Copyright Protection, Technological Change, and the Quality of New Products: Evidence from Recorded Music since Napster

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Intro – assuring flow of creative works

- Appropriability
  - begets creative works
  - depends on both law and technology
- IP rights are monopolies granted to provide incentives for creation
  - Harms and benefits
- Recent technological changes may have altered the balance
  - File sharing makes it harder to appropriate revenue

…and revenue has plunged

RIAA Total Value of US Shipments, 1994-2009
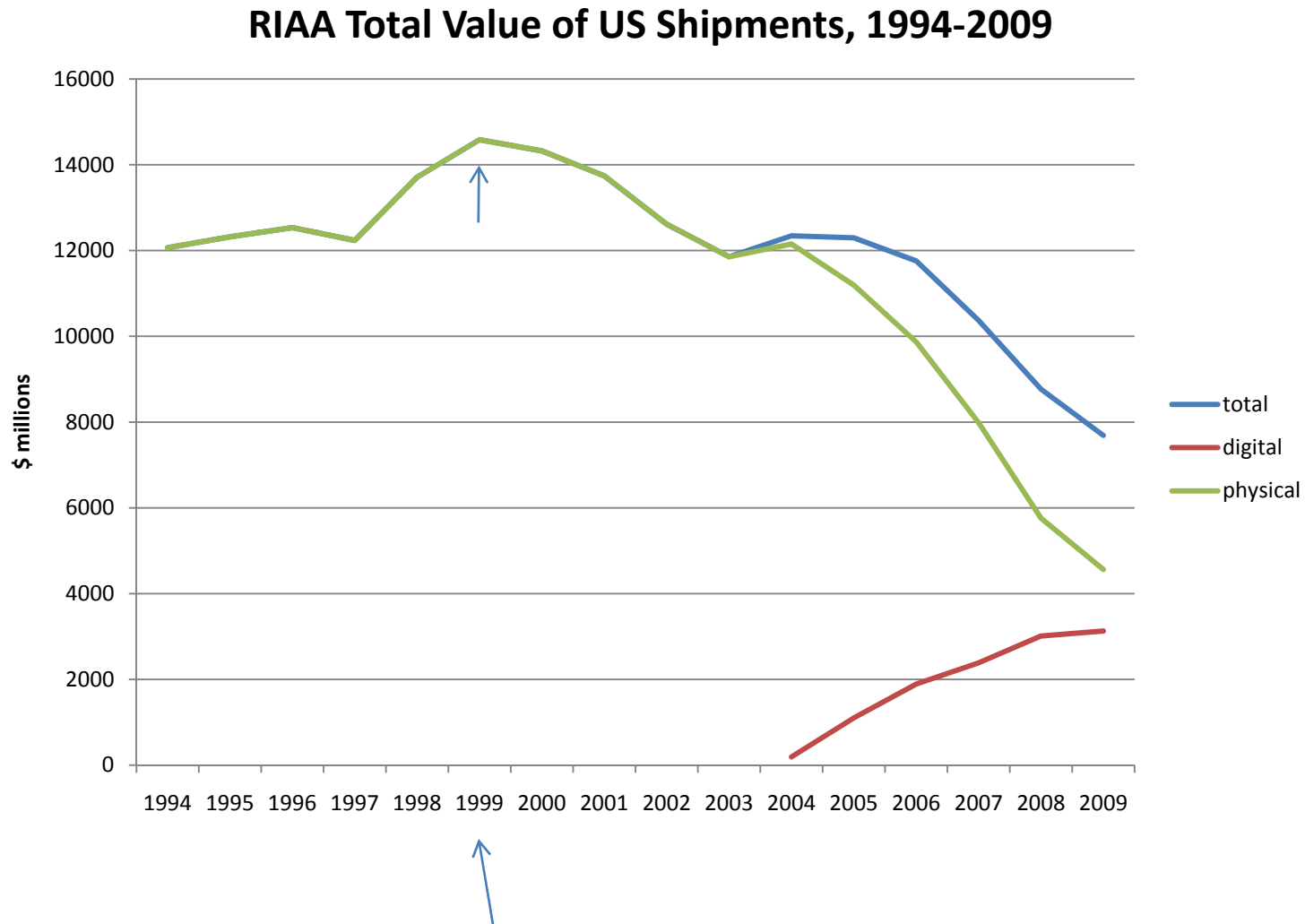
Ensuing Research

- Mostly a kerfuffle about whether file sharing cannibalizes sales
    - Oberholzer-Gee and Strumpf (2006),Rob and Waldfogel (2006), Blackburn (2004), Zentner (2006), and more
- Most believe that file sharing reduces sales
- …and this has led to calls for strengthening IP protection

My Epiphany

- Revenue reduction, interesting for producers, is not the most interesting question

- Instead: *will flow of new products continue?*

- We should worry about both consumers and producers

Industry view: the sky is falling

- IFPI: "**Music is an investment-intensive business**... Very few sectors have a comparable proportion of sales to R&D investment to the music industry."

- Warner Music: "...**piracy makes it more difficult for the whole industry to sustain that regular investment in breaking talent**."

- RIAA: "Our goal with all these anti-piracy efforts is to **protect the ability of the recording industry to invest in new bands** and new music..."

File sharing is not the only innovation

- "Compound experiment"
  - Costs of production, promotion, and distribution may also have fallen
  - Maybe weaker IP protection is enough
- <u>My empirical question: What has happened to the quality of new products since Napster?</u>
  - Contribute to an evidence-based discussion on adequacy of IP protection in new economy

The current standard of empirical evidence

- ## Lennon and McCartney story
- ""'Somebody said to me, 'But the Beatles were anti-materialistic.' That's a huge myth. John and I literally used to sit down and say, 'Now, let's write a swimming pool.'" "

Hard problem

- Quantifying the volume of high-quality new music released over time is hard

- Some obvious candidates are non-starters
  - # works released (but skew)
  - # works selling > X copies (moving target)
  - Estimate consumer surplus over time
    - (But tendency to purchase has declined, independent of value to consumers)

Three Separate Approaches

- Quality index based on critics' best-of lists
- 2 indices based on vintage service flow
  - Airplay by time and vintage
  - Sales by time and vintage

Roadmap

- Theory
  - welfare from music
- Critic-based approach
  - Data, validation, results
- Usage-based approaches
  - Data, validation, results
- Discussion
  - Changes in demand *and* supply, further puzzles

Welfare from Music

- Static case (for music that already exists)
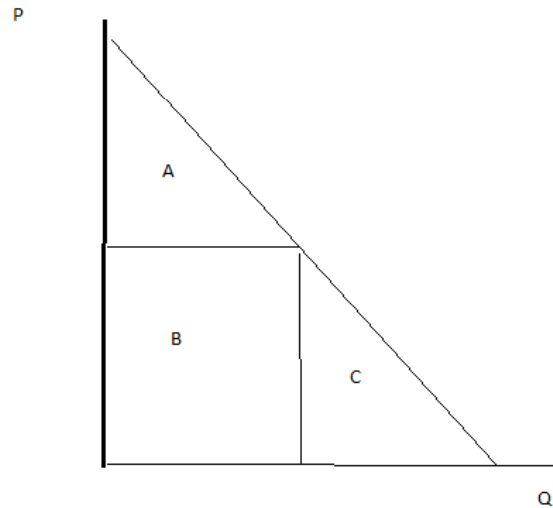
- Buying regime: CS = A, PS=B,DWL=C
- Stealing regime: CS = A + B + C, PS=0, DWL=0
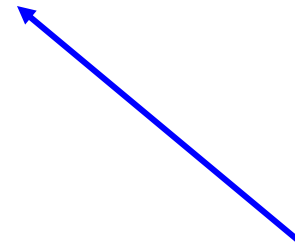- Static benefits of stealing outweigh costs

Dynamic Case

- Suppose PS motivates supply and music depreciates

- (already know that music depreciates)
  - Beatles +26 %/year
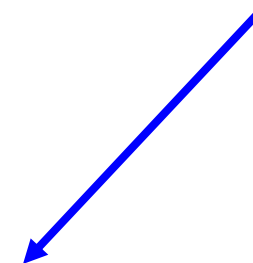 - Britney Spears -28%/year

Album Depreciation for Major Artists

artist	adjusted depreciation	Pleasantly surprised	Grew on me	Familiar before got it	Guessed right	Disappointed from start	Got tired of it	N
RED HOT CHILI PEPPERS	31.3%	30.0%	43.3%	26.7%	10.0%	0.0%	13.3%	30
BEATLES, THE	26.2%	25.9%	22.2%	33.3%	0.0%	0.0%	22.2%	27
JONES, NORAH	17.4%	35.3%	58.8%	11.8%	5.9%	11.8%	11.8%	17
U2	9.8%	18.8%	43.8%	18.8%	6.3%	6.3%	18.8%	16
LINKIN PARK	9.8%	37.0%	14.8%	29.6%	7.4%	7.4%	14.8%	27
DION, CELINE	9.7%	18.8%	0.0%	25.0%	12.5%	12.5%	31.3%	16
COLDPLAY	6.3%	25.0%	27.8%	27.8%	22.2%	0.0%	8.3%	36
2 PAC	1.9%	10.7%	25.0%	21.4%	7.1%	0.0%	42.9%	28
EMINEM	0.7%	22.9%	21.4%	21.4%	8.6%	0.0%	31.4%	70
SOUNDTRACK	0.0%	28.3%	23.9%	19.6%	6.5%	6.5%	23.9%	45
DOORS, THE	-1.2%	12.5%	12.5%	25.0%	12.5%	6.3%	37.5%	16
MATTHEWS, DAVE BAND	-5.2%	7.1%	19.0%	26.2%	14.3%	19.0%	26.2%	42
MOBY	-6.2%	5.9%	5.9%	47.1%	5.9%	17.6%	17.6%	17
MAYER, JOHN	-8.7%	31.3%	25.0%	18.8%	6.3%	6.3%	25.0%	16
NELLY	-17.2%	15.8%	21.1%	15.8%	5.3%	5.3%	31.6%	19
DESTINY'S CHILD	-20.2%	0.0%	6.7%	20.0%	20.0%	6.7%	46.7%	15
50 CENT	-20.5%	17.4%	21.7%	17.4%	8.7%	0.0%	39.1%	23
'N SYNC	-20.7%	4.8%	0.0%	4.8%	4.8%	14.3%	71.4%	21
AGUILERA, CHRISTINA	-21.6%	10.3%	0.0%	10.3%	13.8%	10.3%	55.2%	29
BLINK 182	-23.0%	6.7%	13.3%	6.7%	6.7%	26.7%	46.7%	15
CAREY, MARIAH	-23.5%	0.0%	10.5%	26.3%	5.3%	31.6%	26.3%	19
BACKSTREET BOYS	-24.5%	0.0%	0.0%	17.6%	5.9%	11.8%	64.7%	17
DMX	-24.8%	10.5%	5.3%	21.1%	10.5%	10.5%	52.6%	19
SPEARS, BRITNEY	-28.3%	0.0%	3.4%	6.9%	3.4%	3.4%	82.8%	29
JA RULE	-48.4%	6.7%	0.0%	26.7%	0.0%	26.7%	40.0%	15
JAY-Z	-52.4%	17.4%	0.0%	8.7%	17.4%	26.1%	34.8%	23
VARIOUS	-86.9%	10.0%	0.0%	5.0%	5.0%	10.0%	45.0%	15
								618

These albums don't depreciate much

These albums depreciate a lot

*From Rob and Waldfogel (2004)*

Dynamic Case

- Suppose PS motivates supply and music depreciates

- (already know that music depreciates)

    - Beatles +26 %/year
    - Britney Spears -28%/year

- Then in next period, CS=PS=DWL=0

- <u>Key question</u>: ebbed flow of new products?

