

The Price of Silence: Media Competition, Capture, and Electoral Accountability

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Abstract

Is competition in the mass media market an effective deterrent against media capture? Does it prevent political groups from influencing reporting? This paper shows that in many cases it does not. Building on the literature on media capture, the model highlights that, under fairly generic assumptions, high competition in the media market can drive the cost of media capture to zero, making capture easier. Moreover, it highlights conditions on the parameters where the effect of competition on capture is non-monotonic, i.e. capture occurs when competition is either too little or too much. The model is motivated by empirical analysis of the staggered digitalization of terrestrial television in Europe: higher digitalization (and hence higher competition) reduces the freedom of the media from political influence in countries with a high level of pre-treatment competition.

Keywords: Political Agency, Mass Media, Competition, Media Capture.

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1 Introduction

A free media has been seen as a powerful guarantor of political accountability, both theoretically (e.g. Besley 2006) and empirically (e.g. Ferraz and Finan 2008). However, the media may be powerful enough to determine an electoral outcome and to promote a bad candidate, even when voters are fully rational and “Bayesian” (Prat 2014, Anderson and McLaren 2012). As a consequence, an incumbent politician may be interested in controlling what media outlets report, to present a positive image to voters and to stay in power. This paper looks at the effect of competition in influencing the incentives towards media capture, with novel results.

The current literature stresses the positive effect of competition on media freedom: increasing the number of outlets means that the bad politician has more publishers to deal with, so capture is more costly. However, there is a more subtle effect, because the competitive pressure decreases profits, and firms with smaller financial margins may be more willing to sacrifice editorial independence for political money. Hence, they are cheaper to capture.

Overall, the direction of this trade off is not trivial: the “positive” view of the role of competition in deterring capture can be questioned if more competition means smaller (and financially weaker) media outlets, less able to inform the public opinion and to resist to political pressure. Media outlets may be more numerous, but are they freer? Under some conditions, more competition can actually harm the media’s independence from political influence, as the empirical section of this paper suggests. This highlights the need for a deeper understanding of the forces behind this trade off.

This paper makes two contributions: on the empirical side, it is the first¹ to analyse the effect of competition on media freedom in an identified way, showing novel results. On the theoretical side, the model provides an explanation for the counter-intuitive empirical results, showing that potential risks to media independence from the political power are high not only when competition is too little, but also when it is too much. Moreover, the model highlights that the standard “positive” result of competition and capture relies on restrictive assumptions about voters’ behaviour and media outlets’ profits. From a policy perspective, both the empirics and the theory stress the risk, in terms of editorial independence, of excessive competition in the media sector.

More specifically, the theoretical model is a natural extension of the seminal contribution by Besley and Prat (2006). It shows that, relaxing some of the assumptions in a fairly natural way²,

¹To the best of the author’s knowledge.

²In this paper, voters are allowed to be heterogeneous in their interest for politically related news and profits are convex in readership. Note that I refer to readers as consumers of media contents for simplicity. However, the paper is agnostic with respect to the type of media firm (newspapers, televisions, websites etc).

high competition is actually bad for media freedom, as the cost of media capture is driven to zero as the number of outlets goes to infinity. Moreover, the relationship can be non-monotonic, overall, meaning that media capture occurs when competition is either very weak or very strong. Intuitively, increasing the number of media outlets can make capture overall more expensive for the politician, as long as the number of outlets that need to be silenced increases in the same way, and the politician pays monopoly profits to every captured outlet. But competition has a decreasing effect on the influence that each individual outlet has on voters: basically, with more competition every outlet is able to inform a smaller fraction of the electorate. In fact, even established media outlets have limits in their ability to inform voters, as the recent spreading of fake news highlights. Hence, when there are enough outlets, the politician may be willing to allow for some free media outlets, since they will not be powerful enough to change electoral outcomes. This decreases the profits that captured outlet would make by rejecting the bribe from the politician, hence they are cheaper. The overall effect of this trade off induced by competition (more outlets to be silenced, but each of the is cheaper) depends on the relationship between readership and profits. When it is convex (e.g. because the media market is modelled as a two sided one) then high competition makes capture cheaper, overall.

This result may sound surprising and somewhat counter-intuitive. But does it also make sense in the real world? Of course, it is very hard to measure media capture empirically, since “influence” is difficult to observe (and it can be generated in many different ways: from bribing to buying advertising space). The empirical section of this paper suggests that high competition in the mass media market reduces media freedom from political influence. The identification strategy exploits the staggered digitalization of terrestrial television in Europe: a technological change that allowed for a more efficient use of the spectrum and, hence, for the entry of new players in the market. In an event study analysis, this paper shows that higher digitalization (and hence higher competition) reduces the freedom of the media from political influence precisely in countries with high level of pre-treatment competition, suggesting that media capture is easier in those places.

Also, importantly, it is possible to find anecdotal confirmation for the two steps leading to this result: firstly, competition has a negative effect on outlets’ profitability. Secondly, financially weak outlets may be more willing to accept political influence³. For the first step, Cagé (2014)

³Additional anecdotal evidence comes from Drago et al. (2014). They find that the entry of newspapers increases the re-election probability of the incumbent: this is at odds with Besley and Prat (2006), but it is consistent with the results of this paper. Moreover, they find that “competition matters”, meaning that the effect of entry does not disappear as more newspapers participate in the market, and in this model I will try to go into more depth than the standard monopoly *versus* duopoly approach.

has precise estimations about the effects of an exogenous increase in media competition on profitability, noticing that “entry reduces the circulation of incumbent newspapers by nearly 25%”, and this implies a 20 to 36 per cent reduction in revenues, 14 to 29 per cent reduction in size and a 9 to 13 per cent reduction in the share of hard news. Moving to the second step, many different sources show that the media is more easily influenced when revenues are low. The 2015 edition of the Media Sustainability Index (IREX 2015), for example, stresses that “[o]verall the issue seems to be that media have been weakened by a poor economy and been preyed upon by political money, or political pressure has weakened the economic environment in which media operate, thus *making it easier for political money to distort the market and put independent media at a strong disadvantage*”⁴. One example is Bulgaria, where “most traditional media operate at a financial loss, which leads to compromises with editorial independence. With few exceptions, the big advertisers enjoy complete media support. As public institutions remain the biggest advertisers, any government regardless of its political affiliation receives media support”⁵. Others are Albania⁶, FYR of Macedonia⁷ and Turkey⁸.

In the theoretical model, voters act as principal while the incumbent (of good or bad type) is the agent. Media outlets may receive a common, verifiable signal about the type of the incumbent, and may be bribed by the bad politician not to reveal it. Hence, outlets face a trade off between publishing the signal and enjoying the audience-related rents and accepting the politician’s bribe instead. In contrast to the basic version of Besley and Prat (2006), in this paper not all the voters are interested in politically related news, hence not all of them will become aware of the incumbent’s type if only a small fraction of the outlets is publishing the signal. Moreover, audience-related revenues are not constrained to be linear in readership. This allows me to check the robustness of the results to different specifications of the profit function, noticing that a profit function convex in readership can emerge from a media market modelled

⁴IREX (2015), pag. ix, italics added.

⁵IREX (2015), pag. xi, italics added.

⁶The website worldaudit.org points out the risk of political influence on financially weak media in Albania: “many independent media outlets are hampered by a lack of revenue. Publishers and media owners tend to dictate editorial policy based on political and economic affiliations, which, together with the employment insecurity journalists face, nurtures a culture of self-censorship”.

⁷According to fairpress.eu (Iloska 2014), the country is characterized by a “*large number of broadcast and print outlets* in comparison with its population size”. Despite this, “Macedonian media are subject to *severe interference and political pressure*. [...] In the last few years the Government was regularly criticized for its liberal use of promotional advertising, leading to increased financial dependence of media and increasing the number of outlets that favour its position”.

⁸The Turkish newspaper “Today’s Zaman” (Zibak 2015) recently claimed that “the diversity and abundance of media outlets in Turkey do not necessarily guarantee the presence of a free, independent and pluralistic media”. This highlights two things: on the one hand, the existence of free media even in a country with potentially serious problems of media capture; on the other hand, the fact that a very competitive market is not enough to avoid these problems.

as a two-sided one, where outlets are selling content to the readers and advertising space to a monopolist advertiser, who seeks to place advertisements where the readers are.

In this setting, increasing the number of outlets increases the number of players that the incumbent politician may want to silence (as in Besley and Prat 2006), but it may also *reduce* the cost of capture by reducing the “business-as-usual” profits for captured outlets⁹, which would have to compete with more subjects and hence attract lower audience-related rents. As a consequence, they are more willing to sacrifice their independence in exchange for money. When the profit function is convex in the readership, as the number of outlets goes to infinity, media competition makes capture easier.

This result follows from the combined effect of the two modifications highlighted before. First of all, when the politician does not need to capture the whole industry, the bribe he has to pay to each captured outlet is no longer the monopoly profits, but it is reduced by the competition effect. As the number of outlets increases, the readership gains from publishing the signal are divided with more and more free outlets, hence the individual bribe to be paid becomes smaller. However, at the same time, there are more outlets to be silenced. The total cost of capture is simply the product between the number of outlets to be silenced and the individual bribe and, when the profit function is convex in the readership, the “reduction in bribe” effect prevails on the “increasing in number” one, reducing the total cost of capture as the number of outlets goes to infinity. Note that both modifications are necessary¹⁰.

On top of this, the model shows conditions on the parameters where the relationship is non-monotonic, i.e. capture happens when competition is either too little or too much. Essentially, this happens when an increase in competition, keeping constant the number of free outlets, increases the total cost of capture (because the politician has to silence more of them). But, at some point, more competition implies that the politician can allow some outlets to be free. Hence, the reduction in the “business-as-usual” profits kicks in and, as competition goes to infinity, the total cost of capture goes to zero. Finally, since the voters’ welfare ex ante is strictly decreasing in the ex-ante probability of successful media capture, the effect of competition on welfare can be negative as well.

The remainder of this paper is as follows. Section 2 briefly reviews the related literature. Section 3 presents an empirical analysis of the digitalization of terrestrial television in Europe which, by showing a negative effect of competition on media freedom, motivates the theoretical

⁹I.e. the profits that each captured outlet would make by rejecting the bribe and publishing the signal.

¹⁰The online appendix of Besley and Prat (2006) considers an extension where the politician does not need to capture the whole industry, pointing out that this does not change the result. This happens precisely because the linearity assumption on the profit function is maintained.

part of the paper. Section 4 describes the setting of the model and comments on the main assumption, while I derive the equilibrium and its consequences on welfare in section 5. Section 6 provides a two-sided market based microfoundation for the profit function used in the basic model and 7 concludes.

2 Related literature

This paper contributes to different branches of the economic literature, from the political economy of mass media, to the economic regulation of the media market. There is particular attention on media capture and on the effects that media competition has on political outcomes via media capture.

The relationship between media and politics has been widely studied in the political economy literature, and detailed and comprehensive reviews are provided by Prat and Strömberg (2013), Strömberg (2015), Gentzkow et al. (2016) and Puglisi and Snyder (2016).

Media capture can be seen as a particular way of endogenizing supply-driven media bias¹¹, with the important difference that, in media capture models, the political preferences of media outlets are endogenous, and hence determined and constrained by the parameters of the game. Generally speaking, competition is seen as sometimes problematic in models of demand-driven bias, while the current literature considers it a good deterrent in the case of supply-driven bias. Prat (2016) offers a good summary of the literature on media capture. The seminal paper is Besley and Prat (2006): the basic framework of their model is the starting point for the model in this paper. Given the necessity of capturing the whole industry, in equilibrium the politician will either silence every outlet or none of them, and has to pay monopoly profits to each of them. As a consequence, the cost of media capture (and hence politicians' turnover and voters' welfare) monotonically increases in the number of outlets.

Petrova (2008) and Corneo (2006) look at media capture too, in cases where the capturing entities are interest groups or particular factions of society. Drufuca (2014) extends Besley and Prat (2006), endogenizing voters informational choices, but she does not focus on the effects of competition and the market structure. Vaidya and Gupta (2016) study the effect of media competition on corruption via media capture, finding a mixed result: when the probability that bad news about the incumbent can be discredited is sufficiently high, then it may be cheaper to capture a duopoly than a monopoly, while the opposite is true when the probability is low.

¹¹The vast political economy literature on media acknowledges the existence of a demand driven media bias as well. See, for example, Strömberg (2004), Mullainathan and Shleifer (2005), Gentzkow and Shapiro (2006), Bernhardt et al. (2008), Chan and Stone (2013), Andina-Diaz and Garcia-Martinez (2016). Models of supply driven media bias (but without an explicit model of media capture) are for example Baron (2006), Anderson and McLaren (2012), Duggan and Martinelli (2011) and Prat (2014), Hafer et al. (2017), Levy et al. (2017).

However, this result is obtained in a setting where signals are not perfect and voters are not fully rational, meaning that they ignore the possibility of interactions between the politician and media outlets. Gehlbach and Sonin (2014) look at the link between media bias and a continuous outcome that the government is interested in - political “mobilization”¹² - while Kibris and Kocak (2017) look at how the presence of social media can make capture more or less effective.

