

# ONLINE APPENDIX

## **“How the Internet Changed the Market for Print Media”**

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## A Appendix: Details on Data Sources

Table A.1: Data on Newspapers.

Newspaper Name	Circulation* (2000)	Releases Per Week	Year of Website	Data Availability:					
				Readership	Balance Sheets	Worker Data	Product Data	Content	
<i>Tabloids:</i>									
1. Dagbladet	182,741	5	1996	✓	✓	✓	✓	✓	✓
2. VG	343,828	5	1996	✓	✓	✓	✓	✓	✓
<i>Non-tabloids:</i>									
3. Aftenposten morgen	258,162	5	1996	✓	✓	✓	✓	✓	✓
4. Ávvir (Est. 2008)	1,192	5	2008	✓	✓	✓	✓	✓	Partial
5. Dag og Tid	6,099	1	1999	✓	✓	✓	✓	✓	✓
6. Dagenmagazinet	8,198	6	2001	✓	✓	✓	✓	✓	✓
7. Dagens Næringsliv	63,030	5	2000	✓	✓	✓	✓	✓	✓
8. Finansavisen	18,419	6	1997	✓	✓	✓	✓	✓	Partial
9. Fiskaren (Merged 2008)	8,135	3	1998	✓	✓	✓	✓	✓	✓
10. Fiskeribladet/Fiskaren (Est. 2008)	10,806	3	1999	✓	✓	✓	✓	✓	✓
11. Klassekampen	6,911	6	1996	✓	✓	✓	✓	✓	✓
12. Morgenbladet	5,950	1	2004	✓	✓	✓	Partial	✓	✓
13. Nationen	17,383	6	1997	✓	✓	✓	✓	✓	✓
14. Ny Tid	6,223	1	2001	✓	✓	✓	Partial	✓	Partial
15. Vårt Land	27,650	4	2001	✓	✓	✓	✓	✓	✓
<i>Daily Locals:</i>									
16. Adresseavisen	88,084	6	1998	✓	✓	✓	✓	✓	✓
17. Aftenposten Aften	170,438	5	1996	✓	✓	✓	✓	✓	✓
18. Agderposten	12,663	6	1999	✓	✓	✓	✓	✓	✓
19. Akershus Amtstidende	4,818	5	2000	✓	✓	✓	✓	✓	✓
20. Altaposten	5,693	6	2001	✓	✓	✓	✓	✓	✓
21. Asker og Bærum Budstikke (Budstikka)	31,279	6	1998	✓	✓	✓	Partial	✓	✓
22. Aura Avis	3,687	4	2000	✓	✓	✓	✓	✓	✓
23. Avis Nordland (Est. 2002)	26,816	6	2000	✓	✓	✓	✓	✓	✓
24. Avis Sør-Trøndelag	7,032	5	2000	✓	✓	✓	✓	✓	✓
25. Bergens Tidende	92,339	7	1996	✓	✓	✓	Partial	✓	✓
26. Bergensavisen (BA)	29,576	7	1996	✓	✓	✓	✓	✓	✓
27. Bladet Vesterålen	10,590	5	2005	✓	✓	✓	✓	✓	Partial
28. Brønnøysunds Avis	4,776	5	1997	✓	✓	✓	✓	✓	✓
29. Dagsavisen	37,650	7	1998	✓	✓	✓	✓	✓	✓
30. Drammens Tidende	46,948	6	2001	✓	✓	✓	✓	✓	✓
31. Eidsvoll Ullensaker Blad	7,702	5	2005	✓	✓	✓	✓	✓	Partial
32. Farsunds Avis	6,058	6	2004	✓	✓	✓	✓	✓	Partial
33. Finnmark Dagblad	7,443	6	2000	✓	✓	✓	✓	✓	✓
34. Finnmarken	7,634	6	2000	✓	✓	✓	✓	✓	✓
35. Firda	14,603	6	2000	✓	✓	✓	✓	✓	✓
36. Fredrikstad Blad	3,033	7	2000	✓	✓	✓	✓	✓	✓
37. Fremover	9,717	6	1998	✓	✓	✓	✓	✓	✓
38. Fædrelandsvennen	45,872	6	2004	✓	✓	✓	✓	✓	✓
39. Gjengangeren	6,105	6	1998	✓	✓	Partial	✓	✓	✓
40. Glåmdalen	20,748	6	2000	✓	✓	✓	✓	✓	✓
41. Gudbrandsdølen Dagningen	28,652	6	2000	✓	✓	✓	✓	✓	✓
42. Hadeland	7,505	5	1999	✓	✓	✓	✓	✓	✓
43. Halden Arbeiderblad	9,880	6	1998	✓	✓	✓	✓	✓	✓
44. Hamar Arbeiderblad	19,166	6	2003	✓	✓	✓	✓	✓	✓
45. Harstad Tidende	14,992	6	2000	✓	✓	✓	✓	✓	✓
46. Haugesunds Avis	35,408	6	2006	✓	✓	✓	✓	✓	✓
47. Helgeland Arbeiderblad	10,221	6	1998	✓	✓	✓	✓	✓	✓
48. iTromsø	10,550	6	2000	✓	✓	✓	Partial	✓	✓
49. Laagendalsposten	10,886	6	1999	✓	✓	✓	✓	✓	✓
50. Lindesnes	6,605	6	2002	✓	✓	✓	✓	✓	✓
51. Lofotposten	9,413	6	1997	✓	✓	✓	✓	✓	✓
52. Moss Avis	15,436	7	1996	✓	✓	✓	✓	✓	✓
53. Namdals-Avisa	13,569	6	2001	✓	✓	✓	✓	✓	✓
54. Nordlands Framtid (Merged 2002)	19,354	6	2000	✓	✓	✓	✓	✓	✓
55. Nordlandsposten (Merged 2002)	15,454	6	1998	✓	✓	✓	✓	✓	✓
56. Nordlys	29,810	6	1997	✓	✓	✓	✓	✓	✓
57. Oppland Arbeiderblad	29,440	6	1998	✓	✓	✓	✓	✓	✓
58. Østlandets Blad	18,059	6	1998	✓	✓	✓	✓	✓	✓
59. Østlands-Posten	14,502	6	1999	✓	✓	✓	✓	✓	✓
60. Østlendingen/Hamar Dagblad	20,334	6	1999	✓	✓	✓	✓	✓	✓

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Newspaper Name	Circulation* (2000)	Releases Per Week	Year of Website	Data Availability:					
				Readership	Balance Sheets	Worker Data	Product Data	Content	
<i>Daily Locals (continued):</i>									
61. Porsgrunns Dagblad	6,391	6	1999	✓	✓	✓	✓	✓	✓
62. Rana Blad	11,151	6	1999	✓	✓	✓	✓	✓	✓
63. Ringerikes Blad	13,144	6	2000	✓	✓	✓	✓	✓	✓
64. Rjukan Arbeiderblad	2,373	5	2007	✓	✓	✓	✓	✓	✓
65. Rogalands Avis	15,179	6	1998	✓	✓	✓	✓	✓	✓
66. Romerikes Blad	33,988	4	2000	✓	✓	✓	✓	✓	✓
67. Romsdals Budstikke	18,767	6	2006	✓	✓	✓	✓	✓	✓
68. Sandefjords Blad	15,289	6	1999	✓	✓	Partial	✓	✓	✓
69. Sarpsborg Arbeiderblad	1,189	6	1999	✓	✓	✓	✓	✓	✓
70. Smaalenenes Avis	14,260	6	2000	✓	✓	✓	✓	✓	Partial
71. Stavanger Aftenblad	72,954	6	1996	✓	✓	✓	✓	✓	✓
72. Sunnhordland	8,464	5	2001	✓	✓	✓	✓	✓	Partial
73. Sunnmørsposten	38,328	6	1998	✓	✓	✓	✓	✓	✓
74. Telemarksavisa	22,416	6	2000	✓	✓	✓	✓	✓	✓
75. Telen	5,840	6	2000	✓	✓	✓	✓	✓	✓
76. Tidens Krav	7,185	6	2000	✓	✓	✓	✓	✓	✓
77. Tønsbergs Blad	32,796	6	2001	✓	✓	✓	✓	✓	✓
78. Troms Folkeblad	7,412	6	1998	✓	✓	✓	✓	✓	✓
79. Trønder-Avisa	23,615	6	2002	✓	✓	✓	✓	✓	✓
80. Valdres	9,627	4	2000	✓	✓	Partial	✓	✓	✓
81. Varden	31,439	6	2000	✓	✓	✓	✓	✓	✓

*Notes:* Our sample consists of 81 newspapers that operated between 2000-2010 with complete circulation data by municipality and year from the Norwegian Media Businesses' Association, which also provided annual data on product characteristics (e.g. format, ad prices, etc.) for 80 of these newspapers. Further, we accessed detailed annual balance sheets for 60 newspapers in our sample provided by the Norwegian Media Authority. We also match to annual worker data (e.g. wages, hours, etc.) from Statistics Norway's employer-employee registers using newspaper firm IDs for 76 newspapers. And, we were to retrieve content data for 76 newspapers in our sample from the National Library of Norway's online database of historical newspapers. In addition we make use of a readership survey provided by Kantar/TNS Gallup, which has information about readership of 80 newspapers in our sample, as well as the readership of major online only news sites (e.g., nettavisen.no, e24.no, na24.no, side2.no, tv2.no, nrk.no, sol.no, etc.) that do not have a print counterpart. The year of website reported above denotes the first year in which a website for the newspaper can be found on the Internet Archive Wayback Machine ([Internet Archive](https://www.archive.org/), 2022).

\*Circulation figures show total circulation in Norway per released edition as reported by MBL for the municipalities in our sample. For three newspapers that did not exist in the year 2000, namely Ávvir, Avisa Nordland, and FiskeribladetFiskaren, we instead show the newspaper's circulation in the year it was established. Ávvir is the only new entrant to the newspaper market in our sample, being established in 2008. The two other newspapers were formed by mergers of pre-existing newspapers. Avisa Nordland was established in 2002, by a merger of Nordlands Framtid and Nordlandsposten. FiskeribladetFiskaren was established in 2008, by a merger of Fiskaren with a smaller newspaper Fiskeribladet. No newspapers in our sample (apart from the aforementioned ones that merged) went defunct during our sample years 2000-2010.

Table A.2: Descriptions of Variables.

Variable	Description
<b>A. Main Outcomes:</b>	
<i>Newspaper Sales</i>	
Print Circulation Rate	Total newspaper circulation per edition per household in municipality $k$ in year $t$ . This is calculated as the summation of every newspaper's circulation (per edition) within a municipality in a given year, and then dividing by the number of households.
Annual Print Sales Volume	Yearly newspaper circulation per household in municipality $k$ in year $t$ . Yearly circulation is calculated for each newspaper as circulation per edition $\times$ number of releases each week $\times$ 52.
Readership Rate	Yearly newspaper readership rate among surveyed individuals aged 12 or above in media district $d$ in year $t$ . Readership rates are estimated by Kantar/TNS Gallup based on the Pure Recent Reading (PRR) method that uses information on whether a respondent (i) has read a newspaper in the last 12 months, (ii) when a newspaper was most recently read, and for daily newspapers, (iii) how many of the last 6 editions were read. See <a href="#">Østnes and Futsaeter (2003)</a> for details. Readership is further distinguished by online and print readership.
<i>Market Revenues</i>	
Sales	Total yearly newspaper revenue per household from sales of newspapers in municipality $k$ in year $t$ (in 2010 NOK). For each newspaper we allocated its sales revenue to a municipality based on the share of its circulation in that municipality. We then aggregate across all newspapers in each municipality. Sales revenues include revenues generated from print and online sales.
Advertisement	Total yearly newspaper advertisement revenue per household in municipality $k$ in year $t$ (in 2010 NOK). For each newspaper we allocated its advertisement revenue to a municipality based on the share of its circulation in that municipality. We then aggregate across all newspapers in each municipality. Ads revenues include revenues generated from any type of ads (such as classified ads), irrespective of the platform where the ads were displayed.
<i>Average Revenue Per Unit</i>	
Average Sales Revenue Per Unit	Average Sales Revenue Per Unit (ARPU) is a measure of average sales revenue per sold copy in municipality $k$ in year $t$ (in 2010 NOK). For each municipality this is calculated as 'Revenue' divided by 'Sales Volume'.

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**B. Balance Sheets and Labor Input Outcomes:**

Direct Salary Costs	Total yearly newspaper salary costs per household in municipality $k$ in year $t$ (in 2010 NOK). For each newspaper we allocated its direct salary costs to a municipality based on the share of its circulation in that municipality. We then aggregate across all newspapers in each municipality.
Labor Hours	Total yearly newspaper labor hours per household in municipality $k$ in year $t$ (in 2010 NOK). For each newspaper we allocated its direct salary costs to a municipality based on the share of its circulation in that municipality. We then aggregate across all newspapers in each municipality.
Hourly Wage Rate	Average hourly wage rate in municipality $k$ in year $t$ (in 2010 NOK). For each municipality this is calculated as 'Direct Salary Costs' divided by 'Labor Hours'.
Wage Costs	Total yearly newspaper wage costs per household in municipality $k$ in year $t$ (in 2010 NOK). For each newspaper we allocated its wage costs to a municipality based on the share of its circulation in that municipality. We then aggregate across all newspapers in each municipality.
Intermediate Costs	Total yearly newspaper intermediate costs per household in municipality $k$ in year $t$ (in 2010 NOK). For each newspaper we allocated its intermediates costs to a municipality based on the share of its circulation in that municipality. We then aggregate across all newspapers in each municipality.
Profits (EBITDA)	Total newspaper earnings before interest, taxes, depreciation, and amortization per household in municipality $k$ in year $t$ (in 2010 NOK). For each newspaper we allocated its profits to a municipality based on the share of its circulation in that municipality. We then aggregate across all newspapers in each municipality.

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**C. Format and Content Outcomes:*****Listed Sales Price***  
Sales Price per Copy

Average listed price of a single copy newspaper in municipality  $k$  in year  $t$  (in NOK, deflated to 2010 values). This variable is constructed as a weighted average of the newspapers in the municipality based on their sales in that municipality.

**Listed Advertisement Prices**

Full Page in 4 Colors      Average price of a full page, 4 color, newspaper advertisement in municipality  $k$  in year  $t$  (in NOK, deflated to 2010 values). This variable is constructed as a weighted average of the newspapers in the municipality based on their sales in that municipality.

Full Page in B/W      Average price of a full page, black and white, newspaper advertisement in municipality  $k$  in year  $t$  (in 2010 NOK, deflated to 2010 values). This variable is constructed as a weighted average of the newspapers in the municipality based on their sales in that municipality.

Column Ads, Per cm      Average price per centimeter of a column newspaper advertisement in municipality  $k$  in year  $t$  (in 2010 NOK, deflated to 2010 values). This variable is constructed as a weighted average of the newspapers in the municipality based on their sales in that municipality.

**Format**

Format in  $cm^2$       Newspaper format size (page length x page width) in  $cm^2$  in municipality  $k$  in year  $t$ . For each newspaper we allocated the size of the format to a municipality based on the share of its circulation in that municipality. We then aggregate across all newspapers in each municipality.

No. of Pages      Number of pages per copy in municipality  $k$  in year  $t$ . For each newspaper we allocated the number of pages per copy to a municipality based on the share of its circulation in that municipality. We then aggregate across all newspapers in each municipality.

Total Size      Total size per copy (page size in  $cm^2$  x number of pages) of newspaper in municipality  $k$  in year  $t$ . For each newspaper we allocated the number of mentions of a keyword to a municipality based on the share of its circulation in that municipality. We then aggregate across all newspapers in each municipality.

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### C. Format and Content Outcomes (continued):

#### Content

Keyword Mention Share We count mentions of keywords in municipality  $k$  in year  $t$  within three categories of news – (i) Entertainment; (ii) Sports; (iii) Crime; (iv) Health; (v) Politics; (vi) Foreign Affairs; and (vii) Business/Finance. For each newspaper we allocated the number of mentions of a keyword to a municipality based on the share of its circulation in that municipality. We then aggregate across all newspapers in each municipality. Finally, we divide by the total number of mentions in all categories that were assigned to that municipality to give a ‘mention share’ to each category. For the list of keywords in each category please see Table A.3.

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### D. Broadband Usage and Availability:

Usage Rate Broadband usage rate in municipality  $k$  in year  $t-1$ . This is the fraction of households residing in a given municipality at the beginning of year  $t-1$ , who are subscribing to broadband internet (with access speed at or above 256 kilobits per second).

Availability Rate Broadband availability rate in municipality  $k$  in year  $t-2$ . This is the fraction of households residing in a given municipality at the beginning of year  $t-2$ , who can have access to broadband internet (with access speed at or above 256 kilobits per second). It is used as an instrument for the usage rate (in  $t-1$ ).

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### E. Baseline Controls: Demographic Characteristics

Age-groups (%) Percentage share aged 16–21, 22–24, 25–34, 35–44, 45–54, 55–66, and 67 or above at the beginning of year  $t$ .

Students (%) Percentage share aged above 15 registered as students at the beginning of October each year  $t$ .

Poverty Rate (%) Percentage share having an annual income below half of the median equivalent after-tax income, when using the OECD equivalence scale to calculate the equivalent income.

Unemployed (%) Percentage share aged 16–59 registered as fully unemployed at beginning of year  $t$ .

Immigrants (%) Percentage share who are foreign-born at the beginning cc

Income (NOK) Average after-tax disposable income earned during year  $t$  by individuals aged 16–59 years.

