No Meaningful Impact?
The Effect of Pre-Release Movie Piracy on Box-Office Sales

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Expert Address
Room 613, United Centre, Admiralty, HK

1

Outline

- Understanding Movie Piracy
- Piracy: Industry and Academic Perspectives
- Promotional potential for piracy?
- Conclusions

2

The Problem of Movie Piracy

3

Pre-Release Piracy:
Studio's Response

- Pirated copies of Lions Gate Entertainment Corp's horror sequel "Hostel: Part II" appeared a month before theatrical release on 8 June 2008
- In response, Lion Gate's President Tom Ortenberg said "It's distressing and disappointing, but it will have no meaningful impact on the box office."

4

Pre-Release Piracy:
Director's Response

"However, piracy has become worse than ever now, and a stolen workprint (with unfinished music, no sound effects, and no VFX) leaked out on line before the release, and is really hurting us, especially internationally. Piracy will be the death of the film industry, as it killed the music industry, and while it makes a smaller dent in huge movies like Spider-man 3, it really hurts films like mine, which have far less of an advertising and production budget. Not only that, critics have actually been REVIEWING the film based off the pirated copy, which is inexcusable. Some of these critics I have actually known for a few years, and while I wouldn't dignify them by mentioning them by name, I know who they are, as do the studios, and other filmmakers, and they will no longer have any access to any of my films"
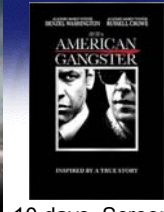
Director Eli Roth (MySpace blog)
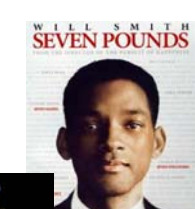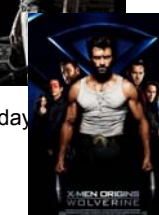
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The Problem
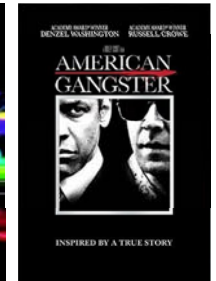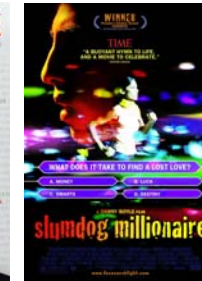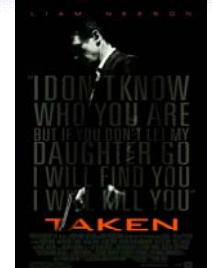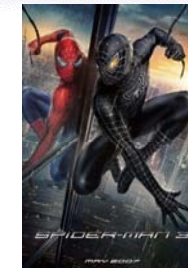
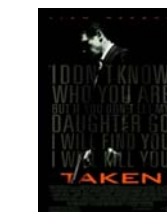

The Problem

9 days, Cam   5 days, Telesync   3 months, Workprint   2 days, Cam   10 days, Screener

27 days   1 month, S...   ...days, Screener

6 month, Screener   1 month, Workprint

1 month, Screener
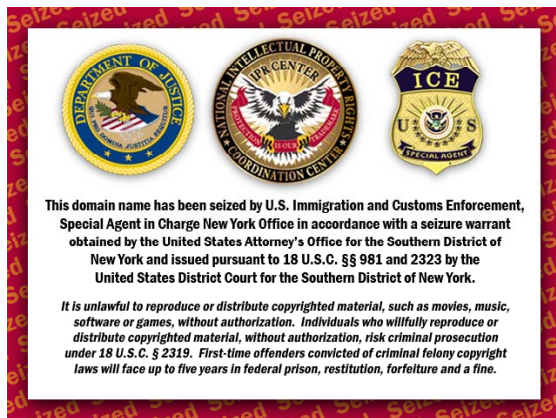
Movie Piracy will Increase

- The initial emphasis has been on music piracy
  - Small download sizes amenable to download via dialup
- However these factors mean movie piracy will grow:
  - Increasing network bandwidth
  - Continuing growth in Internet penetration of consumer markets
  - Merger of media, television, and personal computing

Proposed Solutions

- *Security:* Metal detectors, Camcording felony law
- *Technological*: Watermarking
- *Managerial*: Limit promotional distribution
- *Legal*: Lawsuits against movie pirates
- *Policy*: IP Policy Tsar

US Government shut down nine sites on 30June2010

This domain name has been seized by U.S. Immigration and Customs Enforcement, Special Agent in Charge New York Office in accordance with a seizure warrant obtained by the United States Attorney's Office for the Southern District of New York and issued pursuant to 18 U.S.C. §§ 981 and 2323 by the United States District Court for the Southern District of New York.

