Believe the Hype: Solving Coordination Problems with Television Advertising

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Introduction

This paper looks at data on how advertisers choose network television commercial slots. The main result is that advertisers of "coordination problem" or "social" goods, in our sample computers, beer, pizza, and wine, tend to advertise on more popular shows and are willing to spend significantly more per viewer than advertisers of other products such as batteries, deodorant, and breakfast cereal. The explanation offered here is that for technological reasons in the case of computers and social reasons in the case of beer, pizza, and wine, a person's preference for these

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goods increases in the number of other people who buy that good. When a consumer sees a brand advertised on a popular show, she not only learns about the brand, she learns that many other people know about it also. Hence advertisers of social goods are willing to pay a premium for slots on popular shows.

This result, at this point more suggestive than definitive because of data limitations, has at least two implications. First, coordination problems are crucial in a wide variety of social contexts, from political action and social movements (for example Moore 1995) to technological change (for example Katz and Shapiro 1994) to macroeconomics (for example Cooper and John 1988) to economic growth and development (for example Matsuyama 1997). People often solve coordination problems by adaptation or evolution (for example Young 1996), historical precedent, or "focal point" salience (Schelling 1980; see also Kreps 1990). But at least as often, people solve coordination problems by direct communication (Lewis 1969, Chwe 1998): if I want to go to a new restaurant if you go and you want to if I go, we do not need historical precedent or one of us to enter the restaurant by mistake; I can simply call you and make a date. In other words, "when there is no apparent focal point for agreement, [a person] can create one by his power to make a dramatic suggestion" (Schelling 1980, p. 144; see also Calvert 1992 and DeMarzo 1992).

Second, the finding suggests another mechanism by which advertising can affect people's decisions. Attempts to understand advertising as providing product information face the difficulty that many advertisements have almost no explicit content (Telser 1964). More recently advertising has been understood as a way for firms to signal quality: if their product were low quality, they would not want to spend so much on advertising (Nelson 1974, Kihlstrom and Riordan 1984, Milgrom and Roberts 1986). The mechanism suggested in this paper does not rely on a commercial signalling or informing anything about the product itself; all that is necessary is for a person to know that other people are watching too.

An illustrative anecdote is Apple Computer's introduction of the Macintosh computer during the 1984 Super Bowl. The Macintosh was incompatible with existing personal computers, and hence the group of potential Macintosh buyers faced a coordination problem. By airing the commercial during the Super Bowl, the most popular regular US television program each year, Apple did not simply inform each viewer about the Macintosh; Apple told each viewer that many other viewers also know about the Macintosh. The Discover card, another "network externality" example, was introduced with no fewer than six commercials during the 1986 Super Bowl (Horovitz 1987). If people like to see what's popular, then going to a movie is a coordination problem; in 1996, in what was widely seen as a marketing masterstroke, *Independence Day* was the first movie to be advertised on the Super Bowl (Cassidy 1997). This paper tries to move from anecdote to evidence.

Model

Here I simply illustrate that when consumers' utility from buying a good increases when other people buy the good, total sales can increase more than linearly as a commercial's audience size increases. Say that a consumer i gets utility $k_i + lm$ if she buys the good, where k_i is her "intrinsic" utility from the good, m is the total number of other people who buy the good, and l is a parameter, assumed the same for everyone, which indicates the strength of social interaction. A consumer gets utility 0 if he does not buy the good. We assume that k_i is independently and uniformly distributed on the interval $[b-1, b]$, where $0 < b < 1$.

Say that a commercial is shown to N people; we assume that people who do not see the commercial do not change their behavior and hence we ignore them. Now each of the N people choose whether to buy the good, considering both their intrinsic utility from the good and the number of other people who will buy it. First, note that there is a critical value k^* such that people who have intrinsic utility higher than k^* buy the good, people who have intrinsic utility lower than k^* do not, and people whose intrinsic utility is exactly k^* are indifferent (assume $k^* \in (b-1, b)$). Thus person i expects a fraction $b - k^*$ of the other $N-1$ people to buy the good, and hence his utility from buying the good is $k_i + l(N-1)(b-k^*)$. But since a person with intrinsic utility k^* is indifferent between buying and not buying, we have the equilibrium condition $k^* + l(N-1)(b-k^*) = 0$, which we solve to get $k^* = -lb(N-1)/(1-l(N-1))$. Hence a fraction $b - k^* = b/(1-l(N-1))$ buy the good, and the total amount sold is $bN/(1-l(N-1))$.