Approach #1: critics' lists

- Want index of the number of works released each year surpassing a constant threshold

- Use critics' retrospective best-of lists

  - E.g. Number of albums on a best-of-the-decade list from each year

  - Retrospective: to be on list, album's quality must exceed a constant threshold

Rolling Stone's 500 Best Albums (2004)

Rolling Stone Index
from 2004 album list
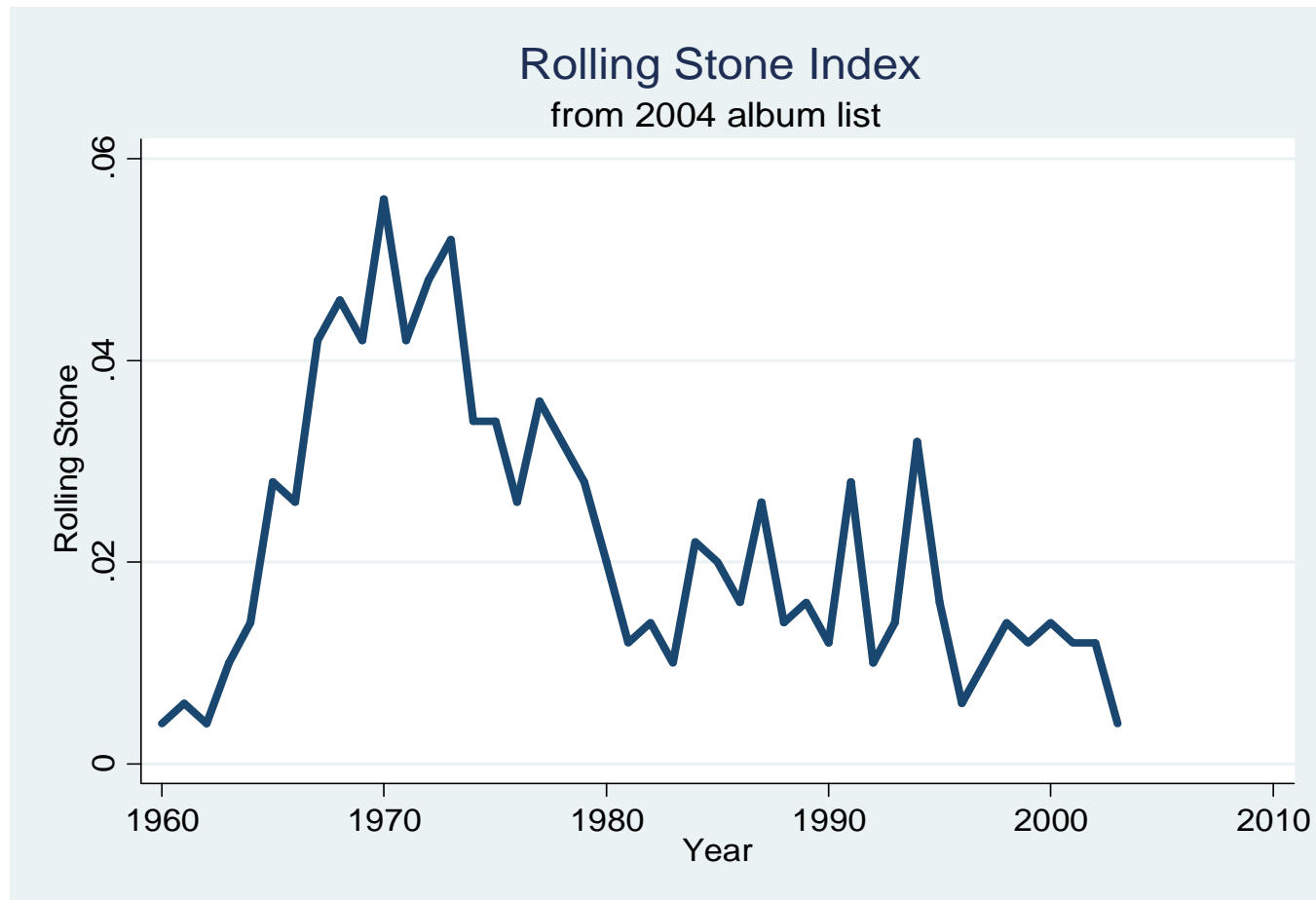
Index Availability
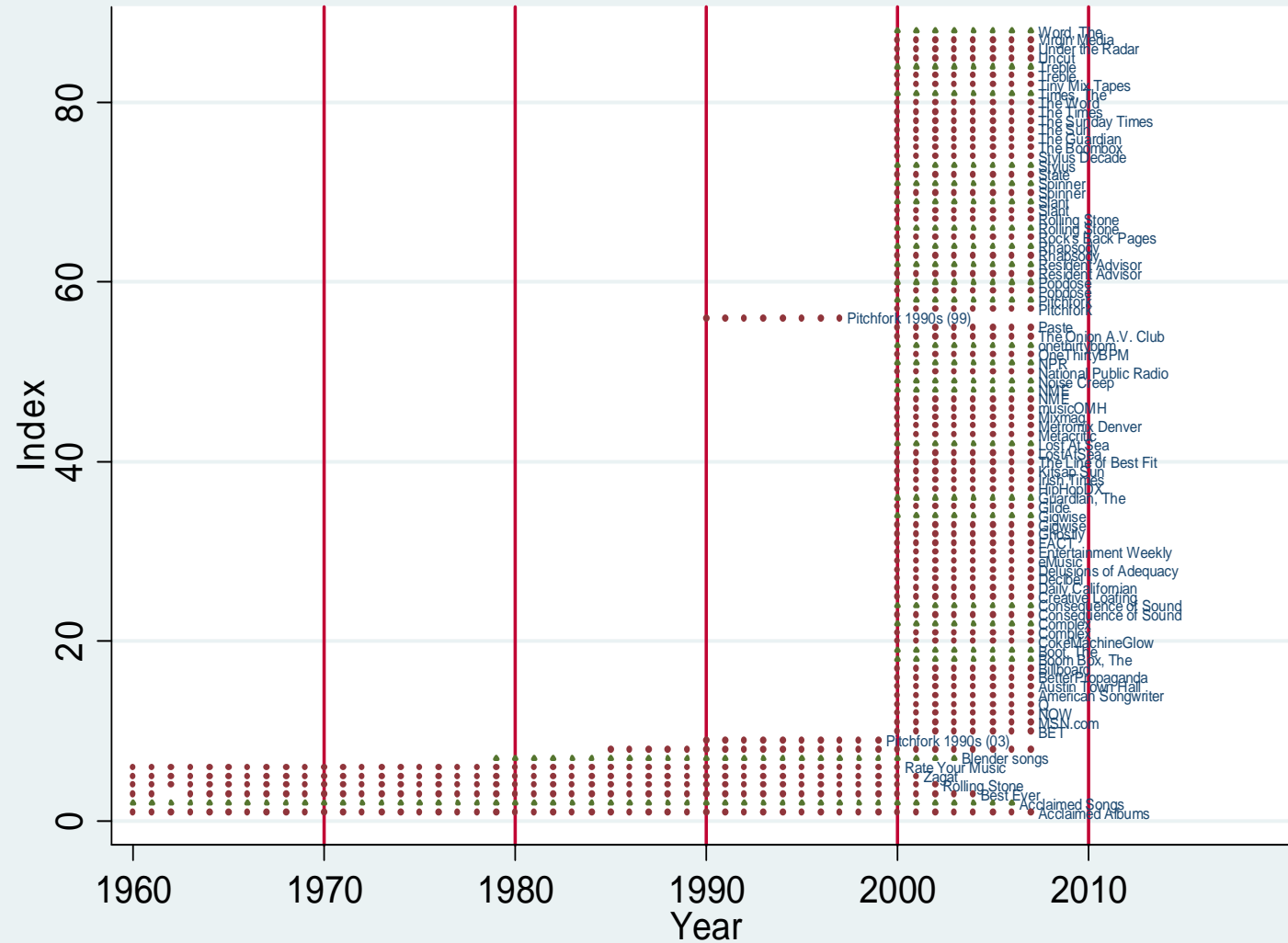
"Splice" together to create overall index, covering pre- and post-Napster era.

Data Validity

- Do indices pick up major eras?
  - Larkin (2007): "The 60s will remain, probably forever, the single most important decade for popular music."

- Do indices track each other?

- Are critical responses relevant to demand (and therefore economic welfare)?

Concordance of Long Term Indices
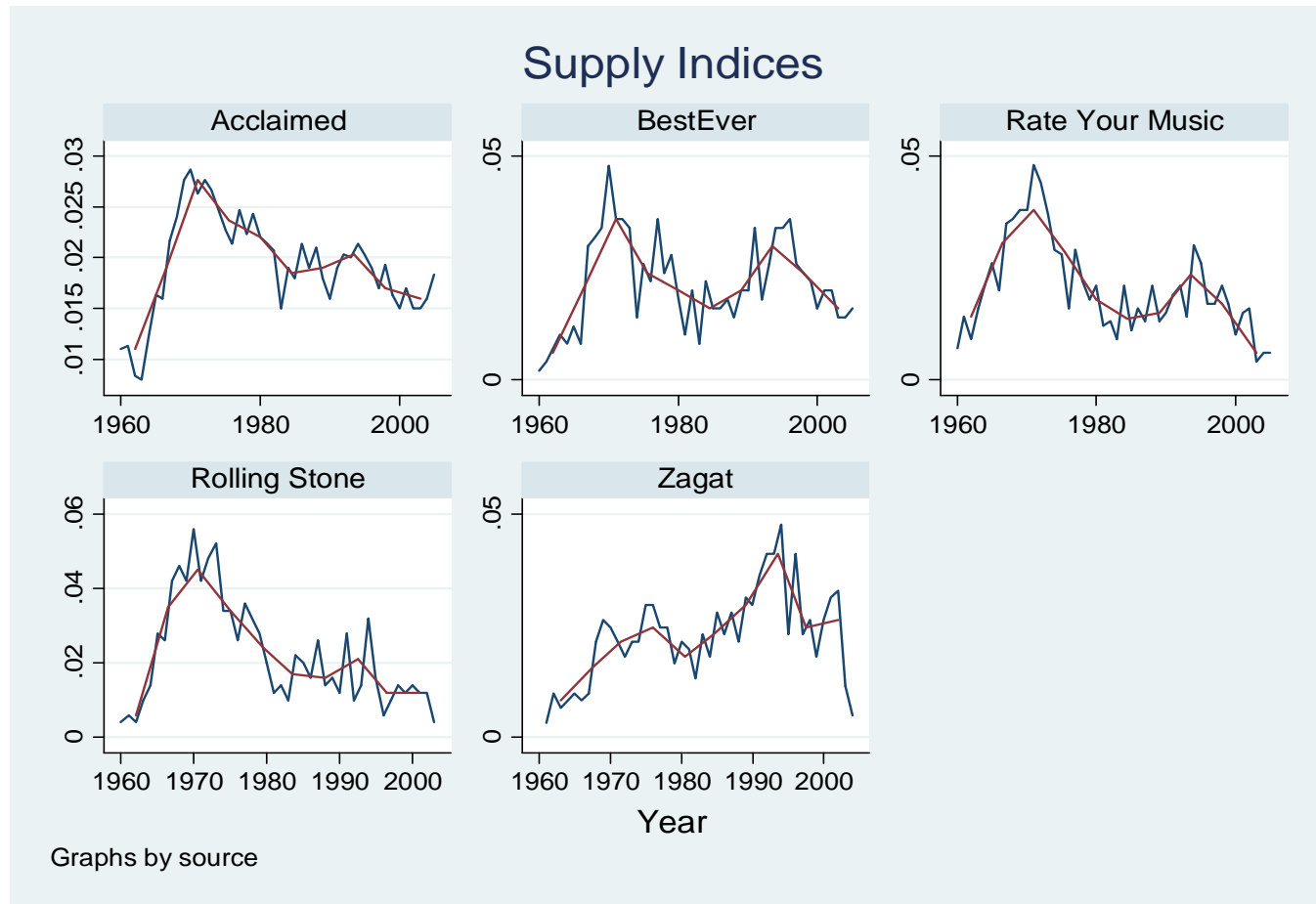
The Most Listed Albums of the 2000s, or *How Cool Are You?*

Lots of concordance

Significant sales; not economically irrelevant

rank	artist	album	number of lists	year	RIAA cert
1	Radiohead	Kid A	32	2000	P
2	Arcade Fire	Funeral	31	2004	
3	Strokes, The	Is This It	29	2001	G
4	OutKast	Stankonia	29	2000	3xP
5	Wilco	Yankee Hotel Foxtrot	28	2002	G
6	Jay-Z	The Blueprint	25	2001	2xP
7	Flaming Lips, The	Yoshimi Battles the Pink Robots	21	2002	G
8	LCD Soundsystem	Sound of Silver	20	2007	
9	West, Kanye	The College Dropout	20	2004	2xP
10	Stevens, Sufjan	Illinois	20	2005	
11	TV on the Radio	Return to Cookie Mountain	19	2006	
12	Modest Mouse	The Moon & Antarctica	19	2000	G
13	White Stripes, The	Elephant	19	2003	P
14	Daft Punk	Discovery	19	2001	G
15	Interpol	Turn On the Bright Lights	18	2002	
16	Eminem	The Marshall Mathers LP	18	2000	9xP
17	Radiohead	In Rainbows	18	2007	G
18	Beck	Sea Change	17	2002	G
19	Bon Iver	For Emma, Forever Ago	17	2007	
20	Broken Social Scene	You Forgot It in People	16	2002	
21	Spoon	Kill the Moonlight	15	2002	
22	Knife, The	Silent Shout	15	2006	
23	White Stripes, The	White Blood Cells	15	2001	G
24	Animal Collective	Merriweather Post Pavillon	15	2009	
25	Madvillain	Madvillainy	15	2004	

