The Effect of the Internet on Advertising Expenditures
An Empirical Analysis Using a Panel of Countries

Abstract

The Internet can affect advertising expenditures through various channels. Although the traditional news media perceives the increase in Internet use as a challenge to their survival, the effect of the Internet on the assignment of advertising budgets across media outlets is unclear. For example, offline advertising can induce search engine use making online and offline advertising complements. The impact of the Internet on advertising expenditures is also uncertain because the Internet has made media available for many individuals in places where their consumption was previously either banned or technologically infeasible (e.g. work, mobile), the Internet has reduced waste impressions by improving advertising targeting, the Internet has changed the nature of many commercial transactions that now obviate the need for paid advertising (e.g. Craigslist), and the Internet can also affect advertising equilibrium prices by changing the competitive environment. This paper quantifies the effect of the increase in Internet use on advertising expenditures for both individual media types and overall. I use a panel of ten years of data at the country level containing information on advertising expenditures by medium and Internet penetration for more than eighty countries. I find that the Internet reduced advertising expenditures on both television and print media (newspapers and magazines), but had no effect on radio expenditures. I also find that the Internet reduced total advertising expenditures, including expenditures on both traditional media and the Internet.

Keywords: Internet, Media, Advertising, Substitution

I- Introduction

The traditional news media often trumpet that competition from the Internet is threatening their survival. Decreases in newspaper circulation and advertising revenues observed over the previous decade are pressing concerns for print media executives. Other traditional media executives also fear an imminent decrease in their advertising revenues, although to date print media have the grimmest outlook.[1] Figure I presents advertising expenditure trends in the United States. The figure shows that advertising expenditures on print media, including print newspapers and magazines, have decreased sharply since 2000 (31.2 percent). Advertising expenditures on radio, television, and overall do not show consistent trends, and advertising expenditures on the Internet have grown very rapidly over the past decade, from a low starting level in 1998. Global advertising expenditure trends by medium show similar qualitative patterns to those in the United States. Figure II presents global average media proportions of the total advertising expenditures.[2]

[1] For example, CNN president Jon Klein recently argued that Facebook and not Fox News was their biggest competitor (Kaplan 2010). Most media outlets are primarily supported by advertising. For example, 80% of newspaper revenues come from advertising (Vogel 2007).

[2] Figures I and II use data from the World Advertising Research Centre (WARC). Average media proportions in Figure II are unweighted averages computed across countries. Due to the unbalanced nature of the panel and to allow a comparison across media Figure II uses information from only 44 countries for all media except Internet, although the regressions below use all available information. Importantly, information on Internet advertising is complete (for all years) only for ten countries; Internet advertising in Figure II is therefore not comparable with the advertising expenditures on other media because the statistics are based on a different selection of countries. The WARC aims to count all advertising online (e.g. advertising expenditures on online newspapers) as separate from traditional media. See Section II for a detailed explanation of the data. Section 1 in the appendix presents global advertising per capita measured in both US dollars and Euros.

Figure I: Advertising Expenditures in the United States (In Constant 2008 Million US$)[3]

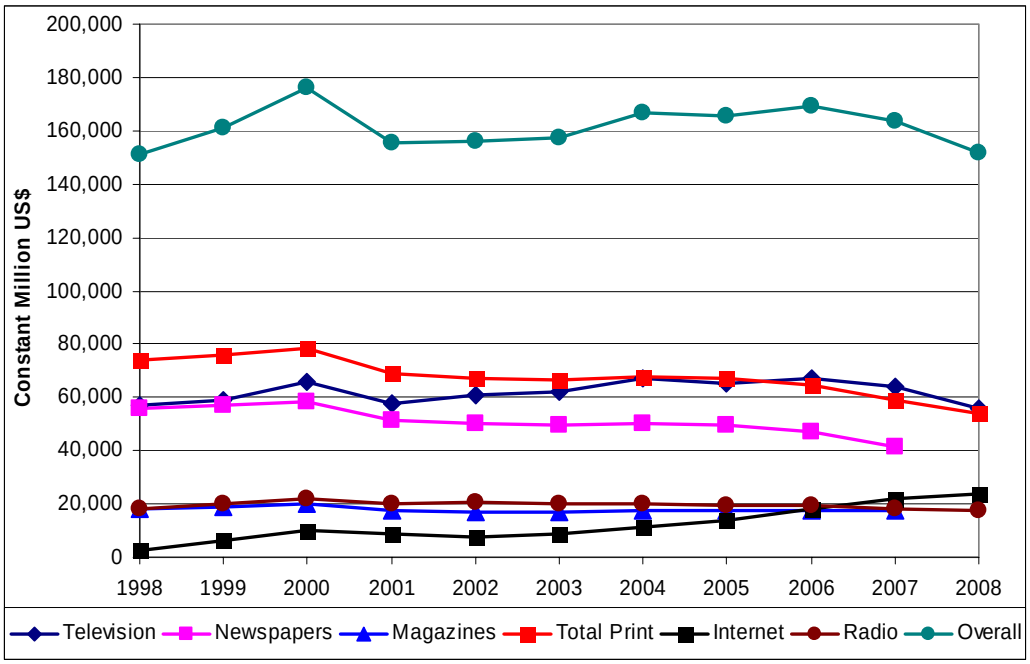
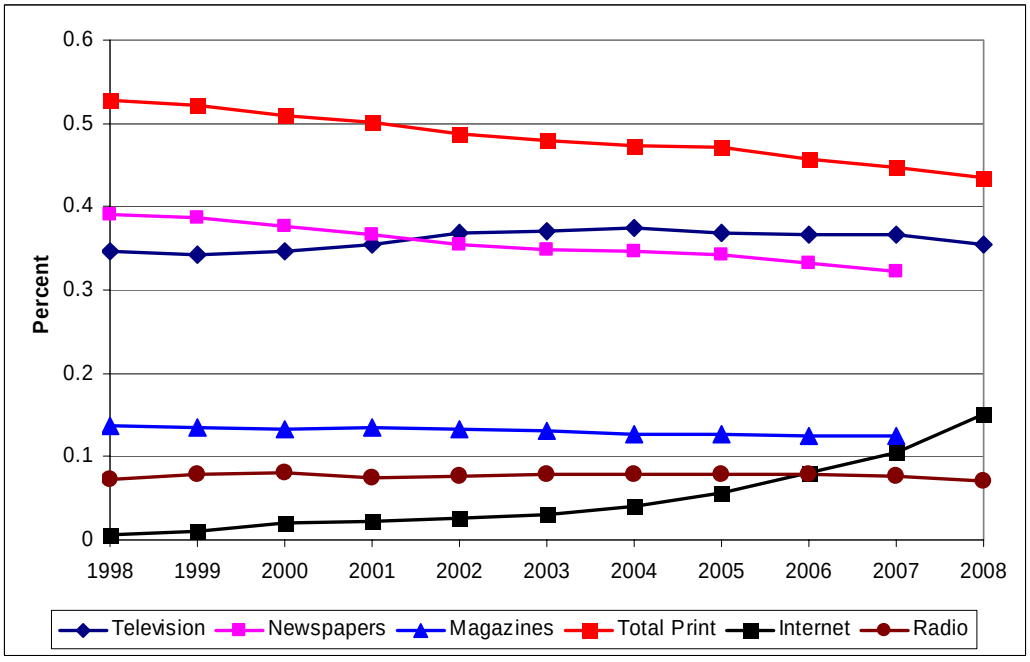


Figure II: Global Advertising Expenditures: Average Media Shares



[3] The WARC also lists advertising expenditures on cinemas and out-of-home. Advertising expenditures on cinemas are small relative to other media outlets and the data are missing for many countries. I do not study out-of-home advertising because it is not related to content creation. The WARC does not list direct-mail advertising expenditures. Direct-mail advertising expenditures represent an important portion of total advertising expenditures in the US, but are also unrelated to content creation.

One question that arises is: what is the effect of the rise in Internet use on advertising expenditures across media? The extent to which the Internet has altered counterfactual advertising expenditures on each medium is uncertain. The assignment of advertising expenditures across media outlets likely follows changes in the way individuals consume media products. Although the Internet appears to have been replacing traditional media outlets as a source for news and entertainment, the magnitudes of the existing estimated displacement impacts are smaller than earlier predictions made during the height of the initial Internet frenzy (Gentzkow 2007, George 2008, and Liebowitz and Zentner 2010).[4] Additionally, online and offline advertising expenditures need not be substitutes; synergies between online and offline advertising and multitasking could make them complements. For example, offline advertising can generate interest and induce searches online (Lambert and Pregibon 2008, Joo, Wilbur, and Zhu 2010 and Goldfarb and Tucker 2011a).

It would also be of interest to know whether the Internet reduces advertising primarily for print media or is an equal opportunity threat to all traditional media outlets. The data reveal that to date only print media are experiencing an unquestionable decrease in advertising expenditures. Even for newspapers, which have experienced a more pronounced decrease in advertising expenditures than magazines, the degree to which the decline is due to competition with the Internet is uncertain. Newspaper's share of total advertising expenditures in the United States has experienced a long-term decay since the early 1950s, and today represents less than half of the share of overall advertising it represented in 1950 (Varian 2010). The decrease in newspapers'

[4] Gentzkow (2007) finds that online newspapers are crowding out off-line papers, George (2008) finds that the Internet attracts younger, educated, and urban individuals away from print newspapers, and Liebowitz and Zentner (2010) finds that the Internet is reducing the time young individuals spend using television.

advertising revenues over the previous decade might therefore merely represent the continuation of a longer temporal trend that happens to coincide with an aggregate increase in Internet use.

Extant research indicates that the growing usage of the Internet that has taken place since the birth of web browsing has not substituted one-to-one for the consumption of traditional media. Although online newspapers' consumption appears to have displaced print consumption, existing estimates of the crowding out effect indicate it is smaller than envisioned in earlier predictions (Gentzkow 2007 and George 2008). The Internet's effect on television viewing also appears to have been moderate, and primarily affected the viewing of the youngest individuals while having no impact on the viewing of the oldest individuals (Liebowitz and Zentner 2010). Importantly, the Internet has made media available for many individuals where their consumption was previously either banned or impractical (e.g. read the newspaper online at work or watch mobile television). The increase in Internet use since the birth of web browsing approximately fifteen years ago coupled with the moderate estimated displacement effects of the Internet on traditional media consumption suggest that the time and attention allocated to media consumption, including both traditional and Internet media, has increased. This raises the question of how Internet use has affected aggregate advertising expenditures on all media, including advertising on both traditional media and the Internet. Have advertisers increased their aggregate expenditures as total media consumption has increased? Have advertisers maintained a fixed budget, implying that the dollar increase in Internet advertising has come at the expense of dollars that would have otherwise been spent on advertising in traditional media? Figure I shows that total advertising expenditures in the US have oscillated over the period of analysis. Although the absence of a clear trend may suggest that in the US the budget for advertising has not been substantially affected by the increase in overall media consumption, the actual Internet's impact

is unknown because advertising expenditures are affected by various factors other than the increase in Internet use.

The Internet can also reduce overall advertising expenditures. Complications in predicting the sign of the impact of the increase in Internet use on the amount of total advertising expenditures arise because: the Internet allows advertisers to improve their effectiveness in targeting their potential customers reducing waste impressions (e.g. geo-tracking), the Internet may change equilibrium advertising prices (Athey, Calvano, and Gans 2010), the Internet has changed the nature of many commercial transactions that now obviate the need for paid advertising (e.g. Craigslist), and different uses of the Internet support heterogeneous advertising capacities than traditional media (e.g. online gaming might reduce television viewing, but individuals can only be accessed by advertising in limited ways while playing online games).[5] The Internet might therefore either increase or reduce overall advertising expenditures. This admittedly brief examination should make it clear that the expected impact of the increase in Internet use on the amount of overall advertising expenditures is unclear; the actual impact is an empirical question.

This paper seeks to examine and quantify how advertising expenditures for both individual media types and aggregate change as Internet adoption increases. I use a panel of ten years of data at the country level containing information on advertising expenditures by medium and Internet penetration for more than eighty countries. My findings, in short, indicate that the Internet is not an equal opportunity threat to all traditional media outlets: the Internet reduced advertising expenditures on both television and print media (newspapers and magazines), but had no effect on radio. I also find that the Internet reduced total advertising expenditures including

[5] It is unclear whether or not some uses of the Internet (e.g. online gaming) can be categorized as media consumption.

expenditures on both traditional media and the Internet, although the regressions on overall advertising expenditures use substantially fewer observations.