If people do not care about whether others buy the good, we have $l = 0$ and thus the total amount sold is simply bN, which is linear in N. If people do care, we have $l > 0$ and the total amount sold increases more than linearly in the size of the commercial audience N. In fact, the greater l is, the greater the nonlinearity; the stronger the social interaction, the greater "kick" there is from increasing audience size.

We can get this kind of result in a much more general setting; the crucial modelling concept, left implicit above, is Aumann's (1974, 1987) correlated equilibrium: when a person sees a message, it affects his beliefs about the messages other people receive. Crucial here is that when a person sees the commercial, he knows how many other people also see it. In fact, this is the entire "content" of the commercial message: here the commercial does not communicate or "signal" anything else.

Data

I look at 119 brands advertised on the three major US national television networks during three months of a television season: October 1988, February 1989, and July 1989. The data were obtained from the publications of Nielsen Media Research and are available from the author.

Nielsen estimates audience size ("ratings") and demographics for virtually every network television program. Nielsen's estimates of the cost of commercial slots on a given program are based on reports from the television networks, not on actual transactions. Actually a slot on a given program usually does not have "its own" price; slots are often bought and sold in blocks in a complicated sequence of bargaining and negotiations (Poltrack 1983). This cost data, the only such available (with the exception of actual contracts made available to the Federal Communications Commission in 1980; see Fournier and Martin 1983 and FCC Network Inquiry Special Staff 1980), at least is relied upon by the advertisers and television networks themselves. Information on which programs a given brand advertises is the greatest limitation of our data set: only those brands which Nielsen clients contract for are available, and only for the months October, February, and July (for a description see Webster and Lichty 1991, p. 222). Although this sample of brands is somewhat limited, at least for each brand we know the complete television advertising strategy, in full cost and demographic detail, during three months chosen by Nielsen to represent a television season.

Results

First I categorize the goods according to whether buying a given brand is a coordination problem. Crudely, along with computers, I include in "social" goods those which are typically consumed together with people outside the household. In our sample, the social goods are the Apple Macintosh, IBM hardware, the US Army, Dominos Pizza, Gallo Wines, and thirteen brands of beer. Table 1 shows the social and nonsocial goods by product type.

Category	Number of brands in category	Typical brand in category	Average audience size (millions)	Average cost per thousand (dollars)
Armed forces	1	US Army	5.9	10.1
Beer	13	Coors Light	7.3	10.5
Computers	2	Apple Macintosh	5.4	9.5
Pizza	1	Dominos Pizza	9.5	9.1
Wine	1	Gallo Wines	7.9	9.1
Total social goods	18		7.1	10.2
Baby care	2	Chubs Baby Wipes	4.6	4.8
Bath and soap	3	Caress Beauty Bar	7.4	7.0
Batteries	2	Energizer	5.3	5.8
Bleach and detergent	6	Clorox Bleach	5.9	4.6
Cameras and film processing	2	Canon Cameras	6.9	10.7
Candy	2	Carefree Gum	6.1	4.2
Cereal	27	Kellogg Crispix	6.0	6.3
Deodorant	6	Arrid Deodorant	5.6	5.2
Foods	12	Shedds Spread	5.5	5.0
Hair care	10	Head & Shoulders	5.5	5.0
Household cleaners	14	Lysol	5.3	3.9
Household medications	10	Nuprin	5.3	5.2
Pet food	1	Milk Bone Biscuits	5.7	4.8
Shaving	2	Atra Plus Razor	7.8	9.7
Toothpaste	1	Aquafresh	4.3	5.5
Wood finishing	1	Minwax	4.5	5.1
Total nonsocial goods	101		5.6	5.4

Table 1. Average audience size and average cost per thousand for various brand categories

Table 1 also shows the average audience size and average cost per thousand for each brand category; Figure 1 shows all 119 brands individually. What these terms mean is best explained in an example: if Brand X pays $25,000 for one 30-second slot (the standard commercial unit) on a show with an audience of 9 million households and pays $10,000 each for two 30-second slots on a show with an audience of 3 million households, the average audience size for Brand X is 5 million and the average cost per thousand is $3, since the total cost is $45,000 and there are a total of 15 million "gross impressions" (see Webster and Lichty 1991, p. 192). There are an estimated

90.4 million households, so a typical Dominos Pizza commercial reaches about ten percent of the population.

