

Vertical Integration, Exclusivity and Game Sales Performance in the US Video Game Industry

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This paper

- What is the empirical relation between vertical integration and video game performance?
What are the benefits and costs of vertical integration on video game performance?
- Monthly video game sales for 6th and 7th generation consoles
 - Universe of 3,382 games 2000-2007
 - Collection by-hand of information on vertical structure by video game ... and over time!
 - Valuable information on takeovers, mergers and acquisitions
- Empirical Strategy:
 - First, present empirical correlation between vertical integration and video game revenues, unit sales and retail prices
 - Second, estimate logit demand with VI as video game characteristic
 - Third, explore causality (warning: no instrument for vertical integration, instrument for price)
- Most previous empirical work on this industry focuses on platform level demand and existence of network effects
 - here, evaluate benefits/costs of VI at the video game level

Institutional details

- This paper is about video game industry, final good: video game + console
- Industry features:
 - Three big players: Nintendo, Microsoft and Sony
 - Every 5 to 7 years, new generation of consoles (2000, 6th generation; in 2005, 7th)
 - Console manufacturers face trade-off (Control stock of games versus network effects)
 - This industry is well-suited to the study of vertical integration because very clear vertical structure ...
 - Developers
 - Publishers
 - Console Manufacturers
- Benefits of vertical integration,
 - Development stage (pre-release): better coordination at production stage
 - Release stage: softening competition of games within publisher
 - Post-release stage: more advertising, better marketing, network effects
- Potential costs of vertical integration,
 - Bigger firms, higher costs of “managed coordination”
 - Loss of “market-based” incentives



Data description

- Monthly video game sales information between Oct 2000 – Oct 2007 from NPD
 - Universe of 3,382 games for 6th and 7th generation
 - 6th generation: Nintendo Gamecube, Xbox, PS2
 - 7th generation: Wii, Xbox 360, PS3
 - Also information on revenues (and therefore average prices per month) as well as platform, game and publisher information (no developer info)
 - Throw away observations with unreasonable prices (<\$5 and >\$60)
- Complement information available from NPD data with following items
 - Developer info per game at release (from different websites)
 - Takeovers, acquisitions and mergers between 2000 and 2007
 - Checked, coded and matched by hand all this info with newspapers and multiple sources
- Nature of the industry provides three different types of vertical integration:
 - Developer-Publisher integration
 - Publisher-Platform integration
 - Developer-Publisher-Platform integration
 - Variation in vertical integration measures unusually good: within platform, within publisher, within developer, within genre, within game, etc

Table 1. Summary Statistics for Performance Outcomes and Vertical Integration Variables

	All obs.	If VertInt Dev-Pub	If VertInt Pub-Platf	If VertInt Dev-Pub-Platf
Monthly Revenues	220172.3 (1449824)	274473.4 (1651469)	350968.8 (1597786)	609629.9 (3604588)
Average Monthly Price	22.9 (12.0)	25.6 (12.6)	22.9 (14.1)	24.3 (13.6)
Monthly Units Sold	5946.3 (29587.0)	7217.0 (34419.9)	9071.9 (31843.6)	14926.1 (67409.6)
Age	25.0 (18.1)	25.0 (18.3)	26.5 (18.6)	26.0 (18.8)
Vertical Integration Variables				
VertInt Dev-Pub?	44.03%	100%	-	-
VertInt Pub-Platf?	4.67%	-	100%	-
VertInt Dev-Pub-Platf?	3.41%	-	-	100%
Integrated Developer?	53.31%	100%	17.13%	100%
Integrated Publisher?	88.43%	92.40%	100%	100%
Game Int Dev-Pub?	47.40%	100%	0%	100%
Game Int Pub-Platf?	8.30%	0%	100%	100%
Game Int Dev-Pub-Platf?	3.41%	0%	0%	100%

Empirical Association btw Performance and VI?