It is difficult to find empirical evidence for media capture, since it is neither visible nor precisely defined. A very recent review of empirical research on media capture is in Enikolopov and Petrova (2016). Their overall finding is that competition helps in reducing media capture, even if the method for testing the presence of media capture is generally indirect¹³.

Probably the most direct insights on how media capture works come from McMillan and Zoido’s (2004) study on Fujimori’s media control mechanism in Perù, showing the huge costs he had to pay to silence media channels (with respect to members of congress or judges), and from Szeidl and Szucs (2017), pointing out that media capture, in Hungary, occurs through advertisement misallocation. Di Tella and Franceschelli (2011) find a negative correlation between advertisements bought by the government and the space dedicated to scandals in Argentinian newspapers, while Hamilton (2004) relates the emergence of independent (rather than politically affiliated) newspapers to the increasingly important advertising market. Petrova (2011) has a similar result. Finally, Petrova (2008) finds empirical support for the theory that media freedom is decreasing in income inequality in democracies.

This paper is distinguished from standard models of media capture because it looks more closely at the media market. In particular, this model is related to those stressing the importance of the “two-sidedness” of the market of media (Argentesi and Ivaldi 2005)¹⁴ and of the role of the advertising market, highlighted for example in Germano and Meier (2013) and Blasco et al. (2015).

Finally, this paper adds to the literature on media market regulation. Since there is no general agreement about what a “healthy” broadcasting sector is (Seabright and von Hagen

¹²The modelling strategy of this paper shares with Gehlbach and Sonin (2014) the importance given to a precise structure for the advertising market, related to readership. It takes it further by modelling it in a precise two-sided setting. However, the political setting is quite different (and closer to Besley and Prat 2006) since it does not assume a particular “bad” nature of the government, and citizens are interested in being governed by a “good” type.

¹³For example, Galvis et al. 2016 looks at the effect of competition on media bias in US late 19th century newspapers. This can be due to political capture, but it is more generic than that.

¹⁴Ellman and Germano (2009), for example, use a two-sided market model in order to see the effect of the advertising industry on media bias, while Godes et al. (2009) and Dukes (2006) use a two-sided model to study how media competition affects pricing strategies and content quality choices respectively. This paper “incorporates” their approach (media outlets selling copies to the readers, i.e. competing on prices, and advertising space to the advertisers, i.e. competing on quantity) in a standard media capture political agency framework.

2007), this paper highlights that the role of competition, in the context of media capture, may be more complex than the standard answer given by the political economy literature¹⁵.

Outside the formal economic modelling, Hollifield (2006) highlights the possibility of a reverse-U shaped relationship between competition and journalistic performance, listing many different channels that may contribute to it. In contrast to that paper, this work focuses solely on media capture, deriving the non-monotonic relationship as a result of a formal, game theoretical model and looking directly at the effects of political and commercial forces.

3 Empirical evidence

The empirical identification of a causal effect of competition on media capture is problematic. Firstly, media capture is rarely explicitly observed and recorded. Secondly, the effect of competition in the media market on political outcomes is normally identified using local variations in the number of media outlets (e.g. Drago et al. 2014, Cagé 2014, Galvis et al. 2016), but media capture (or its proxy: media freedom from political influence) is measured at the national level. Hence, instead of using local variations, this paper exploits the staggered implementation, at a country level, of the digitalization of terrestrial television, i.e. a policy that was expected to increase the level of competition in the TV market.

In the estimation, the causal effect of digitalization on media freedom is negative, and anecdotal evidence highlights the positive relationship between digitalization and competition. Moreover, splitting the sample between countries with above- and below-average levels of pre-treatment competition in the TV market¹⁶ shows that this effect comes precisely from those countries with a *high* level of competition, while it is not statistically different from zero in low pre-treatment competition countries. In other words, too much competition seems to reduce the freedom of the media from political influence, making capture easier.

¹⁵In particular, Polo (2005) studies whether market incentives are powerful enough to guarantee internal and external pluralism in the media market, finding that the differentiation triggered by the market does not necessarily extend to political views, and that internal pluralism is limited by the personal interests of the media owner, while Torrens (2014) looks into the optimal media market structure from a normative perspective, taking into account the possibility of media capture and finding the same results as in Besley and Prat (2006). The basic welfare trade-off is given by the fact that, in his model, more media outlets imply a lower probability of capture but also higher fixed costs to be supported without an increase in the amount of information available. It is interesting to note, however, that Torrens' (2014) main effect of the number of outlets on the possibility of capture is analogous to Besley and Prat (2006) *precisely because* he shares the same assumption about the fact that a single media outlet publishing the news is enough to inform the whole electorate.

¹⁶Competition is measured as the Herfindahl index calculated using the annual average daily audience market share of the top eight TV channels.

3.1 Background

Terrestrial television is one of three main modes for transmitting television signals (the other two are satellite and cable). It is the oldest technology and it is based on radio waves. Until the end of the 20th century, terrestrial television was based on analogue transmission that allowed for a limited number of frequencies and hence, a limited number of TV channels. Technological innovation made possible the digitalization of terrestrial television, allowing for a more efficient use of the spectrum¹⁷ and, as a consequence, an increase in the number of TV channels that can be transmitted.

Over the first decade of the 21st century, some countries started to replace analogue terrestrial signals with digital ones. In order to harmonize the process within the Continent, the European Commission¹⁸ (EC) set 2012 as the deadline for the full replacement of analogue terrestrial signals with digital terrestrial signals. This process was supposed to reduce transmission costs, free up frequencies and give consumers a wider choice of TV channels.

The positive relationship between terrestrial digitalization and competition in the mass media market has been mentioned by multiple sources. For example, Barone et al. (2015) notice that Italy had 78 new free to air channels after the transition, “51 of which have no ties with Berlusconi or the public network”¹⁹, implying that new players are entering in the market. The aforementioned EC communication mentions the increased number of alternatives for consumers, while Kenny et al. (2014) stress the “key role” of digital terrestrial television in securing competition between platforms and content providers.

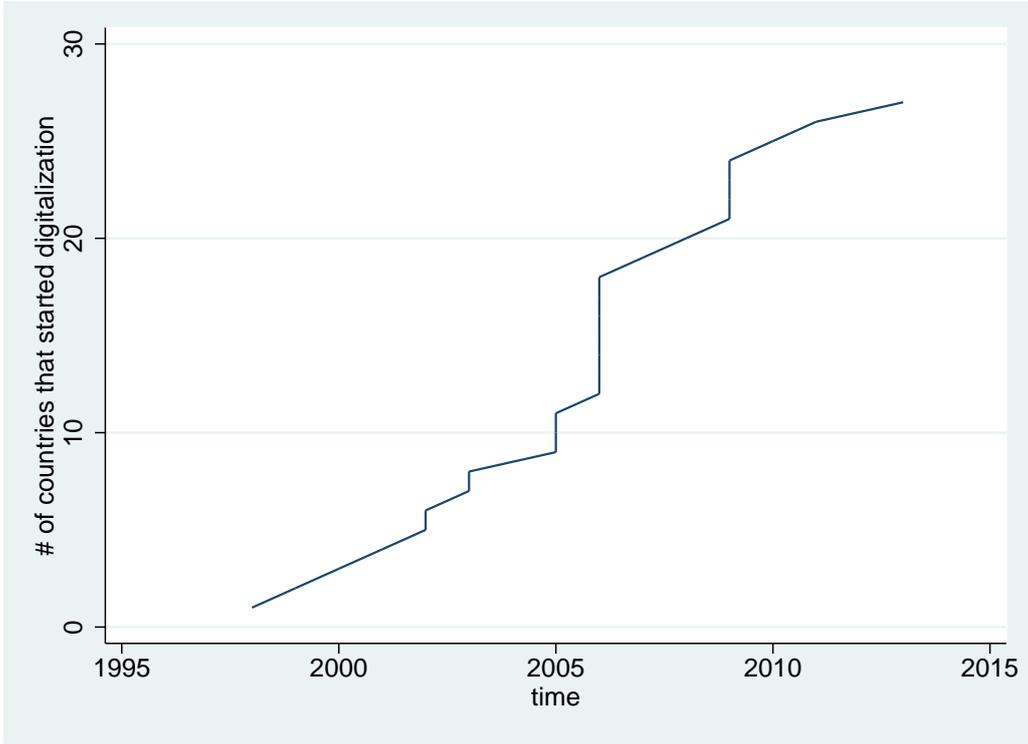
For identification purposes, the empirical strategy will exploit the implementation of this European decision to find the causal effect of digitalization of terrestrial television on media freedom from political influence. The fact that digitalization happened in a staggered way between countries is important, with some countries starting the process earlier than others. Figure 1 gives an idea of the staggered process, plotting the cumulative number of countries that started digitalization as a function of time. Overall, the analysis is a reduced form one, looking at the direct effect of digitalization on media freedom in an event study set up.

¹⁷Technically, multiplexes are able to “squeeze” multiple signals in a smaller space, freeing frequencies for other signals and other multiplexes.

¹⁸COM(2005) 204.

¹⁹Barone et al. (2015), pag. 33.

Figure 1: Cumulative number of countries that started the digitalization process over time



3.2 Empirical strategy

The switch over process took place in a staggered way between and within EU countries²⁰, with some regions switching off the analogue terrestrial signal earlier than others.

Hence, thanks to the EU Commission deadline, every EU country is treated, while the staggered implementation allows me to exploit a quasi-experimental set up with an event study approach, where the treatment intensity (i.e. the portion of terrestrial television that has already been digitalized) varies over time.

The treatment variable is the penetration of digital terrestrial television, i.e. the number of households receiving TV signals primarily through digital terrestrial over the total number of households in a country (formally, $\frac{DTT_{i,t}}{Hous_{i,t}}$).

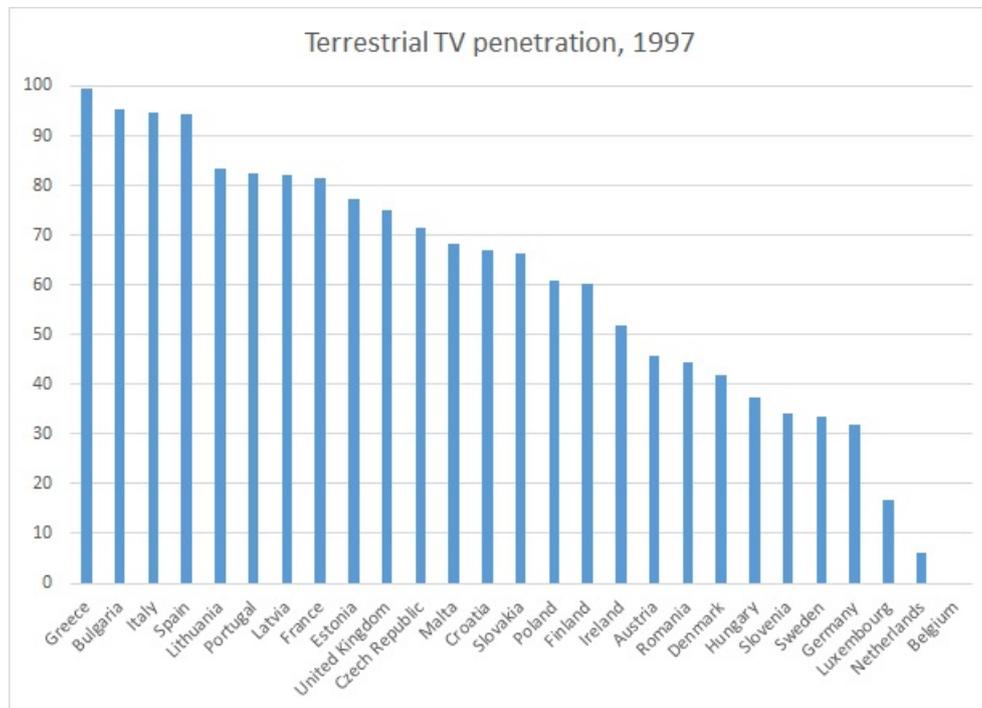
Note, however, that this treatment is basically the composition of two different effects. First of all, the staggered implementation within countries implies that the replacement ratio, i.e. the fraction of terrestrial television households already receiving digital terrestrial television (DTT), is different at different points in time, and moving between 0 (before the launch of digital terrestrial television) and 1 (when all analogue terrestrial signals are switched off). Define the implementation part of the treatment as $I_{i,t} = \frac{DTT_{i,t}}{TerrTV_{i,t}}$, where $DTT_{i,t}$ and $TerrTV_{i,t}$ are the number of households receiving digital terrestrial television and the number of households

²⁰On average, there are more than 5 years between the launch of the first digital terrestrial signal in a country and the cessation of analogue terrestrial signals, i.e. the end of the replacement process.

receiving terrestrial television²¹ in country i at time t respectively.

Secondly, the fraction of the population affected by the reform is different in different EU countries. The reform only affects the digital terrestrial television, so its impact depends on the number of households using primarily terrestrial television, rather than cable or satellite TV. This number is heterogeneous amongst EU countries: some are traditionally “cable” countries (e.g. Belgium, Denmark, the Netherlands), while others are traditionally “terrestrial” countries (e.g. Greece, Italy, Spain). Figure 2 shows the penetration of terrestrial television in Europe in 1997.

