

Strategic responses to cultural quotas: evidence from French radio

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Abstract

This paper empirically examines the strategic responses of French radio stations to “cultural quotas” that promote Francophone music. Using detailed data on playlists of major radio stations in France from 2013-2016, we show that stations vary in their compliance with the law. In addition, stations have some scope for adjusting their playlists subject to the quota constraints. For many stations, the realized audience for Francophone music is lower than would be the case in the absence of these adjustments. We then estimate a regression model to show how French stations adjust content in response to the size of their audience, using instrumental variables to address the endogeneity of demand. The results show that although quotas increase the diffusion of Francophone music, stations reduce Francophone play during times of peak demand, which has a countervailing effect on the exposure of French music. We further show that these strategic responses are more pronounced for stations that gained audience during our sample period than for stations that lost audience. Our early results suggest that strategic responses to cultural quotas have a statistically and economically significant effect on the exposure of Francophone music.

Keywords: Cultural economics, regulation, media.

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1. Introduction

Many countries regulate the media, particularly television and radio. For example, the United States restricts foreign ownership of broadcast media,¹ and in China, most media outlets are state-run. A specific form of media regulation observed in some countries concerns cultural quotas. That is, broadcast media may be required to include a minimum of nationally-produced content (e.g., Australia) or a minimum of content in the local language (e.g., Quebec). Governments justify this intervention in markets as necessary to support local culture or protect it from an international cultural hegemon. As media markets have evolved, however, the effect of these regulations may also be changing. International trading partners sometimes push for the removal of quotas, arguing that they constitute non-tariff barriers to trade.² Traditional media now face greater competition from online content providers that are not necessarily subject to the same regulations. The strategic responses of regulated media to this increased competition may result in market outcomes unanticipated by lawmakers.

The paper focuses on the impact of cultural quotas in the French radio industry. Regulations require that French radio stations devote a minimum percentage of airplay to Francophone artists, as well as to new talent and new productions. If binding, these quotas change the composition of radio programming and the diversity of music to which French consumers are exposed. In particular, since radio play is historically a driver of music sales, these quotas are meant to support Francophone and new talent. However, by restricting how radio stations can respond to consumer demand, quotas may also affect the ability of radio stations to adapt to competition from streaming services or other means of accessing content. If quotas lower demand for radio and therefore their advertising revenues, they may threaten the sustainability of the radio industry. In addition, there are implications for the owners of intellectual property rights tied to music. A shift of the audience from radio to other media, with different terms for compensating artists, may affect other parts of the music ecosystem.

In this research, we examine the strategic responses of French radio stations to cultural quotas. We first show that stations vary in their compliance with the law, which we describe in more detail in the following section. In addition, stations have some scope for adjusting their playlists subject to the quota constraints. We show that for many stations, the realized audience for Francophone music is lower than would be the case in the absence

¹Section 310(b)(4) of the Communications Act of 1934.

²For example, in 2006 South Korea halved the number of days per year that cinemas were required to show locally-produced films under pressure from the United States, with which it was negotiating a free trade agreement.

of these adjustments. In contrast, the quota for new music does not appear to induce strategic responses. We estimate a regression model to show that stations reduce their play of Francophone music when audience is high, using instrumental variables to address the endogeneity of demand. Strategic responses to cultural quotas have a statistically and economically significant effect on the exposure of Francophone music.

The paper is structured as follows. After a review of the literature in 2, we describe the institutional environment of quota regulations in 3. In 4, we describe our data sources and the construction of our dataset and provide variable definitions. We explain our identification strategy and provide empirical results in 5. Finally, we conclude in 6.

2. Literature review

Despite their widespread use, the literature on cultural quotas is relatively sparse and focuses mainly on the diversity of content and consumer welfare. Theoretical models highlight several subtle effects of quotas. [Richardson and Wilkie \(2015\)](#) suggests a mild quota will increase the diversity of local content by inducing domestic record companies to sign up more new bands and will improve the welfare of consumers who value diversity. However, quotas can have perverse effects on diversity. When a quota requires that a certain percentage of new content be aired, the entry of local content may be distorted. A greater share of local content will be produced by bands in genres where international music is most prevalent. [Perona \(2015\)](#) suggests a reduction in programming diversity. Broadcasters facing a quota will compensate for the reduction of foreign programming by increasing the number of diffusions of substitutable domestic programs. Total broadcasting time being limited, this will force the broadcaster to abandon less popular types of programming, reducing overall program diversity.

In [Richardson \(2006\)](#), quotas can increase *diffusion* of local content, but *audience* increases by less. Stations choose a mix of local and international content to meet the demand of consumers with diverse preferences. This paper benchmarks a cultural quota against other regulations, such as a limit on advertising and a publicly-funded (non-advertising based) station. A quota is more effective than the other two options in achieving the regulator's goal of increasing the diversity of local content. [Crampes and Hollander \(2008\)](#) also looks at the impact of quota in the bundle composition of television broadcasting, and finds that a quota may increase the number of channels but reduce the audience of these programs.

Empirical work on cultural quotas is similarly limited. Most papers focus on cultural trade in motion pictures. [Masood \(2015\)](#) examines quotas implemented in the cinema

sector in Brazil, and concludes that the quota reduces the diversity of foreign imports. [Ren \(2011\)](#) explores the diversity of films from 78 countries between 2000 and 2007. This paper finds that both quota and investment restrictions increase the diversity of local content, and concludes that quotas are an effective way to counter the domination of foreign cultural content. In a study covering a long panel of 22 countries, [Ferreira and Waldfogel \(2013\)](#) study how quotas contribute to the home bias for music. They find that broadcasters provide predominantly local content rather than imported music using a dataset on trade in popular music among 22 countries.

Other studies, notably ([Sweeting, 2009](#)), have examined the strategic behavior of radio stations, although not with respect to cultural quotas. In a study of the US market, Sweeting estimates stations' strategic incentives to coordinate on the timing of commercial breaks. Our focus here is instead on the interaction of quotas with playlist choices, which is new to the empirical literature.

3. Institutional environment of cultural quotas in France

Regulators around the world, particularly in Europe, pay close attention to trade in cultural products. Governments can protect local content using several policy instruments. They can give subsidies for the production of content, or impose import quotas or cultural quotas. Quota regulations emerged during the 20th century with the expansion of broadcasting. As broadcasters have considerable market power when entry is limited, the state may have an interest in regulating their behavior. In addition, in some countries, quota regulations were introduced in response to the increased reach of “Anglo-saxon” content. Their use is widespread: fewer than 30 countries impose no content quotas. The United States and New Zealand are two exceptions that have opted for a laissez-faire approach to content [Puppis \(2008\)](#).

3.1. *Quota regulation in France*

For decades, France has imposed quotas for Francophone music, new “production” and new “talent.”³ Songs mostly in French are considered Francophone, while songs performed by a French artist in another language are not. “New” music is that with a premiere

³France also regulates the timing of advertising for public stations as well as those that are privately owned. For public stations, advertising is limited to an average of 30 minutes per day over the year. From 7:00 to 9:00 in the morning, a maximum of 3 minutes of advertising is permitted. For private stations, advertising can be no more than 12 to 14 minutes per hour. The total ad time is about 25% programming per day.

Table 1: Quota category

Francophone	New	Number of stations
60%	7.5%	1
50%	20%	2
40%	20%	14
35%	25%	13

within the previous year. “Recurrent” music is defined as having premiered 1-2 years ago, and “gold” is older than 3 years. The quota regulation introduced in 1994 specified minimum percentages of airplay, with the goal of protecting French culture and increasing the diversity of music offered. Quotas vary by station format: stations with younger audiences generally have lower Francophone quotas than “heritage” stations, and public stations face different quotas than privately-held stations. In response to complaints from some radio stations about the difficulty in meeting the 40% quota (as well as concerns that to do so, they played a small number of French songs many times), the quota for some stations was lowered to 35% in March 2016.⁴ A summary of the current quotas is provided in Table 1.

Quotas apply from 6:30-22:30 on weekdays and 8:00-22:30 on weekends (i.e., hours when audience is likely to be high). Advertising revenues are the main financial income of French radio stations, and they pay licensing fees as a share of their advertising revenues (between 3% and 4%) regardless of the titles they broadcast. The producers and SACEM (the Society of Authors, Composers and Publishers of Music) then distribute these fees to the artists in proportion to the rotations.

The Conseil supérieur de l’audiovisuel (CSA)⁵ monitors compliance with these quotas on a monthly basis.⁶ There are about 7-10 violations per year, with mild sanctions.

3.2. *Quotas and competition between broadcasters*

Traditional radio stations compete in a two-sided market using an advertising-based business model. Listeners do not pay directly for content, but they must tolerate advertising. Standard models of competition, in which price is the tactical variable and product characteristics are often considered as exogenous, do not apply in this context. Rather, radio stations compete for audience by choosing differentiated playlists.

