

# Programming differentiation and regulation in the competitive radio markets

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# Outline



Introduction

Measurement of program differentiation

Overlap

Product space

Empirical specification

Conclusions



## Motivation

- ▶ In most settings, firms differentiate in order to soften price competition.
  - ▶ However, traditional radio stations compete for audience along non-price dimensions: music genre, music variety etc.
  - ▶ When there is no competition in price in media, firms have a strong incentive to locate wherever the audience is.
- ▶ In radio industry, will program differentiation increase/decrease with market size, competition, and regulation?



## Economics of program differentiation

- ▶ Standard Hotelling model (Hotelling.H. 1929)
  - ▶ where price is 0, firms are choosing a point on a uniform segment  $[0,1]$
  - ▶ consumers are equally distributed in preference along this line, all firms should locate at 0.5
  - ▶ firms seek to imitate competitors to soften competitions
- ▶ Other models may have different predictions
  - ▶ Free-to-air television, channels are being similar in programming(Jack H. Beebe 1977)
  - ▶ Reduction in programming diversity (Perona 2015)
  - ▶ Stations' strategic incentives to coordinate on the timing of commercial breaks(Sweeting 2006,2009)
  - ▶ programming differentiation should increase with market size/ownership(Berry and Waldfogel 1999,2001; DC Chisholm, MS Mcmillan, G Norman 2006)



## Our focus

- ▶ Regulators have been concerned that there is too little variety offered.
- ▶ For decades, France has imposed quotas
  - ▶ Francophone music
  - ▶ New “production” and new “talent” quotas
  - ▶ Quotas apply to 6:30-22:30 weekdays and 8:00-22:30 weekends (i.e., peak hours), and are assessed on a monthly basis
- ▶ French regulators list the following criteria in order to increase music diversity.
  - ▶ the share of the top 40 most widely distributed titles on each station
  - ▶ the rotation number of different artists and titles
  - ▶ the proportion of new releases in the overall broadcast
  - ▶ the distribution of musical genres



## Research question

**Do stations focus on the same songs or try to increase differentiation when demand is low?**

- ▶ Intuitively, quotas mean that stations are drawing from a smaller pool of songs during quota hours.
  - ▶ The regulation increases the chance that they play the same music in any given 15 minutes interval
- ▶ stations may coordinate in playing less attractive music to times when audience is low
  - ▶ Result: Strategic responses in selecting music can lead to less music diversity during peak hour



## Data: Yacast

- ▶ Panel of 34 major French radio stations
- ▶ January 2013 to January 2016
- ▶ 11,534,843 songs
- ▶ Audience for each station at 15 minute intervals



## Overlap

Following Sweeting (2006), we calculate overlap as:

$$Overlap_t = \frac{Conc_t^{Actual} - \overline{Conc_t^{Sim}}}{SD(Conc_t^{Sim})}$$

where

$$Conc_t = \sum_{j=0}^{14} \left( \frac{\sum_{i=1}^N I_{ijt}}{\sum_{j=0}^{14} \sum_{i=1}^N I_{ijt}} \right)^2$$

- ▶ We compute  $Conc^{Sim}$  to control how much stations should be expected to overlap with the constraint of regulation.
- ▶ We simulate the concentration of 34 stations for 10000 times
- ▶ if stations coordinate in music play, overlap  $\uparrow$





# Overlap simulation



station1	station2	station3	overlap simulation
1	0	0	
0	0	1	
0	1	0	-1,237858425
0	1	0	
1	0	0	
0	0	1	-1,237858425
1	0	0	
0	0	0	
0	1	1	-0,091693319
1	0	0	
0	0	1	
0	1	0	-1,237858425
0	0	0	
1	1	1	
0	0	0	2,200636586



