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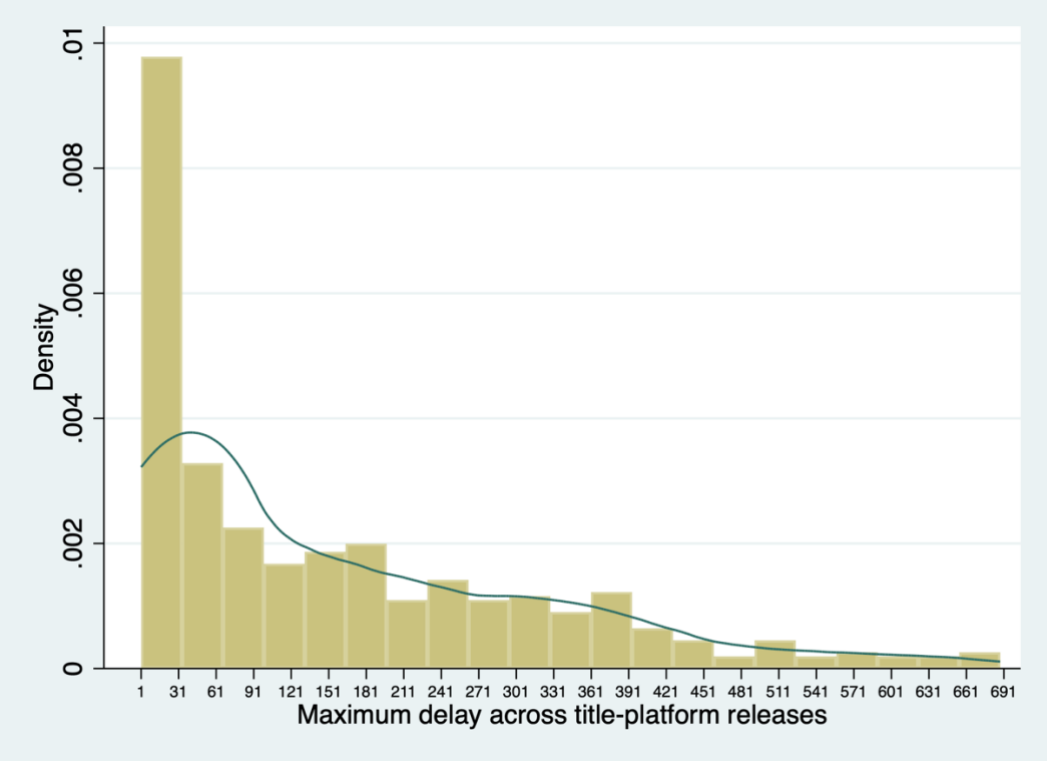
Figure A1. Distribution of Maximum Delay across title-platform releases



Notes. Graph shows the distribution of delay as measured by the maximum number of days of delay across the title-platform releases for a title only for the delayed releases. The top 5% of titles with highest delayed values are omitted in the histogram for readability of the histogram.

Table A1. Results without Cult Game and Bleeding-edge Game Controls

	Base Outcome: Single Homing	Outcome: Sequential Multihoming	Outcome: Simultaneous Multihoming
Independent Variables			
Breadth of Unique Consoles		0.038	0.238
		(0.044) [0.380]	(0.061) [0.000]
PC Specialization		1.980	1.564
		(0.199) [0.000]	(0.251) [0.000]
Licensed Title		0.438	1.287
		(0.148) [0.003]	(0.158) [0.000]
Cult Game Specialization		-0.587	-0.905
		(0.246) [0.017]	(0.327) [0.006]
Console-Specific Programming		-0.281	-1.182
Specialization		(0.199) [0.157]	(0.243) [0.000]
Game Engine Use		1.114	0.782
		(0.251) [0.000]	(0.280) [0.005]
Control Variables			
Physics Engine Use		1.412	1.913
		(0.714) [0.048]	(0.647) [0.003]
Minor Middleware Use		0.711	0.113
		(0.264) [0.007]	(0.299) [0.705]
Bleeding-edge Game Specialization		-0.252	-0.128
		(0.278) [0.364]	(0.329) [0.698]
Sequel		-0.030	-0.174
		(0.156) [0.848]	(0.196) [0.376]
Inhouse		0.392	0.165
		(0.167) [0.019]	(0.212) [0.435]
Project Size		0.032	0.292
		(0.104) [0.761]	(0.117) [0.012]
Assumed Project Size		-0.954	-0.776
		(0.202) [0.000]	(0.179) [0.000]
Observations		1,865	1,865
Year Dummies		YES	YES