Figure 2: Terrestrial television penetration, in per cent of households with a television, in 1997. The remainder is cable and satellite.



Moreover, the fraction of households receiving primarily terrestrial television (rather than cable or satellite) changes over time. Formally, the population affected by the reform is defined as $PA_{i,t} = \frac{TerrTV_{i,t}}{Hous_{i,t}}$.

Therefore, the treatment variable can be decomposed as the product of those two effects as

²¹I.e. the total number of households minus those receiving TV signals *via* cable, satellite and those not having a television.

follows:

$$\begin{aligned}\frac{DTT_{i,t}}{Hous_{i,t}} &= \frac{\frac{DTT_{i,t}}{Hous_{i,t}}}{\frac{TerrTV_{i,t}}{Hous_{i,t}}} * \frac{TerrTV_{i,t}}{Hous_{i,t}} \\ &= I_{i,t} * PA_{i,t}\end{aligned}$$

Given the precision of the data it is not possible to disentangle the two parts of the treatment²². However, the results are robust to different ways of measuring the treatment (dummy times pre-treatment population affected, as in Card 1992, and dummy times pre treatment population affected using only observations where the digitalization is either 0 or 100 per cent), as discussed in Appendix A. The main specification used is

$$mf_{i,t} = \lambda_i + \mu_t + \beta_1 DTTpenetration_{i,t} + \gamma' \mathbf{X}_{i,t} + \epsilon_{i,t} \quad (1)$$

where $mf_{i,t}$ is the Freedom House media freedom from political influence score, $DTTpenetration_{i,t}$ is defined above²³ and λ_i and μ_t are country and time fixed effects, $\mathbf{X}_{i,t}$ is a vector of time-varying control variables (log of GDP per capita, corruption perception index and low/unique chamber electoral years) and $\epsilon_{i,t}$ is the error term.

In practice, I am comparing the level of media freedom from political influence at different stages of the implementation process, and weighting this effect by the fraction of population affected by the reform. In this set up β_1 , under the assumption of parallel pre-trends and no other policies changing at the same time, measures the causal effect of the digitalization of terrestrial television on media freedom.

The main threat to this identification strategy is from the endogeneity of the digitalization decision at a country level. In other words, every EU country had to complete the switch over process, but the timing was decided by national governments. Ways to address this concern are discussed in section 3.5.

²²In particular, the EAO yearbooks contain a measure of digital terrestrial penetration, but not of terrestrial penetration. This can be obtained as a residual once the number of households receiving primarily cable and satellite is subtracted from the total number of households with a television, but this variable is extremely noisy, with some peculiar results (e.g. a supposedly negative number of terrestrial television households). This is probably due to different measurement methods for cable and satellite penetration. An exception is the terrestrial penetration in 1997, provided directly by the 1998 Statistical Yearbook.

²³Given the fact that there are some discrepancies in the data, I use two different measures of DTT penetration. One is calculated manually by dividing the number of households using primarily terrestrial television by the total number of households, both coded using observations from the most recent yearbook available. The other is directly provided in each yearbook and I use, for every year, the observation coming from the next yearbook (i.e. the closest one). In this paper, I report the results using the former, but almost nothing changes if I use the latter.

3.3 Data

The newly assembled dataset of 28 EU countries combines data from two main sources: Freedom House and the European Audiovisual Observatory. Media freedom from political influence is measured using the score of the political environment from the “Freedom of the Press” index produced every year by the American NGO Freedom House. The score goes from 1 to 40²⁴ and evaluates the level of media freedom from political influence in every country, leaving aside economic and legal constraints on what the media is able to report on²⁵.

All the variables about television signal penetration and the European audiovisual market (number of households, number of households receiving primarily digital terrestrial television, percentage of DTT penetration, terrestrial, cable and satellite penetration in 1997, country by country DTT launch year and year of completed switch off of analogue signal, daily audience market share of the biggest 8 TV channels, total expenditure on TV advertising) come from the European Audiovisual Observatory yearbooks (1998 edition to 2015 edition). The level of competition in the television market is measured using the Herfindahl Index, using the daily audience market share of the biggest eight channels per country per year.

In addition I collected data for GDP per capita (from the UNESCO Institute for Statistics), corruption (using the corruption perception index from Transparency International) and a dummy equal to 1 for electoral years in the lower/unique legislative chambers (from the International Foundation for Electoral System). Table 1 summarizes these variables.

²⁴The original score measures the level of influence, hence 0 is a country whose media sector is completely free from political influence and 40 is a country with the highest possible level of influence. However, to give a more intuitive interpretation to the outcome variable as a measure of media freedom, I use 41-original score.

²⁵These are captured by the other two environments.

Variable	Obs.	Mean	St. Dev.	Min	Max
Media freedom	392	32.844	3.788	20	40
# of households	392	7339.625	9859.954	118	40129
DTT penetration (%)	379	12.414	17.608	0	77.83
Households with DTT	379	1206.19	3073.866	0	17690
GDP per capita	391	29522.6	13775.04	6507.8	97661.94
Corruption	387	6.293	1.863	2.6	9.9
Election year	392	0.263	0.441	0	1
Herfindahl audience	354	1345.314	560.616	397	3674.93
TV adverts	373	1067.308	1544.048	7	6201

Table 1: Media freedom is 41 minus the Freedom of the Press score for the Environment B; # of households is the number of households, DTT penetration (%) is the penetration of terrestrial digital calculated using the most recent observation available, Households with DTT is the raw number of households receiving DTT calculated using the most recent observation. GDP per capita is in PPP at current international dollars. Corruption is the Corruption Perception Index, Election year is 1 if elections have been hold for the lower or for the unique chamber of the Parliament (whichever applies). Herfindahl audience uses the daily audience share of the 8 biggest TV channels; TV adverts is the expenditure for TV advertising (mill. of Euro).

3.4 Results

The results of regression (1) are summarized in Table 2²⁶. I first estimate the pure difference-in-difference regression, without any control. Columns (2)-(4) show that the treatment effect is not affected by the inclusion of different controls²⁷. Wild bootstrapped standard errors are added to take into account the low number of clusters, and results with group specific time trends are presented in Appendix A.

²⁶Reported results are estimated with a standard OLS regression, hence treating the discrete outcome variable as a continuous one, given that it takes 40 values. This is consistent with the literature (e.g. Petrova 2008).

²⁷I do not control for our measure of competition and for our measure of advertisement expenditures because they are potential outcomes of the treatment.

Dep. variable: media freedom	(1)	(2)	(3)	(4)
DTT penetration	-0.027	-0.026	-0.025	-0.025
	(0.013)*	(0.011)**	(0.011)**	(0.011)**
	[0.014]*	[0.012]**	[0.012]**	[0.012]**
ln(GDP p.c.)		0.244	0.880	0.932
		(2.156)	(2.606)	(2.532)
Corruption			-0.242	-0.253
			(0.300)	(0.305)
Elections				-0.147
				(0.121)
Time FE	Y	Y	Y	Y
Country FE	Y	Y	Y	Y
N	379	377	373	373
R^2	0.483	0.457	0.466	0.467

Table 2: Dependent variable: media freedom score. DTT penetration uses the most recent observation. Column 1 is the pure DID set up without controls. Columns 2-4 add one control each. Country level clustered standard errors are in parentheses. Wild bootstrap s.e. in squared parentheses, in order to take into account for the small number of clusters. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Interestingly, a policy change that increases media competition is associated with a *decrease* in media freedom from political influence. Moreover, this result is only marginally affected by the introduction of different control variables. In terms of magnitude, a one standard deviation increase in digital terrestrial penetration is associated with a decrease in media freedom from political influence of 0.12 standard deviations.

This result is already at odds with the existing theoretical literature on media capture and competition. To better understand what is driving it, I split the sample between countries whose Herfindahl Index, calculated using 1999 data, is above and below the 1999 average. This is to see whether the treatment effect is different in countries whose TV sector was already highly competitive before the digitalization and countries where competition was lower.

The results, reported in table 3, show an interesting pattern: on the one hand, the effect of digitalization on media freedom is not statistically different from zero in countries with a low level of initial competition. On the other hand, digitalization has a strong and negative effect on media freedom where there was already a high level of competition²⁸. In other words, it seems that too much competition makes it easier for politicians to influence media outlets.

²⁸Even though the difference between the two is not significant in a regression with the full sample interacted with the high/low competition dummy.

Dep. variable: media freedom	Competitive 1999	
	Low comp	High comp
DTT penetration	-0.009 (0.012) [0.013]	-0.035 (0.016)** [0.018]*
Controls	Y	Y
Time FE	Y	Y
Country FE	Y	Y
N	160	213
R^2	0.525	0.476

Table 3: Dependent variable: media freedom score. DTT penetration uses the most recent observation. Column 1 uses countries with a 1999 Herfindahl index above the average, Column 2 uses countries with a 1999 Herfindahl index level below the average. Controls are corruption, log of GDP per capita, election dummy. Country level clustered standard errors are in parentheses. Wild bootstrap s.e. in squared parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

The model reconciles those results with the theoretical literature on media capture. This explanation holds as long as digitalization is associated with higher competition, and there is evidence that this is indeed the case. In particular, Figure 3 shows the correlation between digital terrestrial penetration and concentration, as measured by the audience market share Herfindahl index described above. The correlation is negative and statistically significant, showing that digitalization is associated with higher competition²⁹.

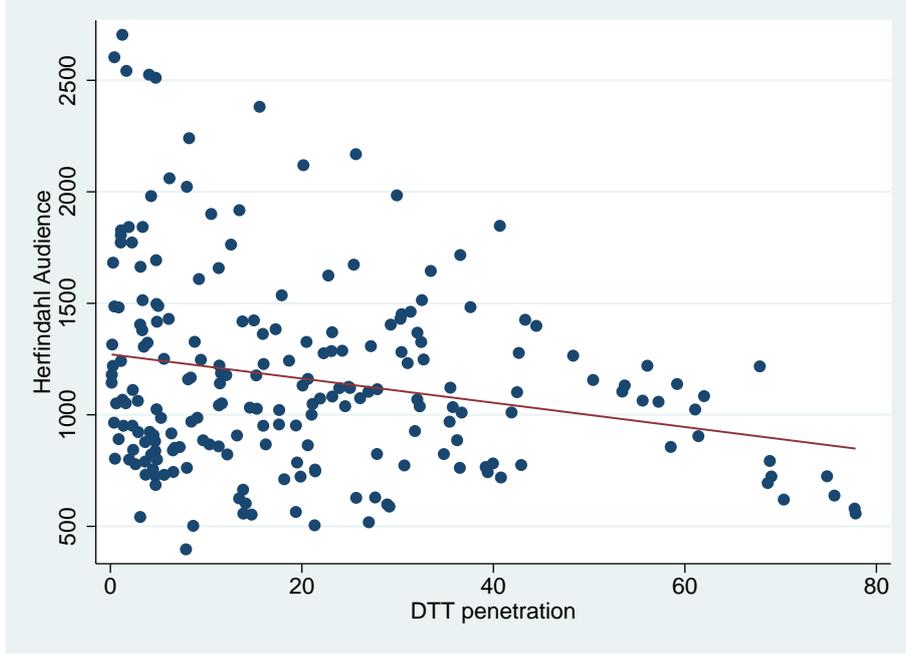
3.5 Parallel trends and robustness

One concern about the validity of the identification strategy is the endogeneity (at country level) of the decision to begin the switch to digital. I address this concern in three ways. First, even if the timing of the initiation of the digitalization process is at the discretion of each country, they all had to make the switch before the European Commission deadline. Second, this endogeneity seems not to affect the parallel pre trends. To test for this, I perform an event-study analysis using logic similar to Dobkin et al. (2014). In practice, this rules out the presence of unmeasured state specific trends correlated with digitalization of terrestrial television. To do so, I run the following regression:

$$mf_{i,t} = \lambda_i + \mu_t + \sum_{\tau=-2}^{+6} \gamma_{\tau} * d_{i,\tau} + \delta' \mathbf{X}_{i,t} + \epsilon_{i,t} \quad (2)$$

²⁹The coefficient remains negative and significant when the Herfindahl index is regressed on penetration, the controls, country and year fixed effect. A one standard deviation increase in DTT penetration is associated with a 0.15 standard deviations decrease in the Herfindahl index.

Figure 3: Correlation between the Herfindahl Index (top 8 channels) using daily audience market share and DTT penetration. Correlation is -0.312 , p -value < 0.01 .



where d_τ is a dummy that takes value 1 for country i two years before the beginning of the adoption process, one year before and so on, up to six years after³⁰ the starting point of the adoption process. Since every country in the sample gets the treatment at some point in time, I normalize with respect to the coefficient of the DTT launch year³¹.

Figure 4 shows the coefficient plot of (2) noticing that - reassuringly - coefficients are not significant before the adoption year, and become significant (and negative) afterwards.