Years of Education Average years of schooling among persons aged 16–59 at the beginning of year  $t$ .

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**F. Additional Controls: Newspaper Demand**

Population Size	Number of residents in the municipality at the beginning of year t.
Urban Residence (%)	Percentage share living in a densely populated locality at the beginning of year t.
Public Sector (%)	Percentage share aged 16–59 employed in the public sector at the beginning of year t.
Services Sector (%)	Percentage share aged 16–59 employed in the services sector at the beginning of year t.
Private Services Sector (%)	Percentage share aged 16–59 employed in the private services sector at the beginning of year t.

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**G. Additional Controls: Broadband Expansion**

Distance (in km)	Average distance in kilometers to the municipal sub-center at the beginning of year t.
Travel Time (in Minutes)	Average travel time per person in minutes to the municipal center at the beginning of year t.
Roads (in km)	Municipal road networks measured in kilometers per 1000 residents at the beginning of year t.
Total Expenditure	Per capita spending on municipal public services in year t (in 1000 NOK, deflated to 2010 values).
Administration Expenditure	Per capita spending on municipal administration in year t (in 1000 NOK, deflated to 2010 values).
Education Expenditure	Per capita spending on municipal schools and other educational institutions in year t (in 1000 NOK, deflated to 2010 values).
Health Expenditure	Per capita spending on municipal health care services in year t (in 1000 NOK, deflated to 2010 values).
Infrastructure Expenditure	Per capita spending on municipal infrastructural maintenance (roads, pipes, tunnels) in year t (in 1000 NOK, deflated to 2010 values).

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Table A.3: List of Keywords Used in the Content Analysis.

Topic:	Entertainment		Sports		Crime		Health		Politics		Foreign Affairs		Business/Finance	
	Word	English	Word	English	Word	English	Word	English	Word	English	Word	English	Word	English
1	bursdag	birthday	ball	ball	beshlag	seizure	aktiv	active	arbeiderparti	labor party	ambassador	ambassador	aksje	stock
2	drama	drama	basket	basketball	bevis	proof	alderdom	old age	avstemning	vote	bilateralt	bilaterally	arbeidsledighet	unemployment
3	dronning	queen	em	Cup	dom	judgement	bakterie	bacteria	demonstrasjon	demonstration	efta	EFTA	bolig	housing
4	film	film	forball	soccer	dommer	judge	diabetes	diabetes	formannskap	chairmanship	eos	EEA	børs	stock
5	fritid	leisure time	friddrett	athletics	drap	murder	ernaering	nutrition	fremskrittsparti	progressive party	eu	EU	eksport	export
6	hollywood	hollywood	hockey	hockey	fengsel	prison	grønnsaker	vegetables	hoyre	conservative party	europaradet	the council of europe	fattigdom	poverty
7	komedie	comedy	idrettsgren	sports	forbrytelse	felony	helse	health	innvandring	immigration	fn	UN	finans	finance
8	komiker	comedian	kapploeping	branch racing	kriminalliet	crime organized	helsekost	health food	konservativ	conservative	haag	the Hague	gjeld	debt
9	konge	king	kaptein	captain	kripos	crime unit	kalori	calorie	liberal	liberal	krig	war	handel	trade
10	kongehuset	the royal house	landslag	national team	lensmann	sheriff	kjøtt	meat	politiker	politician	menneskerettigheter	human rights	import	import
11	kronprins	prince	mål	goal	mord	murder	kreft	cancer	politikk	policy	nato	nato	inflasjon	inflation
12	lyrikk	lyrics	mesterskap	championship	narkotika	drugs	lege	doctor	regjering	government	oecd	OECD	lån	loan
13	musikk	music	nm	NM	offer	victim	matvarer	foodstuffs	senterparti	center party	terrorisme	terrorism	næringsliv	business
14	oppførsel	arts performance	offside	offside	overgrep	abuse	mosjon	exercise	statsminister	prime minister	traktat	treaty	overskudd	profit
15	orkester	orchestra	score	score	påtale	prosecution	syk	sick	statsråd	State	utenriks	abroad	prisindeks	price index
16	show	show	sjakk	chess	politi	police	sykehus	hospital	storting	Parliament	utenriksminister	Foreign Minister	rente	interest
17	skuespiller	actor	ski	ski	ran	robbery	sykepleie	nursing	transport	transportation	utenrikspolitikk	policy	stilling	positions
18	stjerneetegn	star sign	sport	sport	tiltale	indictment	trening	training	vedtak	decision	våpen	guns	streik	strike
19	tv	tv	tennis	tennis	tyveri	theft	ufør	disabled	veibygging	road construction	våpenhvile	truce	ulikhet	inequality
20	underholdning	entertainment	vm	World Cup	varetekt	custody	vekt	weight	velgere	voters	washington	Washington	valuta	currency

## B Appendix: Segments of the Norwegian Newspaper Market

The newspaper market in Norway is characterized by relatively high differentiation comprising distinct market segments. Most newspapers are local or regional, and serve relatively small geographic markets. The newspapers with national orientation and nationwide distribution can be further segmented in two groups; tabloid newspapers (VG and Dagbladet) and about a dozen non-tabloid newspapers. In our analysis, we thus rely on a classification the Norwegian newspaper market into three segments; locals, tabloids and non-tabloids, which is often used in Norwegian media policy.

**Characterization of Market Segments.** We provide here a characterization of the salient dimensions along which newspapers in the three segments tend to differ, namely their (i) geographical distribution patterns, (ii) reliance on public subsidies, and (iii) content and other product characteristics. First, as indicated above, a key distinction between local and national newspapers is that the former serve relatively small geographic markets, while the latter have national orientation and nationwide circulation. We quantify the differences in the geographical distribution across market segments below, finding that local newspapers indeed have a dominant position in their local markets (e.g., their main municipality of distribution), while both tabloids and non-tabloids have a much more balanced spread across geography.

Second, Norway has a system of direct subsidies that are differentially targeted towards print newspapers.<sup>36</sup> Our calculations show that while local newspapers generated around 46% of the total market revenue (excluding subsidies) in the print market in 2000, these newspapers received almost 62% of the overall direct subsidies.<sup>37</sup> The remaining share of subsidies was awarded to national non-tabloids, while tabloids are not eligible for such support. Indeed, the goal of the subsidy system is to maintain a variety of print newspapers across the country, which can represent different ideological/political, geographical, linguistic, or religious/ethnic opinions. Thus, it is not surprising that locals and non-tabloids are the beneficiaries.

Finally, locals, tabloids and non-tabloids also differ significantly in terms of content, format and other product characteristics. We document these differences in Appendix Table E.13, where Columns (3), (6) and (9) show the mean content shares (in 2000) by seven broad categories for locals, tabloids and non-tabloids, respectively. Unsurprisingly, tabloids tend to have a much higher share of content related to Sports, Entertainment, and Crime, and substantially lower shares of content related to Politics and Business/Finance, as compared to national non-tabloids. For most categories, locals tend to lie somewhere between tabloids and non-tabloids, however, they report content related to Politics almost at the same rate as non-tabloids, while non-tabloids stand out in terms of the reporting of Foreign Affairs content. While we are not able to quantify political content in local newspapers further, it seems reasonable to assume that content related to Local Politics would find a natural place in these newspapers. With respect to format and size, locals are much more similar to non-tabloids. Further, we find that listed ads prices for locals (e.g., the price of publishing a full page ad) are often much lower than those for tabloids and non-tabloids.

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<sup>36</sup>In addition to the direct subsidies, print newspapers in Norway are exempt from the value added tax (normal goods and services are levied a VAT of 25% on sales). This indirect subsidy, however, is not differentiated across the three market segments we consider.

<sup>37</sup>Direct subsidies accounted for almost 2% of the total revenues of local newspapers. However, the subsidy rates vary considerably across newspapers, with some local newspapers receiving up to one-fifth of their revenue through a direct subsidy.

**Geographical Distribution Patterns.** To verify that our classification in three segments (locals, tabloids and non-tabloids) is reasonable, we compare the geographical dispersion patterns of these segments. To this end, we define for each newspaper the municipality with the highest level of sales as the main municipality of the newspaper. We then calculate the share of total circulation of each newspaper in four geographical areas: (i) the main municipality, (ii) municipalities neighboring the main municipality, (iii) other municipalities within the same county, and (iv) outside the county. Table B.1 shows the average of these shares within each newspaper type. Because municipalities differ in size, we also report the average circulation rate (i.e., copies sold per edition per household) in each region and for each type.

Table B.1: Geographical Dispersion of Circulation by Newspaper Market Segments.

	<b>Locals</b>	<b>Tabloids</b>	<b>Non-tabloids</b>
	(1)	(2)	(3)
<b>A. Share of Total Circulation</b>			
Main Municipality	50.7%	16.8%	37.0%
Neighboring Municipalities	25.3%	7.0%	12.8%
Rest of County	17.3%	4.1%	7.5%
Rest of Norway	6.8%	72.1%	42.7%
<b>B. Circulation Rate</b>			
Main Municipality	0.51	0.13	0.20
Neighboring Municipalities	0.35	0.14	0.18
Rest of County	0.14	0.12	0.14
Rest of Norway	0.00	0.12	0.03

*Notes:* The shares of total circulation (panel A) and circulations rates (panel B) are calculated as weighted averages across all newspapers within each type using data on newspapers' circulation by municipality and year obtained from the Norwegian Media Businesses' Association for years 2000-2010. The weighted averages use each newspaper's total annual circulation as weights to account for size differences across newspapers within each type. The 'main' municipality refers to the municipality with the highest share of a newspaper's circulation. The shares of total circulation sum to 100 % across the four geographical areas. The circulation rates are calculated as the number of copied sold (per edition) divided by the number of households residing in each geographical area at the start of each year. For a complete list of newspapers included see Appendix Table A.1.

The geographical dispersion documented in Table B.1 shows that newspapers differ distinctly by type: Among local newspapers, 51 % of circulation is within the main municipality, and 93 % within a single county. Local newspapers also have a strong position locally, with an average circulation rate of 0.51 in the main municipality and 0.35 in neighboring municipalities. In contrast, among tabloid newspapers, 72.1 % of circulation is outside the county of the main municipality, and the circulation rates are very similar across geographic markets. Non-tabloids stand somewhere between the other two, with 37 % of circulation in the main municipality. Note, however, that this is largely due to the strong urban base of non-tabloids, with high circulation in Oslo and other major cities.

**Cross-Price Elasticities Across Newspaper Segments.** Another way to assess the classification of newspapers is to estimate the price elasticity of newspaper circulation with respect to (i) their own price, (ii) the price of other newspapers of the same type, and (iii) the price of other types of newspaper types. To assess the cross-price elasticity of demand between newspapers of different types (locals, tabloids, non-tabloids)

within each market (municipality), we calculate the following:

$$p_{c(n),m,t} = \sum_{i \neq n} \frac{1[c(n) = c(i)]Q_{i,m,t}}{\sum_{i \neq n} 1[c(n) = c(i)]Q_{i,m,t}} p_{i,t} = \text{price of same type in municipality } m \quad (\text{B.1})$$

$$p_{c'(n),m,t} = \sum_{i \neq n} \frac{1[c(n) \neq c(i)]Q_{i,m,t}}{\sum_{i \neq n} 1[c(n) \neq c(i)]Q_{i,m,t}} p_{i,t} = \text{price of other type in municipality } m \quad (\text{B.2})$$

where  $p_{n,t}$  is the price per copy of newspaper  $n$  of type  $c(n)$  in year  $t$  and  $Q_{n,m,t}$  is its sales quantity in municipality  $m$ . We then estimate the following equation:

$$\ln(Q_{n,m,t}) = a + b_1 \ln(p_{n,t}) + b_2 \ln(p_{c(n),m,t}) + b_3 \ln(p_{c'(n),m,t}) + x_{n,m,t}\beta + g_t + e_{n,m,t}, \quad (\text{B.3})$$

where  $x_{n,m,t}$  includes a full set of municipality-by-newspaper interacted fixed effects and year fixed effects  $g_t$ . By controlling for these variables, we use within municipality-newspaper price variation and remove common time effects.

Table B.2: IV Estimates of Own-Price and Cross-Price Elasticities of Newspaper Circulation.

	Estimate (1)	(SE) (2)	Estimate (3)	(SE) (4)
Own-Price Elasticity ( $b_1$ )	-1.512***	(0.138)	-1.459***	(0.140)
Cross-price Elasticity Within Type ( $b_2$ )	1.383***	(0.117)	1.443***	(0.119)
Cross-price Elasticity Across Type ( $b_3$ )	-0.131	(0.230)	0.106	(0.253)
Municipality x Newspaper Fixed Effects		✓		✓
Year Fixed Effects		✓		✓
All Controls				✓
No. Observations	110,546		110,546	

Notes: Equation (B.3) is estimated using annual data on newspapers' unit prices and circulation (by municipality) obtained from the Norwegian Media Businesses' Association for years 2000-2010. IV estimates of own- and cross-price elasticities are constructed by instrumenting own price, within-type average price and across-type average price by corresponding measures of per-unit wage costs. Controls include all variables listed in Panel E of Appendix Table A.2.

\*  $p < 0.1$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ .

We expect own-price elasticity to be negative, i.e.,  $b_1 < 0$ . For the segmentation into different newspaper categories we should expect that there is substitution within categories, but not much substitution between categories, i.e.,  $b_2 > 0$ , and  $b_3$  is close to zero. To address endogeneity concerns over in prices, we instrument  $p_n$ ,  $p_{c(n),m}$ , and  $p_{c'(n),m}$  with the corresponding wage costs per unit. Table B.2 shows the own- and cross-price elasticities. Looking at the IV estimates in the first two rows, we can see that newspapers are price elastic and go in the direction that we expect. The point estimates suggest the same type of newspapers are relatively close substitutes, and that newspaper demand is largely independent across the different types.

## C Appendix: Specification Checks

In the following, we challenge the assumption of common trends underlying our main identification strategy in a number of ways. First, we assess the robustness of our findings to adding time-varying covariates of newspaper demand and broadband expansion. Second, we drop big cities to make sure that differential trends across big cities and other municipalities are not driving our results. Third, we drop the post-2008 years from our analysis to avoid picking up potential differential effects of the financial crisis. Fourth, we allow for municipality-specific time trends and provide results from placebo tests. Finally, we verify that our results are robust to alternative specifications of the relationship between broadband availability, broadband adoption and newspaper sales by including lagged responses.

**Additional Time-Varying Controls.** Our identification strategy rests on the roll-out of broadband internet being unrelated to other drivers of newspaper demand. To test this, we start by including control variables to see to what extent the IV-estimates of internet use on newspaper sales are sensitive to the inclusion of time-varying covariates. It is useful to include control variables in steps, both to guard against potentially bad control variables and to clarify what type of control variables may be influencing the estimates. Our baseline estimates in column (1) of Table C.1 already control for demographic characteristics, including population composition in seven different age bins, and fractions of unemployed, immigrants, low-income households, and students, and average income and years of education. In column (2), we further add controls that account for newspaper demand factors, including population size, urbanization, public sector and services sector employment shares. In column (3), we add controls that are expected to correlate with the broadband expansion, such as travel times and distance to municipality center, road density, and local government spending on infrastructure and other public services. The different sets of controls are detailed in Appendix Table A.2, Panels E-G. Our estimates across columns (1)-(3) in Table C.1 are relatively stable.

**Municipality-Specific Trends.** Next, we perform several additional steps to assure against the concern of differential underlying time trends in the newspaper market across municipalities. In Table C.1, Column (4), we check that our estimates are robust to excluding the five largest cities (Oslo, Bergen, Trondheim, Stavanger and Bærum) across all years from our estimation, providing assurance that differential trends across big cities and other municipalities are not driving our results. Looking across columns, it is reassuring to see that estimates are virtually unchanged both on the first stage and the second stage. Another related concern is that the 2008 Financial Crisis may have hit municipalities differently and thus could potentially confound our estimates of broadband internet expansion. In an attempt to address this concern, we drop all post-2008 years from our analysis. The resulting estimates in column (5) confirm robustness of our findings.

Further, we include municipality-specific trends in our baseline specification, using data covering 1991 to 1999,<sup>38</sup> prior to broadband expansion. For each municipality we obtain a slope estimate  $\hat{v}_m$ . We then

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<sup>38</sup>While for most outcomes we calculate municipality-specific trends using data from 1991-1999, for outcomes relating to product characteristics we lack data before 1997 and therefore calculate municipality-specific trends using data from 1997-1999.