- Define performance measure Y as monthly sales, revenues and average monthly price
- Regress each performance measure Y on vertical integration variables, exclusivity and age plus a variety of fixed effects

$$\begin{aligned}\log(Y_{itk}) = & \beta_0 + \beta_1 \text{VI_Dev-Pub}_{itk} + \beta_2 \text{VI_Pub-Platf}_{itk} + \beta_3 \text{VI_Dev-Pub-Platf}_{itk} + \\ & + \text{Exclusivity}_{itk} + \beta_4 \text{Age}_{itk} + \text{Platform}_k + \rho_t + \text{Genre}_i + u_{itk}\end{aligned}$$

- In this specification, VI variables are defined exclusive of each other
 - Residual group is video games “fully-independent”
- Exclusivity, indicator variable if video game only for one platform within generation

Table 4. Empirical Relation Between Vertical Integration and Monthly Video Game Sales

Dep Var: log(quantity)					
	(1)	(2)	(3)	(4)	(5)
VertInt Dev-Pub	0.3813 (0.0559)***	0.3834 (0.0552)***	0.4616 (0.0563)***	0.4459 (0.0556)***	0.4351 (0.0549)***
VertInt Pub-Platform	1.2009 (0.1367)***	1.3574 (0.1321)***	1.4403 (0.1264)***	1.4712 (0.1261)***	1.5178 (0.1257)***
VertInt Dev-Pub-Platform	1.4364 (0.1809)***	1.5203 (0.1843)***	1.6474 (0.1719)***	1.6765 (0.1665)***	1.7193 (0.1771)***
Exclusivity	-0.2764 (0.0557)***	-0.1548 (0.0483)***	-0.1692 (0.0467)***	-0.2970 (0.0529)***	-0.4128 (0.0542)***
Age		-0.1012 (0.0011)***	-0.1012 (0.0011)***	-0.0963 (0.0017)***	-0.0946 (0.0017)***
Constant	6.2613 (0.0478)***	8.5831 (0.0471)***	8.5489 (0.0458)***	9.0342 (0.1274)***	8.7639 (0.1359)***
Genre FE	No	No	Yes	Yes	Yes
Month FE	No	No	No	Yes	Yes
Platform FE	No	No	No	No	Yes
Observations	122069	122069	122069	122069	122069
R-squared	0.02	0.55	0.58	0.6	0.61

Robust standard errors in parentheses and clustered by game-platform dyad.

* significant at 10%; ** significant at 5%; *** significant at 1%

Logit Demand Model

- Individual i obtains utility from consuming game j in period t such that

$$U_{ijt} = X_j\beta + \alpha p_{jt} + \xi_j + \gamma(t - t_j) + \phi_t + \varepsilon_{ijt} \text{ and } U_{i0t} = \varepsilon_{i0t}$$

assuming that consumers do not substitute across games (Lee, 2009)

- The well-know logit formula provides solution for the market share of game j in period t such that

$$s_{jt} = \exp(\delta_{jt}) / (1 + \exp(\delta_{jt})) \text{ and } s_{0t} = 1 / (1 + \exp(\delta_{jt}))$$

and therefore

$$\ln(s_{jt}) - \ln(s_{0t}) = \delta_{jt}$$

- From this specification, we run the following regression equation

$$\ln(s_{jt}) = X_j\beta + \alpha p_{jt} + \xi_j + \gamma(t - t_j) + \phi_t + u_{jt}$$

- Use fixed effects that deal with ξ_j (game-platform FE) and ϕ_t (with month-year FE)
- As unbundle the game-platform FEs, more unobservables left loose not correlated with VI
- Instrument for price (average time for price to 60% of initial price by genre and platform)
- No instrument for organizational form

Table 6. Video Game Demand Estimation Accounting for Vertical Integration Characteristics

Dep Var: log(Share)						
	(1)	(2)	(3)	(4)	(5)	(6)
	OLS	OLS	2SLS	2SLS	2SLS	2SLS
Average Price	-0.0015 (0.0027)	-0.0295 (0.0016)***	-0.0881 (0.0544)*	-0.0637 (0.0523)	-0.0484 (0.0528)	-0.0577 (0.0532)
Integrated Developer					0.1029 (0.0876)	0.0950 (0.0869)
Integrated Publisher					0.3847 (0.0898)***	0.3811 (0.0907)***
Game Int Dev-Pub				0.3840 (0.0555)***	0.2607 (0.0912)***	0.2547 (0.0908)***
Game Int Pub-Platform				1.5075 (0.1411)***	1.4108 (0.1424)***	1.4267 (0.1420)***
Game Int Dev-Pub-Platform				-0.2674 (0.2460)	-0.2324 (0.2460)	-0.2604 (0.2416)
Exclusivity				-0.4370 (0.0555)***	-0.3795 (0.0572)***	-0.3837 (0.0599)***
Constant	-7.3932 (0.2328)***	-10.1737 (0.2048)***	-5.5180 (1.1932)***	-6.0403 (1.1476)***	-6.7698 (1.1593)***	-10.2551 (1.1706)***
Age FE	Yes	Yes	Yes	Yes	Yes	Yes
Month-Year FE	Yes	Yes	Yes	Yes	Yes	No
Game-Platform FE	No	Yes	No	No	No	No
Game FE	No	No	Yes	Yes	No	No
Platform FE	No	No	Yes	Yes	Yes	No
Genre FE	No	No	No	No	Yes	Yes
Platform-Month FE	No	No	No	No	No	Yes
Observations	121791	121791	121482	121482	121482	121482
R-squared	0.61	0.9	0.6	0.63	0.63	0.64

Robust standard errors in parentheses and clustered by game-platform dyad.