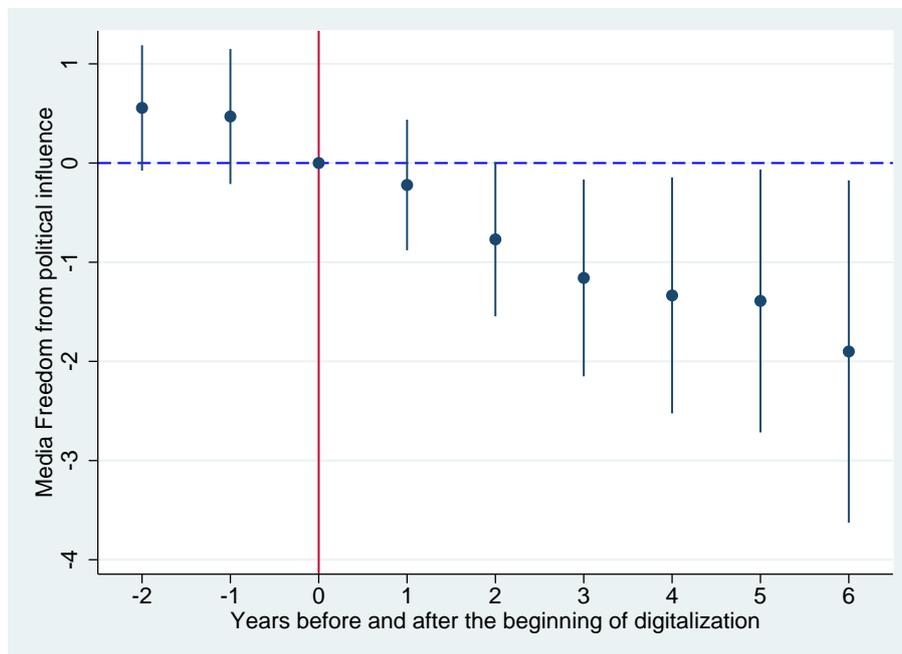
Finally, Table 4 looks at the treatment effect splitting the sample in two different ways. First, the sample is divided between late and early adopters (i.e. countries that started the digitalization before or during 2006 vs after 2006). Obviously this implies a lower statistical power, but note that the treatment effect is negative, similar to that in the whole sample, and only marginally non significant (both p -values are below 0.15). Hence, even if early and late adopters are different in terms of observables, it seems that the treatment works on both subsamples in a very similar way.

Another possible concern is whether the effect that I find is driven by countries with a low level of freedom from political influence on the media to start with. The last two columns of Table 4 show that this is not the case. I split the sample into countries with a level of media freedom from political influence above the average in 2001 (i.e. at the beginning of our dataset) and those below. Neither of the coefficients is statistically different from zero, but while the

³⁰Since the process begins quite early for some countries, I include as many pre-adoption years as possible, such that there are at least two thirds of the countries determining each coefficient.

³¹In other words, $d_{i,\tau} = 0$ when $\tau = 0$.

Figure 4: Start year effect on media freedom score, where 0 is the DTT launch year. Media freedom from political influence score is regressed on country fixed effects, year fixed effects, time varying controls and indicator variables corresponding to the number of years before and after the launch of digital terrestrial television in country i . Coefficients plot of the indicator variables with 95 per cent confidence intervals using the DTT launch year as reference point.



p-value of the treatment effect in the high freedom sample is 0.13, the treatment effect in low freedom countries is not different from zero. Hence, if anything, the effect seems to be driven by countries with a high level of media freedom to start with.

Dep. variable: media freedom	Early-late adopters		High-low freedom	
	Pre 2006	Post 2006	High freedom	Low freedom
DTT penetration	-0.024 (0.015) [0.018]	-0.038 (0.022) [0.029]	-0.048 (0.030) [0.045]	-0.002 (0.012) [0.015]
Controls	Y	Y	Y	Y
Time FE	Y	Y	Y	Y
Country FE	Y	Y	Y	Y
N	242	131	231	142
R^2	0.484	0.601	0.504	0.561

Table 4: Dependent variable: media freedom score. DTT penetration uses the most recent observation. Column 1 uses countries that started the digitalization before or in 2006. Column 2 uses countries that started after 2006. Column 3 uses countries with a 2001 level of media freedom above the average, Column 4 uses countries with a 2001 level of media freedom below the average. Controls are corruption, log of GDP per capita, election dummy. Country level clustered standard errors are in parentheses. Wild bootstrap s.e. in squared parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Finally, note that the tests in this section are necessary only in order to give causal interpretation to the negative relationship between digitalization and media freedom from political influence. Even if taken as correlations only, the results of section 3.4 go in the opposite direction with respect to the current view of the literature on media capture, thus providing a

motivation for extending the existing theoretical analysis.

4 The Model

The model builds on Besley and Prat (2006), keeping essentially the same structure (principal-agent-supervisor, as in Tirole (1986), pure adverse selection) and the same timing. There are two important modifications. Firstly, voters have heterogeneous interests in political news, hence not all of them become informed when one media outlet publishes news about the politician. Secondly, the relationship between readership and outlets' profits is not necessarily linear, but it is assumed to be described by a generic iso-elastic function. Section 6 shows that it can be derived as the equilibrium profit of a two sided media market where outlets are selling content to the readers and advertising space to a monopolist advertiser.

4.1 The game

4.1.1 Incumbent's type and voters' payoffs

The players of this game are a politician (he), media outlets (it) and voters (she). In period 1 an incumbent of type $\theta \in \{b, g\}$ is in power, with $Pr(\theta = g) = \gamma$. θ is private information of the incumbent. The "good" incumbent always picks the policy that maximizes voters' welfare, while the "bad" incumbent is only a rent seeker. While in power, he earns rent equal to R . As in the baseline of Besley and Prat (2006), the problem is a purely adverse selection one, so when a good incumbent is in power voters' payoff is 1, and when a bad incumbent is in power this payoff is 0.

4.1.2 Signal structure

Media outlets (but not the voters) may receive a common, verifiable signal $s = \{\emptyset, b\}$ of the incumbent type. In particular, $Pr(s = b|\theta = b) = q$, $Pr(s = \emptyset|\theta = b) = 1 - q$ and $Pr(s = \emptyset|\theta = g) = 1$. Upon observing s , the incumbent offers a vector of bribes $\{t_i\}_{i=1, \dots, n}$ in exchange for silence.

Every media outlet then has the option to choose a reporting strategy, defined as $\tilde{s}_i \in \{b, \emptyset\}$. If $s = \emptyset$, then the only option available is $\tilde{s}_i = \emptyset$, since there are no signals and news cannot be fabricated. However, if $s = b$, each outlet can decide between reporting $\tilde{s}_i = b$, enjoying the profits from a higher readership, or accepting t_i while publishing $\tilde{s}_i = \emptyset$. A media outlet that chooses $\tilde{s}_i = b$ is referred to as an outlet that *publishes the news about the incumbent*.

4.1.3 Voters' types

Voters are heterogeneous in their interest in politics, meaning that only some of them will be interested in political news. Formally, there are two types of consumers/voters³². A fraction α of them is composed of *interested voters*, who are exactly like every voter in Besley and Prat (2006). In particular, they are interested in political news and willing to consume political news from any outlet willing to publish them. Hence, they observe whether some of the outlets have published the news about the politician and they consume that content. They are not going to consume news from any outlet otherwise. In terms of Bayesian updating, note that it is enough that one outlet publishes the news in order for them all to become informed about the signal. The other $1 - \alpha$ voters are *rationally ignorant*, meaning that they have no interest in expending money or effort to buy political content. As a consequence, unlike the interested voters, they do not actively seek outlets reporting news about the politician, hence they do not pay attention to whether any of the outlets has published the news about the incumbent. However, they read the media for other reasons (e.g. they like sport, gossip, gardening etc.), and hence they are equally divided amongst all the outlets, irrespective of the signal that they publish. Hence, a fraction of rationally ignorant voters may become informed about the politicians type by reading, for other reasons, one of the outlets publishing the signal³³. Voters know their type and $\alpha \in (0, 1)$ is common knowledge. As is quite standard in these models, every reader/voter reads at most one piece of news.

As the only relevant piece of news that outlets can publish is the fact that the incumbent is bad, I define *informed* voters as those who are aware of the fact that $s = b$ has been received by media outlets (and hence $\theta = b$). Note that both interested and rationally ignorant voters can become informed about the (bad) type of the incumbent. This is a consequence of the outlet they read. In particular, every interested voter will become informed if at least one outlet publishes the signal, while the fraction of rationally ignorant voters that becomes informed depends on the fraction of outlets publishing the signal.

4.1.4 Media outlets

The number of media outlets, n , is exogenously given and it will be the main aspect of the comparative statics analysis. In general, media outlets derive revenues from two sources: audience-related revenues and money from the politician. Formally, the total profits are defined

³²In total, consumers/voters are a large number normalized to 1.

³³This precise assumption about the behaviour of rationally ignorant voters is not crucial for our main result. This holds as long as a fraction of rationally ignorant voters becomes informed when some outlets are publishing the signal, and this fraction is increasing in the fraction of outlets publishing the signal.

by Π_i . The component coming from readership is defined by $\pi(r_i) = (r_i)^\delta$, with $\delta \geq 0$. Note that $\delta = 1$ incorporates the case of Besley and Prat (2006), while $\delta > 1$ can be the equilibrium result of a two sided media market, as explained in section 6. The bribe offered to outlet i is defined by t_i . For simplicity, it is assumed that outlets offer their contents for free.³⁴

After the vector of bribes is decided, outlets observe it and each of them simultaneously decides whether to accept the individual offer or not. Defining I the set of media that accepts the offer, the incumbent gets a payoff of $R - \sum_{i \in I} t_i$ if he is elected and of $-\sum_{i \in I} t_i$ if he is voted out of office. R is drawn from a distribution F_R with support $[0, +\infty)$. The distribution is common knowledge, while the realization is private information of the incumbent and the outlets.

At the end of period one, voters decide whether to confirm the incumbent or to choose a challenger that is good with probability γ . It is assumed that every voter votes sincerely³⁵. In period 2 there is voters' and politicians payoff payment only.

4.2 Summary of the timing

1. θ is realized. If $\theta = g$ then $s = \emptyset$ with probability 1. If $\theta = b$, $s = b$ with probability q and $s = \emptyset$ with probability $(1 - q)$. The incumbent observes the media signal and decides $\{t_i\}_{i=1, \dots, n}$.
2. Each media i observes s and $\{t_i\}_{i=1, \dots, n}$ and decides whether to accept or reject t_i . If she rejects, she reports the true signal (if $s = b$) competing with the other outlets that reported the news, if she accepts she reports $\tilde{s}_i = \emptyset$.
3. Voters make readership decisions. Rationally ignorant voters do not observe the vector of reports $\{\tilde{s}_i\}_{i=1, \dots, n}$ and they just split themselves among all the outlets, observing just the report of the outlet they pick, i.e. \tilde{s}_i . Interested voters instead observe the vector $\{\tilde{s}_i\}_{i=1, \dots, n}$ and either split themselves among the outlets choosing $\tilde{s}_i = b$ or do not consume any content.
4. Consumers/voters use the information they have to update beliefs and vote. If the incumbent is voted out, the new incumbent is randomly drawn with $Pr(\theta = g) = \gamma$. Period 1 ends.
5. In period 2, payoffs for both periods are paid and the game ends.

³⁴This assumption makes the model more tractable, but it can be shown that it appears quite easily as an equilibrium result in a model where outlets choose the price of their contents in a competitive way and are sufficiently interested in maximizing the readership.

³⁵Note that, with two alternatives, this is a weakly undominated voting strategy.

5 Equilibrium and welfare

5.1 Solving the game

The model is solved by backward induction, focusing on showing the existence of a symmetric³⁶ sincere pure strategy perfect Bayesian equilibrium. I construct the equilibrium using a series of lemmas: all the proofs are in Appendix B. Of course, it makes sense to focus only on the case where $\theta = b$ and $s = b$, since nothing interesting happens in the rest of the game.

First of all, let us look at voters' choice. Note that, irrespective of their type, the voters' information set is binary (i.e. they observe \emptyset or that there is at least one b). This is because rationally ignorant voters will just observe the report of the outlet they consume, while informed voters can use the whole vector of reports. Lemma 1 describes their equilibrium choices, assuming sincere voting. It is reminded that an informed voter is a voter that knows that observes at least one $\tilde{s}_i = b$, hence she knows that $\theta = b$. A uninformed voter is a voter that observes only $\tilde{s}_i = \emptyset$.

Lemma 1 *In a sincere voting equilibrium, all uninformed voters vote for the incumbent and all informed voters vote for the challenger.*

Intuitively, in this type of model no news is good news, and this is true even when voters take into account the possibility of media capture. As a result, the politician only needs to keep half the voters uninformed to win elections and remain in power.

Given the assumption about voters' heterogeneous interest in political news, it is straightforward to derive the readership of each outlet depending on its reporting strategy. In particular, define I^C the set of outlets that rejected the bribe from the incumbent (with cardinality $m \geq 0$) and I the set of outlets that accepted the bribe. It is easy to see that $r_j = \frac{1-\alpha}{n} \forall j \in I$ and $r_k = \frac{\alpha}{m} + \frac{1-\alpha}{n} \forall k \in I^C$.³⁷

In other words, n outlets enjoy some readership coming from the rationally ignorant voters, while only those outlets publishing news about the politician will enjoy the additional readership of interested voters. As a consequence,

$$\pi_k = \left(\frac{\alpha}{m} + \frac{1-\alpha}{n} \right)^\delta \quad \forall k \in I^C \quad \pi_j = \left(\frac{1-\alpha}{n} \right)^\delta \quad \forall j \in I \quad (3)$$

³⁶I.e. every outlet follows the same strategy.