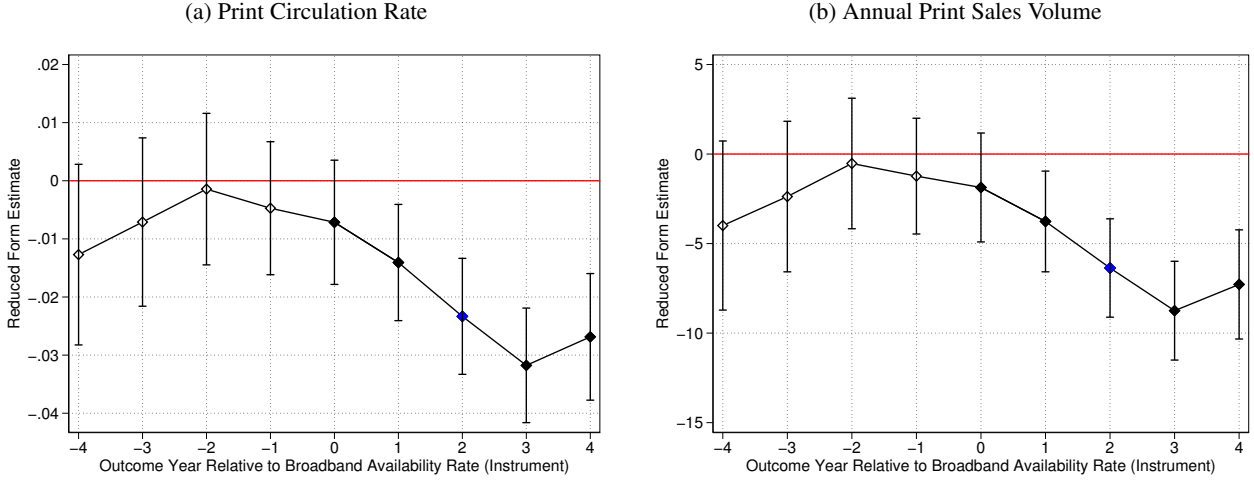
Table C.1: Impacts on Newspaper Sales: Specification Checks.

	Baseline	Additional Controls		Drop Five	Exclude Years	Municipality-Specific Time Trends		
	(1)	(2)	(3)	Largest Cities	2008-2010	Linear	Quadratic	Covariate
						Slope	Slope	Interacted
								Time FEs
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
<b>A. Dependant Variable: Broadband User Rate</b>								
First-Stage Estimate	0.137*** (0.0072)	0.137*** (0.0072)	0.131*** (0.0073)	0.129*** (0.0074)	0.149*** (0.0073)	0.131*** (0.0073)	0.131*** (0.0073)	0.081*** (0.0097)
Kleibergen-Paap F-stat	358.4	359.0	315.2	302.8	404.7	4620	4620	4620
<b>B. Dependant Variable: Print Circulation Rate</b>								
Reduced Form	-0.028*** (0.005)	-0.028*** (0.005)	-0.023*** (0.005)	-0.022*** (0.005)	-0.039*** (0.007)	-0.0233*** (0.005)	-0.0229*** (0.005)	-0.0138** (0.005)
IV Estimate	-0.202*** (0.038)	-0.202*** (0.038)	-0.178*** (0.038)	-0.171*** (0.038)	-0.261*** (0.047)	-0.178*** (0.038)	-0.175*** (0.038)	-0.170** (0.069)
Baseline Mean	1.047	1.047	1.047	1.047	1.047	1.047	1.047	1.047
<b>C. Dependant Variable: Annual Print Sales Volume</b>								
Reduced Form	-7.45*** (1.48)	-7.44*** (1.49)	-6.36*** (1.40)	-6.02*** (1.38)	-10.37*** (2.01)	-6.341*** (1.400)	-6.238*** (1.397)	-3.602** (1.524)
IV Estimate	-54.35*** (10.47)	-54.34*** (10.58)	-48.62*** (10.56)	-46.71*** (10.70)	-69.85*** (13.39)	-48.46*** (10.57)	-47.71*** (10.55)	-44.27** (19.56)
Baseline Mean	304.2	304.2	304.2	304.2	304.2	304.2	304.2	304.2
<b>Controls:</b>								
Demographics	✓	✓	✓	✓	✓	✓	✓	✓
Newspaper Demand		✓	✓	✓	✓	✓	✓	✓
Broadband Expansion			✓	✓	✓	✓	✓	✓
Observations	4,620	4,620	4,620	4,565	2,940	4,620	4,620	4,620

Notes: Columns (1)–(8) display estimates from our main specification at municipality x year level. Panel A shows estimates from the first stage regression equation (1). Panels B–C show results from the second stage regression equation (2), where the dependent variable,  $y_{m,t+1}$ , is either newspaper print circulation rate (Panel B) or newspaper print annual sales volume (Panel C). The reduced form estimate shows the coefficient on broadband availability rate in year  $t-1$ ,  $z_{m,t-1}$ , while the IV estimate shows the coefficient on the endogenous variable of interest, the broadband user rate in year  $t$ ,  $d_{m,t}$ , which has been instrumented using the broadband availability rate in year  $t-1$ ,  $z_{m,t-1}$ . For a detailed description of each outcome variable see Appendix Table A.2, Panel A. Print circulation and sales volume are scaled by the number of households in each municipality-year cell. Regressions are based on 420 municipalities  $\times$  11 years = 4,620 observations. Column (1) displays the same specification as our main results in Table 2, Panel B, with baseline demographic controls. Columns (2) and (3) add additional controls. For a description of all control variables see Table A.2, Panels E–G. In column (4) we exclude the 5 largest municipalities: Oslo, Bergen, Trondheim, Stavanger, and Bærum. In column (5) we exclude the years 2008–2010 as those were the years of the financial crisis. In columns (6) and (7), we first estimate pre-expansion municipality-specific linear and quadratic time trends, respectively, and next extrapolate these into our specification, as shown in equation (C.1). In column (8), in addition to the pre-expansion municipality-specific linear and quadratic time trends, we interact the baseline values of urbanization, population size and education level for each municipality with time fixed effects and include these in the specification, as is shown in equation (C.2). The mean for each outcome variable from the baseline year, 2000, is displayed. Standard errors are heteroskedasticity robust and clustered at the municipality level.

\*  $p < 0.1$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ .

Figure C.1: The Effects of Broadband Availability Rate on Past and Future Newspaper Sales.



Notes: The figures above displays coefficient estimates of  $\hat{\delta}_k$  from separate regressions of equation  $y_{m,t+k} = \delta_k z_{m,t} + x'_{m,t} \beta_k + \alpha_m + \tau_t + \varepsilon_{m,t+k}$ , for each value of  $k \in \{-4, 4\}$  along with the corresponding 95% confidence intervals. For a detailed description of each outcome variable see Appendix Table A.2, Panel A. Print circulation and sales volume are scaled by the number of households in each municipality-year cell. All regressions include municipality fixed effects and year dummies, and the baseline demographic controls discussed in Table A.2, Panel E. Standard errors are heteroskedasticity robust and clustered at the municipality level. In our baseline IV model in equations (1)-(2), there is a two-year lag between the outcome ( $y_{m,t+1}$ ) and the broadband availability instrument ( $z_{m,t-1}$ ), i.e., the coefficient from the above regression at  $k = 2$  corresponds to our baseline reduced form estimate, which is marked in blue in the figures.

extrapolate pre-expansion time trends in our specification (both the first and the second stage) as follows

$$y_{m,t+1} = \lambda d_{m,t} + x'_{m,t-1} \beta + \alpha_m + \kappa_1 \hat{v}_m t + \kappa_2 \hat{v}_m t^2 + \tau_t + \varepsilon_{m,t+1} \quad (\text{C.1})$$

This procedure will remove variation in our instrument that coincides with pre-existing trends in the outcome.

A second and related test follows Duflo (2001) in interacting baseline (year 2000) covariates with time dummies, i.e.

$$y_{m,t+1} = \lambda d_{m,t} + x'_{m,t-1} \beta + \alpha_m + \tau_t \sum_q \kappa_q x_{(m,2000),q} + \varepsilon_{m,t+1} \quad (\text{C.2})$$

By interacting time with observable characteristics, we allow the expansion of broadband internet to be related to different nonlinear underlying time trends in the newspaper market across municipalities, depending on their pre-reform characteristics. Columns (7)–(8) in Table C.1 report the estimates based on these specifications, which are usually very close to our baseline estimates.

**Placebo.** We next perform placebo tests to examine whether current year’s broadband availability “affects” past outcomes: If it did, this would suggest that some omitted variable might be affecting both the newspaper market and the spread of broadband internet. Specifically, we regress the outcome in year  $t + k$  on internet coverage in year  $t$ , and vary  $k$  between -4 and 4 to capture the correlation between the outcome and the instrument around a four-year window before and after the year when the instrument is measured. For  $k = 2$ , this regression thus corresponds to the reduced form of our IV model in equations (1)-(2). Figure C.1 presents the results from this placebo test. It is reassuring that we find no effect of current coverage on past circulation and sales (i.e., no sign of a pre-trend), with only future outcomes being significantly impacted.

**Alternative Dynamic Structure.** Our baseline IV model in equations (1)-(2) specifies the relationship between broadband usage and newspaper sales in the following year, while instrumenting broadband usage with lagged broadband availability. We now assess the stability of our estimates to alternative specifications of the lag structure between broadband availability, broadband usage and newspaper sales.

Table C.2: IV Estimates of Internet Use on Newspaper Sales in Future Years.

	Dependent Variable Measured in Year:		
	Year $t + 1$ (baseline)	Year $t + 2$	Year $t + 3$
	(1)	(2)	(3)
<b>A. Print Circulation Rate</b>			
Overall	-0.202*** (0.0379)	-0.223*** (0.0373)	-0.213*** (0.0403)
<i>By Newspaper Segment:</i>			
Locals	0.0003 (0.0248)	-0.0239 (0.0247)	-0.0319 (0.0264)
Tabloids	-0.129*** (0.0153)	-0.136*** (0.0154)	-0.150*** (0.0156)
Non-tabloids	-0.0734*** (0.0184)	-0.0628*** (0.0150)	-0.0307* (0.0162)
<b>B. Annual Print Sales Volume</b>			
Overall	-54.35*** (10.47)	-60.48*** (10.38)	-56.45*** (11.19)
<i>By Newspaper Segment:</i>			
Locals	-0.68 (7.58)	-7.83 (7.47)	-10.73 (8.10)
Tabloids	-33.52*** (3.98)	-35.32*** (4.01)	-39.10*** (4.06)
Non-tabloids	-20.15*** (4.40)	-17.32*** (3.71)	-6.62* (3.83)

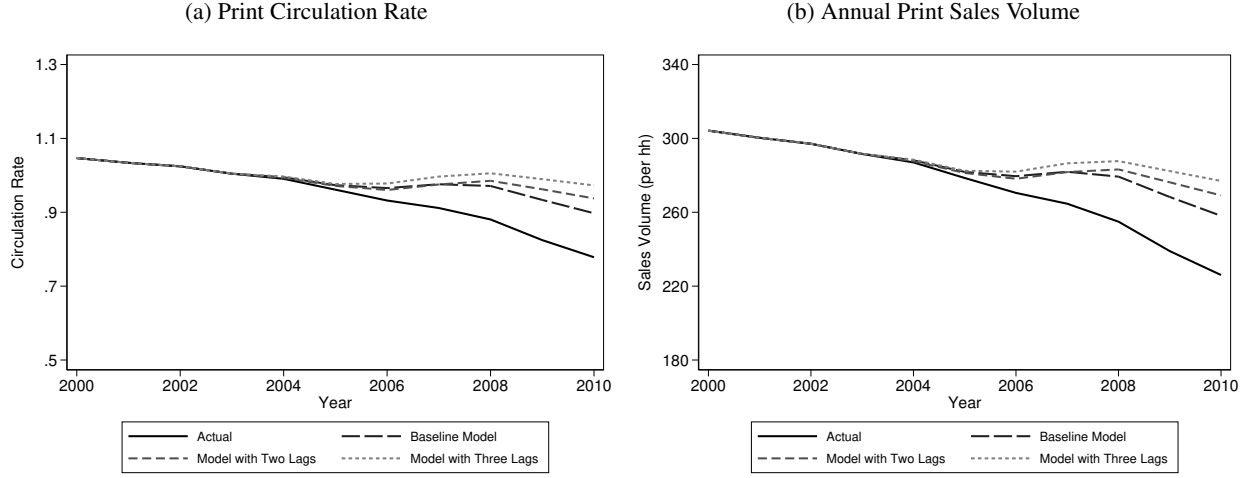
*Notes:* The estimates in this table come from the second stage regression equation (2), where the coefficient on the dependent variable,  $y_{m,t+k}$ , is displayed separately for each outcome in each row and at different values of  $k$  in each column. The endogenous variable of interest is the broadband user rate in year  $t$ ,  $d_{m,t}$ , which has been instrumented using the broadband availability rate in year  $t-1$ ,  $z_{m,t-1}$ . For a detailed description of each outcome variable see Appendix Table A.2, Panel A. Print circulation and sales volume are scaled by the number of households in each municipality-year cell. All regressions are based on 420 municipalities  $\times$  11 years = 4,620 observations. The specifications for  $k = 2$  and  $k = 3$  include additional data for the years 2011 and 2012. All regressions include municipality fixed effects and year dummies. All regressions include the demographic controls discussed in Table A.2, Panel E. Standard errors are heteroskedasticity robust and clustered at the municipality level.

\*  $p < 0.1$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ .

We begin by replacing the outcome of interest in the second-stage equation (2) by the same outcome measured in future periods, and otherwise keeping equations (1)-(2) unchanged. Specifically, rather than newspaper sales in the following year,  $y_{m,t+1}$ , we now consider the impacts of broadband usage on newspapers sales in two,  $y_{m,t+2}$ , or three,  $y_{m,t+3}$ , years ahead. The results are reported in Table C.2, columns (2)-(3), while our baseline estimates are repeated in column (1). Reassuringly, our effect estimates are highly stable to the measurement of newspaper sales at different intervals, suggesting that our results are robust to the lag structure specified in the relationship between broadband usage and newspaper sales. The same is true when we look across different newspaper types in Table C.2.



Figure C.2: The Impacts on Newspaper Sales: Alternative Model Specifications.



Notes: Figures show the overall actual (solid line) and predicted counterfactual (dashed line) newspaper print circulation rate (panel a) and annual print sales volume per household (panel b). For a detailed description of each outcome variable see Appendix Table A.2, Panel A. Print circulation and sales volume are scaled by the number of households in each municipality-year cell. The counterfactual is given by the actual outcome minus the predicted effect of internet use in the past year(s) on each outcome, providing an estimate of the outcome in a counterfactual situation with zero internet use in (all) the past year(s). The counterfactual trends are constructed based on three alternative specifications of equations (C.3)-(C.4): one lag (our baseline model), two lags ( $J=2$ ) and three lags ( $J=3$ ).

Next, we assess the robustness of our findings to alternative specifications of both the lag structure between broadband usage and newspaper sales, and the lag structure between broadband availability and broadband usage. Specifically, we estimate a model that at the same time allows lagged responses of broadband usage to broadband availability, and lagged responses of newspaper sales to broadband usage. To capture these responses, we augment our IV-model with  $j = 1, 2, \dots, J$  lagged values for broadband availability and user rates as specified in equations (C.3) and (C.4) below:

$$y_{m,t+1} = \sum_{j=1}^J \lambda_j d_{m,t+1-j} + x'_{mt-1} \beta + \alpha_m + \tau_t + \varepsilon_{m,t+1}, \quad (\text{C.3})$$

$$d_{m,t+1-j} = \sum_{s=1}^J \delta_{s,j} z_{m,t-s} + x'_{mt-1} \mu_j + \gamma_{m,j} + v_{t,j} + \eta_{m,t+1-j}, \quad j = 1, 2, \dots, J, \quad (\text{C.4})$$

where equation (C.3) is the second stage and equation (C.4) represents the  $J$  first stages. This gives a system of  $J + 1$  equations with  $J$  endogenous variables and  $J$  instruments, which we estimate simultaneously.

Figure C.2 presents the estimated counterfactual trends for newspaper sales using three alternative models: one lag (our baseline model), two lags ( $J = 2$ ) and three lags ( $J = 3$ ) of broadband user rates and of broadband coverage rates. The plots suggest that by allowing lagged responses of take-up to availability and delayed impacts of take-up on sales, one could potentially explain more of the decline in print newspaper circulation and sales volume between 2000 and 2010. However, while the estimated impact of internet use on circulation and sales is larger when we include a longer time to respond, most of the impact of broadband usage is already captured in our baseline. Indeed, the difference from our baseline prediction is relatively small and we can't statistically distinguish predictions from the three models. This again suggests that our baseline model performs well at capturing the main impacts of broadband usage on newspaper sales.