Overlap

## Summary statistics



Table: Summary statistics

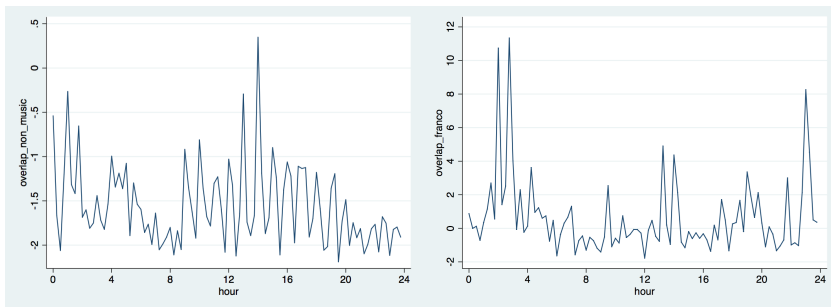
Variable	Mean	Std. Dev.	Min.	Max.	N
Overlap Non music	-1.582	0.481	-2.172	3.773	3,916,222
Overlap French	0.465	1.952	-2.343	13.904	3,916,222
Overlap New	-0.778	0.824	-2.154	9.302	3,916,222
Overlap top French	12.777	19.590	-2.222	36.289	3,916,222
Overlap top English	6.392	7.544	-2.072	25.525	3,916,222
Overlap top all	5.574	7.123	-2.067	23.739	3,916,222
Asymmetry French	1.756	6.139	0	34	3,916,222
Asymmetry Non music	1.907	6.355	0	34	3,916,222
Asymmetry audience	2.432	7.242	0	34	3,916,222
Share audience	0.032	0.052	0	0.631	3,571,457

Observations are station-15 minute intervals.



## Overlap

## Overlap of non music and French music





## Interpretation



- ▶ We compute the average overlap of non music(advertising) and French music by hour of the day for stations across one sample day.
- ▶ Stations coordinate in playing non music (advertising) during peak hour, while coordinate in playing French music in non-peak hour (from 1 am to 4 am)



# Product space



$$\cos(\theta) = \frac{A \cdot B}{\|A\| \|B\|} \quad (1)$$

- ▶ we compute the top 40/top 20 most played artists in one sample month.
  - ▶ we locate them in high-dimensional space and calculate the angle between their location vectors.

$$\sum_{i=1}^{19} \sum_{j=i+1}^{20} (d_{ij} - \sqrt{(x_i - x_j)^2 + (y_i - y_j)^2})^2 \quad (2)$$

where  $d_{ij}$  is the high-dimensional distance between music  $i$  and  $j$  found above,  $x_i$  and  $y_i$  are the coordinates of music  $i$  in the plane. The most played music is fixed at the origin and the second most played music is fixed to be on the x-axis.

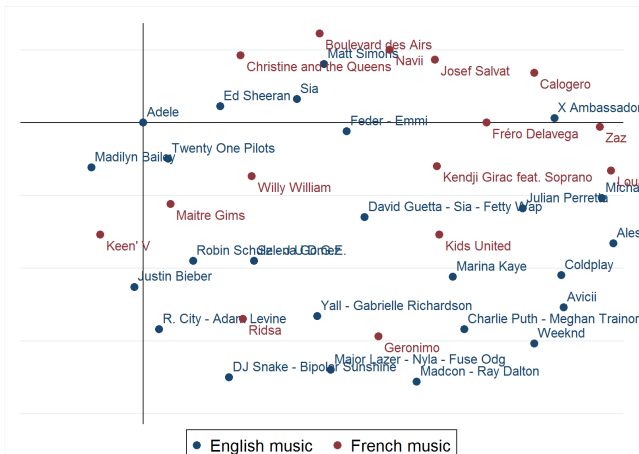
- ▶ Then those music contents are projected into 2 dimensional plane to minimize the distance



# Top 40 most played artists



Figure: Top 40 most played artists of 34 stations in November 2015 located in 2-dimensional music product space