³⁷This abstracts from the outlets' pricing decisions. However, section 6 shows that an equilibrium with zero price can be easily obtained.

The politician determines the optimal number of outlets to silence knowing that all of the α interested voters will become informed once a single outlet publishes the news, while the fraction of the other $1 - \alpha$ rationally ignorant voters that become informed is increasing in the fraction of media outlets reporting the news. Hence, if every outlet publishes the news, then all the voters become aware of the type of the politician, while if $m = 0$ then none of them are. To stay in power, given Lemma 1, the bad politician needs at least 50 per cent of the voters to be uninformed³⁸. Because getting a higher percentage of uninformed voters is irrelevant in terms of re-election, but costly in terms of bribes, the politician knows that he can have a certain number m of outlets “allowed” to publish the news about his type, without affecting his re-election. In particular, m must be such that

$$\alpha + (1 - \alpha) \frac{m}{n} \leq \frac{1}{2} \quad (4)$$

Note that, if $\alpha \in [\frac{1}{2}, 1]$, i.e. if there is a majority of interested voters, then the result is the same as in Besley and Prat (2006), where the bad politician has to silence the whole industry. Hence, the interesting case is when $\alpha \in (0, \frac{1}{2})$. In this respect, Hamilton (2004) points out that interested readers/voters are usually a minority, compared with the rationally ignorant. Hence, the case considered here is likely to reflect reality.

Equation (4) can be rearranged as

$$\frac{m}{n} \leq \frac{1 - 2\alpha}{2(1 - \alpha)}$$

As a consequence, defining λ the fraction of outlets that the politician has to silence in order to be re-elected, we can see that, in case of capture, it is optimal for him to have

$$1 - \lambda = \frac{1 - 2\alpha}{2(1 - \alpha)}$$

and hence

$$\lambda = \frac{1}{2(1 - \alpha)} \quad (5)$$

Given that λ is not a function of n , from now on $\lceil \lambda n \rceil$, i.e. the smaller integer greater or equal to λn , defines the number of outlets that the politician silences in equilibrium.

It is now possible to characterize (in Lemma 2) the bribe structure and the total equilibrium cost of capture in the lowest-cost equilibrium, from the point of view of the incumbent.

³⁸As an indifference breaking rule, I give a small “incumbency advantage” to the politician in power assuming that, in case of a 50-50 result, he would be re-elected.

Lemma 2 *To be re-elected at the minimum cost, the politician offers a positive bribe $t_i = \left(\frac{\alpha}{\lfloor(1-\lambda)n\rfloor+1} + \frac{1-\alpha}{n}\right)^\delta - \left(\frac{1-\alpha}{n}\right)^\delta$ to exactly $\lceil\lambda n\rceil$ outlets, where λ is defined in equation (5), and $t_j = 0$ to the remaining outlets.*

The formal proof of this equilibrium is in Appendix B. Note, however, that there are no unilateral profitable deviations. Outlets not receiving any bribe cannot do anything other than publish the signal. On the other hand, the politician has to pay to every bribed outlet its outside option, i.e. the profits each of them would make if, when the other $\lceil\lambda n\rceil - 1$ outlets are captured, it would decide to deviate from accepting the offer, publishing the news and hence competing with the other $\lfloor(1-\lambda)n\rfloor$ free outlets, minus the profits the outlet is making by staying silent.

In this case, then, $m = \lfloor(1-\lambda)n\rfloor + 1$ and hence the profits from a deviation, following (3), would be $\left(\frac{\alpha}{\lfloor(1-\lambda)n\rfloor+1} + \frac{1-\alpha}{n}\right)^\delta$. The politician has to pay the difference between this and the amount of profit made under capture to all the $\lceil\lambda n\rceil$ outlets he needs to capture. The total amount to be paid is

$$K = \lceil\lambda n\rceil \left[\left(\frac{\alpha}{\lfloor(1-\lambda)n\rfloor+1} + \frac{1-\alpha}{n} \right)^\delta - \left(\frac{1-\alpha}{n} \right)^\delta \right] \quad (6)$$

Moreover, the politician cannot hope to stay in power by bribing a lower number of outlets (as seen above) or with a lower offer, since it would be rejected. Clearly, it is optimal for the bad politician to bribe the outlets if this amount is lower than the office rent he could realize by staying in power in period 2 (defined as R), and hence capture occurs, in equilibrium, when

$$\lceil\lambda n\rceil \left[\left(\frac{\alpha}{\lfloor(1-\lambda)n\rfloor+1} + \frac{1-\alpha}{n} \right)^\delta - \left(\frac{1-\alpha}{n} \right)^\delta \right] \leq R \quad (7)$$

It is immediately clear that the effect of n on this condition is non trivial. On one hand, raising n implies, as in Besley and Prat (2006), that the politician has to silence more outlets. On the other hand, raising n also increases competition in the slice of market that remains free (if this exists, of course). This reduces the outside option for every firm and makes capture more attractive (and cheaper, for the politician). Given this:

Proposition 1 *If $\delta > 1$ then, as n becomes large, competition drives the total cost of capture to zero.*

Intuitively, when an increase in readership is sufficiently important for the profits of media outlets, then the “reduction in the outside option” effect of competition dominates, driving down

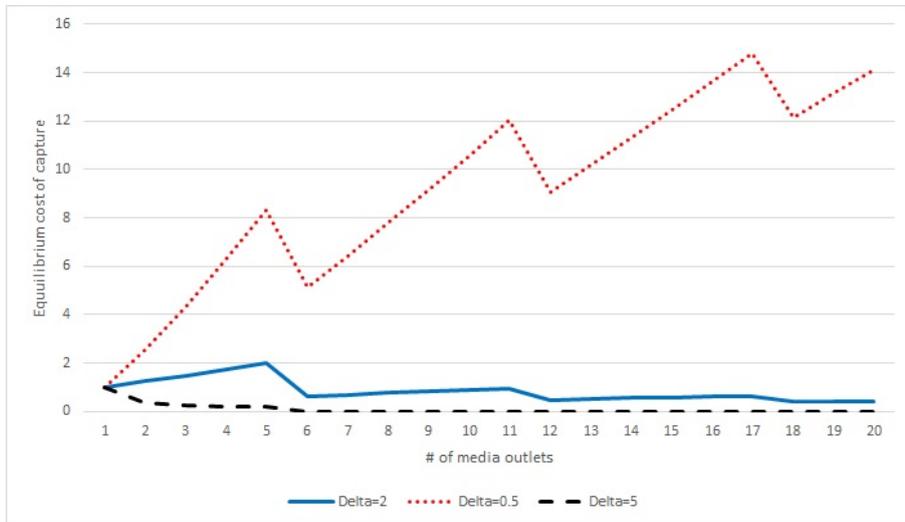
the total cost of capture. Hence, consistent with the empirical results of section 3, excessive competition is actually bad for media freedom.

Figures 5 and 6 illustrate of the effect of δ on the total equilibrium cost of capture (normalized so that $K(n = 1) = 1$ irrespective of δ). When it is below 1 (red dotted line), the cost tends to “explode”, hence competition makes capture more costly (in the limit) precisely because the “increasing in number” effect dominates the “outside option reduction effect”. When δ is big enough (black dashed line), then the total cost of capture is always decreasing in competition, irrespective of the number of free outlets.

The most interesting case occurs for intermediate values of δ (blue solid line), where the effect of competition on capture is non-monotonic. K still goes to 0 in the limit, but this effect kicks in only when competition is sufficiently high, i.e. there is a sufficiently large number of media outlets so that one of them publishing the news is not enough to inform the majority of the voters. Section 5.2 discusses this in greater detail.

Finally, note that the basic message of Figures 5 and 6 is not affected by α .

Figure 5: Total equilibrium cost of capture for different values of δ when $\alpha = 0.4$. The dotted red line is $K(\delta = 0.75)$, blue solid line is $K(\delta = 2)$, black dashed line is $K(\delta = 5)$. Everything is normalized so that $K(n = 1) = 1$ irrespective of δ .

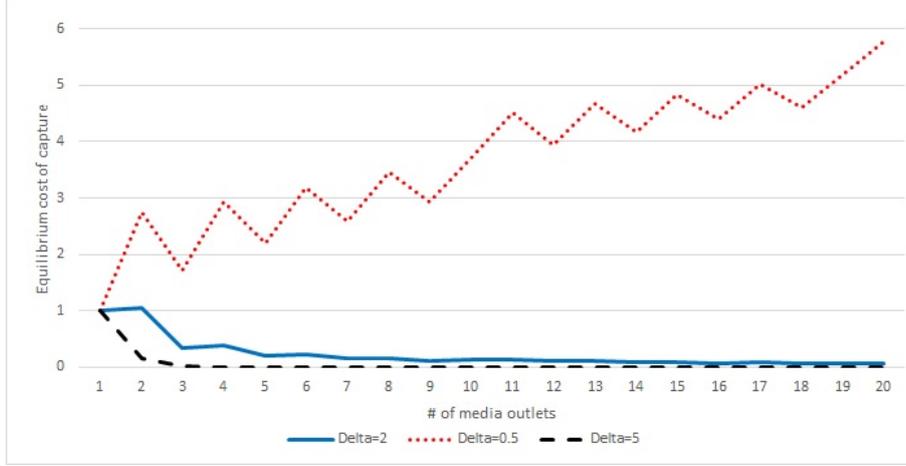


5.2 Non-monotonic effect of competition

Can this negative result of competition be reconciled with the more positive message of Besley and Prat (2006)? It seems to be the case, at least for specific values of δ . In fact, it can be shown that, when $\delta \in (1, 2]$, the effect of competition on media capture can be non-monotonic.

To see this, note that since $\lambda > \frac{1}{2}$, total capture will be necessary for at least $n = 1$ and

Figure 6: Total equilibrium cost of capture for different values of δ when $\alpha = 0.2$. The dotted red line is $K(\delta = 0.75)$, blue solid line is $K(\delta = 2)$, black dashed line is $K(\delta = 5)$. Everything is normalized so that $K(n = 1) = 1$ irrespective of δ .



$n = 2$. The aforementioned restriction on δ guarantees that, before the competition effect kicks in reducing the outside options of captured outlets (i.e. as long as $\lfloor (1 - \lambda)n \rfloor = 0$), K is increasing in n . This This is formalized in the following corollary:

Corollary 3 *If $\delta \in (1, 2]$, there is at least one configuration of the market with free media characterized by a number of outlets $n^* > 1$ and $R \in (K(1); K(n^*))$, then we observe media capture for $n < \underline{n}$ and for some $n > \bar{n}$, so the effect of n on the possibility of media capture is non monotonic.*

This means that media will be captured when their number is either too small or too big, since competition would, at some point, make them so cheap that it will be convenient for the incumbent to silence them. To understand the behaviour of the cost function, Figure 7 simulates the model with parameters consistent with Corollary 3.

The number of media outlets is on the x-axis, while the cost of silencing enough of them to have a bad incumbent re-elected when the outlets get the signal is on the y-axis. For the other parameters, $R = 1.5$, $\alpha = 0.45$, $\delta = 2$.

The non monotonic effect of competition is readily apparent: the incumbent can capture enough outlets and stay in power after a bad signal is received when the blue solid line (the total equilibrium cost of capture) is below the orange dotted line (office rent). That is, when there are at most 4 or at least 11 media outlets. In between, there will be no capture as it would be too costly for the incumbent.

It is clear from the graph that rounding plays a rol³⁹. In particular, the cost of capture is

³⁹The graph where n is treated as a real, rather than as a natural number, is shown in Appendix C.

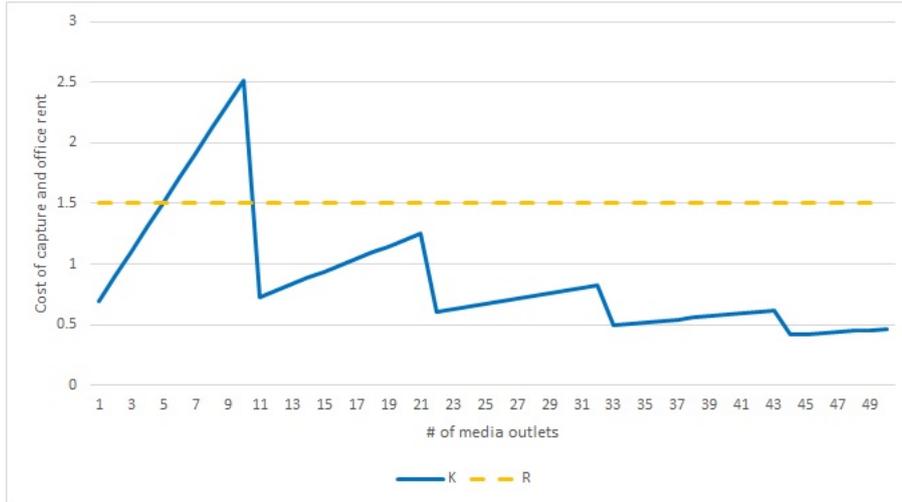


Figure 7: Model simulation for different values of n when $R = 1.5$, $\alpha = 0.45$, $\delta = 2$.

increasing in n as long as the number of outlets is such that the politician has to silence the whole market. It “jumps down” when n goes from 10 to 11 because of the competition effect given by the possibility of having one free outlet (this lowers the outside option of every captured outlet and hence the total cost). The behaviour is similar for the remaining parts of the graph, with jumps when n goes from 21 to 22, from 32 to 33 and so on. Note, however, that the slope of the cost function is progressively decreasing as n grows, because n enters at the denominator with a power of two.