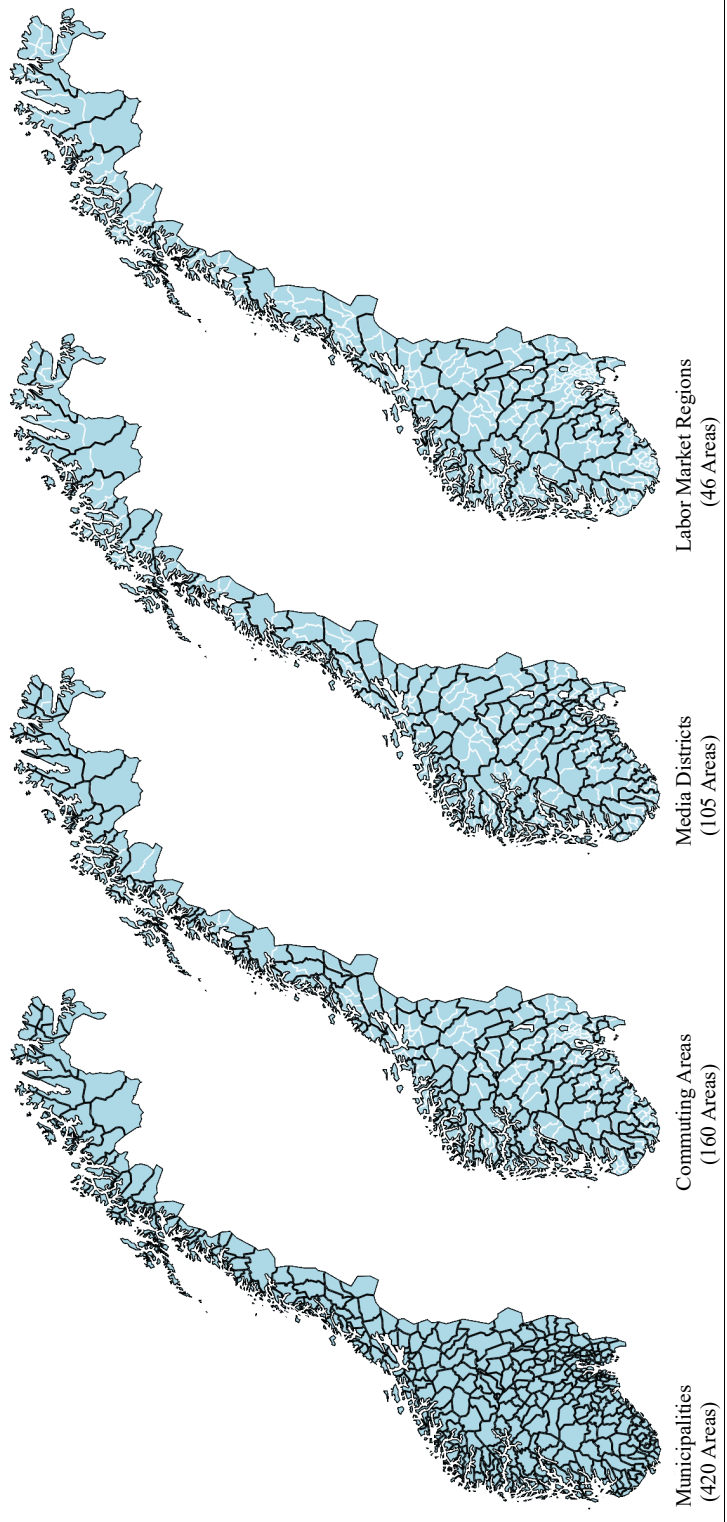
## D Appendix: Geographic Spillovers

Our main empirical analysis uses the municipality as the baseline geographic unit. This choice is mainly driven by features of the Norwegian setting, where municipalities are distinct local government units, and moreover reasons of data availability, as broadband availability and usage are measured at this level for each year. We now assess the sensitivity of our findings to an assumption of geographical segmentation of markets implicit in this analysis. In theory, one could imagine geographic spillovers for (at least) two distinct reasons. Firstly, one could imagine spillovers in newspaper demand. For instance, the roll-out of broadband internet in a municipality that facilitates consumers to substitute from print to online news media may trigger (similar) changes in other parts of the same geographic newspaper market through spillovers in demand (i.e., tastes). Secondly, one could also imagine geographic spillovers taking place through newspapers' endogenous response to a local demand shock. For instance, a newspaper that is being circulated in multiple destinations, while being hit by a demand shock in one of its locations through broadband expansion may alter its production (e.g., product characteristics), which in turn may affect its sales in other locations.

In the following, we shed some light on the nature of geographic spillovers in our setting. We do so in the following steps. First, we aggregate our units of analysis to geographical regions and rely on variation in broadband availability and usage within regions over time, so that we can capture spillovers that take place within regional boundaries. Second, we return to our main analysis at the municipality-year level, but allow newspaper sales in a municipality to depend both on broadband usage in the same municipality as well as the average broadband usage rate in the same region (leaving-out own municipality). Third, we rely on the features of our setting and data that we observe each newspaper's sales in all municipalities and that newspapers are initially circulated in different geographical locations and thus differently exposed to broadband expansion over time. These features allow us to perform alternative analysis at the newspaper-municipality-year and newspaper-year levels, while still using the broadband expansion as an exogenous shock to broadband usage in different newspapers' initial markets. In the following, we describe each of these analyses in more detail and provide our findings on geographic spillovers.

**Regional Analysis.** We start by amending our main specification to consider the larger region to which each municipality belongs. Lacking precise prior knowledge about the geographical extent of spillovers in demand (i.e., tastes), we rely on alternative regional classifications that exist in Norway for this purpose: (i) a classification of 160 commuting areas developed by [Gundersen and Juvkam \(2013\)](#), (ii) a classification of 105 media districts used by the Norwegian Media Businesses' Association (MBL) and Kantar/TNS Gallup for statistical purposes, and (iii) a much more aggregated classification of 46 labor market regions developed by [Bhuller \(2009\)](#). Figure [D.1](#) displays side-by-side maps of Norway with each geographical classification. We start by estimating our main specification at each of the larger geographic units by aggregating for each year all variables in our dataset to each of these levels. Specifically, we aggregate all municipality level variables to the regional level as a weighted average using population size of each municipality as the weight. In columns (2)-(4) of Table [D.1](#), we show that sales effects are similar at the regional level, and are not statistically distinguishable from our baseline estimates.

Figure D.1: Geographical Regions of Norway.



Notes: Each subfigure shows the map of Norway with different geographical boundaries. The left-most subfigure shows the municipality boundaries (in black), while the remaining three subfigures show the geographical boundaries associated with different regional classifications (in black) along with the municipality boundaries (in white). Each regional classification provides a different aggregation of municipalities into unique geographical areas; a region consists of one or more municipalities, and a single municipality is never split between different geographical regions.

Table D.1: Geographic Spillovers in the IV Estimates of Effects of Internet Use on Newspaper Sales.

	Alternative Geographical Level:				Leave Out Specification:		
	Baseline (420 Municipalities)	Commuting Areas (160 Regions)	Media Districts (105 Regions)	Labor Market Regions (46 Regions)	Commuting Areas (160 Regions)	Media Districts (105 Regions)	Labor Market Regions (46 Regions)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
<b>A. Print Circulation Rate</b>							
<i>Own</i>	-0.202*** (0.038)	-0.204*** (0.066)	-0.309*** (0.085)	-0.336*** (0.099)	-0.196*** (0.0407)	-0.189*** (0.0387)	-0.189*** (0.0385)
<i>Rest of the Region (Excluding Own)</i>					-0.009 (0.0421)	-0.052 (0.0471)	-0.061 (0.0480)
<i>Base mean</i>	1.047	1.008	1.092	1.111	1.091	1.090	1.120
<i>Own Est/Mean</i>	-19.3 %	-20.2 %	-28.3 %	-30.2 %	-18.0 %	-17.3 %	-16.9 %
<b>B. Annual Print Sales Volume</b>							
<i>Own</i>	-54.35*** (10.47)	-56.37*** (18.47)	-84.63*** (23.03)	-86.92*** (28.20)	-53.30*** (11.39)	-50.80*** (10.69)	-51.44*** (10.61)
<i>Rest of the Region (Excluding Own)</i>					-0.407 (11.94)	-13.07 (13.09)	-13.92 (13.49)
<i>Base mean</i>	304.2	294.2	316.2	324.0	316.5	316.2	324.0
<i>Own Est/Mean</i>	-17.9 %	-19.2 %	-26.8 %	-26.8 %	-16.8 %	-16.1 %	-15.9 %
Observations	4,620	1,760	1,155	506	3,817	4,543	4,620

*Notes:* The regressions in column (1) is based on 420 municipalities  $\times$  11 years = 4,620 observations. The regression in columns (2)-(4) aggregates all variables to region-level, weighted by the populations in each municipality in that region. The regressions in columns (5)-(7) is at municipality level but includes average broadband usage in the region the municipality is located in (excluding that municipality) and instruments this with broadband availability (two endogenous variables with two instruments). In column (5), 73 municipalities that were in a region of their own are excluded, and therefore regressions are based on 347 municipalities  $\times$  11 years = 3,817 observations. Similarly, in column (6), 7 municipalities that were in a region of their own are excluded, and therefore regressions are based on 413 municipalities  $\times$  11 years = 4,543 observations. For a detailed description of each outcome variable see Appendix Table A.2, Panel A. Print circulation and sales volume are scaled by the number of households in each location-year cell. All regressions include municipality or region fixed effects, year dummies and demographic controls. For a description of the demographic control variables see Table A.2, Panel E. The mean for each outcome variable is from the baseline year, 2000. Standard errors are heteroskedasticity robust and clustered at the municipality in columns (1) and at region level in columns (2)-(7).

\* p < 0.1, \*\* < 0.05, \*\*\* p < 0.01.

**Leave-out Analysis.** Next, we check whether newspaper sales in a municipality depend on broadband usage rate in the same region, while controlling for broadband usage in the same municipality. Specifically, consider other municipalities in region  $r(m')$  where municipality  $m$  is located. We amend equation (2) as follows:

$$y_{m,t+1} = \lambda_1 \hat{d}_{m,t} + \lambda_2 \hat{d}_{r(m'),t} + x'_{m,t-1} \beta + \alpha_m + \tau_t + \varepsilon_{m,t+1} \quad (\text{D.1})$$

where  $\hat{d}_{r(m'),t}$  is internet use in the region excluding the municipality  $m$  and  $\hat{\cdot}$  indicates that both  $\hat{d}_{m,t}$  and  $\hat{d}_{r(m'),t}$  are predicted values using instruments  $z_{m,t-1}$  and  $z_{r(m'),t-1}$ , constructed based on the same regional classification. For instance, if there are no demand spillovers across municipality, then we should expect that sales in a municipality to be affected by local shocks but not shocks that occur in rest of the region once we have controlled for local shocks, i.e.,  $\lambda_1 > 0$  while  $\lambda_2 = 0$ . Estimates are reported in columns (4)-(6) of Table D.1: While the effect of the local broadband use is close to our baseline effect, there seems to be no significant effect of broadband use in the rest of the region, suggesting an absence of geographic spillovers.

**Newspaper-level Analysis.** We now provide two additional sets of estimates for how the internet impacts newspaper sales, respectively, at the newspaper-municipality-year level and at the newspaper-year level, where we rely on differential exposure to broadband internet due to initial differences in the spread of newspapers across locations.

First, we provide evidence from a specification at the newspaper-municipality-year level where we rely on within-newspaper variation in broadband usage across different locations by including a newspaper fixed effect. Specifically, we estimate an IV model with the following second stage equation

$$y_{n,m,t+1} = \lambda d_{m,t} + x'_{m,t-1} \beta + \alpha_m + \tau_t + \phi_n + \varepsilon_{n,m,t+1} \quad (\text{D.2})$$

where  $y_{n,m,t+1}$  is newspaper  $n$ 's circulation in municipality  $m$ , divided by the number of households of  $m$ . As before,  $d_{m,t}$  is the internet usage rate in municipality  $m$ . Results presented in columns (1)-(2) of Table D.2 show that our conclusions remain unchanged also conditional on newspaper fixed effects  $\phi_n$ . Effectively, this specification relies on variation in differential exposure to broadband expansion across municipalities, for a given newspaper, while also controlling for common time trends and permanent differences across municipalities. The IV estimate on circulation rate of -0.0038, scaled relative to baseline mean of 0.0207, implies that internet use reduces newspaper-level circulation rate by 18.3%. In relative terms, this is close to the reduction in municipality-level newspaper circulation of 19.3% implied by the point estimate of -0.202 (scaled by baseline mean of 1.047).

As noted above, one mechanism for how geographic spillovers could occur in our setting is through endogenous supply-side changes in newspapers, so that newspapers' reactions to local demand shocks in one location may trigger changes in sales also in other locations. To capture such effects we now also introduce an alternative specification where the dependant variable is aggregated to the newspaper-level.

This analysis provides estimates on the effects of broadband usage on an exposed newspaper's overall sales across all locations as opposed to overall newspaper sales in an exposed municipality.

Table D.2: Impacts on Newspaper Sales: Newspaper-level Analysis.

Level of Analysis:	Newspaper-Municipality-Year		Newspaper-Year	
	Baseline Controls	Additional Controls	Baseline Controls	Additional Controls
	(1)	(2)	(3)	(4)
<b>A. Dependant Variable: Broadband User Rate</b>				
First-Stage Estimate	0.131*** (0.0064)	0.127*** (0.0064)	0.114*** (0.0109)	0.0981*** (0.0102)
Kleibergen-Paap F-stat	414.3	388.1	78.3	79.4
<b>B. Dependant Variable: Print Circulation Rate</b>				
Reduced Form	-0.0005*** (0.0001)	-0.0004*** (0.0001)	-0.0074*** (0.0025)	-0.0054** (0.0026)
IV Estimate	-0.0038*** (0.0008)	-0.0031*** (0.0008)	-0.0644*** (0.0218)	-0.0547** (0.0266)
Baseline Mean	0.0207	0.0207	0.0671	0.0671
<b>C. Dependant Variable: Annual Print Sales Volume</b>				
Reduced Form	-0.132*** (0.0292)	-0.105*** (0.0285)	-1.875*** (0.622)	-1.427** (0.659)
IV Estimate	-1.005*** (0.222)	-0.827*** (0.224)	-16.44*** (5.53)	-14.55** (6.76)
Baseline Mean	6.008	6.008	18.18	18.18
<b>Controls:</b>				
Year FEs	✓	✓	✓	✓
Municipality FEs	✓	✓		
Newspaper FEs	✓	✓	✓	✓
Demographics	✓	✓	✓	✓
Newspaper Demand		✓		✓
Broadband Expansion		✓		✓
Observations	233,948	233,948	850	850

Notes: For a detailed description of each outcome variable see Appendix Table A.2, Panel A. Columns (1)-(2) display estimates for outcomes measured at the newspaper x municipality x year level (233,948 observations) as described in equation D.2, with controls for newspaper fixed effects. In Columns (1)-(2), print circulation and sales volume are scaled by the number of households in each municipality-year cell. Standard errors are heteroskedasticity robust and clustered at the newspaper level. Columns (3)-(4) display estimates for outcomes measured at the newspaper x year level (850 observations) as described in equations D.3-D.4. In Columns (3)-(4), print circulation and sales volume are scaled by the number of households in each newspaper's national market in each year. Standard errors are heteroskedasticity robust.

\* p < 0.1, \*\* < 0.05, \*\*\* p < 0.01.

This alternative specification can be represented by the following IV model with the first and second stage equations:

$$d_{n,t} = \delta z_{n,t-1} + x'_{n,t-1} \mu + \gamma_n + v_t + \eta_{n,t}, \quad (\text{D.3})$$

$$y_{n,t+1} = \lambda d_{n,t} + x'_{n,t-1} \beta + \tau_t + \phi_n + \varepsilon_{n,t+1}. \quad (\text{D.4})$$

In order to exploit differential exposure to the changes in broadband availability and usage over time across newspapers, we first construct weighted averages of these variables at the newspaper-year level. Specifically, for each newspaper  $n$  in year  $t$ , we construct the weighted averages of broadband availability rates  $z_{m,t}$ , usage rates  $d_{m,t}$ , and municipality covariates  $x_{m,t}$  measured in municipality  $m$  in year  $t$  by the share of newspaper  $n$ 's total sales in municipality  $m$  in year 2000. Specifically,

$$\begin{aligned} z_{n,t} &= \sum_m s_{n,m,2000} \cdot z_{m,t} \equiv \sum_m \frac{Q_{n,m,2000}}{\sum_m Q_{n,m,2000}} \cdot z_{m,t} \\ d_{n,t} &= \sum_m s_{n,m,2000} \cdot d_{m,t} \equiv \sum_m \frac{Q_{n,m,2000}}{\sum_m Q_{n,m,2000}} \cdot d_{m,t} \\ x_{n,t} &= \sum_m s_{n,m,2000} \cdot x_{m,t} \equiv \sum_m \frac{Q_{n,m,2000}}{\sum_m Q_{n,m,2000}} \cdot x_{m,t} \end{aligned}$$

where  $Q_{n,m,2000}$  is newspaper  $n$ 's annual print sales volume in municipality  $m$  in year 2000. Then,  $s_{n,m,2000}$  is the share of newspaper  $n$ 's initial sales volume that occurs in municipality  $m$ , which can be seen as a measure of how exposed a newspaper is to broadband expansion in that municipality. Effectively, this procedure allows us to construct annual measures of broadband availability  $z_{n,t}$  and usage  $d_{n,t}$  in newspaper  $n$ 's initial market. As shown in the equations above, the underlying variation in these newspaper market-level measures stems from (i) initial differences in newspapers' sales across locations  $s_{n,m,2000}$ , and (iii) differential exposure to broadband availability  $z_{m,t}$  and usage  $d_{m,t}$  across locations and time.

Results presented in Table D.2, Panel A, columns (3)-(4), show that there are indeed significant first-stage estimates of broadband availability on usage, also when we aggregate units to the newspaper level. Moreover, considering the impacts on newspaper-level sales in Panels B-C, our conclusions are broadly similar to those from the municipality-level analysis, with significant reductions in sales from increased broadband usage in a newspaper's market. Further, note that the dependent means reported in Columns (3)-(4) are around three times larger compared to those in Columns (1)-(2), which is because we have aggregated outcomes to the newspaper-level. This reflects the difference in variables across specifications: Columns (1)-(2) uses the circulation and sales for a newspaper per household in each municipality; whereas Columns (3)-(4) uses the circulation and sales for a newspaper in their whole national market. In terms of relative impact sizes, we find stronger reductions in Columns (3)-(4) than in Columns (1)-(2), indicating that a newspaper's overall sales are strongly hit when there is an increase in broadband usage in its market as a whole, compared to when there is an increase in broadband usage in one of the locations where the newspaper is circulated. This difference may reflect that newspapers' endogenous supply-side responses to broadband expansion on their sales are captured in the newspaper-year level specification, while the newspaper-municipality-year level specification provides impacts net of such responses that are common across all locations.