A Few Albums Appear on Many Rankings
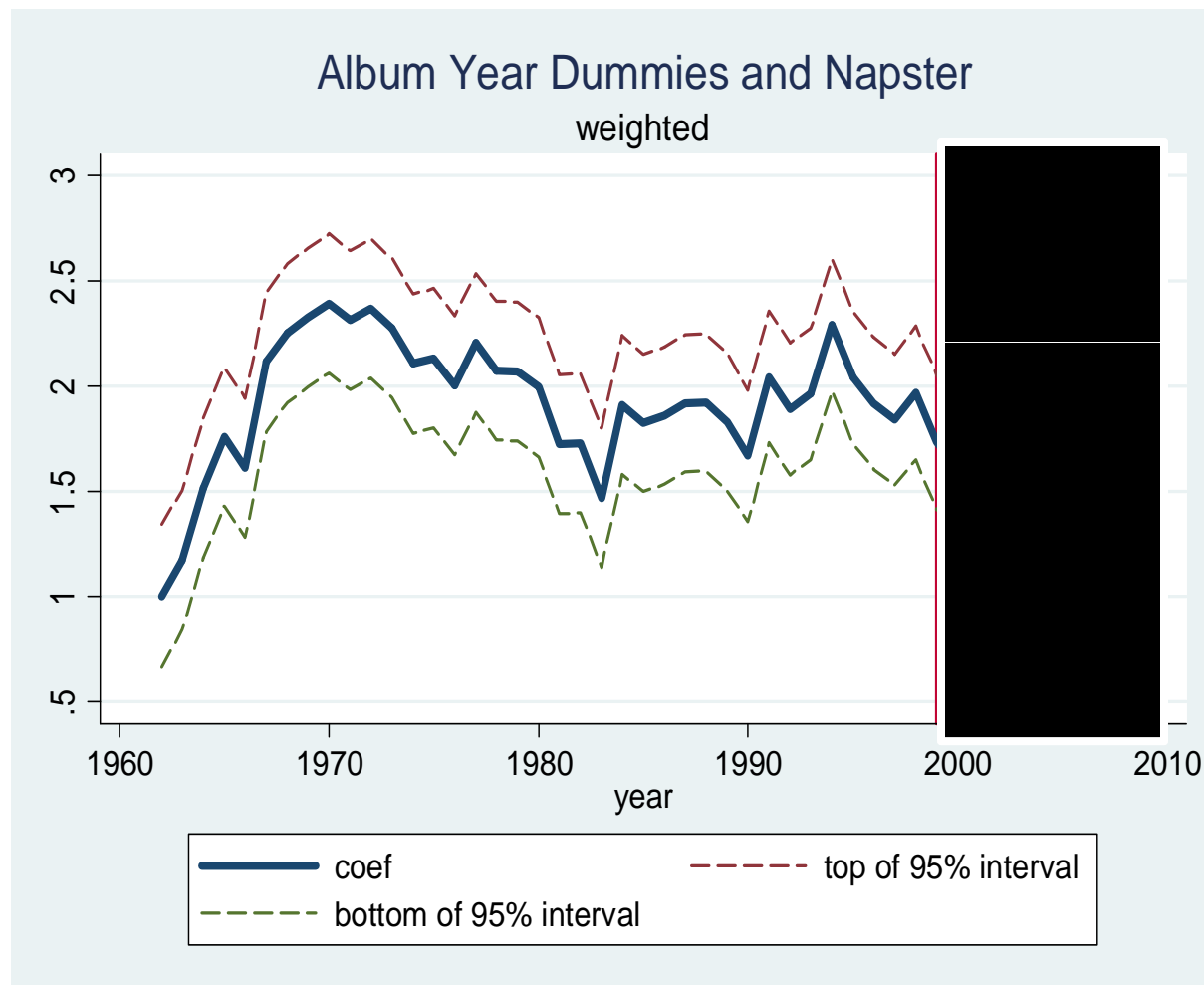## 37 North American Rankings (2390 entries)
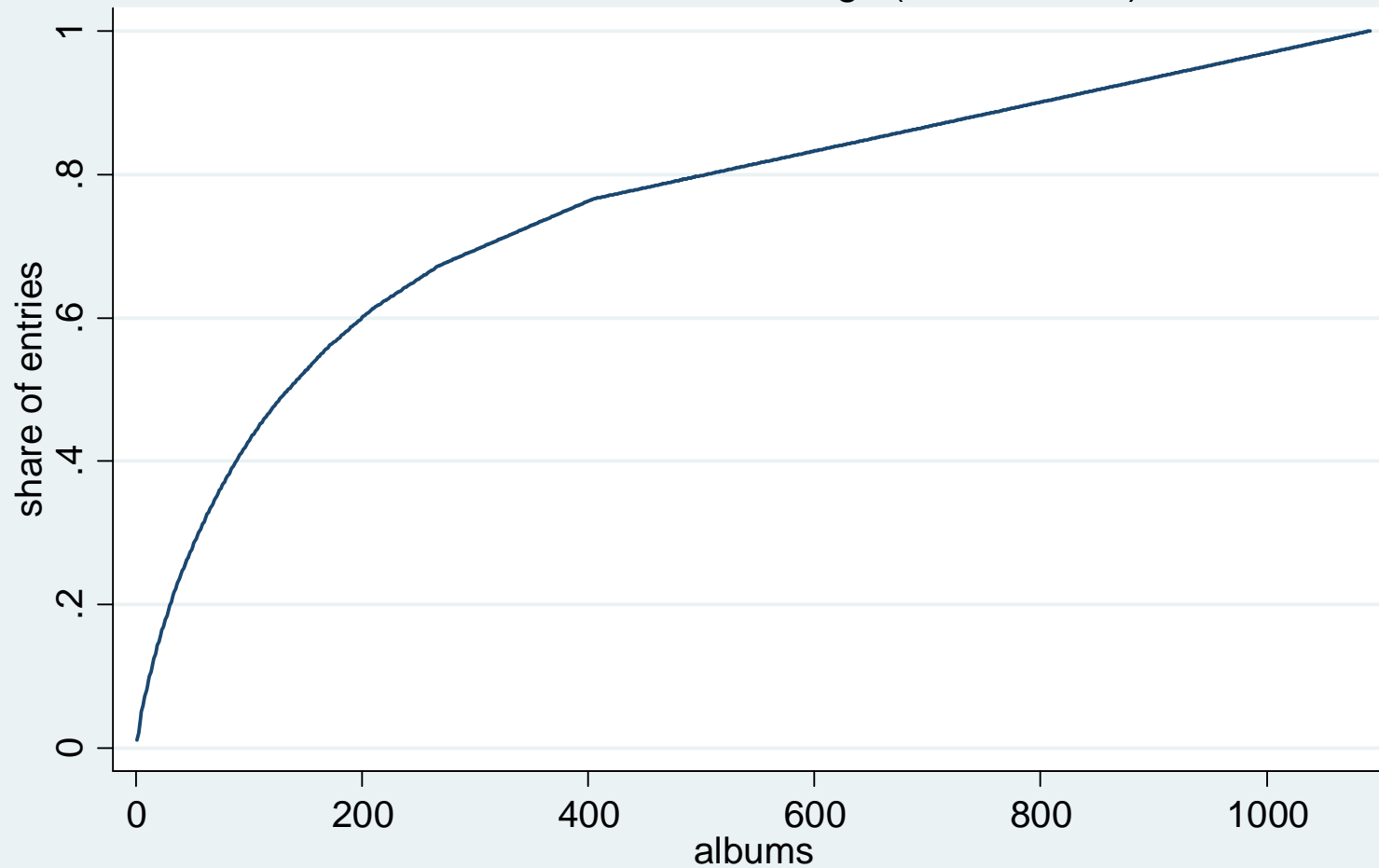
The lists are highly correlated: 250 albums account for two thirds of the 2390 "best of" list entries
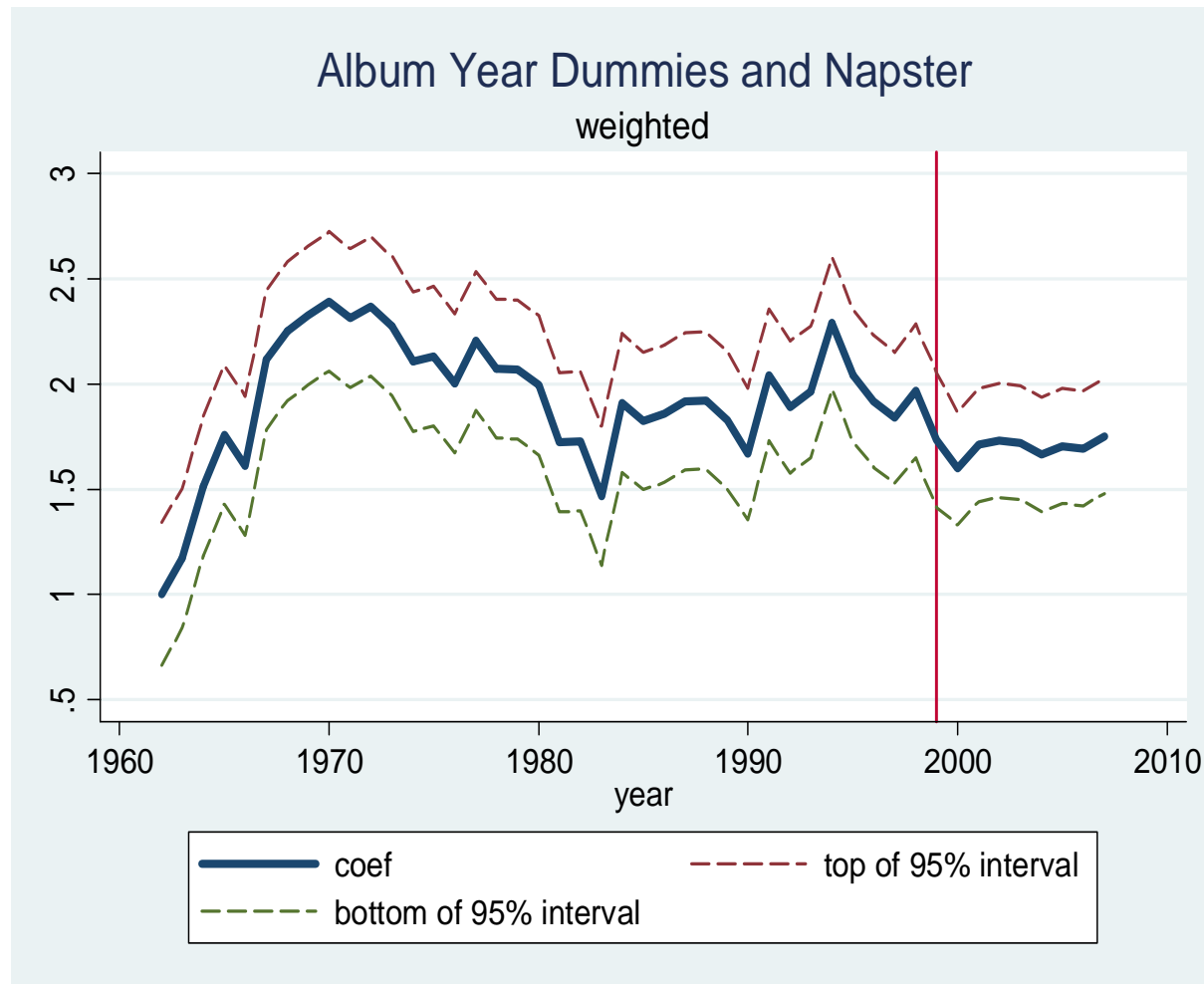
Splice Indices

$$\ln(y_{it}) = \mu_i + \theta_t + \epsilon_{it}$$

- Plot θ's

And voila: Index of vintage quality

Album Year Dummies and Napster
weighted

And voila: Index of vintage quality

Album Year Dummies and Napster
weighted

Index is falling prior to Napster

Post-Napster constancy is, if anything, a relative increase

Approaches #2 and #3

- Measure of vintage quality based on service flow/consumer decision
  - Sales and airplay
- Idea: *if one vintage's music is better than another's, its superior quality should generate higher sales or greater airplay through time, after accounting for depreciation*

Data: Airplay

- (Describing data first makes empirical approach easier to exposit)

- For 2004-2008, observe the annual share of aired songs originally released in each prior year.