First, note that the average cost per thousands for the social brands are consistently higher than for the nonsocial brands (exceptions are Shaving and Cameras and film processing). In other words, beer and pizza advertisers are willing to spend more per household than battery and deodorant advertisers. Second, audience sizes for social brands are larger than for nonsocial brands. With two exceptions (Bath and soap and Shaving) nonsocial categories have audience sizes of less than 7 million, and with two exceptions (Armed forces and Computers) social categories have audience sizes of greater than 7 million. If we exclude computers, Canon Cameras, and the US Army because they are the only brands in the sample which have a price of more than a few dollars, the distinction is clearer.

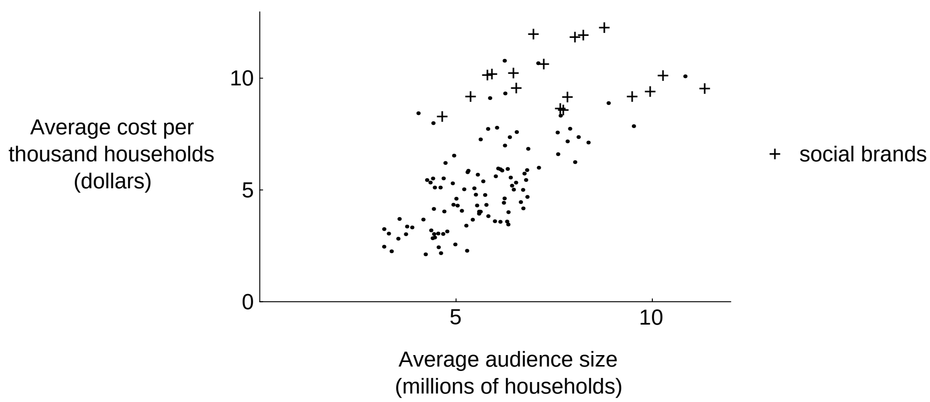

Figure 1. Costs per thousand versus average audience size

Alternative explanations

The first and most obvious competing explanation is that audiences of popular shows have more favorable demographic characteristics. Nielsen reports on more than forty demographic categories, including age, sex, region, county size, rural versus urban, household size, presence of children, household income, and cable television subscription. Since we know demographic characteristics for each show, and we know which shows an advertiser places commercials on, we can determine the demographic composition of the audience of a brand's complete campaign. Many demographic categories are highly correlated with others and hence we can ignore them (for example, household size is highly correlated with percentage of children in the audience).

A second possible explanation has to do with a campaign's cumulative effect over a month. Two commercials which each reach 5 million together reach fewer than 10 million people because their audiences to some degree overlap. A commercial slot on a program which reaches 10 million people all at once might thus cost more even though it provides the same total number of exposures (see also Fisher, McGowan, and Evans 1980, p. 700; on audience duplication generally, see Rust 1986). Fortunately, data is available on each campaign's "four-week reach," the percent of households who saw at least one commercial during the month.

The standard tool for removing these complications is linear regression, and results are shown in Table 2. Here we consider monthly campaigns and hence there are 357 observations.