5.3 Discussion

In terms of assumptions, the most important difference between this model and the literature on media capture is the heterogeneity in voters’ interest in politics. This implies that this model does not assume that having one outlet publish the news is enough to inform the whole electorate.

Gentzkow and Shapiro (2008) use the argument of re-broadcasting as a justification for the assumption in Besley and Prat (2006). However, “silenced” media may not be willing to re-broadcast anything, since they have been compensated in for not doing so. Moreover, in reality there are many ways of re-broadcasting a news item. What matters in this model is the message transmitted to the readers about the type of the incumbent, and - even if it is not captured here - the same news can be re-broadcast in many ways. Even a “hard” signal, e.g. a phone conversation in which a politician discusses bribes, can be presented as “the politician is taking bribes” but also as “yes, he made that call, but it is taken out of the context. And anyway everyone takes bribes”. The second way is the same as re-broadcasting the news without giving any information about the politician’s type.

Moreover, it must be noted that even in places traditionally associated with media capture (e.g. Italy, Russia), the capture never reached the whole media industry (in Italy it did not even reach the whole television industry when Mr Berlusconi was simultaneously Prime Minister and owner of the three main private television stations). McMillan and Zoido (2004), for example, point out that Montesinos was not bribing the whole media industry, but was choosing the outlets with the highest viewership/readership, and this is consistent with this model. Hence, the possibility that $\lambda < 1$ should at least be considered.

The second important difference is the generic way of describing the relationship between readership and profits. Note, first of all, that the linear case is just a special case of this specification. Secondly, section 6 will provide a microfoundation, based on the two sided market literature, of a profit function where $\delta > 1$.

5.4 Welfare of the voters

It is now possible to look at the (*ex ante*) welfare of the voters, and how it is affected by competition and the presence of media capture. As already mentioned, office rents R are assumed to be drawn from a generic distribution F_R , with support \Re^+ . As a consequence, when $\alpha < \frac{1}{2}$, the *ex ante* probability of successful media capture, conditional on having a bad incumbent in power and on $s = b$, is defined as

$$\begin{aligned}\sigma &:= Pr \left(R \geq \lceil \lambda n \rceil \left[\left(\frac{\alpha}{\lfloor (1-\lambda)n \rfloor + 1} + \frac{1-\alpha}{n} \right)^\delta - \left(\frac{1-\alpha}{n} \right)^\delta \right] \right) \\ &= 1 - F_R \left(\lceil \lambda n \rceil \left[\left(\frac{\alpha}{\lfloor (1-\lambda)n \rfloor + 1} + \frac{1-\alpha}{n} \right)^\delta - \left(\frac{1-\alpha}{n} \right)^\delta \right] \right)\end{aligned}$$

With this definition, the probability that a bad incumbent is voted out is $(1 - \sigma)q$ and the expected turnover is $(1 - \gamma)(1 - \sigma)q$. Hence, it is decreasing in σ . In the standard Besley and Prat (2006) model, since n was monotonically decreasing σ , then n was supposed to increase the expected turnover. Interestingly, Drago et al. (2014) find that this is not the case, at least for the entry of local newspapers in Italian municipalities. In this model, when $\delta > 1$, n increases σ in the limit, falling as a consequence the expected turnover. This is consistent with Drago et al. (2014).

Finally, the *ex ante* voters' welfare is defined as

$$W := \gamma(2) + (1 - \gamma) [q(1 - \sigma)\gamma] \tag{8}$$

because the good incumbent would be re-elected for sure, leading to a payoff of 1 in each period. On the other hand, the bad incumbent is voted out with probability $q(1 - \sigma)$, and in that case the new politician is good with probability γ . If confirmed, the bad incumbent would bring a payoff of 0 in both periods.

As expected, (8) shows that voters' welfare is decreasing in the probability of media capture. As a consequence, the effect of media competition on voters' welfare can be described as follows:

Proposition 2 *If $\alpha < \frac{1}{2}$ and $\delta > 1$ competition has, in the limit, a decreasing effect on voters' welfare.*

This result suggests that some care is required when thinking about competition as a tool for avoiding media capture. Under some conditions, excessive competition can be counter-productive.

6 Microfounding the profit function

As mentioned in sections 4 and 5, the relationship between outlets' profits and readership pays an important role in my results, and it is important to look beyond the linearity assumption of Besley and Prat (2006). One way of micro-founding a more generic relationship is through a two-sided market approach, where outlets are assumed to be selling contents to the readers and advertising space to a monopolist advertiser, who is interested in placing advertisements where they will reach a large audience.

The timing of the media market part of the game, which determines the shape of the profit function and hence the bribe that the politician has to pay recalls Ellman and Germano (2009)⁴⁰, is as follows.

1. Every media outlet $i \in N$ sets the price of its content, $p_i \geq 0$, achieving as a consequence a readership r_i . Interested voters/consumers are buying the content (one copy each) as long as it publishes the political news and as long as $p_i \leq \bar{p}$, where $\bar{p} \sim U[0, 1]$ is a positive individual reservation price. Since these consumers/voters are interested only in the political news, and this news will be the same in every outlet, they treat the m outlets as homogeneous, and hence they will all buy their copy from the outlet setting the lowest price. Rationally ignorant voters/consumers are just equally split between the outlets with the lowest price⁴¹.

⁴⁰The idea behind this timing is that readership choices and editorial choices tend to be stable, while you can sign advertising contracts based on them. However, this timing choice is not crucial for the results of this paper.

⁴¹As long as this price is below their reservation price.

2. Given the readership, outlets choose the unit price of advertising space, q_i .
3. Finally, the monopolist advertiser, knowing the readership and the price, chooses the quantity of advertising it wants to buy.

Note that the results are qualitatively unchanged if, instead of a sequential game between each outlet and the advertiser, I assume that they can write the optimal contract and then split the revenue it generates.

In this set up, every media outlet $i \in N$ derives profit from readership and from advertising space. Formally,

$$\pi_i = \pi_{r,i} + \pi_{a,i} \tag{9}$$

where $\pi_{r,i}$ and $\pi_{a,i}$ are the profits that outlet i makes from readership and from advertising space respectively. When the decision about the quantity and price of advertising is made, the readership of every outlet has already been determined, hence the (monopolist) advertiser's problem is

$$\max_{y_1, \dots, y_n} \sum_{i=1}^n r_i \sqrt{y_i} - \sum_{i=1}^n q_i y_i$$

where y_i is the quantity of advertising purchased from outlet i , r_i is the readership of that outlet (determined in stage 1) and q_i is the market price of a unit of advertising on outlet i , already chosen by each outlet i .

The justification for this objective function is found in the literature on advertising and the media market. As pointed out by Hamilton (2004), "once people are watching a program or reading a news entry, advertisers care about the chance to divert their attention to a commercial product". So, following this idea and similarly to the microfoundation of advertiser's demand in Ellman and Germano (2009), I assume that each reader/consumer's demand for the advertised good is increasing and concave in the quantity of advertising in the publication he buys⁴². In other words, the quantity of advertising space boosts the demand for the advertised good at a decreasing rate. As in Ellman and Germano (2009), the advertiser is interested in the total demand for the good, so she multiplies the individual demand determined by the quantity of advertising on outlet i by the readership of that outlet, summing across all outlets publishing the signal. This leads directly to the objective function. Note that, as in Dukes (2006), the objective function is additively separable in the media outlets; moreover it is linear in the readership, as

⁴²The squared root is chosen for convenience. It is easy to see that, defining $z \in (0, 1)$ the exponent on y_i , then $\delta = \frac{1}{1-z} > 1$, hence the negative limit effect of competition is always there. If $z \in (0, \frac{1}{2}]$ then the non-monotonicity in the effect of competition on media capture is always there as well.

in Ellman and Germano (2009) and it exhibits decreasing marginal returns in the quantity of advertising space as in Godes et al. (2009).

The problem is concave and, from first order conditions, the inverse demand function for every outlet is given by

$$y_i = \left(\frac{r_i}{2q_i} \right)^2 \quad \forall i \in N$$

Moving now to the outlets, each one will choose q_i to maximize its profits, knowing how the market would react to its decision. As a consequence, the problem for every outlet i is:

$$\begin{aligned} & \max_{q_i} (q_i - c) y_i \\ \text{s.t. } & y_i = \left(\frac{r_i}{2q_i} \right)^2 \end{aligned} \tag{10}$$

where c is the cost of hosting advertising space (in terms of foregone “useful” space in a newspaper or on a website etc.) that is strictly positive but arbitrarily small. For reasons that will be justified shortly, it is assumed $c \leq \frac{\alpha}{8}$.

Solving (10),

$$q_i^* = 2c$$

and

$$y_i^* = \frac{r_i^2}{16c^2}$$

So, the profits from advertising for the media outlet are given by

$$\pi_{a,i}^* = \frac{r_i^2}{16c}$$

that is strictly increasing in r_i . Note that the advertiser is also making positive profits on every outlet, since

$$\pi_{ADV,i}^* = r_i \frac{r_i}{4c} - 2c \frac{r_i^2}{16c^2} = \frac{r_i^2}{8c}$$

where $\pi_{ADV,i}^*$ is the equilibrium profit level for the advertiser on outlet i .

Going backwards to stage 1, note that outlets may, in principle, adopt a different pricing strategy depending on whether they are publishing the signal or not, hence whether they are trying to “attract” also interested readers or not. However, it is easy to note that, as long as $m \geq 2$ and $n - m \geq 2$, the standard features of a Bertrand competition apply in this setting. Every outlet will try to undercut the others in order to reach more readers. Given the zero marginal cost assumption, the only equilibrium is the one where $p_i = p_j = 0$ for $\forall i, j \in N$. The readership decision is the same as above, hence the profits are a convex function of outlets’ readership. In

particular,

$$\pi_{i,b} = \frac{1}{16c} \left(\frac{\alpha}{m} + \frac{1-\alpha}{n} \right)^2 \quad \forall i \in I^C \quad \pi_{i,\emptyset} = \frac{1}{16c} \left(\frac{1-\alpha}{n} \right)^2 \quad \forall i \in I$$

For cases where Bertrand competition does not apply, the following lemma is sufficient for a zero price equilibrium:

Lemma 4 *If $c \leq \frac{\alpha}{8}$ then every outlet, irrespective of the market configuration and on whether they are captured or not, will find optimal to set a price equal to 0 in order to maximize the readership.*

As proved in Lemma 4, as long as c is small enough⁴³ even the monopolist outlet behaves in the same way as in the “Bertrand competition” environment, and as a consequence $\pi_{r,i}^* = 0$ and $\pi_i^* = \pi_{a,i}^* = \frac{r_i^2}{16c}$ and all the rationally ignorant voters are equally divided between all the outlets.

Finally, note that many types of media outlets offer their content for free (websites, most of the TV channels, radio channels, free newspapers), deriving 100 per cent of their profits from advertising and, as pointed out by Ellman and Germano (2009), revenues from advertising account for 50-80 per cent of the total revenues of “standard” newspapers. Hence, the assumption is not far from reality.

7 Conclusion

This paper shows that competition in the mass media market does not have a universally positive role in deterring media capture by bad politicians. On the empirical side, it is possible to identify the negative effect on media freedom from political influence of a competition-increasing reform (digitalization of terrestrial television in the European Union). Interestingly, this effect seems to be driven by countries with high level of pre-treatment competition, highlighting that the risks comes from excessive competition.

The theoretical model provides a rationale for those results, reconciling the theoretical literature on media capture with the empirical evidence. It relaxes two assumptions from the media capture literature (voters’ homogeneity in interest for politics and profits linear in readership)

⁴³The assumption of $c \leq \frac{\alpha}{8}$ is made for simplicity, since even captured outlets have a readership and hence a pricing decision to make. Hence, for example if $n = 2$ and the politician needs to capture every outlet and the optimal outside option choice for an outlet that rejects the bribe involves a positive price, then the other one may find it optimal to impose a positive and slightly lower price. But this would affect the readership of those outlets and hence the number of readers/voters informed and so on. Hence, this assumption plays a role only when Bertrand competition does not apply.

and derives conditions for a negative limit effect and for a non-monotonic effect of competition on the total equilibrium cost of capture. The profit function necessary for those results can arise from a media market modelled as a two sided one.

These findings are relevant in a complex world where the internet seems to allow for proliferation of media outlets and the independence of media from political influence is under threat in many contexts.

This paper is a basis for further research to understand the effect of media competition on media freedom from political influence, identifying and testing all the possible channels.

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Appendix A Robustness Checks

I present here two alternative empirical strategies, showing that the main point of the results of Section 3 (a negative, significant sign) is robust to those different specifications.