From an economic standpoint the question of how the Internet affects advertising expenditures is important because changes in advertising revenues may alter content creation. Shifts in advertising revenues across media platforms could cause creative destruction or just plain destruction. Shifts in advertising revenues from traditional media outlets to the Internet may reduce the incentives to invest in traditional ad-supported media content. On the other hand, the new Internet-based media outlets may upgrade their content creation as the Internet raises their revenues. The creation of content, however, is a fixed cost and the incentives to create thus depend on the size of the market. Media fragmentation may decrease the quality of media content. Total investment in content creation by both traditional and new media (e.g., blogs, search engines, news aggregators, YouTube, Facebook, or Twitter) may be lower as individuals now have a larger menu of media options for news and entertainment and advertisers may reassign their budgets accordingly.[6] Additionally, online sites often use content created by traditional news organizations without paying for that use.[7] Free riding may reduce content creation.

By empirically examining how the Internet affects advertising expenditures for individual traditional media types and aggregate advertising expenditures this paper contributes to the empirical literatures examining both how the Internet is reshaping the media industry, and

[6] On the other hand, neither total media consumption nor the total advertising budgets are necessarily fixed. The television industry has seen an outburst of reality shows. These shows are more inexpensive than scripted shows, and it has been argued that the movement toward reality television might be a response to the existence of too many television channels. See Caves (2005) and Goolsbee (2007).

[7] However, Chiou and Tucker (2010) find that the removal of articles by The Associated Press from Google News due to a breakdown in licensing negotiations at the end of 2009 reduced visits to traditional news sites, suggesting that news aggregators complement the original content.

substitution between online and offline advertising. Chandra and Kaiser 2009 study the scope of targeted advertising in the magazine industry (targeted advertising might induce advertisers to shift from traditional media to online platforms); Filistrucci (2005), Gentzkow (2007), and George (2008) examine the effect of the Internet on newspaper circulation; Goldfarb and Tucker (2011a) study how competition from offline advertising affects search engine advertisement prices; Goldfarb and Tucker (2011b) use local restrictions on offline alcohol advertising in order to study how these bans affect the effectiveness of online advertising; Liebowitz and Zentner 2010 examine the effect of the Internet on television viewing; and Seamans and Zhu (2011) study the impact of Craigslist on local newspapers.[8]

The question of what the counterfactual trends in advertising would have been in the absence of the Internet is not only important for scholars seeking to understand behavior and media managers seeking to gain insight regarding the existence and extent of substitutability across media platforms, but is also an important input for many policy debates. In the US, the government has heard the concerns of traditional media executives and is considering whether or not to intervene. The Federal Trade Commission is studying, "whether to recommend policy changes to support the ongoing 'reinvention of journalism' and has put forward, 'potential policy recommendations.'" The policy changes currently under study aim at inducing content creation by changing copyright and antitrust laws and by providing government support (FTC 2010). For example, to what extent should content copying by news aggregators be permitted under the "fair use" doctrine? Knowledge of the impact of the Internet on advertising expenditures should be useful in informing this debate.

[8] I cannot use variation in the timing of Craigslist's entry across markets in my empirical strategy as an additional source of identification because Craigslist operates by cities and not countries.

The outline of the remainder of the paper is as follows. The next section provides background metrics and describes the data. Section III lays out the empirical strategy. Section IV presents the estimation results. The final section offers some conclusions.

II- Background Metrics and Data

This paper seeks to empirically measure the effect of the Internet on advertising expenditures by individual medium and overall. I acquired data on advertising expenditures at the country level from the World Advertising Research Centre (WARC), listing expenditures from 87 countries for the years 1998 through 2008.[9] These data are disaggregated by medium including newspapers, magazines, television, Internet, and radio.

The WARC collects data by surveying advertising monitoring organizations in each country. Measuring advertising expenditures is not an easy task. There are two major methodologies for measuring these expenditures: rate card measurements and net of discounts measurements. A rate card is a table of prices listing all the possible alternative costs of placing an ad in a given media outlet. Some country-level organizations (e.g. Nielsen in the US) produce rate card measurements, meaning that they measure advertising expenditures by monitoring the ads placed across the different media outlets and applying the prices from rate cards. These measurements

[9] The countries are: Algeria, Argentina, Australia, Austria, Bahrain, Belgium, Brazil, Bulgaria, Canada, Chile, China, Colombia, Costa Rica, Croatia, Cyprus, Czech Republic, Denmark, Ecuador, Egypt, Estonia, Finland, France, Germany, Ghana, Greece, Guatemala, Honduras, Hong Kong, Hungary, India, Indonesia, Ireland, Israel, Italy, Japan, Jordan, Kenya, Kuwait, Latvia, Lebanon, Lithuania, Luxembourg, Macedonia, Malaysia, Malta, Mexico, Morocco, the Netherlands, New Zealand, Nicaragua, Norway, Oman, Pakistan, Paraguay, Peru, Philippines, Poland, Portugal, Qatar, Romania, Russia, Saudi Arabia, Serbia, Singapore, Slovak Republic, Slovenia, South Africa, South Korea, Spain, Sweden, Switzerland, Syria, Taiwan, Tanzania, Thailand, Tunisia, Turkey, Uganda, the United Kingdom, Ukraine, United Arab Emirates, the United States of America, Uruguay, Venezuela, Vietnam, Yemen, and Zambia. There is high heterogeneity across the countries in the sample. For example, in 2008 total media advertising expenditures amounted to US$150,000 million in the US and US$37 million in Malta, although the regressions use expenditures per capita. Section 2 in the appendix presents additional summary statistics, and Section 4 in the appendix presents regressions separating countries by sizes.

are sometimes not sufficiently accurate because many advertising buyers pay substantially less than the rate card price. Discounts are given for various reasons such as volume booking, unused space, and other negotiated terms. Net of discounts measurements take discounts into account, either by measuring expenditures using information from publishers or adjusting the rate card measurements to reflect discounts. The WARC publishes explanatory notes indicating the method employed to collect the data in each market.

The development of new media platforms has complicated advertising expenditure measurement even further. Take, for example, the case of newspapers. Newspapers today publish both print and online editions. Advertising in these outlets may be either sold independently or there might be cross-selling. Cross-selling may lead to double counting when Internet advertising expenditures are not stripped from advertising expenditures on print newspapers and other traditional media outlets. Although the methodology used in each country is generally proprietary to the company producing the measurements,[10] the WARC aims to count advertising online as a separate medium from expenditures on traditional media outlets (the WARC aims to strip online advertising from print, television, and radio). Additionally, complications created by cross-selling might have been relatively unimportant during the period of my analysis because advertising expenditures on traditional media outlets delivered online (e.g. online newspapers) were relatively insignificant. For example, according to the Newspaper Association of America,

[10] For example, "Monitor de Medios Publicitarios" is a company originated by a partnership between a company named IBOPE and Nielsen that produces the measurements for eleven Latin American countries. I contacted the company in Argentina with questions regarding their methodology and they indicated that the methodology is proprietary.

online advertising expenditures on newspapers in the US represented 8.2 percent of total newspaper advertising in 2008.[11]

Table 1 presents summary statistics. It is more illustrative to show the percentages of total advertising expenditures for each medium in each year than aggregate global monetary values for each medium. This is because aggregate trends in monetary values are different depending on the currency employed in the measurements (Section 2 in the appendix presents trends measured in monetary values in both US dollars and Euros). The table shows unweighted means across countries of the proportions of advertising expenditures on each medium over total advertising expenditures. Due to the unbalanced nature of the panel and to allow a comparison across media I computed statistics using information from 44 countries (except Columns IV and VI). The standard deviations indicate that there is substantial variation across countries in the proportions that each media outlet represents in total expenditures.

Consistent with Figure 2, Columns I through IV in Table 1 show that the share of advertising expenditures on print media has experienced a significant decrease. In 2008, advertising expenditures on print media are not disaggregated into newspapers and magazines. The decrease in expenditures is more pronounced for newspapers than it is for magazines (Columns I and II). Classified advertising in print media has lost substantial business to online sites such as Monster and Craigslist. Although the WARC data does not disaggregate advertising in newspapers into display and classified, according to the Newspaper Association of America classified advertising

[11] Year 2008 is the final year in the study period (year 2007 in the regressions on advertising expenditures in newspapers and magazines) and the US is a developed country relative to most countries in the sample. See Varian 2010; the original data source is from the Newspaper Association of America. According to the Newspaper Association of America, the dollar amount of expenditures on online newspapers decreased 1.8 percent in 2008 and 11.8 percent in 2009. Comparatively, the dollar amount of expenditures on offline newspapers decreased 17.7 percent in 2008 and 28.6 percent in 2009.

in the US has decayed by 70% from 2000 to 2009 (PEW, 2010). Net of discounts advertising expenditures in print media are presented in Column IV; 34 of the 44 countries used in Column III collect net of discounts measurements. Because Columns III and IV are computed using different selections of countries, proportions in Column IV are not lower than proportions in Column IV for every year (as is expected if the statistics were based on the same selection of countries).

Proportions of expenditures on television increased until 2004 and decreased substantially in 2008. The proportion of expenditures in radio also decreased substantially in 2008. Unfortunately, information on Internet advertising expenditures is missing for many countries. Using the ten countries that have complete data (for all years), the table shows that the share of advertising expenditures on the Internet has increased rapidly (note that the statistics on Internet advertising in Table 1 are not comparable to the statistics in other columns for other media because they use a different selection of countries). The WARC data does not disaggregate Internet advertising into different ad formats, but according to the Interactive Advertising Bureau (IAB) in the US Internet advertising related to search engines is the primary and fastest growing online advertising format. In 2008, search-based Internet advertising in the US accounted for 46% of total Internet advertising, followed by display banner advertising and classified accounting for 21% and 13% respectively (Interactive Advertising Bureau 2009).

Advertisers have a large menu of online options for placing display banners (although consumer attention is the constraint – see Athey, Calvano, and Gans 2010). This might reduce the likelihood that online revenues will replace offline revenues, because the rates for online display are much lower than those previously charged by traditional offline media. Online revenues are,

"often described as 'digital dimes' as compared to the dollars generated by print ads" (FTC 2010).

The Internet has created another subtle yet important problem for newspapers. Newspapers' advertising revenues from the front pages never represented a substantial amount of their total revenues. Instead, the primary share of their advertising revenues originated from the business pages, automotive, home and garden, travel, real estate, and technology (Varian 2010). Newspapers traditionally subsidized the creation of the front page news with the advertising revenues from other sections. The Internet, however, might have ruined the cross-subsidization model because individuals now go to specialized online sites for purchases (e.g. Expedia for travel and Edmunds for cars).

Table 1
Descriptive Statistics
Global Advertising Expenditures: Average Media Shares

	Column I		Column II		Column III		Column IV	
	Newspapers		Magazines		Total Print All Countries		Total Print Net of Discounts	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
1998	39.1%	14.2%	13.7%	6.0%	52.8%	14.6%	52.4%	13.3%
1999	38.7%	14.3%	13.4%	6.1%	52.1%	14.9%	52.2%	13.0%
2000	37.7%	14.7%	13.2%	6.0%	51.0%	15.2%	51.0%	12.8%
2001	36.7%	15.6%	13.5%	6.3%	50.1%	16.2%	50.2%	13.7%
2002	35.5%	15.8%	13.3%	6.2%	48.7%	16.2%	48.4%	13.6%
2003	34.9%	15.1%	13.0%	6.2%	47.9%	15.5%	47.7%	12.6%
2004	34.5%	14.9%	12.8%	6.1%	47.3%	15.3%	47.0%	12.5%
2005	34.3%	15.5%	12.8%	6.0%	47.1%	15.9%	46.5%	12.2%
2006	33.2%	15.7%	12.5%	6.2%	45.8%	16.1%	45.2%	12.0%
2007	32.2%	15.5%	12.5%	6.1%	44.7%	16.0%	44.2%	11.8%
2008	na	na	na	na	43.4%	15.5%	42.1%	11.3%

	Column V		Column VI		Column VII	
	Television		Internet		Radio	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
1998	34.6%	12.7%	0.5%	0.5%	7.3%	5.0%
1999	34.2%	12.6%	1.1%	1.2%	7.8%	5.8%
2000	34.6%	13.1%	2.1%	1.9%	8.0%	6.2%
2001	35.5%	15.1%	2.1%	1.8%	7.5%	5.0%
2002	36.8%	15.9%	2.5%	1.9%	7.6%	5.6%
2003	37.0%	15.1%	3.1%	1.9%	7.8%	6.4%
2004	37.4%	15.0%	4.0%	2.2%	7.9%	7.0%
2005	36.9%	15.3%	5.6%	3.0%	7.8%	7.1%
2006	36.7%	15.6%	8.1%	4.7%	7.9%	7.6%
2007	36.7%	15.9%	10.5%	6.0%	7.6%	7.4%
2008	35.4%	16.0%	15.1%	5.6%	7.1%	6.2%

The table presents unweighted averages computed across countries. Due to the unbalanced nature of the panel, the statistics use information from 44 countries for all media except Internet. Column IV uses information from 34 countries and Column VI (Internet) uses data from 10 countries.
The regressions below use all information available in the unbalanced panel.

