

Are Digital Rights Valuable? Theory and Evidence from the eBook Industry

Gal Oestreicher-Singer
Arun Sundararajan

New York University



International Conference on Information Systems
December 14, 2004

Motivation

A number of industries are being transformed by IT

- Transformation of products from "tangible" to digital
- Music, video, books,...

During this transition, simultaneous availability of

- Pure digital goods
- Traditional goods, embedded in physical (tangible) artifacts
- Potentially, illegal pirated versions created from the digital goods

Motivation

The "digital rights" conjecture

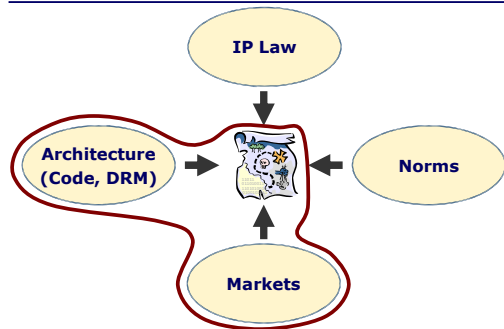
Managing digital rights in order to deter piracy involves restricting the same rights that contribute to the value of legal digital good.

The key tradeoff: value versus piracy

- If digital rights are:
 - Excessively restricted: Digital products are not valuable enough substitutes for their tangible counterparts, and the transformation fails.
 - Unrestricted: Widespread piracy can lower the legal sale of tangible and digital goods, and threaten the industry's continued existence.
- Effectively balancing these objectives involves:
 - Implementing an effective DRM platform
 - A judicious choice of rights granted to legal users
 - An appropriate pricing strategy (for both tangible and digital goods)

Motivation

Forces that regulate (digital piracy)



Research Questions

Pricing and rights management: theory

- What are the optimal pricing and rights management policies?
- How are those policies affected by:
 - Potential cannibalization of the revenue from an existing tangible (physical) substitute
 - The threat of digital piracy
 - The technological sophistication of target consumers

Testing the DR conjecture in the ebook industry

- How does granting digital rights affect a seller's pricing power?
- What are the characteristics of digital rights that are associated with an increase/decrease in the seller's pricing power?

Summary of key results

Pricing and rights management: theory

- In the absence of piracy, sellers should grant unrestricted rights for their digital goods: cannibalization can be managed using prices.
- In the presence of piracy, the extent to which sellers grant a digital right is affected critically by:
 - A direct effect: how much it increases the value of the legal good.
 - A differential effect: how much it affects differential quality between legal and pirated versions of the digital good.

Support for the DR conjecture in the ebook industry

- Granting two digital rights has a significant positive effect on ebook prices, while granting two other digital rights has a significant **negative** effect on ebook prices.
- What differentiates these rights:
 - Relative magnitude of direct and differential effects.
 - Enhancing the digital experience vs. replicating the physical experience.



Prior related work

The economics of piracy: theory

- Conner and Rummelt (1991), Takeyama (1994), Shy and Thisse (1999), Bakos et al (1999)
- Sundararajan (2004), Png and Chen (2003), Belleflamme (2003), Chellappa and Shivendu (2003), Gu and Mahajan (2004), Acquisti (2004), various ICIS '03 papers

Empirical studies of piracy

- Gopal and Sanders (1998), Zentner (2003), Hui and Png (2003), various studies by the BSA and industry groups

Channel conflict

- Konana et al. (2000), Viswanathan (2005), various marketing papers



Analytical model: Overview

Monopoly seller, three goods

- Tangible (physical) good T (price p_T , quality s_T)
- Legal digital good D (price p_D , quality s_D)
- Pirated digital good P (price 0, quality s_P)

Choices made by seller

- Rights granted to legal users of the digital good: $r = (r_1, r_2, \dots, r_n)$
- Price p_D of the digital good (price p_T of the tangible good is exogenous and fixed).