- From Mediaguide
  - 2000, over 1 million spins/year
  - Lots of data: smooth, precise

Direct evidence of depreciation

Vintage Distribution for Songs Aired in 2008

Vintage Distribution for Songs Aired in 2008
1960 to 1990
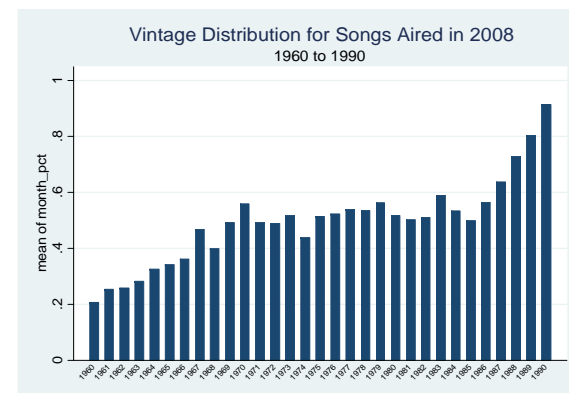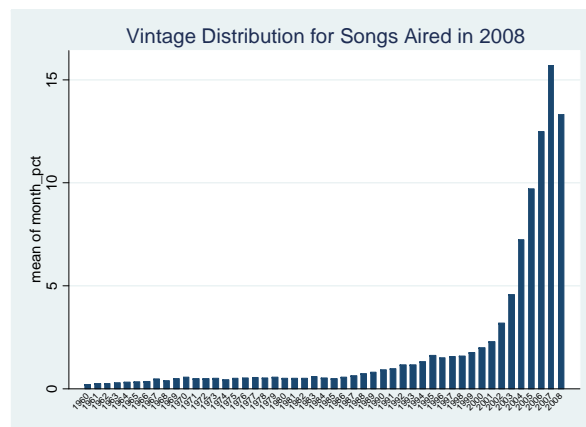
Data: Sales

- Coarse sales data: RIAA certifications
  - See when sales pass thresholds, know when released
    - Gold=0.5 million, Platinum=1 million, multi-platinum=X million.
    - 17,935 album certs; 4428 single certs
    - Covers most of music sales
    - Tracks known patterns
    - Sparse < 1970

Certification-Based Shipments
millions of physical albums
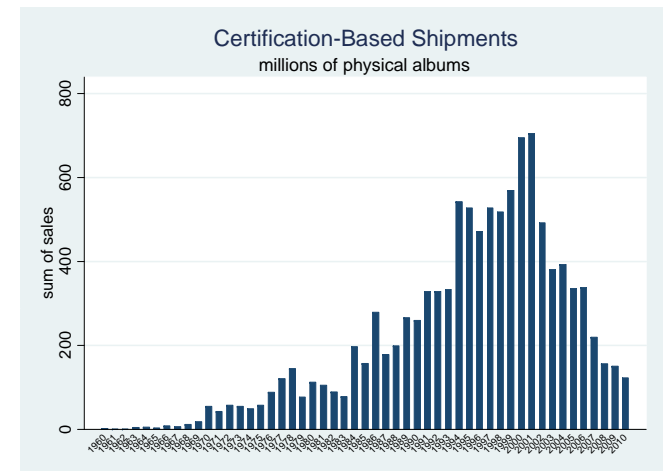
Depreciation in Sales Data

- Older albums sell less

- Sales data are noisier

Distribution of Sales by Time since Release

Distribution of 2000 Sales by Release Year

Distribution of 2000 Sales over Distant Release Years
1970 to 1989
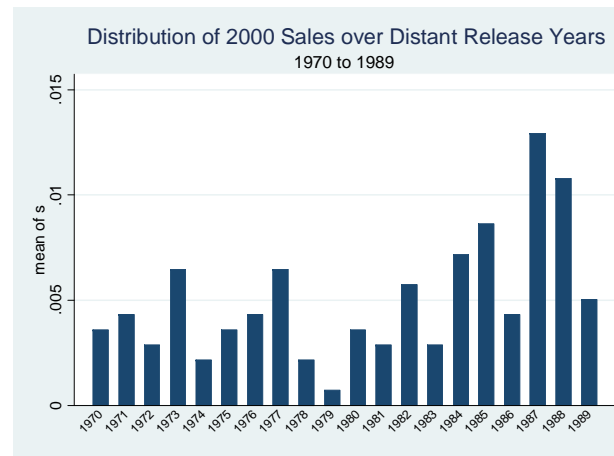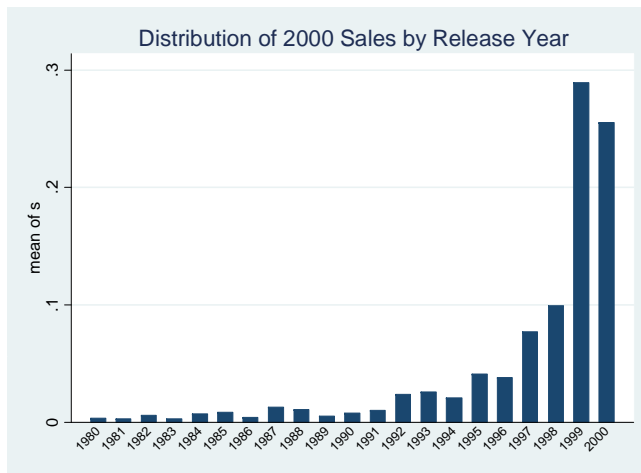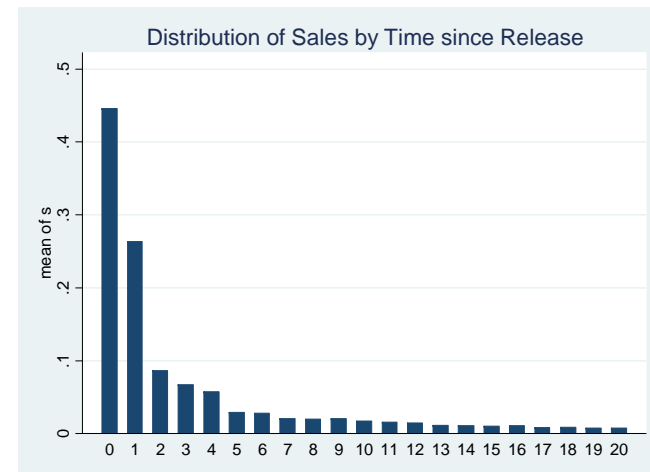
Empirical Approach

- <u>Goal</u>: derive an index of the importance of the music from each vintage
- Define $s_{t,v}$ = share of vintage v music in the sales or airplay of music in period t.
  - Observe s for V vintages and T years
- For a given year t, s varies across vintages for two reasons
  - Depreciation
  - Variation in vintage quality
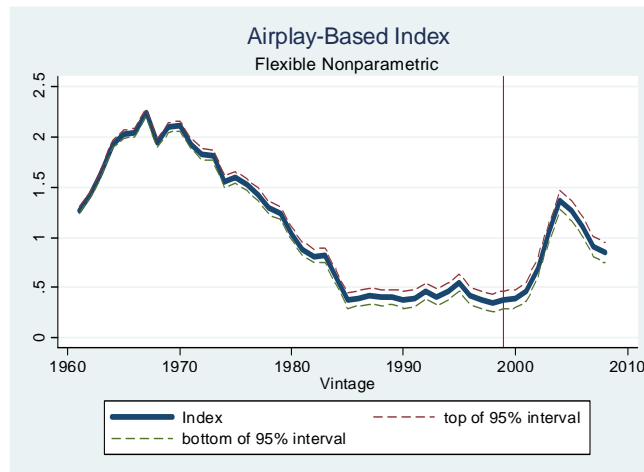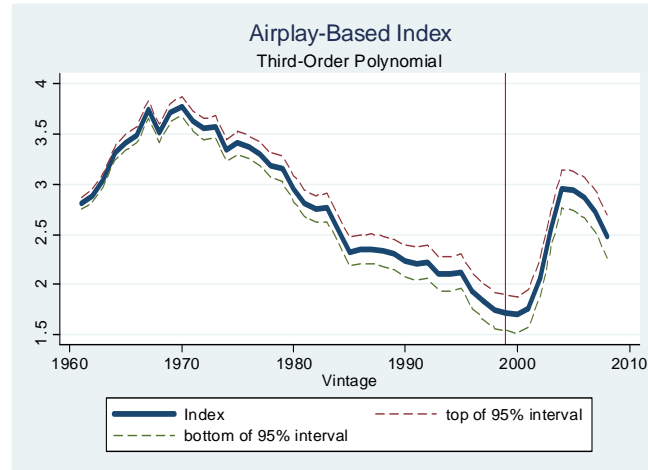
Regression approach description

- Regress $\ln(s_{t,v})$ on age dummies, vintage dummies.
  - Allow flexible depreciation pattern
- Then: vintage dummies are index of vintage quality

Random utility interpretation

- Consumers choose between vintages
  - No outside good (literally in airplay)
    - in sales, don't believe music is falling in utility relative to outside good
- $U_{t,v} = f(t-v) + \mu_v + \epsilon_{t,v}$ with extreme-value error
  - $\ln(s_{t,v}) - \ln(s_{t,0}) = f(t-v) + \mu_v.$
  - Normalization: $\ln(s_{t,0}) = $ constant
- Regression of $\ln(s_{t,v})$ on age and vintage dummies recovers the evolution of "mean utility" with vintage

Regression Estimates of Depreciation (vintage dummies not shown)

	(1) airplay	(2) airplay	(3) certifications	(4) certifications
Age	-0.1897	-0.1557	-0.2515	-0.4049
	(0.0311)**	(0.0616)*	(0.0119)**	(0.0224)**
Age squared	0.0020	-0.0001	0.0036	0.0140
	(0.0006)**	(0.0026)	(0.0004)**	(0.0017)**
Age cubed		0.0000		-0.0002
		(0.0000)		(0.0000)**
Constant	2.6590	2.6493	-3.3120	1.5280
	(0.5323)**	(0.5381)**	(0.5955)**	(1.1789)
Observations	235	235	868	868
R-squared	0.99	0.99	0.77	0.80

