

PRODUCT COMPOSITION IN VERTICALLY INTEGRATED MARKETS

IO SUMMER MEETINGS 2025

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AUGUST 29, 2025

MOTIVATION AND RESEARCH QUESTION

- Consumer welfare depends on prices but also on product offerings.
 - Through variety (# of products).
 - Or product composition (e.g, quality).
- Vertical integration (VI) can shift product composition.
 - Through endogenous decision of which firms to acquire.
 - By aligning investment incentives for quality.
 - Or through foreclosure of rivals.
- Goal: Understand the welfare effects of VI through these channels.
 - In the market for (digital) PC videogames.
 - Focus on publisher-developer acquisitions.

LITERATURE REVIEW

- Endogenous product choice.
 - Fan (2013); Mazzeo et al. (2018); Wollmann (2018); Fan & Yang (2020); Sullivan (2020); Berry & Waldfogel (2001).
- Vertically integrated markets/Exclusive agreements.
 - Chen & Waterman (2007); Conlon & Mortimer (2013); Lee (2013); Asker (2016); Crawford et al. (2018).
- Videogame industry.
 - Nair (2007); Lee (2013); Gil & Warzynski (2015); Rusakov & Kretschmer (2024); Argyres et al. (2025).

PRODUCT VARIETY CAN CHANGE HORIZONTALLY OR VERTICALLY

- VI can change product offerings directly through quality investment.
 - Integrated firms might have higher returns to investment/better coordination.
 - But might change investment incentives for competitors or future products.
- Horizontal differentiation might be impacted in equilibrium.
 - Integration can happen in different locations in characteristic space.
 - Diversification/specialization \Rightarrow different product offerings in equilibrium.

A SIMPLE MODEL: AGENTS AND TIMING

- Consider a market with one publisher P and two developers/titles $d = i, j$.
 - Each d characterized by marginal cost $c_d = 0$ and genre $g(d)$.
 - Assume i is already integrated with P .
- Agents play the following game:
 - **Stage 1:** P posts a TIOLI acquisition offer to j with transfer T .
 - **Stage 2:** j accepts or declines and controlling agents invest in quality.
 - If j accepts, they integrate (**I**), relinquishing control.
 - If j declines, they self-publish (**S**) and retain control.
 - **Stage 3:** Controlling agents set prices simultaneously and consumption occurs.

A SIMPLE MODEL: INVESTMENT AND CONSUMER DEMAND

- Investment in quality follows technology

$$a_i = \theta_s x_i, \quad C_s(x_i) = \frac{1}{2} x_i^2$$

where s is the governance structure and $\theta_I \geq \theta_S = 0$.

- Assume demands for both games are linear:

$$q_d = \underbrace{A_{g(d)} + \beta_a a_d - \beta_p p_d}_{:= t_d} + \sigma_{g(d), g(d')} p_{d'},$$

- A_g is a genre-specific demand shifter.
- $\sigma_{g(i), g(j)}$ is a (symmetric) cross- or within-genre substitution parameter.
- Assume $\sigma_{g,g} = \sigma_w$ and $\sigma_{g,g'} = \sigma_c$ for $g \neq g'$.

A SIMPLE MODEL: PREDICTIONS

- Equilibrium prices are different depending on governance. Prices
 - *Ceteris paribus*, integration increases prices.
 - Prices are higher for high quality games.
- Given pricing schedules, quality differs by governance. Investment
 - Integration increases quality.
 - Quality is a strategic complement and decreases with substitutability.
- For a publisher, integration is more profitable when substitutability is low.
 - In particular, $\sigma_c < \sigma_w \Rightarrow$ diversification more likely.
 - But, with high $A_{g(i)}$ specialization may be preferred.

DATA: OVERVIEW

- Dataset features all videogames currently in the Steam store.
 - A total of ~106,000 games.
 - Will only consider those launched between 2007 and 2025 (104,575 games).
- Includes developer(s) and publisher(s), release date and genre.
 - Among others; More information (such as prices or sales) is also available.
- Characteristics to focus for today.
 - Genre as horizontal characteristic.
 - Share of positive reviews as vertical characteristic.

DATA: ACQUISITIONS BY PUBLISHERS

- To test the predictions of the model, I will focus on 25 acquisition events.
 - Acquisitions are large and spaced in time. [Timeline](#)
 - Publishers and developers are relevant players. [Developers](#) [Publishers](#)
- Using these acquisitions:
 - Verify if they improved studio/game quality after acquisition.
 - Classify them between specialization and diversification.
 - Study relationship between acquisition “type” and different genres.