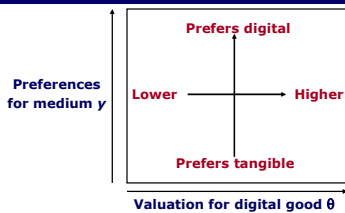
Quality of each good determined as follows

$$s_D = f_D(r_1, r_2, \dots, r_n); \frac{df_D}{dr_i} \geq 0.$$

$$s_P = f_P(r_1, r_2, \dots, r_n); \frac{df_P}{dr_i} \geq 0.$$



Analytical model: Overview

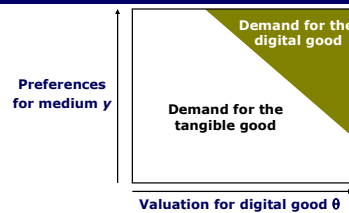


Consumers indexed by pair (y, θ)

- Utility functions
 - Physical good: $s_T - \theta y - p_T$
 - Legal digital good: $\theta s_D - \iota(1-y) - p_D$
 - Pirated digital good: $\theta s_P - \iota(1-y)$



Analytical model: Results

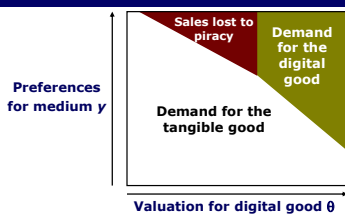


In the absence of digital piracy

- Price of the digital good
 - increases with price of the tangible good p_T , quality of the digital good s_D
 - decreases with level of "technological sophistication" ι .
- Seller should offer maximum possible digital rights allowed by their DRM platform



Analytical model: Results



In the presence of digital piracy

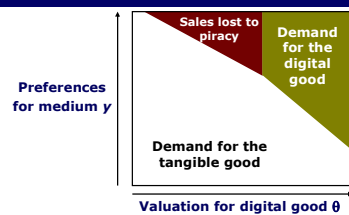
- Price of the digital good
 - increases with price of the tangible good p_T , legal digital quality s_D , quality differential $(s_D - s_P)$
 - decreases with level of "technological sophistication" ι .

Direct quality effect

Differential quality effect



Analytical model: Results



In the presence of digital piracy

- A seller should grant a digital right if the positive direct effect dominates the differential effect
- Rights that enhance the digital experience rather than replicating the tangible consumption experience are more likely to increase the seller's pricing power.



Empirical model: Overview

Data

- 5000+ titles sold by a specialty ebook retailer, gathered using a Perl spider, collected periodically
- These results based on a subset (1788 titles) collected in April 2004 (596 X 3 categories: Computers, SciFi, Philosophy)
- Sold in 4 formats: Adobe PDF, MS Reader, Palm, MobiPocket
 - We use the Adobe format since it allows most flexibility in granting digital rights
- 4 rights available: Print, Copy, Lend, Read Aloud



Empirical model: Overview

Example

The eBook you are interested in is available for purchase in the following formats:

	Adobe eBook Reader	Buy this Format
Price:	\$29.99	
ISBN:	0672320673	
Published Date:	6/19/2001	
File Size:	1666kb	
Security:	Settings listed below	
Printing:	On, any number of pages can be printed over any number of days.	
Copying:	On, any number of pages can be copied over any number of days.	
Expiry:	Off	
Lending:	Off	
Reading Aloud:	On	
Minimum Software Version:	N/A	
Suitable Devices:	Palm handhelds, Tablet PCs, PCs, Macs, Laptops	



Empirical model: Overview

Example

The eBook you are interested in is available for purchase in the following formats:

	Adobe eBook Reader	Buy this Format
Price:	\$39.99	
ISBN:	047101379X	
Published Date:	3/22/2001	
File Size:	3168kb	
Security:	Settings listed below	
Printing:	On, 25 pages can be printed every 10 days.	
Copying:	On, 25 pages can be copied every 10 days.	
Expiry:	Off	
Lending:	Off	
Reading Aloud:	Off	
Minimum Software Version:	N/A	
Suitable Devices:	Palm handhelds, Tablet PCs, PCs, Macs, Laptops	