Notes. Robust standard errors clustered by developer and reported in ( ), p values reported in [ ]; results show effects compared to the base outcome (single homing).

Table A2. Multinomial Logit Regression Results with Alternative Delay Day Cutoff for Sequential Homing (Sequential Homing if Delay > 0 days)

	Base Outcome: Single Homing	Outcome: Sequential Multihoming	Outcome: Simultaneous Multihoming
Independent Variables			
Breadth of Unique Consoles		0.039	0.230
		(0.044) [0.379]	(0.061) [0.000]
PC Specialization		1.979	1.535
		(0.198) [0.000]	(0.249) [0.000]
Licensed Title		0.447	1.256
		(0.150) [0.003]	(0.154) [0.000]
Cult Game Specialization		-0.568	-0.712
		(0.243) [0.020]	(0.334) [0.033]
Console-Specific Programming		-0.275	-1.223
Specialization		(0.198) [0.164]	(0.244) [0.000]
Game Engine Use		1.103	0.789
		(0.252) [0.000]	(0.280) [0.005]
Control Variables			
Bleeding-edge game		0.095	-0.307
		(0.177) [0.593]	(0.189) [0.105]
Cult game		-0.026	-0.318
		(0.195) [0.896]	(0.239) [0.183]
Physics Engine Use		1.385	1.904
		(0.713) [0.052]	(0.652) [0.004]
Minor Middleware Use		0.708	0.107
		(0.266) [0.008]	(0.301) [0.722]
Bleeding-edge Game Specialization		-0.311	0.053
		(0.286) [0.277]	(0.354) [0.882]
Sequel		-0.027	-0.210
		(0.156) [0.862]	(0.192) [0.274]
Inhouse		0.388	0.153
		(0.167) [0.020]	(0.212) [0.470]
Project Size		0.021	0.332
		(0.107) [0.848]	(0.118) [0.005]
Assumed Project Size		-0.942	-0.796
		(0.202) [0.000]	(0.178) [0.000]
Observations		1,865	1,865
Year Dummies		YES	YES

Notes. Robust standard errors clustered by developer and reported in ( ), p values reported in [ ]; results show effects compared to the base outcome (single homing).

Table A3. Multinomial Logit Regression Results with Alternative Delay Day Cutoff for Sequential Homing (Sequential Homing if Delay > 90 days)

	Base Outcome: Single Homing	Outcome: Sequential Multihoming	Outcome: Simultaneous Multihoming
Independent Variables			
Breadth of Unique Consoles		-0.001	0.218
		(0.047) [0.980]	(0.057) [0.000]
PC Specialization		2.087	1.397
		(0.215) [0.000]	(0.233) [0.000]
Licensed Title		0.228	1.240
		(0.163) [0.163]	(0.145) [0.000]
Cult Game Specialization		-0.487	-0.668
		(0.254) [0.056]	(0.323) [0.038]
Console-Specific Programming		-0.218	-1.175
Specialization		(0.208) [0.294]	(0.230) [0.000]
Game Engine Use		1.106	0.846
		(0.270) [0.000]	(0.262) [0.001]
Control Variables			
Bleeding-edge game		0.172	-0.282
		(0.196) [0.379]	(0.174) [0.105]
Cult game		0.044	-0.293
		(0.205) [0.830]	(0.220) [0.183]
Physics Engine Use		1.177	1.917
		(0.736) [0.110]	(0.632) [0.002]
Minor Middleware Use		0.789	0.142
		(0.274) [0.004]	(0.294) [0.630]
Bleeding-edge Game Specialization		-0.246	-0.011
		(0.306) [0.421]	(0.332) [0.974]
Sequel		0.129	-0.333
		(0.166) [0.440]	(0.181) [0.066]
Inhouse		0.386	0.213
		(0.178) [0.030]	(0.198) [0.282]
Project Size		-0.004	0.288
		(0.119) [0.976]	(0.108) [0.008]
Assumed Project Size		-0.960	-0.834
		(0.225) [0.000]	(0.172) [0.000]
Observations		1,865	1,865
Year Dummies		YES	YES

