Online Appendix to the Paper: Media Competition, Information Provision and Political Participation: Evidence from French Local Newspapers and Elections, 1944-2014*

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A Data sources

A.1 Newspaper data

A.1.1 Number of newspapers

To determine for each year between 1944 and 2014 the number of newspapers present in each French "département"/county, I use various sources of information that I digitize and merge.

For the **1944-1958** period, I use as a first source of information Guillauma (1995) who lists all the political and general information newspapers that have been published in France over the period. I extract from this list all the local daily newspapers. I check the consistency of Guillauma's data using three other sources. First, the *Cahiers de L'Institut Français de Presse*, a standard publication from an important French institute of press studies. Second, data from Ministry of Information reports on the state of French newspapers, which I collect in the French national archives. Third, the *Annuaires de la Presse et de la Publicité*, an annual directory of French newspapers. Newspaper directories are standard sources for historical research on French newspapers, but have never been digitized before. They originated as a guide to potential advertisers and were intended to be complete.

For the **1959-2006** period, I use the *Annuaires de la Presse et de la Publicité* as the first source of information.

For the **2007-2014** period, I use a more recent directory of newspapers (*Tarif média. La première source d'information sur les médias*).

I always check the consistency of the data on the number of newspapers present in each French county by using circulation data (see below). I also check that this data is consistent with the information provided in history books on French newspapers (Kayser, 1963; Derieux and Texier, 1974; Guillauma, 1988; Floch and Sonnac, 2000; Albert, 2004; Martin, 2005; Eveno, 2008).

A.1.2 Newspaper circulation

I collect information on aggregate newspaper circulation at the newspaper level; and on newspaper circulation in each county for newspapers circulating across nearby counties.

Aggregate circulation For the period **1944-1959**, newspaper circulation data comes first from Albert (1989) which is a standard source of historical research on this topic. I digitize this data. I check its consistency and complete it using archive data from the French Ministry of Information's reports on the state of French newspapers. I used three reports:

1. *"Tirage des quotidiens de province au printemps 1945"*(local newspapers circulation during the spring of 1945). These tables are from a file called "Local press, Political and

news publications". They originate from the French Ministry of Informations regional delegations in major cities and date from April 1945.

2. "*Tirage des quotidiens de province de 1945 à 1952"* (local newspaper circulation between 1945 and 1952). These tables provide for each city and year the average circulation of all the local newspapers published in the city.

3. "*Tirage des quotidiens de province de 1951 à 1958"* (local newspaper circulation between 1951 and 1959).

For the period **1960-1974**, I use the French Ministry of Information's non-publicly available records in the National archives. Newspapers were asked by the Ministry of Information to report annually on revenues, expenses and circulation. I collect and digitize data by having direct access to their responses to these queries.

For the **1975-1978** period, I use data in paper format from "Proscop Media"[1] reports that I digitize. These reports are available in the French National Library.

Finally, for the period **1979-2014**, newspaper circulation data is available in digitized format from the OJD, which is the French press observatory whose aim is to certify circulation data.[2]

Circulation data with geographical dispersion For the **1944-1958** period, circulation data with geographical dispersion is from the French Ministry of Information's reports described above.

For the **1959-1988** period, circulation data with geographical dispersion in paper format is from "Opération Vérité", an annual survey on local newspaper circulation at the city level conducted by the *Centre d'Etude des Supports de Publicité* (CESP). The CESP is a French interprofessionnal association gathering all of the actors of the advertising market concerned with the study of the media audience (advertisers, agencies and councils media, central merchandising of space, advertising media and controls). Figure A.1 provides an example of this data.

I check the consistency of this data using data on geographical dispersion from Proscop Media for 1968-1970, 1973, 1975-1978, 1980, 1981, 1983, 1985-1987, 1989, 1991 and 1996.

For the **1990-2014** period, circulation data with geographical dispersion is available in digitized format from the OJD.

[1] The Proscop Institute is a firm specialized in market research and marketing and geostrategic consulting.
[2] http://www.ojd.com/

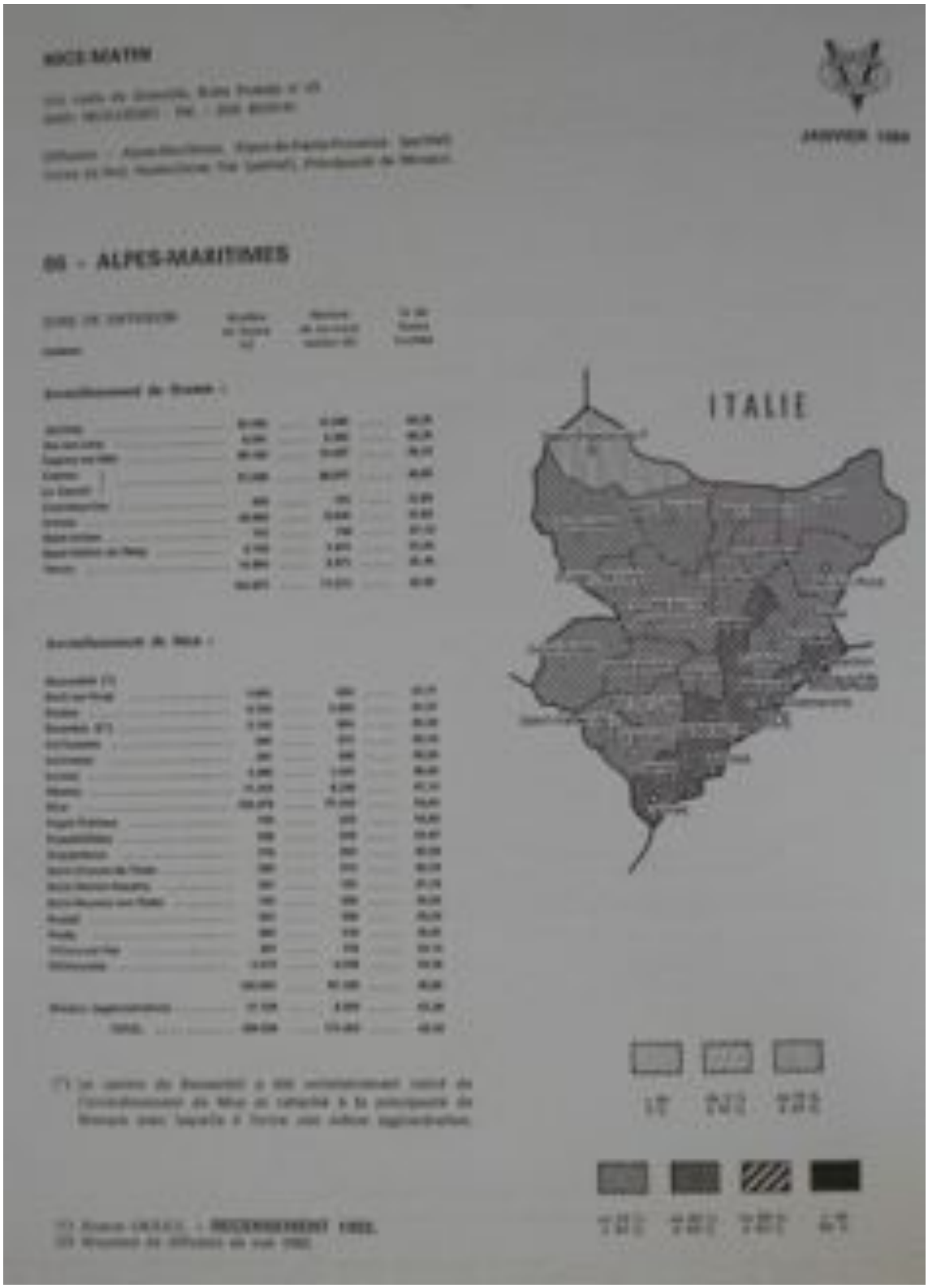


Figure A.1: Example showing the "Opération Vérité" circulation data in paper format

A.1.3 Newspaper revenues and expenditures

I collect annually for local daily newspapers between 1960 and 2014 a number of important economic indicators, namely sales, profits, value-added, operating expenses (payroll, inputs, taxes), operating revenues (revenues from sales and revenues from advertising), and the number of employees.

For the **1960-1974** period, the data is from the French Ministry of Information's non-publicly available records in the National archives described above (newspapers were asked by the Ministry of Information to report annually on revenues, expenses and circulation). Figure A.2 provides an example of this data.

For the **1984-2014** period, the data (in digitized format) is from the Enterprise Survey (*Enquêtes Annuelles d'Entreprise* – EAE) conducted by the French National Institute of Statistics (INSEE) and the files constructed for the tax regime (*Bénéfice Réel Normal* – BRN) by the Finance Ministry (*Direction Générale des Impôts* – DGI). I identify newspapers in the dataset using the French registry of establishments and enterprises ("Sirene"). For the newspapers not covered in the Enterprise Survey, I use information from the Bureau van Dijk's websites (in particular ORBIS).

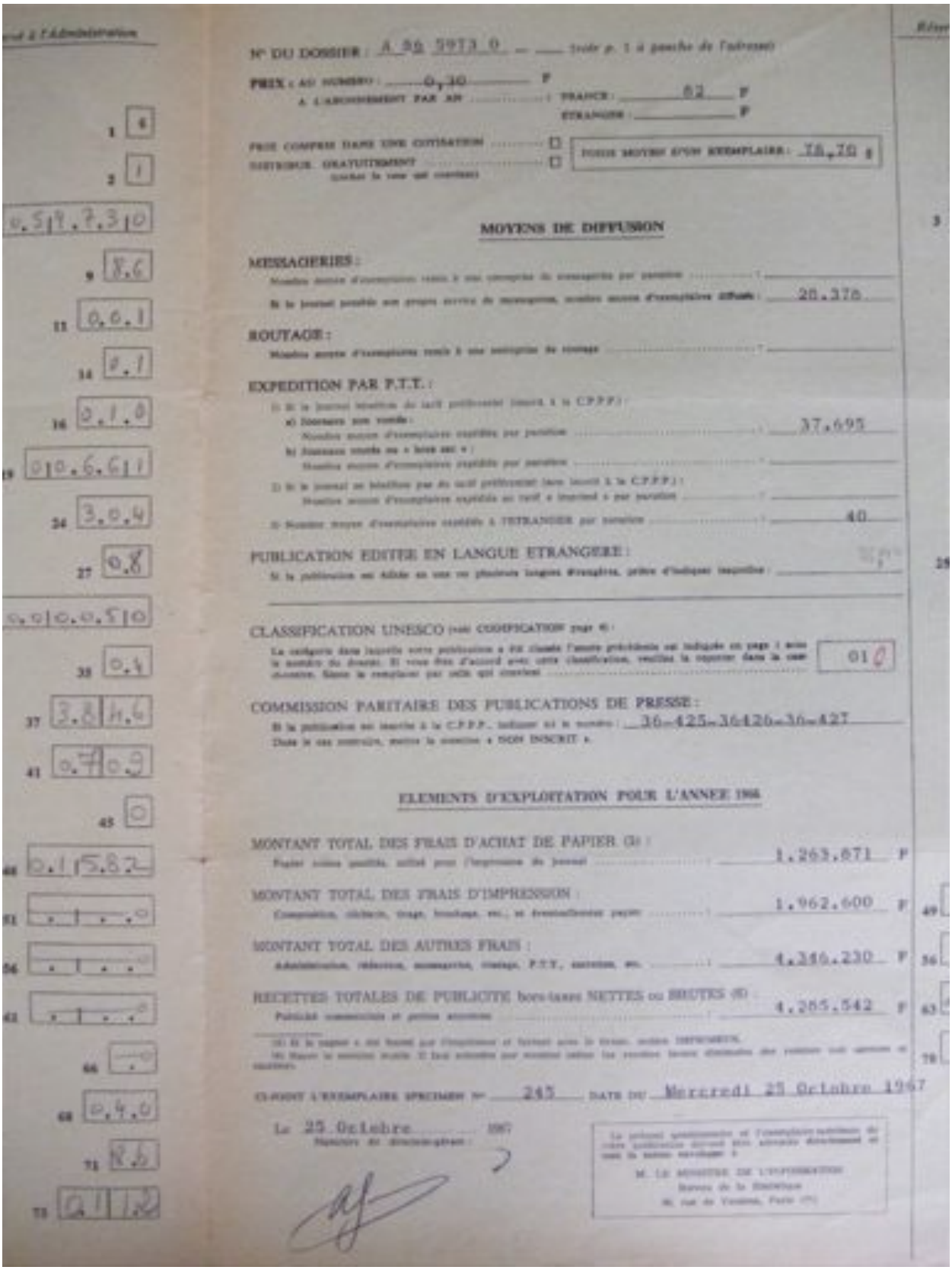
A.1.4 Newspaper newsroom

I obtain exclusive access to the non-publicly available CCIJP paper data disaggregated at the individual level. This data contains information on the age, education, career and annual compensation of all French journalists since 1944. (Although the CCIJP met for the first time in 1936, the WWII interruption makes it difficult to exploit the pre-1944 data.)

More precisely, I exploit two different data sources: first, the individual files that allow me to get information on the journalists' characteristics (e.g. the journalists were required to send a detailed CV when they applied for the first time), and then the annual collective slips that provide me with annual information at the media outlet level on the qualification and compensation of each of the journalist working for the media outlet. Regarding journalists' compensation, the information reported in the CCIJP data is the monthly gross salary, i.e. before social security contributions (*"salaire mensuel brut, c'est-à-dire, avant retenue de Sécurité sociale et Caisses de retraites"*).

This information also allows me to reconstruct the career path of all the journalists. Each journalist can indeed be uniquely identified by her press card number that she obtains when she applies for the first time.

This data is from Cagé (2016). In this paper, I focus on the local daily newspapers and determine for each newspaper on an annual basis the number of journalists, as well as the journalists' monthly gross salary since 1960.



N° DU DOSSIER : A 96 5973 0

PRIX : AU NUMERO : 0,30 F

A L'ABONNEMENT PAR AN : FRANCE : 62 F

ETRANGER : F

PRIX COMPRIS DANS UNE COTISATION

DISTRIBUE GRATUITEMENT

TOTAL MOYEN D'UN EXEMPLAIRE : 78,70

MOYENS DE DIFFUSION

MESSAGERIES :

Si le journal possède son propre service de messagerie, nombre moyen d'exemplaires diffusés : 28.378

ROUTAGE :

EXPEDITION PAR P.T.T. :

a) Journaux non vendus :

37.695

40

PUBLICATION EDITEE EN LANGUE ETRANGERE :

CLASSIFICATION UNESCO (voir CODIFICATION page 4) :

010

COMMISSION PARITAIRE DES PUBLICATIONS DE PRESSE :

Si la publication est inscrite à la C.P.P.P., indiquer ici le numéro : 36-425-36426-36-427

ELEMENTS D'EXPLOITATION POUR L'ANNEE 1966

MONTANT TOTAL DES FRAIS D'ACHAT DE PAPIER (1) : 1.263.671 F

MONTANT TOTAL DES FRAIS D'IMPRESSION : 1.962.600 F

MONTANT TOTAL DES AUTRES FRAIS : 4.346.230 F

RECETTES TOTALES DE PUBLICITE hors-taxes NETTES ou BRUTES (2) : 4.265.542 F

JOINDRE L'EXEMPLAIRE SPECIMEN N° 245 DATE DU Mercredi 25 Octobre 1967

Le 25 Octobre 1967

Signature du déclarant :

M. LE MINISTRE DE L'INFORMATION

Bureau de la Statistique

Figure A.2: Example showing the expenses and revenues data in paper format

A.1.5 Newspapers' content

Front pages Newspapers' front pages come from the SPQR website which publishes every day the "front pages of the day" of 54 local daily newspapers.[3] I download these front pages in ".pdf" format using an automated script, convert ".pdf" files in ".txt" files using an OCR software and count the number of words on each frontage.