Notes: Dependent variable is the log vintage share in a year. All regressions include vintage fixed effects (coefficients not shown).
Robust standard errors in parentheses. * significant at 5% level; ** significant at 1% level.
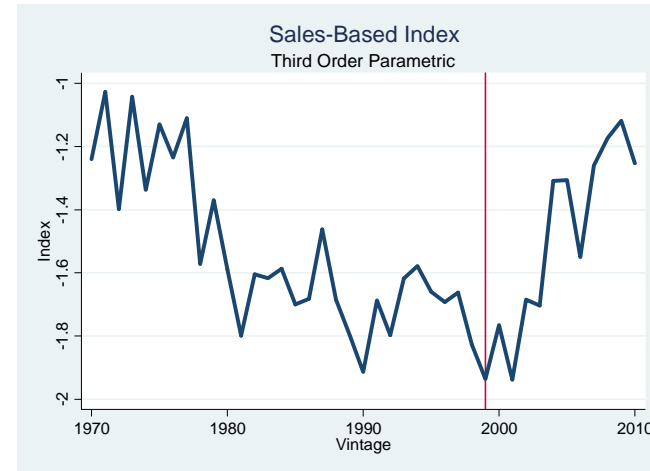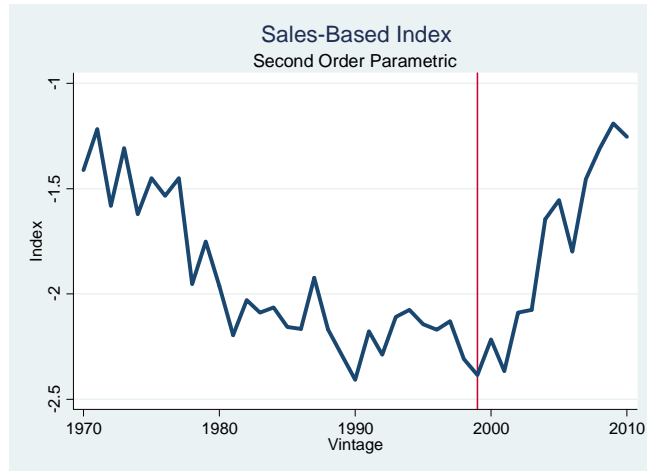
Flexible Depreciation Patterns
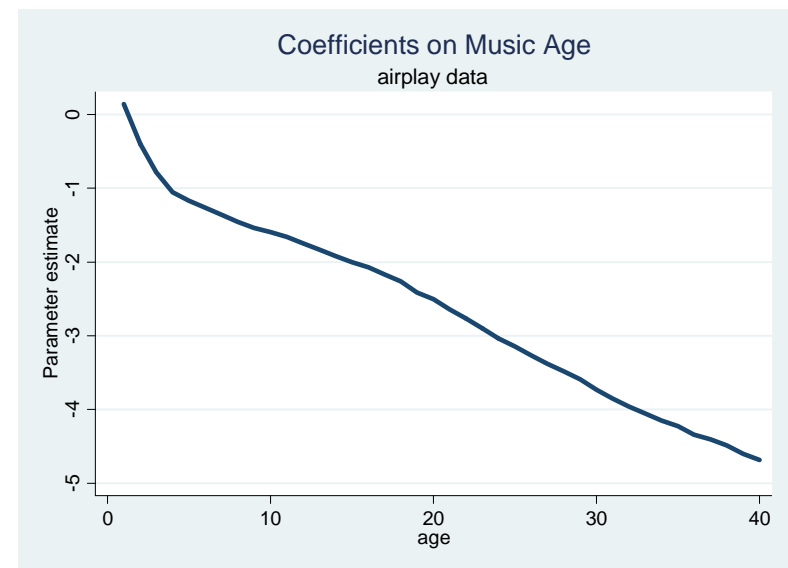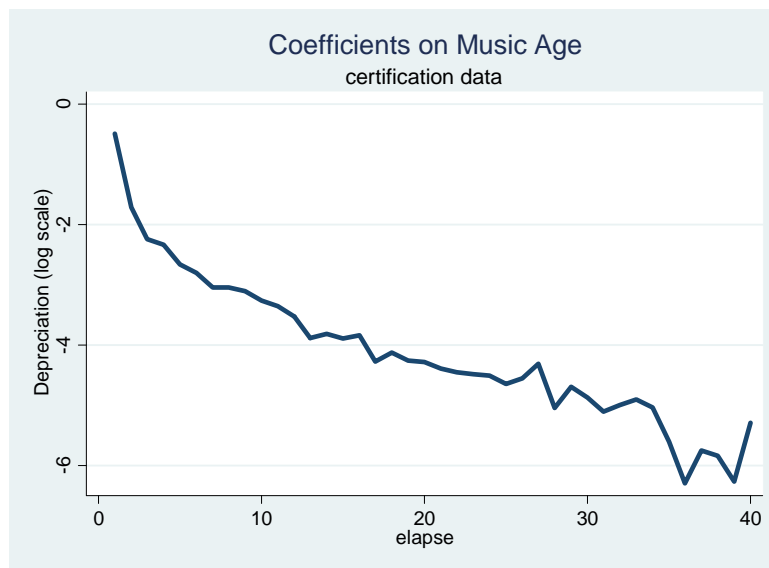
Airplay-Based Vintage Quality Index
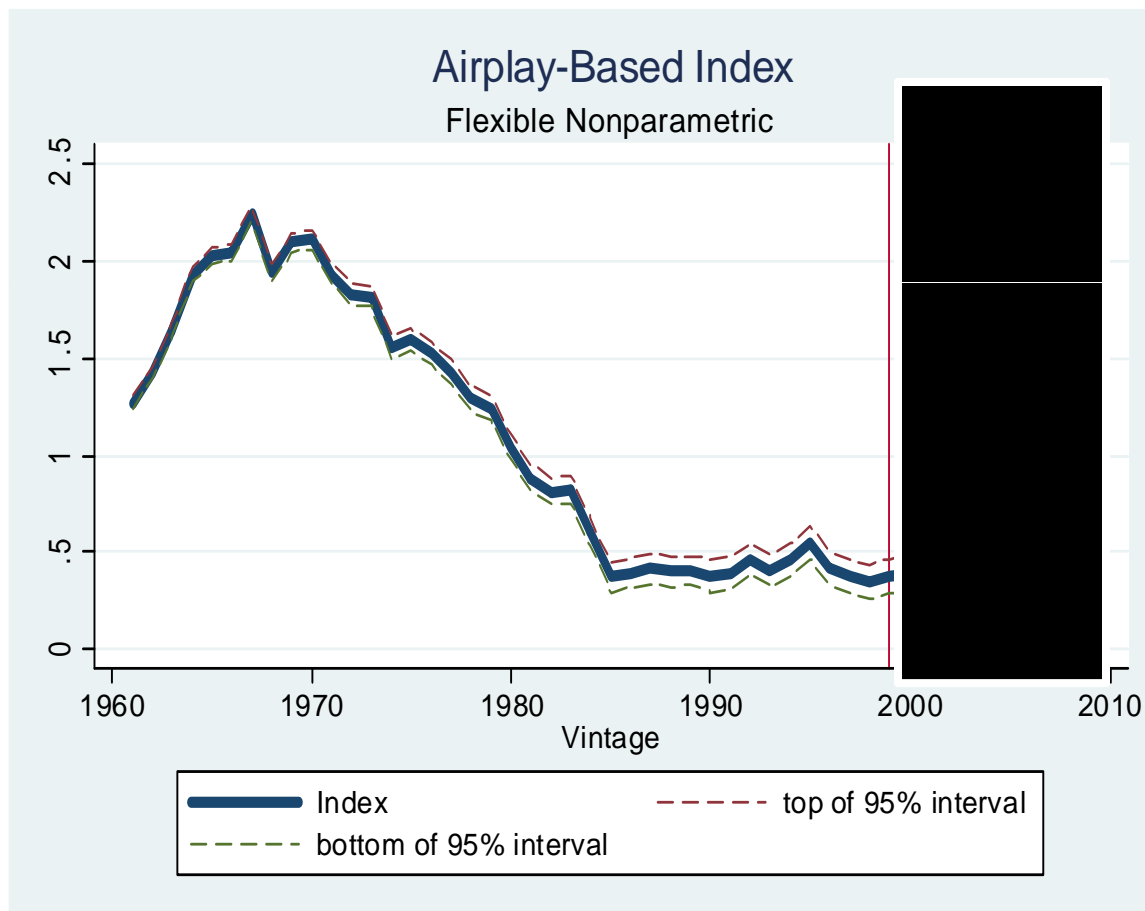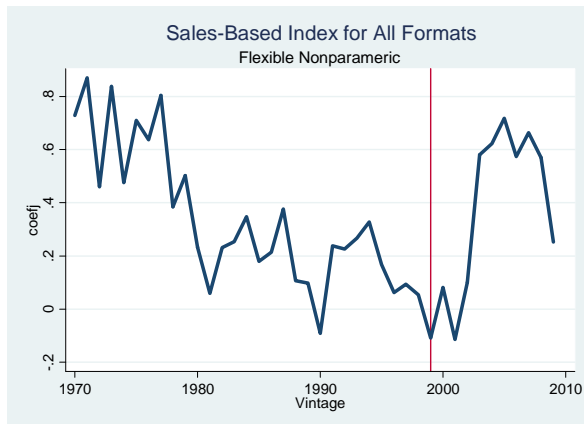
Ditto for Parametric Indices

Certification-Based Vintage Quality Index (albums)

Sales-Based Index
Second Order Parametric

Sales-Based Index
Third Order Parametric

Sales-Based Index
Flexible Nonparameric
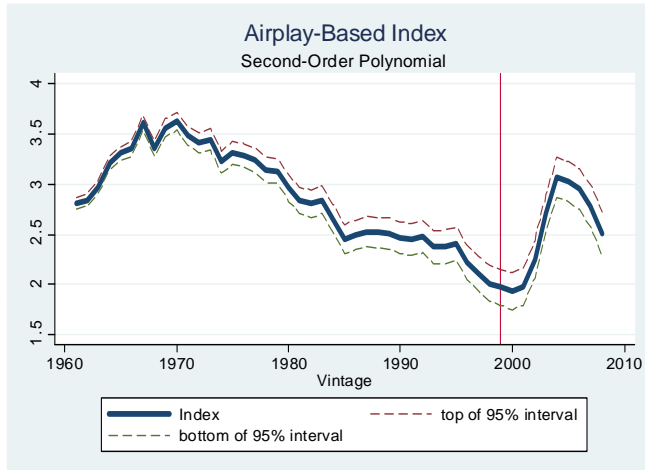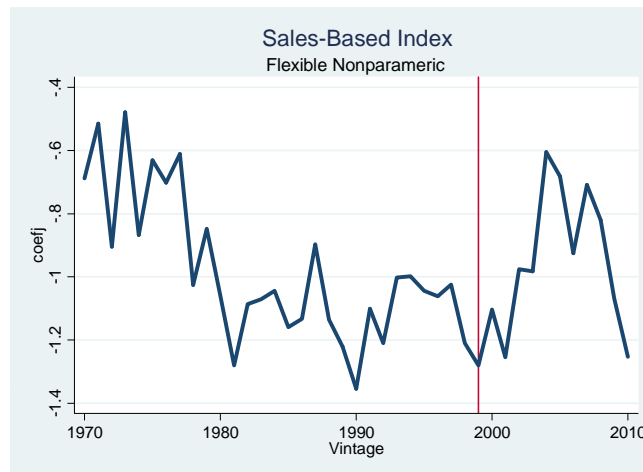
Noisier. But similar pattern.

Certification-Based Vintage Quality Index (all media)
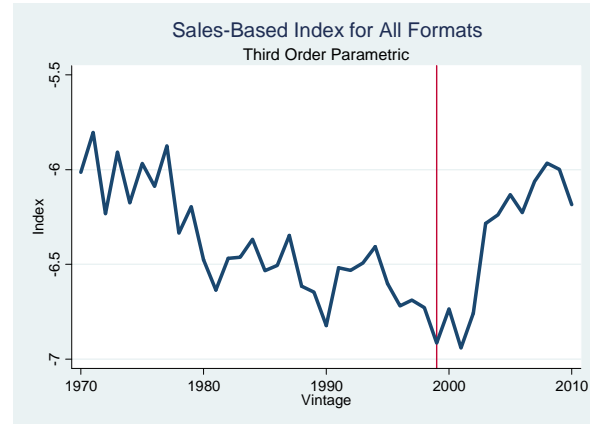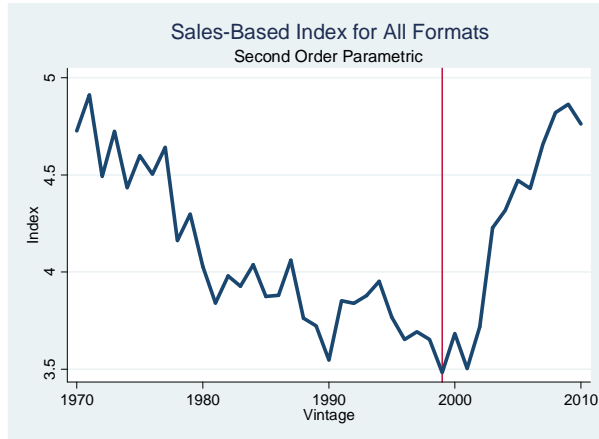
Noisier. But similar pattern.

Tests

- Following Napster, is vintage quality
  - Above or below previous level?
    - Relative to various starting points
  - Above or below previous trends?
    - Relative to various starting points

The Post-Napster Airplay-Based Sales Index Relative to Pre-Napster Levels and Trends

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Post-Napster Level	-0.2231 (0.2340)	0.4875 (0.3277)	0.4822 (0.2346)*	0.3790 (0.1126)**	0.0032 (0.1944)				
Level since 1995		-0.8151 (0.2814)**							
Level since 1990			-0.9484 (0.1873)**						
Level since 1980				-1.2359 (0.0899)**					
Level since 1970					-0.9806 (0.1944)**				
Post-Napster Trend						0.3223 (0.1350)*	0.2391 (0.0747)**	0.2239 (0.0393)**	0.2032 (0.0241)**
Trend since 1995						-0.2165 (0.0827)*			
Trend since 1990							-0.1170 (0.0301)**		
Trend since 1980								-0.0767 (0.0094)**	
Trend since 1980									-0.0595 (0.0043)**
Constant	2.8434 (0.1013)**	2.9479 (0.1007)**	3.0866 (0.0948)**	3.4772 (0.0644)**	3.5977 (0.1705)**	2.9097 (0.1005)**	2.9942 (0.0985)**	3.2408 (0.0822)**	3.5293 (0.0680)**
Observations	48	48	48	48	48	48	48	48	48
R-squared	0.02	0.17	0.38	0.81	0.37	0.13	0.25	0.60	0.81

# The Post-Napster Album Certification-Based Sales Index Relative to Pre-Napster Levels and Trends

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Post-Napster Level	0.0446	0.1806	0.1852	0.1752			
	(0.0807)	(0.1217)	(0.0937)	(0.0615)**			
Level since 1995		-0.1633					
		(0.1105)					
Level since 1990			-0.2109				
			(0.0831)*				
Level since 1980				-0.3918			
				(0.0635)**			
Post-Napster Trend					0.0564	0.0401	0.0464
					(0.0452)	(0.0259)	(0.0167)**
Trend since 1995					-0.0341		
					(0.0303)		
Trend since 1990						-0.0173	
						(0.0122)	
Trend since 1980							-0.0155
							(0.0052)**
Constant	-0.9879	-0.9607	-0.9176	-0.7267	-0.9668	-0.9519	-0.8745
	(0.0418)**	(0.0451)**	(0.0480)**	(0.0518)**	(0.0440)**	(0.0469)**	(0.0525)**
Observations	41	41	41	41	41	41	41
R-squared	0.01	0.06	0.15	0.50	0.04	0.06	0.20

The Post-Napster Album Certification-Based Sales Index Relative to Pre-Napster Levels and Trends (all recorded music products)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Post-Napster Level	0.0801	0.3515	0.2817	0.2383				
	(0.1008)	(0.1411)*	(0.1112)*	(0.0752)**				
Level since 1995		-0.3257						
		(0.1262)*						
Level since 1990			-0.3024					
			(0.0963)**					
Level since 1980				-0.4745				
				(0.0752)**				
Post-Napster Trend					0.1629	0.1099	0.0964	0.0938
					(0.0525)**	(0.0299)**	(0.0186)**	(0.0151)**
Trend since 1995					-0.0923			
					(0.0340)**			
Trend since 1990						-0.0422		
						(0.0133)**		
Trend since 1980							-0.0263	
							(0.0053)**	
Trend since 1970								-0.0233
								(0.0036)**
Constant	0.3248	0.3791	0.4256	0.6411	0.3630	0.3940	0.4987	0.6695
	(0.0504)**	(0.0515)**	(0.0556)**	(0.0614)**	(0.0480)**	(0.0502)**	(0.0531)**	(0.0651)**
Observations	40	40	40	40	40	40	40	40
R-squared	0.02	0.17	0.22	0.53	0.22	0.27	0.44	0.56

Bottom line

- No evidence that vintage quality has declined

- Some evidence that it has increased

- Hard to know what it might otherwise have been

- Puzzle: why do high quality products continue to be produced despite collapse in effective copyright protection?