Listeners choose radio stations based on their expectation that the content will match

⁴See [Les quotas francophones à la radio ont été assouplis...mais la bataille continue](#).

⁵The CSA was created on 17 January 1989 to monitor broadcasting in France.

⁶The data is provided to the CSA by Yacast, a company specialized in monitoring media.

their tastes for variety and musical genre. Likewise, each radio station's choice of playlist characteristics is based on its expectations of audience preferences and the playlists of its competitors, subject to regulatory quotas and the attractiveness of the outside option. Regulatory quotas constrain playlist choice, which affects competition, the size of the audience attracted, and advertising revenues.

The effect of cultural quotas depends on the preferences of listeners for local content. If demand for local content is high, quotas are unlikely to be binding. If instead, listeners have a strong taste for non-local content, quotas affect the payoffs of both radio stations and local artists or producers. In the absence of quotas, local content receives less exposure, which has two effects on the revenues of local artists and producers. First, it reduces their share of royalties paid by stations from advertising revenues. Second, because they benefit less from the publicity provided by radio play, their sales of physical or digital content are likely to be lower.

From the perspective of radio stations, quotas restrict their ability to meet the demands of listeners. If this reduces demand for radio, advertising revenues fall; this could be particularly salient in the presence of competition from streaming platforms or other options for listeners. Stations may therefore have incentive to strategically shift quota-required content, for which there is low demand, to times when their audience is low. Put another way, the opportunity cost of playing an additional minute of local content is higher when the audience is large, because the foregone advertising revenue is higher at these times. In addition, listeners may switch stations if their taste for local content is low.

4. Data

We use data on the minute-by-minute broadcasts of major French radio stations that have national coverage from Yacast. This dataset, used by the CSA to monitor quotas, covers January 2013 to April 2016. In total, this yields 11,534,843 songs played by 34 major French radio stations, which have more than 90% of the total market. We exclude talk stations from our analysis, as music quotas are less relevant for them. The Yacast dataset includes details of the broadcast content, including the language, genre and release date of each song. Thus, we have very complete information on the supply side of the French radio market.

On the demand side, we have data on the average audience during 15-minute intervals for weekdays and weekends for each week and each station, based on measurements made by Mediametrie.⁷ This aggregate measure is based on a representative panel of listeners.

⁷Mediametrie is a private company measuring the audiences as well of radio and television. Its share-

Table 2: Skyrock on March 30, 2015 from 10-11 AM: Data source: Yacast from January 2013 to April 2016

Time	Artist	Song	Language	Premiere	Audience
10:01:28	Major Lazer - DJ Snake - MO	Lean on	English	27/02/15	315000
10:04:13	JUL	La fusée	French	08/12/14	315000
10:08:25	Jay Sean - Lil Wayne	Down	English	02/06/09	315000
10:11:52	Kaaris	Le bruit de mon âme	French	26/01/15	315000
10:19:31	Ariana Grande	One last time	English	27/08/14	292000
10:22:40	Soprano feat. Uncle Phil	Fresh Prince	French	15/09/14	292000
10:25:52	Selah Sue	Alone	English	27/10/14	292000
10:29:31	Black M.	On s’fait du mal	French	10/11/14	292000
10:32:39	Destiny’s Child	Say my name	English	15/01/99	302000
10:36:37	Natalie La Rose - Jeremih	Somebody	English	03/12/14	302000
10:39:43	Usher - Juicy J	I don’t mind	English	27/06/14	302000
10:52:11	Chris Brown - Tyga	Ayo	English	18/12/14	294000
10:55:53	Soprano	Clown	French	07/10/14	294000

Table 2 shows an extract from the play log of a station called Skyrock. We convert these play logs into observations of 15-minute intervals (for a total of 96 observations per day) for each station, and calculate the total number of minutes of music played. We then decompose the total minutes into minutes by language and status as “new.” Table 3 presents the descriptive statistics. About one-third of each 15-minute interval is devoted to non-music minutes, i.e. advertising or talk (we cannot distinguish between the two). An average quarter hour has about a mean of 3.1 minutes of French music, and more than double that of Anglophone music. “New” music accounts for an average of 5.31 minutes, while “gold” (music more than 3 years old) has 3.53. Noted that new music here refers to both new music production and new talent.

4.1. Compliance with quotas

Figures 1 to 4 show the average compliance of radio stations during our sample period. We calculate the fraction of Francophone minutes to total music minutes played during the

holders are both major television channels (France Télévision, TF1) as well as radio stations (Radio France, Europe 1) or advertisers. The database compiles data on programming and corresponding audiences on major radio stations in France.

Table 3: Summary statistics

Variable	Mean	Std. Dev.	Min.	Max.	N
Francophone minutes	3.10	3.15	0	15	3606845
Anglophone minutes	6.80	3.92	0	15	3606845
New minutes	5.31	3.72	0	15	3606845
Audience (MMs)	0.08	0.16	0	1.98	3606573
Gold minutes	3.53	3.66	0	15	3606845
Recurrent minutes	1.39	2.10	0	15	3606845
New Francophone minutes	1.54	2.06	0	15	3606845
New Anglophone minutes	2.96	3.11	0	15	3606845
Non-music minutes	5.19	4.55	0	15	3606845

hours for which the quota applies, and compare this to the minimum percentage specified by the regulations. It is clear that most stations fall short of perfect compliance with their Francophone quotas. In contrast, the quota for new music does not appear to be binding (see Figures 5-6).

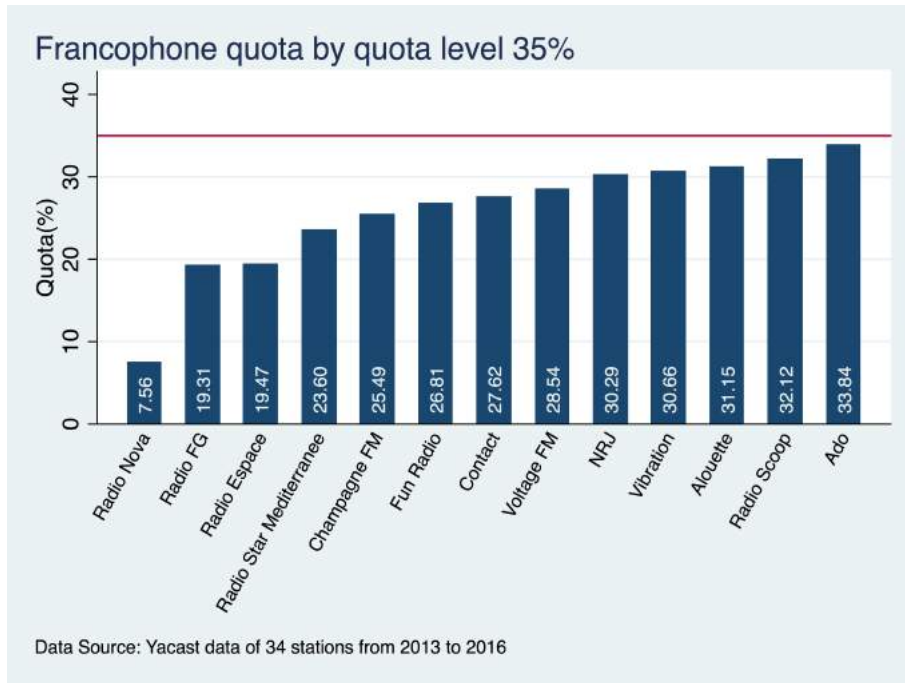


Fig. 1. Compliance with 35% quota for Francophone music

Despite imperfect compliance, stations do not ignore Francophone quotas completely. For example, in Figure 7, we show the average percentage of Francophone minutes by hour of day for Fun Radio. During non-quota hours, the percentage of Francophone play is very small. In other words, when stations are constrained by the Francophone quota, we see a constantly highly percentage of French music play. Figure 8 shows a similar