Average cost per thousand (dollars) regressed on:	(1)	(2)	(3)	(4)	(5)	(6)
Social good				4.29 (0.33)	1.22 (0.26)	1.21 (0.26)
Average audience size (millions)	0.59 (0.05)	0.26 (0.04)	0.27 (0.04)			
Working women		0.16 (0.07)	0.15 (0.07)		0.40 (0.07)	0.39 (0.07)
Women 18–34		0.01 (0.05)	0.03 (0.06)		-0.06 (0.06)	-0.06 (0.06)
Women 35–49		-0.10 (0.12)	-0.09 (0.12)		-0.22 (0.12)	-0.22 (0.12)
Women 50 and over		0.09 (0.05)	0.09 (0.05)		0.11 (0.06)	0.10 (0.06)
Men 18–34		0.01 (0.07)	0.01 (0.07)		-0.11 (0.08)	-0.11 (0.08)
Men 35–49		0.36 (0.12)	0.35 (0.12)		0.41 (0.13)	0.40 (0.13)
Men 50 and over		-0.13 (0.08)	-0.11 (0.08)		-0.22 (0.08)	-0.21 (0.08)
Teen females		-0.34 (0.09)	-0.38 (0.10)		-0.23 (0.10)	-0.24 (0.10)
Teen males		0.54 (0.18)	0.58 (0.18)		0.66 (0.18)	0.67 (0.19)
Income > $60,000		0.40 (0.08)	0.41 (0.08)		0.34 (0.08)	0.34 (0.08)
East central		-0.02 (0.08)	-0.01 (0.08)		-0.10 (0.08)	-0.10 (0.08)
West central		0.05 (0.08)	0.04 (0.08)		-0.02 (0.08)	-0.03 (0.08)
South		-0.12 (0.05)	-0.11 (0.05)		-0.15 (0.05)	-0.15 (0.05)
Pacific		0.12 (0.07)	0.12 (0.07)		0.24 (0.07)	0.24 (0.07)
Urban		-0.10 (0.06)	-0.10 (0.06)		-0.14 (0.06)	-0.15 (0.06)
Semi-urban		0.00 (0.10)	-0.02 (0.10)		0.05 (0.10)	0.04 (0.10)
Pay cable		-0.13 (0.06)	-0.13 (0.06)		-0.07 (0.06)	-0.07 (0.06)
Basic cable		0.03 (0.07)	0.01 (0.07)		0.25 (0.06)	0.25 (0.07)
Four-week reach			0.0036 (0.0029)			0.0011 (0.0031)
February	-0.98 (0.30)	-0.62 (0.17)	-0.64 (0.17)	-1.49 (0.29)	-0.61 (0.18)	-0.62 (0.18)
July	0.77 (0.31)	1.20 (0.26)	1.23 (0.26)	-0.45 (0.29)	0.33 (0.25)	0.34 (0.25)
Intercept	2.37 (0.41)	2.13 (5.94)	2.48 (5.95)	5.89 (0.21)	0.04 (6.22)	0.15 (6.23)
R^2	0.325	0.851	0.852	0.364	0.837	0.837

Table 2. Regressions of average cost per thousand on average audience size, demographic characteristics, four-week reach, and social good

First we regress cost per thousand on audience size and month dummies (to correct for seasonality), and find the coefficient on audience size, 0.59, to be large and significant. Adding the demographic categories in the second regression brings this coefficient down to 0.26, but this is still economically as well as statistically significant: since audience size has mean 6.11 million and standard deviation 2.59 million and a typical cost per thousand is around $5 to $6, increasing audience size by a relatively small one million increases cost per thousand by about five percent. The demographic categories are fairly self-explanatory (urban represents counties belonging to the 25 largest metropolitan areas, and semi-urban represents all other counties which have population over 150,000 or are in SCSAs or SMSAs of population over 150,000). They are all in terms of percentage of the campaign's total audience belonging to that group; for example, a typical advertiser is willing to pay 16 cents more per thousand to reach an audience which is composed of 11 percent working women as opposed to 10 percent working women. Most of the demographic categories are not significant: advertisers seem to care mainly about working women, middle aged and teenage men, and households with incomes greater than $60,000 (data on other uppper income categories are available, but are all highly correlated). The third regression adds four-week reach; its coefficient is positive, but small and not statistically significant, and the regression as a whole is barely affected (including more detailed cumulative exposure measures, such as the percent who have seen exactly 1 commercial during the month, 2 commercials, 3 commercials, and so forth, also has little effect).

The next three regressions consider a dummy variable for social good (1 if social, 0 if not) instead of audience size. The results are that producers of social brands are willing to pay significantly more per thousand ($1.22, around 20 percent more); as before, correcting for demographics is clearly necessary but correcting for cumulative exposure makes little difference.