Discussion
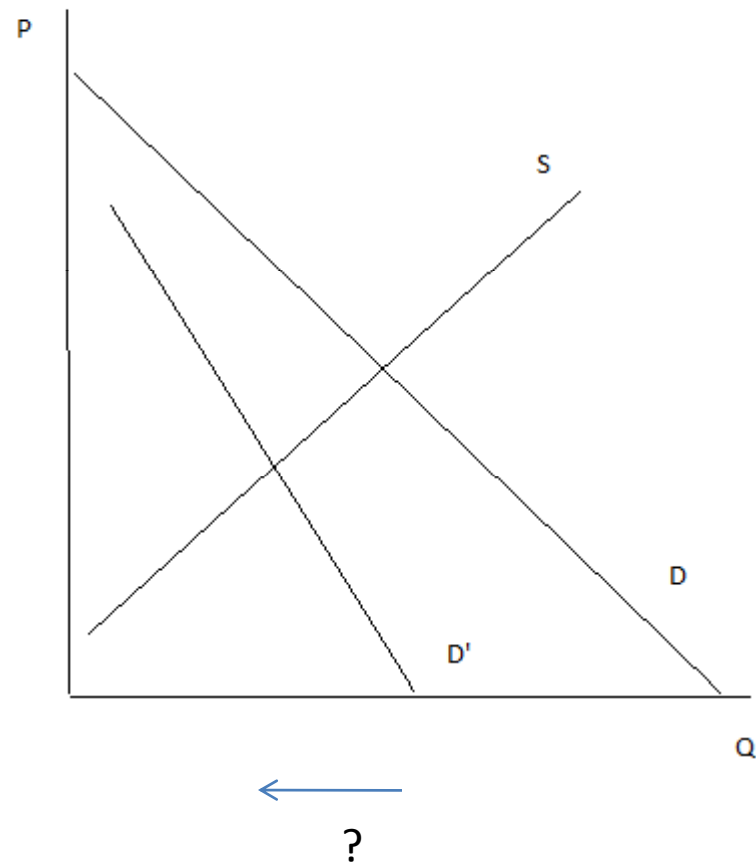
File sharing reduced demand, but the quantity of new works seems not to have decline. How?

Cost Reduction
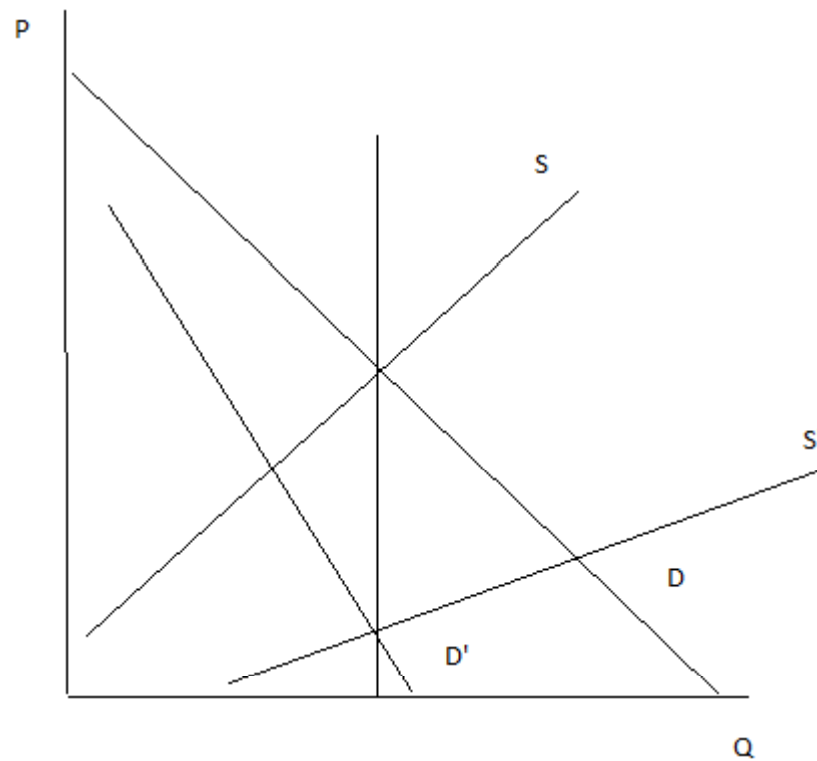
Changes on Supply Side

- Costs of <u>creation</u>, <u>promotion</u>, and <u>distribution</u> have all fallen
- Creation
  - Succession of cost-reductions
  - Reel-to-reel tape (≈1948), DAT (≈1985), Pro-Tools & Garageband (since Napster)
- Promotion/musical discovery
  - Old days: Radio and payola
    - $60 million payments to radio in 1985, when recording industry profits were $200 million
    - $150,000 to promote hit single

Promotion, Now

- "Infinite Dial" study

Changing media for musical discovery

Internet Dominates How Younger Consumers Discover Music

"Among Internet, television, radio and newspapers, which do you turn to first to learn about new music?"

Media	P 12-34	P 12+
Internet	52%	31%
Radio	32%	39%
Television	10%	12%
Newspapers	2%	3%

- P 12-34
- P 12+

edison research

ARBITRON

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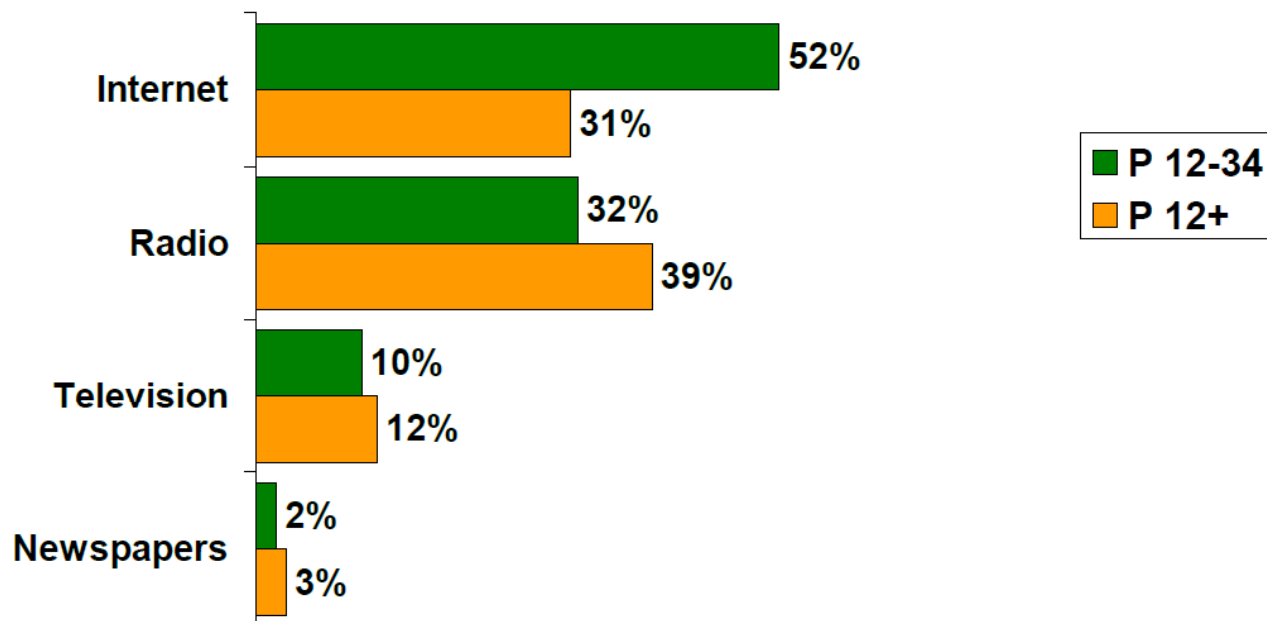
Which outlets?

Pandora Is the Clear Leader in Top-of-Mind Awareness Among Internet-Only Audio Providers
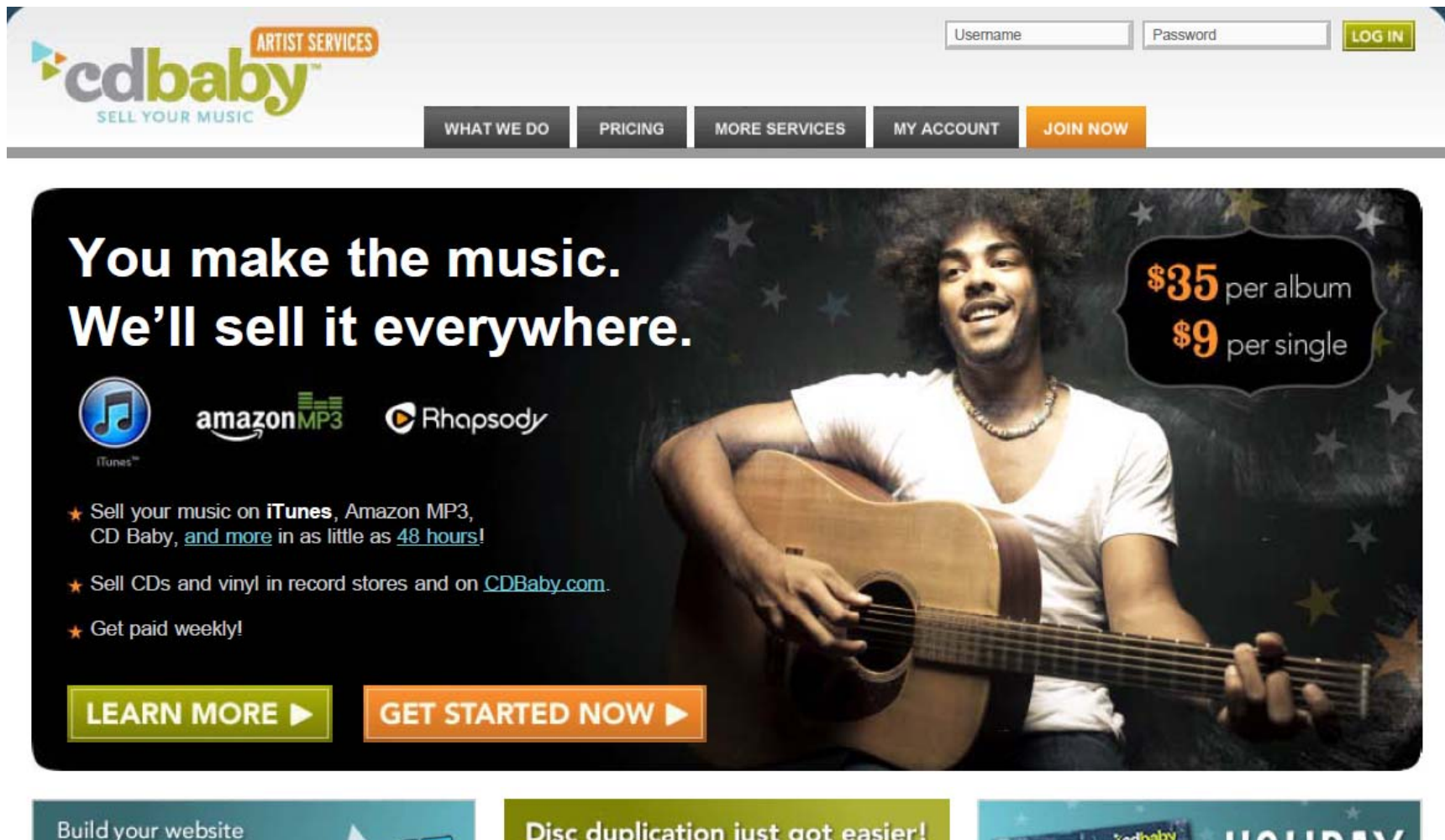
% Naming Internet-Only Audio Provider on Unaided Basis

28%

9%

6%

4%

Last.fm | AOL Radio | Yahoo Music | Pandora
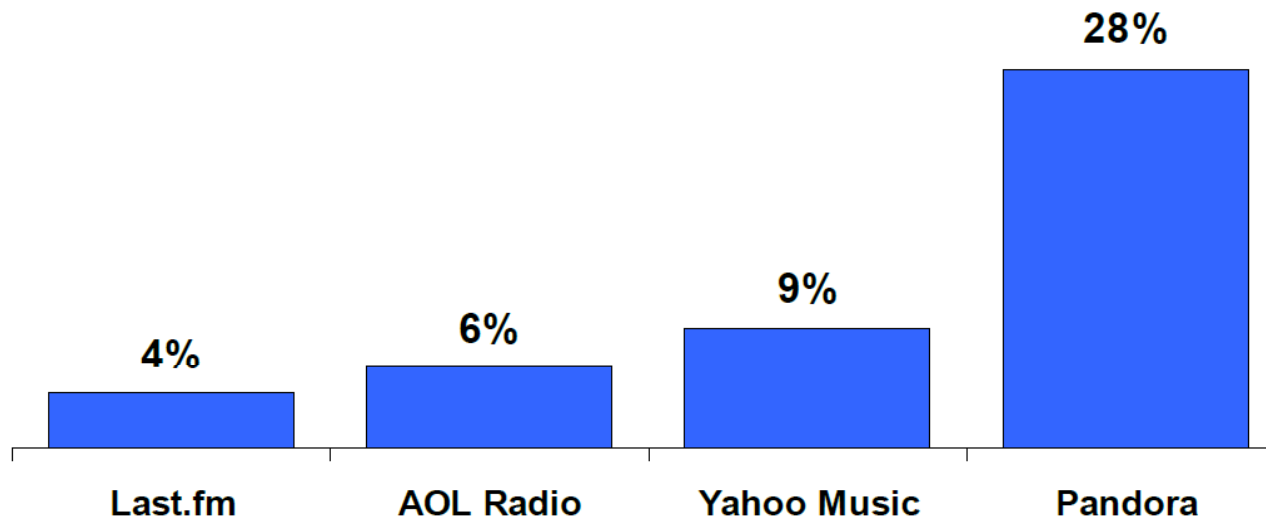
Distribution has changed too

- Old days: physical product, trucks, billing
- Now, can get song available at iTunes Music Stores for $10 (or less)
  - CDBaby, TuneCore, etc.