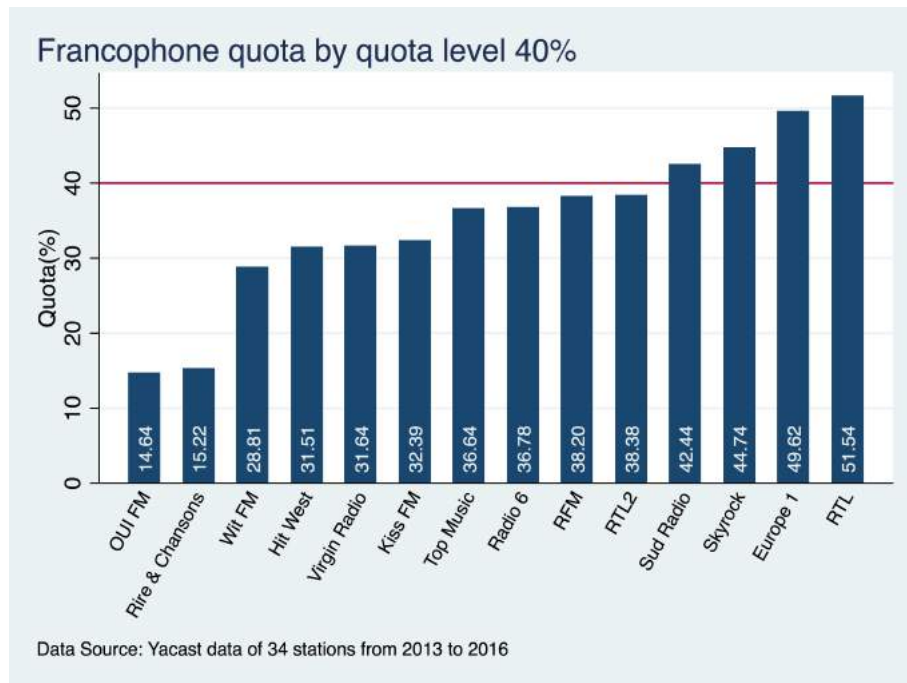


Fig. 2. Compliance with 40% quota for Francophone music

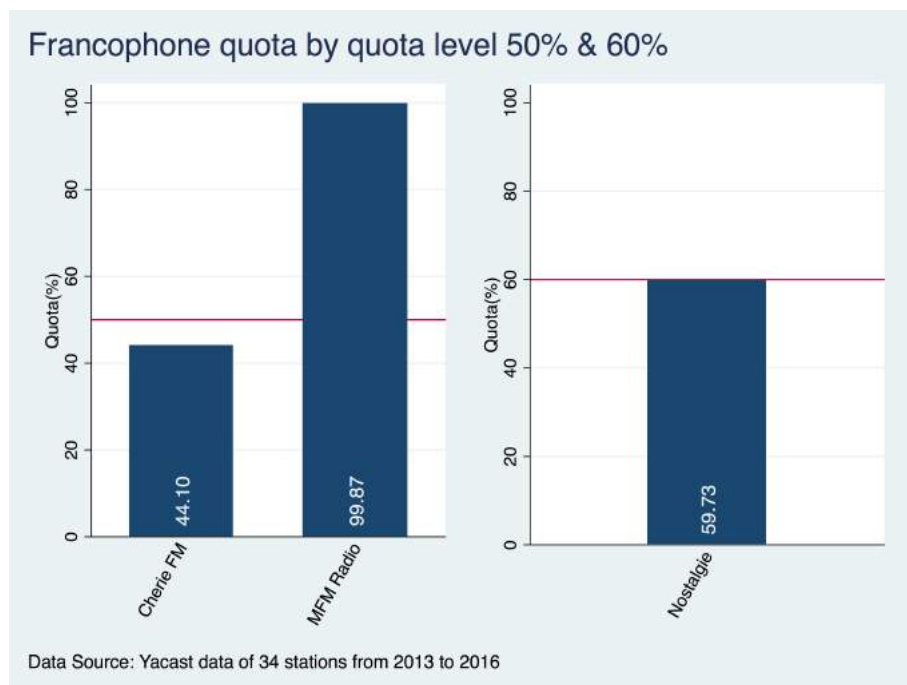


Fig. 3. Compliance with 50-60% quota for Francophone music

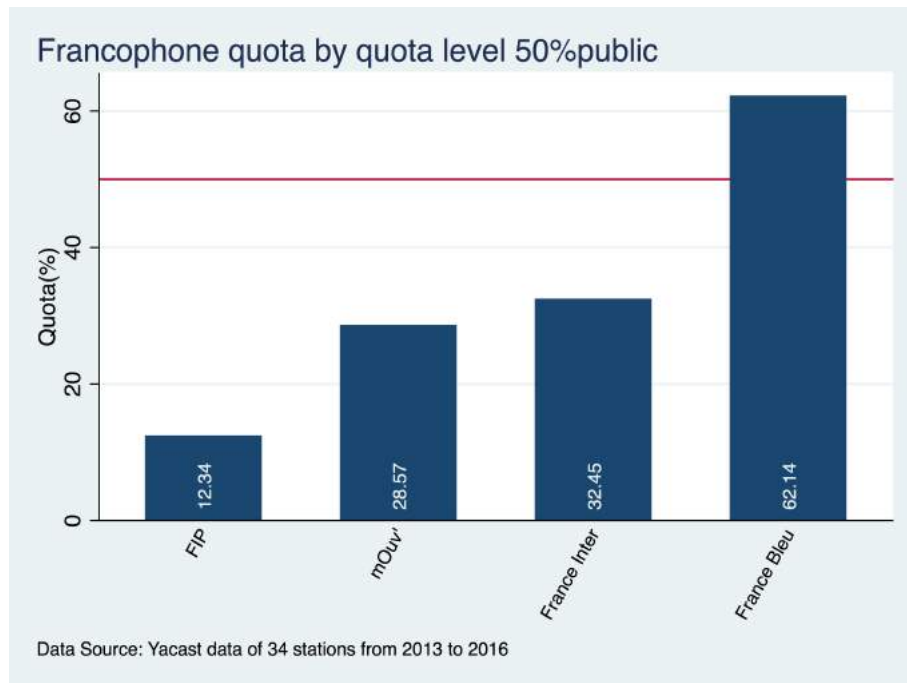


Fig. 4. Compliance of public stations with 50% quota for Francophone music

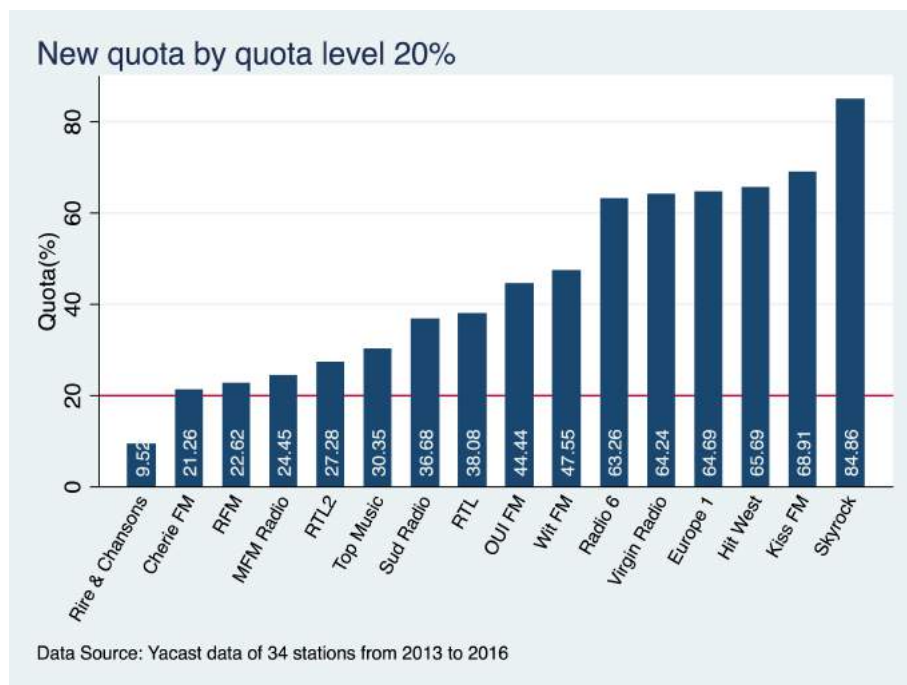


Fig. 5. Compliance with 20% quota level for new music

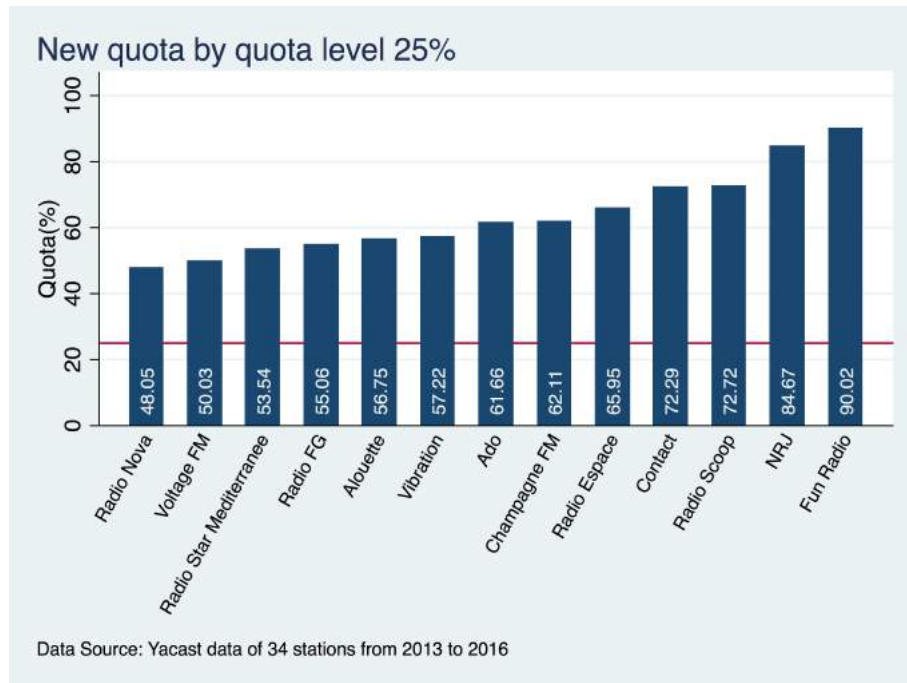


Fig. 6. Compliance with 25% quota for new music

breakdown for new music, where quota-relevant hours appear very similar to those that are unconstrained.