QUALITY EFFECTS ARE AMBIGUOUS AFTER ACQUISITION

EXAMPLES

	PPML			
	Positive review Share (1)	Metacritic Score (2)	Positive Reviews (3)	Negative Reviews (4)
Acquired	-0.036 (0.044)	0.157 (3.292)	-0.209 (0.375)	0.062 (0.412)
Control mean	0.816	77.427	7,213.929	1,050.995
Developer FE	✓	✓	✓	✓
Year FE	✓	✓	✓	✓
Weight	Est. sales	Est. sales	Est. sales	Est. sales
Observations	264	132	270	270

LESS SPECIALIZATIONS WHEN GENRE IS MORE CROWDED

	Specialization			
	Hard coded (0.5)		Above median (0.77)	
	(1)	(2)	(3)	(4)
# Games in genre (1000s)	-0.037 (0.034)	-0.043 (0.080)	0.002 (0.039)	0.004 (0.345)
Control mean	0.762	0.762	0.476	0.476
Average games by genre (1000s)	3.768	3.768	3.768	3.768
Year FE		✓		✓
Observations	21	16	21	16

MORE SPECIALIZATIONS WHEN EXISTING PORTFOLIO IS LARGER

	Specialization			
	Hard coded (0.5)		Above median (0.77)	
	(1)	(2)	(3)	(4)
# Publisher games in genre	0.007* (0.003)	0.009** (0.004)	0.012*** (0.003)	0.012*** (0.003)
Control mean	0.762	0.762	0.476	0.476
Average games by genre	22.423	22.423	22.423	22.423
Year FE		✓		✓
Observations	21	16	21	16

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. Robust standard errors in parentheses.

THANK YOU!

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MODEL: EQUILIBRIUM PRICES

[BACK TO EQUILIBRIUM](#)

- If j self-publishes (**S**):

$$p_i^S = \frac{2\beta_p t_i + \sigma t_j}{4\beta_p^2 - \sigma^2}$$

$$p_j^S = \frac{2\beta_p t_j + \sigma t_i}{4\beta_p^2 - \sigma^2}$$

- If j integrates (**I**):

$$p_i^I = \frac{\beta_p t_i + \sigma t_j}{2(\beta_p^2 - \sigma^2)}$$

$$p_j^I = \frac{\beta_p t_j + \sigma t_i}{2(\beta_p^2 - \sigma^2)}$$

MODEL: EQUILIBRIUM PRICES

[BACK TO EQUILIBRIUM](#)

- If j self-publishes (**S**):

$$p_i^S = \frac{2\beta_p t_i + \sigma t_j}{4\beta_p^2 - \sigma^2} + \frac{2\beta_p \Delta_i}{4\beta_p^2 - \sigma^2}$$

$$p_j^S = \frac{2\beta_p t_j + \sigma t_i}{4\beta_p^2 - \sigma^2} + \frac{\sigma \Delta_i}{4\beta_p^2 - \sigma^2}$$

- If j integrates (**I**):

$$p_i^I = \frac{\beta_p t_i + \sigma t_j}{2(\beta_p^2 - \sigma^2)} + \frac{\beta^P \Delta_i + \sigma \Delta_j}{2(\beta_p^2 - \sigma^2)}$$

$$p_j^I = \frac{\beta_p t_j + \sigma t_i}{2(\beta_p^2 - \sigma^2)} + \frac{\beta^P \Delta_j + \sigma \Delta_i}{2(\beta_p^2 - \sigma^2)}$$

MODEL: EQUILIBRIUM INVESTMENT

[BACK TO EQUILIBRIUM](#)

- If j self-publishes (**S**):

$$x_i^S = \frac{\theta_I \beta_a \mu_S (2\beta_p A_{g(i)} + \sigma A_{g(j)})}{1 - 2(\theta_I \beta_a)^2 \beta_p \mu_S}, \quad \mu_S := \frac{4\beta_p^2}{4\beta_p^2 - \sigma^2}$$

$$x_j^S = 0$$

- If j integrates (**I**):

$$x_i^I = \frac{\theta_I \beta_a \mu_I (\beta_p A_{g(i)} + \sigma t_j)}{1 - (\theta_I \beta_a)^2 \beta_p \mu_I}, \quad \mu_I := \frac{1}{2(\beta_p^2 - \sigma^2)}$$

$$x_j^I = \frac{\theta_I \beta_a \mu_I (\beta_p A_{g(j)} + \sigma t_i)}{1 - (\theta_I \beta_a)^2 \beta_p \mu_I}$$