Entire content I collect data on the entire daily content of each newspaper issue using an automated script to retrieve for each day all the articles published in the issue. I download the data from two different websites which aggregate content from newspapers (Factiva[4] and Lexis-Nexis[5]).

Hard news and soft news To divide newspaper content into hard news and soft news, I use the information provided by the website Lexis-Nexis. When I retrieve the entire set of newspaper issues, I also retrieve all the metadata (tag) associated with each article on Lexis-Nexis (title, topic and subject). Figure A.3 provides an example of the format of the information I obtain from Lexis-Nexis. This example covers the May 8th, 2011 issue of the newspaper *Berry Républicain*. In this issue, there are 114 articles. The length of the article in this example is 330 words. The topic is sport; I classify this article as soft news.

Combining information from the title, topic and subject, I determine the category of each article. I create 13 different categories: agriculture, culture, economics, education, environment, health, international affairs, leisure activities, movies, "news in brief" (*faits divers*), politics, religion and sports.

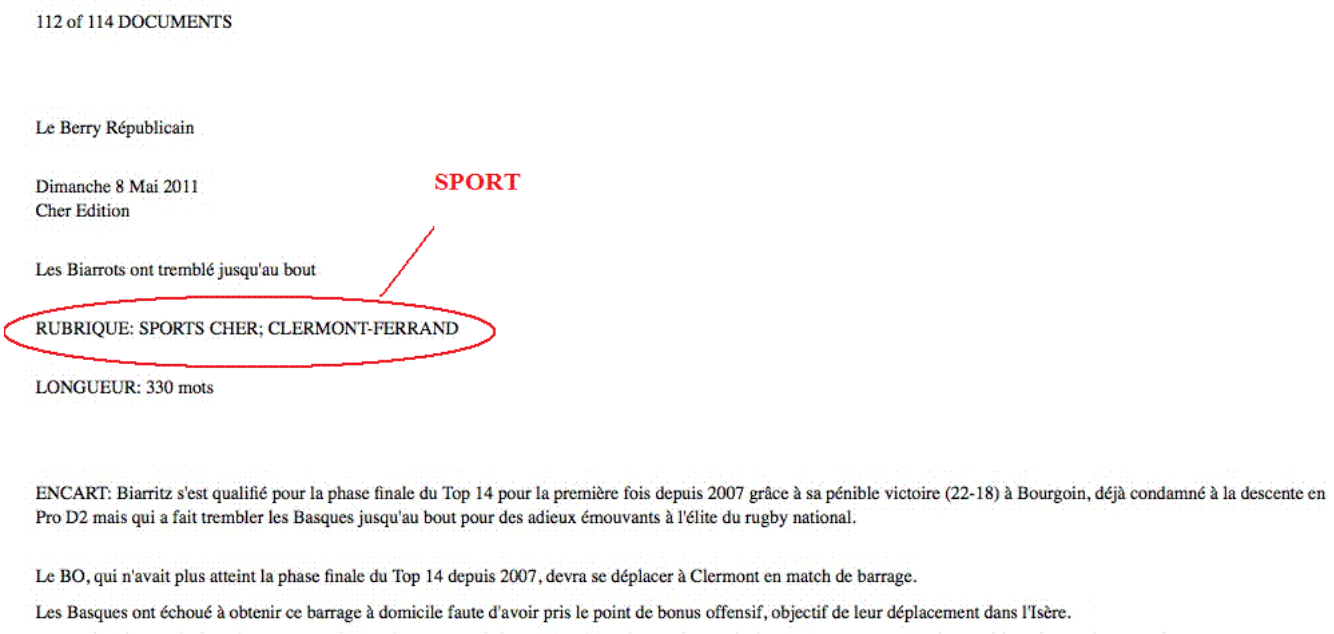
I define as **hard news** the articles on agriculture, economics, education, environment, international affairs or politics.

I define as **soft news** the articles on culture, health, leisure activities, movies, "news in brief", religion or sports.

[3] http://www.pqr.fr/editeurs/les-unes-du-jour/

[4] The data from Factiva covers 18 newspapers (beginning date in parentheses): *Berry Républicain* (2010-04-01); *Charente Libre* (2005-05-06); *Centre Presse Aveyron* (2006-09-01); *Est Républicain* (2008-02-27); *Indépendant* (2006-09-01); *Maine Libre* (2011-03-04);*Midi Libre* (2006-09-01); *Montagne* (2010-04-01); *Nouvelle République* (2011-01-12);*Ouest France*(2002-07-17); *Parisien* (2005-06-15); *Populaire du Centre* (2010-04-01);*Presse Océan* (2008-10-01); *Progrès* (2003-10-23); *République du Centre* (2011-05-02); *Sud Ouest* (2003-09-22); *Voix du Nord* (2011-02-01); *Yonne Républicaine* (2010-04-01).

[5] The data from Lexis-Nexis covers 21 newspapers: *Berry Républicain* (2010-03-22); *Centre Presse Aveyron* (2010-03-22); *Est Républicain* (2008-02-07); *Havre Libre* (2008-01-05); *Havre Presse* (2008-01-07); *Indépendant* (2007-05-11); *Journal Du Centre* (2010-03-22); *Maine Libre* (2011-09-05); *Midi Libre* (2006-11-01); *Montagne* (2010-03-22); *Nouvelle République* (2004-03-23); *Ouest France*(2006-04-20); *Paris Normandie* (2004-09-02); *Parisien* (2006-12-20); *Populaire du Centre* (2010-03-22); *Presse Océan* (2010-12-08); *Progrès de Fcamp* (2008-01-022); *Sud Ouest* (1994-05-07); *Tégramme (2002-02-01)*; *Voix du Nord* (2009-09-14); *Yonne Républicaine* (2010-03-22).


112 of 114 DOCUMENTS

Le Berry Républicain

Dimanche 8 Mai 2011
Cher Edition

SPORT

Les Biarrots ont tremblé jusqu'au bout

RUBRIQUE: SPORTS CHER; CLERMONT-FERRAND

LONGUEUR: 330 mots

ENCART: Biarritz s'est qualifié pour la phase finale du Top 14 pour la première fois depuis 2007 grâce à sa pénible victoire (22-18) à Bourgoin, déjà condamné à la descente en Pro D2 mais qui a fait trembler les Basques jusqu'au bout pour des adieux émouvants à l'élite du rugby national.

Le BO, qui n'avait plus atteint la phase finale du Top 14 depuis 2007, devra se déplacer à Clermont en match de barrage.

Les Basques ont échoué à obtenir ce barrage à domicile faute d'avoir pris le point de bonus offensif, objectif de leur déplacement dans l'Isère.

Figure A.3: Example showing the format of the Lexis-Nexis data

Table A.1: French local juridictions: Descriptive statistics (2008)

	Région *State*	Département *County*	Canton	Cities	Cities over 9,000 inhabitants
Number	22	96	3,883	36,570	1,011
Average population (nb)	2,839,500	650,719	16,088	1,722	61,789
Average area (km^2)	24,865	5,698	141	14.88	541

Sources: French national institute for statistics (INSEE).

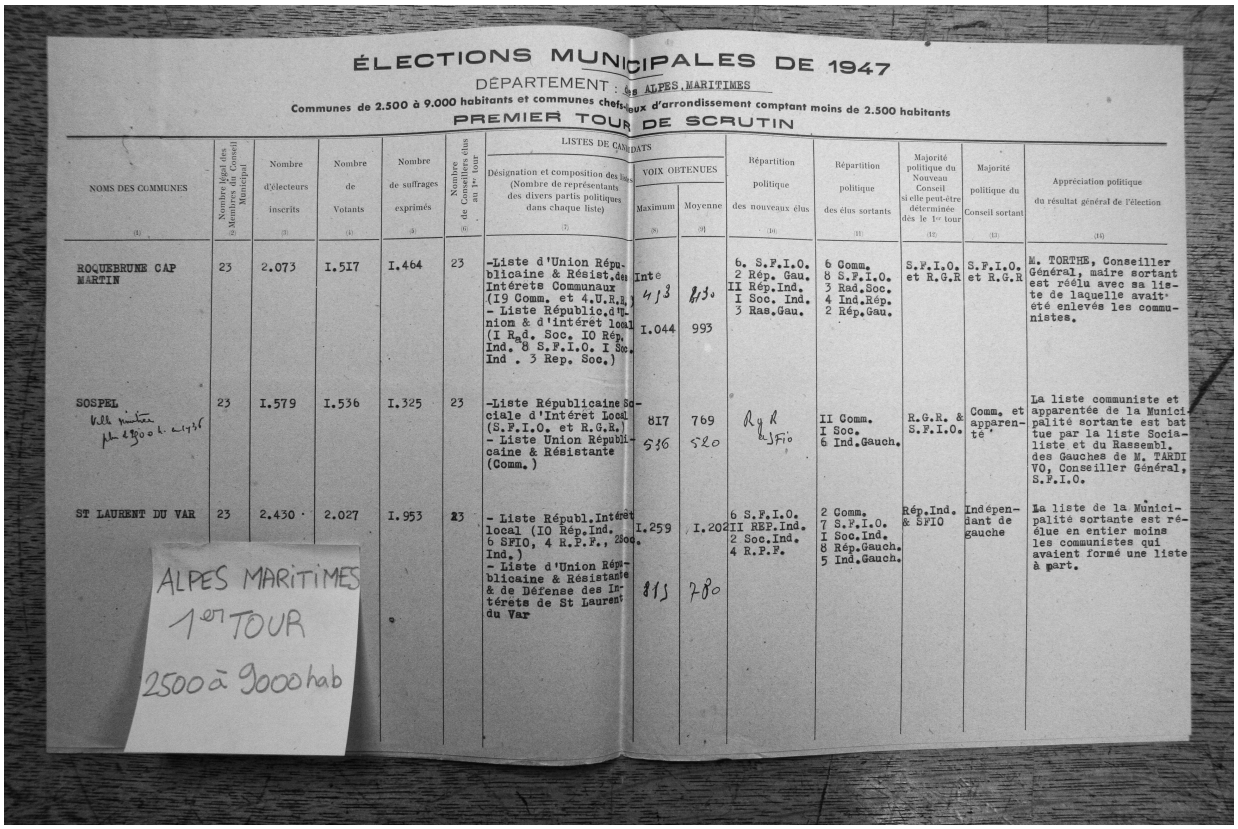
A.2 French voting system, electoral data and demographic controls

Local jurisdictions France is organized into six different levels of local jurisdictions: (i) *régions* (states); (ii) *départements* (counties); (iii) arrondissements; (iv) cantons (administrative districts); (v) *"intercommunalités"* (intercommunal consortium); and (vi) cities. Four levels correspond to electoral circumscriptions: (i) "régions"/states (regional elections); (ii) "départements"/counties (legislative elections); (iii) cantons (cantonal elections); and (iv) cities (mayoral elections).

A "département"/county is a French administrative division. There are 101 French counties. The median land area of a county is 2,303 sq mi, which is slightly more than three-and-half times the median land area of a county of the United States. There are 36,570 cities in metropolitan France. There are 2,282 cities with more than 3,500 inhabitants outside the area of Paris. Table A.1 presents descriptive statistics on local jurisdictions.

Voting system The French voting system for local (mayoral) elections is the two-round list system with proportional representation (*"scrutin de liste à deux tours avec représentation proportionnelle"*). For cities with more than 3,500 inhabitants, which are the focus of this paper, the system functions as follows: if a list obtains the absolute majority in the first round, then a number of seats equal to half of the available seats is attributed to this list. The other seats are shared between all the other lists following proportional representation with the highest averages method. If no list obtains the absolute majority in the first round, then a second round takes place. The only lists that can take part in this round are those that obtained more than 10% of the recorded votes in the first round. A number of seats equal to half of the available seats is attributed to the list which obtains most votes and the other seats are shared between all the other lists following the proportional representation with the highest averages method.

Mayoral elections take place in France every six years.



ÉLECTIONS MUNICIPALES DE 1947

DÉPARTEMENT : des ALPES-MARITIMES

Communes de 2.500 à 9.000 habitants et communes chefs-lieux d'arrondissement comptant moins de 2.500 habitants

PREMIER TOUR DE SCRUTIN

NOMS DES COMMUNES	Nombre légal des Membres du Conseil Municipal	Nombre d'électeurs inscrits	Nombre de Votants	Nombre de suffrages exprimés	Nombre de Conseillers élus au 1er tour	LISTES DE CANDIDATS — Désignation et composition des listes (Nombre de représentants des divers partis politiques dans chaque liste)	VOIX OBTENUES — Maximum	VOIX OBTENUES — Moyenne	Répartition politique des nouveaux élus	Répartition politique des élus sortants	Majorité politique du Nouveau Conseil si elle peut être déterminée dès le 1er tour	Majorité politique du Conseil sortant	Appréciation politique du résultat général de l'élection
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
ROQUEBRUNE CAP MARTIN	23	2.073	I.517	I.464	23	-Liste d'Union Républicaine & Résist. des Intérets Communaux (I9 Comm. et 4.U.R.R.) - Liste Républic. d'Union & d'intérêt local (I Rad. Soc. IO Rép. Ind. 8 S.F.I.O. I Soc. Ind . 3 Rep. Soc.)	Inte I.044	413 993	6. S.F.I.O. 2 Rép. Gau. II Rép. Ind. I Soc. Ind. 3 Ras.Gau.	6 Comm. 8 S.F.I.O. 3 Rad.Soc. 4 Ind.Rép. 2 Rép.Gau.	S.F.I.O. et R.G.R	S.F.I.O. et R.G.R	M. TORTHE, Conseiller Général, maire sortant est réélu avec sa liste de laquelle avait été enlevés les communistes.
SOSPEL Ville nouvelle plus de 2.500 h. en 1936	23	I.579	I.536	I.325	23	-Liste Républicaine Sociale d'Intéret Local (S.F.I.O. et R.G.R.) - Liste Union Républicaine & Résistante (Comm.)	817 536	769 520	R. & R. S.F.I.O.	II Comm. I Soc. 6 Ind.Gauch.	R.G.R. & S.F.I.O.	Comm. et apparenté	La liste communiste et apparentée de la Municipalité sortante est battue par la liste Socialiste et du Rassembl. des Gauches de M. TARDIVO, Conseiller Général, S.F.I.O.
ST LAURENT DU VAR	23	2.430	2.027	I.953	23	- Liste Républ. Intérêt local (IO Rép. Ind. 6 SFIO, 4 R.P.F., 2 Soc. Ind.) - Liste d'Union Républicaine & Résistante & de Défense des Intérets de St Laurent du Var	I.259 815	I.202 780	6 S.F.I.O. II REP. Ind. 2 Soc. Ind. 4 R.P.F.	2 Comm. 7 S.F.I.O. I Soc. Ind. 8 Rép. Gauch. 5 Ind. Gauch.	Rép. Ind. & SFIO	Indépendant de gauche	La liste de la Municipalité sortante est réélue en entier moins les communistes qui avaient formé une liste à part.