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The Questions

How much does pre-release movie piracy harm box office revenue?

How does this vary over movie lifecycle?

How does this vary by piracy quality?

Piracy

Industry and Academic Perspectives

# Industry Arguments against Piracy

- Companies now have to "compete" against pirated copies of their own IP
- Will produce less and reduce investments
- Loss of tax revenues and jobs

BSA/IDC Economic Impact Study (2005) found 10% decrease in worldwide piracy rate over 4 years would
- *Add 1.5 million new jobs, $64b in taxes and $400b in economic growth*
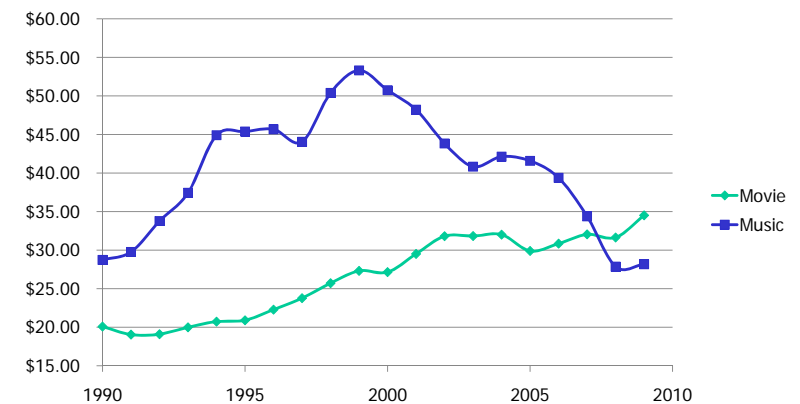- *Yield larger benefit for countries with higher piracy rates*
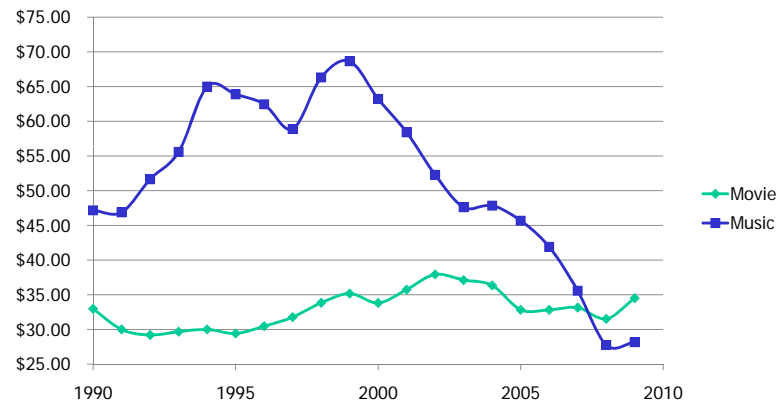