To determine the "pure" relationships between social good, average audience size, and average cost per thousand, we need to eliminate spurious correlations due to demographic and cumulative effects. One way to do this is to regress social good, average audience size, and average cost per thousand on our demographic and cumulative variables and consider only the residuals. That is, the residual after regressing social good, for example, on demographic and cumulative variables is the purely social good "component" unexplained by demographic or cumulative effects. We can then regress these "pure components" against each other, as shown in Table 3.

Average audience*	=	0.948 (0.379)	Social good*	R^2 = 0.017
Average cost per thousand*	=	1.446 (0.256)	Social good*	R^2 = 0.082
Average cost per thousand*	=	0.249 (0.035)	Average audience*	R^2 = 0.127

* Residual after regressing over demographic characteristics and cumulative exposure distribution

Table 3. Relationships among residuals of average audience, average cost per thousand, and social good

All coefficients are significantly positive. Again, after correcting for demographic and cumulative effects, advertisers of social goods place their ads on shows which have larger audiences (on average roughly one million households larger) and pay around $1.45 more per thousand for those commercial slots.

A third possible explanation is that people who rarely watch television tend to watch the most popular shows. Since only popular shows manage to reach these people, popular shows can command a higher price, and producers of social brands might be willing to pay a premium to reach them. However, this does not seem to be the case, as illustrated in Figure 2, which for each of the 357 monthly campaigns plots total cost versus four-week reach. It is true that reaching remaining households is exponentially costly, but it is also true that producers of social brands are consistently willing to pay more, at all levels of cumulative exposure.

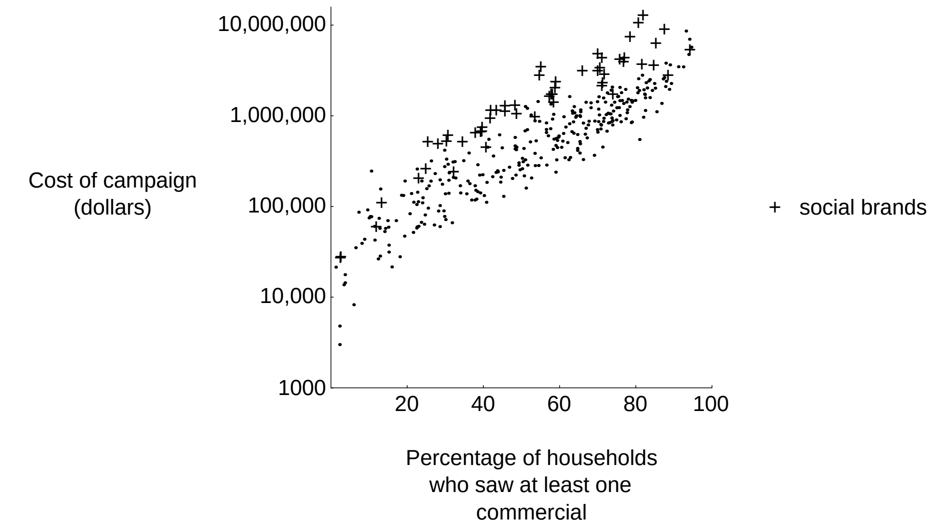

Figure 2. Total cost of campaign versus four-week reach

A fourth possible explanation is that advertisers of social brands simply need to advertise more than advertisers of nonsocial brands; since the total number of commercial slots is limited, advertisers of social brands are forced to buy the more expensive programs. Figure 3 plots average cost per thousand versus the total cost of the campaign over the year for each of the 119 brands.

