4\alpha\beta - \theta^2 + 2(-1 + Y)\theta\lambda_O + (-1 + Y)\lambda_O^2 - 2Y\theta\lambda_Y - Y\lambda_Y^2) + Q^2(4\alpha\beta((-1 + Y)\mu_O - Y\mu_Y) + (-1 + Y)Y(\lambda_O - \lambda_Y)((\theta + \lambda_Y)\mu_O - (\theta + \lambda_O)\mu_Y))\vartheta \neq 0$

it can be shown that $\frac{\partial X_Y}{\partial Q} > 0$ and $\frac{\partial X_O}{\partial Q} < 0$ when the proportion of younger individuals is sufficiently high, $Y > Y^*$. Further, $\frac{\partial A}{\partial Q} > 0$ for $Y > Y^*$ and $\xi_A > \xi_A^*$. Using equations (D1) to (D5) it follows that $\frac{\partial \pi}{\partial Q} > 0$, which is exemplified in Figure D1. Interestingly, older customers may be driven out of the market even if they constitute the majority of the population.

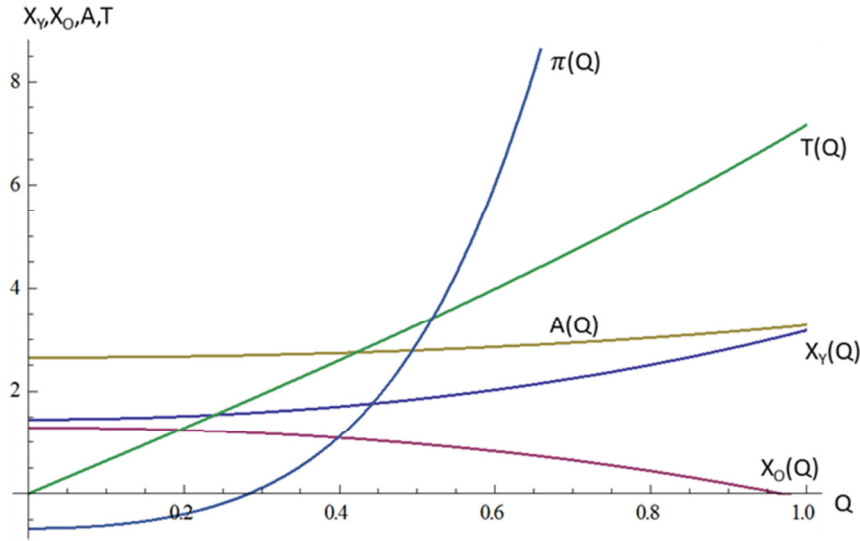


Figure D1: In this setting, 47.2% ($Y = 0.472$) of the population belong to the younger group, whereas 52.8% ($O = 0.528$) belong to the older group. However, older individuals are driven out of the market because younger customers are more attractive to advertisers. While the overall amount of sales decreases in Q , profit increases strongly with a higher reporting propensity. The values of the other chosen parameters are: $\xi_X = 7.46$, $\xi_A = 10.94$, $\beta = 3.5$, $\alpha = 3.26$, $\rho = 1.04$, $\vartheta = 3.18$, $\mu_O = -2.66$, $\mu_Y = 3.08$, $\lambda_O = 1.6$, $\lambda_Y = 2.58$.

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