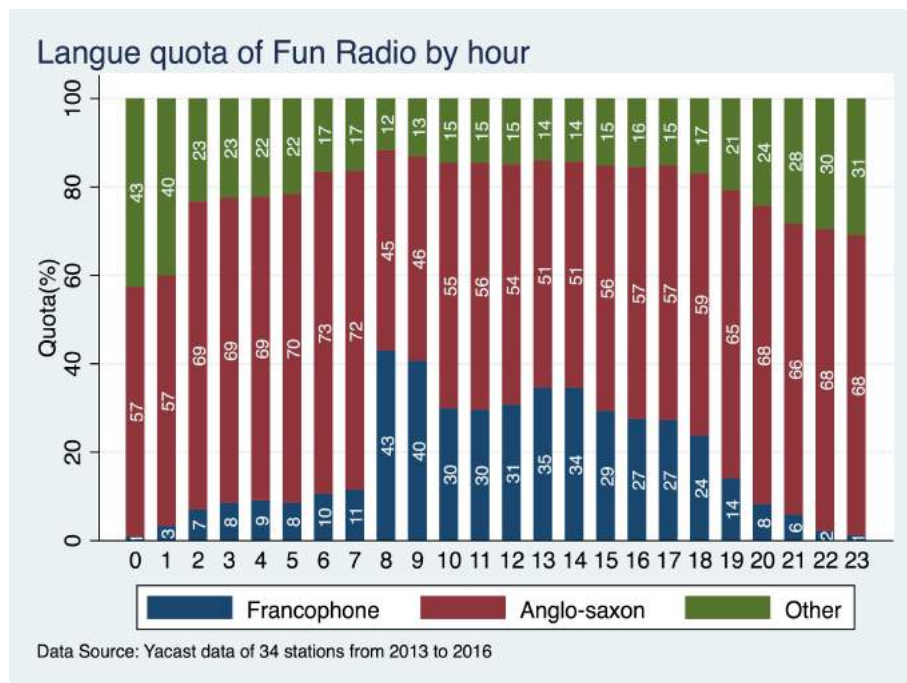


Fig. 7. Francophone play by hour, Fun Radio

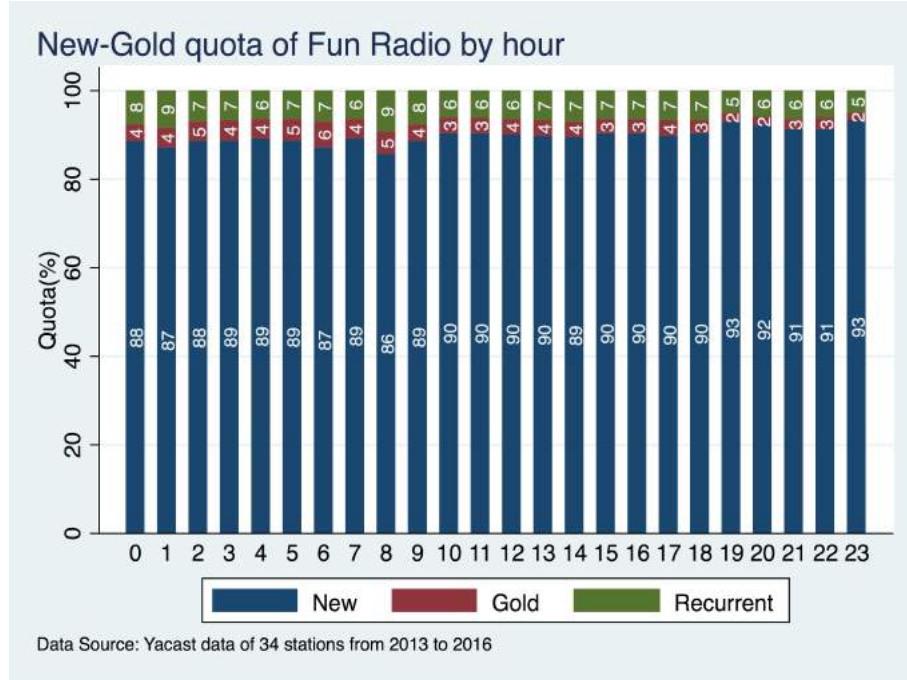


Fig. 8. New music play by hour, Fun Radio

4.2. Exposure to Francophone music

French regulations specify Francophone (or new) play as a function of minutes played, although the actual audience reached is arguably more relevant for the regulatory aim. In practice, 40% of minutes does not necessary imply exposure to 40% of the total audience. [Richardson \(2006\)](#)’s theoretical model predicts that stringent quotas can increase diffusion (in time played) of local content, but the audience reached will increase by less. There are two reasons this might happen. First, consumers can switch to a different station to avoid listening to Francophone music. Second, stations can shift Francophone play to periods when audience is lower.

To explore this, we calculate a “counterfactual” weekly audience exposed to Francophone music that assumes the Francophone quota is strictly applied in each 15-minute interval, or equivalently, that stations are not strategic in their Francophone play (so that in each quarter hour, we would expect the fraction of Francophone play to be the quota level). We compare this to the actual weekly audience reached. In both cases, we focus only on the hours to which the quota applies, and compare weekends to weekdays. We do similar calculations for new music.

As Figures 9 show, the weekly reach of Francophone music is well below the counterfactual for private stations. The opposite is true for public stations (Figure 10). In contrast, figures 11 new music has greater reach than that suggested by the counterfactual for both

public and private stations. These patterns are consistent with profit-oriented stations (i.e., private stations that are more dependent on advertising revenues than public ones) shifting Francophone play to times when audience is relatively small, and reserving peak demand periods for Anglophone music. New music does not induce this shift, which is not surprising given our earlier evidence that the quota for new music is not binding.

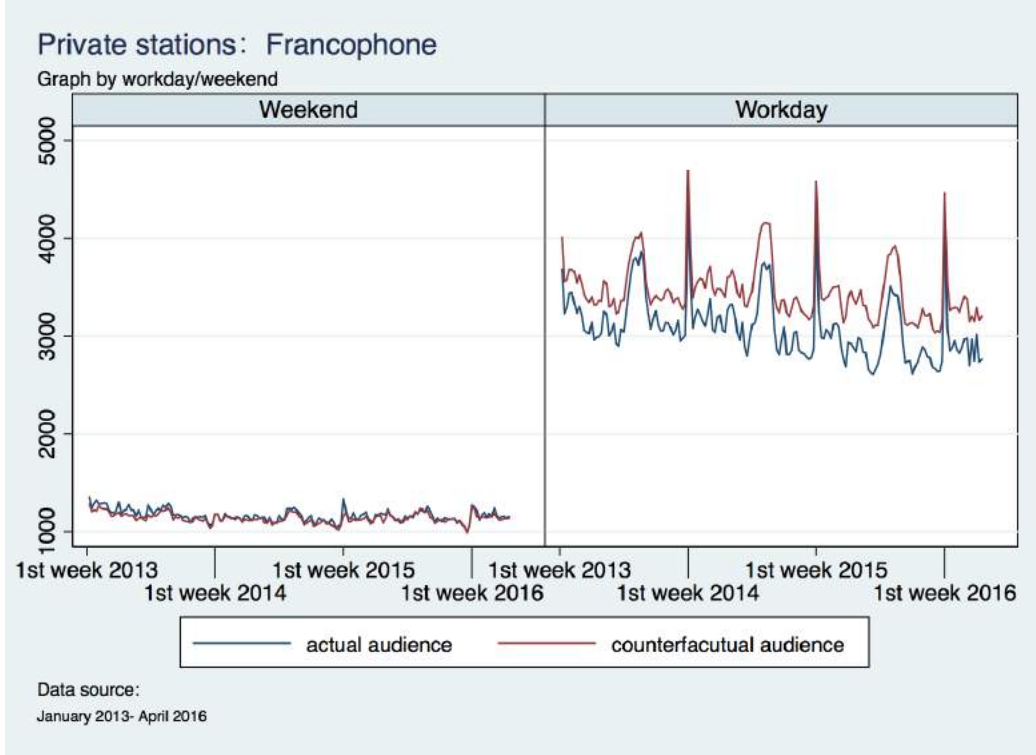


Fig. 9. Private stations: Exposure to Francophone music

5. Estimation

5.1. Regression specification

In this section, we test whether the patterns of strategic shifting described in the previous section hold in a regression model. Specifically, we examine how stations choose content as a function of audience using the following regression model:

$$Minutes_{ijt} = \beta_0 + \beta_1 \ln(audience_{it}) + \beta_2 quota_applies_{it} + \gamma_i + \epsilon_{ijt}$$

where i indexes stations, t corresponds to a 15-minute interval, and j is the type of content: non-music, Francophone, Anglophone, new, etc. Station fixed effects are included