Empirical model: Results

Variables (I)

Variable	Brief description	Data points	Range	Mean	SD
EPrice	Ebook price	1788	1.49 - 214.5	17.23	22.11
Log[EPrice]	Log of ebook price	1788	0.39 - 5.36	2.393	0.899
Variable	Brief description	Data points	Range	% non-zero	
CopyAll	Allows unlimited copying of text	1788	{0,1}	9%	
CopyPartial	Allows limited copying of text	1788	{0,1}	24%	
PrintAll	Allows unlimited printing of pages	1788	{0,1}	6%	
PrintPartial	Allows limited printing of pages	1788	{0,1}	7%	
Lend	Allows lending	1788	{0,1}	20%	
Read	Has the "Read Aloud" feature	1788	{0,1}	57%	



Empirical model: Results

$$\log[EPPrice] = \alpha + \beta_1 CopyAll + \beta_2 CopyPartial + \beta_3 PrintAll + \beta_4 PrintPartial + \beta_5 Lend + \beta_6 Read$$

Variable	Co-efficient (β)	Corresponding value of β^0
Constant	2.314 *** (0.031)	10.10
CopyAll	0.560 *** (0.201)	1.75
CopyPartial	0.219 *** (0.101)	1.24
PrintAll	-0.636 *** (0.188)	0.53
PrintPartial	-0.208 * (0.115)	0.81
Lend	-1.11 *** (0.105)	0.33
Read	0.461 *** (0.048)	1.59
$R^2 = 14.1\%$, $F = 49.8$		
		* significant with $p < 0.1$ ** significant with $p < 0.05$ *** significant with $p < 0.01$

Implications of the coefficients

- Allowing copying and read aloud is associated with higher prices.
- Allowing printing and lending is associated with lower prices.



Empirical model: Results

Variables (II)

Variable	Brief description	Data points	Range	Mean	SD
EPrice	ebook price	300	2.5 - 137.5	23.72	18.83
TPrice	Tangible book price (paperback)	300	1.75 - 108	25.89	15.32
CatSciFi	Science fiction category	300	{0,1}		
CatPhilosophy	Philosophy category	300	{0,1}		



Empirical model: Results

$$EPrice = \alpha + \beta_1 TPrice + \beta_2 CatSciFi + \beta_3 CatPhilosophy$$

Variable	Co-efficient (β)
Constant	4.716 ** (1.842)
TPrice	0.905 *** (0.062)
CatSciFi	-3.743 *** (1.723)
CatPhilosophy	4.746 ** (1.927)
$R^2 = 62.8\%$, $F = 169.5$ ** significant with $p < 0.05$ *** significant with $p < 0.01$	

Implications of the coefficients

- ebook price increases as the price of the tangible book increases
- ebook price decrease as the level of technology sophistication of the readers increases



Summary of key results

Pricing and rights management: theory

- In the absence of piracy, sellers should grant unrestricted rights for their digital goods: cannibalization can be managed using prices.
- In the presence of piracy, the extent to which sellers grants a digital right is affected critically by:
 - A direct effect: the value of the legal good.
 - A differential effect: how it affects differential quality between legal and pirated versions of the digital good.

Support for the DR conjecture in the ebook industry

- Granting two digital rights has a significant positive effect on ebook prices, while granting two other digital rights has a significant **negative** effect on ebook prices.
- What differentiates these rights:
 - Relative magnitude of direct and differential effects.
 - Enhancing the digital experience vs. replicating the physical experience.



Concluding remarks

Ongoing work

- Analysis of eBook data based on a more sophisticated underlying model
- Factor in more controls (price of the tangible book, category)
- Test the model on data from other digital industries



Questions?