ALPES MARITIMES
1er TOUR
2500 à 9000 hab

Figure A.4: Example showing the turnout data in paper format

Electoral data Between 1947 and 2014, 12 local elections took place: in 1947, 1953, 1959, 1965, 1971, 1977, 1983, 1989, 1995, 2001, 2008 and 2014.

Before 1983, data on French mayoral elections had never been digitized. I construct the first electronically available dataset on French local elections results at the city level between 1945 and 1982, using official data sources in paper format.

For the **1947 and 1953 elections**, I digitize data from the National archives in Paris (available in various boxes beginning with shelf mark "F/1cII/"). The data covers all the cities with more than 2,500 inhabitants. Figure A.4 shows an example of this electoral data (for the 1947 election).

For the **1959, 1965, 1971, and 1977 elections**, I digitize data from the newspaper *Le Monde*. This information is available only for cities with more than 9,000 inhabitants. I supplement the 1959 data for cities with under 9,000 inhabitants using data from the National archives.

For the **1983, 1989, 1995 and 2001 elections**, I use the data from the *Centre de Données Socio-Politiques* (CDSP) of Science-Po Paris for all cities with over 3,000 inhabitants.

Finally, for the **2008 and 2014 elections**, the data is available in digitized format from the Interior ministry for all the cities with over 3,500 inhabitants.

Demographic data City-level demographic data from the French census is available in electronic format from the French national institute for statistics (INSEE) website for 1968, 1975, 1982, 1990, 1999, 2009, 2010 and 2013. The 1962 census data is from the *Centre Maurice Halbwachs*.[6]

First, the census provides information on the total population, and on the share of the population by age group.

Second, the census provides information on the share of the population by occupation. Individuals (the working population between 15 and 64 year old) are classified into 6 different socio-economic groups:

1. Farmers;
2. Artisans, shopkeepers and company managers (*"artisans-commercants-chefs d'entreprises"*);
3. Senior executives and knowledge workers (*"cadres et professions intellectuelles supérieures"*);
4. Intermediate occupations (*"professions intermédiaires"*);
5. Employees;
6. Laborers.

Third, the census provides information on the share of the population by degree. Individuals above 15 years old are classified into 6 different education degrees:

1. No diploma;
2. "Certificat d'études primaires" which is a diploma awarded at the end of elementary primary education in France (which was officially discontinued in 1989);
3. "BEPC" or "brevet" which is a diploma given to French pupils at the end of the "3ème" (which corresponds to year 10 or ninth grade);
4. "Certificat d'aptitude professionnelle" (CAP) or "brevet d'études professionnelles" (BEP) which are secondary and vocational education diplomas;

[6] http://www.cmh.ens.fr/greco/adisp.php

5. "Baccalauréat" which is an academic qualification taken at the end of the lycée (secondary education) and the main diploma required to pursue university studies;

6. Higher (post-secondary) education.

I digitize data for the 1936, 1946 (INSEE, 1947) an 1954 (INSEE, 1958) censuses from original publications by the French national institute for statistics. However, I only obtain information on the size of the population and the share of the population by age group for this time period.

B The local daily newspaper industry in France

B.1 An overview the evolution of the local daily newspaper industry

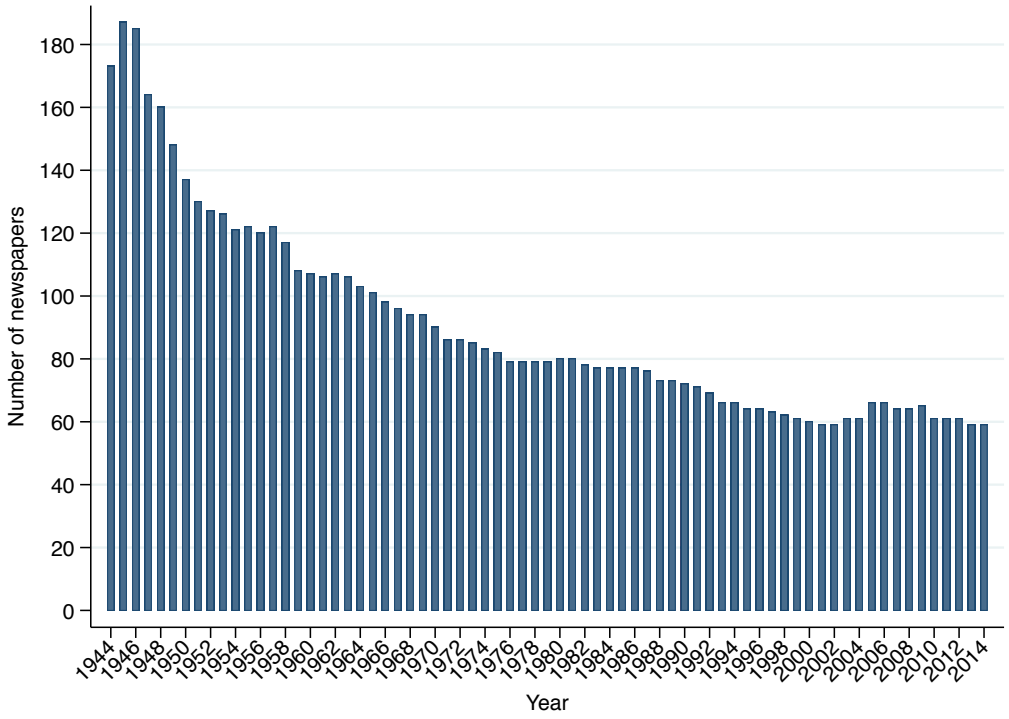
In this section, I give an overview of my data and of the evolution of the local daily newspaper industry in France between 1944 and 2014.

Figure B.1 shows the total number of newspapers by year in France. This number decreases sharply between 1944 and 2014. There are 172 local daily newspapers in 1944 and 57 in 2014.

Circulation across nearby counties Despite this decrease, it is important to underline that between 1944 and 2014 there are nearly as many entries than exits. This comes from the fact that many newspapers circulate across nearby counties. In Figure B.2 I report the number (and the share) of newspapers circulating in more than one county. In 1950 (respectively 2000), 41 (27) newspapers over a total of 136 (60) are circulating in more than one county. This represents respectively 30% and 45% of the total number of newspapers in France at the time. On average, these newspapers circulate across 4 counties in 1950 (3.7 in 2000) as shown in Figure B.3.

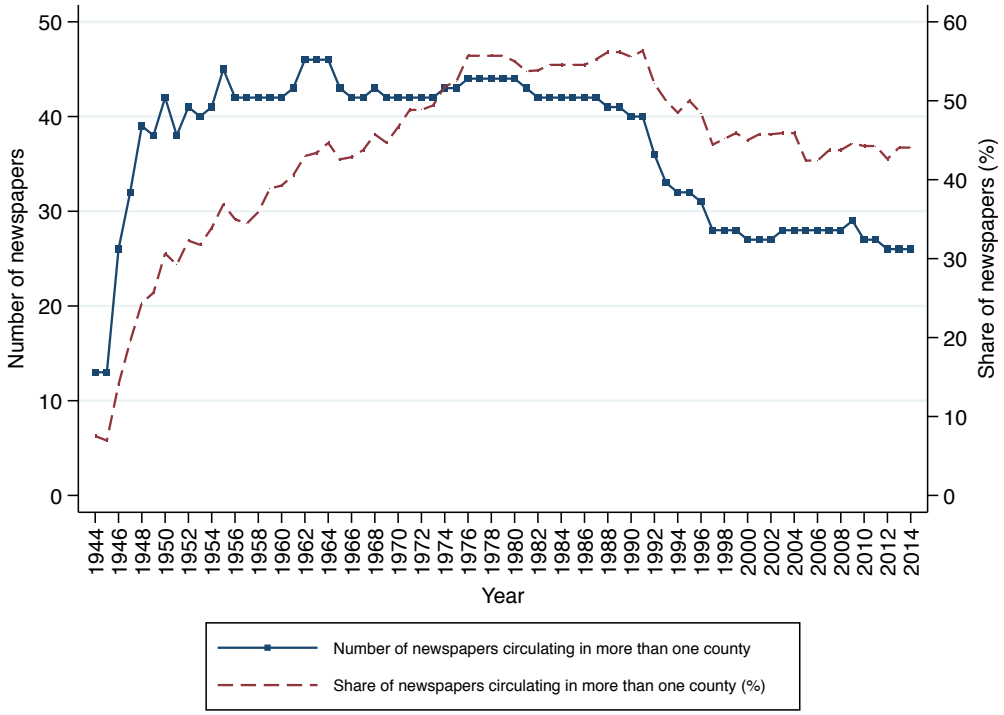
Newspaper-county pairs Entries can thus come either from the "creation" of new newspapers, or from the expansion of existing newspapers in nearby counties. Figure B.4 shows the total number of newspaper-county pairs by year in France. This number decreases between 1944 and 2014 but is still above 150.

Over this period, I observe a total of 356 county-years with net entry and 355 county-years with net exit. The high number of entries/exits between 1944 and 1955 comes from the 1944-1945 tabula rasa of the past in the newspaper industry described in more details in the article (Section 3.1). Between 1955 and 2014, there are 96 county-years with net entry and 228 county-years with net exit.



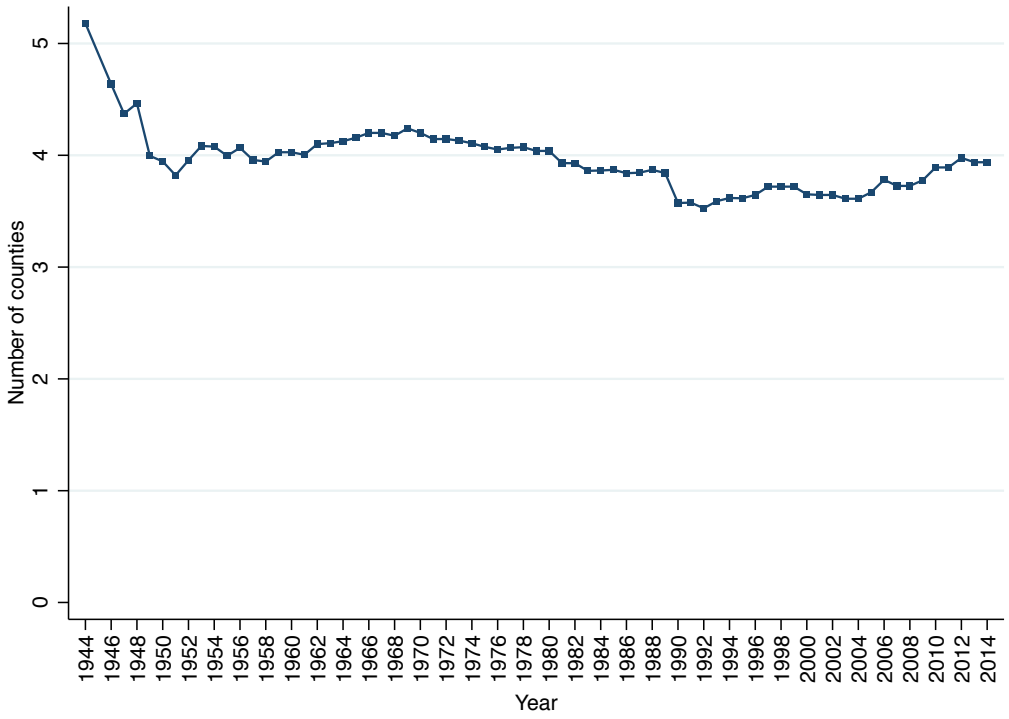
Notes: The figure plots the total number of local daily newspapers circulating in France between 1944 and 2014 on an annual basis. The data was constructed by the author using various sources described in details in this Appendix.

Figure B.1: Total number of local daily newspapers by year in France



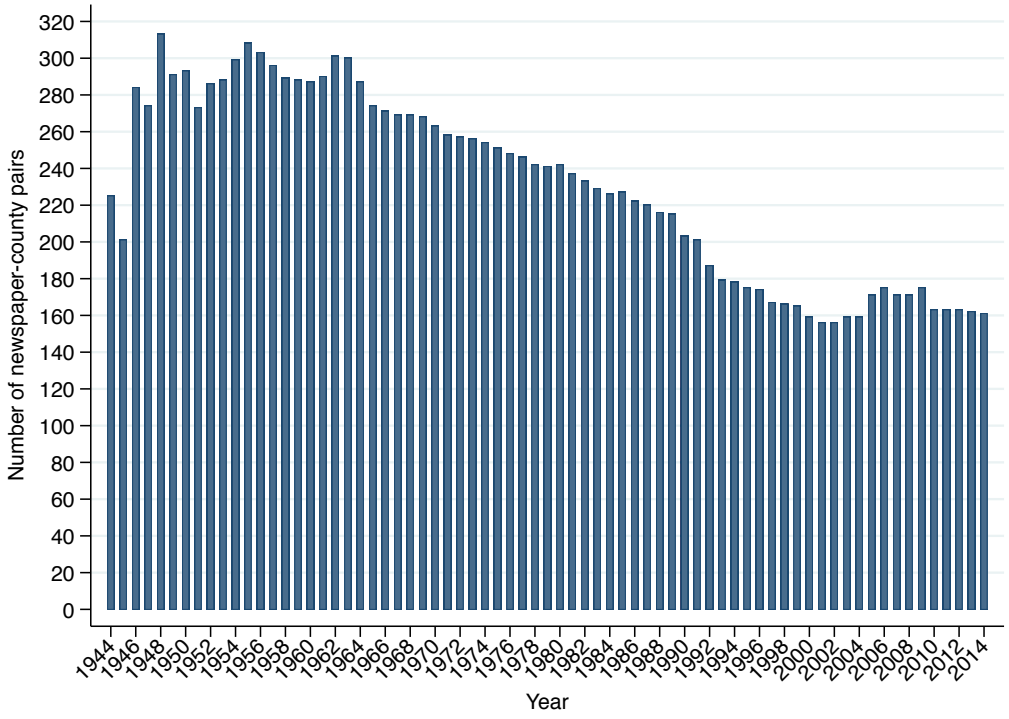
Notes: The figure plots the total number (blue line with squares) and share (red dashed line with points) of local daily newspapers circulating in more than one county between 1944 and 2014 on an annual basis. The data was constructed by the author using various sources described in details in this Appendix.