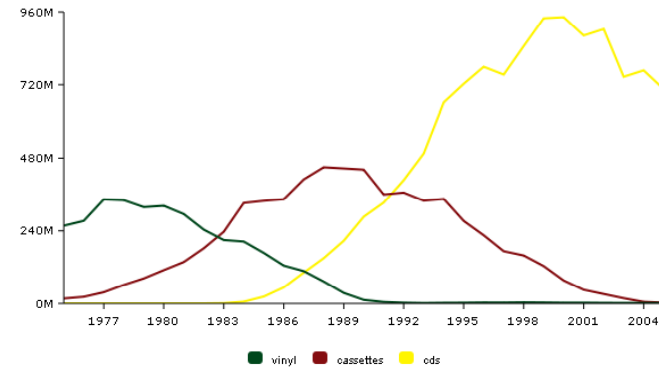# Movie versus Music Sales

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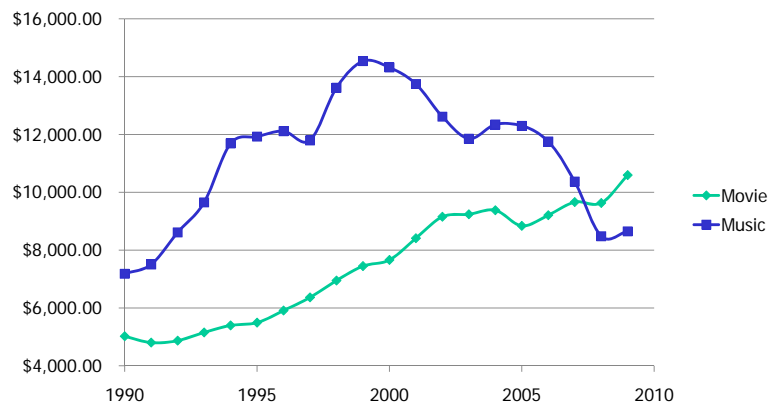
Movie versus Music Sales: Per Capita

Movie versus Music Sales: Per Capita and Real $

Product Lifecycle for Music

U.S. Music Sales, 1975-2005: Vinyl, cassettes, and CDs

vinyl   cassettes   cds

Literature: Effects of Piracy

- Impact of Piracy on Music Demand
  - Oberholzer and Strumpf 2007, Liebowitz 2007, Peitz and Waelbroeck 2004, Hui and Png 2003, Zentner 2006, Rob and Waldfogel 2006, ...
- Impact of Piracy on Video Demand
  - Piracy reduces demand for DVDs (Rob and Waldfogel 2007) and theatrical revenue (Danaher and Waldfogel 2008)
  - No impact on catalog DVD sales (Smith and Telang 2009)
  - Digital distribution substitute for piracy (Danaher et. al. 2009)
  - Piracy hurts "bad" movies (Chellappa and Shivendu 2005)
- Impact of Piracy on Software Demand
  - Pirates may subsequently purchase (Chellappa et al. 2006)

Literature: Modeling Movie Box Office

- What drives box office success?
  - Script (Eliashberg et al. 2007)
  - Advertising (Rennhoff and Wilber 2008)
  - Stars (Elberse 2007)
  - Distribution (Swami et al. 1999)
  - Critics' reviews (Eliashberg and Shugan 1997)
  - User reviews (Dellarocas et al. 2007, Duan et al. 2008)
- Consumer heterogeneity / product differentiation (Eaton and Lipsey 1989)
  - Most (all?) piracy papers in environment with both (low quality?) piracy and (high quality?) legitimate product

Theory: Impact?

↓ Substitution

"During 2007, the entertainment industry generated a trade surplus of $13.6 billion, imagine what those numbers would be if we could reign in piracy." *Rep. Howard Berman, Chairman, House Committee on Foreign Affairs*

↓↑ Word of Mouth

"If people see this movie and don't like it, and they tell their friends, and their friends blog about it, and it just spreads throughout the blogosphere, there are a lot of people that don't even get near a pirated copy of this film, who don't go to see [the movie in theaters] because of this leak" *Steve Zeitchik, The Hollywood Reporter, discussing Wolverine Leak.*

Hypotheses

- H1: Pre-release piracy reduces movie box-office sales.
- H2: Pre-release piracy has a higher impact on earlier periods of movie-box office sales than later periods.
- H3: Higher quality pre-release piracy has a lower impact on box-office sales than lower quality leaks do.