Table D.3 presents IV estimates from the newspaper-year level specification on how broadband internet affected the newspaper product available to readers and advertisers. These results are discussed in Section



5.2 of the paper. The corresponding reduced form estimates are provided in Table E.11, Columns (7)-(9).

Table D.3: IV Estimates of Internet Use on Content, Format and Listed: Newspaper-level Analysis.

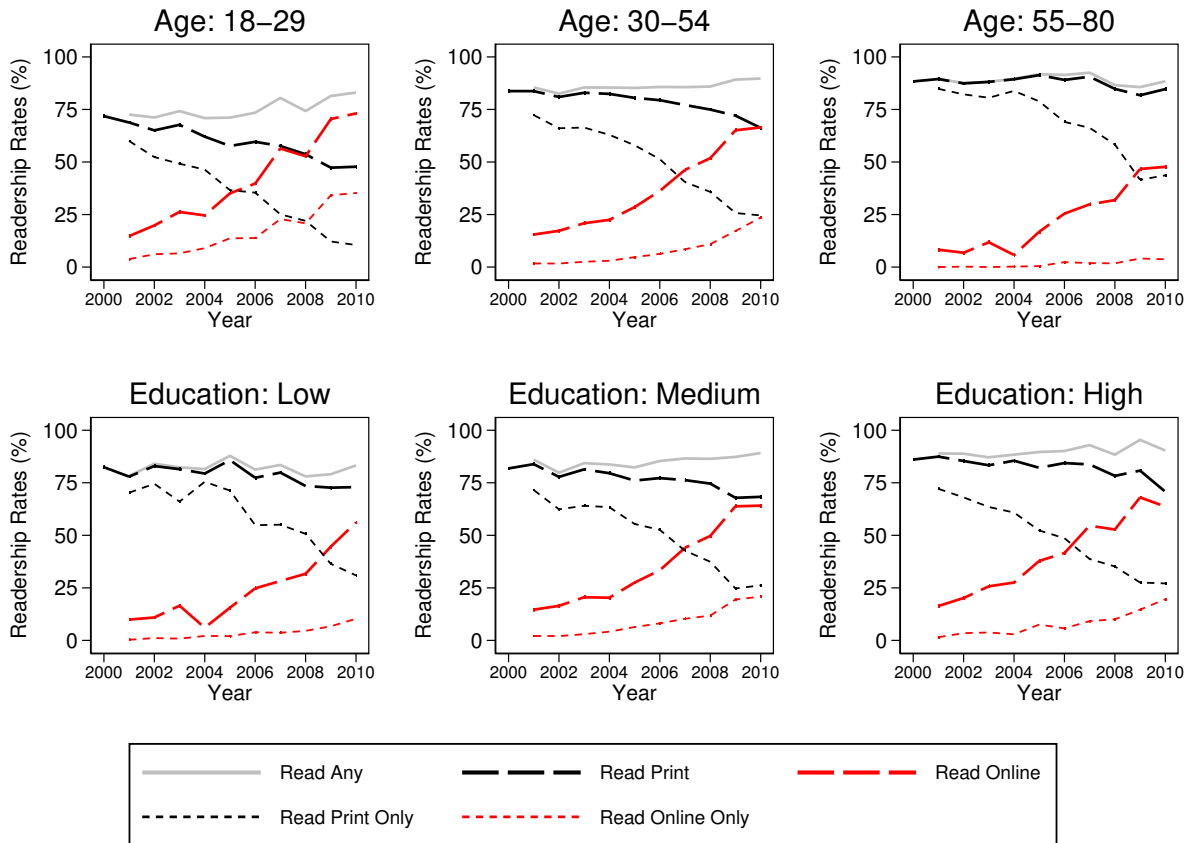
Level of Analysis:	Newspaper-Year Level		
	(1) Estimate	(2) (SE)	(3) Mean
<b>A. Content Shares</b>			
Sport and Entertainment	-25.03*	(14.02)	35.94
<i>Entertainment</i>	-19.09*	(11.56)	19.26
<i>Sport</i>	-5.939	(6.803)	16.69
Health and Crime	0.470	(7.855)	27.33
<i>Health</i>	5.176	(4.040)	12.27
<i>Crime</i>	-4.706	(6.694)	15.06
Politics, FA and B/F	24.56**	(11.55)	36.73
<i>Politics</i>	16.83**	(6.779)	14.62
<i>Foreign Affairs</i>	-5.075	(3.117)	3.659
<i>Business/Finance</i>	12.79	(9.521)	18.46
<b>B. Format and Size</b>			
Format (Page Size in cm <sup>2</sup> )	310.2	(1,950)	1,499
No. of Pages	-67.5	(44.2)	46.31
Total Size (Format × No. of Pages)	-44,856	(122,888)	67,267
<b>C. Listed Sales Price and Advert Prices</b>			
Sales Price per Copy	-5.684	(8.220)	12.11
Full Page in 4 Colors	-160,462	(108,190)	114,202
Full Page in B/W	-13,1953*	(70,091)	71,130
Column Ads, per cm	-14.65	(20.27)	63.54

*Notes:* This table displays estimates for outcomes measured at the newspaper-year level (850 observations) as described in Section D. Estimates show the results from the second stage regression equation (D.4). Regressions include the demographic controls discussed in Table A.2, Panel E. For a detailed description of each outcome variable see Appendix Table A.2, Panel A. Prices are in 2010 NOK. In 2010, 1 USD ≈ 6 NOK. The mean for each outcome variable from the baseline year, 2000, is displayed in columns (3). Regressions are weighted by the initial circulation of newspapers. Standard errors are heteroskedasticity robust. \* p < 0.1, \*\* p < 0.05, \*\*\* p < 0.01.



## E Appendix: Additional Figures and Tables

Figure E.1: Trends in Newspaper Readership by by Age and Education.



*Notes:* Figures show the annual trends in newspaper readership rates by age and education. Appendix Table A.1 provides a complete list of the 81 newspapers in our sample. The online and print readership rates are constructed for a sample of adult responders in the Norwegian Media User Surveys, and measured as the fraction of positive responses scaled by the number of survey respondents.

Figure E.2: Evolution of Broadband Internet Availability and Newspaper Print Circulation across Norway.

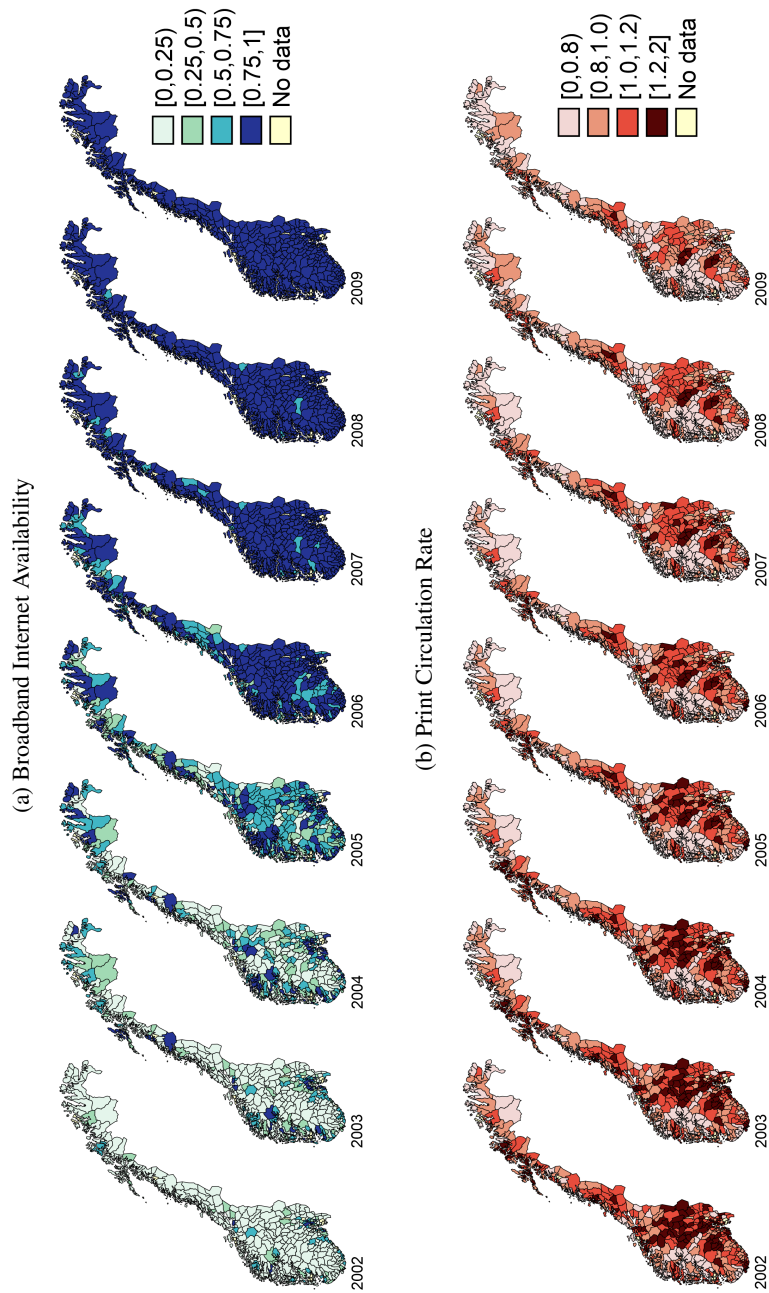
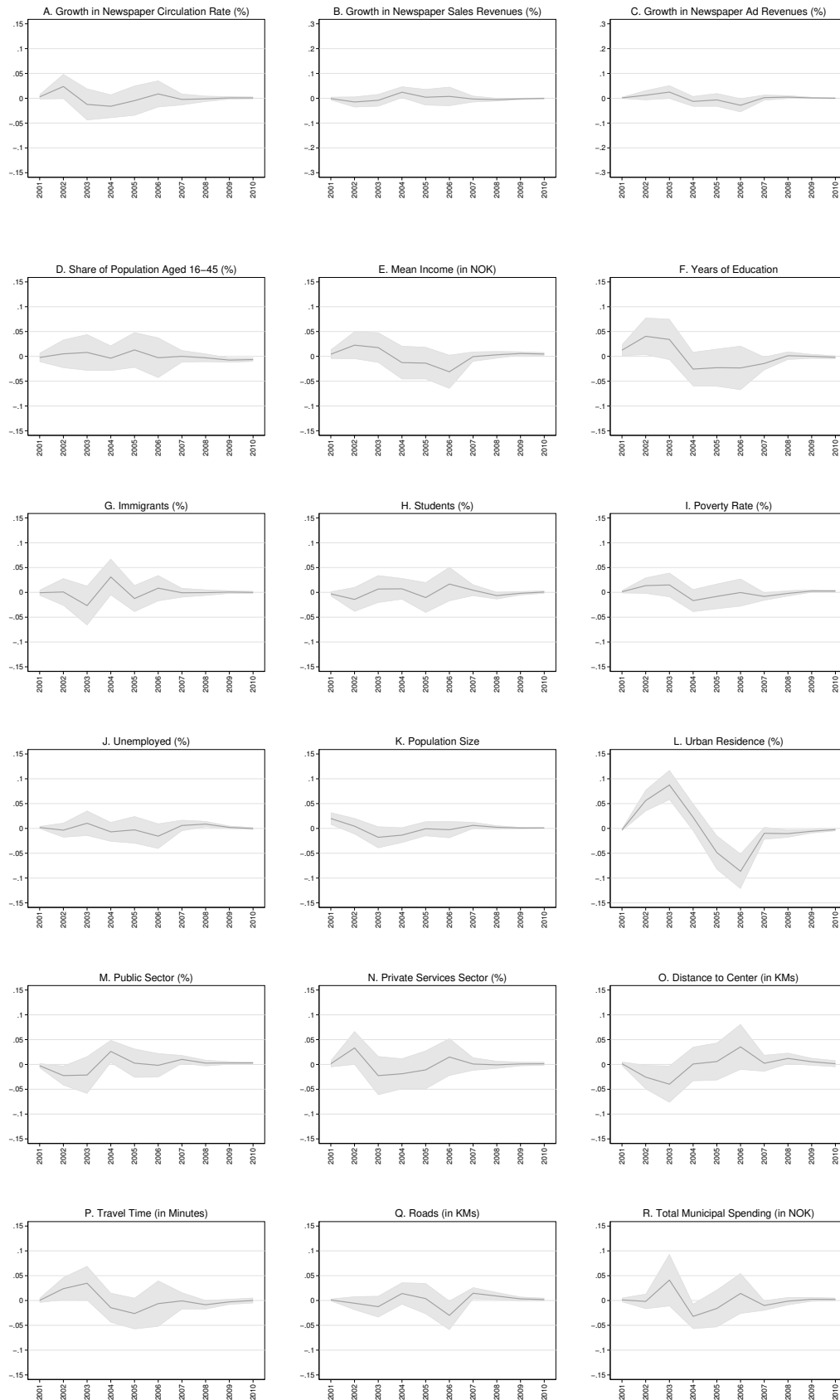


Figure E.3: Expansion of Broadband Internet by Baseline Municipality Characteristics



Notes: Figures display the change in broadband internet coverage rate,  $\Delta z_{it}$ , regressed on baseline municipality characteristics. As shown in equation (4), we regress changes in coverage rates on municipality specific baseline characteristics interacted with time dummies, while controlling for fixed effects. The figures plot the interaction terms for each variable, along with the associated 95% CIs.

Table E.1: Descriptive Statistics – Control Variables.

Variable	Overall		2000		2005		2010	
<b>A. Demographic Characteristics</b>								
Aged 16–21 (%)	7.97	(0.96)	7.75	(1.02)	7.91	(0.92)	8.34	(0.88)
Aged 22–24 (%)	3.50	(0.50)	3.64	(0.50)	3.49	(0.49)	3.51	(0.49)
Aged 25–34 (%)	11.31	(2.01)	13.10	(1.76)	11.17	(1.61)	10.07	(1.81)
Aged 35–44 (%)	13.72	(1.48)	13.54	(1.28)	13.80	(1.51)	13.56	(1.57)
Aged 45–54 (%)	11.65	(0.99)	13.74	(1.15)	13.59	(0.93)	13.73	(0.97)
Aged 55–66 (%)	14.12	(2.11)	11.76	(1.36)	14.33	(1.65)	15.84	(1.87)
Aged 67– (%)	22.07	(4.73)	16.40	(3.60)	21.92	(2.85)	28.14	(2.35)
Students (%)	11.14	(1.61)	11.56	(1.72)	11.23	(1.46)	10.44	(1.37)
Poverty Rate (%)	5.03	(1.43)	5.68	(1.60)	5.19	(1.40)	4.61	(1.26)
Unemployed (%)	1.44	(0.79)	1.34	(0.69)	1.85	(0.84)	1.21	(0.57)
Immigrants (%)	4.44	(2.79)	3.26	(2.18)	4.13	(2.42)	6.61	(3.32)
Income (1000 NOK)	501.0	(43.1)	482.8	(41.5)	506.2	(38.5)	514.6	(40.5)
Years of Education	11.57	(0.46)	11.27	(0.42)	11.58	(0.42)	11.84	(0.43)
<b>B. Population Size, Density, and Industry Structure</b>								
Population Size	10,386	(31,535)	10,038	(29,835)	10,328	(31,146)	10,891	(34,240)
Urban Residency (%)	49.18	(27.62)	47.71	(27.43)	49.02	(27.73)	50.08	(27.69)
Public Sector (%)	26.91	(5.27)	25.77	(5.42)	26.04	(4.80)	29.25	(5.36)
Services Sector (%)	30.63	(4.88)	28.59	(5.31)	29.66	(4.45)	33.47	(4.39)
Private Services (%)	7.50	(3.37)	6.97	(3.37)	7.15	(3.23)	8.27	(4.39)
<b>C. Geography</b>								
Distance (in km)	8.27	(7.28)	8.69	(7.46)	8.25	(7.07)	8.03	(7.47)
Travel time (in minutes)	9.60	(7.48)	12.17	(9.50)	9.29	(7.19)	9.10	(6.80)
Roads (in km per 1000 residents)	164.5	(105.9)	158.7	(98.3)	165.8	(106.2)	167.7	(110.8)
<b>D. Municipal Expenditures (1000 NOK per Capita)</b>								
Total	55.36	(18.65)	50.69	(14.28)	51.85	(14.87)	79.29	(27.26)
Administration	5.75	(3.42)	4.13	(2.70)	5.59	(3.19)	6.93	(4.08)
Education	14.06	(5.44)	13.35	(2.94)	12.81	(2.57)	25.60	(10.28)
Health	19.89	(7.28)	18.76	(6.30)	18.27	(5.78)	30.43	(8.61)
Infrastructure	6.66	(4.09)	7.06	(3.01)	6.90	(3.97)	2.33	(2.61)

Notes: All variables are constructed as averages at the municipality and year level; means and standard deviations are calculated across municipalities (overall and by year). Detailed descriptions of the variables are given in Table A.2.

Table E.2: Descriptive Statistics – Outcome Variables.