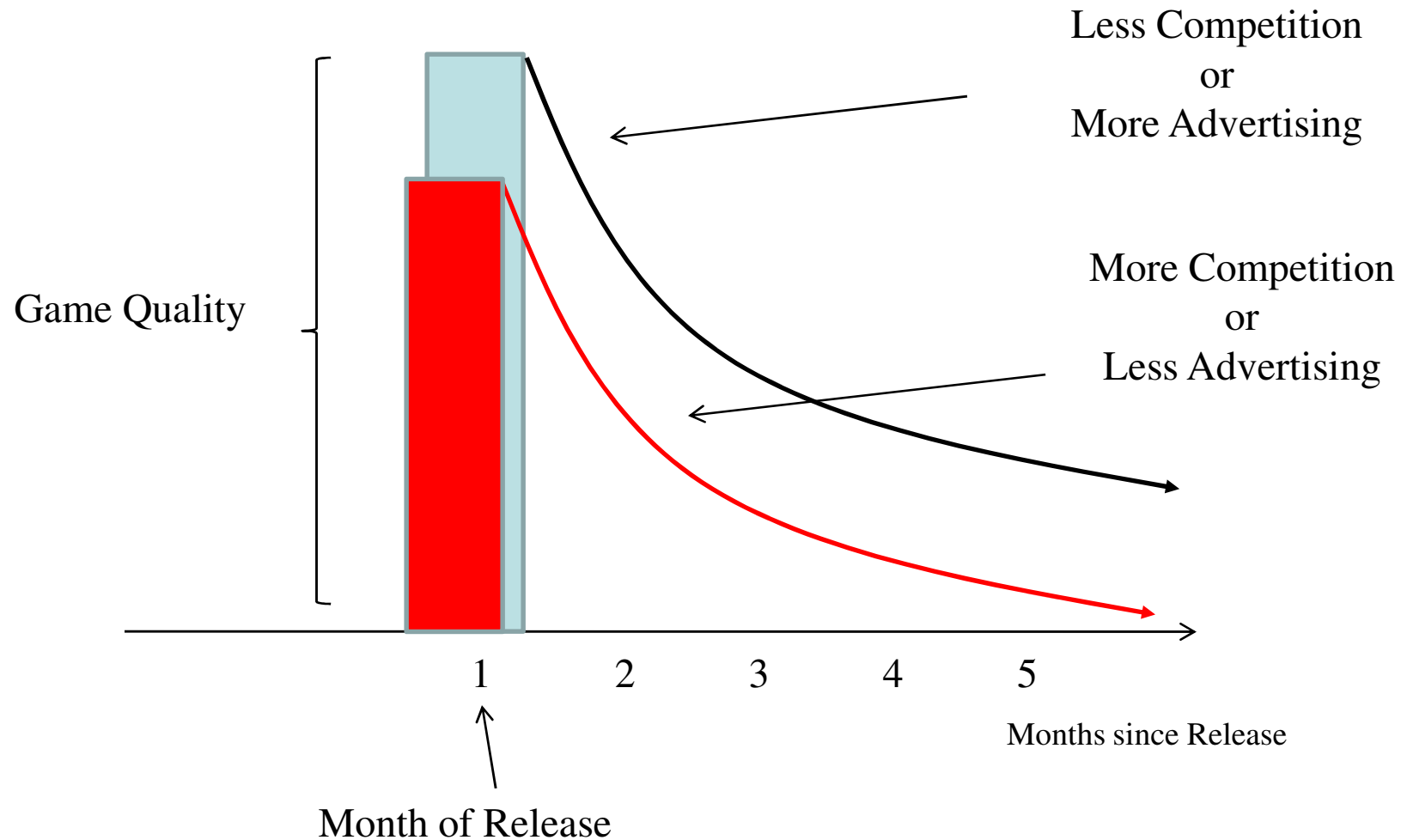
The instrument used for average price in 2SLS regressions is the average time in months to decrease to 60% of maximum price by platform and genre. * significant at 10%; ** significant at 5%; *** significant at 1%.