First of all, table A1 uses an approach similar to Card (1992), where the treatment is measured by a dummy variable (equal 0 before the beginning of the switch over process, and 1 when it starts) multiplied by the terrestrial television penetration measured in 1997, to capture the difference in affected population discussed in section 3. Despite the measurement error implied by this specification (the digitalization process takes time, while the treatment variable is 1 immediately after the beginning of the process) the coefficient is negative and significant.

Dep. variable: media freedom	(1)	(2)	(3)	(4)
Treatment*population	-0.013 (0.006)** [0.007]*	-0.014 (0.005)** [0.007]**	-0.013 (0.005)** [0.007]*	-0.013 (0.005)** [0.006]*
ln(GDP p.c.)		1.898 (2.137)	2.263 (2.589)	2.322 (2.628)
Corruption			-0.163 (0.322)	-0.177 (0.327)
Elections				-0.129 (0.117)
Time FE	Y	Y	Y	Y
Country FE	Y	Y	Y	Y
<i>N</i>	378	377	374	374
<i>R</i> ²	0.453	0.462	0.449	0.450

Table A1: Dependent variable: media freedom score. Treatment*population is the interaction of a dummy = 1 when the digitalization process begins and the penetration of terrestrial television in 1997. Only observations before the beginning of digitalization or after the ASO are used. Column 1 is the pure DID set up without controls. Columns 2-4 add one control each. Country level clustered standard errors are in parentheses. Wild bootstrap s.e. in squared parentheses, in order to take into account for the small number of clusters. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Secondly, table A2 performs a similar exercise, but using only observations where the digitalization process is not started or where it is completed. The results are slightly more noisy, but the treatment effect is negative and loses significance only when the wild bootstrapped standard errors are considered.

Dep. variable: media freedom	(1)	(2)	(3)
Treatment*population	-0.018 (0.009)* [0.011]*	-0.021 (0.009)** [0.017]	-0.015 (0.008)* [0.012]
Implementation dummies	N	Y	Y
Controls	N	N	Y
Time FE	Y	Y	Y
Country FE	Y	Y	Y
<i>N</i>	249	235	231
<i>R</i> ²	0.456	0.505	0.522

Table A2: Dependent variable: media freedom score. Treatment*population is the interaction of a dummy = 1 when the digitalization process is completed and the penetration of terrestrial television in 1997. Column 1 is the pure DID set up without controls. Column 2 controls for implementation dummies only, column 3 for the full set of controls. Country level clustered standard errors are in parentheses. Wild bootstrap s.e. in squared parentheses, in order to take into account for the small number of clusters. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Finally, I look at the effect of different specific time trends on the treatment effect. In particular, Table A3 repeats the estimation of (1) controlling for subgroup specific linear and flexible time trends

(where the chosen subgroups are countries with terrestrial television penetration in 1999 above and below 50 per cent and early and late adopters as specified above) and country specific linear time trends. The result is robust to all the specifications but the last one, and the coefficients of columns 1-4 are similar to the specification in the main body of the paper. The result of column 5 is not particularly worrying: Borusyak and Jaravel (2016) show that this type of time trends should not be added to event study analysis, such as the present one.

Dep. variable: media freedom	(1)	(2)	(3)	(4)	(5)
DTT penetration	-0.024 (0.013)* [0.014]*	-0.024 (0.014)* [0.015]	-0.025 (0.012)** [0.013]*	-0.025 (0.013)* [0.014]*	-0.009 (0.012) [0.012]
Terr. linear trend	Y	N	N	N	N
Terr. flexible trend	N	Y	N	N	N
Early-late linear trend	N	N	Y	N	N
Early-late flexible trend	N	N	N	Y	N
Country specific linear trend	N	N	N	N	Y
Controls	Y	Y	Y	Y	Y
Time FE	Y	Y	Y	Y	Y
Country FE	Y	Y	Y	Y	Y
N	352	352	373	373	373
R^2	0.473	0.500	0.488	0.499	0.712

Table A3: Dependent variable: media freedom score. DTT penetration uses the most recent observation. Column 1 controls for terrestrial specific linear time trends, Column 2 for terrestrial specific flexible time trends, Column 3 for early-late adopter specific linear time trend, Column 4 for early-late adopter flexible time trend, Column 5 for country specific linear time trends. Controls are corruption, log of GDP per capita, election dummy. Country level clustered standard errors are in parentheses. Wild bootstrap s.e. in squared parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Appendix B Proofs

Proof of of Lemma 1.

Let us start with interested voters, who behave exactly as the voters in Besley and Prat (2006), i.e. they will all become immediately informed if at least one outlet publishes the signal and they will all observe $\tilde{s}_i = \emptyset$ otherwise. Note that

$$Pr(\theta = g | \text{at least one } \tilde{s}_i = b) = 0 < \gamma$$

Moreover, suppose the voters believe that the bad politician is able to silence all the media with probability⁴⁴ $\sigma' \in [0, 1]$. Then, again by Bayes' rule,

$$\begin{aligned} Pr(\theta = g | \{\tilde{s}_i\}_{i=1, \dots, n} = \emptyset) &= \frac{Pr(\{\tilde{s}_i\}_{i=1, \dots, n} = \emptyset | \theta = g) Pr(\theta = g)}{Pr(\{\tilde{s}_i\}_{i=1, \dots, n} = \emptyset | \theta = g) Pr(\theta = g) + Pr(\{\tilde{s}_i\}_{i=1, \dots, n} = \emptyset | \theta = b) Pr(\theta = b)} \\ &= \frac{\gamma}{\gamma + [(1 - q) + q\sigma'](1 - \gamma)} \end{aligned}$$

From this, I derive that

$$Pr(\theta = g | \{\tilde{s}_i\}_{i=1, \dots, n} = \emptyset) \geq \gamma$$

is true when

$$(1 - \sigma')q \geq 0$$

and hence it is never sequentially rational for an interested voter observing $\{\tilde{s}_i\}_{i=1, \dots, n} = \emptyset$ to vote out the incumbent⁴⁵.

Consider now the fraction of uninformed rationally ignorant voters. The single voter, despite knowing his type, does not know if she is observing $\tilde{s}_i = \emptyset$ because she picked up one of the silenced outlets or

⁴⁴Voters do not know the realization of R , but they know that it is a random variable drawn from a generic cumulative distribution function F_R . Note that σ' is the probability of total media capture conditional on having a bad incumbent and on the media having received the signal about his type.

⁴⁵As a tie-breaking rule, I am assuming that the indifferent voter will confirm the incumbent.

because there is no signal to be transmitted. Of course, she is still rational and hence she assigns a probability σ to the event of (partial or total) media capture⁴⁶ and a probability η to her belonging to the fraction of rationally ignorant voters that would become informed in case of the publication of the signal and capture. In particular, η is equal to the ratio between the number of free outlets in case of capture over the total number of outlets. In equilibrium I will show that $\eta = \frac{m}{n}$, where m is the total number of free outlets and n is the total number of outlets. Note that the rationally ignorant voter knows n and is able to work out how many outlets can be left free by a bad incumbent in case of successful capture. In other words,

$$Pr(\tilde{s}_i = \emptyset | \text{capture}, \theta = b, s = b) = 1 - \frac{m}{n}$$

So, every rationally ignorant voter observing $\tilde{s}_i = \emptyset$ would update her belief in the following way:

$$Pr(\theta = g | \tilde{s}_i = \emptyset) = \frac{\gamma}{\gamma + [(1-q) + q\sigma(1 - \frac{m}{n})](1-\gamma)}$$

This happens because, when the incumbent is a bad type, the voter observes $\tilde{s}_i = \emptyset$ when there is no signal to be transmitted (this happens with probability $(1-q)$) and when there is a signal to be transmitted, but there is capture and she belongs to the fraction of voters that stays uninformed (and this event has probability $q\sigma(1 - \frac{m}{n})$). Given this,

$$Pr(\theta = g | \tilde{s}_i = \emptyset) \geq \gamma$$

is true when

$$1 \geq \sigma \left(1 - \frac{m}{n}\right)$$

So it is always optimal for the rationally ignorant voter observing $\tilde{s}_i = \emptyset$ to confirm the incumbent. Trivially, they will vote out the incumbent after $\tilde{s}_i = b$ since $Pr(\theta = g | \tilde{s}_i = b) = 0$. ■

Proof of Lemma 2.

To characterize formally the equilibrium in the game between the politician and the outlets, I follow closely the proof used in the 2001 working paper version of Besley and Prat (2006).

First of all, it is without loss of generality to order the observed vectors of transfers $\{t_i\}_{i=1,\dots,n}$ such that $t_1 \leq t_2 \leq \dots \leq t_n$. Defining $I_i = 1$ if outlet i accepts the offer and $I_i = 0$ if she rejects it, I characterize the best response recursively.

Given $I_1, I_2, \dots, I_{i-1}, I_i = 1$ if and only if

$$t_i \geq \left[\left(\frac{\alpha}{i - \sum_{j < i} I_j} + \frac{1-\alpha}{n} \right)^\delta - \left(\frac{1-\alpha}{n} \right)^\delta \right] \quad (\text{B.1})$$

Since the LHS is non-decreasing in i and the RHS is non-increasing in i , there must be a $k \in [0, n]$ such that $I_i = 1$ for every $i \geq k+1$ and $I_i = 0$ otherwise.

Note that this implies $t_k < \left[\left(\frac{\alpha}{k - \sum_{j < k} I_j} + \frac{1-\alpha}{n} \right)^\delta - \left(\frac{1-\alpha}{n} \right)^\delta \right] = \left[\left(\frac{\alpha}{k} + \frac{1-\alpha}{n} \right)^\delta - \left(\frac{1-\alpha}{n} \right)^\delta \right]$ and $t_{k+1} \geq \left[\left(\frac{\alpha}{k+1} + \frac{1-\alpha}{n} \right)^\delta - \left(\frac{1-\alpha}{n} \right)^\delta \right]$. As a consequence, an outlet $i \leq k$ does not want to deviate and accept the offer because

$$t_i \leq t_k < \left[\left(\frac{\alpha}{k} + \frac{1-\alpha}{n} \right)^\delta - \left(\frac{1-\alpha}{n} \right)^\delta \right] \leq \left[\left(\frac{\alpha}{i - \sum_{j < i} I_j} + \frac{1-\alpha}{n} \right)^\delta - \left(\frac{1-\alpha}{n} \right)^\delta \right]$$

⁴⁶Note that σ and σ' are not the same thing. The latter is the probability that the whole industry is silenced. This is relevant for the interested voters, since they all become informed if a single outlet publishes the news, hence when only partial capture is necessary, then $\sigma' = 0$. On the other hand, σ is the probability that some outlets are captured (both conditional on having a bad incumbent and $s = b$). Note that the voters are able to work out the fraction of media outlets a bad incumbent needs to capture in order to stay in power and the fact that a bad incumbent will either capture just enough outlets or none of them.

A similar type of reasoning shows that $i \geq k + 1$ does not want to deviate rejecting the offer, since

$$t_i \geq t_{k+1} \geq \left[\left(\frac{\alpha}{k+1} + \frac{1-\alpha}{n} \right)^\delta - \left(\frac{1-\alpha}{n} \right)^\delta \right] = \left[\left(\frac{\alpha}{i - \sum_{j < i} I_j} + \frac{1-\alpha}{n} \right)^\delta - \left(\frac{1-\alpha}{n} \right)^\delta \right]$$

Hence, equation (B.1) describes actual best responses. Finally, note that in equilibrium $k = \lfloor (1-\lambda)n \rfloor$, because the incumbent does not need to capture $\lfloor (1-\lambda)n \rfloor$ outlets, and hence the first $\lfloor (1-\lambda)n \rfloor$ offers can be equal to zero. Then, the lowest positive transfer must satisfy

$$t_{k+1} \geq \left[\left(\frac{\alpha}{\lfloor (1-\lambda)n \rfloor + 1} + \frac{1-\alpha}{n} \right)^\delta - \left(\frac{1-\alpha}{n} \right)^\delta \right]$$

Finally, note that a strictly positive bribe to the outlets that it is not necessary to capture is a weakly dominated strategy, hence I focus on the equilibrium where all the first t_k bribes are zero. ■

Proof of Proposition 1.

To see this, it is enough to take the limit of (6) for n going to infinity. Note, however, that it is possible to rewrite K as follows:

$$\begin{aligned} K &= \lceil \lambda n \rceil \left[\left(\frac{\alpha}{\lfloor (1-\lambda)n \rfloor + 1} + \frac{1-\alpha}{n} \right)^\delta - \left(\frac{1-\alpha}{n} \right)^\delta \right] \\ &= \frac{\lceil \lambda n \rceil}{n} \left[n \left(\frac{\alpha}{\lfloor (1-\lambda)n \rfloor + 1} + \frac{1-\alpha}{n} \right)^\delta - n \left(\frac{1-\alpha}{n} \right)^\delta \right] \\ &= \frac{\lceil \lambda n \rceil}{n} \left[n \left(\frac{\alpha}{\frac{\lfloor (1-\lambda)n \rfloor + 1}{n} + 1 - \alpha} \right)^\delta \frac{1}{n^\delta} - n (1-\alpha)^\delta \frac{1}{n^\delta} \right] \\ &= \frac{\lceil \lambda n \rceil}{n} \frac{1}{n^{\delta-1}} \left[\left(\frac{\alpha}{\frac{\lfloor (1-\lambda)n \rfloor}{n} + \frac{1}{n}} + 1 - \alpha \right)^\delta - (1-\alpha)^\delta \right] \end{aligned}$$

To calculate $\lim_{n \rightarrow \infty} K$, I use the fact that $\lim_{n \rightarrow \infty} \frac{\lceil \lambda n \rceil}{n} = \lambda$ and $\lim_{n \rightarrow \infty} \frac{\lfloor (1-\lambda)n \rfloor}{n} = 1 - \lambda$. Moreover, note that $\lim_{n \rightarrow \infty} \frac{1}{n^{\delta-1}} = 0$ when $\delta > 0$. Hence,

$$\begin{aligned} \lim_{n \rightarrow \infty} K &= \lambda 0 \left[\left(\frac{\alpha}{1-\lambda+0} + 1 - \alpha \right)^\delta - (1-\alpha)^\delta \right] \\ &= 0 \end{aligned}$$

■

Proof of Corollary 3.