Empirical Model

- Sawhney and Eliashberg (1996), Krider and Weinberg (1998)
    - where...

$$BO_{it} = m_i e^{-\lambda_i t + \varepsilon_{it}} = e^{\log m_i - \lambda_i t + \varepsilon_{it}}$$

$$\lambda_i = Z_i' \gamma_i + \xi_i$$

$$\log m_i = X_i' \beta_i + \zeta_i$$

Empirical Model

- Sawhney and Eliashberg (1996), Krider and Weinberg (1998)
    - where...

$$BO_{it} = m_i e^{-\lambda_i t + \varepsilon_{it}} = e^{\log m_i - \lambda_i t + \varepsilon_{it}}$$

$$\lambda_i = Z_i' \gamma_i + \tau Pir_i + \xi_i$$

$$\log m_i = X_i' \beta_i + \rho Pir_i + \zeta_i$$

Data: Movie Characteristics

- All movies released Jan 2006 - Jan 2009
- *IMDB:* budget, star appeal, user rating, release date (USA)
- *BoxOfficeMojo:* weekly box office, distributor, genre, MPAA rating, director appeal, screens,
- *Yahoo Movies:* critic rating

Data: Piracy/Quality

Video Rating :: 3.0 (10 votes) [vote]

Audio Rating :: 3.2 (10 votes) [vote]

Movie Rating :: 4.7 (9 votes) [vote]

Data: Piracy

Video Rating :: 8.4 (11 votes) [vote]
Audio Rating :: 8.3 (11 votes) [vote]
Movie Rating :: 8.9 (11 votes) [vote]

Data: Piracy

- *Pre-release piracy:*
  - =1 if available before US theatrical release
- *Audio Quality:* Avg. audio quality from vcdq
- *Video Quality:* Avg. video quality from vcdq

Final Dataset

- 194 movies, 21 with pre-release piracy

Table 2: Movie Descriptive Statistics				
		Total US Box Office	Production Cost	Opening Weekend Screens
With Pre-release Piracy	Mean	$41 million	$43 million	1421
	Std Dev	$60 million	$51 million	1293
	Min	$110 thousand	$2.5 thousand	11
	Max	$210 million	$200 million	3940
Without Pre-release Piracy	Mean	$55 million	$45 million	2324
	Std Dev	$70 million	$47 million	1138
	Min	$740 thousand	$100 thousand	13
	Max	$530 million	$260 million	4366

Results: Homogeneous Decay

$$\log BO_{it} = X_i'\beta_t - \lambda t + \rho Pir_i - \tau Pir_i t + u_i + \upsilon_{it}$$

Table 3: Result - Fixed Rate of Decay			
Parameter	Estimate	Parameter	Estimate
Constant	7.446(***)	Warner	0.07249
τ	-0.1959(***)	Universal	0.5858(*)
ρ	-0.6542(*)	Paramount	0.4829(.)
λ	0.6514(***)	Fox	0.2186
Budget	0.1094(.)	Sony	0.5061(*)
Screen	0.9585(***)	Newline	0.1861
Director Appeal	0.6099(**)	Lionsgate	0.4421
User Rating	0.08921	MGM	-0.5442(.)
Critic Rating	0.07337	Action	-0.0807
Star Appeal	0.4589(**)	Comedy	-0.01419
G	0.5472	Drama	-0.1913
R	-0.6928	Adventure	0.02227
PG13	-0.1476	Horror	0.1788
PG	0.05638	Thriller	-0.1119
		Animation	-0.2254

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
Multiple R-squared: 0.8055, Adjusted R-squared: 0.8007

- inc. movie-level random effects
- $\rho<0$ → total revenue loss = 18.2%
- $\tau<0$ → faster decay

Results: Heterogeneous Decay

$$\log BO_{it} = X_i'\beta_t - Z_i'\gamma_i t + \rho Pir_i - \tau Pir_i t + u_i + \upsilon_{it}$$

Table 4: Result - Variable Rate of Decay			
Piracy and Market Potential			
Parameter	Estimate	Parameter	Estimate
Constant	7.680(***)	Warner	0.07301
τ	-0.1627(***)	Universal	0.5860(*)
ρ	-0.5369(*)	Paramount	0.4831(.)
λ	0.7192(***)	Fox	0.2189
Budget	0.1095	Sony	0.5067(*)
Screen	0.9590(***)	Newline	0.1869
Director Appeal	0.3253	Lionsgate	0.4429
User Rating	0.1175	MGM	-0.5436(.)
Critic Rating	-0.03210	Action	-0.08076
Star Appeal	0.008	Comedy	-0.01395
G	0.5435	Drama	-0.1921
R	-0.6957	Adventure	0.02226
PG13	-0.1503	Horror	0.1788
PG	0.05375	Thriller	-0.1116
		Animation	-0.2256
Rate of Decay			
User Rating	0.00817	Director Appeal	-0.08123(***)
Critic Rating	-0.03021(***)	Star Appeal	-0.1239(***)