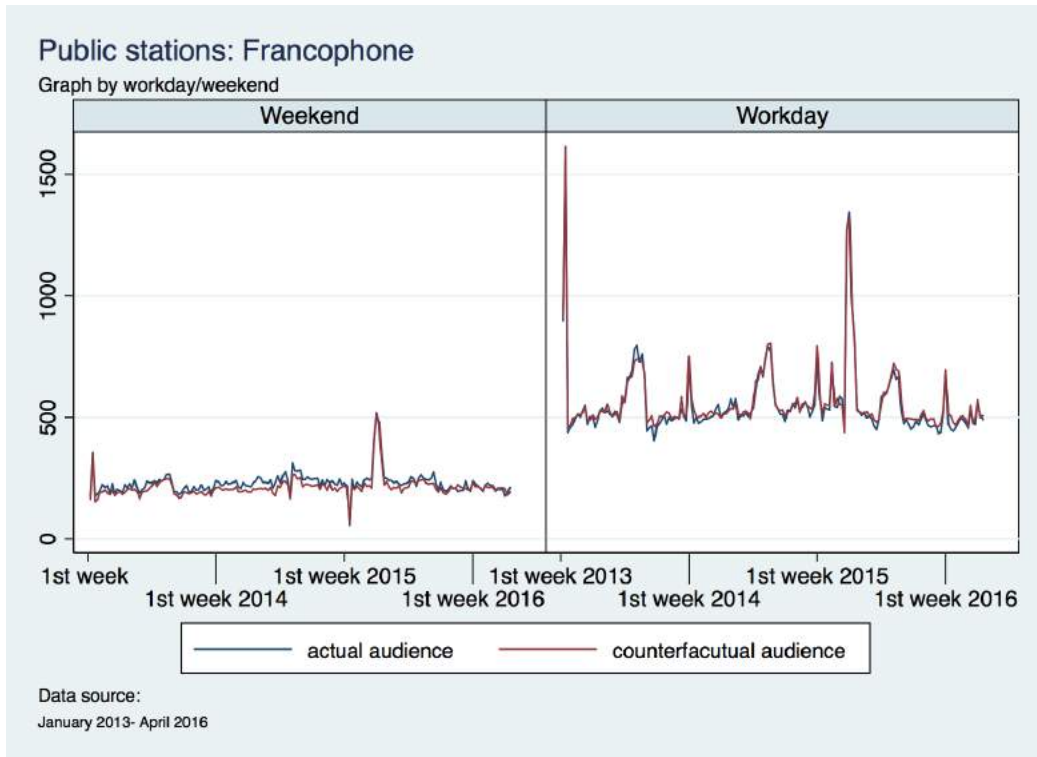


Fig. 10. Public stations: Exposure to Francophone music

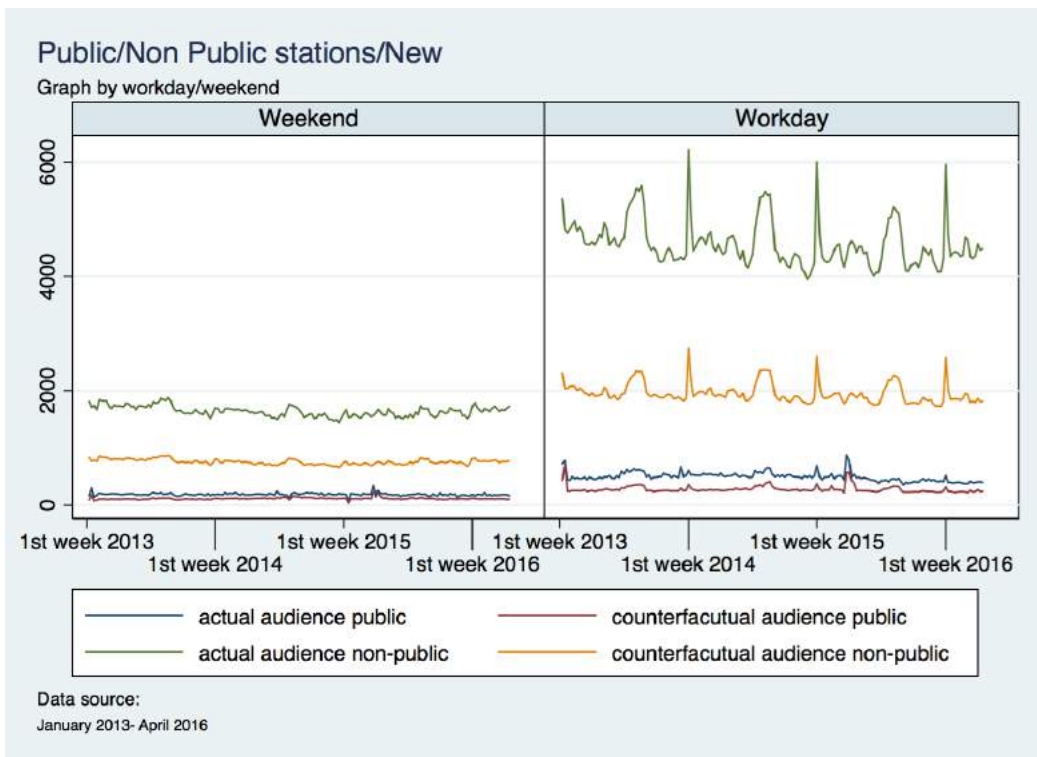


Fig. 11. Exposure to New music

as the γ s. We exclude talk radio from this analysis.

Our main objects of interest are the coefficients β_1 and β_2 . β_1 captures the marginal impact of a change in audience on choice of content. β_2 controls for whether the interval falls in the hours for which the quota applies. If β_2 is significantly larger than 0, we can conclude the presence of the quota changes the choice of content.

A key challenge for identification is the endogeneity of audience. Normally, audience demand should respond to a DJ's music selection. If we observe lower audiences when Francophone music is played, we don't know whether this reflects audience shifting to other stations (because listeners don't like Francophone music) or the strategic choice to play Francophone music when the station expects few listeners. Note that our audience measure is an average across weekdays and weekends within a week for a given 15-minute interval, so does not pick up real-time changes in audience behavior; this presents a problem of measurement error. We address the endogeneity problem by using instrumental variables.

We argue that the audience for radio varies over the course of a day for reasons unrelated to content. Figure 12 shows the average total audience in each 15-minute interval during our sample period. There are obvious peaks during commuting hours (7-9AM and 5-7PM). Assuming that listeners do not change their commuting habits in response to expectations about radio content, the day of week and time of day are exogenous shifters of radio audience that should not affect content except through the change in audience. Similarly, demand for radio varies over the year for exogenous reasons, such as school holidays. We therefore instrument for audience using month of the year, hour of the day, weekday, and weekend dummies.

