

**PRODUCT COMPOSITION IN  
VERTICALLY INTEGRATED MARKETS  
IO SUMMER MEETINGS 2025**

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# 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  $\theta_1 \geq \theta_s = 0$ .

- Assume demands for both games are linear:

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

- $A_g$  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  $\sim 106,000$  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**):

$$x_i^S = \frac{\theta_1 \beta_a \mu_S (2\beta_p A_{g(i)} + \sigma A_{g(j)})}{1 - 2(\theta_1 \beta_a)^2 \beta_p \mu_S}, \quad \mu_S := \frac{4\beta_p^2}{4\beta_p^2 - \sigma^2}$$

$$x_j^S = 0$$

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

$$x_i^I = \frac{\theta_1 \beta_a \mu_I (\beta_p A_{g(i)} + \sigma t_j)}{1 - (\theta_1 \beta_a)^2 \beta_p \mu_I}, \quad \mu_I := \frac{1}{2(\beta_p^2 - \sigma^2)}$$

$$x_j^I = \frac{\theta_1 \beta_a \mu_I (\beta_p A_{g(j)} + \sigma t_i)}{1 - (\theta_1 \beta_a)^2 \beta_p \mu_I}$$

# MODEL: INVESTMENT COMPARATIVE STATICS

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

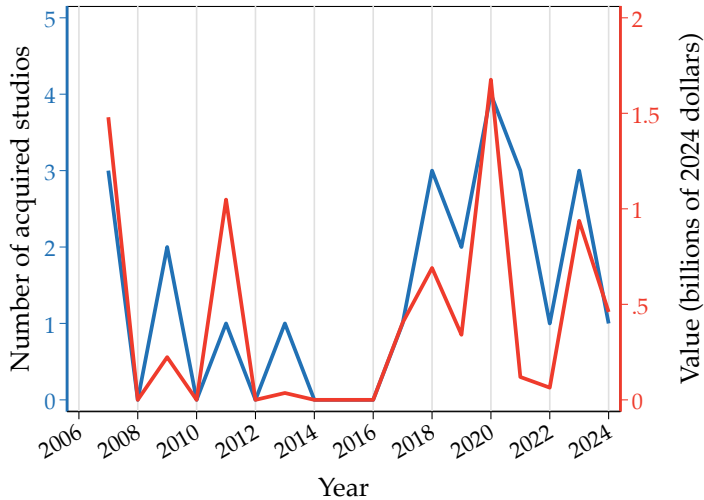
$$\mu_I > 2\mu_S$$

- 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
<b>Panel (a): Games</b>				
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
<b>Panel (b): Developers</b>				
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

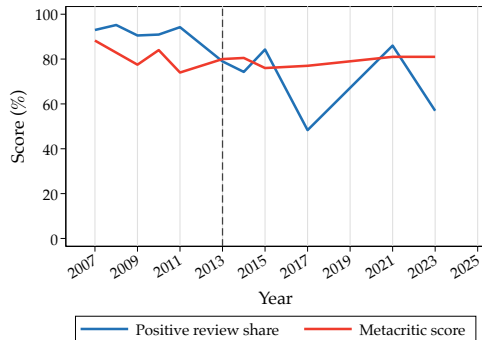
# PUBLISHERS: SUMMARY STATISTICS

[BACK TO DATA](#)

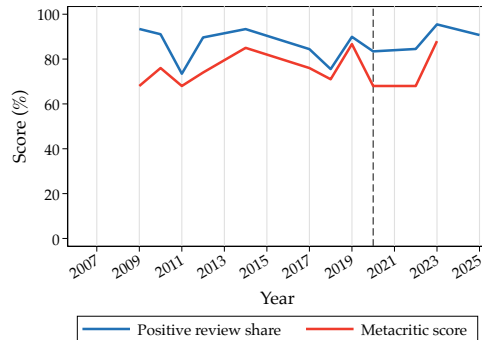
	Mean	SD	Min	Max
<b>Panel (a): Games</b>				
Estimated Sales (millions)	0.97	5.06	0.01	150.00
Metacritic Score (%)	75.58	9.10	43.00	96.00
Positive Reviews (thousands)	11.64	37.29	0.00	668.05
Negative Reviews (thousands)	2.43	12.67	0.00	326.93
<b>Panel (b): Publishers</b>				
Number of Games	111.27	28.40	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

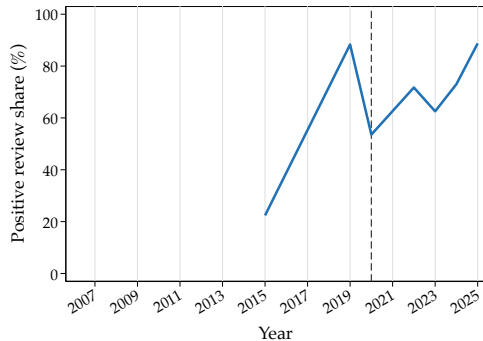
[BACK TO RESULTS](#)

**(a)** Relic Entertainment (SEGA, 2013)

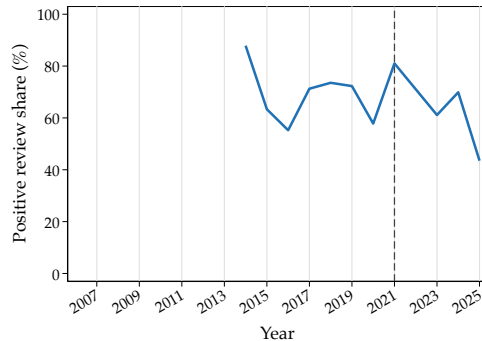


**(b)** Croteam (Devolver Digital, 2020)

# QUALITY EVOLUTION IS AMBIGUOUS

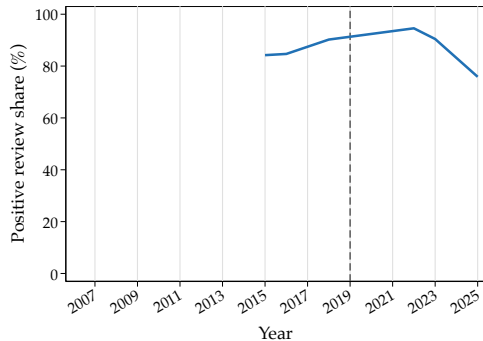
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**(a)** Codemasters (Electronic Arts, 2020)

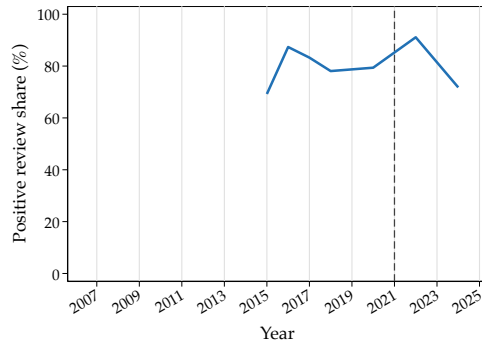


**(b)** Big Ant Studios (Nacon, 2021)

# QUALITY EVOLUTION IS AMBIGUOUS

[BACK TO RESULTS](#)

**(a)** Insomniac Games (Sony, 2019)



**(b)** Nerial (Devolver Digital, 2021)