This paper combines data on advertising expenditures with data on Internet usage by countries from the International Telecommunication Union (ITU), a United Nations agency for information and communication technology issues. Table 2 shows that Internet penetration has increased steadily over the last decade and that it has a large variation across countries.

Substantial idiosyncratic variation in the rates of adoption of the Internet provides a high contrast that is essential for identification.

Finally, I also use panels of data at the country level on cell phone penetration,[12] GDP per capita measured in power purchasing parity (PPP) in constant international US dollars,[13] population, inflation, and exchange rates. Exchange rates are measured in units of each foreign currency per US dollar. These data are from the ITU, the World Bank, and the International Monetary Fund. Table 2 shows descriptive statistics.

Table 2
Additional Descriptive Statistics

	Internet Penetration (Unweighted-Percentage of the Population)		**Cell Phone Penetration** (Unweighted-Percentage of the Population)		**GDP per capita in Constant International US$ (PPP)** (Unweighted)		**Population (in millions)** (Unweighted)	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
1998	6.6%	8.7%	12.5%	13.5%	13,031	10,880	56.6	173.2
1999	9.7%	11.7%	19.2%	19.4%	13,305	11,261	57.3	175.3
2000	13.3%	14.5%	28.4%	26.4%	13,829	11,741	57.9	177.2
2001	16.4%	16.7%	36.3%	30.3%	13,951	11,767	58.6	179.2
2002	22.0%	21.2%	42.2%	32.4%	14,139	11,865	59.2	181.1
2003	25.1%	22.3%	48.4%	33.8%	14,460	12,029	59.9	182.9
2004	27.8%	23.5%	55.9%	34.0%	15,044	12,543	60.5	184.8
2005	30.5%	24.3%	66.3%	34.4%	15,514	12,830	61.1	186.6
2006	33.8%	24.5%	77.4%	35.3%	16,144	13,422	61.8	188.4
2007	37.8%	24.8%	89.5%	36.7%	16,818	14,155	62.4	190.1
2008	42.0%	25.3%	100.4%	37.9%	17,061	14,315	63.0	191.9

[12] The data on cell phone penetration by countries is from the ITU. The cell phone penetration rate has been over 100% in recent years for several countries. The explanation for a penetration rate over 100% is that this variable includes prepaid cell phones subscriptions; prepaid cell phone lines retain their status for three months after the expiration of their card while these lines are still able to receive calls. Prepaid cell phones are popular in many European countries and some individuals replace their cell phone lines several times in any given year.

[13] I constructed this variable following the guidelines proposed in the IMF discussion forum. The GDP measured in PPP values accounts for the prices of goods and services in each country, and is an accepted measurement for comparison of the level of development of different countries at any given time. However, the GDP in PPP values does not measure income in constant values and is therefore not appropriate for comparisons across time. A measurement of the level of development that makes the comparison of levels of development across countries and across time feasible is constructed by combining the GDP in PPP values for a base year (I use 1998) and growth rates of GDP in local currency. A GDP measurement for each country and each year is constructed by multiplying the GDP in PPP US dollar values in the base year by the yearly growth rates of the GDP measured in local currency.

III- Empirical Methodology

The advent of the Internet might have caused shifts in the demands for advertising in each traditional medium and overall. The specific characteristics of the market determine the extent of the Internet impacts on both advertising prices and quantities. I will study the Internet's impact on revenues; revenues might better approximate the incentives to invest in traditional ad-supported media content than either prices or quantities.

A simple approach to this question would be studying the relationship between advertising expenditures and Internet penetration using cross-sectional data at the country level. However, an important problem with this approach is that advertising expenditures across countries are likely related to factors that a limited number of control variables are unable to capture. These factors might include unobserved characteristics of the countries or media in each country (e.g. the regulatory environment for each medium in each country).

One way of accounting for unobserved heterogeneity is to use panel data and study how the advertising expenditures on each medium and each country have changed over time in connection with changes in Internet adoption at the country level. For each medium *j* I can estimate a random trend fixed effects model of the following form:

$$A_{it}^{j} = \beta^{j} I_{it} + \gamma^{j} X_{it} + \alpha_{t}^{j} + u_{i}^{j} + \delta_{i}^{j} t + v_{it}^{j} \qquad (1)$$

using panel data.[14] In Model (1) A_{it}^{j} represents the advertising expenditures on medium *j* (although *j* also represents overall media in the regressions on aggregate advertising

[14] See Wooldridge (2010) page 375. Reverse causality is unlikely; Internet adoption is unlikely to be caused by changes in advertising expenditures.

expenditures), country *i*, and year *t*; I_{it} represents Internet penetration in country *i* and year *t*; X_{it} is a vector of country-level and time-varying controls; α_t^j is a medium-specific time fixed effect (a year fixed effect); u_i^j is a medium-specific country fixed effect; and $\delta_i^j t$ is a medium-specific country-specific time trend.

Medium-specific country fixed effects absorb time invariant factors that may be specific to each country and its media characteristics, such as the size of the country and the regulatory characteristics of each medium in each country. Using a longitudinal model I can "difference out" the medium-specific time-invariant unobserved characteristics at the country level, u_i^j. By including medium-specific year fixed effects, α_t^j Model (1) controls for medium-specific global advertising trends. The identification in Model (1) therefore arises from idiosyncratic variation in Internet penetration and advertising expenditures by medium *within* countries from year to year, and not from aggregate variation in Internet penetration and advertising expenditures by medium over time. It is likely that idiosyncratic trends in media markets and technology adoption occurring during the study period are correlated with idiosyncratic trends in Internet adoption. For example, we do not observe the rate of adoption of video games consoles at the country-level, although these trends might influence advertising (e.g. playing games might reduce television viewing) and be correlated with idiosyncratic trends in Internet adoption. In a random trend fixed effect model, country-specific (and media-specific) time trends account for unobservable idiosyncratic trends.

IV- Estimation Results

Random trend fixed effects (OLS) regression results are reported in Table 3.[15] The dependent variables are measured per capita and in logarithms. In addition to the Internet penetration variable measured in percentages, these regressions include as covariates the cell phone penetration rate, logarithm of the GDP per capita, logarithm of the exchange rate, price index, logarithm of population, country fixed effects, year fixed effects, and country-specific time trends. Medium-specific country fixed effects control for time invariant factors that may be specific to each medium in each country. For example, both the relative size of each country and the time-invariant media-specific country-level characteristics are captured by these country fixed effects. Medium-specific year fixed effects account for aggregate medium-specific trends. Medium-specific country-specific time trends account for preexisting medium-specific idiosyncratic time trends; the influence of unobservable idiosyncratic trends in media markets and technology adoption taking place during the study period is subsumed within these country-specific time trends. It is important to include the exchange rate as a covariate in order to control for any idiosyncratic variation over time in the value of the US dollar against other currencies (the exchange rate is measured in units of each domestic currency per US dollar in each year). The regressions include the logarithm of the exchange rate because its units of measurement vary widely across countries. For example, the Vietnamese currency devaluated from VND 13,252

[15] The units of analysis in this study, countries, are heterogeneous in size. One common discussion when studying units of analysis of heterogonous size is whether or not the observations should be weighted in the regressions using a measurement of their size. Weighting is warranted and leads to gains in efficiency when observations have heterogeneous variance. In the context of this paper, giving more weight to large countries would only be preferable if information from large countries had lower variance, and therefore data from larger countries were more informative than data from smaller countries. Weights should not be used when observations are equally informative. This is because the thought experiment is to treat each country as a trial in a laboratory, where each observation receives a treatment. There are no reasons to believe that the data from larger countries are in the present case more informative than the data from smaller countries. However, Section 4 in the appendix shows regressions separating countries by sizes.

per dollar in 1998 to VND 16,450 per dollar in 2008; the Euro revaluated from 0.90 Euros per dollar in 1998 to 0.68 Euros per dollar in 2008. It is more sensible to compare percentage changes in exchange rates because a unitary change in the Euro-dollar exchange rate represents a much larger change than a unitary change in the VND-dollar exchange rate. Because advertising revenues are measured in current US dollars and idiosyncratic trends in inflation might not be entirely captured by variations in the exchange rate, the regressions control for the inflation rate in each country (the inflation variable is a price index equal to one hundred in year 2000).

Table 3
OLS Random Trend Fixed Effect Regressions on Advertising Expenditures
Panel of Years 1998 through 2008

	I	II	III	IV	V	VI
	Total Print	Newspapers	Magazines	Radio	Television	Total Media
Internet Penetration	-0.0051***	-0.0031**	-0.0043**	-0.0001	-0.0037**	-0.0039***
(in percentages)	(0.0013)	(0.0015)	(0.0017)	(0.0024)	(0.0016)	(0.0012)
Cell Phone Penetration	-0.0011	-0.0013	-0.0006	-0.0013	-0.0020**	0.0004
(in percentages)	(0.0009)	(0.0011)	(0.0010)	(0.0015)	(0.0010)	(0.0009)
GDP per capita	1.3939***	1.4479***	1.5007***	0.5624	1.1679***	0.7806**
(in logarithms)	(0.2811)	(0.3333)	(0.4356)	(0.4725)	(0.3518)	(0.3055)
Exchange Rate	-0.7468***	-0.8239***	-0.8638***	-0.4740**	-0.8270***	-0.9833***
(in logarithms)	(0.0967)	(0.1062)	(0.1475)	(0.1975)	(0.1236)	(0.1031)
Price Index	0.0043***	0.0041**	0.0053**	-0.0011	0.0046**	0.0011
(year 2000=100)	(0.0015)	(0.0016)	(0.0025)	(0.0029)	(0.0023)	(0.0022)
Population	-0.6661	-0.1256	-0.2948	-0.0433	3.9328**	-1.4307
(in logarithms)	(0.6635)	(0.7409)	(1.0584)	(1.6510)	(1.6625)	(1.8943)
Year Fixed-Effects	Yes	Yes	Yes	Yes	Yes	Yes
Country Fixed-Effects	Yes	Yes	Yes	Yes	Yes	Yes
Country-Specific Trends	Yes	Yes	Yes	Yes	Yes	Yes
Observations	796	777	734	767	852	313
R-squared	0.9947	0.9948	0.9918	0.9804	0.9889	0.9977

Notes: The dependent variables are measured in logarithms.
Robust standard errors in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%

According to the regressions in Table 3 Internet adoption had a large negative impact on both print media and television. The average Internet penetration rate across the countries in the sample was 42% in 2008. The regression in Columns I in Table 3 therefore indicate that had there been no Internet then advertising expenditures on total print media would have been 21% higher than they actually were. Columns II, III, and V indicate that the Internet reduced

advertising expenditures in newspapers by 13%, magazines by 18%, and television by 15% (the regressions on newspapers and magazines do not include year 2008). Conversely, the regression in Column IV in Table 3 indicates that the Internet did not reduce the advertising expenditures on radio. Column VI presents a regression on total advertising expenditures. Column VI uses a substantially smaller sample relative to the samples used in the regressions by medium because Internet advertising expenditures are missing for many countries, and I cannot compute total advertising expenditures in a country in a year when the advertising expenditures are missing for any medium. The regression in Column VI therefore excludes country-year observations when the advertising expenditures are missing for any medium. Using these limited data, the regression shows that the Internet reduced total advertising expenditures by 16%.[16] (Section 3 in the appendix presents graphs with both actual and predicted advertising expenditures absent the Internet).

Table 3 shows that cell phone adoption did not have a consistent impact on the amount of advertising expenditures. As expected, an increase in GDP increases advertising expenditures. Since both advertising expenditures and GDP are measured in logarithms, the coefficients on the GDP variable measure an elasticity. The elasticity is greater than one for print media and television, but lower than one (and not statistically significant) for radio. The coefficients on the exchange rate in Table 3 are negative as expected. When the advertising expenditures measured in domestic currency in a country do not change from year to year, an increase in the exchange

[16] The number of observation is substantially higher if the dependent variable is computed adding expenditures in print, radio, and television but excluding Internet advertising (because many observations on Internet advertising are missing). Using this alternative dependent variable the coefficient is similar to that in Column in VI of Table 3 (-0.0037). Advertising expenditures on the Internet would be zero absent the Internet. I am abusing on the counterfactual interpretation of the estimates on overall advertising since overall advertising expenditures include the advertising expenditures made on the Internet. The reason I define the dependent variable inclusive of Internet advertising is that my goal is to examine whether advertising expenditures on the Internet compensate for any decay in advertising expenditures in traditional media.

rate (a devaluation of the domestic currency against the dollar) decreases the advertising expenditures measured in US dollars. Conditional on the exchange rate, advertising expenditures measured in current dollars increase when domestic prices increase; thus a positive coefficient on the inflation variable is expected. The population variable does not have a consistent impact.