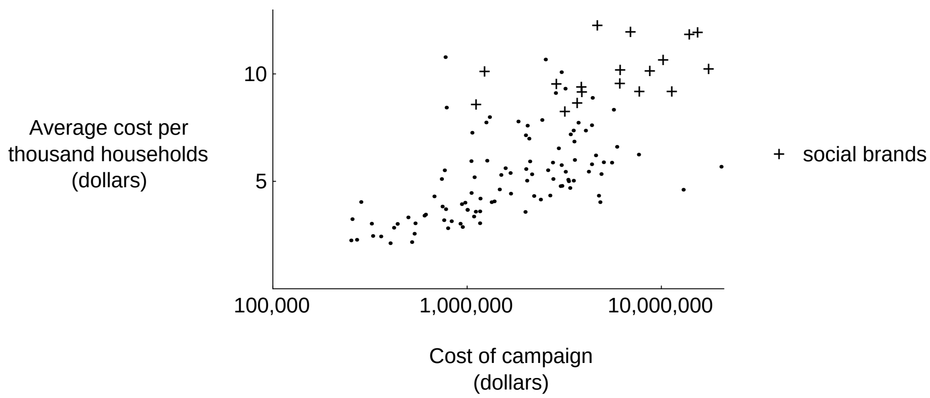

Figure 3. Cost per thousand versus total cost of campaign

Figure 3 confirms the prediction (for example in Becker 1991, p. 1113) that social brands are in general more heavily advertised than nonsocial brands. But the graph shows that many nonsocial brands spend comparable amounts on advertising, but still spend much less per household. In other words, social brands do not pay high cost per thousands simply because they advertise heavily.

There are several other plausible explanations. Popular shows might be more interesting and hence viewers might recall the commercials better (Webster and Lichty 1991). Advertising expensively on a popular show might indicate a higher quality product (Nelson 1974, Schmalensee 1978, Kihlstrom and Riordan 1984, Milgrom and Roberts 1986). Since there are relatively few popular shows, networks might be in a better bargaining position when negotiating with advertisers over these shows and can thus charge higher prices. Popular shows might simply be more persuasive, better at changing preferences toward purchase (Dixit and Norman 1978). The audience size and demographics of popular shows might be more predictable, which would appeal to risk averse advertisers (Fournier and Martin 1983). All of these explanations can explain why popular shows are more expensive, but not why social goods tend to be advertised on expensive popular shows. In other words, there is no obvious reason why issues such as recall, quality, persuasion, and risk aversion apply more to social goods than to nonsocial ones.

The main problem with our analysis is that our sample of social goods is so limited, dominated by male oriented products and beer in particular. As we have seen, we can correct for this to some extent, but there remains the possibility that instead of describing a social good effect, we are simply describing a beer drinker effect. The only way to settle this convincingly is to look at data wherever available on other social goods, especially those with different demographic characteristics such as shoes, clothes, and soft drinks.

Another more conceptual problem is that it is difficult to distinguish whether a person buys a good because he expects that others will buy it or more simply because he knows that other people know about it. For example, Master Locks advertised on the Super Bowl for twenty consecutive years, for example spending most of its 1991 advertising budget for a single spot of a Master lock surviving a gunshot (Amos 1991). When buying a lock, I care not so much that others buy the same brand but rather that other people, including would-be thieves, think that the lock is tough. Instead of triggering coordination, publicity might simply be another aspect of the product, a real or "symbolic" benefit (Becker and Murphy 1993, Keller 1993, p. 4). Also, here we focus on coordination gains among consumers, but gains from coordination can arise "across" sectors: for example, the more available software, the more consumers would want to buy a Macintosh, and the larger the consumer market, the more programmers would write Macintosh software; Bagwell and Ramey (1994a, 1994b, 1994c) consider how advertising can help in achieving coordination gains between retailers and consumers.

Related findings

The finding that popular shows are more expensive per viewer is similar to results from data not across shows but across localities. Fischer, McGowan, and Evans (1980) find that local television station revenue increases not only in the total number of households viewing but also in the square of the total number of households viewing. Similarly, Ottina (1995, p. 7) finds that the larger the local television market, the more advertising revenue is generated per household. Wirth and Bloch (1985, p. 136) find that the rates charged by local stations for a spot on the program "MASH" increase more than linearly in the number of viewing households. Again, there are many possible explanations, including differences in audience demographics and stations' market power across localities. Our data have fewer problems in picking up a pure nonlinearity because they come from the same nationwide viewing audience and advertising market and have more complete demographic measures. In their explanation, Fischer, McGowan, and Evans (1980, p. 700) emphasize audience duplication: "advertisers may value the single spot on the large-audience station more than the two spots on the small audience one. . . because the audiences for the two spots on the station with the smaller audience may have some viewers in common." But since they do not have data on audience duplication across localities, they cannot argue for this on the basis of evidence. The data we have on audience duplication across different shows suggest that it does not explain the nonlinearity (for that matter, repeated exposures, far from being a waste, might be necessary to stimulate purchases; see Stewart 1992).