The fact that media capture will be observed for sufficiently high competition follows directly from Proposition 1.

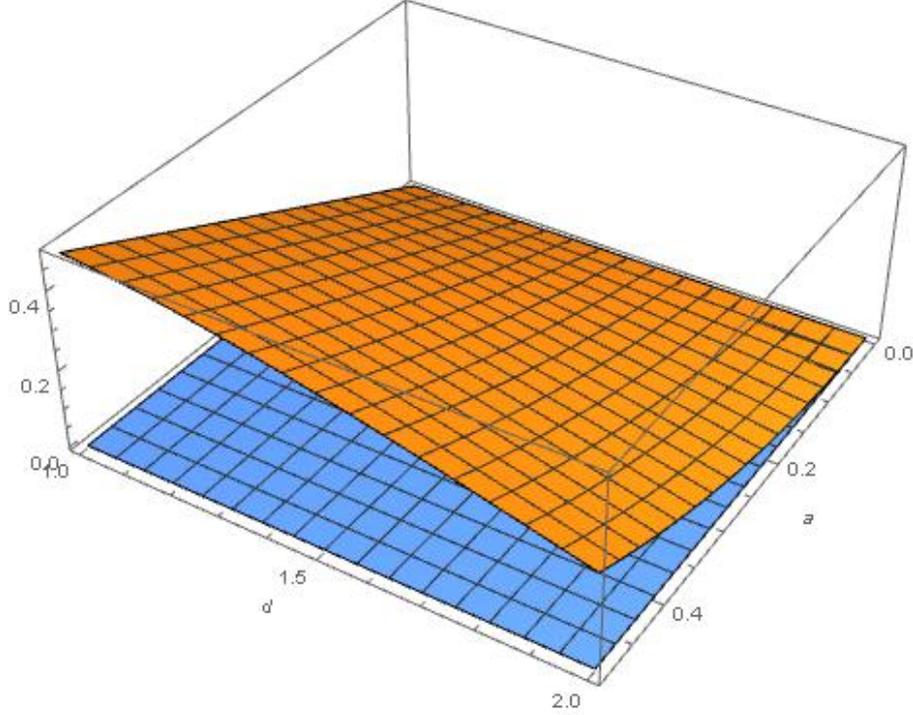
The increasing effect of n on K is guaranteed by the simulation in Figure B1, that plots $\Delta = K(n+1) - K(n)$ when $\lfloor (1-\lambda)n \rfloor = 0$ for all the relevant values of δ and α . The fact that $\Delta > 0$ in the entire space implies that K is increasing in n , at least before the competition effect starts reducing the outside option of captured outlets.

Finally, the condition on R ensures that media outlets can be captured in the case of monopoly and are free for some market configuration, hence the non-monotonicity is actually meaningful. ■

Proof of Proposition 2.

The result follows directly from Proposition 1 and equation (8). ■

Figure B1: Plot of $\Delta = K(n+2) - K(n)$ (orange plane) when $\lfloor (1-\lambda)n \rfloor = 0$ for all the relevant values of δ and α . The blue plane is the zero plane. This simulation is for $n = 1$, but nothing changes, qualitatively, for different values of n (as long as $\lfloor (1-\lambda)n \rfloor$ remains zero or constant).



Proof of Lemma 4.

If there is one free (say i) and (at least) one captured (say j) outlet, then the captured one has the incentive to undercut the free one, since rationally ignorant voters would just pick the cheapest one. Hence, outlet i can either choose a positive price and sell in equilibrium to interested readers only, or set $p_i = 0$ getting a readership $r_i = \alpha + \frac{1-\alpha}{2}$.

If the optimal price is strictly positive, it must be the $\operatorname{argmax}_{p_i} p_i (1-p_i) \alpha + \frac{1}{16c} [(1-p_i) \alpha]^2$, since she will sell to interested voters only and their demand, as a consequence of the assumption about the individual reservation price, is:

$$D(p_i) = \begin{cases} 0 & \text{if } p_i \geq 1 \\ \alpha & \text{if } p_i = 0 \\ (1-p_i) \alpha & \text{if } p_i \in (0, 1) \end{cases}$$

Note that, after few manipulations, the objective function can be written as

$$h(p_i) := \alpha \left[\left(\frac{\alpha}{16c} - 1 \right) p_i^2 - \left(\frac{\alpha}{8c} - 1 \right) p_i + \frac{\alpha}{16c} \right] \quad (\text{B.2})$$

so the function is quadratic in p_i . Moreover, note that $h(p_i) = 0 \forall p_i \geq 1$ and that $\lim_{p_i \rightarrow 0} h(p_i) = \frac{\alpha^2}{16c} < \frac{(\alpha + \frac{1-\alpha}{2})^2}{16c}$. A necessary condition for an interior solution is the concavity of (B.2), hence $\frac{\alpha}{16c} - 1 < 0$ or $c > \frac{\alpha}{16}$. However, this is not sufficient. In fact, if $\frac{\alpha}{8c} - 1 > 0$, i.e. if $c < \frac{\alpha}{8}$, then $h(p_i)$ would reach its maximum for a $p_i < 0$, which of course is ruled out by the constraints. Hence, if $\frac{\alpha}{16} < c < \frac{\alpha}{8}$, then the only admissible solution is $p_i = 0$, since the function would be strictly decreasing for $p_i \in [0, 1)$. Moreover, note that if $c < \frac{\alpha}{16}$, then $h(p_i)$ is a convex function in $p_i \geq 0$. There are two possibilities, in this case. Either the minimum of the function is in $p_i \geq 1$ or it belongs to the interval $(0, 1)$. In the first

case, $h(p_i)$ would be strictly decreasing in $(0, 1)$, and as a consequence the solution of the maximization problem is $p_i = 0$. The same is true also for the second case, since the function would be strictly convex in $[0, 1]$ and as a consequence the maximum can only be on a corner. Since $h(0) > 0 = h(1)$, then the unique solution is $p_i = 0$.

Finally, consider the case of $n = 1$. In case of capture, her objective function will be

$$h'(p_i) = p_i(1 - p_i)(1 - \alpha) + \frac{1}{16c} [(1 - p_i)(1 - \alpha)]^2$$

and, for the same argument as above, $p_i^* = 0$ if $c \leq \frac{1-\alpha}{8}$ that is greater than $\frac{\alpha}{8}$. If she publishes the signal, her objective function is

$$h''(p_i) = p_i(1 - p_i) + \frac{1}{16c} [(1 - p_i)]^2$$

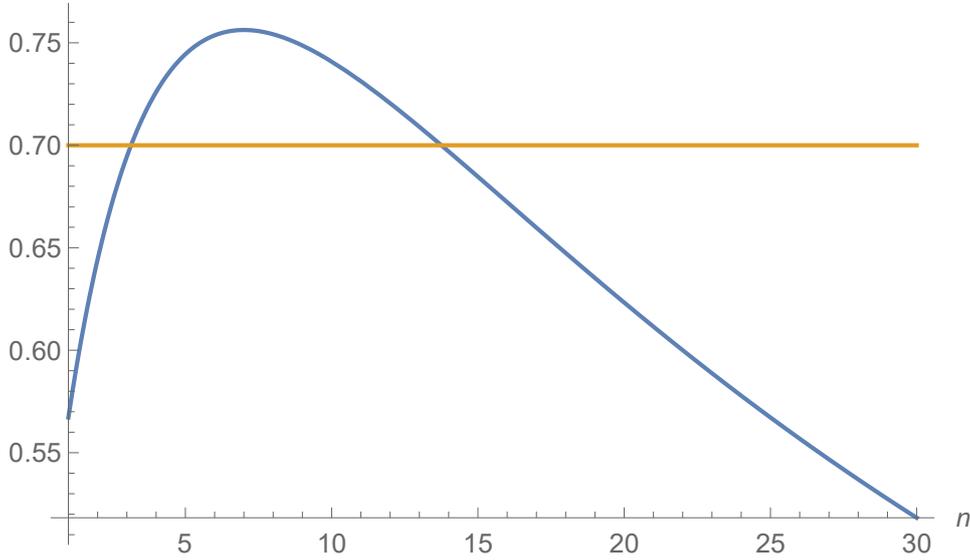
and, for the same argument as above, $p_i^* = 0$ if $c \leq \frac{1}{8}$ that is greater than $\frac{\alpha}{8}$. Hence, the assumption of $c \leq \frac{\alpha}{8}$ ensures that the optimal price is 0 in every possible market configuration and irrespective of the capturing decision. ■

Appendix C n as a real number

Figure C1 shows what happens if n is treated as a real number, rather than as a natural one. This is obviously an approximation, since n is the number of outlets and hence it is discrete by nature. However, it provides a different way of showing the non monotonicity of K in n . It increases as long as increasing the number of outlets dominates the effect of reducing their outside options, and then it starts decreasing converging to 0 in the limit.

As a consequence, media capture occurs when there is a too small or a too large a number of outlets.

Figure C1: Plot of K (blue) and R (orange) as a function of n setting $\delta = 2$, $\alpha = 0.45$ and $R = 0.7$.



Appendix D Data sources

Variables used in the empirical analysis and their sources:

Media freedom score: 41 minus the Environment B score from the Freedom of the Press (Freedom House);

EU: dummy =1 if a country belongs to the European Union on the 25 August 2016;

DTTlaunch: year in which the country started the DTT adoption process. Source: Yearbook 2015;

ASO: year in which the country completed the DTT switch over process. Source: Yearbook 2015;

DTTpen: primary DTT receiver / number of households *100, using country specific tables from 2006-2015 Yearbooks. 0 for years before the DTTlaunch year. Note: no country specific tables for 2014 Yearbook, so I use other data (in practice, DTTraw2013 and HH2013) to work that out. For earlier Yearbooks (2003-2005), I calculated DTTpen using the table “digital TV reception in Europe”, vol 2, divided by the number of households, with linear interpolation when necessary and all rounded to the first decimal number;

HH: number of households in thousands, from country specific tables, 2004-2015 Yearbooks. Note: no country specific tables for 2014 Yearbook, so I use the average between YB2013 and YB2015 households to compute HH in 2013 (i.e. linear interpolation);

DTTraw: number of DTT households in thousands from country specific tables and using always the most recent observation available (i.e. taking them from the “market trends” graphs for all the previous years). Note that there are no “market trends” country tables for YB2014, so I use the YB2013 market trend graph for DTTraw 2009. Again, =0 before DTT launch year. For DTTraw 2001-2003 I used the tables T.7.12 (YB2003, vol 2 pag 48) and T.7.6 (YB2003, vol. 2, pag. 42);

Penhh: measure of DTT penetration, equal to dttraw/hh*100. In practice, it calculates the DTT penetration using only the most recent observation available;

GDP per capita: GDP per capita in PPP in current international dollars, from UNESCO Institute for Statistics, demographic and socio economic indicators. Used in logs in the regression. Available at: <http://data.uis.unesco.org/Index.aspx?queryid=234>;

Corruption: Corruption Perception Index from Transparency International. Available at <http://www.transparency.org> (recent years) and from Teorell, J. et al (2015) (older observations);

GDP per capita: GDP per capita in PPP from the UNESCO Institute for Statistics database;

Election: dummy =1 if election year in the lower chamber or in the national assembly. Data collected manually from electionguide.org, provided by the International Foundation for Electoral Systems (IFES).

Herfindahl Audience: Herfindahl index calculated using the annual average of the daily audience market share of the top eight TV channels per country per year. I take the data from the most recent yearbook where available. In particular, Aud1, Aud2 etc denote the yearly average daily audience market share of the highest, second ... eight channel in term of audience in that year (hence, the identity of the channel may change). I use only channels listed in the table. Hence, if less than 8 channels have a listed market share, I put a 0 on the remaining channels (irrespective of whether the row “Others” is different from zero). Most of the observations for Belgium are missed, since data are divided between French and Flemish community. Luxembourg and Malta are also coded differently and hence missed.

TV Advert: total expenditures in television advertising in millions of Euro (when not available directly, I use the expenditures in dollars and convert them to Euro using the year-specific average exchange rate).

TerrPen97: terrestrial television penetration (as a fraction of TV household) in 1997. Coded using table T.2.16 of the 1998 EAO Statistical Yearbook.

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