Figure B.2: Newspapers circulating in more than one county



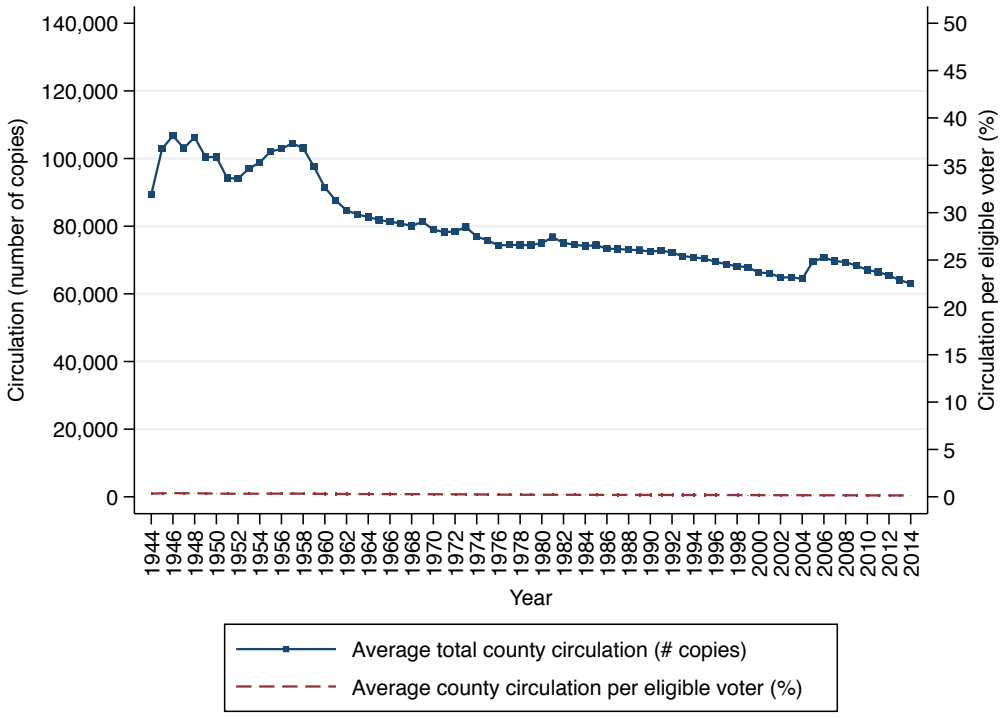
Notes: The figure plots on an annual basis the average number of counties in which newspapers circulating in more than one county circulate. The data was constructed by the author using various sources described in details in this Appendix.

Figure B.3: Average number of counties across which newspapers circulating in more than one county circulate



Notes: The figure plots the total number of newspaper-county pairs by year in France from 1944 to 2014. The data was constructed by the author using various sources described in details in this Appendix.

Figure B.4: Total number of newspaper-county pairs by year in France



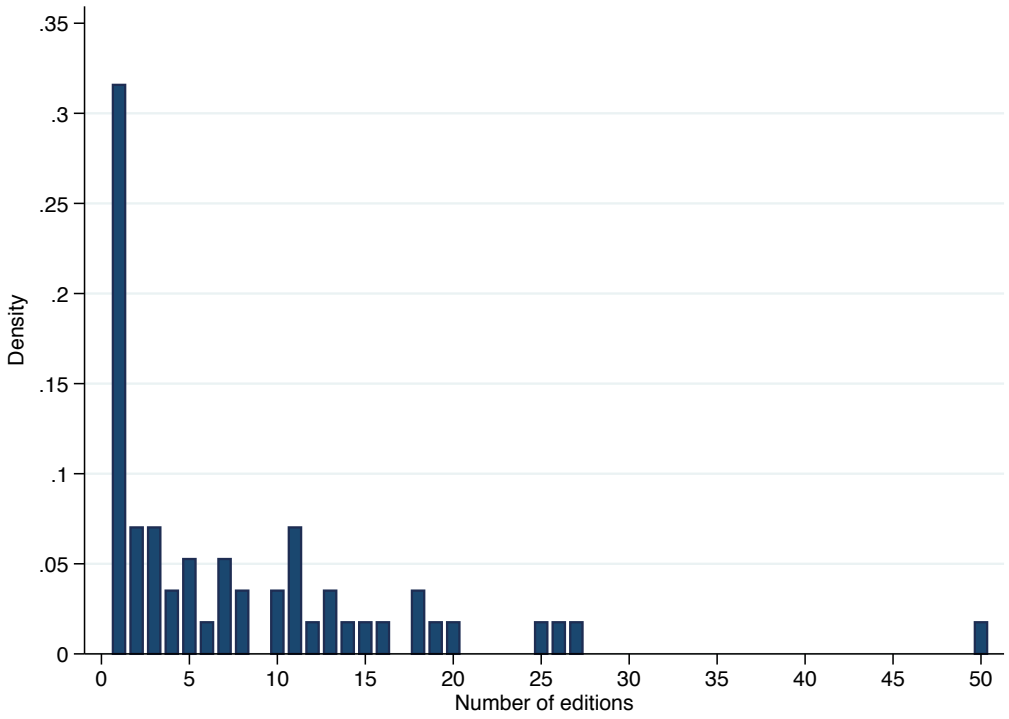
Notes: The figure plots the average total county circulation (number of copies) and the average total county circulation per eligible voter (share) per year. It was constructed by the author using the circulation data described in details in this Appendix.

Figure B.5: Total county circulation (average)

The size of the local daily newspaper industry The total circulation of local daily newspapers in France varies between 9 million copies at the beginning of the period and around 4.4 million today. Local newspapers are a key provider of information over the 1944-2014 period. In comparison, the circulation of national newspapers (including the Paris area) is below 1 million. If one only focuses on the circulation of general information newspapers (dropping sport and financial newspapers) outside Paris, then it is below 890,000. However, it is important to underline that if in aggregate terms the circulation of local newspapers is much higher than the circulation of national newspapers, the average total circulation of a given national newspaper is higher than the average total circulation of given local newspaper. National newspapers are on average bigger than local newspapers, but there are few of them.[7]

Finally, in Figure B.5, I plot the evolution of the average total county circulation.

[7]There are only 6 general information national newspapers as of today (*Aujourd'hui en France*; *La Croix*; *Le Figaro*; *L'Humanité*; *Libération*; *Le Monde*), to which one can add 7 sport newspapers (*L'Equipe* and 6 dedicated horse racing newspapers: *Bilto*; *La Gazette des Courses*; *Paris Courses*; *Paris Turf*; *Tiercé Magazine*; *Week-End*) and 1 financial newspaper (*Les Echos*).



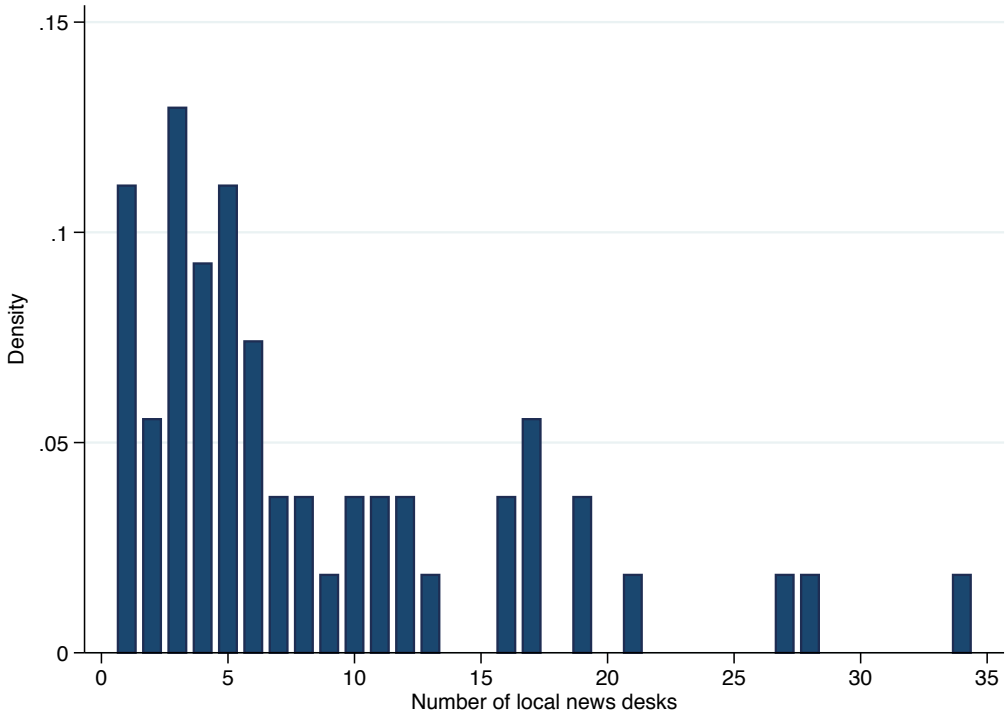
Notes: The figure plots the distribution of the number of editions published by local daily newspapers in France in 2014 (with bins equal to one).

Figure B.6: Number of editions per newspaper (2014)

B.2 Newspapers' local editions

French local daily newspapers publish several local editions. Figure B.6 plots the distribution of the number of editions per newspaper for the year 2014. The average number of editions published by local newspapers in 2014 was 8 (the median was 5).

Moreover, most of the local daily newspapers also have local news desks. The average number of local news desks per newspaper in 2014 was 8.4 (the median was 5.5), as illustrated in Figure B.7.



Notes: The figure plots the distribution of the number of local news desks of the local daily newspapers in France in 2014 (with bins equal to one).

Figure B.7: Number of local news desks per newspaper (2014)

C Additional summary statistics

Table C.1: Descriptive statitics on incumbent newspapers' newsroom the year before an entry

	mean/sd
Number of journalists of incument newspapers	44
	(67)

Notes: Time period is 1944-2014. The table presents the average and the standard deviations (between parentheses) of the variables.

Table C.2: Low- vs. high-heterogeneity counties' characteristics

	High heterogeneity	Low heterogeneity	Diff/se
Education			
No diploma (%)	58.55	59.84	-1.29
			(1.79)
Secondary and vocational education (%)	16.98	19.20	-2.22**
			(0.70)
Baccalaureat (%)	11.23	9.97	1.26**
			(0.44)
Higher (post-secondary) education (%)	13.24	10.98	2.26**
			(0.74)
Socioeconomic group			
Farmers (%)	10.33	13.71	-3.38**
			(1.20)
Artisans, shopkeepers and company managers (%)	10.46	8.63	1.83***
			(0.22)
Senior executives and knowledge workers (%)	8.66	7.22	1.44***
			(0.32)
Intermediate occupations (%)	18.39	16.78	1.61**
			(0.57)
Employees (%)	23.51	21.92	1.59*
			(0.64)
Laborers (%)	28.64	31.74	-3.09***
			(0.63)
Age			
Below 25 years old (%)	31.37	32.79	-1.41*
			(0.57)
Between 25 and 54 years old (%)	27.39	26.47	0.92**
			(0.35)
Between 55 and 64 years old (%)	11.74	11.62	0.12
			(0.16)
Above 65 years old (%)	15.88	15.77	0.11
			(0.39)
Total population (100,000)	5.36	4.69	0.67*
			(0.30)
Newspapers			
Number of newspapers (1944-2014)	3.07	2.56	0.50***
			(0.05)
Number of newspapers (1960-2014)	2.83	2.37	0.45***
			(0.05)
Observations	6,121		

Notes: * p<0.10, ** p<0.05, *** p<0.01. The table compares the characteristics of counties with high and low heterogeneity. Column 1 presents the results for counties with high heterogeneity. Column 2 presents the results for counties with low heterogeneity. In Column 3 I perform a t-test on the equality of means (standard errors in parenthesis).

D Additional results and Robustness checks

D.1 Newspapers' entry decision

In this section, I provide evidence that, on the one hand, the market size is a good predictor of the number of active newspapers, and that on the other hand, newspapers move in where there is a trending population.

My estimating equation is:

$$y_{ct} = \alpha + \beta_1 \text{ population}_{ct} + \beta_2 \text{ population growth}_{ct} + \beta_3 \text{ population density}_{ct} + \mu_t + \varepsilon_{ct} \quad (1)$$

where c indexes counties, t indexes years and μ_t is a year fixed effect. I exclude the post-war (1944-1954) period and focus on 1955-2014. Table D.1 presents the results of the estimation. y_{ct}, the dependent variable, is alternatively the number of newspapers in county c and year t (columns 1 to 4); an indicator variable equal to one when a newspaper enters in county c and year t and to zero otherwise (columns 5 to 8); and an indicator variable equal to one when a newspaper *owner* enters in county c and year t and to zero otherwise (columns 9 to 12). The independent variables are population, population growth, and population density. I control for population density because delivery costs may be lower in densely populated areas and thus the number of newspapers may be higher in these areas. As expected given existing empirical evidence (see e.g. Berry, 1992), I find that the number of newspapers in a county is strongly correlated with the county population (columns 1 and 4). A one-standard deviation increase in population yields a 0.24 standard deviation increase in the number of newspapers. The number of newspapers is also positively correlated with population density.

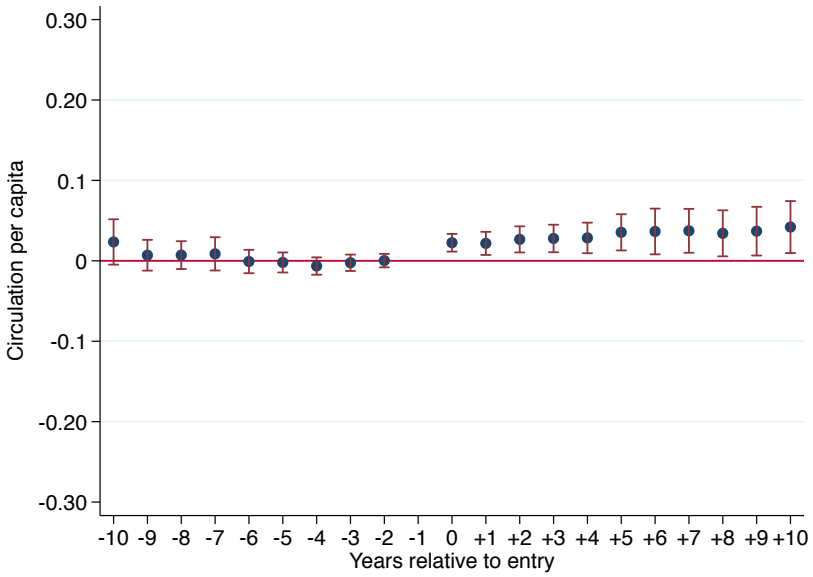
Given the latent variable model – newspapers move in when there is a growing population – the entry decision should be correlated with population growth. This is indeed the case: whether or not I control for population, I find that population growth is positively and significantly correlated with the entry decision of newspapers (columns 5 and 8). Moreover, once I control for population growth, population *per se* has no statistically significant impact on the entry decision (column 8). This finding holds whether I consider all entries (columns 5 to 8) or reduce the set of entries to episodes where not only a new newspaper but also a new newspaper *owner* enters a county (columns 9 to 12). Importantly, all my empirical results are robust to controlling or not for population and population growth.