Exploring Causality of Impact of Vertical Integration

- Previous results show that vertical integration is associated with up to extra +1.78 log share points in demand ... where is this correlation coming from?
- Three possible sources of this correlation:
 - Ex-ante effect (A): cheaper game development, higher quality
 - Better release (B): better release coordination softening competition from the start
 - After release (C): better marketing strategies (pricing, bundling, etc)
- We know +1.78 is joint effect (A+B+C) ... consider next how to unravel these three possible stories

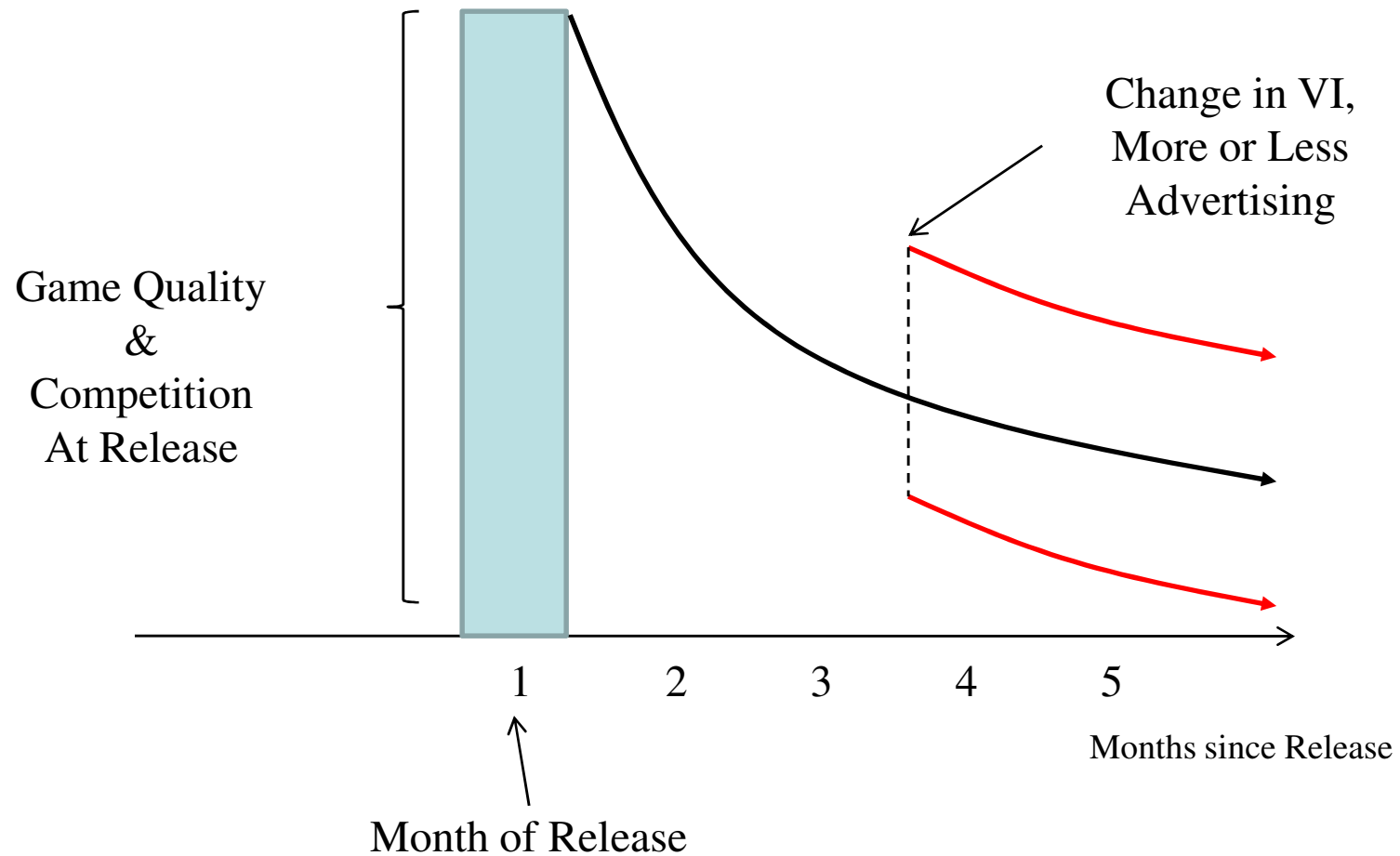
Identification Strategy :