MODEL: INVESTMENT COMPARATIVE STATICS

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- It can be shown that if $\sigma > 0$

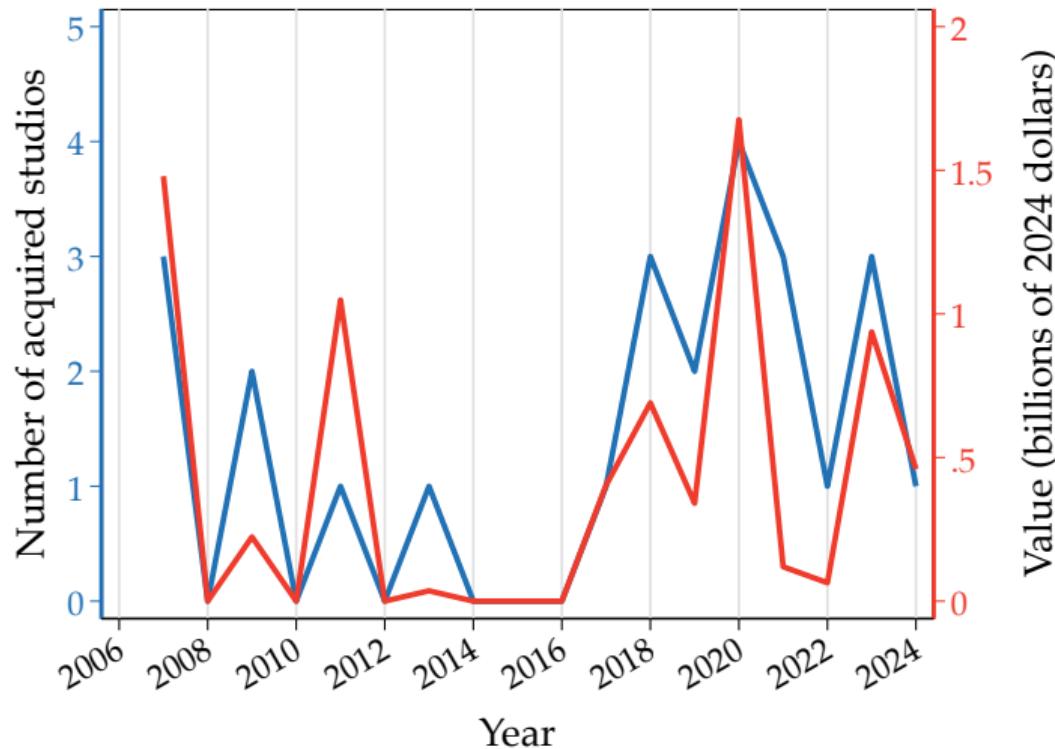
$$\mu_I > 2\mu_S$$

- This implies that,

$$\frac{x_i^I}{x_i^S} = \frac{\mu_I}{2\mu_S} \cdot \frac{\beta_p A_{g(i)} + \sigma t_j}{\beta_p A_{g(i)} + \frac{1}{2}\sigma A_{g(j)}} \cdot \frac{1 - 2(\theta_I \beta_a)^2 \beta_p \mu_S}{1 - (\theta_I \beta_a)^2 \beta_p \mu_I} > 1$$

ACQUISITIONS IN THE VIDEOGAME INDUSTRY

[BACK TO DATA](#)