Table D.1: The impact of population on the number of newspapers and newspapers' entry decision

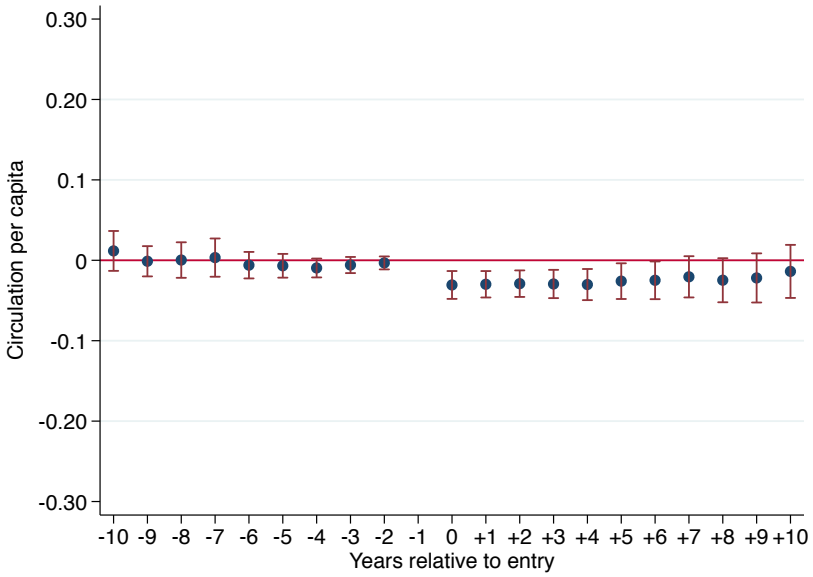
	Number of newspapers				Entry decision (newpaper)				Entry decision (owner)			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Population (in million)	0.91***			0.54***	0.03***			0.01	0.04***			0.01
	(0.04)			(0.08)	(0.01)			(0.01)	(0.01)			(0.01)
Population growth		1.63*		0.95		0.13**		0.11**		0.14***		0.12**
		(0.89)		(0.70)		(0.05)		(0.04)		(0.05)		(0.05)
Population density (in thousand)			4.45***	2.08***			0.17***	0.14*			0.19***	0.13
			(0.21)	(0.39)			(0.04)	(0.08)			(0.04)	(0.08)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R-sq	0.23	0.17	0.22	0.23	0.06	0.05	0.06	0.06	0.06	0.05	0.06	0.06
Observations	5,220	5,219	5,220	5,219	5,220	5,219	5,220	5,219	5,220	5,219	5,220	5,219
Mean DepVar	2.56	2.56	2.56	2.56								

Notes: * p<0.10, ** p<0.05, *** p<0.01. Standard errors in parentheses are robust. Time period is 1955-2014. Models are estimated using OLS estimations. In columns 1 to 4, the dependent variable is the number of newspapers in a county. In columns 5 to 8, the dependent variable is an indicator variable equal to one when a new newspaper enters in a county and to zero otherwise. In columns 9 to 12, the dependent variable is an indicator variable equal to one when a new newspaper *owner* enters in a county and to zero otherwise. Variables are described in more details in the text.

D.2 Robustness checks



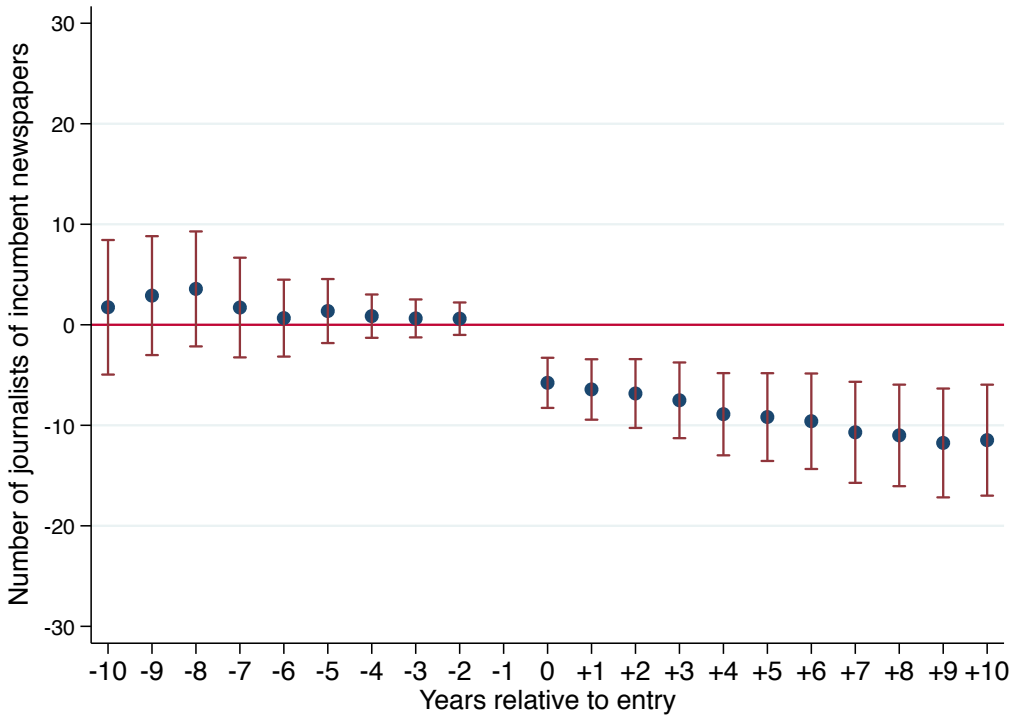
(a) **Total circulation**



(b) **Circulation of incumbent newspapers**

Notes: The figures show coefficients from a regression of circulation on a vector of year dummies going from -10 to $+10$ with the events of entry taking place in $j = 0$ (see equation (1) for details). In the upper figure D.1a, the dependent variable is total county circulation per eligible voter. In the bottom figure D.1b, the dependent variable is the circulation of incumbent newspapers per eligible voter. Models include year and county fixed effects and demographic controls. Error bars are $+/-$ 2 standard errors. Standard errors are clustered by events. Time period is 1960-2014.

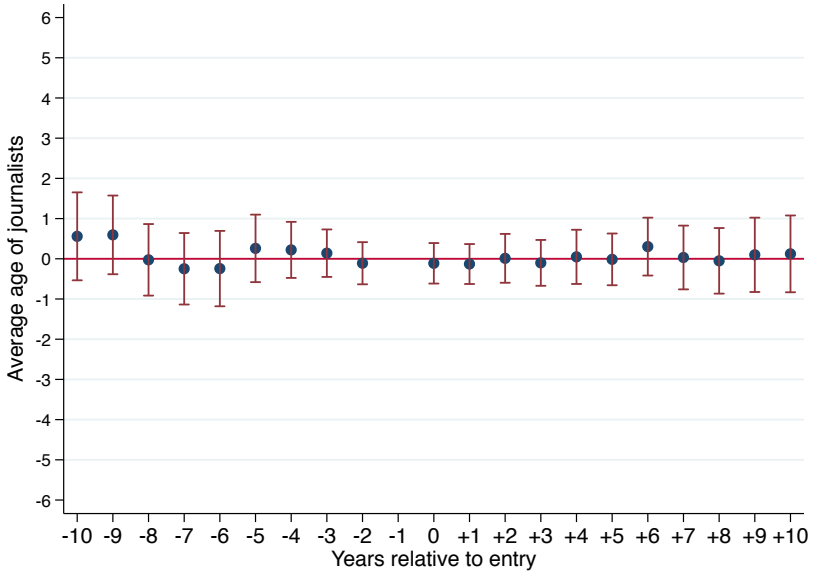
Figure D.1: Impact of newspaper entry on newspaper circulation (1960-2014) (controlling for demographics)



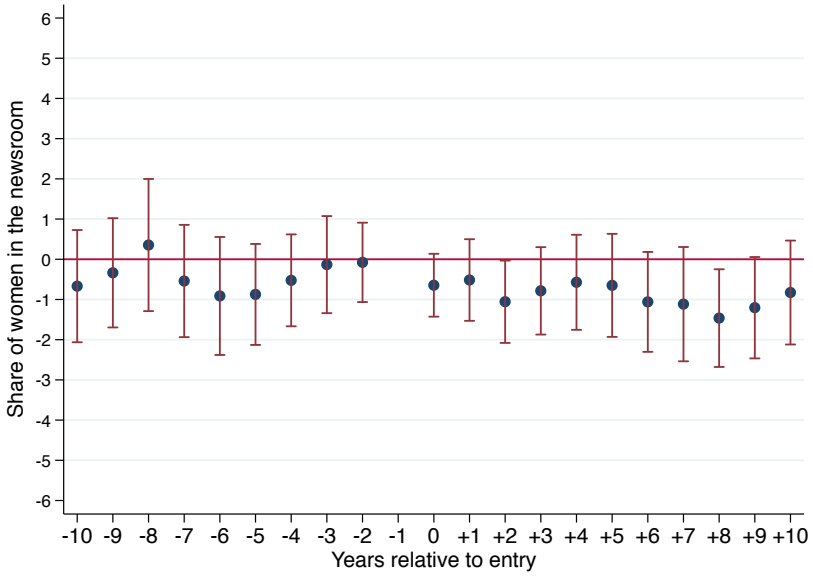
Notes: The figure shows coefficients from a regression of the number of journalists on a vector of year dummies going from -10 to $+10$ with the events of entry taking place in $j = 0$ (see equation (1) for details). The dependent variable is the number of journalists working for incumbent newspapers. For newspapers circulating across n counties (with $n > 1$), the number of journalists working in each county is equal to $\frac{1}{n}$ times the newspaper's total number of journalists. Models include year and county fixed effects, and demographic controls. Error bars are $+/-$ 2 standard errors. Standard errors are clustered by events. Time period is 1944-2014

Figure D.2: Impact of newspaper entry on newspapers' size of the newsroom, county-level analysis, equal allocation of journalists to each county for newspapers circulating across nearby counties (1944-2014)

D.3 Other additional results



(a) Average age



(b) Share of women

Notes: The figures show coefficients from a regression of circulation on a vector of year dummies going from -10 to $+10$ with the events of entry taking place in $j = 0$. The estimation is performed at the newspaper level (see equation (2) for details). In the upper figure D.3a, the dependent variable is the average age of the journalists working for the incumbent newspapers. In the bottom figure D.3b, the dependent variable is the share of women working in the newsroom of the incumbent newspapers. Models include year and county fixed effects, and demographic controls. Error bars are $+/-$ 2 standard errors. Standard errors are clustered by events. Time period is 1944-2014.

Figure D.3: Impact of newspaper entry on newspapers' average age of and share of women in the newsroom, newspaper-level analysis, only counties in which newspapers are headquartered (1944-2014)

Table D.2: The effect of entry on newspaper newsroom, revenues and expenses (county-level analysis)

		Revenues			
	(1)	(2)	(3)	(4)	(5)
	Number of journalists	Total	Sales	Ad	Total expenditures
$\mathbf{1}entry^{j=-2}$	-0.03	-0.05	0.01	-0.02	-0.05
	(0.06)	(0.08)	(0.10)	(0.08)	(0.08)
$\mathbf{1}entry^{j=-1}$	-0.02	-0.03	-0.02	-0.02	-0.01
	(0.06)	(0.09)	(0.11)	(0.09)	(0.09)
$\mathbf{1}entry^{j=0}$	0.06	-0.18	-0.21	-0.06	-0.12
	(0.07)	(0.15)	(0.19)	(0.18)	(0.16)
$\mathbf{1}entry^{j=1}$	0.07	-0.19	-0.19	-0.05	-0.13
	(0.07)	(0.14)	(0.17)	(0.16)	(0.15)
$\mathbf{1}entry^{j=2}$	0.03	-0.13	-0.16	-0.18	-0.18
	(0.07)	(0.15)	(0.16)	(0.18)	(0.16)
$\mathbf{1}entry^{j=3}$	0.00	0.15*	-0.02	0.04	0.15*
	(0.08)	(0.08)	(0.21)	(0.13)	(0.08)
$\mathbf{1}entry^{j=4}$	0.02	-0.00	-0.04	0.03	0.07
	(0.08)	(0.11)	(0.12)	(0.11)	(0.10)
$\mathbf{1}entry^{j\geq 5}$	-0.05	-0.03	-0.04	-0.05	-0.03
	(0.08)	(0.08)	(0.11)	(0.08)	(0.09)
County FE	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes
R-sq	0.88	0.80	0.68	0.73	0.81
Observations	5,296	3,728	3,357	3,376	3,278
Clusters (county)	87	87	87	87	87

Notes: Standard errors in parentheses are clustered by county. Time period is 1960-2014. Models are estimated using OLS estimations. The dependent variables are in logarithm. All variables (except the number of journalists) are in thousand (constant 2014) euros. Models include year and county fixed effects and demographic controls. Variables are described in more details in the text.

Table D.3: The effect of the number of newspapers on newspapers' specialization

	Newspaper Specialization					
	(1)	(2)	(3)	(4)	(5)	(6)
Number of newspapers	0.053***	0.071***	0.052***	0.078***	0.050***	0.058***
	(0.012)	(0.014)	(0.010)	(0.011)	(0.009)	(0.009)
Number of Newspapers						
* Low Political Heterogeneity		-0.054***		-0.063***		-0.047***
		(0.015)		(0.012)		(0.017)
Low Political Heterogeneity		0.073***		0.099***		0.245
		(0.027)		(0.024)		(0.169)
Year FE	No	No	Yes	Yes	Yes	Yes
Controls	No	No	No	No	Yes	Yes
R-sq	0.10	0.13	0.11	0.15	0.17	0.17
Observations	28,180	28,180	28,180	28,180	28,180	28,180
Clusters (County-Year)	94	94	94	94	94	94
Mean DepVar	0.173	0.173	0.173	0.173	0.173	0.173

Notes: * p<0.10, ** p<0.05, *** p<0.01. Standard errors in parentheses are clustered by county-year. Time period is 2005-2012. The dependent variable is newspaper specialization computed alternatively on a daily basis. "Newspaper specialization" is an Herfindahl index of newspaper differentiation. This index is equal to the sum of the squares of the shares of the different newspaper topics in each newspaper issue: agriculture, culture, economics, education, environment, health, international affairs, leisure activities, movies, "news in brief', politics religion and sports. Models include year fixed effects in columns 3 to 6, and demographic controls and demographic controls interacted with the heterogeneity indicator variable in columns 5 and 6. Variables are described in more details in the text.

E Theoretical framework: competition, news production and voting

I present a simple theoretical framework on competition, news production and voting. This framework is made up of two key parts. First, the competition and news production part of this framework is related to existing models of product quality in the context of vertical consumer heterogeneity (Shaked and Sutton, 1982; Tirole, 1988; Choi and Shin, 1992; Motta, 1993). I show that newspaper quality varies with the number of newspapers, and that under low heterogeneity of tastes, under duopoly, both duopolists produce a lower quality newspaper than the monopoly (subsection E.1). I then investigate the extent to which this affects political participation (subsection E.2).

E.1 Competition and news production

I explore the conditions under which an increase in the number of newspapers can decrease both the quantity and quality of news provided. Following Wauthy (1996), I offer the complete characterization of quality choices without assuming ex ante that the market is, or not, covered. But while in Wauthy (1996) there is no cost of producing quality, I model competition under fixed costs of quality improvement. Newspapers indeed operate under increasing returns to scale.

There is a continuum of consumers of mass 1 and two profit-maximizing newspapers under duopoly, newspaper 1 and newspaper 2 (only one newspaper under monopoly, newspaper m). I study the production choices (price and quality) of newspapers under monopoly and duopoly. The analysis is based on a two-stage non-cooperative sequential game. Newspapers first choose simultaneously their quality and then compete simultaneously in price.

E.1.1 Model set-up: Consumers

Consumers choose whether to buy a newspaper. I assume that there is unit-demand: consumers cannot buy more than one unit of the newspaper. Moreover, in order to keep the model tractable, I assume that there is no multi-homing: when there are two newspapers, consumers can only buy one of the two. They cannot buy both newspapers at the same time. Each consumer has an outside option normalized to 0.[8]

I assume that there is vertical differentiation.[9] Consumers are heterogeneous with respect

[8] Assuming the existence of an outside good is a common assumption in discrete choice models. The distinction between the outside good and the competing products is that the price of the outside good is not set in response to the prices of the inside goods. In the absence of an outside good, consumers are forced to choose from the inside goods and demand depends only on differences in prices (Berry, 1994).

[9] Products are vertically differentiated when all consumers agree about the quality ordering of the products but differ in how much they are willing to pay for higher quality. On the contrary, products are horizontally differentiated when consumers disagree about which type of product provides them with greater utility holding

to their willingness-to-pay for a single attribute of the newspaper: the quality of the newspaper whatsoever the type of content.