Entry barrier: change back from $10

Indies Filling Void?

- Leeds (2005) - independent labels appear to have lower costs, allowing them to subsist on smaller sales:

  – "Unlike the majors, independent labels typically do not allocate money to producing slick videos or marketing songs to radio stations. An established independent …can turn a profit after selling roughly 25,000 copies of an album; success on a major label release sometimes doesn't kick in until sales of half a million."

Label Examples

- Majors:

- Indies (selected artists):
  - 4AD (Pixies, National)
  - SST (Husker Du)
  - Matador (Pavement, Interpol)
  - Merge (Arcade Fire, Spoon)

Indie Role by Decade

Independent Release Share among Pitchfork Top 100
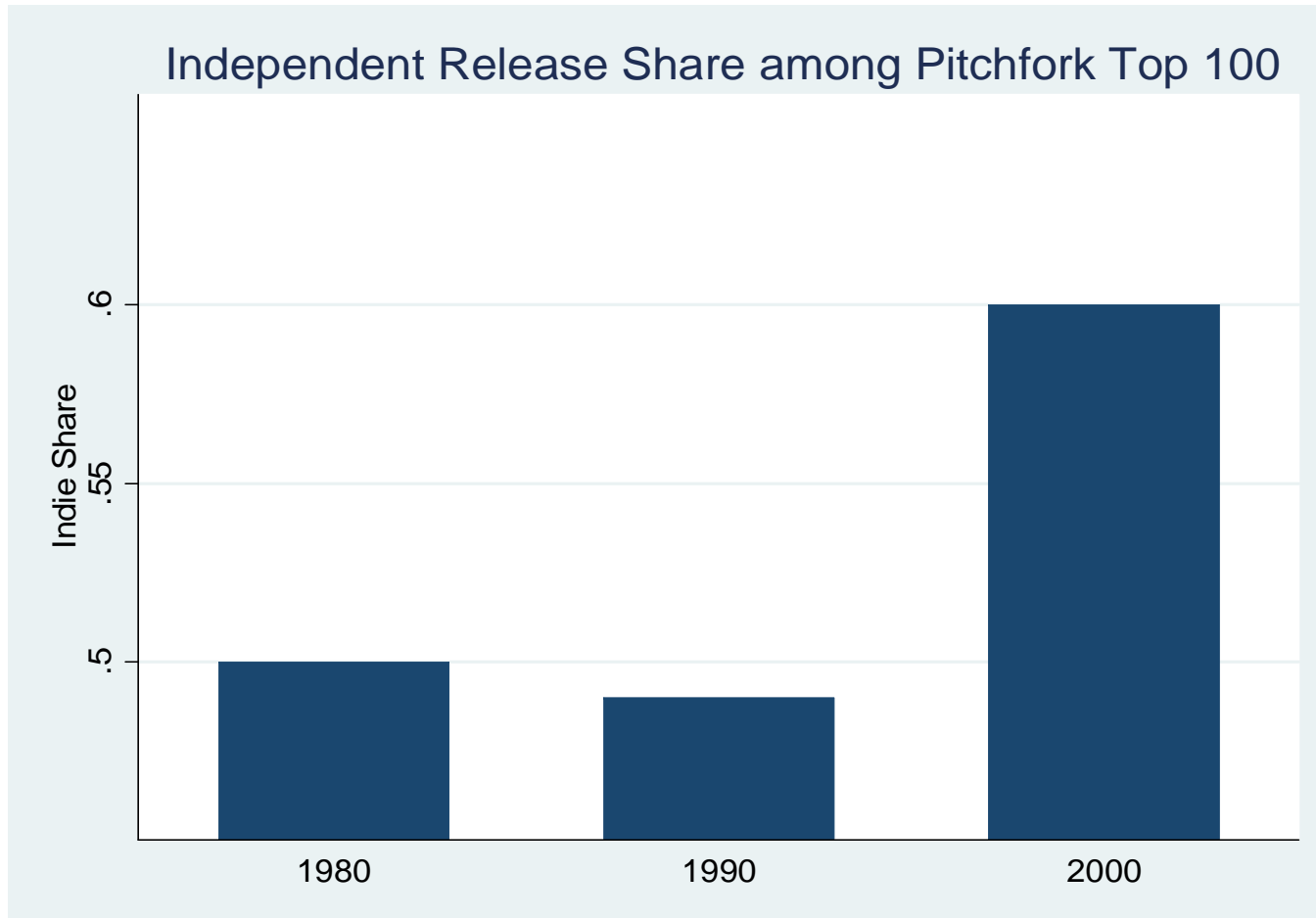
Difference between the 2000s and the previous two decades is significant at the 5 percent level in a one-sided test (p-val =0.04).

Also true among top sellers

Indie Albums among Billboard 200
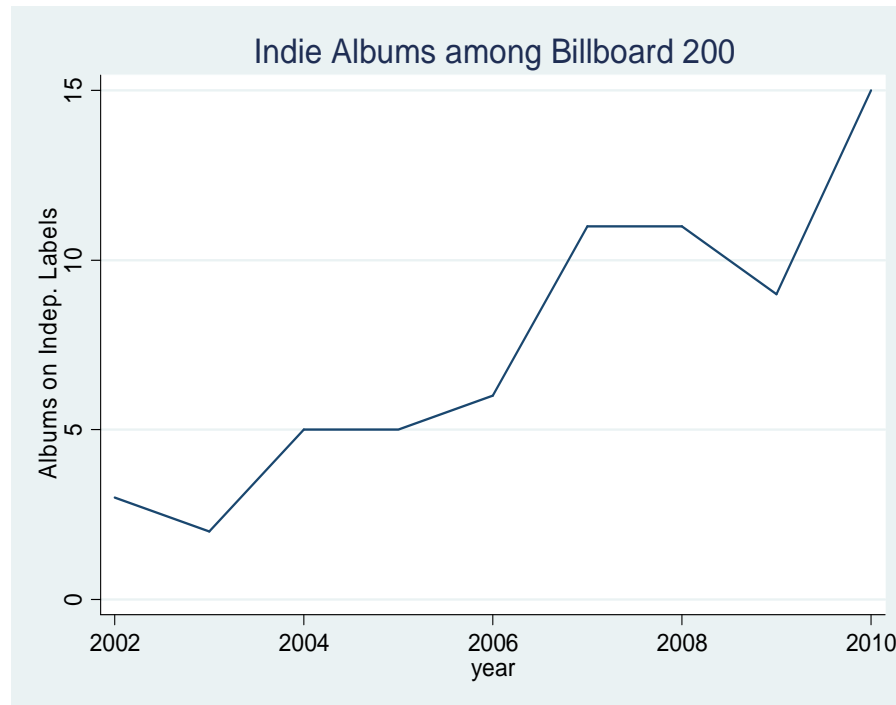
Changed Rewards for Artists

- More readily available music stimulates demand for live performance
    - Shapiro and Varian (1999), Connolly and Krueger (2006), Mortimer, Nosko, and Sorenson (2010)
- Potentially why artists don't go back to law school

Conclusions

- New data for documenting effects on supply following Napster based on behavior vs critics

- No reduction – *and possibly an increase* - in consequential new products <u>despite reduction in demand</u>

- Reduced costs, changed industrial organization (majors vs indies)

Conclusions, cont'd

- Far from clear we need stronger IP protection here
- Caveats:
  - Not clear what relevance results have for other kinds of works (e.g. movies are still pretty expensive to make)
  - Don't know the counter-factual
- Next step: look under the hood of recording industry

Backup slides

Controlling for Depreciation

- Compare different vintages' market shares in years that occur equally long after the respective releases

- Define $s(k,v)=s_{t,v|t-v=k}$ = <u>share of vintage v music among airplay or sales k years later ($t=v+k$)</u>
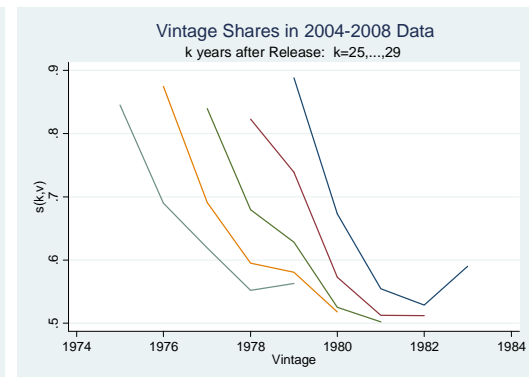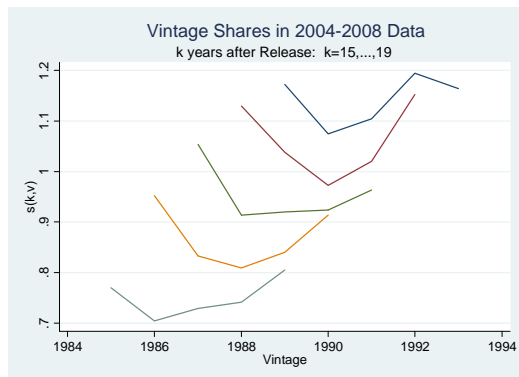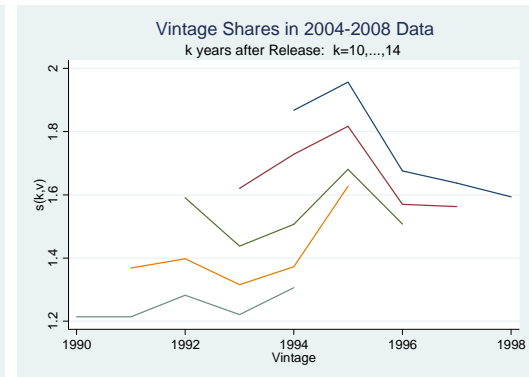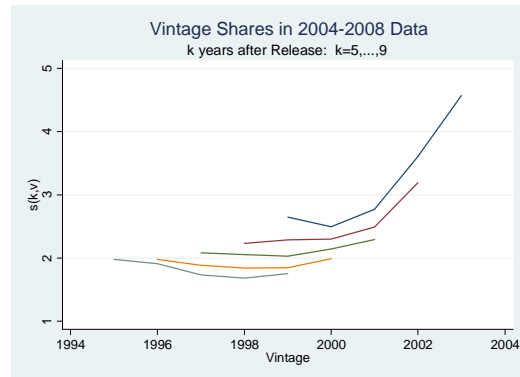
With airplay data, t=2004,…,2008; v=1960,..t,
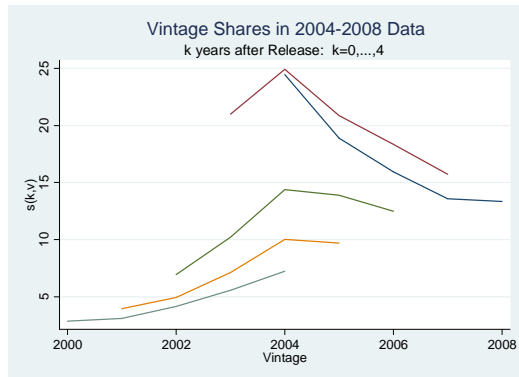
- So
  - s(0,v) can be calculated for v=2004,…,2008.
    - showing evolution of vintage quality, 04-08
- Music that's one year old in 2004 was released in 2003, so…
  - s(1,v) can be calculated for v=2003,…,2007
    - showing evolution of vintage quality 03-07
  - s(k,v) can be calculated for 2004-k,…,2008-k