Variable	Overall		2000		2005		2010	
<u>A. Newspaper Circulation and Sales Volume</u>								
Print Circulation Rate	0.94	(0.25)	1.05	(0.26)	0.96	(0.24)	0.78	(0.20)
Locals	0.63	(0.21)	0.70	(0.22)	0.63	(0.20)	0.54	(0.19)
Tabloids	0.19	(0.09)	0.22	(0.10)	0.20	(0.08)	0.13	(0.05)
Non-tabloids	0.12	(0.08)	0.13	(0.08)	0.12	(0.08)	0.11	(0.07)
Annual Print Sales Volume	274	(70.6)	304	(71.51)	279	(67.54)	226	(59.2)
<u>B. Balance Sheets, Average Revenue Per Unit and Labor Inputs</u>								
Total Revenues	5,371	(2,595)	5,443	(2,532)	5,517	(2,719)	4,752	(2,303)
Market Revenues	4,853	(2,345)	4,935	(2,278)	5,002	(2,393)	4,449	(2,238)
Sales Revenues	2,386	(978)	2,421	(962)	2,444	(1,006)	2,162	(899)
Ads Revenues	2,467	(1,425)	2,514	(1,363)	2,558	(1,433)	2,287	(1,386)
Other Revenues	518	(464)	508	(452)	515	(487)	303	(202)
Average Market Revenue Per Unit	8.88	(3.04)	8.07	(2.75)	8.88	(2.94)	9.77	(3.39)
Average Sales Revenue Per Unit	18.02	(7.38)	16.38	(6.60)	18.11	(7.07)	20.02	(8.27)
Average Ads Revenue Per Unit	9.14	(4.60)	8.30	(4.06)	9.23	(4.35)	10.25	(5.17)
Total Costs	4,764	(2,247)	4,687	(2,178)	4,908	(2,351)	4,228	(1,991)
Wage Costs	1,889	(949)	2,054	(953)	1,896	(986)	1,560	(800)
Intermediates	864	(616)	900	(688)	927	(732)	652	(340)
Other Costs	2,010	(938)	1,734	(658)	2,085	(798)	2,016	(1,079)
Profits (EBITDA)	608	(427)	756	(401)	610	(410)	524	(434)
Direct Salary Costs	1,609	(840)	1,613	(721)	1,625	(1,006)	1,456	(781)
Managers	453	(234)	427	(192)	475	(278)	404	(227)
Journalists	586	(342)	458	(216)	590	(380)	652	(376)
Other	570	(338)	728	(370)	559	(378)	400	(216)
Labor Hours	6.87	(3.79)	7.57	(3.67)	6.72	(4.34)	5.99	(3.35)
Managers	1.56	(0.84)	1.66	(0.78)	1.59	(0.98)	1.28	(0.77)
Journalists	2.43	(1.49)	1.98	(1.02)	2.4	(1.67)	2.72	(1.6)
Other	2.88	(1.88)	3.93	(2.21)	2.73	(1.85)	2.00	(1.2)
Hourly Wage Rate	240	(26.46)	218	(19.25)	246	(20.47)	250	(29.35)
Managers	296	(31.2)	261	(21.14)	303	(23.46)	322	(26.13)
Journalists	245	(25.05)	235	(21.36)	250	(23.36)	246	(27.92)
Other	206	(25.73)	191	(19.66)	209	(18.86)	210	(32.78)
<u>C. Content, Format and Listed Prices</u>								
Content: % Sport & Entertainment	39.79	(5.34)	35.38	(4.81)	39.39	(3.89)	44.04	(4.64)
Content: % Health & Crime	25.83	(2.92)	27.68	(2.45)	25.57	(2.16)	24.82	(2.59)
Content: % Politics, FA & B/F	34.37	(3.76)	36.94	(3.87)	35.04	(3.08)	31.14	(3.46)
Format (Page Size in cm <sup>2</sup> )	1264	(331)	1447	(363)	1263	(332)	1117	(202)
No. of Pages	47.47	(10.5)	43.43	(6.54)	46.66	(7.4)	51.3	(13.72)
Total Size (Format × No. of Pages)	59,866	(19,942)	62,613	(17,227)	58,793	(17,465)	58,257	(23,666)
Sales Price Per Copy	14.05	(2.28)	12.03	(0.26)	13.57	(1.05)	18.63	(1.07)
Full Page in 4 Colors	88,978	(27,819)	90,356	(28,325)	91,158	(27,947)	81,240	(25,691)
Full Page in B/W	55,987	(16,536)	56,348	(17,180)	56,063	(16,405)	54,997	(16,768)
Column Ads, Per cm	58.53	(17.31)	52.85	(15.25)	59.84	(17.18)	60.29	(18.29)

Notes: Means and standard deviations are calculated across municipalities (overall and by year). Detailed descriptions of the variables are given in Table A.2. Revenues, profits, costs, wages and prices are in 2010 NOK. In 2010, 1 USD ≈ 6 NOK. Descriptive statistics for all other variables used in our analysis as controls can be found in Table E.1 in the appendix.

Table E.3: Compliance and Newspaper Readership by Age and Education.

	A. Complier Characterization				B. Newspaper Readership (2001)			
	$p[X = x]$ (1)	First Stage (2)	$P[X = x   I_{ii} > I_{0i}]$ (3)	$\frac{P[X = x   I_{ii} > I_{0i}]}{p[X = x]}$ (4)	Print (5)	Only Print (6)	Online (7)	Only Online (8)
<b>By Age</b>								
18-24	0.24	0.25*** (0.07)	0.38	1.61	69%	60%	15%	4%
25-54	0.48	0.17*** (0.05)	0.52	1.09	84%	72%	16%	2%
55-80	0.29	0.04 (0.04)	0.07	0.24	90%	85%	8%	0%
<b>By Education</b>								
Low	0.20	0.05 (0.06)	0.06	0.31	78%	70%	10%	0%
Medium	0.58	0.19*** (0.04)	0.72	1.23	84%	72%	15%	2%
High	0.22	0.07 (0.10)	0.10	0.48	88%	72%	16%	2%
<b>Overall</b>	1.00	0.15*** (0.04)	1.00	1.00	82%	71%	14%	2%

Notes: Column (1) reports the distribution of the population by age and education,  $P[X = x]$ , based on microdata for respondents from Media User Surveys for the period 2000–2013, with a total of 26,877 observations. The Education groups are categorised as: Low: 10 or less years of education; Medium: between 10 and 16 years of education; High: over 16 years of education. Education groups exclude any individuals aged younger than 21 and anyone with missing years of education, which leaves 20,136 observations. Also using the Media User Surveys, we perform separate estimations of the first-stage equation (1) for each group. The first-stage coefficients are reported in column (2). All regressions include municipality fixed effects and year dummies. Column (3) reports the distribution of compliers by age and education group,  $P[X = x | I_{ii} > I_{0i}]$ , calculated as (first-stage coefficient for the group  $\times$  pop. share) divided by the overall first-stage coefficient. Column (4) shows the relative likelihood of compliers belonging to a particular group, compared to the population at large. Columns (5)–(9) reports the print and online readership rates from Media User Surveys in 2001, which is the first year when we can observe print and online readership separately in these surveys.

\*  $p < 0.1$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ .

Table E.4: Impacts on Newspaper Sales: Circulation vs. Readership Sample.

Sample:	Circulation Sample		Readership Sample			
	Print Circulation Rate	Annual Print Sales Volume	Print Circulation Rate	Annual Print Sales Volume	Print Circulation Rate	Annual Print Sales Volume
	(1)	(2)	(3)	(4)	(5)	(6)
<b>Reduced Form</b>	-0.028***	-7.45***	-0.027***	-7.15***	-0.0353***	-9.701***
<i>Std Error</i>	(0.005)	(1.48)	(0.005)	(1.46)	(0.0106)	(2.891)
<b>IV Estimate</b>	-0.202***	-54.35***	-0.194***	-52.20***	-0.296***	-81.16***
<i>Std Error</i>	(0.038)	(10.47)	(0.037)	(10.34)	(0.0842)	(22.83)
Observations	4,620	4,620	4,620	4,620	1,115	1,115
Demographic Controls	✓	✓	✓	✓	✓	✓
Municipality-level	✓	✓	✓	✓		
District-Level					✓	✓

*Notes:* The estimates in Columns (1)-(2) are identical to Table 2, Panel B, Columns (1)-(2). In Columns (3)-(4), we construct municipality-year level circulation and sales measures relying only on newspapers that are included in the Readership Survey, and the regression analysis is performed at municipality-year level, controlling for municipality fixed effects, year dummies and all baseline demographic controls. Further, in Columns (5)-(6), we further aggregate all variables to the media districts that are observed in the Readership Survey, and the regression analysis is performed at media district-year level, controlling for district fixed effects, year dummies and all baseline demographic controls. For a detailed description of each outcome variable see Appendix Table A.2, Panel A. Print circulation and sales volume are scaled by the number of households in each municipality-year cell in Columns (1)-(4) and by the number of households in each media district-year cell in Columns (5)-(6).

\* p < 0.1, \*\* < 0.05, \*\*\* p < 0.01.

Table E.5: Impacts on Newspaper Sales and Readership for Tabloids.

	Circulation		Readership		
	Print Circulation Rate	Annual Print Sales Volume	Print Readership Rate	Online Readership Rate	Total Readership Rate
	(1)	(2)	(3)	(4)	(5)
<b>A. Tabloids</b>					
Reduced Form	-0.0177***	-4.595***	-0.0252*	0.0485***	0.0233
<i>Std Error</i>	(0.00233)	(0.605)	(0.0139)	(0.0143)	(0.0209)
IV Estimate	-0.129***	-33.52***	-0.211*	0.406***	0.195
<i>Std Error</i>	(0.0153)	(3.982)	(0.116)	(0.121)	(0.175)
Baseline Mean	0.219	56.84	0.559	0.147	0.706
<b>B. VG</b>					
Reduced Form	-0.0117***	-3.055***	-0.0241**	0.0278***	0.00370
<i>Std Error</i>	(0.0016)	(0.415)	(0.0106)	(0.00895)	(0.0149)
IV Estimate	-0.0857***	-22.28***	-0.201**	0.232***	0.0309
<i>Std Error</i>	(0.0107)	(2.775)	(0.0888)	(0.0721)	(0.125)
Baseline Mean	0.149	38.64	0.355	0.088	0.444
<b>C. Dagbladet</b>					
Reduced Form	-0.0059***	-1.541***	-0.0012	0.0208**	0.0196
<i>Std Error</i>	(0.0010)	(0.248)	(0.0088)	(0.00942)	(0.0133)
IV Estimate	-0.0432***	-11.24***	-0.010	0.174**	0.164
<i>Std Error</i>	(0.00642)	(1.668)	(0.0736)	(0.0790)	(0.113)
Baseline Mean	0.0700	18.19	0.203	0.059	0.262

Notes: The estimates in Panel A of this table are the same as Table 3, Panel B (see table notes for details). Panels B and C separate the Tabloids into their two newspapers: VG and Dagbladet. The mean for each outcome variable from the baseline year, 2000, is displayed.

\*  $p < 0.1$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ .



Table E.6: IV Estimates of Internet Use on Newspaper Sales: Geographic Heterogeneity.

	Obs.	Print Circulation Rate			Annual Print Sales Volume		
		Est.	SE	Mean	Est.	SE	Mean
<b>All</b>	4,620	-0.275***	(0.0358)	1.047	-74.61***	(10.03)	304.2
<b>Urbanization</b>							
High	1,540	-0.191**	(0.0930)	1.093	-51.08**	(25.39)	315.0
Medium	1,529	-0.330***	(0.111)	1.041	-86.23***	(31.18)	302.7
Low	1,551	-0.240**	(0.118)	1.007	-67.07**	(34.22)	295.0
<b>Average Education</b>							
High	1,540	-0.320***	(0.0666)	1.113	-84.62***	(17.99)	322.1
Medium	1,529	-0.360***	(0.0670)	1.038	-100.4***	(18.60)	302.7
Low	1,551	-0.271***	(0.0736)	0.989	-71.89***	(20.90)	288.0
<b>Average Income</b>							
High	1,529	-0.318***	(0.0690)	1.050	-87.55***	(18.99)	305.6
Medium	1,551	-0.244***	(0.0545)	1.024	-65.89***	(15.27)	298.7
Low	1,540	-0.310***	(0.0894)	1.066	-83.19***	(25.42)	308.4

Notes: The estimates in this table come from the second stage regression equation (2), where the coefficient on the dependent variable,  $y_{m,t+1}$ , is displayed separately for each outcome in each row and by newspaper type in each column. The endogenous variable of interest is the broadband user rate in year  $t$ ,  $d_{m,t}$ , which has been instrumented using the broadband availability rate in year  $t-1$ ,  $z_{m,t-1}$ . For a detailed description of each outcome variable see Appendix Table A.2, Panel A. All regressions include municipality fixed effects and year dummies. 'High' is categorized as municipalities above the 66th percentile of municipalities in that category in 2000. Similarly, 'Medium' is municipalities between the 33rd and 66th percentile and 'Low' is those below of the 33rd percentile. Standard errors are heteroskedasticity robust and clustered at the municipality level.

\*  $p < 0.1$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ .

Table E.7: IV Estimates of Internet Use on Newspaper Sales: Newspaper Heterogeneity.

	Obs.	Print Circulation Rate			Annual Print Sales Volume		
		Est.	SE	Mean	Est.	SE	Mean
<b>All</b>	233,948	-0.00382***	(0.000795)	0.0207	-1.005***	(0.222)	6.008
<b>Ad Revenue Share</b>							
High	120,736	0.000941	(0.00121)	0.0168	0.0314	(0.323)	4.912
Medium	56,089	-0.00617***	(0.00166)	0.0193	-1.159***	(0.400)	5.934
Low	57,123	-0.0114***	(0.00168)	0.0302	-2.937***	(0.469)	8.396
<b>Local Market Power</b>							
High	82,687	0.00157	(0.00147)	0.0138	0.00965	(0.416)	4.350
Medium	75,383	-0.00134	(0.00187)	0.0216	-0.230	(0.560)	6.516
Low	75,878	-0.0108***	(0.00148)	0.0272	-2.650***	(0.360)	7.309

*Notes:* The estimates come from the second stage regression equation (D.2), where the dependent variable is newspaper  $j$ 's circulation rate in municipality  $m$  in year  $t+1$ ,  $y_{j,m,t+1}$ . The endogenous variable of interest is the municipality-level broadband usage rate in year  $t$ ,  $d_{m,t}$ , which has been instrumented using the municipality-level broadband availability rate in year  $t-1$ ,  $z_{m,t-1}$ . All regressions include newspaper fixed effects, municipality fixed effects and year dummies, and the demographic controls discussed in Appendix Table A.2, Panel E. 'Ad Revenue Share' is the percentage of total revenue that arises from advertisements. 'Local Market Share' is a newspaper's largest percentage of total circulation in a single municipality. 'High' is categorized as newspapers above the 66th percentile of newspapers in that category in 2000. Similarly, 'Medium' is newspapers between the 33rd and 66th percentile and 'Low' is those below the 33rd percentile. Standard errors are heteroskedasticity robust and clustered at the municipality level.

\*  $p < 0.1$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ .

Table E.8: Regression Table: IV Estimates of Internet Use on Newspaper Sales and Readership.