It is useful to know to what extent outlier observations might be affecting the estimates; since there is high heterogeneity among the countries in the sample it is important to rule out that a few outlier countries have a substantial effect on the results. For this purpose Table 4 presents Huber-robust estimation results. Huber-robust regressions iteratively decrease the weights given to outlier observations.

Table 4
Huber-Robust Random Trend Fixed Effect Regressions on Advertising Expenditures
Panel of Years 1998 through 2008

	I	II	III	IV	V	VI
	Total Print	Newspapers	Magazines	Radio	Television	Total Media
Internet Penetration	-0.0041***	-0.0030***	-0.0037***	-0.0011	-0.0023**	-0.0028***
(in percentages)	(0.0008)	(0.0011)	(0.0010)	(0.0010)	(0.0010)	(0.0007)
Cell Phone Penetration	0.0009**	-0.0003	0.0017***	0.0020***	-0.0006	0.0015***
(in percentages)	(0.0004)	(0.0005)	(0.0005)	(0.0005)	(0.0005)	(0.0005)
GDP per capita	1.0658***	1.3189***	1.5434***	-0.1201	0.6571***	1.0848***
(in logarithms)	(0.1272)	(0.1689)	(0.1557)	(0.1553)	(0.1432)	(0.1891)
Exchange Rate	-1.1119***	-1.0553***	-1.0022***	-1.0436***	-0.9497***	-1.1638***
(in logarithms)	(0.0390)	(0.0457)	(0.0440)	(0.0454)	(0.0422)	(0.0475)
Price Index	0.0030***	0.0035***	0.0000	0.0010	0.0049***	0.0015
(year 2000=100)	(0.0007)	(0.0010)	(0.0009)	(0.0008)	(0.0008)	(0.0013)
Population	-0.3251	0.0123	-0.2254	2.8858***	-0.0897	0.6894
(in logarithms)	(0.3415)	(0.4834)	(0.4304)	(0.4666)	(0.3927)	(1.1452)
Year Fixed-Effects	Yes	Yes	Yes	Yes	Yes	Yes
Country Fixed-Effects	Yes	Yes	Yes	Yes	Yes	Yes
Country-Specific Trends	Yes	Yes	Yes	Yes	Yes	Yes
Observations	794	776	734	766	851	313
R-squared	0.9984	0.998	0.9987	0.9978	0.9975	0.9994

Notes: The dependent variables are measured in logarithms.
Standard errors in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%

The coefficients on the Internet variable in Table 4 are similar to those in Table 3, although the impact of the Internet variable is slightly smaller – comparing Tables 3 and 4 the coefficient on

the Internet variable in Column V of Table 4 shows a smaller impact of the Internet on television advertising, and the coefficient on the Internet variable in Column VI of Table 4 shows a smaller impact of the Internet on total advertising expenditures. Compared with Table 3 cell phone adoption in Table 4 has a positive impact on advertising expenditures on total print media, magazines, radio, and total advertising expenditures. The remaining covariates in the Huber-robust regressions have similar qualitative effects to those in Table 3.

The results in Tables 3 and 4 indicate that the Internet substantially reduced advertising expenditures not only in print media (both newspapers and magazines), but also on television, although to a lower extent than print media according to the Huber-robust regression. Actual median advertising expenditures per capita in total print and television across countries in 2008 amounted to US$45.6 and US$46.2 respectively. According to the OLS coefficients (Huber-robust) had there been no Internet then the median advertising expenditures per capita in total print and television across countries in 2008 would have amounted to US$55.3 (US$53.4) and US$53.3 (US$50.6) respectively.[17] On the other hand, we do not find that radio advertising declined with the increase in Internet use. The expected sign of the impact of the increase in Internet use on overall advertising expenditures is unclear from a theoretical standpoint. My empirical estimates indicate that the advent of the Internet substantially reduced total advertising expenditures, including expenditures on both traditional media and the Internet, although the regressions on overall advertising use fewer observations. Overall median advertising expenditures per capita amounted to US$215.8 in 2008 (note that the sample of countries is

[17] Medians are computed across countries that have information for 2008 in each regression sample. Information on advertising in newspapers and magazines is not available for 2008. Median advertising expenditures per capita in newspapers and magazines in 2007 amounted to US$18.0 and US$8.2 respectively, and Internet penetration in 2007 was 37.8%. According to the OLS coefficients (Huber-robust), had there been no Internet then the median advertising expenditures per capita in newspapers and magazines across countries in 2007 would have amounted to US$20.1 (US$20.0) and US$9.5 (US$9.3) respectively

remarkably different than that in the regressions by medium); had there been no Internet they would have amounted to US$251.1 (US$241.1) according to the OLS (Huber-robust) estimates.

The results from Tables 3 and 4 are the primary finding of this paper. I now turn to a brief exploration of two issues: whether or not the estimates change when using information only from countries with net of discounts advertising expenditures measurements, and how the estimates differ according to the degree of state interference in media markets. Further analyses aimed at both providing additional insights and testing the robustness of the results are presented in Section 4 in the appendix.

Section II discussed that there are two methodologies for measuring advertising expenditures: rate card measurements and net of discounts measurements. Due to discounts rate card measurements might not be sufficiently accurate. In order to study how this factor affects my previous estimates, Table 5 presents OLS and Huber-robust regressions using only information from countries with net of discounts measurements. The table shows only the coefficients on the Internet variable; the complete tables are included in Table S4A1 and S4A2 in the appendix. The impact of the Internet on radio advertising expenditures is negative in the OLS regression but essentially zero in the Huber-robust regression. The effect of the Internet on television advertising expenditures is larger in the OLS regression in Column V in Table 5 than in the OLS in Column V in Table 3, but the Internet impacts are similar when comparing the Huber-robust regression results in Column V in Table 5 and Column V in Table 4. The remaining results in Table 5 are similar to those for all countries in Tables 3 and 4.

Table 5
Random Trend Fixed Effect Regressions on Advertising Expenditures (Summary)†
Net of Discounts Measurements - Panel of Years 1998 through 2008

		I	II	III	IV	V	VI
		Total Print	Newspapers	Magazines	Radio	Television	Total Media
OLS	Internet Penetration	-0.0051***	-0.0036**	-0.0044***	-0.0057***	-0.0055***	-0.0049***
	(in percentages)	(0.0013)	(0.0016)	(0.0014)	(0.0021)	(0.0014)	(0.0012)
Huber-Robust	Internet Penetration	-0.0045***	-0.0046***	-0.0038***	-0.0009	-0.0026***	-0.0035***
	(in percentages)	(0.0008)	(0.0011)	(0.0008)	(0.0010)	(0.0008)	(0.0008)

† This table presents only the coefficients on the Internet variable; Tables S4A1 and S4A2 in the appendix present the complete tables. The dependent variables are measured in logarithms.
Robust standard errors in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%

In the US the government has both directly and indirectly subsidized journalism since the founding of the US, for example by giving newspapers postal subsides, publication of public and legal notices, and tax breaks. In other countries the government either owns a substantial amount of the available media outlets, or the state provides significant financial assistance. Additionally, media advertising might have different degrees of government regulation across the countries in the sample. The estimates presented thus far measure the *average effect* of the Internet on advertising expenditures; the country fixed effects capture the time invariant factors and the country-specific time trends capture idiosyncratic time trends. Nevertheless, it might be of interest to analyze how the impact varies across different groups of countries. Information on the government ownership of media outlets, amount of state subsidies, or regulation on advertising is not available to us for more than a few countries in the sample. However, the World Association of Newspapers provides information by countries concerning regulations on foreign ownership of newspapers.[18] This variable might provide a measurement of state interference in the media market. Table 6 includes an interaction term between Internet penetration and a dummy variable equal to one if the country restricts the foreign ownership of newspapers. Table 6 shows only the

[18] Among the countries in the sample foreign ownership of shares in newspapers is restricted in Brazil, Canada, China, France, India, Kenya, Lebanon, Malaysia, Mexico, Russia, South Korea, and Thailand.

coefficients on the Internet variable and the interaction term; the complete tables are included in Table S4A3 and S4A4 in the appendix.

Table 6
Random Trend Fixed Effect Regressions on Advertising Expenditures (Summary)†

		I	II	III	IV	V	VI
		Total Print	Newspapers	Magazines	Radio	Television	Total Media
OLS	Internet Penetration	-0.0045***	-0.0045**	-0.0015	-0.0022	-0.0046***	-0.0051***
	(in percentages)	(0.0014)	(0.0018)	(0.0016)	(0.0020)	(0.0015)	(0.0012)
	Interaction Internet Penetration and	0.0004	0.0067*	0.0061	0.0045	0.0082	0.0075**
	Restrictions on Foreign Ownership	(0.0045)	(0.0039)	(0.0038)	(0.0062)	(0.0054)	(0.0033)
Huber-Robust	Internet Penetration	-0.0050***	-0.0039***	-0.0034***	0.0000	-0.0036***	-0.0039***
	(in percentages)	(0.0009)	(0.0012)	(0.0009)	(0.0011)	(0.0010)	(0.0010)
	Interaction Internet Penetration and	0.0066***	0.0032	0.0042**	-0.0043*	0.0110***	0.0037*
	Restrictions on Foreign Ownership	(0.0021)	(0.0029)	(0.0020)	(0.0025)	(0.0023)	(0.0020)

† This table presents only the coefficients on the Internet variable; Tables S3A3 and S4A4 in the appendix present the complete tables. The dependent variables are measured in logarithms.
Robust standard errors in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%

Table 6 shows similar estimates to those presented above for countries that do not restrict foreign ownership. On the other hand, the regressions do suggest that the Internet did not reduce advertising expenditures on print media, television, or total media in countries that restrict foreign ownership, although the standard errors are large.[19]

VI- Conclusions

This paper has examined the extent to which the increase in Internet penetration has displaced counterfactual advertising expenditures on each traditional media outlet and overall. Although the Internet could in theory either increase or decrease advertising expenditures in traditional media, my results appear to substantiate the concerns of traditional media executives that the Internet reduces their advertising revenues. However, the Internet does not appear to be an equal opportunity threat to all traditional media outlets: my estimates indicate that the Internet reduced

[19] The appendix shows additional regressions analyzing whether or not the impact of the Internet changed over time, regressions including cable and satellite penetration as a covariate, and regressions studying how the effect of the Internet varies across countries depending on their size.

advertising expenditures on both television and print media (newspapers and magazines), but had no effect on radio. I also find that the Internet reduced overall advertising expenditures, including expenditures on traditional media and the Internet. Decreases in advertising expenditures in traditional media caused by the Internet do not appear to be compensated by an increase in advertising expenditures on the Internet.

The estimates of this paper are not only important for scholars and media managers seeking to understand behavior and gain insight, but should also be useful in informing a public policy debate. The newspaper industry appears to be particularly struggling. Some newspapers have gone bankrupt (e.g. the Chicago Tribune and Los Angeles Times), most have substantially downsized their staff, some are experimenting with new ways to generate revenues (e.g. by charging for web subscriptions),[20] and some are considering saving on production and distributions costs by going either entirely or mostly online (according to Vogel 2007 production and distributions costs represent 52% of newspapers' total revenues). The sharp decrease in advertising expenditures on print media has raised the debate of whether or not the government should intervene. Intervention supporters argue that free riding from online sites (e.g. news aggregators) and a large menu of media options for news and entertainment may reduce content creation.[21] The government is considering intervention policies that include regulation changes and providing government support.

[20] The Wall Street Journal has charged a web subscription fee since 1996.

[21] As argued in the introduction, content creation may decrease when there are more competitors and the cost of creating content is fixed. Traditional media outlets charge substantially lower rates for online ads than for print ads, possibly due to the high competition they face online. Another obstacle for newspapers' online advertising to ever compensate for the reduction in offline advertising is that the percentage of time spent reading news online relative to offline reading is only 3% (Varian 2010).

There is obviously a great deal of additional work that is called for if we are to be in a position to predict the future impact of the Internet on the media industry. This paper is a small first step in that direction.

References

Athey, Susan, Calvano, Emilio, and Gans, Joshua, "Will the Internet Destroy the News Media? Or Can Online Advertising Save the News Media?," Working Paper, 2010.

Caves, Richard, "Switching Channels: Organization and Change in TV Broadcasting," Harvard University Press, 2005.

Chandra, Ambarish, and Kaiser, Ulrich, 2009, "Targeted Advertising in Magazine Markets," Journal of Industrial Economics 57(1), 58-84.

Chiu, Lesley and Tucker, Catherine, "News, Copyright, and Online Aggregators," Working Paper, 2010.