Series show vintages' shares 2004-2008, when they are k-years old

Vintage Shares in 2004-2008 Data
k years after Release: k=0,...,4

Current music share falls 2004-2008

1-yr-old music's share rises 2003-4, falls to 08

2-year-old music's share rises 2002-4, then falls

3-year-old music's share rises 2001-4, then falls
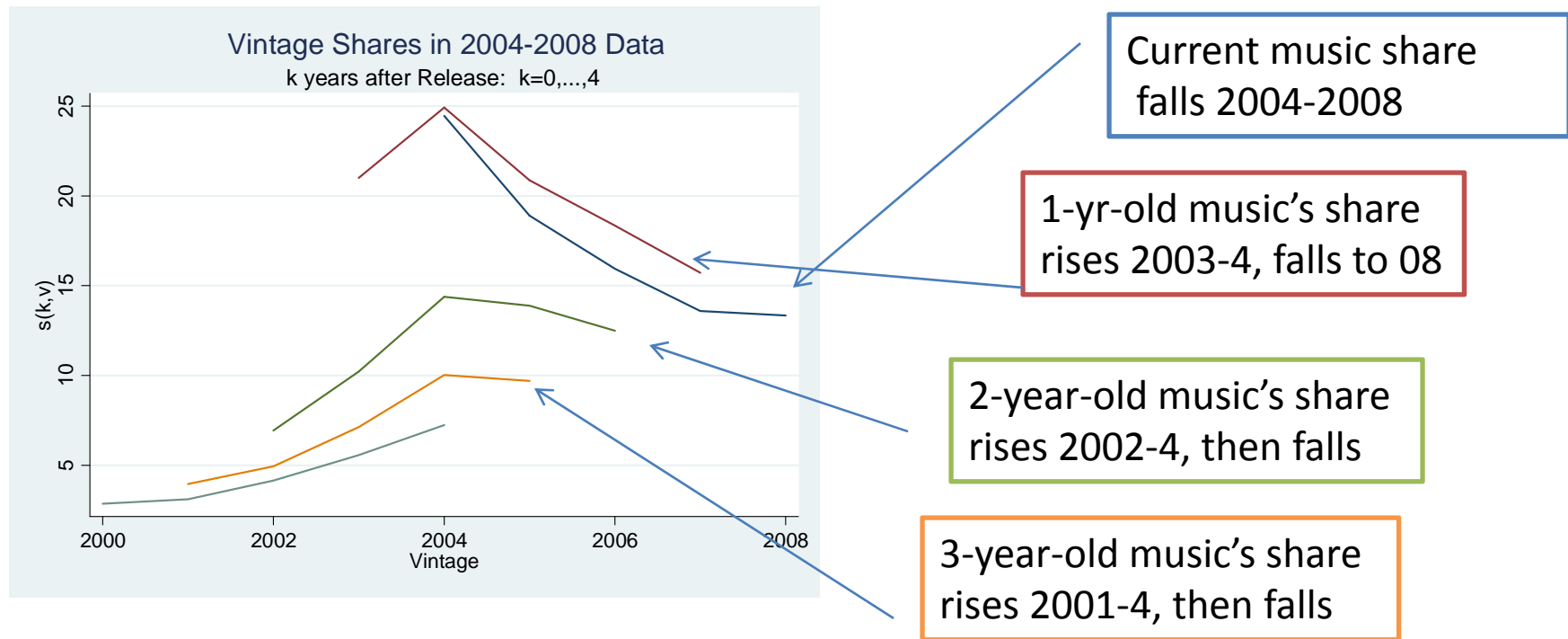
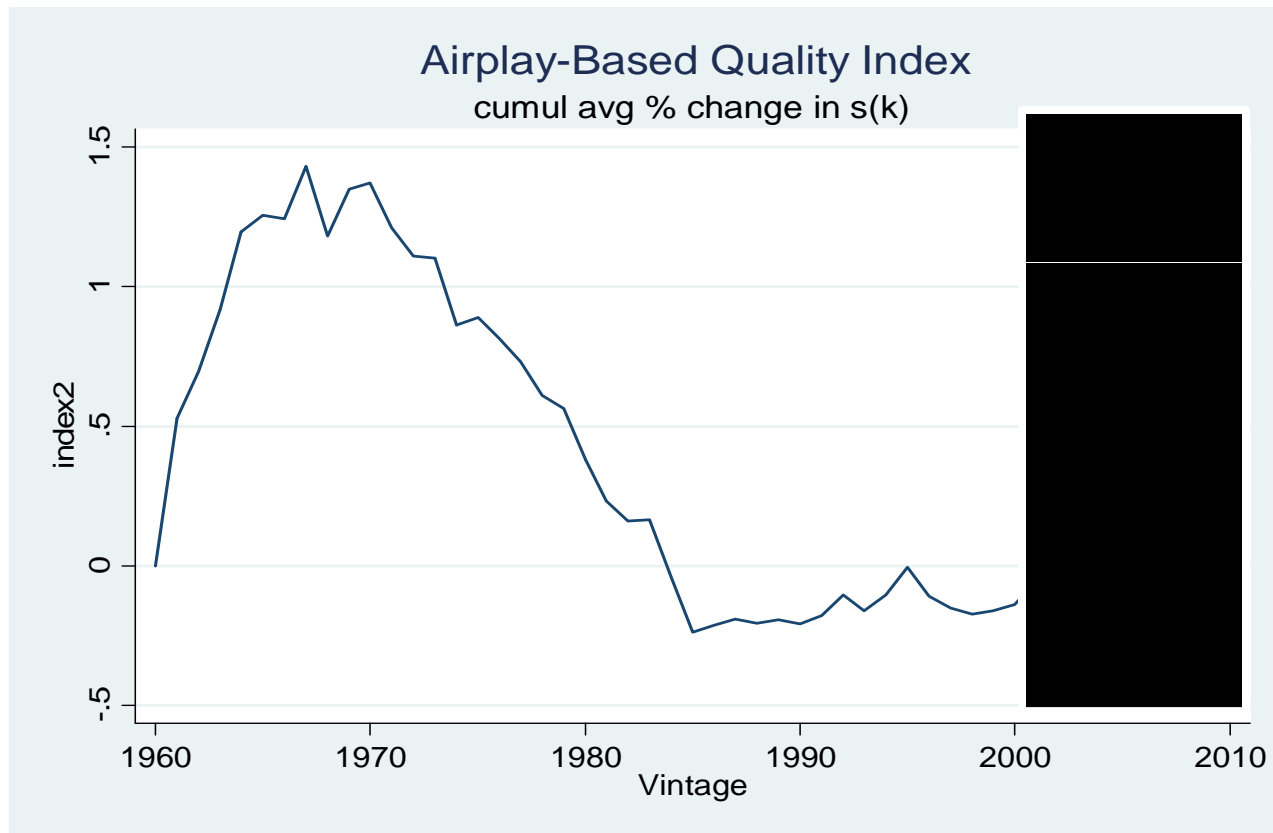For any vintage, we have 4 estimates of % change in vintage quality
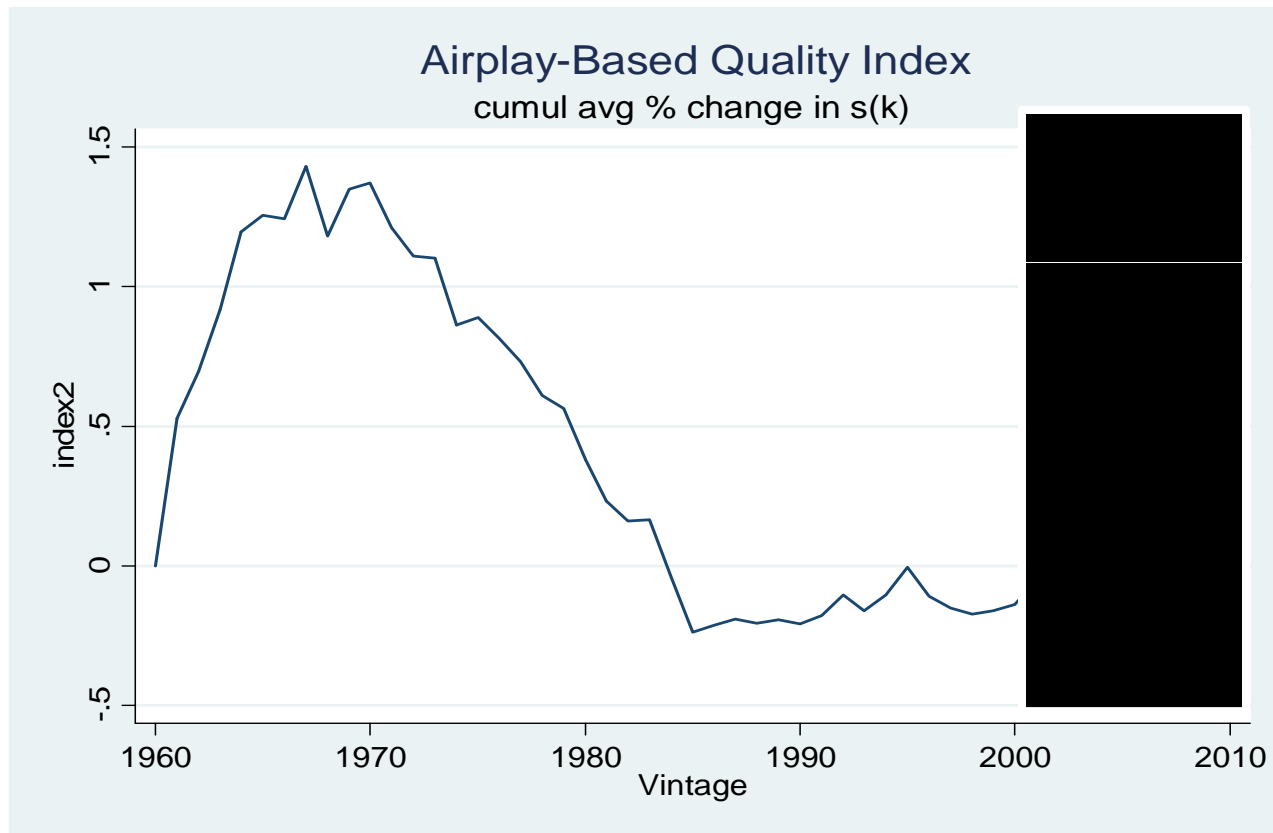
Concordance back to 1960
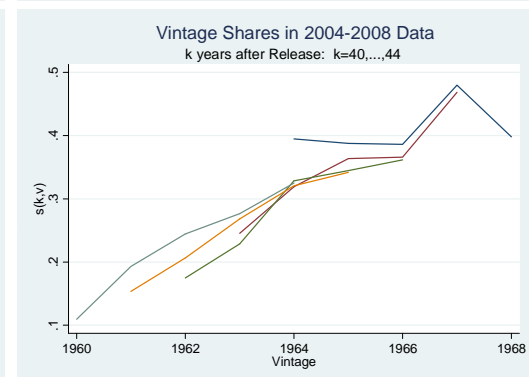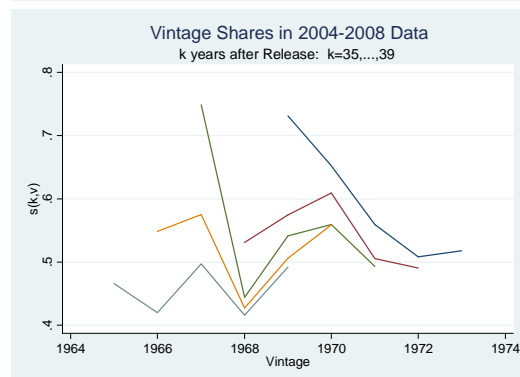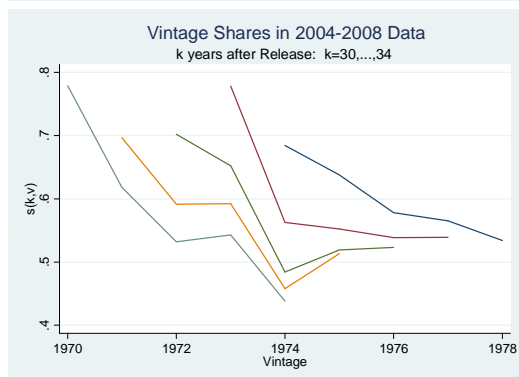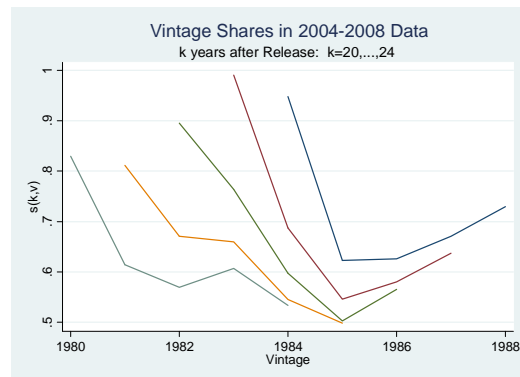
Vintage quality index

- For each vintage between 1960 and 2004, there are five separate series $s(k,v)$ covering the vintage
  - 4 percent changes
- Calculate the average percent change for each vintage, accumulate them

Resulting Airplay Index

Any guesses?

Next steps: understanding the increase in quality

- Perhaps cheaper "experimentation" allows us to find better music (Tervio, 2009)
- Have been collecting data on volume of new releases from independent and major labels
- Indie share among successful
- Average career age among indie and major releases
- Aggressive experimentation by indies vs majors