DEVELOPERS: SUMMARY STATISTICS

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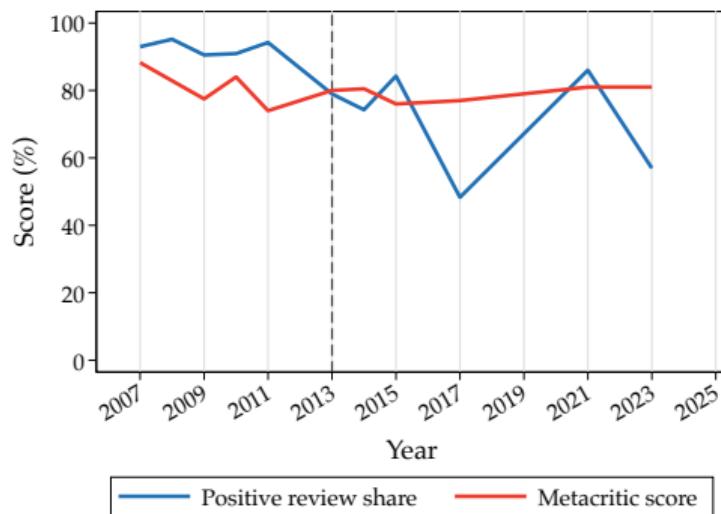
	Mean	SD	Min	Max
Panel (a): Games				
Estimated Sales (millions)	0.73	1.19	0.01	7.50
Metacritic Score (%)	78.39	7.41	64.00	94.00
Positive Reviews (thousands)	9.45	22.35	0.00	154.06
Negative Reviews (thousands)	1.37	3.36	0.00	25.76
Panel (b): Developers				
Number of Games	19.02	7.63	2.00	26.00
Estimated Sales (millions)	11.36	8.28	1.16	33.04
Metacritic Score (%)	77.47	5.17	65.00	85.20
Positive Reviews (thousands)	119.59	83.75	10.09	388.39
Negative Reviews (thousands)	17.74	16.01	1.98	57.83

PUBLISHERS: SUMMARY STATISTICS

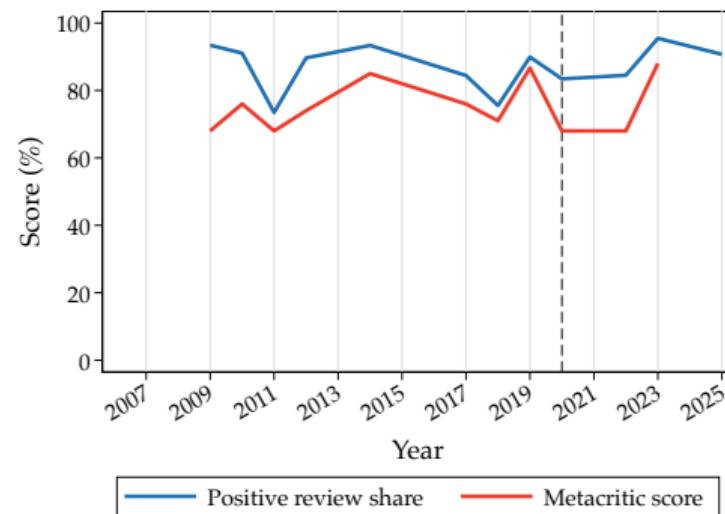
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	Mean	SD	Min	Max
Panel (a): Games				
Estimated Sales (millions)	0.97	5.06	0.01	150.00
Metacritic Score (%)	75.58	9.10	43.00	96.00
Positive Reviews (thousands)	11.64	37.29	0.00	668.05
Negative Reviews (thousands)	2.43	12.67	0.00	326.93
Panel (b): Publishers				
Number of Games	111.27	28.40	1.00	142.00
Estimated Sales (millions)	99.65	96.57	0.01	349.27
Metacritic Score (%)	74.84	3.61	51.00	80.00
Positive Reviews (thousands)	1152.43	1041.06	0.02	3670.00
Negative Reviews (thousands)	243.67	323.99	0.01	1111.46

QUALITY EVOLUTION IS AMBIGUOUS

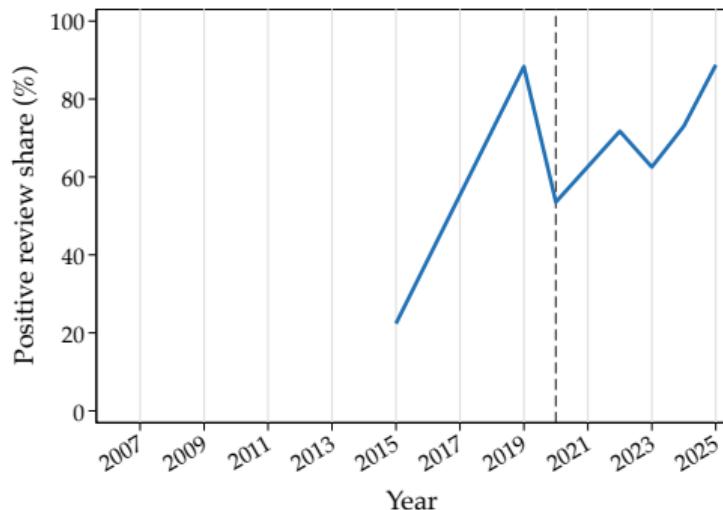
[BACK TO RESULTS](#)