	Sales				Readership					
	Print Circulation Rate		Annual Print Sales Volume		Print Readership Rate		Total Online Readership Rate		Total Readership Rate	
	Est. (1)	(SE) (2)	Est. (3)	(SE) (4)	Est. (5)	(SE) (6)	Est. (7)	(SE) (8)	Est. (9)	(SE) (10)
<b>A. Baseline</b>										
Broadband User Rate	-0.202***	(0.0379)	-54.35***	(10.47)	-0.690**	(0.304)	0.585*	(0.307)	-0.105	(0.437)
Age-groups (%): 0-16	0.0279	(0.439)	50.30	(113.9)	-5.342**	(2.523)	-3.438	(3.460)	-8.780*	(4.810)
Age-groups (%): 16-21	-0.622	(0.424)	-163.8	(115.7)	-1.183	(3.449)	-3.992	(3.551)	-5.175	(5.551)
Age-groups (%): 22-24	-0.640	(0.458)	-200.5	(122.7)	-1.116	(3.115)	-2.346	(3.792)	-3.462	(5.291)
Age-groups (%): 25-34	-1.482***	(0.343)	-435.4***	(92.62)	-1.920	(2.658)	-2.038	(2.440)	-3.957	(4.028)
Age-groups (%): 35-44	-1.066***	(0.290)	-317.5***	(78.96)	-2.006	(2.109)	-4.815**	(2.056)	-6.821**	(3.303)
Age-groups (%): 45-54	-		-		-		-		-	
Age-groups (%): 55-66	-0.0641	(0.332)	-37.28	(88.54)	-4.137*	(2.277)	1.623	(2.009)	-2.514	(3.276)
Age-groups (%): 67-00	-0.606*	(0.357)	-160.3*	(94.74)	-5.500**	(2.442)	1.163	(3.333)	-4.337	(4.784)
Income (10,000 NOK)	0.0120***	(0.00158)	3.243***	(0.429)	0.00564	(0.00800)	-0.0105	(0.00949)	-0.00487	(0.0126)
Years of Education	0.0424	(0.0295)	13.62*	(7.714)	-0.0987	(0.237)	0.842***	(0.199)	0.744**	(0.351)
Unemployed (%)	-0.835***	(0.271)	-204.2***	(70.73)	-1.186	(2.515)	0.633	(1.544)	-0.552	(2.981)
Students (%)	-0.198	(0.177)	-32.01	(48.76)	-2.148*	(1.109)	0.415	(1.124)	-1.733	(1.639)
Poverty Rate (%)	0.206	(0.169)	58.55	(46.61)	0.818	(1.418)	-1.607	(1.333)	-0.789	(2.114)
Immigrants (%)	-1.04***	(0.222)	-283.7***	(59.86)	-2.091**	(1.011)	2.393**	(1.218)	0.302	(1.601)
<b>B. All Controls</b>										
Broadband User Rate	-0.178***	(0.038)	-48.62***	(10.56)	-0.709**	(0.326)	0.768**	(0.331)	0.0591	(0.464)
Population size (000s)	-0.003*	(0.001)	-0.714*	(0.414)	-0.00115	(0.00104)	0.00233	(0.00204)	0.00118	(0.00241)
Age-groups (%): 0-16	-0.333	(0.408)	-90.11	(112.6)	-3.895	(2.456)	-3.880	(3.050)	-7.776*	(4.423)
Age-groups (%): 16-21	-0.253	(0.453)	-96.52	(122.2)	0.566	(3.582)	-5.390	(3.525)	-4.825	(5.371)
Age-groups (%): 22-24	-1.078***	(0.347)	-335.4***	(94.19)	0.433	(3.080)	-4.994	(3.816)	-4.561	(5.359)
Age-groups (%): 25-34	-0.877***	(0.280)	-274.2***	(76.56)	-1.671	(2.656)	-2.186	(2.655)	-3.857	(3.999)
Age-groups (%): 35-44	0.122	(0.444)	80.27	(117.6)	-3.665*	(2.042)	-4.657*	(2.467)	-8.322**	(3.400)
Age-groups (%): 45-54	-		-		-		-		-	
Age-groups (%): 55-66	-0.250	(0.327)	-82.84	(87.88)	-4.105*	(2.232)	1.385	(2.030)	-2.720	(3.145)
Age-groups (%): 67-00	-0.457	(0.356)	-118.9	(95.78)	-4.687**	(2.355)	-0.0656	(3.135)	-4.753	(4.578)
Income (10,000 NOK)	0.0106***	(0.00153)	2.878***	(0.415)	-0.00267	(0.00894)	-0.00327	(0.0107)	-0.00594	(0.0135)
Years of Education	0.0299	(0.0288)	11.06	(7.731)	-0.127	(0.220)	0.761***	(0.187)	0.634*	(0.326)
Unemployed (%)	-0.676**	(0.270)	-166.8**	(70.35)	-1.351	(2.661)	2.541*	(1.474)	1.190	(3.130)
Students (%)	-0.205	(0.163)	-33.17	(45.18)	-1.462	(1.132)	0.322	(1.047)	-1.141	(1.548)
Poverty Rate (%)	0.175	(0.154)	47.51	(42.88)	0.592	(1.475)	-1.256	(1.358)	-0.664	(2.164)
Immigrants (%)	-0.897***	(0.210)	-247.2***	(57.42)	-1.989*	(1.026)	0.858	(1.337)	-1.131	(1.820)
Urban Residence (%)	-0.0943	(0.073)	-21.10	(19.19)	0.128	(0.319)	-0.596	(0.654)	-0.468	(0.693)
Public Sector (%)	0.0295	(0.240)	-4.046	(71.48)	0.286	(1.367)	2.521	(1.710)	2.807	(2.743)
Services Sector (%)	0.192	(0.258)	51.67	(74.93)	-0.275	(1.418)	-3.693**	(1.762)	-3.968	(2.704)
Priv. Services Sector (%)	0.0249	(0.284)	13.19	(82.53)	2.741*	(1.541)	3.752*	(1.984)	6.492**	(3.013)
Total Exp. (1000 NOK)	-0.001**	(0.000)	-0.133	(0.0810)	0.00524	(0.00362)	-0.00747	(0.00626)	-0.00223	(0.00655)
Administration Exp.	0.003***	(0.001)	0.754***	(0.292)	0.00669	(0.00925)	0.00766	(0.0111)	0.0143	(0.0124)
Education Exp.	0.001***	(0.000)	0.304***	(0.0977)	-0.000859	(0.00584)	0.00632	(0.00895)	0.00546	(0.00933)
Health Exp.	0.001	(0.001)	0.123	(0.240)	-0.00764	(0.00737)	0.00801	(0.00962)	0.000370	(0.0109)
Infrastructure Exp.	0.001***	(0.000)	0.313***	(0.121)	-0.00873	(0.00653)	-0.00006	(0.00774)	-0.00880	(0.0132)
Distance (in km)	0.006	(0.013)	1.521	(3.349)	-0.254***	(0.0946)	-0.163	(0.104)	-0.417***	(0.153)
Roads (in km)	4.615**	(2.130)	1191.5**	(584.9)	-16.10*	(8.298)	-4.200	(13.52)	-20.30	(16.02)
Travel Time (mins)	-0.010*	(0.054)	-22.88	(14.89)	-0.0310	(0.204)	-0.268	(0.256)	-0.299	(0.387)
Baseline Mean	1.047		304.2		1.805		0.208		2.013	
Observations	4,620		4,620		1,115		1,115		1,115	

Notes: The estimates in Panel A of this table is the same as Table 2, Panel B (see table notes for more details) with the coefficients on demographic controls listed. Panel B includes all controls. For a description of all control variables see Table A.2, Panels E-G. The mean for each outcome variable from the baseline year, 2000, is displayed.

\* p < 0.1, \*\* < 0.05, \*\*\* p < 0.01.

Table E.9: IV Estimates of of Internet Use on Revenues, Costs and Labor Inputs: Specification Checks.

	Baseline	Additional Controls		Drop Five	Exclude Years	Municipality-Specific Time Trends		
	(1)	(2)	(3)	Largest Cities (4)	2008-2010 (5)	Linear Slope (6)	Quadratic Slope (7)	Covariate Interacted Time FEs (8)
<b>A. Balance Sheets</b>								
<b>Total Revenues</b>	-1214.1*** (444.9)	-1219.1*** (448.0)	-1063.9** (470.2)	-976.1** (481.6)	-1708.5*** (562.5)	-1241.1*** (467.8)	-1025.2** (429.2)	-467.5 (948.6)
<b>Market Revenues</b>	-1375.0*** (383.4)	-1387.9*** (385.6)	-1280.0*** (413.0)	-1221.5*** (422.9)	-1947.0*** (546.2)	-1482.6*** (410.5)	-1326.0*** (373.9)	-1665.8* (886.6)
<b>Sales Revenues</b>	-808.9*** (124.3)	-802.9*** (125.1)	-745.5*** (129.0)	-724.3*** (132.4)	-868.8*** (171.9)	-774.7*** (120.1)	-743.9*** (123.6)	-902.8*** (276.7)
<b>Ads Revenues</b>	-566.2** (288.3)	-585.1** (289.6)	-534.4* (314.1)	-497.2 (322.4)	-1078.3*** (415.1)	-699.3** (329.7)	-574.0** (280.2)	-731.2 (658.5)
<b>Other Revenues</b>	160.9 (225.6)	168.8 (224.1)	216.0 (229.6)	245.4 (241.2)	238.5 (244.5)	285.4 (221.1)	211.0 (214.8)	952.4** (430.9)
<b>Total Costs</b>	-1289.0*** (366.7)	-1290.9*** (369.5)	-1147.0*** (381.9)	-1030.4*** (392.0)	-1557.6*** (432.6)	-1263.7*** (365.3)	-1172.3*** (347.0)	-1031.9 (773.0)
<b>Wage Costs</b>	-698.7*** (182.4)	-695.9*** (182.3)	-625.2*** (188.2)	-550.9*** (192.3)	-572.3*** (197.3)	-707.1*** (185.2)	-702.1*** (186.7)	-581.4 (390.9)
<b>Intermediates</b>	-186.7 (285.0)	-198.8 (284.4)	-117.9 (291.9)	-20.1 (293.7)	-412.2 (301.4)	-102.5 (288.0)	-119.0 (325.4)	764.2 (629.1)
<b>Other Costs</b>	-403.6 (285.5)	-396.2 (284.7)	-403.9 (298.7)	-459.5 (306.9)	-573.2** (273.6)	-421.5 (293.8)	-434.5 (295.6)	-1289.7** (549.9)
<b>Profits (EBITDA)</b>	74.85 (178.1)	71.72 (180.1)	83.13 (190.0)	54.28 (192.3)	-150.8 (182.0)	10.35 (204.2)	34.27 (201.8)	419.9 (403.7)
<b>B. Average Revenue Per Unit (ARPU)</b>								
<b>Market Revenue PU</b>	0.0238 (0.738)	-0.0536 (0.741)	-0.182 (0.802)	-0.0733 (0.832)	-1.484 (1.287)	-1.122 (0.804)	-0.449 (0.798)	1.144 (1.748)
<b>Sales Revenue PU</b>	-0.691*** (0.237)	-0.705*** (0.243)	-0.799*** (0.244)	-0.786** (0.253)	-0.782** (0.313)	-0.879*** (0.241)	-0.822*** (0.257)	-0.323 (0.497)
<b>Ads Revenue PU</b>	0.715 (0.643)	0.652 (0.643)	0.618 (0.704)	0.713 (0.731)	-0.703 (1.061)	-0.350 (0.731)	0.279 (0.705)	1.345 (1.562)
<b>C. Labor Inputs</b>								
<b>Direct Salary Costs</b>	-832.2*** (279.0)	-821.2*** (278.3)	-814.9*** (315.4)	-804.9** (326.2)	-1098.7** (465.5)	—	—	-1391.3* (827.0)
<b>Managers</b>	-173.9** (68.28)	-169.0** (68.03)	-166.1** (77.24)	-172.1** (79.91)	-255.2** (115.1)	—	—	-350.8* (196.4)
<b>Journalists</b>	-194.1** (85.47)	-191.3** (85.10)	-210.5*** (103.1)	-204.7* (106.6)	-408.6** (182.8)	—	—	-379.4 (270.8)
<b>Other</b>	-464.2*** (148.6)	-460.8*** (148.5)	-438.3*** (158.3)	-428.1*** (164.0)	-434.9** (196.3)	—	—	-661.2* (399.5)
<b>Labor Hours</b>	-3.545*** (1.269)	-3.470*** (1.269)	-3.401*** (1.400)	-3.373** (1.450)	-4.723** (2.045)	—	—	-5.612 (3.514)
<b>Managers</b>	-0.633*** (0.218)	-0.616*** (0.217)	-0.600** (0.240)	-0.617** (0.248)	-0.783** (0.352)	—	—	-1.261** (0.590)
<b>Journalists</b>	-0.749** (0.371)	-0.734** (0.372)	-0.813* (0.438)	-0.797* (0.453)	-1.736** (0.766)	—	—	-1.521 (1.127)
<b>Other</b>	-2.162*** (0.830)	-2.120** (0.830)	-1.987** (0.881)	-1.959** (0.915)	-2.204* (1.161)	—	—	-2.829 (2.097)
<b>Hourly Wage Rate</b>	16.00 (10.48)	14.80 (10.47)	16.81 (10.88)	18.40 (11.35)	27.53** (12.38)	—	—	34.37 (21.42)
<b>Managers</b>	15.95 (9.894)	15.24 (9.836)	17.32* (10.18)	18.64* (10.63)	18.15* (10.72)	—	—	49.15** (19.76)
<b>Journalists</b>	3.880 (9.761)	3.390 (9.759)	6.286 (10.32)	7.267 (10.70)	5.894 (8.998)	—	—	13.22 (19.79)
<b>Other</b>	5.914 (12.26)	4.280 (12.24)	4.066 (12.66)	6.227 (13.26)	33.37** (14.70)	—	—	25.36 (26.03)
<b>Controls:</b>								
Demographics	✓	✓	✓	✓	✓	✓	✓	✓
Newspaper Demand		✓	✓	✓	✓	✓	✓	✓
Broadband Expansion			✓	✓	✓	✓	✓	✓
Observations	4,620	4,620	4,620	4,565	2,940	4,620	4,620	4,620

Notes: The estimates in this table come from the second stage regression equation (2), where the coefficient on the dependent variable,  $y_{m,t+1}$ , is displayed in the each row. The endogenous variable of interest is the broadband user rate in year  $t$ ,  $d_{m,t}$ , which has been instrumented using the broadband availability rate in year  $t-1$ ,  $z_{m,t-1}$ . For a detailed description of each outcome variable see Table A.2, Panel A. Prices are in 2010 NOK. In 2010, 1 USD  $\approx$  6 NOK. All regressions (excluding columns (4)-(5)) are based on 420 municipalities  $\times$  11 years = 4,620 observations, and include municipality fixed effects and year dummies. Column (1) displays the same IV specification as our main results in Table 2, while columns (2)-(3) add additional controls. For a description of all of the various control variables see Table A.2. In column (4), we exclude the 5 largest municipalities: Oslo, Bergen, Trondheim, Stavanger, and Bærum, while in column (5), we exclude post-2008 years from estimation. In columns (6) and (7) we estimate pre-expansion municipality-specific linear and quadratic time trends, as is shown in equation (C.1), and then extrapolate these into our specification. In column (8), in addition to the pre-expansion municipality-specific linear and quadratic time trends, we interact the baselines values of urbanization, population size and education level for each municipality with time fixed effects and include these in the specification, as is shown in equation (C.2).

\* p < 0.1, \*\* < 0.05, \*\*\* p < 0.01.

Table E.10: IV Estimates of Internet Use on Revenues, Costs and Labor Inputs By Market Segment.

	Locals			Tabloids			Non-tabloids		
	Est. (1)	(SE) (2)	Mean (3)	Est. (4)	(SE) (5)	Mean (6)	Est. (7)	(SE) (8)	Mean (9)
<b>A. Balance Sheet</b>									
Total Revenues	67.58	(296.5)	3315.4	-509.2***	(81.45)	1257.7	-772.5***	(102.7)	870.0
Market Revenue	-194.3	(245.6)	2895.5	-541.5***	(76.73)	1245.3	-639.3***	(93.22)	794.5
Sales Revenue	-62.09	(76.24)	1172.7	-463.4***	(57.59)	929.9	-283.3***	(32.56)	318.7
Ads Revenue	-132.2	(192.8)	1722.8	-78.02***	(20.98)	315.3	-356.0***	(68.72)	475.9
Other Revenues	261.9	(189.5)	419.9	32.28	(24.53)	12.46	-133.2***	(15.60)	75.46
Total Costs	-155.5	(244.2)	2860.0	-348.7***	(68.34)	1039.0	-784.8***	(125.3)	788.5
Wage Costs	-202.8	(135.1)	1428.3	-128.7***	(18.55)	288.9	-367.1***	(72.53)	336.8
Intermediates	356.6	(251.0)	555.0	-50.22***	(13.17)	169.3	-493.1***	(60.34)	175.3
Other Costs	-309.2	(266.1)	876.6	-169.7***	(39.11)	580.8	75.42	(79.10)	276.4
Profits (EBITDA)	223.1*	(128.0)	455.4	-160.5***	(27.82)	218.7	12.28	(69.55)	81.49
<b>B. Average Revenue Per Unit (ARPU)</b>									
Market Revenue PU	-0.0785	(1.395)	13.85	0.168	(0.109)	21.89	-1.802*	(0.995)	22.77
Sales Revenue PU	-0.337	(0.461)	5.562	0.00640	(0.0729)	16.35	-1.146***	(0.370)	10.01
Ads Revenue PU	0.259	(1.056)	8.289	0.162***	(0.0473)	5.537	-0.656	(0.801)	12.76
<b>C. Labor Inputs</b>									
Direct Salary Costs	-605.2***	(205.5)	1185.7	-88.77***	(13.61)	218.0	-138.3***	(22.00)	209.0
Managers	-124.2**	(53.34)	297.5	-25.26***	(4.925)	76.86	-24.47***	(6.179)	52.46
Journalists	-130.7	(91.23)	328.8	-23.81***	(3.970)	64.10	-39.59***	(8.530)	64.68
Other	-350.3***	(100.4)	559.4	-39.70***	(5.357)	77.04	-74.22***	(12.18)	91.84
Labor Hours	-2.637***	(1.001)	5.957	-0.343***	(0.0426)	0.714	-0.565***	(0.0945)	0.901
Managers	-0.436**	(0.178)	1.234	-0.0989***	(0.0143)	0.234	-0.0981***	(0.0227)	0.191
Journalists	-0.489	(0.423)	1.531	-0.0769***	(0.0124)	0.201	-0.183***	(0.0366)	0.252
Other	-1.712***	(0.616)	3.193	-0.167***	(0.0193)	0.279	-0.283***	(0.0600)	0.457
Hourly Wage Rate	20.15*	(10.67)	202.3	3.218**	(1.372)	305.3	-2.462	(6.034)	226.8
Managers	18.81*	(10.36)	242.5	2.099*	(1.143)	328.3	1.405	(7.875)	269.9
Journalists	7.216	(10.60)	217.8	3.328**	(1.698)	319.2	1.800	(7.764)	246.5
Other	11.70	(12.74)	180.2	3.179**	(1.580)	276.1	-18.33***	(6.458)	194.7

Notes: The estimates in this table are the same as Table 4, but broken down by newspaper segment. For a detailed description of each outcome variable see Table A.2, Panel A. Revenues, costs, profits and wages are in 2010 NOK. In 2010, 1 USD  $\approx$  6 NOK. All regressions are based on 420 municipalities  $\times$  11 years = 4,620 observations. All regressions include municipality fixed effects and year dummies. All regressions include the demographic controls discussed in Table A.2, Panel E. Standard errors are heteroskedasticity robust and clustered at the municipality level. The mean for each outcome variable is from the baseline year, 2000.

\*  $p < 0.1$ , \*\*  $< 0.05$ , \*\*\*  $p < 0.01$ .

Table E.11: Reduced Form Estimates of Internet Coverage on Content, Format and Listed Prices.