Consumer i maximizes the following utility function:

$$V_i = \begin{cases} \gamma_i n_j - p_j, & \text{if she buys newspaper j} \\ 0, & \text{otherwise} \end{cases}$$

where p_j is the price of newspaper j, n_j is its quality and γ_i is consumer i's willingness-to-pay for quality. I assume that γ is uniformly distributed with unit density over the interval $\left[\underline{\gamma}, \overline{\gamma}\right]$: $U \sim \left[\underline{\gamma}, \overline{\gamma}\right]$.[10]

In the monopoly case, consumer i buys newspaper j iff

$$\gamma_i n_j - p_j \geq 0$$

In the duopoly case, newspaper j's ($j = 1, 2$) demand, D_j, is defined as the set of consumer types who get greater surplus from its quality-price offering than from the other firm's quality-price offering or the outside option:

$$D_j = \left\{\gamma \sim U\left[\underline{\gamma}, \overline{\gamma}\right] : \gamma n_j - p_j \geq \gamma n_z - p_z \ \forall z = 0, 1, 2\right\} \tag{2}$$

Higher types (consumers with a high γ) more strongly prefer higher-quality newspapers since they get a higher marginal benefit. They thus choose the higher-quality newspaper under duopoly. Middle types choose the lower-quality newspaper. Finally, if the market is not covered, lower types choose the outside option. Importantly here I am not assuming market coverage ex ante. The extent of consumers' heterogeneity – measured by the ratio $\frac{\overline{\gamma}}{\underline{\gamma}}$ – determines whether the market is actually covered or not. Market coverage is an endogenous outcome of the quality game, as can clearly be seen below.

E.1.2 Model set-up: Newspapers

Newspapers maximize their profits by choosing their price p and their quality n:

$$\max_{(n_j, p_j)} \Pi_j = \left[p_j D_j\left(\mathbf{n}, \mathbf{p}\right) - \frac{c n_j^2}{2} - S\right] \tag{3}$$

prices constant.

[10] Assuming that consumers type are distributed uniformly allows me to remove non-uniformity of the consumer preference distribution as a possible explanation of product positioning. With a uniform distribution, if a firm chooses to produce a certain quality, it is not because more consumers have that quality as their ideal product than any other. On the contrary, with non-uniform distributions, firms may tend to cluster around the majority customer preference ("agglomeration effect") (see e.g. Ansari et al., 1994). Moreover, the uniformity assumption is convenient for deriving analytical results.

where S is the fixed cost for setting up a newspaper.[11] Implicitly in this profit function, I am considering advertising revenues as a per-reader proportional subsidy.[12]

Key here are the increasing returns to scale. The production cost is a quadratic function of the quality n and is given by $\frac{cn_j^2}{2}$. This cost is fixed with respect to output. The cost of producing the first newspaper is indeed high and increasing in quality – it depends on the number of journalists on staff –, but once this fixed cost has been borne, the variable cost of selling additional newspapers is limited to the cost of paper, printing and distribution, which is relatively low (see e.g. Baron, 2006; Berry and Waldfogel, 2010). Note that this quadratic production cost increases with quality at a faster rate than any agent's willingness-to-pay (consumers' utility functions are linear in quality).

E.1.3 Timing of the game

The game proceeds as follows:

1. Newspapers simultaneously choose their product positioning n.

2. Newspapers simultaneously choose their price.

This time ordering is standard. Price can indeed often be adjusted faster than product characteristics. Competing first simultaneously in quality before competing simultaneously in price allows newspapers to differentiate in quality in order to soften price competition. The two-stage modeling enables the existence of a pure-strategy equilibrium, when none would exist if qualities and prices were chosen simultaneously.[13]

E.1.4 Solving the model

I compare the production choices of newspapers under monopoly and under duopoly. I do not consider the cases with more than two newspapers. That is, I assume that the set-up cost is sufficiently large ($S > \underline{S}$) so that a third entrant would suffer losses. Whether monopoly or duopoly prevails in equilibrium also depends on S. One can easily show that if S is sufficiently small ($\underline{S} < S < \overline{S}$), the second entrant can make positive profits, so that there is a duopoly. Conversely, for S sufficiently large ($S > \overline{S}$), no entry is profitable, and there is a monopoly (see Section F).

[11] This includes the annual costs that must be incurred in order to set up a newspaper (office space, equipment, printing press, etc.) and to maintain a reputation as a media outlet (e.g. one needs to have a minimal number of journalists covering core issues, etc.).

[12] I am implicitly assuming here that advertisers place the same value on all kinds of readers. One could argue that depending on the demographics of the readers, advertisers may place different values for example on those who prefer soft news than on those who prefer hard news. In an extension of the model below (Section E.1.5), I divide newspaper content into hard and soft news. One simple way to take into account different values advertisers place on different readers is simply to assume different average tastes for hard and soft news.

[13] The sequential game specification has also implications for what markets a second paper enters. Specifically, I am ruling out any limit-pricing type of behavior where a first-mover positions itself to deter entry by others.

I solve the game by backward induction. I only consider pure-strategy equilibria. Solutions fall under two cases depending on the degree of heterogeneity of consumers' willingness-to-pay. Comparing the quality of the newspaper under monopoly (n_m^*) to the quality of the competing newspapers under duopoly (n_1^*,n_2^*), I obtain the following proposition.

Proposition 1 (Business stealing and returns to scale in news production)
Assume n_m^* is the monopoly equilibrium and (n_1^*,n_2^*) is the duopoly equilibrium. $\exists\ \underline{\lambda}, \overline{\lambda}$ such that
If $\frac{\overline{\gamma}}{\underline{\gamma}} \geq \overline{\lambda}$ (high heterogeneity of tastes), $n_1^* < n_m^* < n_2^*$ (i.e. under duopoly, one duopolist produces a lower-quality newspaper than the monopolist, and the other one a higher-quality newspaper).
If $\frac{\overline{\gamma}}{\underline{\gamma}} < \underline{\lambda}$ (low heterogeneity of tastes), $n_1^* < n_2^* < n_m^*$ (i.e. under duopoly, both duopolists produce a lower-quality newspaper than the monopolist).

Proof. See Section F ■

The only Nash Equilibrium is an asymmetric equilibrium in which one newspaper is of higher quality than the other newspaper. Newspapers indeed always choose to differentiate because differentiation allows them to relax price competition while a symmetric equilibrium yields Bertrand competition – and zero profits – in the second stage of the game. The key point is thus to determine whether the high-quality duopolist produces a higher-quality newspaper than the monopolist. The impact of competition on the quality of newspapers depends on the degree of taste heterogeneity. Under competition, newspapers can choose between delivering a high-quality newspaper or lowering their price. They do not want to be close on quality since that leads to less market power. Prices increase both in the quality of the newspaper and in the quality differential ($n_2 - n_1$) for both newspapers.

What is key for the result of Proposition 1 is that I do not assume market coverage *ex ante*.[14] Total reading increases – the business-stealing effect decreases – with $\frac{\overline{\gamma}}{\underline{\gamma}}$. When heterogeneity is high ($\frac{\overline{\gamma}}{\underline{\gamma}} \geq \overline{\lambda}$), the market is not covered under competition. Entry expands the market and newspapers can differentiate on quality to soften price competition and increase market power. One duopolist produces a lower-quality newspaper than the monopolist, and the other one a higher-quality newspaper.

On the contrary, when heterogeneity is low ($\frac{\overline{\gamma}}{\underline{\gamma}} < \underline{\lambda}$), the market is covered under competition. There is business stealing: the second newspaper reduces the incumbent newspaper's

[14]The existing literature studying oligopolies in which firms sell products of different qualities often assume ex ante that the market is, or is not, covered. For example, Choi and Shin (1992) and Moorthy (1988) assume that firms do not cover the market. On the contrary, Tirole (1988) assumes that firms cover the market. To the extent of my knowledge, Wauthy (1996) is the first to provide a full characterization of quality choices, without assuming ex ante market coverage. But he assumes zero costs. On the contrary, I assume the existence of a quadratic cost function for quality.

output. Resources used on the fixed costs of news production increase and competing newspapers reduce their quality. Both newspapers under duopoly thus produce a lower-quality newspaper than the monopolist. Since there is no multi-homing, each reader is less informed than under monopoly and the social surplus is reduced.[15]

E.1.5 Extension: Hard vs. soft news

In this extension, I introduce a second dimension of vertical differentiation (Vandenbosch and Weinberg, 1995; Lauga and Ofek, 2011). I divide newspaper content into hard news (h) and soft news (s). Consumers are heterogeneous with respect to their willingness-to-pay for these two attributes of newspapers. Consumer i maximizes the following utility function:

$$V_{ij} = \begin{cases} \theta_i h_j + \alpha_i s_j - p_j, & \text{if she buys newspaper j} \\ 0, & \text{otherwise} \end{cases}$$

where h_j is the quality of hard news produced by newspaper j, s_j the quality of soft news, and p_j the price.

θ_i is consumer i's willingness-to-pay for high-quality hard news. It is uniformly distributed with unit density over the interval $\theta \sim U\left[\underline{\theta}, \overline{\theta}\right]$. Similarly, α_i is consumer i's willingness-to-pay for high-quality soft news and $\alpha \sim U\left[\underline{\alpha}, \overline{\alpha}\right]$. I assume that θ and α are mutually independent.

Newspapers maximize their profits by choosing their price p, the quality of hard news h and the quality of soft news s:

$$\max_{(h_j, s_j, p_j)} \Pi_j = \left[p_j D_j \left(\mathbf{h}, \mathbf{s}, \mathbf{p}\right) - \frac{c_h h_j^2}{2} - \frac{c_s s_j^2}{2} - S \right]$$

where the production cost of hard news is given by $\frac{c_h h_j^2}{2}$ and the production cost of soft news by $\frac{c_s s_j^2}{2}$. As before I assume that these costs are quality-dependent fixed costs.[16] Following the general case, newspapers first choose their product positioning (h and s) and then simultaneously compete in price.

I allow more heterogeneity in the tastes for one attribute (say soft news) than for the other attribute (say hard news). A simple way to do this is to assume that $\theta_i = \theta \, \forall i$. Everything

[15] This result is in line with the findings of the literature on free entry and social inefficiency. Berry and Waldfogel (1999) quantify for example the inefficiency due to free entry in the radio market (see also Steiner, 1952). The main difference here is that while Berry and Waldfogel (1999) model the radio broadcasting industry as a homogeneous-goods industry, I introduce differentiation in newspapers' characteristics and heterogeneity in consumers' willingness-to-pay for these characteristics. When heterogeneity is not high enough, then the social inefficiency result holds.

[16] To be consistent with the general case of the model, I am assuming here that consumers differ *vertically* in their preferences for hard and soft news. However combining heterogeneity in the willingness-to-pay for newspaper quality with *horizontal* differentiation in the tastes for hard news and soft news will deliver similar predictions.

else is assumed to be symmetrical. The average taste for hard and soft news is the same: $\theta = \frac{\underline{\alpha}+\overline{\alpha}}{2}$. The cost of producing hard and soft news is also identical: $c_h = c_s$.

To increase tractability, I only present results in a discrete setting (however there are robust to a continuous setting). h and s can only take two values: a low value ($\underline{h}$, $\underline{s}$) and a high value ($\overline{h}$, $\overline{s}$). I assume that $\left[\underline{h}, \overline{h}\right] = [\underline{s}, \overline{s}]$. There is no cost of producing a low value of hard or soft news, and a cost $c > 0$ of producing a high value. There are 4 possible strategies for the newspaper:

1. $(\underline{h}, \underline{s})$ (cost = 0);
2. $(\underline{h}, \overline{s})$ (cost = c);
3. $\left(\overline{h}, \underline{s}\right)$ (cost = c);
4. $\left(\overline{h}, \overline{s}\right)$ (cost = 2c).

Monopoly Consider first what happens in the monopoly case. Comparing the profits in the 4 possible cases leads to Lemma 1:

Lemma 1 (Monopoly)
As the production cost increases, a monopoly newspaper first cuts down on soft news and then cuts down on hard news. That is, the monopoly chooses:

$$(h_m^*, s_m^*) = \begin{cases} (\overline{h}, \overline{s}) & \text{if } \ c < c_1^m(\underline{s}, \overline{s}, \underline{\alpha}, \overline{\alpha}) & \text{(M1)} \\ (\overline{h}, \underline{s}) & \text{if } \ c_1^m(\underline{s}, \overline{s}, \underline{\alpha}, \overline{\alpha}) < c < c_2^m(\underline{s}, \overline{s}, \underline{\alpha}, \overline{\alpha}) & \text{(M2)} \\ (\underline{h}, \underline{s}) & \text{if } \ c > c_2^m(\underline{s}, \overline{s}, \underline{\alpha}, \overline{\alpha}) & \text{(M3)} \end{cases}$$

Proof. See Section F ■

Two things have to be highlighted. First, it is never optimal for the monopoly to choose $(\underline{h}, \overline{s})$. Second, the value of hard and soft news provided by the monopoly depends on the degree of taste heterogeneity $\frac{\overline{\alpha}}{\underline{\alpha}}$. The cost thresholds $c_i^m(\underline{s}, \overline{s}, \underline{\alpha}, \overline{\alpha})$ $(i = 1, 2)$ are functions of $\frac{\overline{\alpha}}{\underline{\alpha}}$ and $\frac{\overline{s}}{\underline{s}}$. For a given ratio $\frac{\overline{s}}{\underline{s}}$, the more heterogeneity in tastes $\frac{\overline{\alpha}}{\underline{\alpha}}$, the higher the threshold cost $c_1^m(\underline{s}, \overline{s}, \underline{\alpha}, \overline{\alpha})$ and the lower $c_2^m(\underline{s}, \overline{s}, \underline{\alpha}, \overline{\alpha})$. That is to say, for a given $\frac{\overline{s}}{\underline{s}}$, a higher heterogeneity $\frac{\overline{\alpha}}{\underline{\alpha}}$ increases the chances of soft news being low and hard news being high.

Duopoly Lemma 2 is obtained by computing the best response functions of each newspaper and solving for the Nash equilibrium.

Lemma 2 (Duopoly)
For all production costs, newspapers under duopoly specialize along the soft news dimension.

That is, competing newspapers choose:

$$(h_1^*, s_1^*), (h_2^*, s_2^*) = \begin{cases} (\overline{h}, \underline{s}), (\overline{h}, \overline{s}) & \text{if } c < c_1^d(\underline{s}, \overline{s}, \underline{\alpha}, \overline{\alpha}) \quad \text{(D1)} \\ (\underline{h}, \underline{s}), (\underline{h}, \overline{s}) & \text{if } c_1^d(\underline{s}, \overline{s}, \underline{\alpha}, \overline{\alpha}) < c < c_2^d(\underline{s}, \overline{s}, \underline{\alpha}, \overline{\alpha}) \quad \text{(D2)} \\ (\underline{h}, \underline{s}), (\overline{h}, \overline{s}) & \text{if } c > c_2^d(\underline{s}, \overline{s}, \underline{\alpha}, \overline{\alpha}) \quad \text{(D3)} \end{cases}$$

Proof. See Section F ■

Regardless of where the other newspaper is located, each newspaper's best product strategy is always to differentiate on at least one dimension. Newspapers always differentiate along the dimension with the greater heterogeneity, here soft news: if one newspaper chooses to produce $\underline{s}$, the other newspaper's best product strategy is always to produce $\overline{s}$. One can think of the attribute with more heterogeneity as playing the same role as the single dimension. Firms differentiate along this attribute to relax price competition. The role of the second attribute is different. Newspapers use this attribute to manage demand and cost considerations. If the production cost is low (equation (D1)), both newspapers produce a high value of hard news $\overline{h}$ (since it is not costly for them to do so). When the production cost increases above c_1^d (equation (D2)) then newspapers choose to offer a low value of information $\underline{h}$ to contain costs. Finally, when the cost increases above c_2^d (equation (D3)), it becomes optimal for newspaper 2 to sell to high-end consumers only to alleviate price competition. In this case, newspapers exploit both dimensions to differentiate.