Federal Trade Commission, "Potential Policy Recommendations to Support the Reinvention of Journalism," Staff Discussion Draft, June 2010. http://www.ftc.gov/opp/workshops/news/jun15/docs/new-staff-discussion.pdf

Filistrucchi, Lapo, 2005, "The Impact of Internet on the Market for Daily Newspapers in Italy," EUI Working Paper, No. 2005-12.

Gentzkow, Matthew, "Valuing New Goods in a Model with Complementarity: Online Newspapers," American Economic Review 97 (3), June 2007.

George, Lisa, "The Internet and the Market for Daily Newspapers," The B.E. Journal of Economic Analysis & Policy, Vol. 8, No. 1 (Advances), Article 26, 2008.

Goldfarb, Avi and Tucker, Catherine 2011a, "Search Engine Advertising: Channel Substitution When Pricing Ads to Context," Management Science, Articles in Advance, pp. 1–13,

Goldfarb, Avi and Tucker, Catherine, 2011b, "Advertising Bans and the Substitutability of Online and Offline Advertising," Journal of Marketing Research, Forthcoming.

Goolsbee, Austan, "American Idol' Is the Price We Pay for a Menu of So Many Channels," The New York Times, April 26, 2007.

Interactive Advertising Bureau, "Internet Advertising Revenue Report," March 2009. http://www.iab.net/media/file/IAB_PwC_2008_full_year.pdf

Joo, Mingyu, Wilbur, Kenneth, and Zhu Yi, "Television Advertising and Online Search," Working Paper, 2010.

Kaplan, David, "CNN: Facebook and not Fox News is our biggest competitor," The Guardian, March 10, 2010. http://www.guardian.co.uk/media/pda/2010/mar/10/digital-media-television

Lambert, Diane and Pregibon, Daryl, "Online Effects of Offline Ads," AdKDD08 (in the ACM digital library), 2008, pp. 10-17.

Liebowitz, Stan and Zentner, Alejandro, "Clash of the Titans: Does Internet Use Reduce Television Viewing?," 2010, Forthcoming in The Review of Economics and Statistics.

Pew, “The State of the News Media: An Annual Report on American Journalism,” 2010. http://www.stateofthemedia.org/2010/printable_newspaper_chapter.htm

Seamans, Robert and Zhu, Feng, “Technology Shocks in Multi-Sided Markets: The Impact of Craigslist on Local Newspapers,” Working Paper, 2011.

Varian, Hal, “Newspaper economics: Online and Offline,” presentation, March 9, 2010. http://www.ftc.gov/opp/workshops/news/mar9/docs/varian.pdf

Vogel, Harold, Entertainment Industry Economics, 7th edition, 2007.

Wooldridge, Jeffrey, “Econometrics Analysis of Cross Section and Panel Data,” Second Edition, 2010, MIT Press.

Appendix

Section 1

Figure II in the text presents the average media proportion of advertising expenditures by medium because both exchange rate fluctuations and variation in inflation rates across countries make the global aggregation of monetary values difficult. For example, aggregate global trends in advertising expenditures for each medium are substantially different when measured in US dollars or Euros. The regressions include the exchange rate and the inflation rate in order to control for both exchange rate fluctuations and idiosyncratic changes in prices, and therefore their results are not affected by the currency employed in the measurements. Figure S1A1 presents trends in global advertising expenditures by medium in US dollars and Euros, including information from 44 countries that have complete data (for all years) for every media except the Internet. Figure S1A2 presents trends in advertising expenditures by medium and overall measured in US dollars and Euros, including information from 10 countries that have complete data (for all years) for every medium.[22]

[22] The statistics in Figures S1A1 and S1A2 include information from: Argentina, Australia, Austria, Bahrain, Belgium, Bulgaria, Canada, Chile, Costa Rica, Czech Republic, Denmark, Egypt, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Japan, Kenya, Kuwait, Latvia, Lebanon, Lithuania, Malaysia, Malta, Mexico, the Netherlands, New Zealand, Norway, Poland, Portugal, Romania, Slovak Republic, South Africa, Spain, Sweden, Switzerland, Taiwan, the United Kingdom, United Arab Emirates, and the United States of America. The statistics in Figures S1A3 and S1A4 include information from: Belgium, Canada, Czech Republic, Denmark, Finland, Germany, Japan, Sweden, the United Kingdom, and the United States of America.

Figure S1A1: Global Advertising Expenditures
(In Current Million US$ and Euros)

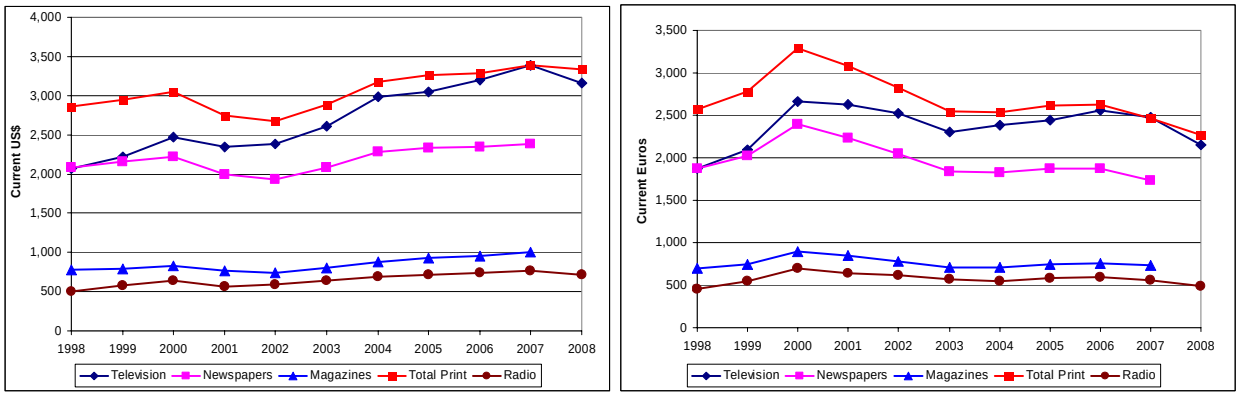
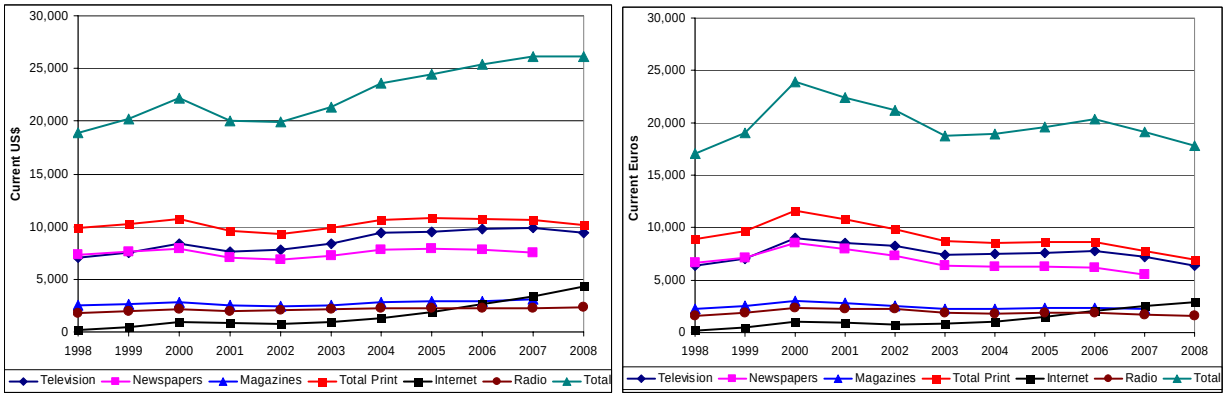


Figure S1A2: Global Advertising Expenditures
(In Current Million US$ and Euros)



Section 2

Tables S2A1 and S2A2 present summary statistics analogous to those in Table 1 in the text, although they measure advertising expenditure trends in current US dollars and Euros per capita.

Table S2A1
Descriptive Statistics
Global Advertising Expenditures: In Current US Dollars per Capita

	Column I		Column II		Column III		Column IV	
	Newspapers		Magazines		Total Print All Countries		Total Print Net of Discounts	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
1998	54.7	55.3	18.7	18.4	73.4	71.4	87.4	75.0
1999	54.8	54.9	18.8	18.6	73.6	71.3	87.6	74.9
2000	54.3	53.9	18.4	18.0	72.7	69.2	85.9	72.8
2001	50.0	49.5	17.6	16.6	67.6	63.3	78.5	66.8
2002	50.1	49.5	17.8	16.5	67.9	62.8	78.4	65.5
2003	57.2	53.6	20.5	18.4	77.7	68.8	90.4	71.2
2004	66.7	62.2	23.4	20.3	90.1	78.2	103.5	80.8
2005	70.9	66.2	24.7	20.7	95.6	82.2	109.0	84.3
2006	74.3	70.2	25.5	21.2	99.7	85.8	112.4	87.0
2007	82.6	79.0	28.5	23.2	111.1	95.7	125.3	97.1
2008	na	na	na	na	115.9	101.8	126.6	98.2
	Column V		**Column VI**		**Column VII**		**Column VIII**	
	Television		**Internet**		**Radio**		**Total**	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
1998	38.3	32.9	1.6	2.1	8.2	9.1	226.4	97.4
1999	39.6	34.1	3.3	5.0	8.8	10.1	228.5	103.8
2000	41.0	36.9	6.4	8.6	9.1	10.9	232.3	117.9
2001	39.5	34.2	5.7	7.4	8.4	9.7	210.0	103.1
2002	40.4	34.5	6.3	6.3	8.5	10.1	209.5	102.8
2003	48.3	38.5	8.8	7.6	10.4	11.5	241.0	101.5
2004	57.1	43.7	13.1	10.4	11.8	12.5	274.6	111.1
2005	59.5	44.1	19.4	14.5	12.7	13.4	287.4	112.1
2006	62.3	44.6	29.9	22.6	13.2	13.6	306.4	118.3
2007	71.5	47.5	42.5	32.7	14.7	14.6	337.2	123.6
2008	72.8	46.2	60.5	31.6	14.8	14.5	353.5	108.4

The table presents unweighted averages computed across countries. Due to the unbalanced nature of the panel, the statistics use information from 44 countries in all columns except Internet, Total Print Net of Discounts, and Total. Column IV uses information from 36 countries and Columns VI (Internet) and VIII (Total) use data from 10 countries. The regressions use all information available in the unbalanced panel.

Table S2A2
Descriptive Statistics
Global Advertising Expenditures: In Current Euros per Capita

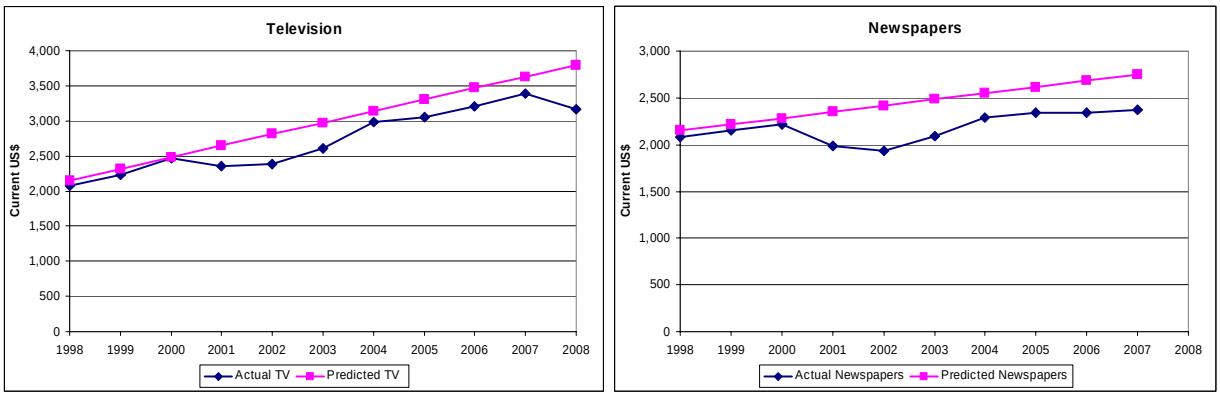
	Column I		Column II		Column III		Column IV	
	Newspapers		Magazines		Total Print All Countries		Total Print Net of Discounts	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
1998	49.2	49.8	16.8	16.6	66.0	64.2	78.7	67.5
1999	51.5	51.6	17.7	17.5	69.1	67.0	82.3	70.4
2000	58.6	58.2	19.9	19.4	78.5	74.8	92.7	78.6
2001	56.0	55.5	19.7	18.6	75.7	70.9	87.9	74.8
2002	53.1	52.4	18.8	17.4	71.9	66.5	83.1	69.5
2003	50.4	47.1	18.1	16.2	68.4	60.5	79.6	62.6
2004	53.4	49.8	18.7	16.2	72.1	62.5	82.8	64.6
2005	56.7	52.9	19.8	16.6	76.5	65.8	87.2	67.4
2006	59.4	56.1	20.4	16.9	79.8	68.7	89.9	69.6
2007	60.3	57.6	20.8	16.9	81.1	69.9	91.5	70.9
2008	na	na	na	na	78.8	69.2	86.1	66.8
	Column V		**Column VI**		**Column VII**		**Column VIII**	
	Television		**Internet**		**Radio**		**Total**	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
1998	34.4	29.6	1.4	1.9	7.4	8.2	203.7	87.7
1999	37.3	32.1	3.1	4.7	8.3	9.5	214.8	97.6
2000	44.3	39.9	6.9	9.3	9.9	11.7	250.9	127.3
2001	44.2	38.3	6.4	8.2	9.4	10.9	235.2	115.5
2002	42.8	36.6	6.7	6.7	9.0	10.7	222.1	109.0
2003	42.5	33.8	7.8	6.7	9.1	10.1	212.1	89.3
2004	45.7	34.9	10.5	8.3	9.5	10.0	219.6	88.8
2005	47.6	35.3	15.5	11.6	10.1	10.7	229.9	89.7
2006	49.8	35.7	23.9	18.1	10.6	10.9	245.1	94.7
2007	52.2	34.7	31.0	23.9	10.7	10.7	246.2	90.3
2008	49.5	31.4	41.1	21.5	10.1	9.8	240.4	73.7