(a) Relic Entertainment (SEGA, 2013)

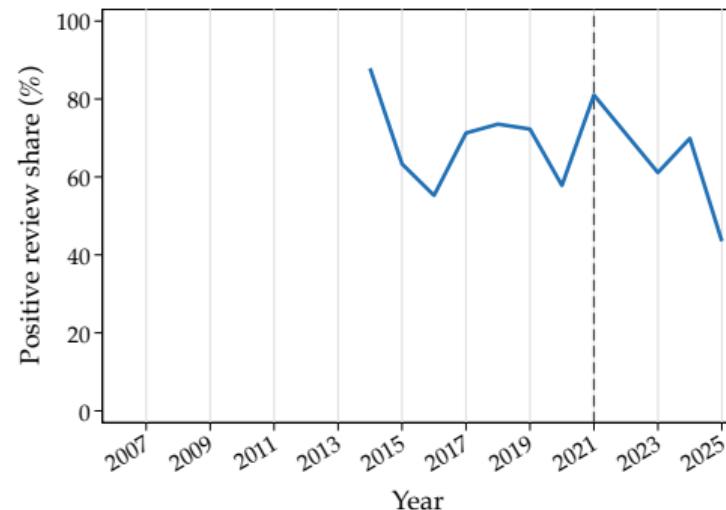


(b) Croteam (Devolver Digital, 2020)

QUALITY EVOLUTION IS AMBIGUOUS

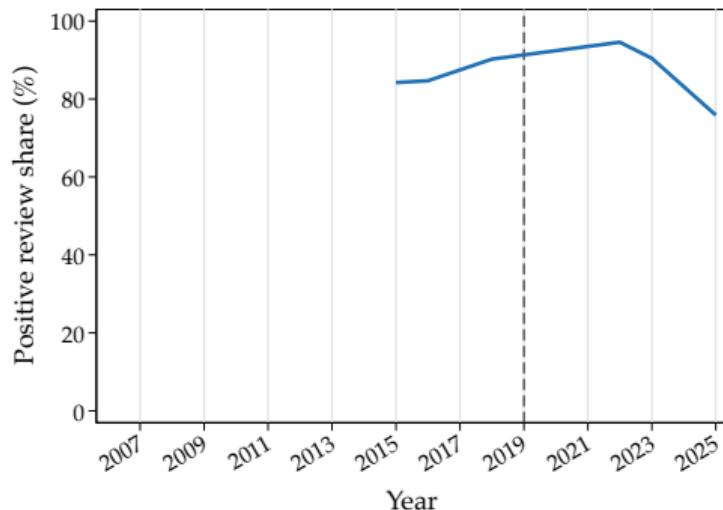
[BACK TO RESULTS](#)

(a) Codemasters (Electronic Arts, 2020)

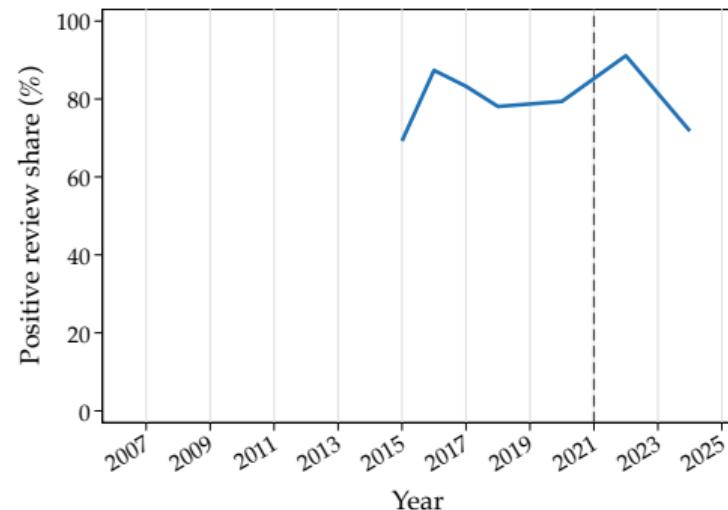


(b) Big Ant Studios (Nacon, 2021)

QUALITY EVOLUTION IS AMBIGUOUS

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(a) Insomniac Games (Sony, 2019)



(b) Nerial (Devolver Digital, 2021)