Estimate difference VI and non-VI= $A+B+C$



Identification Strategy (1): Use Game/Platform FE

Estimate C



Identification Strategy (2): Use Platform-Genre-Month-Year FE
Estimate $A+C$... we can now find out A first and then B

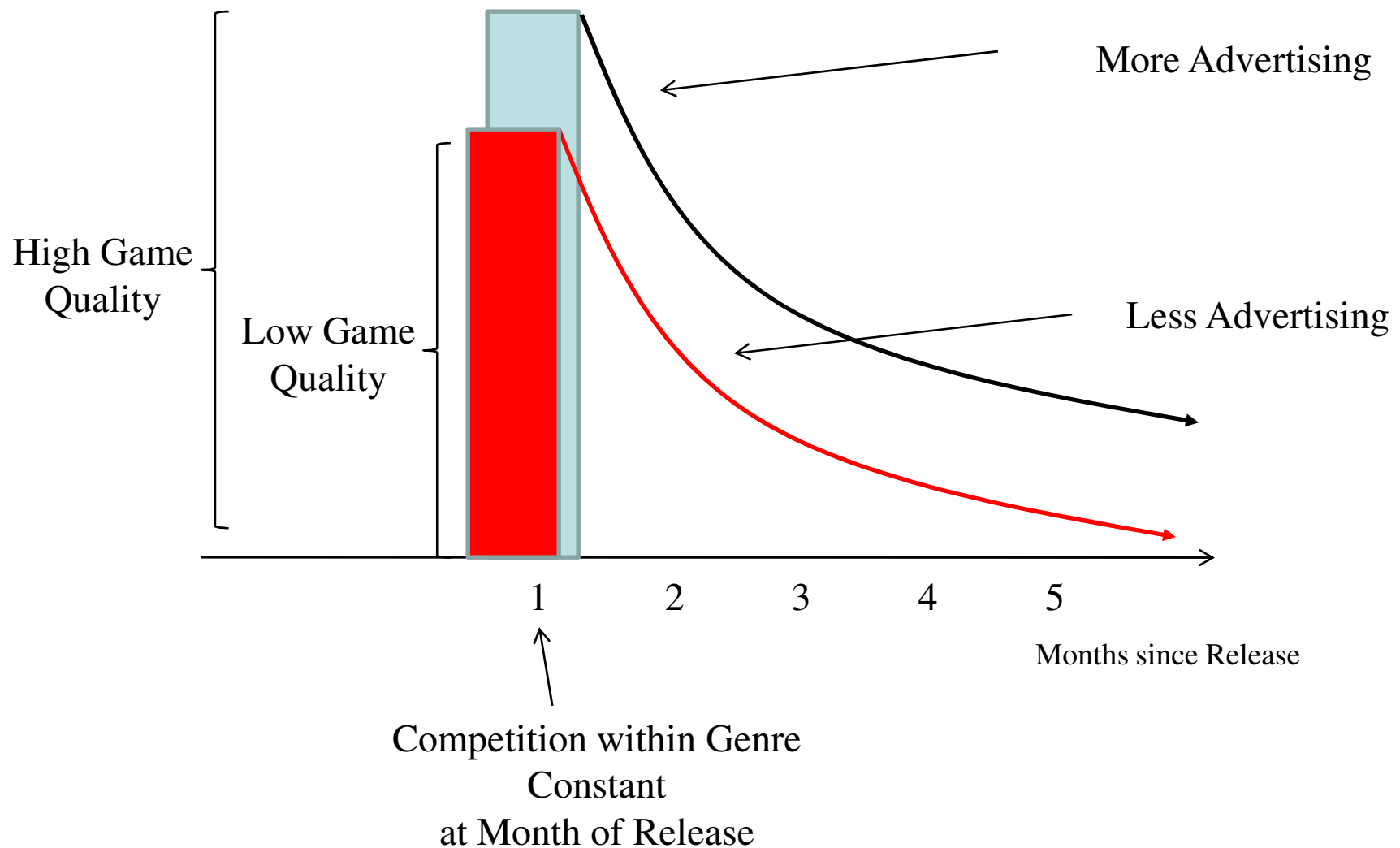


Table 7. The Impact of Vertical Integration on Video Game Demand: Development versus Marketing