Monopoly vs. duopoly Combining the results for the monopoly and the duopoly case, I obtain the following proposition:

Proposition 2 (Specialization effect)
There is an intermediate cost interval $[\tilde{c}, \hat{c}]$ *s.t.* $\forall c \in [\tilde{c}, \hat{c}]$ *both newspapers under duopoly produce less hard news than the newspaper under monopoly:*

1. ***Monopoly****:* $(h_m^*, s_m^*) = (\overline{h}, \underline{s})$.

2. ***Duopoly****:* $(h_1^*, s_1^*), (h_2^*, s_2^*) = (\underline{h}, \underline{s}), (\underline{h}, \overline{s})$.

Proof. See Section F ■

E.2 Competition and political participation

Proposition 1 shows how newspaper quality varies with the number of newspapers and how this effect depends on the extent of heterogeneity. When heterogeneity is low, an increase in

the number of newspapers leads to a decrease in the quality of the two competing newspapers. As a consequence, readers are less informed. I investigate here the extent to which this affects political participation.

The voting framework I present is closely related to Feddersen and Pesendorfer (1996) and Feddersen and Sandroni (2006a,b). Society must choose between two candidates by majority voting. There are two states of nature: one in which all voters prefer the first candidate and a second state where all prefer the other candidate. Voters have state-dependent preferences: there are no partisans. I voluntarily chose to abstract from political bias considerations. In my simple theoretical framework, readers do not have political opinions and individuals are only heterogeneous in their preferences for information and entertainment; there is no media bias and newspapers are pure profit-maximizers. Agents are motivated to vote out of a sense of ethical obligation. Each agent has an action she should take and receives utility from taking this action. Hence each agent behaves strategically even though pivotal probabilities play no role.

I assume that people learn information for their voting decision as a by-product of newspaper readership. An important number of studies have shown that people often learn politically relevant facts as a by-product of nonpolitical routines (Prior, 2007).[17] Taking the example of moviegoers sitting through a newsreel even though they came to be entertained by the main feature, Downs (1957, p. 223) underlines that political information is sometimes obtained from entertainment-seeking behavior: "entertainment sources sometimes yield political information as a surplus benefit from what is intended as an entertainment investment". Focusing on television, Baum (2002, 2003) argues that a mix of entertainment and politics provides political information to people not sufficiently interested in politics to watch hard news.[18] Similarly, Zukin and Snyder (1984) show that many politically uninterested New Jersey citizens who received their broadcast news from New York City stations recalled the names of New York mayoral candidates, even though they could not vote for any of the candidates. Furthermore, recent evidence by Boczkowski et al. (2017) shows that young users mainly consume news on social media "incidentally": rather than engaging with the news content, they no longer differentiate between it and the rest of the social and entertainment information they consume. I assume here along the same lines that even readers buying a newspaper mainly for the entertainment pages it contains acquire information relevant in the political

[17] As underlined by Hamilton (2004): *"The small chance that an individual reader's political action can influence events makes it unlikely he or she will search out the information helpful in making a voting decision."* (p.2).

[18] According to Baum (2002, 2003, 2005), viewers select programs based on their desire to be entertained, but still learn about politics because the programs they pick also contain information. He shows for example that some people who would otherwise not watch any news at all pay attention to coverage of wars and foreign policy crises in soft-news programs (Baum, 2002). He finds in the same way that when presidential candidates appear on entertainment talk shows, they sway a segment of the population that would otherwise not heard much about the campaign (Baum, 2005).

process from the information pages of the newspaper. This information affects whether or not they would go to the polls.

E.2.1 Model set-up: Nature

There are two equally likely states of Nature $\Theta \in \{0,1\}$ that are unobservable. There is a continuum of agents of mass 1 who share a common prior about the state of Nature (one half). There are two candidates running for the election, candidate 0 and candidate 1: $\Omega = \{0,1\}$. The candidate that receives the majority of the votes cast is elected (if there is a tie, each candidate is chosen with equal probability). One can think of the two candidates as being the "status quo" and the "alternative", and assume that there is some uncertainty about the cost of implementing the alternative which can be either high or low.

E.2.2 Model set-up: Consumers

Consumers – who are also the potential newspaper buyers described in the previous section – take two actions. First they choose whether to buy a newspaper, according to the utility function described in more details above, and next they choose whether to vote: $s \in S = \{a, 0, 1\}$, where a denotes abstention, 0 denotes vote for candidate 0 and 1 vote for candidate 1. There is no partisan. Voters have state-dependent preferences, i.e. given a pair (ω, θ), $\omega \in \Omega$ and $\theta \in \Theta$, the utility of a potential voter is:

$$U(\omega, \theta) = \begin{cases} 0, & \text{if } \omega \neq \theta \\ U > 0, & \text{if } \omega = \theta \end{cases}$$

Every voter receives a message $m \in M = \{0, 1, \phi\}$. Voters who receive a message 0 or 1 are informed and all others are uninformed. As underlined above, I assume that the information acquisition is exogenous in the voting stage of the game: voters who buy a newspaper are informed and all others are uninformed.[19] I call $q \in (0,1)$ the fraction of informed voters in the population. Among the informed voters, the fraction which observes the message $m \in \{0,1\}$ in state m is $\rho \in (.5, 1]$. When ρ is close to 0.5 the message is a very noisy signal of the true state, while when ρ is close to 1 the message almost perfectly conveys the true state.

I assume that ρ is an increasing function of n (the quality of the newspaper) s.t. $\rho(0) = 0.5$ and $\rho'(n) > 0$. In other words, the higher the quality of the newspaper, the better the quality of the signal received by the reader. Finally, there is a uniformly distributed cost of voting $C \sim U\left(0, \overline{C}\right)$.

[19] A possible extension will be to endogenize the acquisition of information. However it will make the model much less tractable without modifying its main predictions.

E.2.3 Timing of the game

The game proceeds as follows:

1. Nature draws $\theta \in \Theta = \{0, 1\}$.
2. Newspapers choose their quality n and price p.
3. Voters choose $\alpha \in A = \{B, NB\}$ (whether to buy a newspaper, and which one).
4. Voters choose $s \in \{a, 0, 1\}$ (voting decision).
5. The state of nature is revealed.

I solve the game by backward induction.

E.2.4 Solving the model

Proposition 3 shows how information provided by newspapers affects voting behavior.

Proposition 3 (Less information leads to rational abstention)
(i) Only informed voters (reading a newspaper) vote.
(ii) Among informed voters, if there are different degrees of information (two newspapers with different n competing on the market), then only the informed voters reading the higher-quality newspaper vote.
(iii) There is a cut-off point such that better informed voters with voting costs above this threshold should abstain. This cut-off point is increasing in the quality of the newspaper n.

This is consistent with existing empirical evidence showing that individuals with a high level of information are much more likely to vote than those with low levels (Converse, 2006; Palfrey and Poole, 1987).

Combining Propositions 1 and 3, I obtain the following predictions on how the media environment affects political behavior.

Prediction 1 (High heterogeneity)
If heterogeneity in consumers' willingness-to-pay for quality is high, then
(i) Turnout is higher under duopoly than under monopoly.
(ii) Voters are better informed under duopoly than under monopoly.

Prediction 2 (Low heterogeneity)
If heterogeneity in consumers' willingness-to-pay for quality is low, then
(i) Turnout is lower under duopoly than under monopoly.
(ii) Voters are less informed under duopoly than under monopoly.

F Proofs of the theoretical results

F.1 Monopoly

Under monopoly, agent i buys the newspaper iff

$$\gamma_i \geqslant \frac{p_m}{n_m}$$

The marginal consumer type is thus $\widehat{\gamma}^M = \frac{p_m}{n_m}$ provided that $\widehat{\gamma}^M \in \left[\underline{\gamma}, \overline{\gamma}\right]$ (non-covered market case); otherwise the demand for the monopoly is 0 if $\widehat{\gamma} > \overline{\gamma}$ and 1 if $\widehat{\gamma} < \underline{\gamma}$ (covered marked case).[20]

Thee market configurations may arise at the price equilibrium. They are characterized by the following demand function.

$$D_m(p_m, n_m) = \begin{cases} 0 & \text{if } \overline{\gamma} < \frac{p_m}{n_m} \\ 1 - \frac{\frac{p_m}{n_m} - \underline{\gamma}}{\overline{\gamma} - \underline{\gamma}} & \text{if } \underline{\gamma} < \frac{p_m}{n_m} \leq \overline{\gamma} \quad \text{(NCM)} \\ 1 & \text{if } \underline{\gamma} \geq \frac{p_m}{n_m} \quad \text{(CM)} \end{cases}$$

Figure F.1 shows how demand varies with the ratio $\frac{p_m}{n_m}$ for $\underline{\gamma} = 1$, i.e. $\frac{\overline{\gamma}}{\underline{\gamma}} = 2$. In Figure F.2 it appears clearly that the lower heterogeneity ($\frac{\overline{\gamma}}{\underline{\gamma}} = 2$ for the red continuous line, and 1.5 for the blue dashed line), the higher the demand for a given ratio $\frac{p_m}{n_m}$.

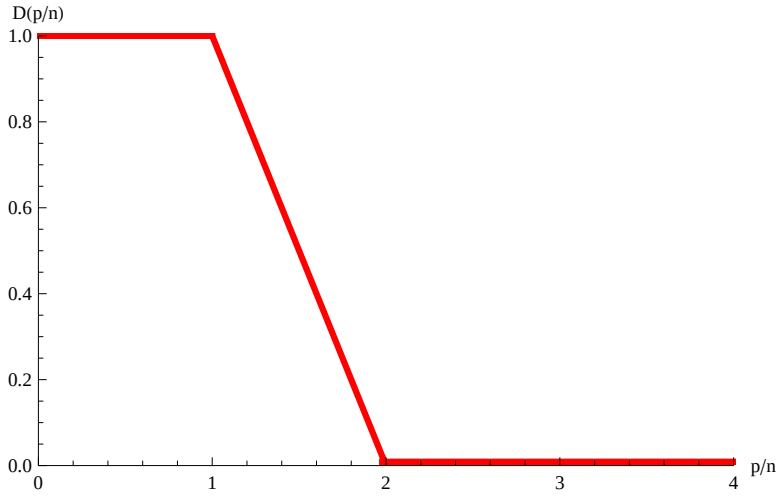


Figure F.1: Demand Function of the Monopoly

The monopoly maximizes its profits according to equation (**??**). The Nash equilibrium is

[20] For the remainder of the proof and to save on space I will use the initials NCM for non-covered market and CM for covered market.

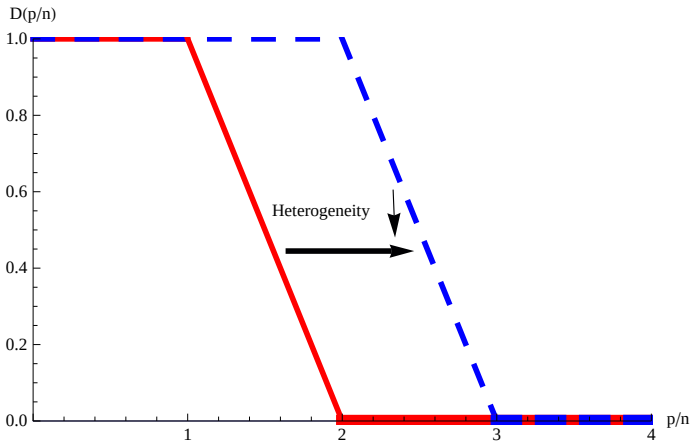


Figure F.2: Demand Function of the Monopoly and Heterogeneity

the price subgame is:

$$p_m^* = \begin{cases} \frac{\overline{\gamma} n_m}{2} & \text{if } \frac{\overline{\gamma}}{\underline{\gamma}} \in [2, \infty[\quad \text{(NCM)} \\ \underline{\gamma} n_m & \text{if } \frac{\overline{\gamma}}{\underline{\gamma}} \in [1, 2[\quad \text{(CM)} \end{cases}$$

Computing the optimal quality n I obtain:

$$n_m^* = \begin{cases} \frac{\overline{\gamma}^2}{4c} & \text{if } \frac{\overline{\gamma}}{\underline{\gamma}} \in [2, \infty[\quad \text{(NCM)} \\ \frac{\underline{\gamma}}{c} & \text{if } \frac{\overline{\gamma}}{\underline{\gamma}} \in [1, 2[\quad \text{(CM)} \end{cases}$$

Proposition 4 (Monopoly Equilibrium) *Depending on the ratio* $\frac{\overline{\gamma}}{\underline{\gamma}}$*, the monopoly equilibrium is characterized by the following price* p_m^**, quality* n_m^**, demand* D_m^* *and profit* Π_m^* *:*

$$\textit{If } \frac{\overline{\gamma}}{\underline{\gamma}} \in [1, 2[\textit{ then } \begin{cases} n_m^* = \frac{\underline{\gamma}}{c} \\ p_m^* = \frac{\underline{\gamma}^2}{c} \\ D_m^* = 1 \\ \Pi_m^* = \frac{\underline{\gamma}^2}{2c} \end{cases} \qquad \textit{If } \frac{\overline{\gamma}}{\underline{\gamma}} \in [2, \infty[\textit{ then } \begin{cases} n_m^* = \frac{\overline{\gamma}^2}{4c} \\ p_m^* = \frac{\overline{\gamma}^3}{8c} \\ D_m^* = \frac{1+\underline{\gamma}}{2} \\ \Pi_m^* = \frac{(1+\underline{\gamma})^4}{32c} \end{cases}$$

Figure F.3 represents the monopoly equilibrium a cost $c = 1$. It clearly shows that for the monopoly profits decrease with heterogeneity.

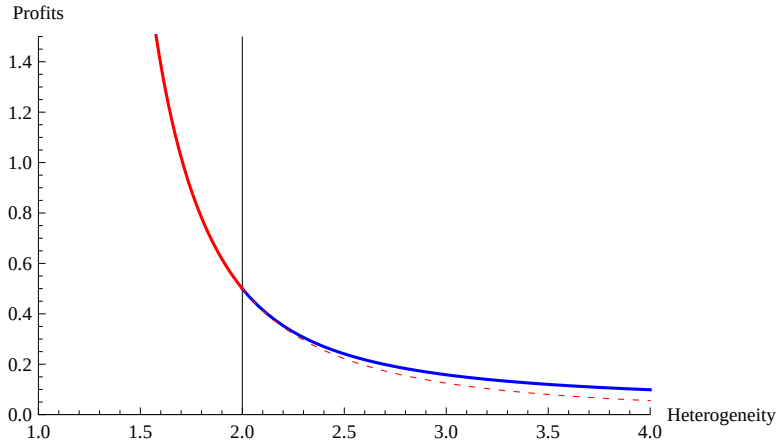


Figure F.3: Monopoly: Profit

F.2 Duopoly

The only Nash equilibrium is an asymmetric equilibrium in which one newspaper is of higher quality than the other newspaper. Newspapers always choose to differentiate because differentiation allows them to relax price competition while a symmetric equilibrium yields Bertrand competition. The key point is thus to determine whether the high-quality duopolist is of higher or of lower quality than the monopolist. It depends on the market coverage (the extent of business stealing). Here I do not assume market coverage ex ante and I determine the equilibrium for each market configuration. More precisely, for each market configuration, I first determine the Nash equilibrium in the price subgame taking as fixed n_2 and n_1. I then solve for the Nash equilibrium in the quality subgame.