Several earlier studies of television advertising considered the question of whether advertisers who purchased large quantities of advertising paid lower rates, through quantity discounts or declining rate schedules (Peterman 1965, Peterman 1968, Comanor and Wilson 1974, Peterman and Carney 1978, Peterman 1979; Noll, Peck, and McGowan (1973) state that by the 1970s these discounts were eliminated). Data from newspapers in the 1960s and earlier show the price of advertising increasing much less than linearly with circulation (Ferguson 1963, p. 56, Ferguson 1983, p. 640). Our nonlinearity result seems at first to run counter to these results, but it is really a separate issue. The claim here is not that advertising becomes more or less expensive in increasing quantities, but that slots on popular shows are more expensive than those on unpopular shows. As Figure 3 shows, heavy advertising buyers can if they prefer make purchases at roughly the same rates as smaller buyers. Newspapers might have distribution and production scale economies which enable large newspapers to charge less (Ferguson 1983), while for a network television program the distribution cost is the same regardless of how large the audience is; one might also say that production costs are unimportant, since popularity does not seem to be related to production costs (Owen and Wildman 1992, p. 58).

Our nonlinearity finding, sometimes explicitly assumed as fact (for example in Rust 1985), is actually not by itself of primary importance: several diverse explanations mentioned earlier, such as quality signalling and market power, would be consistent with nonlinearity. By showing that advertisers of social goods choose slots on more popular shows and are willing to pay a premium to do so, we are able to point to the specific explanation that more popular shows are better at solving coordination problems. By looking at advertisers' purchases rather than market prices, we can isolate attention to the advertisers' revealed preferences and exclude all market considerations such as relative bargaining power.

Concluding remarks

This paper attempts to show that social goods, goods which a person is more likely to buy the more others buy it, "socially induced private commodities" (Telser 1997), are advertised on more expensive popular shows because viewers of popular shows know that many other people are also watching. Here social goods are defined in a very ad hoc way as goods which are usually consumed with people outside the household. Of course, independently determining which goods are in fact social goods is a difficult problem, requiring perhaps direct observation of consumption at the individual level. Becker (1991) suggests that one distinctive aspect of social goods such as books and movies is that their prices are not adjusted when demand increases: if prices were increased on a rising best seller, then the eventual "multiplier" effect would dampened, hurting total profits. Our results here suggest that how a good is advertised might be another indirect way of detecting whether it is a social good. Our approach, looking at the component of advertising costs not explainable by demographic and cumulative measures, is similar to that of Glaeser, Sacerdote, and Scheinkman (1996), who detect social influence by variances in crime rates across localities not explainable by demographics. Similarly, in their study of women's cosmetics, Chao and Schor

(1996) find that “high status” brands can charge a much higher premium for lipsticks, which women take out in public, as compared to facial cleansers, which are normally used at home. Actually, whether a good is social is not completely exogenous; to some extent a social good can be created by advertising. Otnes and Scott (1996) mention how the custom of a diamond engagement ring, weakened by the Depression, was made hegemonic in the US and even Japan by the concerted advertising of the De Beers cartel.

One cliché of the late 20th century has been television’s centrality in US and even world culture. For example, according to the senior vice president of marketing for Walt Disney Attractions, the Super Bowl “really is the convening of American men, women and children, who gather around the sets to participate in an annual ritual” (Lev 1991). Anthropologists observe that rituals “have little to do with the transmission of new information and everything to do with interpersonal orchestration and with social integration and continuity” (Tambiah 1985, p. 138). But “interpersonal orchestration and social integration” can be understood as a coordination problem, not unlike buying a Macintosh computer. Hence calling the Super Bowl a ritual is not a grand metaphor but an accurate characterization (Chwe 1998). This paper’s interpretation of advertising as enabling social coordination allows us to understand advertising as part of our culture as well as our economy.

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