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
Multiple R-squared: 0.0101, Adjusted R-squared: 0.0047

- inc. movie-level random effects
- $\rho<0$ → lower market potential (-14.8%)
- $\tau<0$ → faster decay

Results: Piracy Quality

$$\log BO_{it} = X_i'\beta_t - \lambda t + \rho_1 Pir_i + \rho_2 Pirqual_i - \tau_1 Pir_i t - \tau_2 Pirqual_i t + u_i + \upsilon_{it}$$

Table 5: Impact of Piracy Quality	
Parameter	Estimate
τ_1	-0.1958(***)
τ_2	-0.03215
ρ_1	-0.6575(*)
ρ_2	0.2165 (.)
λ	0.6514(***)

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

- inc. movie-level random effects
- $\rho_2>0$ → higher quality piracy, relatively higher market potential
- $\tau\sim0$ → no difference in decay rate

Endogeneity

- Propensity score matching, re-estimation on matched data
  - Specification 1: Production budget, number of screens predict piracy
  - Specification 2: Production budget, star & director appeal predict piracy

Results

Table 6: Propensity Score Matching - Fixed Rate
Selection Criteria: Budget – Screen

Parameter	Estimate
τ	-0.1506(**)
ρ	-1.329(***)
λ	-0.6156(***)

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Table 7: Propensity Score Matching - Variable Rate
Selection Criteria: Budget – Screen

Parameter	Estimate
τ	-0.0735
ρ	-1.06(***)

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Table 8: Propensity Score Matching - Fixed Rate
Selection Criteria: Budget + Star + Director Appeal

Parameter	Estimate
τ	-0.1761(***)
ρ	-0.2236
λ	-0.6451(***)

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Table 9: Propensity Score Matching - Variable Rate
Selection Criteria: Star + Director Appeal

Parameter	Estimate
τ	-0.1274(*)
ρ	-0.05314

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

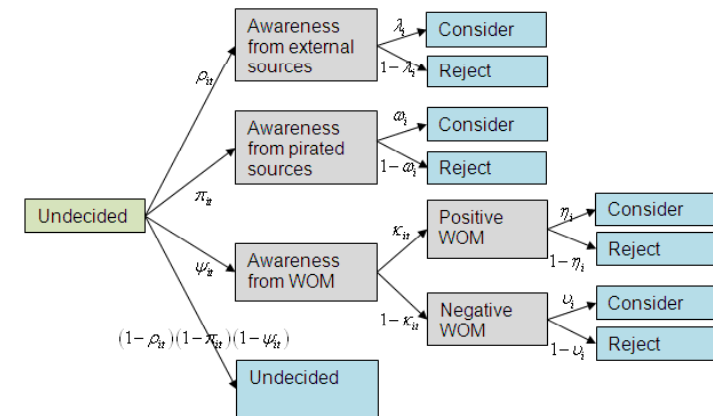# Promotional Potential for Piracy?