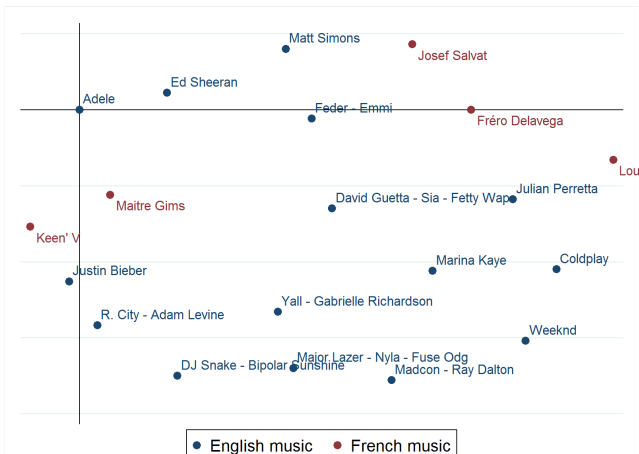




## Top 20 most played artists



**Figure:** Top 20 most played artists of 34 stations in November 2015 located in 2-dimensional music product space





## Interpretation



- ▶ We project top 40 and top 20 artists into a two dimensional space.
  - ▶ The artists who seem similar tend to be played heavily by the stations.
  - ▶ Stations play less French music for the top 20 artist category.
  - ▶ Stations tend to coordinate in playing the hit English music (clustering)





## IV estimates of overlap by music genre

$$Overlap_{jt} = \beta_1 quota\_hour + \beta_2 \ln(audience_{jt}) + \gamma + \epsilon$$

- ▶ Dependent variable is based on the overlap of stations in a 15 minutes interval
- ▶ Unit of observation is a station-interval of 15 minutes
- ▶  $t$  corresponds to a 15-minute interval, and  $j$  is the type of content: non-music, Francophone etc.
- ▶ Station fixed effects are included as the  $\gamma$ s
- ▶ Seasonal dummy is included
  - ▶ Audience is endogenous
  - ▶ We use the time of day as instruments for audience



## IV estimates of overlap by music genre

	overlap non music b/se	overlap franco b/se	overlap new b/se	overlap top franco b/se	overlap top anglo b/se	overlap top all b/se
ln_audience	-0.00238 *** (0.000275)	-0.348 *** (0.00105)	-0.0655 *** (0.000470)	-2.635 *** (0.0108)	-1.680 *** (0.00439)	-1.536 *** (0.00407)
quota_hour	-0.177 *** (0.000984)	-0.692 *** (0.00378)	-0.151 *** (0.00168)	-6.244 *** (0.0387)	1.084 *** (0.0157)	0.0689 *** (0.0146)
N	3,571,457	3,571,457	3,571,457	3,571,457	3,571,457	3,571,457

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



## Interpretation

- ▶ Stations coordinate on playing top English and top all music during regulation hours.
- ▶ Stations have incentives to differentiate in the play of *hit Franco* music when audience number is high
  - ▶ Given a mean of 12.78 overlap of top Francophone music per quarter hour:
  - ▶ When quotas apply, stations overlap 6.24 less of top Francophone music (almost 50% less) compared to non-quota hours
  - ▶ Within quota hours, stations differentiate in playing about 10% less top Francophone play during peak times



## Jaccard and Cosine similarity estimates

	Jaccard similarity b/se	Cosine similarity b/se
same_quota_level	0.00549*** (8.78e - 05)	0.340*** (0.0231)
sameowner	0.0329*** (0.000135)	0.273*** (0.0309)
quota_hour	0.00170*** (8.61e - 05)	
weekend	-0.00180*** (9.09e - 05)	
Compliance to regulation(dummy)		0.0448** (0.0175)
Constant	0.592*** (8.13e - 05)	-0.219*** (0.0178)

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



## Interpretation

- ▶ If stations belong to the same quota level, they are more similar in programming
- ▶ Commonly owned stations by the same company have stronger incentive to coordinate
- ▶ The compliance to regulation dummy is positive and significant at 5% (which is consistent with the patterns we observe)
  - ▶ If station comply with regulation, the expected overlap will increase



## Concluding remarks

- ▶ Stations play heavily the similar hit music (especially English hits) during peak hours
- ▶ Stations's strategic programming response -> reduced exposure of Francophone artists
  - ▶ Stations do not coordinate in playing hit French music to periods when audience is higher
  - ▶ Consumers could switch to a different station to avoid listening to French music



Thank you!