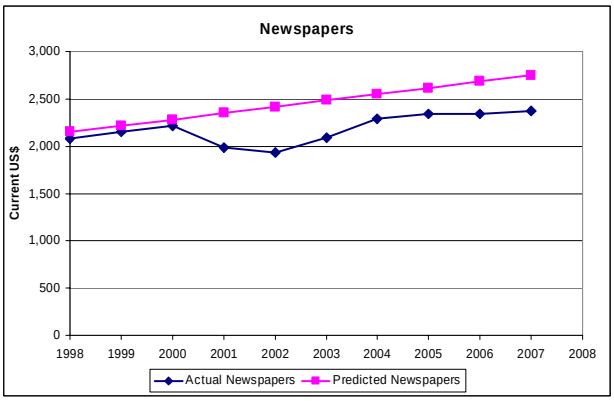
The table presents unweighted averages computed across countries. Due to the unbalanced nature of the panel, the statistics use information from 44 countries in all columns except Internet, Total Print Net of Discounts, and Total. Column IV uses information from 36 countries and Columns VI (Internet) and VIII (Total) use data from 10 countries. The regressions use all information available in the unbalanced panel.

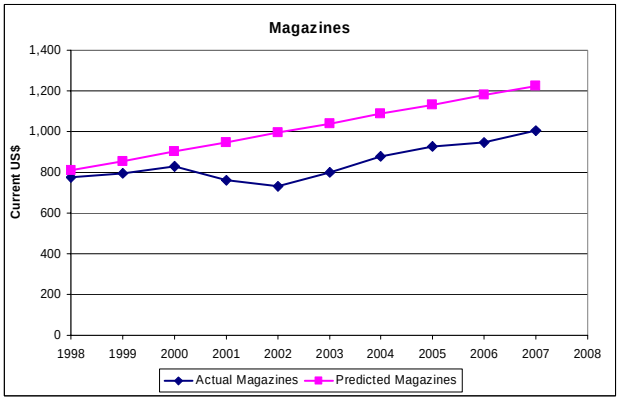
Section 3

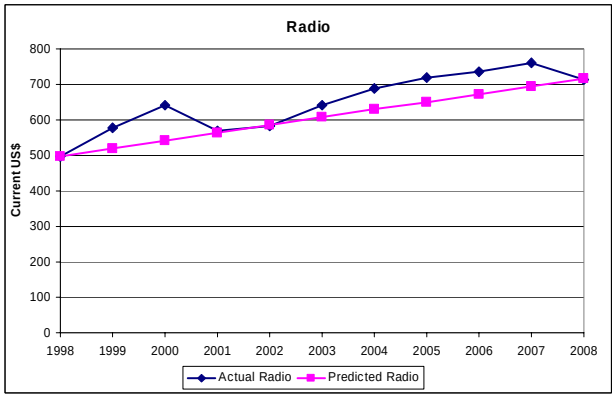
This appendix section uses the estimates in Table 3 to predict advertising expenditures absent the Internet. Figure S3A1 presents actual and predicted global advertising expenditures both by medium and overall. The predicted advertising expenditures by medium are computed using the average Internet penetration rates in years 1998 and 2008. The intermediate years are interpolated. The figure uses information from 44 countries, except for overall advertising which uses information from 10 countries. Average Internet penetration across the 44 countries with complete information on advertising by medium (for all years) was 10.2% in 1998 and 55.5% in 2008. Average Internet penetration across the 10 countries that also have complete information on Internet advertising was 18.5% in 1998 and 75.8% in 2008.

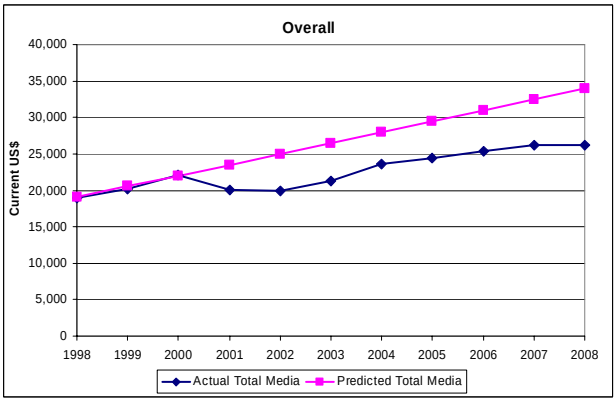
Figure S3A1
Actual and Predicted global Advertising Expenditures
(In Current Million US$)











Section 4

This appendix section presents the complete counterparts of Tables 5 and 6 in the text, as well as presenting additional analyses aimed at both providing additional insights and testing the robustness of the results presented above.

Tables S4A1 and S4A2 present the complete counterparts of Table 5 in the text using only information from countries with net of discounts measurements. [23]

[23] Net of discounts measurement are available for: Algeria, Australia, Austria, Belgium, Bulgaria, Canada, Chile, Costa Rica, Cyprus, Czech Republic, Denmark, Ecuador, Estonia, Finland, France, Germany, Greece, Guatemala, Honduras, Hungary, India, Ireland, Italy, Japan, Latvia, Lithuania, Luxembourg, Macedonia, Malta, Morocco, the Netherlands, New Zealand, Nicaragua, Norway, Pakistan, Poland, Portugal, Romania, Russia, Serbia, Slovak Republic, Slovenia, Spain, Sweden, Switzerland, Taiwan, Tunisia, the United Kingdom, the United States of America, Venezuela, and Vietnam.

Table S4A1
OLS Random Trend Fixed Effect Regressions on Advertising Expenditures
Panel of Years 1998 through 2008

	I	II	III	IV	V	VI
	Total Print	Newspapers	Magazines	Radio	Television	Total Media
Internet Penetration	-0.0051***	-0.0036**	-0.0044***	-0.0057***	-0.0055***	-0.0049***
(in percentages)	(0.0013)	(0.0016)	(0.0014)	(0.0021)	(0.0014)	(0.0012)
Cell Phone Penetration	-0.0036***	-0.0038**	-0.0026*	-0.0025	-0.0012	0.0003
(in percentages)	(0.0012)	(0.0016)	(0.0014)	(0.0015)	(0.0011)	(0.0009)
GDP per capita	1.7195***	1.9154***	0.5077	0.2021	0.5282	0.6764**
(in logarithms)	(0.4444)	(0.5020)	(0.7346)	(0.6155)	(0.4843)	(0.2877)
Exchange Rate	-0.5165***	-0.9084***	-0.6546***	-0.251	-0.5490**	-1.0639***
(in logarithms)	(0.1809)	(0.2438)	(0.2377)	(0.2956)	(0.2160)	(0.0903)
Price Index	0.0049***	0.0053***	0.0072**	-0.0013	0.0062**	0.0002
(year 2000=100)	(0.0018)	(0.0018)	(0.0028)	(0.0036)	(0.0028)	(0.0020)
Population	3.4206*	1.3979	6.5248*	-0.9865	1.8357	-3.4853**
(in logarithms)	(1.7997)	(2.2512)	(3.3671)	(2.9149)	(2.8225)	(1.6715)
Year Fixed-Effects	Yes	Yes	Yes	Yes	Yes	Yes
Country Fixed-Effects	Yes	Yes	Yes	Yes	Yes	Yes
Country-Specific Trends	Yes	Yes	Yes	Yes	Yes	Yes
Observations	478	456	435	494	500	279
R-squared	0.9961	0.9952	0.9953	0.9887	0.9915	0.9989

Notes: The dependent variables are measured in logarithms.
Robust standard errors in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%

Table S4A2
Huber-Robust Random Trend Fixed Effect Regressions on Advertising Expenditures
Panel of Years 1998 through 2008

	I	II	III	IV	V	VI
	Total Print	Newspapers	Magazines	Radio	Television	Total Media
Internet Penetration	-0.0045***	-0.0046***	-0.0038***	-0.0009	-0.0026***	-0.0035***
(in percentages)	(0.0008)	(0.0011)	(0.0008)	(0.0010)	(0.0008)	(0.0008)
Cell Phone Penetration	0.0008*	-0.0008	0.0005	0.0025***	0.0013***	0.0017***
(in percentages)	(0.0004)	(0.0005)	(0.0004)	(0.0005)	(0.0004)	(0.0006)
GDP per capita	1.4354***	2.2001***	1.2989***	-0.4505**	0.7037***	1.0576***
(in logarithms)	(0.1461)	(0.2058)	(0.1637)	(0.1819)	(0.1455)	(0.2121)
Exchange Rate	-1.0755***	-1.0608***	-0.7072***	-0.9511***	-0.9421***	-1.1068***
(in logarithms)	(0.0516)	(0.0595)	(0.0509)	(0.0595)	(0.0474)	(0.0648)
Price Index	0.0030***	0.0015	-0.0007	0.0036***	0.0039***	0.0021
(year 2000=100)	(0.0008)	(0.0012)	(0.0009)	(0.0010)	(0.0008)	(0.0015)
Population	0.9966	1.4369	0.6473	2.9064**	3.1025***	-0.3357
(in logarithms)	(0.9045)	(1.3684)	(1.0674)	(1.1586)	(0.9241)	(1.3022)
Year Fixed-Effects	Yes	Yes	Yes	Yes	Yes	Yes
Country Fixed-Effects	Yes	Yes	Yes	Yes	Yes	Yes
Country-Specific Trends	Yes	Yes	Yes	Yes	Yes	Yes
Observations	477	455	433	494	500	276
R-squared	0.9989	0.9985	0.9993	0.9985	0.9982	0.9993

Notes: The dependent variables are measured in logarithms.
Standard errors in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%

Tables S4A3 and S4A4 present the complete counterparts for Table 6 in the text, including an interaction term between Internet penetration and a dummy variable equal to one if the country restricts foreign ownership of newspapers and zero otherwise.