Conjecture

- Our results suggest that pre-release piracy reduces sales. However, the magnitude suggests that under the right conditions positive promotional effects could offset negative effects of cannibalization.
- Develop a Markovian model with diffusion element to model movie sales.
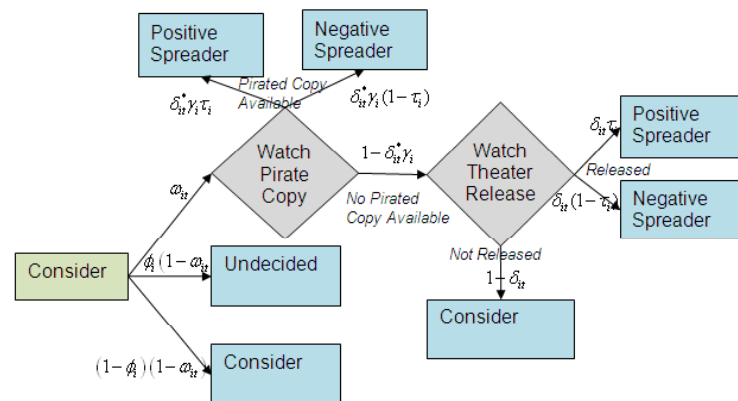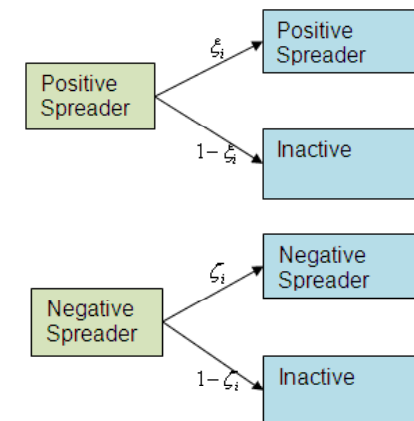
Modeling Consumer Viewership

Positive Spreader

Consider

Inactive

Negative Spreader

Undecided

Reject
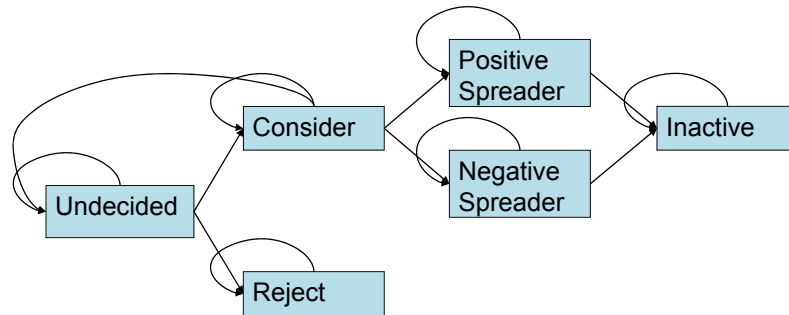
37

Transitions from Undecided

Undecided

ρ_{it} → Awareness from external sources → λ_i → Consider; $1-\lambda_i$ → Reject

π_{it} → Awareness from pirated sources → ω_i → Consider; $1-\omega_i$ → Reject

ψ_{it} → Awareness from WOM → κ_{it} → Positive WOM → η_i → Consider; $1-\eta_i$ → Reject