Dep Var: log(Share)				
	(1)	(2)	(3)	(4)
	2SLS	2SLS	OLS	OLS
Average Price	-0.0577 (0.0532)	-0.0333 (0.0592)	-0.0298 (0.0016)***	-0.0134 (0.0055)**
Integrated Developer	0.0950 (0.0869)	-0.4655 (0.1058)***	-0.1706 (0.0999)*	0.3836 (0.2025)*
Integrated Publisher	0.3811 (0.0907)***	-0.3626 (0.1578)**	0.2550 (0.1512)*	0.3787 (0.1947)*
Game Int Dev-Pub	0.2547 (0.0907)***	0.7515 (0.1245)***	0.1635 (0.1044)*	0.1672 (0.1986)
Game Int Pub-Platform	1.4267 (0.1420)***	2.0648 (0.4818)***	- -	1.7434 (0.3421)***
Game Int Dev-Pub-Platform	-0.2604 (0.2416)	-0.3120 (0.3243)	-0.2450 (0.4588)	-0.8259 (0.4807)*
Exclusivity	-0.3837 (0.0599)***	-0.0909 (0.0557)	-0.1643 (0.0385)***	-0.5384 (0.1371)***
Constant	-10.2551 (1.1706)***	-7.5844 (1.4595)***	-10.2812 (0.2515)***	-9.0032 (0.2378)***
Age FE	Yes	Yes	Yes	No
Platform-Month FE	Yes	No	No	No
Month-Year FE	No	Yes	Yes	No
Developer FE	No	Yes	No	No
Publisher FE	No	Yes	No	No
Game-Platform FE	No	No	Yes	No
Platform-Month-Genre-Age FE	No	No	No	Yes
Observations	121482	120955	121791	121791
R-squared	0.64	0.75	0.9	0.9

Robust standard errors in parentheses and clustered by game-platform dyad.

The instrument used for average price in 2SLS regressions is the average time in months to decrease to 60% of maximum price by platform and genre. * significant at 10%; ** significant at 5%; *** significant at 1%.

Table 8. Exploring the Causal Effect of Vertical Integration on Video Game Demand

		(1)	(2)	(3)	(4)	(5)
		Joint Effect	Post-Release Mktg Strategies Effect	Mktg Strategies + Quality Effect	Net Quality Effect	Net Release Period Effect
		Column (1) Table 7	Column (3) Table 7	Column (4) Table 7	(3)-(2)	(1)-(3)
Game Int Dev-Pub	β	0.2547	0.1635	0.1672	0.0037	0.0874
		0.0907	0.1045	0.1986	0.2244	0.2182
	USD	4.4146	5.4923	12.5257	7.0334	-8.1111
		4.3670	3.5212	15.7416	16.1306	16.3361
Game Int Pub-Platform	β	1.4267	0†	1.7434	0†	-0.3168
		0.1420	-	0.3421	-	0.3703
	USD	24.7322	0†	130.5806	0†	-105.8484
		22.9572	-	22.9572	-	32.4664
Game Int Dev-Pub-Platform	β	-0.2604	-0.2450	-0.8259	-0.5809	0.5655
		0.2416	0.4588	0.4807	0.6645	0.5379
	USD	4.5136	-8.2293	-61.8556	-53.6263	66.3693
		5.9073	15.4201	44.1084	46.7261	44.5022
Exclusivity	β	-0.3837	-0.1643	-0.5384	-0.3741	0.1548
		0.0599	0.0385	0.1371	0.1424	0.1496
	USD	-6.6512	-5.5201	-40.3272	-34.8071	33.6760
		6.2255	1.3269	19.5299	19.5750	20.4982

Note: Numbers in columns of 4: top number is coefficient and % impact on market share. Third number is back of the envelope calculation result of dividing coefficient by corresponding price coefficient. Standard errors appear in small font size. Significant coefficients appear in bold.

†Note that we cannot disentangle the effect of marketing strategies and quality effect because we do not recover coefficient in column (2).

Summary of Results & Conclusions

- Most gains of vertical integration seem to come from
 - better release strategies due to softer competition
 - better ex-post marketing strategies due to better coordination of distribution channels
- Costs of vertical integration: ON AVERAGE, imputed quality of vertically integrated games is lower than those procured elsewhere
 - Presence of network effects (consistent with prior literature)
 - Cheaper to produce in-house, lower quality games are profitable
- Future work
 - Allow for more flexible substitution patterns across games in demand specification
 - Instrumental variable ... find instrument for price with more variation
 - Investigate endogeneity of vertical integration by exploring determinants of takeovers, mergers and acquisitions
 - Non-tangible assets important in this industry
 - Good setting to test GHM's PRT theories