Level of Analysis:	Municipality-Year Level			Newspaper-Year Level						
	Total Effect			Fixed Composition						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	
	Estimate	(SE)	Mean	Estimate	(SE)	Mean	Estimate	(SE)	Mean	
<b>A. Content Shares</b>										
Sport and Entertainment	-0.937***	(0.292)	35.38	-0.857***	(0.276)	35.38	-2.735*	(1.542)	35.94	
<i>Entertainment</i>	-0.599***	(0.195)	18.95	-0.611***	(0.192)	18.95	-2.086*	(1.249)	19.26	
<i>Sport</i>	-0.338**	(0.164)	16.43	-0.246	(0.161)	16.43	-0.649	(0.755)	16.69	
Crime and Health	0.234**	(0.110)	27.68	0.180*	(0.104)	27.68	0.0514	(0.857)	27.33	
<i>Crime</i>	0.323***	(0.0731)	12.47	0.280***	(0.0707)	12.47	0.566	(0.432)	12.27	
<i>Health</i>	-0.0894	(0.104)	15.21	-0.1000	(0.0974)	15.21	-0.514	(0.738)	15.06	
Politics, FA and B/F	0.704***	(0.254)	36.94	0.677***	(0.237)	36.94	2.684**	(1.307)	36.73	
<i>Politics</i>	0.486***	(0.143)	15.61	0.397***	(0.137)	15.61	1.839***	(0.708)	14.62	
<i>Foreign Affairs</i>	-0.158**	(0.0641)	3.402	-0.0500	(0.0519)	3.402	-0.554	(0.339)	3.659	
<i>Business/Finance</i>	0.375***	(0.145)	17.93	0.329**	(0.138)	17.93	1.398	(1.084)	18.46	
<b>B. Format and Size</b>										
Format (Page Size in cm <sup>2</sup> )	-41.33	(26.31)	1,447	-31.33	(26.73)	1,447	35.33	(221.1)	1,499	
No. of Pages	-1.470**	(0.640)	43.43	-1.096*	(0.630)	43.43	-7.589	(4.848)	46.31	
Total Size (Format × No. of Pages)	-3,561***	(1,226)	62,614	-2,622***	(1,253)	62,614	-5,044	(13,857)	67,267	
<b>C. Listed Sales Price and Advert Prices</b>										
Sales Price per Copy	-0.0629	(0.104)	12.03	-0.0593	(0.103)	12.03	-0.639	(0.937)	12.11	
Full Page in 4 Colors	-4,063***	(861.3)	90,356	-1,249	(807.7)	90,356	-18,275	(12,634)	114,202	
Full Page in B/W	-3,479***	(641.1)	56,348	-1,715.5***	(622.2)	56,348	-15,028*	(8,293)	71,130	
Column Ads, per cm	-1.883***	(0.404)	52.85	0.262	(0.357)	52.85	-1.701	(2.368)	63.54	

Notes: This table presents the reduced form estimates corresponding to the IV estimates in Table 5. Columns (1)-(6) display estimates from our main specification at municipality x year level (4,620 observations). In the "Fixed Composition" Columns (7)-(9) we fix the composition of newspaper sales in each municipality to the levels they were in 2000, in order to isolate the direct effect of broadband usage from the change in composition effect. Columns (7)-(9) display estimates for outcomes measured at the newspaper x year level (850 observations) as described in Section D. Regressions in all specifications include the demographic controls discussed in Table A.2. For a detailed description of each outcome variable see Appendix Table A.2, Panel A. Prices are in 2010 NOK. In 2010, 1 USD ≈ 6 NOK. The mean for each outcome variable from the baseline year, 2000, is displayed in columns (3). (6) and (9). Regressions in Columns (7)-(9) are weighted by the initial circulation of newspapers. Standard errors are heteroskedasticity robust and in columns (1)-(6) clustered at municipality level.

\* p < 0.1, \*\* < 0.05, \*\*\* p < 0.01.

Table E.12: IV Estimates of of Internet Use on Content, Format and Listed Prices: Specification Checks.

	Baseline	Additional Controls		Drop Five	Exclude Years	Municipality-Specific Time Trends		
	(1)	(2)	(3)	Largest Cities	2008-2010	Linear	Quadratic	Covariate
						Slope	Slope	Interacted
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	Time FEs
	(8)							
	Total Effect							
<b>A1. Content Shares</b>								
<b>Sport and Entertainment</b>	-6.839*** (2.129)	-6.688*** (2.133)	-6.700*** (2.212)	-6.858*** (2.320)	-11.20*** (2.887)	-6.943*** (2.183)	-6.730*** (2.168)	-4.989 (4.163)
<b>Health and Crime</b>	1.704** (0.814)	1.698** (0.818)	1.852** (0.867)	2.028** (0.891)	1.579* (0.925)	1.892** (0.849)	1.991** (0.845)	2.597 (1.679)
<b>Politics, FA and B/F</b>	5.136*** (1.838)	4.990*** (1.835)	4.848** (1.890)	4.830** (1.982)	9.621*** (2.627)	5.056*** (1.852)	4.644** (1.843)	2.391 (3.478)
<b>B1. Format and Size</b>								
<b>Format (Page Size in cm<sup>2</sup>)</b>	-301.5 (190.1)	-293.8 (189.3)	-222.0 (200.2)	-269.9 (205.6)	-321.6 (212.7)	-220.6 (200.5)	-245.4 (199.0)	313.7 (379.7)
<b>No. of Pages</b>	-10.72** (4.729)	-10.69** (4.747)	-11.19** (4.995)	-9.783* (5.115)	-2.701 (4.256)	-11.32** (5.015)	-10.76** (4.961)	-21.01** (10.33)
<b>Format × No. of Pages</b>	-25.981*** (8.894)	-25.558*** (8.732)	-22.9340** (9.240)	-23.466** (9.449)	-16.599*** (6.150)	-22.992** (9.257)	-21.035** (9.175)	-4.588 (18.943)
<b>A1. Unit Sales Price and Listed Advert Prices</b>								
<b>Sales Price Per Copy</b>	-0.459 (0.762)	-0.432 (0.764)	-0.429 (0.795)	-0.272 (0.826)	0.683 (0.853)	-0.636 (0.806)	-0.559 (0.809)	-2.586* (1.442)
<b>Full Page in 4 Colors</b>	-29,641*** (6,118)	-29,231*** (6,100)	-26,816*** (6,354)	-25,123*** (6,329)	-17,560*** (5,952)	-26,645*** (6,366)	-26,694*** (6,362)	-880.9 (10,869)
<b>Full Page in B/W</b>	-25,380*** (4,582)	-24,967*** (4,557)	-24,044*** (4,746)	-22,664*** (4,635)	-12,612*** (4,419)	-24,039*** (4,759)	-24,119*** (4,758)	-2,274 (7,556)
<b>Column Ads, Per cm</b>	-13.74*** (2.994)	-13.82*** (2.954)	-14.71*** (3.138)	-14.16*** (3.230)	-5.899** (2.762)	-14.78*** (3.150)	-14.65*** (3.154)	-19.21*** (6.664)
<b>Fixed Composition</b>								
<b>A2. Content Shares</b>								
<b>Sport and Entertainment</b>	-6.252*** (2.023)	-6.036*** (2.014)	-6.082*** (2.091)	-6.229*** (2.189)	-10.33*** (2.755)	-6.339*** (2.048)	-6.339*** (2.002)	-4.566 (3.975)
<b>Health and Crime</b>	1.316* (0.768)	1.297* (0.768)	1.438* (0.815)	1.549* (0.840)	1.646* (0.897)	1.527* (0.792)	1.595** (0.789)	1.309 (1.566)
<b>Politics, FA and B/F</b>	4.936*** (1.725)	4.739*** (1.719)	4.644*** (1.769)	4.679** (1.855)	8.679*** (2.488)	4.789*** (1.709)	4.737*** (1.675)	3.303 (3.266)
<b>B2. Format and Size</b>								
<b>Format (Page Size in cm<sup>2</sup>)</b>	-228.6 (193.4)	-220.2 (192.6)	-163.8 (203.2)	-211.6 (208.3)	-272.3 (215.6)	-163.5 (203.7)	-168.1 (203.3)	496.9 (398.2)
<b>No. of Pages</b>	-7.999* (4.648)	-7.963* (4.673)	-8.449* (4.912)	-7.163 (5.050)	-1.066 (4.274)	-8.563* (4.931)	-8.519* (4.926)	-18.92* (10.11)
<b>Format × No. of Pages</b>	-19131.7** (9088.0)	-18701.5** (8940.7)	-16806.8* (9393.5)	-17492.5* (9605.0)	-12228.7* (6529.9)	-16922.3* (9423.2)	-16191.4* (9314.8)	2642.0 (19654.2)
<b>C2. Unit Sales Price and Listed Advert Prices</b>								
<b>Sales Price per Copy</b>	-0.432 (0.751)	-0.411 (0.752)	-0.506 (0.784)	-0.370 (0.816)	0.669 (0.840)	-0.767 (0.797)	-0.684 (0.800)	-2.613* (1.457)
<b>Full Page in 4 Colors</b>	-9.115 (5,829)	-8,889 (5,827)	-7,364 (6,066)	-6,074 (6,064)	-2,203 (5,757)	-7,314 (6,086)	-6,969 (6,109)	20,618* (10,524)
<b>Full Page in B/W</b>	-12,516*** (4,467)	-12,216*** (4,450)	-11,955*** (4,605)	-10,903*** (4,547)	-4,210 (4,473)	-12,033*** (4,622)	-11,193** (4,643)	12,326 (7,669)
<b>Column Ads, Per cm</b>	1.911 (2.605)	1.726 (2.582)	0.293 (2.642)	0.622 (2.732)	6.975*** (1.991)	0.0935 (2.667)	0.261 (2.739)	-1.546 (5.220)
<b>Control:</b>								
Demographics	✓	✓	✓	✓	✓	✓	✓	✓
Newspaper Demand		✓	✓	✓	✓	✓	✓	✓
Broadband Expansion			✓	✓	✓	✓	✓	✓
Observations	4,620	4,620	4,620	4,565	2,940	4,620	4,620	4,620

Notes: The estimates in this table come from the second stage regression equation (2), where the coefficient on the dependent variable,  $y_{m,t+1}$ , is displayed in the each row. The endogenous variable of interest is the broadband user rate in year  $t$ ,  $d_{m,t}$ , which has been instrumented using the broadband availability rate in year  $t-1$ ,  $z_{m,t-1}$ . For a detailed description of each outcome variable see Table A.2. Prices are in 2010 NOK. In 2010, 1 USD  $\approx$  6 NOK. All regressions (excluding columns (4)-(5)) are based on 420 municipalities  $\times$  11 years = 4,620 observations, and include municipality fixed effects and year dummies. Column (1) displays the same IV specification as our main results in Table 2, while columns (2)-(3) add additional controls. For a description of all of the various control variables see Table A.2. In column (4), we exclude the 5 largest municipalities: Oslo, Bergen, Trondheim, Stavanger, and Bærum, while in column (5), we exclude post-2008 years from estimation. In columns (6) and (7) we estimate pre-expansion municipality-specific linear and quadratic time trends as is shown in equation (C.1), using data from 1991-1991 in the A panels, and 1997-1999 in B and C panels, we then extrapolate these into our specification. For panels A1 and A2 we calculate pre-trends using data from 1991-1999, while for the rest of the panels (due to lack of data before 1997) we calculate pre-trends using data from 1997-1999. In column (8), in addition to the pre-expansion municipality-specific linear and quadratic time trends, we interact the baselines values of urbanization, population size and education level for each municipality with time fixed effects and include these in the specification, as is shown in equation (C.2).

\*  $p < 0.1$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ .

Table E.13: IV Estimates of Internet Use on Content, Format and Listed Prices By Market Segment.

	Locals			Tabloids			Non-tabloids		
	Est. (1)	(SE) (2)	Mean (3)	Est. (4)	(SE) (5)	Mean (6)	Est. (7)	(SE) (8)	Mean (9)
<b>Total Effect</b>									
<b>A1. Content Shares</b>									
<b>Sport and Entertainment</b>	-7.416***	(2.365)	35.19	-0.449**	(0.194)	41.53	-10.25***	(2.811)	23.65
<i>Entertainment</i>	-3.952**	(1.780)	18.48	-0.259***	(0.0904)	22.77	-7.723***	(1.743)	13.84
<i>Sport</i>	-3.464***	(1.150)	16.71	-0.190	(0.217)	18.75	-2.529**	(1.142)	9.806
<b>Health and Crime</b>	2.455**	(1.047)	27.21	0.168	(0.117)	31.23	2.586***	(0.857)	21.93
<i>Health</i>	2.234***	(0.608)	12.60	0.0547***	(0.0154)	11.57	1.312**	(0.658)	12.89
<i>Crime</i>	0.221	(0.777)	14.61	0.113	(0.109)	19.66	1.274**	(0.527)	9.039
<b>Politics, FA and B/F</b>	4.961***	(1.874)	37.61	0.281*	(0.148)	27.24	7.666***	(2.405)	54.42
<i>Politics</i>	2.795**	(1.121)	16.08	0.0903	(0.0647)	12.83	4.867***	(1.176)	18.95
<i>Foreign Affairs</i>	-0.358	(0.457)	3.196	0.0576	(0.0379)	3.165	-6.546***	(1.297)	5.642
<i>Business/Finance</i>	2.523**	(1.233)	18.33	0.133**	(0.0571)	11.24	9.346***	(1.910)	29.83
<b>B1. Format and Size</b>									
Format (Page Size in cm <sup>2</sup> )	-452*	(272)	1,576	-	-	1022	-696***	(124.6)	1,386
No. of Pages	-11.74*	(5.612)	39.04	-	-	60	-0.814	(1.435)	38.02
Format × No. of Pages	-28,955**	(9,247)	61,160	-	-	61,320	-35,503***	(6,215)	54,599
<b>C1. Unit Sales Price and Listed Advert Prices</b>									
Sales Price Per Copy	-0.126	(0.884)	12.10	-0.0748**	(0.0381)	10.98	1.618***	(0.567)	13.88
Full Page, 4 colors	-13,771**	(4,056)	52,232	-1.097	(1,791)	212,182	-62,381***	(10,030)	110,883
Full page in B/W	-14,523***	(3,172)	37,374	-428	(606)	112,376	-56,358***	(7,315)	74,244
Column Ads, Per cm	-4.909	(2,989)	23.85	-0.386	(1,272)	145.4	-8.836***	(3,032)	54.92
<b>Fixed Composition</b>									
<b>A2. Content Shares</b>									
<b>Sport and Entertainment</b>	-6.418***	(2.312)	35.19	-0.377**	(0.181)	41.53	-8.876***	(0.998)	23.65
<i>Entertainment</i>	-3.858**	(1.745)	18.48	-0.166*	(0.0939)	22.77	-6.806***	(0.801)	13.84
<i>Sport</i>	-2.560***	(1.145)	16.71	-0.211	(0.194)	18.75	-2.070***	(0.340)	9.806
<b>Health and Crime</b>	2.225**	(1.040)	27.21	0.163	(0.123)	31.23	3.084***	(0.512)	21.93
<i>Health</i>	1.824***	(0.604)	12.60	0.0458***	(0.0164)	11.57	2.009***	(0.346)	12.89
<i>Crime</i>	0.401	(0.775)	14.61	0.117	(0.114)	19.66	1.075***	(0.354)	9.039
<b>Politics, FA and B/F</b>	4.193**	(1.813)	37.61	0.215**	(0.0887)	27.24	5.792***	(0.841)	54.42
<i>Politics</i>	1.999*	(1.066)	16.08	0.0622	(0.0501)	12.83	3.493***	(0.631)	18.95
<i>Foreign Affairs</i>	-0.0657	(0.457)	3.196	0.0311	(0.0239)	3.165	-4.858***	(1.097)	5.642
<i>Business/Finance</i>	2.260*	(1.213)	18.33	0.122***	(0.0339)	11.24	7.157***	(0.724)	29.83
<b>B2. Format and Size</b>									
Format (Page Size in cm <sup>2</sup> )	-286	(204)	1,576	-	-	1022	-855***	(124)	1,386
No. of Pages	-9.753	(5.428)	39.04	-	-	60	2.380***	(0.622)	38.02
Format × No. of Pages	-20,152*	(9,126)	61,160	-	-	61,320	-38,494***	(6,031)	54,599
<b>C2. Unit Sales Price and Listed Advert Prices</b>									
Sales Price Per Copy	-0.0881	(0.874)	12.10	-0.0387	(0.0404)	10.98	0.834	(0.561)	13.88
Full Page, 4 colors	-7,705*	(4,264)	52,232	-965***	(317)	212,182	-63,639***	(7,880)	110,883
Full page in B/W	-9,131***	(3,377)	37,374	-393**	(176)	112,376	-59,822***	(6,254.5)	74,244
Column Ads, Per cm	-2.490	(3,247)	23.85	-0.548*	(0.329)	145	-8.239***	(2,614)	54.92

Notes: The estimates in this table are the same as Table 5, but broken down by newspaper segment. For a detailed description of each outcome variable see Table A.2. All regressions are based on 420 municipalities × 11 years = 4,620 observations. All regressions include municipality fixed effects and year dummies. All regressions include the demographic controls discussed in Table A.2. Standard errors are heteroskedasticity robust and clustered at the municipality level. The mean for each outcome variable is from the baseline year, 2000.

\* p < 0.1, \*\* < 0.05, \*\*\* p < 0.01.