$1-\kappa_{it}$ → Negative WOM → υ_i → Consider; $1-\upsilon_i$ → Reject

$(1-\rho_{it})(1-\pi_{it})(1-\psi_{it})$ → Undecided

38

Transitions from Consider

Positive Spreader

Negative Spreader

$\delta_{it}^{\bullet}\gamma_i\tau_i$ — Pirated Copy Available

$\delta_{it}^{\bullet}\gamma_i(1-\tau_i)$

Watch Pirate Copy

$1-\delta_{it}^{\bullet}\gamma_i$

Watch Theater Release

$\delta_{it}\tau_i$ — Released → Positive Spreader

$\delta_{it}(1-\tau_i)$ → Negative Spreader

ω_{it}

No Pirated Copy Available

Not Released

$1-\delta_{it}$ → Consider

Consider

$\phi_i(1-\omega_{it})$ → Undecided

$(1-\phi_i)(1-\omega_{it})$ → Consider

39

Transition from Spreader

Positive Spreader

ξ_i → Positive Spreader

$1-\xi_i$ → Inactive

Negative Spreader

ζ_i → Negative Spreader
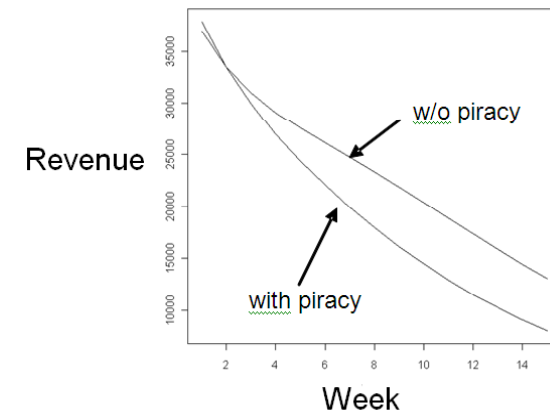
$1-\zeta_i$ → Inactive
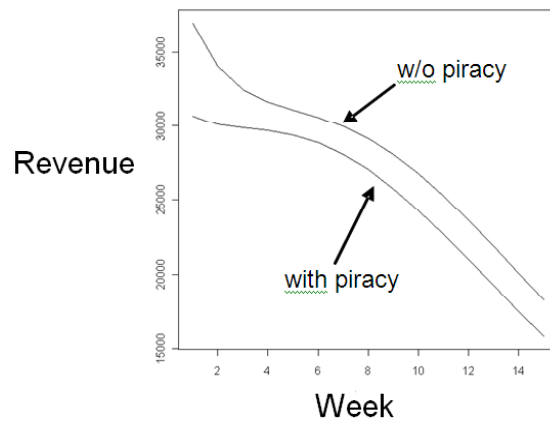
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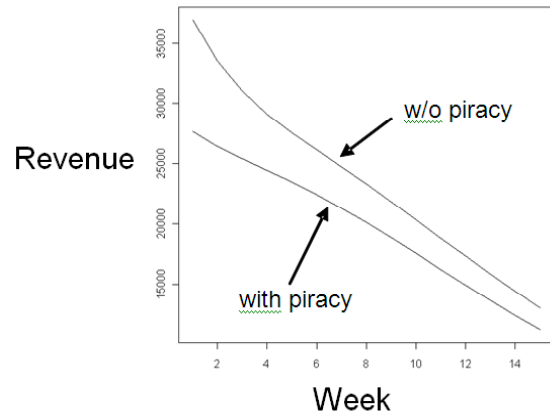
Low Quality/Low WOM
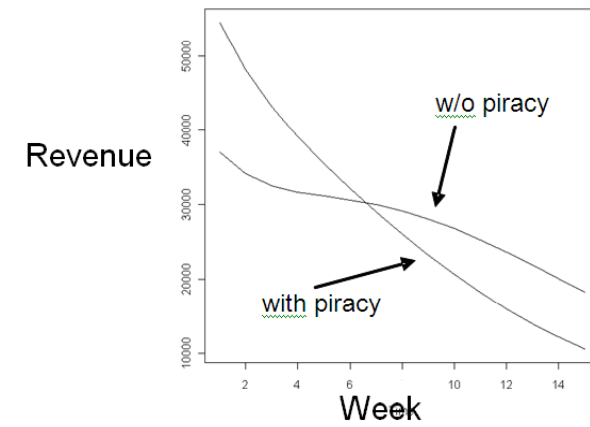

41

Low Quality/High WOM

42

High Quality/Low WOM

43

High Quality/High WOM

44

Findings

Under the right conditions movie piracy could be beneficial:

1. The underlying quality of the movie is high
2. The quality of the movie is not well signaled through traditional promotions
3. Viewing of the movie is not greatly diminished by viewers of the pirated copy
4. Word-of-mouth effects are strong

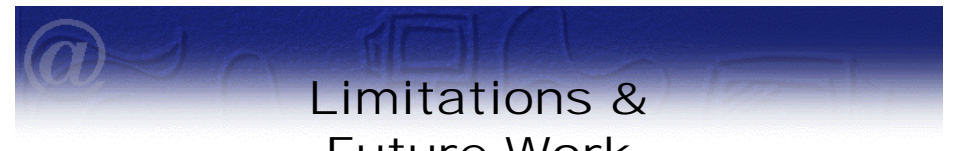## Conclusions

Summary

- Pre-release piracy associated with...
  - 14% lower box office
  - Harm disproportionately on opening weeks
- Higher quality pre-release piracy associated with *lower* decline in box office than other pre-release piracy

Limitations & Future Work

- No data on intensity of pre-release piracy
- Unable to disentangle substitution and word-of-mouth effects
- Small dataset make it difficult to separate effects across genres, etc.