Table S4A3
OLS Random Trend Fixed Effect Regressions on Advertising Expenditures
Panel of Years 1998 through 2008

	I	II	III	IV	V	VI
	Total Print	Newspapers	Magazines	Radio	Television	Total Media
Internet Penetration	-0.0045***	-0.0045**	-0.0015	-0.0022	-0.0046***	-0.0051***
(in percentages)	(0.0014)	(0.0018)	(0.0016)	(0.0020)	(0.0015)	(0.0012)
Interaction Internet Penetration and	0.0004	0.0067*	0.0061	0.0045	0.0082	0.0075**
Restriction on Foreign Ownership	(0.0045)	(0.0039)	(0.0038)	(0.0062)	(0.0054)	(0.0033)
Restriction on Foreign Ownership	6.4915***	7.3257***	-2.8098	1.0114	1.9559	2.991
(dummy equals 1 if restriction)	(2.3443)	(2.6226)	(5.1526)	(4.5301)	(4.4715)	(3.2879)
Cell Phone Penetration	-0.0044***	-0.0045***	-0.0020**	-0.0034**	-0.0028***	0.0006
(in percentages)	(0.0011)	(0.0014)	(0.0010)	(0.0015)	(0.0011)	(0.0010)
GDP per capita	1.1979***	1.3516***	1.0650*	0.8716	0.7673*	0.7581**
(in logarithms)	(0.4167)	(0.5165)	(0.5467)	(0.6223)	(0.4449)	(0.3184)
Exchange Rate	-0.6070***	-0.8018***	-0.7435***	-0.3353	-0.8229***	-0.9230***
(in logarithms)	(0.1329)	(0.1614)	(0.1632)	(0.2113)	(0.1469)	(0.1220)
Price Index	0.0040*	0.0006	0.0061	0.0026	0.0095***	0.0014
(year 2000=100)	(0.0021)	(0.0019)	(0.0039)	(0.0033)	(0.0029)	(0.0022)
Population	0.2315	-0.0134	-2.3305	-3.3084	-2.4333	-1.4424
(in logarithms)	(1.5716)	(1.6601)	(2.7685)	(2.8978)	(2.0482)	(1.8544)
Year Fixed-Effects	Yes	Yes	Yes	Yes	Yes	Yes
Country Fixed-Effects	Yes	Yes	Yes	Yes	Yes	Yes
Country-Specific Trends	Yes	Yes	Yes	Yes	Yes	Yes
Observations	547	531	504	561	576	276
R-squared	0.9953	0.9952	0.9949	0.9852	0.992	0.997

Notes: The dependent variables are measured in logarithms.
Robust standard errors in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%

Table S4A4
Huber-Robust Random Trend Fixed Effect Regressions on Advertising Expenditures
Panel of Years 1998 through 2008

	I	II	III	IV	V	VI
	Total Print	Newspapers	Magazines	Radio	Television	Total Media
Internet Penetration	-0.0050***	-0.0039***	-0.0034***	0.0000	-0.0036***	-0.0039***
(in percentages)	(0.0009)	(0.0012)	(0.0009)	(0.0011)	(0.0010)	(0.0010)
Restriction on Foreign Ownership	0.0066***	0.0032	0.0042**	-0.0043*	0.0110***	0.0037*
(dummy equals 1 if restriction)	(0.0021)	(0.0029)	(0.0020)	(0.0025)	(0.0023)	(0.0020)
Interaction Internet Penetration and	13.2937***	12.8368***	-1.9699	12.7564***	-2.3217	1.8015
Restriction on Foreign Ownership	(1.4245)	(1.8532)	(1.3701)	(1.7000)	(1.9048)	(1.9168)
Cell Phone Penetration	0.0002	-0.0021***	0.0009**	0.0003	-0.0003	0.0025***
(in percentages)	(0.0004)	(0.0006)	(0.0004)	(0.0005)	(0.0005)	(0.0007)
GDP per capita	1.1958***	1.8042***	2.1481***	0.4000**	0.6458***	1.0855***
(in logarithms)	(0.1724)	(0.2392)	(0.1796)	(0.1924)	(0.1820)	(0.2356)
Exchange Rate	-1.0756***	-1.0261***	-0.9187***	-0.9144***	-1.0713***	-1.0839***
(in logarithms)	(0.0476)	(0.0558)	(0.0440)	(0.0502)	(0.0472)	(0.0653)
Price Index	0.0022***	0.0012	0.0010	0.0006	0.0060***	0.0017
(year 2000=100)	(0.0008)	(0.0012)	(0.0009)	(0.0010)	(0.0009)	(0.0017)
Population	2.9307***	3.0634***	-0.302	2.1405**	-1.1034	-0.3571
(in logarithms)	(0.7832)	(1.0273)	(0.7343)	(0.9420)	(0.8596)	(1.3899)
Year Fixed-Effects	Yes	Yes	Yes	Yes	Yes	Yes
Country Fixed-Effects	Yes	Yes	Yes	Yes	Yes	Yes
Country-Specific Trends	Yes	Yes	Yes	Yes	Yes	Yes
Observations	547	531	503	561	576	274
R-squared	0.9987	0.9982	0.9992	0.9977	0.9978	0.9989

Notes: The dependent variables are measured in logarithms.
Standard errors in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%

The rapid evolution of the Internet since the birth of the World Wide Web, in terms of the quality and quantity of content, means that the impact of the Internet on advertising expenditures may have changed over time. Tables S4A5 and S4A6 include an interaction term between Internet penetration and an aggregate time trend in order to conduct an exploratory analysis on whether or how the effect of the Internet on advertising expenditures has changed over the study period.

Table S4A5
OLS Random Trend Fixed Effect Regressions on Advertising Expenditures
Panel of Years 1998 through 2008

	I	II	III	IV	V	VI
	Total Print	Newspapers	Magazines	Radio	Television	Total Media
Internet Penetration	-0.0054**	-0.0026	0.0055	0.0001	-0.0048	-0.0133***
(in percentages)	(0.0022)	(0.0027)	(0.0041)	(0.0046)	(0.0035)	(0.0031)
Interaction Internet Penetration and	0.0001	-0.0001	-0.0021***	0.0000	0.0002	0.0015***
Time Trend	(0.0004)	(0.0005)	(0.0007)	(0.0008)	(0.0006)	(0.0005)
Cell Phone Penetration	-0.0010	-0.0014	-0.0023**	-0.0013	-0.0018*	0.0011
(in percentages)	(0.0009)	(0.0011)	(0.0011)	(0.0016)	(0.0011)	(0.0008)
GDP per capita	1.3986***	1.4429***	1.4288***	0.5581	1.1852***	0.6566**
(in logarithms)	(0.2825)	(0.3372)	(0.4429)	(0.4620)	(0.3605)	(0.3009)
Exchange Rate	-0.7468***	-0.8240***	-0.8604***	-0.4741**	-0.8271***	-0.9304***
(in logarithms)	(0.0967)	(0.1063)	(0.1488)	(0.1975)	(0.1236)	(0.1025)
Price Index	0.0043***	0.0041**	0.0045*	-0.0011	0.0048**	-0.0003
(year 2000=100)	(0.0015)	(0.0016)	(0.0025)	(0.0030)	(0.0023)	(0.0020)
Population	-0.6722	-0.1168	-0.1684	-0.0382	3.8993**	0.3742
(in logarithms)	(0.6617)	(0.7420)	(1.0567)	(1.6568)	(1.6803)	(1.9248)
Year Fixed-Effects	Yes	Yes	Yes	Yes	Yes	Yes
Country Fixed-Effects	Yes	Yes	Yes	Yes	Yes	Yes
Country-Specific Trends	Yes	Yes	Yes	Yes	Yes	Yes
Observations	796	777	734	767	852	313
R-squared	0.9947	0.9948	0.9919	0.9804	0.9889	0.9978

Notes: The dependent variables are measured in logarithms.
Robust standard errors in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%

Table S4A6
Huber-Robust Random Trend Fixed Effect Regressions on Advertising Expenditures
Panel of Years 1998 through 2008

	I	II	III	IV	V	VI
	Total Print	Newspapers	Magazines	Radio	Television	Total Media
Internet Penetration	-0.0003	-0.0012	0.0001	-0.0039**	-0.0035**	-0.0087***
(in percentages)	(0.0014)	(0.0017)	(0.0016)	(0.0015)	(0.0015)	(0.0018)
Interaction Internet Penetration and	-0.0006***	-0.0003	-0.0007***	0.0005**	0.0002	0.0009***
Time Trend	(0.0002)	(0.0003)	(0.0003)	(0.0002)	(0.0002)	(0.0003)
Cell Phone Penetration	0.0003	-0.0008	0.0016***	0.0028***	-0.0004	0.0023***
(in percentages)	(0.0004)	(0.0006)	(0.0005)	(0.0005)	(0.0005)	(0.0006)
GDP per capita	1.0382***	1.2552***	1.2159***	-0.0895	0.6767***	0.8004***
(in logarithms)	(0.1328)	(0.1704)	(0.1590)	(0.1576)	(0.1426)	(0.2136)
Exchange Rate	-1.0860***	-1.0552***	-0.9862***	-1.0481***	-0.9452***	-1.0901***
(in logarithms)	(0.0404)	(0.0460)	(0.0449)	(0.0454)	(0.0417)	(0.0542)
Price Index	0.0026***	0.0035***	-0.0009	0.0017**	0.0049***	0.0002
(year 2000=100)	(0.0007)	(0.0010)	(0.0009)	(0.0008)	(0.0008)	(0.0015)
Population	-0.2973	-0.0307	-0.6373	3.1312***	-0.1423	-0.6698
(in logarithms)	(0.3545)	(0.4867)	(0.4390)	(0.4682)	(0.3897)	(1.3251)
Year Fixed-Effects	Yes	Yes	Yes	Yes	Yes	Yes
Country Fixed-Effects	Yes	Yes	Yes	Yes	Yes	Yes
Country-Specific Trends	Yes	Yes	Yes	Yes	Yes	Yes
Observations	795	774	734	767	852	313
R-squared	0.9983	0.9979	0.9987	0.9978	0.9976	0.9992

Notes: The dependent variables are measured in logarithms.
Standard errors in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%

The time trend is 1 in 1998 and 11 in 2008. Table S4A7 summarizes the results from Tables S4A5 and S4A6; it uses the coefficients on the Internet variable and interaction term in Tables S4A5 and S4A6 in order to compute the marginal effects of the Internet on the advertising expenditures by each medium and overall in years 1998 and 2008. These coefficients should be interpreted with caution because of the large standard errors. The marginal effect of the Internet on advertising expenditures is larger for both newspapers and magazines in 2008 than 1998 – the effect on total print is larger in the Huber-robust regression but slightly smaller in the OLS regression. For television the Internet effect on advertising expenditures is larger in 1998 than in 2008. For total media the marginal Internet effect is negative in 1998 but positive in 2008, although the number of observations in the regressions on total media is small.

Table S4A7
Marginal Impact Computed using Tables S4A5 and S4A6

		Total Print	Newspapers	Magazines	Radio	Television	Total Media
OLS	1998	-0.0053	-0.0027	0.0034	0.0001	-0.0046	-0.0118
	2008	-0.0043	-0.0037	-0.0176	0.0001	-0.0026	0.0032
Huber-robust	1998	-0.0009	-0.0015	-0.0006	-0.0034	-0.0033	-0.0078
	2008	-0.0069	-0.0045	-0.0076	0.0016	-0.0013	0.0012

Tables S4A8 and S4A9 include cable and satellite penetration as an additional covariate.[24] The reason we do not include this table in the text is that the sample size is substantially smaller because information on cable and satellite penetration is missing for many countries (in particular the information is coarse since year 2002). The information on cable and satellite penetration also contains numbers that are likely to be in error because they show unusual jumps. Cable and satellite penetration increased during the study period. Information is complete (for all

[24] I attempted to include a variable measuring the number of stations but could not find data that I considered reliable. Some complications are that the number of over-the-air stations varies across cities within countries, and that cable operators offer different number of channels at different rates (an individual in a location has a menu and can choose the number of channels).

years) for only 7 countries. For these countries, median cable and satellite penetration increased from 57.8% in 1998 to 65.9% in 2008. The results are substantially different than those presented in the text not only for the Internet variable, but also for other covariates. For example, the effect of GDP is not consistent across the regressions, although it is well known that advertising expenditures follow expansions and contractions in the GDP. For this reason I believe these regressions provide limited information. The expected impact of an increase in cable and satellite penetration on advertising expenditures on television is unclear. Cable and satellite provide viewers with greater viewing choices which might increase viewing somewhat, but on the other hand they fragment the audience among channels and cable channels obtain support from both advertising and subscription fees. According to the regressions cable and satellite penetration reduce advertising expenditures on television, although the coefficient is not statistically significant.