F.2.1 Price Competition

Without loss of generality, I assume that $n_2 > n_1$. The marginal consumer type is $\widehat{\gamma}^D = \frac{p_2 - p_1}{n_2 - n_1}$ provided that $\widehat{\gamma}^D \in \left[\underline{\gamma}, \overline{\gamma}\right]$.

Three market configurations may arise at the price equilibrium. Let consider the demand for newspaper 1. All consumers with a γ such that $\gamma < \widehat{\gamma}^D$ strictly prefer newspaper 1 to newspaper 2. However, they could refrain from buying. Only consumers with a γ such that $\gamma > \frac{p_1}{n_1}$ buy newspaper 1. Hence if $\frac{p_1}{n_1} < \underline{\gamma}$, all consumers with a γ such that $\gamma < \widehat{\gamma}^D$ buy newspaper 1, the market is covered and the demand for newspaper 1 is $\widehat{\gamma}^D - \underline{\gamma}$. On the contrary, if $\frac{p_1}{n_1} > \underline{\gamma}$ the market is not covered and the demand for newspaper 1 is $\widehat{\gamma}^D - \frac{p_1}{n_1}$ since all the consumers with a $\gamma \in \left[\underline{\gamma}, \frac{p_1}{n_1}\right]$ refrain from buying a newspaper. Finally, if $\frac{p_2}{n_2} < \underline{\gamma}$ then the market is preempted by newspaper 2.

The demand functions are as follows[21]:

[21] To simplify the notations I am simply using D_1 for $D_1(p_1, p_2, n_1, n_2)$ and D_2 for $D_2(p_1, p_2, n_1, n_2)$.

$$(D_1, D_2) = \begin{cases} \left(\widehat{\gamma}^D - \frac{p_1}{n_1}, \overline{\gamma} - \widehat{\gamma}^D\right) & \text{if } \underline{\gamma} < \frac{p_1}{n_1} \leq \widehat{\gamma}^D \quad \text{(NCM)} \\ \left(\widehat{\gamma}^D - \underline{\gamma}, \overline{\gamma} - \widehat{\gamma}^D\right) & \text{if } \frac{p_1}{n_1} \leq \underline{\gamma} \leq \frac{p_2}{n_2} \quad \text{(CM)} \\ (0,1) & \text{if } \frac{p_2}{n_2} < \underline{\gamma} \quad \text{(Preempted)} \end{cases}$$

The intuition for the preempted market case is as follows: since $n_2 > n_1$ all agents prefer newspaper 2 to newspaper 1 when $p_1 = p_2$. Newspaper 2 thus benefits from the possibility of preempting the market with a limit price: $p_2 = p_1 + \underline{\gamma}(n_2 - n_1)$. It is easy to show that the market is preemted by newspaper 2 whenever $\frac{\overline{\gamma}}{\underline{\gamma}} \in]1, 2]$. In this case if $n_2 > n_1$ only one newspaper (newspaper 2) is active in the price game.

Nash equilibrium in the price subgame is obtained in two steps. First I compute equilibrium candidates corresponding to each market configuration. Second I identify the parameters constellations for which candidates effectively yield the corresponding market outcome. I identify intervals for the values of $\frac{\overline{\gamma}}{\underline{\gamma}}$ whose bounds depend on (n_1, n_2).

Let first consider price equilibrium. The price equilibrium for the non-covered market case is simply determined by maximizing the profits with respect to the price. For the covered-market case, there are two possible solutions: a corner and an interior solution.

Price equilibrium are as follows:

$$(p_1^*, p_2^*) = \begin{cases} \left(\frac{n_1(n_2-n_1)\overline{\gamma}}{4n_2-n_1}, \frac{2n_2(n_2-n_1)\overline{\gamma}}{4n_2-n_1}\right) & \text{if } \underline{\gamma} < \frac{p_1}{n_1} \leq \widehat{\gamma}^D \quad \text{(NCM)} \\ \left(\underline{\gamma} n_1, \frac{(n_2-n_1)\overline{\gamma}+\underline{\gamma}n_1}{2}\right) & \text{if } \frac{p_1}{n_1} \leq \underline{\gamma} \leq \frac{p_2}{n_2} \quad \text{(CM corner)} \\ \left(\frac{\overline{\gamma}-2\underline{\gamma}}{3}(n_2-n_1), \frac{2\overline{\gamma}-\underline{\gamma}}{3}(n_2-n_1)\right) & \text{if } \frac{p_1}{n_1} \leq \underline{\gamma} \leq \frac{p_2}{n_2} \quad \text{(CM interior)} \end{cases}$$

Given these price equilibrium, it is easy to show that the market is non-covered (NCM) if $\frac{\overline{\gamma}}{\underline{\gamma}} \in \left[\frac{4n_2-n_1}{n_2-n_1}, \infty\right[$; that the market is covered with a corner solution (CM corner) if $\frac{\overline{\gamma}}{\underline{\gamma}} \in \left[\frac{2n_2+n_1}{n_2-n_1}, \frac{4n_2-n_1}{n_2-n_1}\right[$; and that the market is covered with an interior solution (CM interior) if $\frac{\overline{\gamma}}{\underline{\gamma}} \in \left]2, \frac{2n_2+n_1}{n_2-n_1}\right[$.

The Nash equilibrium in prices is thus a function of the degree of population heterogeneity ($\frac{\overline{\gamma}}{\underline{\gamma}}$) and the degree of product differentiation (n_1,n_2). This appears clearly when rearranging the conditions. The market is non covered if $\frac{\overline{\gamma}}{\underline{\gamma}} \in \left[\frac{4n_2-n_1}{n_2-n_1}, \infty\right[\Leftrightarrow n_1 < n_2\frac{\alpha-4}{\alpha-2}$. The market is covered with a corner solution if $\frac{2n_2+n_1}{n_2-n_1} \leq \frac{\overline{\gamma}}{\underline{\gamma}} \Leftrightarrow n_1 < n_2\frac{\alpha-2}{\alpha+1}$.

In Figures F.4 and F.5 I plot the prices as a function of heterogeneity for different degrees of product differentiation (n_1,n_2). The price of newspaper 1 p_1 is given by the continuous line and the price of newspaper 2 p_2 by the dashed line. It appears clearly that the more product

differentiation, the higher the price newspapers charge.

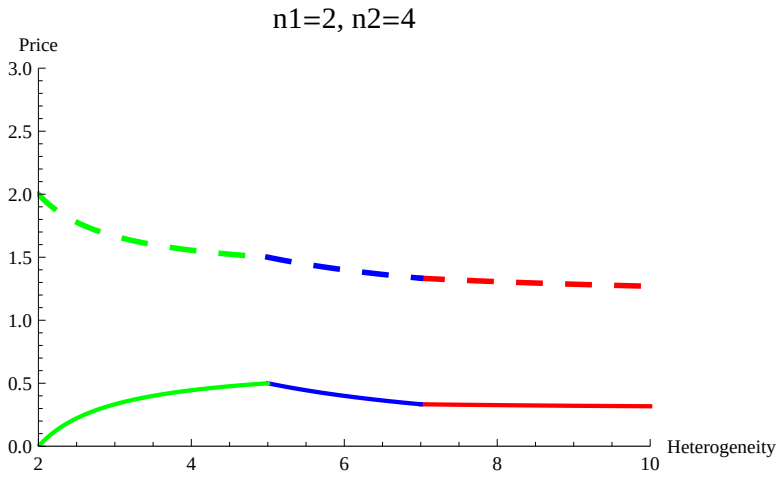


Figure F.4: Duopoly: Nash Equilibrium in Prices

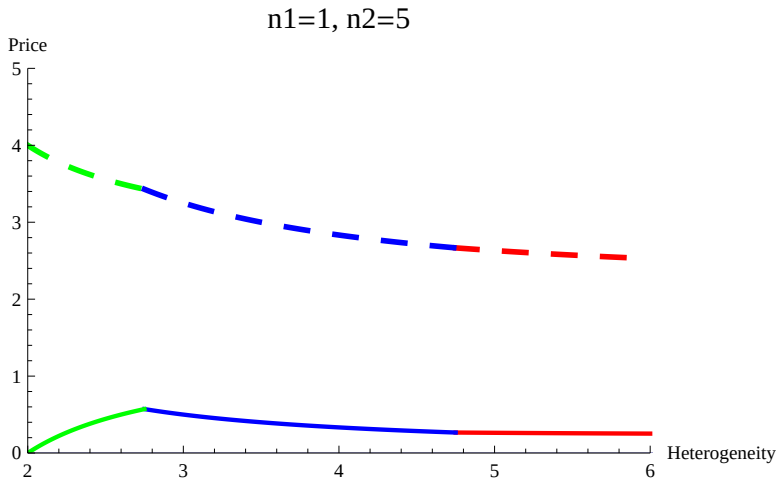


Figure F.5: Duopoly: Nash Equilibrium in Prices

F.2.2 Quality subgame

Newspapers choose their quality in order to maximize their profits:

$$\max_{n_j} \Pi_j = p_j^* D_j \left(p_j^*, p_{j'}^*, n_j, n_{j'}\right) - \frac{c n_j^2}{2},\ j = 1, 2$$

Assuming $(n_2 > n_1)$, I first determine the local maximum for each of the three market configurations – the three price equilibrium. (To simplify the notations I note here Π_j the net profit – after deduction of the set-up cost S).

$$(\Pi_1,\Pi_2)=\begin{cases}\left(\frac{n_1n_2\overline{\gamma}^2(n_2-n_1)}{(4n_2-n_1)^2}-c\frac{n_1^2}{2},\frac{4n_2^2\overline{\gamma}^2(n_2-n_1)}{(4n_2-n_1)^2}-c\frac{n_1^2}{2}\right) & \text{if } \frac{\overline{\gamma}}{\underline{\gamma}}\in\left[\frac{4n_2-n_1}{n_2-n_1},\infty\right[\\ \left(\frac{\underline{\gamma}n_1}{2(n_2-n_1)}\left[(n_2-n_1)\left(\overline{\gamma}-2\underline{\gamma}\right)-\underline{\gamma}n_1\right]-c\frac{n_1^2}{2},\frac{\left[\underline{\gamma}n_1+\overline{\gamma}(n_2-n1)\right]^2}{4(n_2-n_1)}-c\frac{n_1^2}{2}\right) & \text{if } \frac{\overline{\gamma}}{\underline{\gamma}}\in\left[\frac{2n_2+n_1}{n_2-n_1},\frac{4n_2-n_1}{n_2-n_1}\right[\\ \left(\frac{(n_2-n1)\left(\overline{\gamma}-2\underline{\gamma}\right)^2}{9}-c\frac{n_1^2}{2},\frac{(n_2-n1)\left(2\overline{\gamma}-\underline{\gamma}\right)^2}{9}-c\frac{n_2^2}{2}\right) & \text{if } \frac{\overline{\gamma}}{\underline{\gamma}}\in\left]2,\frac{2n_2+n_1}{n_2-n_1}\right[\end{cases}$$

Let first consider the non-covered market case which corresponds to the parameters constellation $\frac{\overline{\gamma}}{\underline{\gamma}}\in\left[\frac{4n_2-n_1}{n_2-n_1},\infty\right[$. Solving for the first order condition of the two newspapers and combining them I obtain:

$$4n_2^3-8n_1^3-23n_1n_2^2+12n_1^2n_2=0 \tag{4}$$

Setting $n_2=\mu n_1$ and dividing both sides by n_1^3 I rewrite equation (4) as follows:

$$4\mu^3-23\mu^2+12\mu-8=0 \tag{5}$$

Equation (5) has only one real solution: $\mu=5.25123$. Hence the non-covered market solution is:

$$\text{If}\quad \frac{\overline{\gamma}}{\underline{\gamma}}>4.7\quad\begin{cases}n_1^*=0.0482\frac{\gamma^2}{c}\\ \\ n_2^*=0.2533\frac{\gamma^2}{c}\end{cases}$$

Second, I study the covered-market case with an interior solution ($\frac{\overline{\gamma}}{\underline{\gamma}}\in\left]2,\frac{2n_2+n_1}{n_2-n_1}\right[$). In this case newspaper 1's profits are given by:

$$\Pi_1=\frac{\left(1-\underline{\gamma}\right)^2}{9}(n_2-n_1)-c\frac{n_1^2}{2}$$

These profits are strictly decreasing in n_1 so newspaper 1 will produce the lowest possible amount of n_1.

Rearranging condition $\frac{\overline{\gamma}}{\underline{\gamma}}\in\left]2,\frac{2n_2-n_1}{n_2-n_1}\right[$ I obtain that the market is covered with an interior solution whenever $n_1>n_2\frac{1-\underline{\gamma}}{1+3\underline{\gamma}}$. Newspaper 1 thus chooses $n_1=n_2\frac{1-\underline{\gamma}}{1+3\underline{\gamma}}$. Combining this value with the first order condition for newspaper 2 the interior solution covered market equilibria is:

$$\text{If} \quad \frac{\overline{\gamma}}{\underline{\gamma}} \in]2, \infty[\quad \begin{cases} n_1^{***} = \frac{1}{3c} \frac{\underline{\gamma}(1-\underline{\gamma})(2+3\underline{\gamma})^2}{\left(1+2\underline{\gamma}\right)^2} \\ \\ n_2^{***} = \frac{1}{3c} \frac{\underline{\gamma}\left(2+3\underline{\gamma}\right)^2}{\left(1+2\underline{\gamma}\right)^2} \end{cases}$$

When $\left(\overline{\gamma}, \underline{\gamma}\right)$ take values such that a reply is defined for two configurations, I compare corresponding profits in order to identify the best reply.

Finally I check that the local maximum I obtain are Nash equilibrium. In other words, I check that (i) newspaper 1 has no incentive to "leapfrog" newspaper 2 and itself produce the highest quantity; and that (ii) newspaper 2 has no incentive to deviate and produce a quantity of news lower than that produced by newspaper 1. Comparing the production choices of newspapers under monopoly and duopoly I obtain the following proposition:

Proposition 5 (Business stealing and returns to scale in news production)
Assume n_m^* is the monopoly equilibrium and (n_1^*,n_2^*) is the duopoly equilibrium. $\exists\ \underline{\lambda}, \overline{\lambda}$ such that
If $\frac{\overline{\gamma}}{\underline{\gamma}} \geq \overline{\lambda}$ (high heterogeneity of tastes), $n_1^* < n_m^* < n_2^*$ (i.e. under duopoly, one duopolist produces a lower-quality newspaper than the monopolist, and the other one a higher-quality newspaper).
If $\frac{\overline{\gamma}}{\underline{\gamma}} < \underline{\lambda}$ (low heterogeneity of tastes), $n_1^* < n_2^* < n_m^*$ (i.e. under duopoly, both duopolists produce a lower-quality newspaper than the monopolist).

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