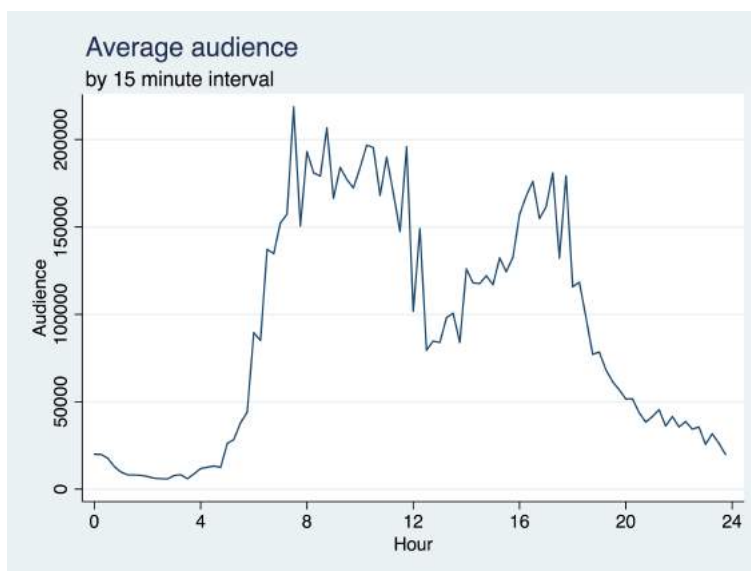


Fig. 12. Average audience by hour of the day

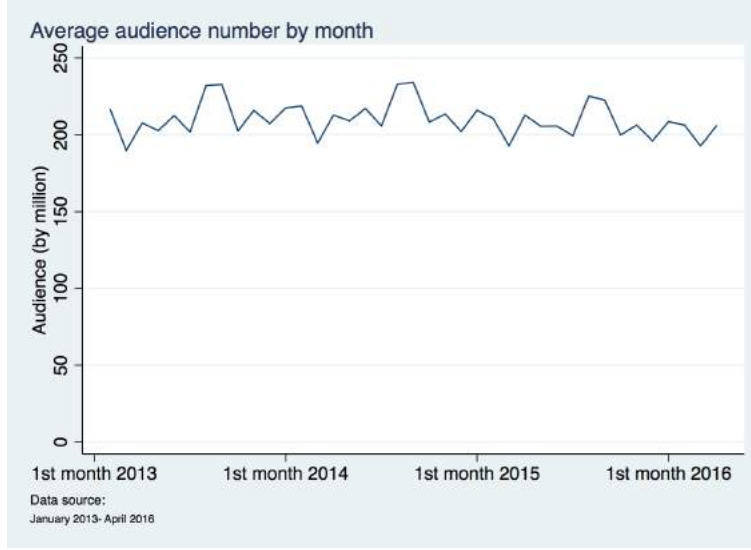


Fig. 13. Average audience by month of the year

5.2. Results

We begin by estimating the regression using the minutes of Francophone music as the dependent variable. In Table 4, we compare the results using OLS with those obtained from instrumental variables, using the instruments just described. The Wu-Hausman F-stat is 27083.5 ($p = 0.0000$), so we reject the null hypothesis that audience is exogenous. The F-stat for the excluded instruments is 3747.52, suggesting that our instruments are reasonably strong. In both OLS and IV estimations, the dummy variable for when the quota applies has a positive and significant impact on the minutes of Francophone music played. In addition, Francophone music is negatively associated with increases in audience. However, our IV estimates are larger in magnitude than OLS, which suggests that accounting for endogeneity is important. When quotas apply, stations play 1.5 minutes more of Francophone music (almost 50% more than the mean of 3.10 minutes of Francophone music per quarter hour) compared to non-quota hours. Within quota hours, strategic shifting implies about 10% less Francophone play during peak times.

The positive sign on the quota dummy is consistent with figures previously presented, and suggests that the quota does increase the diffusion of local content. When unconstrained by quotas, stations play less Francophone music. Our finding that the stations play less French music when audience is large, however, suggests the strategic shifting of content, with the result that the audience reached does not increase by as much as the minutes played.

Of course, it is possible that stations reduce minutes of music play in general when au-

Table 4: OLS and IV estimates

	OLS	IV
	b/se	b/se
Quota applies	1.043 * ** (0.00386)	1.434 * ** (0.00567)
Ln(audience)	-0.0972 * ** (0.000786)	-0.225 * ** (0.00157)
N	2,939,840	2,939,840

*** p < .01.

dience is high, because advertising is most valuable during these periods. To test whether the shift we observe is more pronounced for Francophone music, we compare the Francophone results to those obtained for Anglophone music and non-music minutes in Table 5. Not surprisingly, Francophone quotas crowd out Anglophone play: the coefficient on *quota_{hour}* is negative and significant for the Anglophone specification, and roughly the opposite of that for Francophone play. While stations devote more time to non-music minutes when audience is high (the coefficient on *ln_audience* is .617 for non-music), they reduce Francophone play by more than the reduction in Anglophone play. Given an mean of 3.1 minutes of Francophone music and 6.8 minutes of English music, the coefficients imply that stations decrease Francophone play by 10%, but only 3% for Anglophone, when audience increases.

Table 5: IV estimates for Francophone, Anglophone and non-music minutes

	anglo _minutes	francophone _minutes	non _music _minutes
	b/se	b/se	b/se
ln _audience	-0.203 * ** (0.00192)	-0.281 * ** (0.00154)	0.617 * ** (0.00183)
quota _hour	-1.686 * ** (0.00700)	1.604 * ** (0.00560)	0.148 * ** (0.00668)
N	2,939,840	2,939,840	2,939,840

* p < 0.10, ** p < 0.05, *** p < .01.

We next focus exclusively on the behavior of stations during the hours when quotas apply, and re-estimate a pooled model of minutes of music played by language and “new” status. That is,

$$Minutes_{ijt} = \beta_0 + \beta_1 music_genre_j + \beta_2 ln(audience_{it}) + \beta_3 ln(audience_{it}) * music_genre_j + \gamma_i + \epsilon_{ijt}$$

As before, i indexes station, t indexes 15-minute intervals, and j corresponds to music genre. We estimate specifications based on the following definitions for music genre:

- group1: Anglophone, Francophone, other language, and non-music
- group2: New Anglophone, New Francophone, New other language, Non-new Anglophone, Non-new Francophone, Non-new other language, and non-music

Results for the first definition are presented in Table 6. We instrument for audience using month of the year, hour of the day, weekday, and weekend dummies. The omitted category is non-music minutes.

Table 6: IV estimates with language interactions

	minutes b/se
ln_audience	0.353 * ** (0.00658)
Anglophone#c.ln_audience	-0.335 * ** (0.0114)
Francophone#c.ln_audience	-0.601 * ** (0.0101)
Other#c.ln_audience	-0.478 * ** (0.00743)
Anglophone	5.513 * ** (0.114)
Francophone	5.255 * ** (0.100)
Other	0.938 * ** (0.0744)
Constant	0.823 * ** (0.0652)
N	7,808,128

* $p < 0.10$, ** $p < 0.05$, *** $p < .01$.

Table 7 includes interactions with whether the music is new, allowing us to test whether new Francophone music is affected differently than other genres. The main effects of new Anglophone as well as new Francophone show that older music of both languages receives slightly more play, although this difference is larger for Francophone music. The interaction with audience, however, suggests that stations are more likely to reduce play of older music when audiences increase. Again, Francophone music sees larger reductions than Anglophone, both for new music as well as for older content.

Finally, we consider whether strategic responses differ for stations that gained audience during our sample period versus those that are struggling. In other words, are strategic

Table 7: IV estimates with language and age interactions

	minutes b/se
ln_audience	0.353 * ** (0.00658)
Anglo New#c.ln_audience	-0.306 * ** (0.00918)
Anglo Non-new#c.ln_audience	-0.382 * ** (0.00918)
French New#c.ln_audience	-0.386 * ** (0.00824)
French Non-new#c.ln_audience	-0.569 * ** (0.00823)
Other New#c.ln_audience	-0.452 * ** (0.00717)
Other Non-new#c.ln_audience	-0.380 * ** (0.00683)
Anglo New	2.050 * ** (0.0918)
Anglo Non-new	2.639 * ** (0.0917)
French New	1.460 * ** (0.0816)
French Non-new	2.972 * ** (0.0820)
Other New	0.494 * ** (0.0717)
Other Non-new	-0.379 * ** (0.0679)
Constant	0.823 * ** (0.0652)
N	13,664,224

* p<0.10, ** p<0.05, *** p< .01.

responses related to market success? To examine this, we divide stations into net gainers and net losers. Figure 14 shows the percent change in audience for each station in our sample comparing the first quarter of 2013 and the first quarter of 2016. We then estimate the model separately for those that increased their audience and those that lost. These results are presented in Table 8. Relatively successful stations show a bigger difference in Francophone play during quota-relevant hours, and a bigger reduction in Francophone play in response to increases in audience. Although not necessarily a causal relationship, this suggests that strategic responses are associated with greater profits (assuming that gains in audience generate increases in advertising revenues), but a smaller audience reached by Francophone play.