Table S4A8
OLS Random Trend Fixed Effect Regressions on Advertising Expenditures
Panel of Years 1998 through 2008

	I	II	III	IV	V	VI
	Total Print	Newspapers	Magazines	Radio	Television	Total Media
Internet Penetration	-0.0011	-0.0027	-0.0009	0.0012	-0.0037*	-0.0004
(in percentages)	(0.0017)	(0.0022)	(0.0017)	(0.0032)	(0.0020)	(0.0018)
Cell Phone Penetration	-0.0066***	-0.0078***	-0.0017	-0.0086***	-0.0056***	0.001
(in percentages)	(0.0018)	(0.0022)	(0.0014)	(0.0027)	(0.0016)	(0.0015)
Cable and Satellite Penetration	-0.0718	0.0488	-0.0109	0.1789	-0.0631	0.0497
(in percentages)	(0.1027)	(0.1487)	(0.1536)	(0.1945)	(0.1058)	(0.0862)
GDP per capita	0.7392	0.7973	0.0453	-0.7159	-0.6081	0.6130
(in logarithms)	(0.5032)	(0.7465)	(0.6781)	(0.9337)	(0.6464)	(0.6832)
Exchange Rate	-0.6933***	-1.0585***	-0.6667***	-0.4313	-1.1544***	-0.9975***
(in logarithms)	(0.1763)	(0.2797)	(0.2186)	(0.3575)	(0.2155)	(0.1893)
Price Index	0.0068	0.0010	0.0096	0.0080	0.0128**	-0.0051
(year 2000=100)	(0.0042)	(0.0048)	(0.0064)	(0.0093)	(0.0063)	(0.0071)
Population	-1.2997	-1.8147	-1.6216	-6.7894*	-1.3932	-6.4294**
(in logarithms)	(1.7549)	(2.1754)	(2.4369)	(3.9313)	(3.1136)	(3.0669)
Year Fixed-Effects	Yes	Yes	Yes	Yes	Yes	Yes
Country Fixed-Effects	Yes	Yes	Yes	Yes	Yes	Yes
Country-Specific Trends	Yes	Yes	Yes	Yes	Yes	Yes
Observations	348	342	330	351	361	165
R-squared	0.9967	0.9952	0.997	0.9846	0.9934	0.9956

Notes: The dependent variables are measured in logarithms.
Robust standard errors in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%

Table S4A9
Huber-Robust Random Trend Fixed Effect Regressions on Advertising Expenditures
Panel of Years 1998 through 2008

	I	II	III	IV	V	VI
	Total Print	Newspapers	Magazines	Radio	Television	Total Media
Internet Penetration	-0.0005	-0.0007	-0.0018*	0.0034***	-0.0010	-0.0019*
(in percentages)	(0.0009)	(0.0009)	(0.0010)	(0.0013)	(0.0012)	(0.0010)
Cell Phone Penetration	0.0007	0.0009*	-0.0003	0.0027***	0.0015**	0.0025***
(in percentages)	(0.0005)	(0.0005)	(0.0006)	(0.0007)	(0.0007)	(0.0007)
Cable and Satellite Penetration	0.0521	-0.2744***	0.1346**	-0.0115	-0.0253	0.1483***
(in percentages)	(0.0462)	(0.0548)	(0.0579)	(0.0638)	(0.0583)	(0.0354)
GDP per capita	0.1432	0.3371	0.6913***	0.1638	-0.2778	3.0049***
(in logarithms)	(0.1934)	(0.2073)	(0.2218)	(0.2656)	(0.2405)	(0.2431)
Exchange Rate	-1.0912***	-1.0660***	-0.8196***	-0.8502***	-1.1607***	-1.1991***
(in logarithms)	(0.0484)	(0.0435)	(0.0491)	(0.0649)	(0.0569)	(0.0541)
Price Index	0.0085***	0.0058***	0.0170***	0.0061***	0.0016	-0.0233***
(year 2000=100)	(0.0013)	(0.0012)	(0.0014)	(0.0016)	(0.0015)	(0.0031)
Population	-0.2525	-0.7522	-1.9558**	-1.4314	-5.0254***	-4.8036***
(in logarithms)	(0.8712)	(0.8449)	(0.8927)	(1.2074)	(1.0930)	(1.3411)
Year Fixed-Effects	Yes	Yes	Yes	Yes	Yes	Yes
Country Fixed-Effects	Yes	Yes	Yes	Yes	Yes	Yes
Country-Specific Trends	Yes	Yes	Yes	Yes	Yes	Yes
Observations	346	336	322	348	355	165
R-squared	0.9991	0.9993	0.9993	0.9983	0.9981	0.9995

Notes: The dependent variables are measured in logarithms.
Standard errors in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%

Tables S4A10 through S4A13 present regressions separating the countries based on their sizes. Table S4A10 (S4A12) presents OLS (Huber-robust) regressions using the countries with a total GDP level in 1998 greater than the median, and Table S4A11 (S4A13) presents OLS (Huber-robust) regressions using the countries with a total GDP level below the median. Separating the countries by sizes shows that in the OLS regressions the impact of the Internet on print media and television is larger for smaller countries (comparing Tables S4A10 and S4A11). The regression for total media in smaller countries uses only a few observations because for many of these countries information on Internet advertising expenditures is not available. The Huber-robust regressions also show a higher impact of the Internet on print media in smaller countries, but the difference between the effect of the Internet in small and large countries is smaller in the Huber-robust regressions on total print media and newspapers than in the OLS regressions

(comparing the differences between the estimates on print media and newspapers in Tables S4A12 and S4A13 and the differences between the estimates in Tables S4A10 and S4A11). The effect of the Internet on radio advertising expenditures is positive in the Huber-robust regression for small countries (Table S4A13).

Table S4A10
OLS Random Trend Fixed Effect Regressions on Advertising Expenditures
Panel of Years 1998 through 2008- Large Countries (GDP Greater than the Median GDP in 1998)

	I	II	III	IV	V	VI
	Total Print	Newspapers	Magazines	Radio	Television	Total Media
Internet Penetration	-0.0032***	-0.0007	-0.0032**	0.0008	-0.0018	-0.0028**
(in percentages)	(0.0012)	(0.0015)	(0.0015)	(0.0025)	(0.0015)	(0.0012)
Cell Phone Penetration	-0.0040***	-0.0042***	-0.0008	-0.0045**	-0.0029**	-0.0015
(in percentages)	(0.0014)	(0.0016)	(0.0011)	(0.0019)	(0.0012)	(0.0013)
GDP per capita	2.5063***	2.1727***	2.2153***	1.8565***	0.9719**	1.8613***
(in logarithms)	(0.3557)	(0.3925)	(0.3435)	(0.6293)	(0.3814)	(0.5644)
Exchange Rate	-0.8207***	-0.9575***	-1.0110***	-0.4595**	-1.0081***	-0.9206***
(in logarithms)	(0.0861)	(0.1143)	(0.0772)	(0.2119)	(0.1110)	(0.1120)
Price Index	0.0015	0.0009	-0.0006	-0.0089**	0.0042*	-0.0062
(year 2000=100)	(0.0013)	(0.0013)	(0.0018)	(0.0041)	(0.0023)	(0.0040)
Population	3.4681***	4.3849**	3.5505**	0.4317	1.6513	0.6812
(in logarithms)	(1.3112)	(1.7297)	(1.8024)	(3.3935)	(2.5321)	(2.1485)
Year Fixed-Effects	Yes	Yes	Yes	Yes	Yes	Yes
Country Fixed-Effects	Yes	Yes	Yes	Yes	Yes	Yes
Country-Specific Trends	Yes	Yes	Yes	Yes	Yes	Yes
Observations	449	424	414	444	459	241
R-squared	0.9954	0.9957	0.9972	0.9832	0.9914	0.9968

Notes: The dependent variables are measured in logarithms.
Robust standard errors in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%

Table S4A11
OLS Random Trend Fixed Effect Regressions on Advertising Expenditures
Panel of Years 1998 through 2008- Small Countries (GDP Lower than the Median GDP in 1998)

	I	II	III	IV	V	VI
	Total Print	Newspapers	Magazines	Radio	Television	Total Media
Internet Penetration	-0.0069**	-0.0058*	-0.0089*	0.0024	-0.0097**	-0.0003
(in percentages)	(0.0031)	(0.0033)	(0.0049)	(0.0067)	(0.0044)	(0.0026)
Cell Phone Penetration	0.0011	0.0014	-0.0017	0.0009	-0.0012	0.0017*
(in percentages)	(0.0011)	(0.0014)	(0.0017)	(0.0023)	(0.0014)	(0.0009)
GDP per capita	0.7910**	1.0396**	0.7445	0.0619	1.3506**	0.9521**
(in logarithms)	(0.3746)	(0.4823)	(0.9541)	(0.8293)	(0.6182)	(0.4321)
Exchange Rate	-0.4262**	-0.4325**	-0.6123*	-0.0567	-0.4349	-1.2343***
(in logarithms)	(0.2004)	(0.1941)	(0.3675)	(0.4584)	(0.2648)	(0.2254)
Price Index	0.0043*	0.0060**	0.0151***	0.0039	0.0049	0.0076**
(year 2000=100)	(0.0024)	(0.0030)	(0.0048)	(0.0041)	(0.0042)	(0.0029)
Population	-1.3042**	-1.1477	-1.9622	0.7723	3.9552**	-1.5407
(in logarithms)	(0.6497)	(0.7319)	(1.3217)	(1.9257)	(1.8970)	(4.1989)
Year Fixed-Effects	Yes	Yes	Yes	Yes	Yes	Yes
Country Fixed-Effects	Yes	Yes	Yes	Yes	Yes	Yes
Country-Specific Trends	Yes	Yes	Yes	Yes	Yes	Yes
Observations	344	350	317	320	390	69
R-squared	0.9929	0.9933	0.9857	0.9721	0.9838	0.9991

Notes: The dependent variables are measured in logarithms.
Standard errors in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%

Table S4A12
Huber-Robust Random Trend Fixed Effect Regressions on Advertising Expenditures
Panel of Years 1998 through 2008- Large Countries (GDP Greater than the Median GDP in 1998)

	I	II	III	IV	V	VI
	Total Print	Newspapers	Magazines	Radio	Television	Total Media
Internet Penetration	-0.0028***	-0.0019*	-0.0020**	-0.0011	-0.0001	-0.0020***
(in percentages)	(0.0008)	(0.0010)	(0.0009)	(0.0011)	(0.0008)	(0.0007)
Cell Phone Penetration	0.0001	-0.0027***	0.0019***	-0.0023***	-0.0001	0.0011**
(in percentages)	(0.0005)	(0.0006)	(0.0006)	(0.0007)	(0.0005)	(0.0005)
GDP per capita	2.2470***	2.6224***	1.2846***	1.2849***	0.3538**	2.3078***
(in logarithms)	(0.1433)	(0.1821)	(0.1719)	(0.2038)	(0.1432)	(0.2255)
Exchange Rate	-1.0266***	-0.9734***	-1.0024***	-0.9113***	-0.9238***	-1.1611***
(in logarithms)	(0.0371)	(0.0428)	(0.0430)	(0.0507)	(0.0348)	(0.0408)
Price Index	0.0004	0.0007	-0.0006	-0.0042***	0.0059***	-0.0049***
(year 2000=100)	(0.0007)	(0.0010)	(0.0009)	(0.0011)	(0.0008)	(0.0017)
Population	8.6974***	8.2776***	-1.1464	6.8915***	0.5879	1.7027*
(in logarithms)	(0.7663)	(0.9820)	(0.9100)	(1.0836)	(0.7790)	(1.0150)
Year Fixed-Effects	Yes	Yes	Yes	Yes	Yes	Yes
Country Fixed-Effects	Yes	Yes	Yes	Yes	Yes	Yes
Country-Specific Trends	Yes	Yes	Yes	Yes	Yes	Yes
Observations	449	424	414	444	459	240
R-squared	0.9987	0.9982	0.9988	0.9978	0.9981	0.9995

Notes: The dependent variables are measured in logarithms.
Robust standard errors in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%

Table S4A13
Huber-Robust Random Trend Fixed Effect Regressions on Advertising Expenditures
Panel of Years 1998 through 2008- Small Countries (GDP Lower than the Median GDP in 1998)

	I	II	III	IV	V	VI
	Total Print	Newspapers	Magazines	Radio	Television	Total Media
Internet Penetration	-0.0033*	-0.0038	-0.0093***	0.0063***	-0.0018	0.0002
(in percentages)	(0.0018)	(0.0026)	(0.0034)	(0.0022)	(0.0026)	(0.0002)
Cell Phone Penetration	0.0003	0.0028***	-0.0001	0.0036***	-0.0001	0.0021***
(in percentages)	(0.0006)	(0.0009)	(0.0012)	(0.0008)	(0.0009)	(0.0001)
GDP per capita	0.7638***	1.3091***	0.5944	-0.6631**	0.7401***	0.9273***
(in logarithms)	(0.2035)	(0.2997)	(0.4026)	(0.2976)	(0.2836)	(0.0301)
Exchange Rate	-1.2434***	-0.9938***	-0.5146***	-1.0321***	-1.1480***	-1.2386***
(in logarithms)	(0.0732)	(0.0975)	(0.1311)	(0.1042)	(0.1030)	(0.0188)
Price Index	0.0062***	0.0075***	0.0035	0.0023	0.0068***	0.0047***
(year 2000=100)	(0.0012)	(0.0020)	(0.0027)	(0.0016)	(0.0017)	(0.0002)
Population	-0.2017	-0.7421	-0.4706	3.0695***	0.4644	-1.9776***
(in logarithms)	(0.4063)	(0.6382)	(0.8194)	(0.6020)	(0.5871)	(0.3614)
Year Fixed-Effects	Yes	Yes	Yes	Yes	Yes	Yes
Country Fixed-Effects	Yes	Yes	Yes	Yes	Yes	Yes
Country-Specific Trends	Yes	Yes	Yes	Yes	Yes	Yes
Observations	342	349	317	318	390	66
R-squared	0.9981	0.9974	0.9969	0.9969	0.9960	0.9999

Notes: The dependent variables are measured in logarithms.
Standard errors in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%