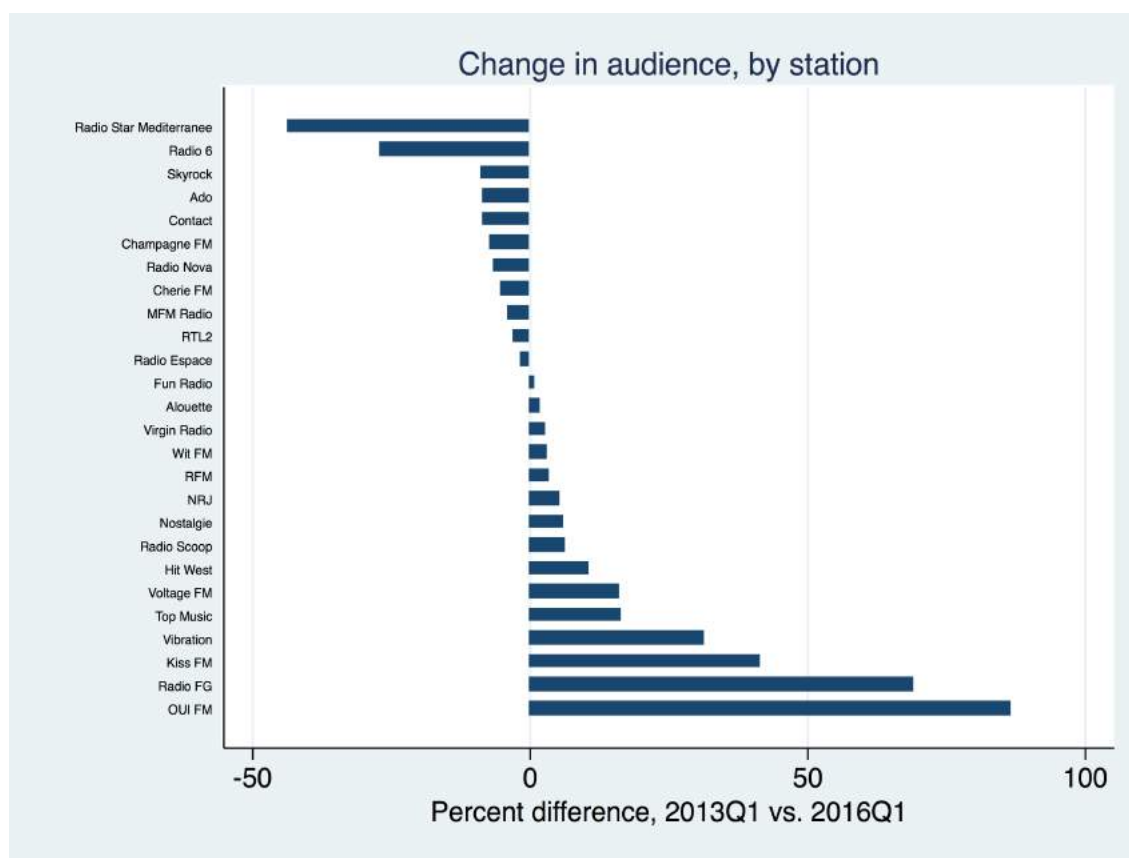


Fig. 14. Percent difference in audience by each station compare between 2013 Q1 and 2016 Q1

6. Conclusion and future extensions

This paper explores the strategic responses of radio stations constrained by cultural quotas. Our findings suggest that stations play more quota-required music when the quota

Table 8: IV estimates by Gain/Loss group

	Net Gain	Net Loss
	b/se	b/se
Log(audience)	-0.234 * ** (0.00203)	-0.194 * ** (0.00239)
Quota applies	1.945 * ** (0.00716)	0.678 * ** (0.00898)
N	1,474,839	1360628

*** p < .01.

applies, not surprisingly. This suggests that the Francophone quotas increases the quantity of Francophone music aired, even if compliance with the quotas is imperfect. However, we also find that the audience reached by Francophone music increases by less than the change in minutes of Francophone music played. This is a result of strategic shifting of Francophone play by radio stations: Francophone music gets less airtime when audience is high. Stations with stronger strategic responses are also those that gained audience during our sample period. Thus, regulators face a challenge when imposing cultural quotas that do not conform to audience tastes. Strategic responses partly offset the intended effects of these quotas, and stations showing greater compliance with the spirit of the law may lose audience, further reducing the exposure of content the quota is meant to protect.

Future work will extend this analysis in a number of ways. First, we would like to evaluate the reduced ability of radio to respond to new sources of competition, like streaming. Second, we would like to explore the exposure of new artists. Broadcast radio faces increasing competition from online streaming platforms for the attention of music listeners. Streaming entrants such as Spotify, Deezer, and others are not subject to the same regulations as broadcast radio. On streaming platforms, listeners can make their own playlists based on their own preferences. This outside option may be more attractive during some hours of the day, for some musical genres, and for some demographic groups of listeners. If the regulatory quotas limit the ability of radio stations to compete with streaming platforms, the radio audience may decline more quickly than in the absence of these quotas. Future analysis will quantify the effect of entry by streaming platforms, and the loss of radio audience that results from regulatory quotas.

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Appendix

In this appendix, we include additional robustness checks. First, we estimate separate regressions of Francophone play for weekdays and weekends in Tables 9 and 10. Strategic shifting of Francophone play appears more pronounced on weekdays, when audiences are generally larger.

Table 9: IV estimates of music genre by Weekday

	anglo_minutes b/se	francophone_minutes b/se	non_music_minutes b/se
ln_audience	-0.183 * ** (0.00240)	-0.262 * ** (0.00192)	0.544 * ** (0.00230)
quota_hour	-1.784 * ** (0.00863)	1.488 * ** (0.00690)	0.442 * ** (0.00828)
N	2,102,578	2,102,578	2,102,578

* p<0.10, ** p<0.05, *** p< .01.

Table 10: IV estimates of music genre by Weekend

	anglo_minutes b/se	francophone_minutes b/se	non_music_minutes b/se
ln_audience	-0.251 * ** (0.00343)	-0.152 * ** (0.00271)	0.572 * ** (0.00314)
quota_hour	-1.454 * ** (0.0126)	1.363 * ** (0.00999)	0.115 * ** (0.0115)
N	837,262	837,262	837,262

* p<0.10, ** p<0.05, *** p< .01.

In Table 11, we estimate a pooled model with categories based on the age of the content played. New music receives more play overall, and substitution to non-music as audience increases is more pronounced for gold music than for the new or recurrent categories.

Finally, we present some additional figures comparing the counterfactual audience and realized audience for different quota categories. Stations with the least stringent quota (35%) show the largest difference between the counterfactual and observed audience for Francophone music. For those facing a 40% quota, the observed audience is also lower than the counterfactual, but the difference is smaller. For the other quota categories, the actual audience is larger than the counterfactual, as several of these stations play more Francophone music than is required by the quota.

Table 11: IV estimates with age interactions

	minutes b/se
ln_audience	0.353 * ** (0.00658)
Gold#c.ln_audience	-0.593 * ** (0.00915)
New#c.ln_audience	-0.437 * ** (0.0105)
Recurrent#c.ln_audience	-0.384 * ** (0.00782)
Gold	5.008 * ** (0.105)
New	5.651 * ** (0.105)
Recurrent	1.048 * ** (0.0778)
Constant	0.823 * ** (0.0652)
N	7,808,128

* $p < 0.10$, ** $p < 0.05$, *** $p < .01$.

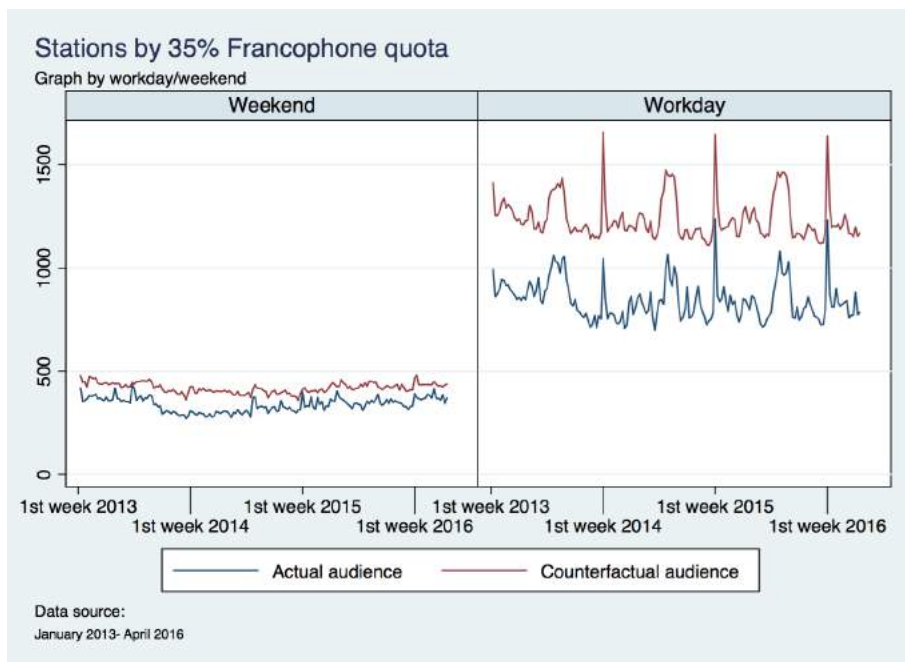


Fig. 15. Actual percentage (of minutes) of Francophone play by week VS 35% quota

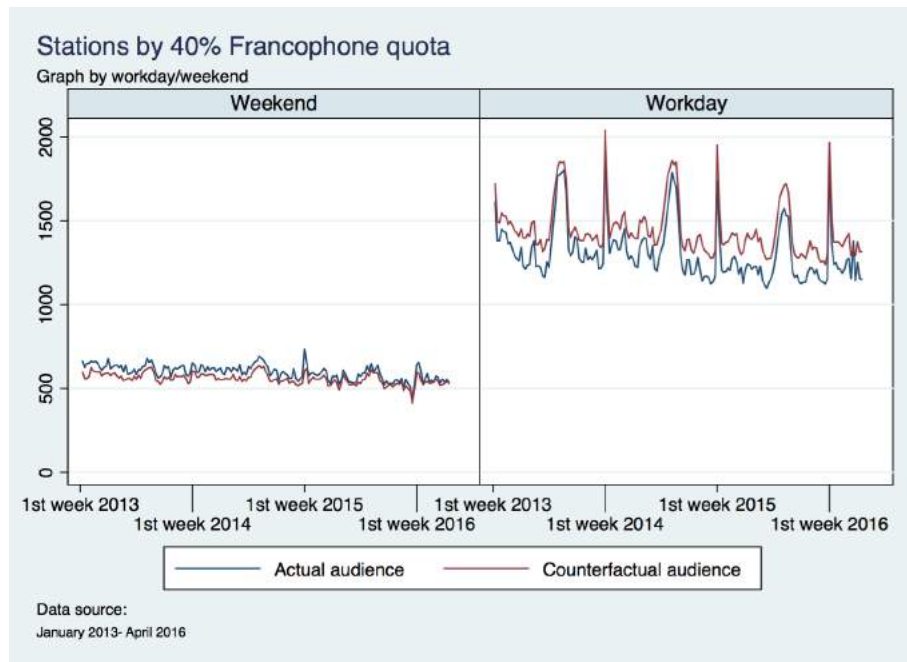


Fig. 16. Actual percentage (of minutes) of Francophone play by week VS 40% quota

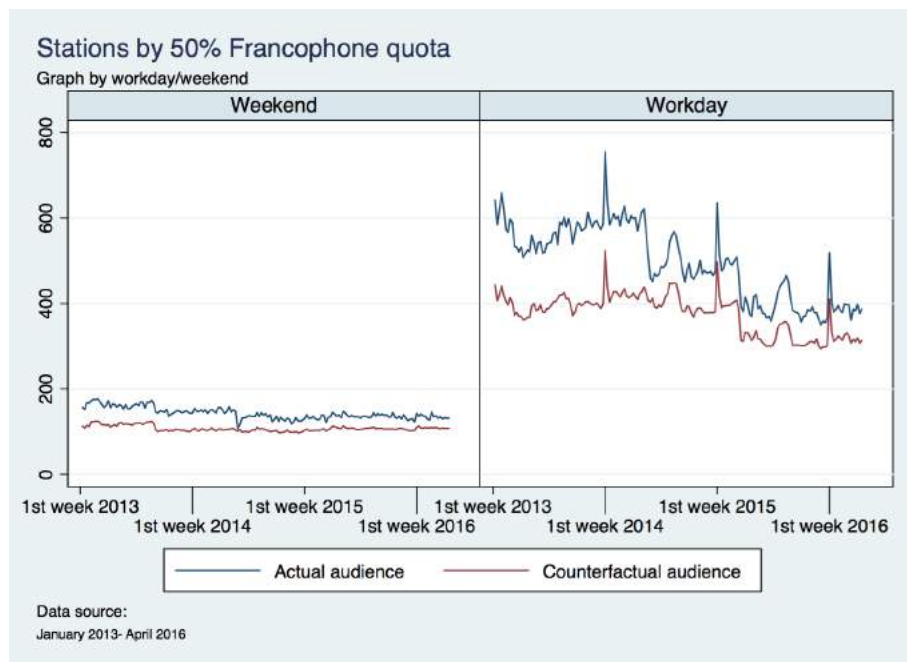


Fig. 17. Actual percentage (of minutes) of Francophone play by week VS 50% quota

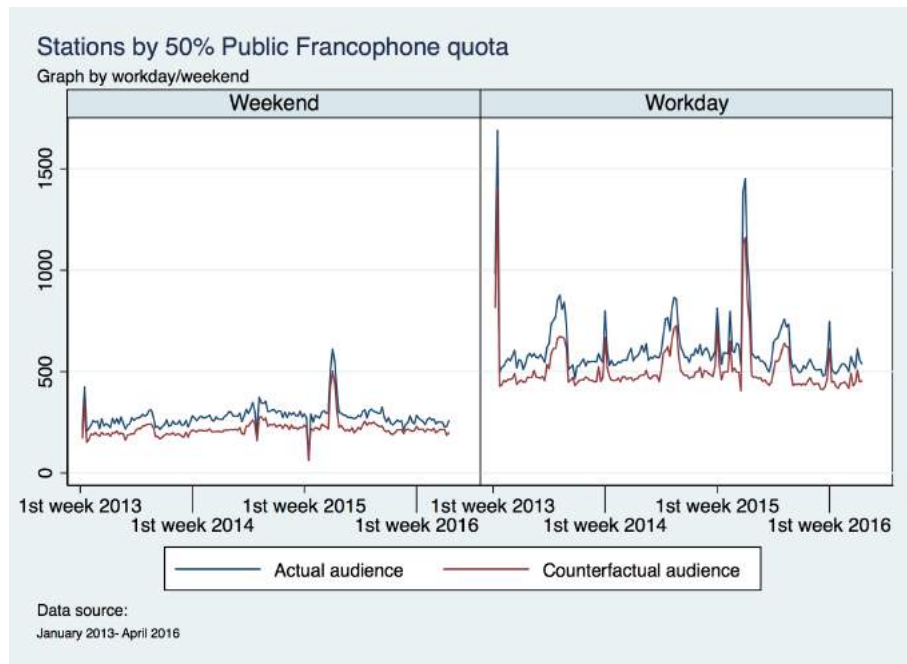


Fig. 18. Actual percentage (of minutes) of Francophone play by week VS 50% public station quota

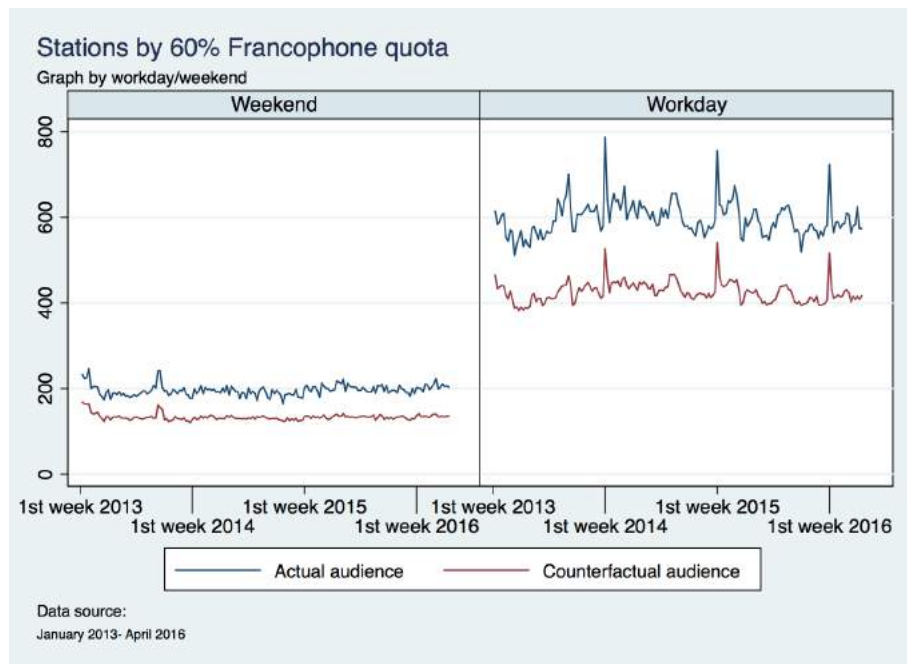


Fig. 19. Actual percentage (of minutes) of Francophone play by week VS 60% quota