Notes. Robust standard errors clustered by developer and reported in ( ), p values reported in [ ]; results show effects compared to the base outcome (single homing).

Table A4. Multinomial Logit Regression Results with Alternative Delay Day Cutoff for Sequential Homing (Sequential Homing if Delay > 180 days)

	Base Outcome: Single Homing	Outcome: Sequential Multihoming	Outcome: Simultaneous Multihoming
Independent Variables			
Breadth of Unique Consoles		0.003	0.185
		(0.050) [0.959]	(0.053) [0.000]
PC Specialization		2.123	1.368
		(0.230) [0.000]	(0.224) [0.000]
Licensed Title		0.213	1.082
		(0.166) [0.200]	(0.142) [0.000]
Cult Game Specialization		-0.323	-0.698
		(0.264) [0.221]	(0.310) [0.024]
Console-Specific Programming		-0.376	-1.078
Specialization		(0.221) [0.089]	(0.207) [0.000]
Game Engine Use		0.864	1.026
		(0.278) [0.002]	(0.256) [0.000]
Control Variables			
Bleeding-edge game		0.181	-0.190
		(0.215) [0.399]	(0.164) [0.247]
Cult game		0.196	-0.331
		(0.221) [0.375]	(0.214) [0.122]
Physics Engine Use		1.405	1.756
		(0.745) [0.059]	(0.632) [0.005]
Minor Middleware Use		0.910	0.196
		(0.285) [0.001]	(0.266) [0.461]
Bleeding-edge Game Specialization		-0.170	-0.021
		(0.333) [0.609]	(0.310) [0.947]
Sequel		0.184	-0.261
		(0.172) [0.283]	(0.178) [0.141]
Inhouse		0.217	0.317
		(0.182) [0.233]	(0.188) [0.091]
Project Size		-0.020	0.237
		(0.143) [0.889]	(0.103) [0.022]
Assumed Project Size		-0.897	-0.866
		(0.253) [0.000]	(0.167) [0.000]
Observations		1,865	1,865
Year Dummies		YES	YES

Notes. Robust standard errors clustered by developer and reported in ( ), p values reported in [ ]; results show effects compared to the base outcome (single homing).

Table A5. Ordered Probit Regression Results

	(1) PC and Console Homing
Independent Variables	
Breadth of Unique Consoles	0.097 (0.027) [0.000]
PC Specialization	0.802 (0.099) [0.000]
Licensed Title	0.541 (0.065) [0.000]
Cult Game Specialization	-0.345 (0.130) [0.008]
Console-Specific Programming Specialization	-0.484 (0.100) [0.000]
Game Engine Use	0.279 (0.102) [0.006]
Control Variables	
Bleeding-edge Game Specialization	-0.041 (0.141) [0.772]
Bleeding-edge game	-0.078 (0.079) [0.325]
Cult game	-0.101 (0.099) [0.311]
Physics Engine Use	0.609 (0.200) [0.002]
Minor Middleware Use	0.106 (0.106) [0.317]
Sequel	-0.078 (0.079) [0.325]
Inhouse	0.113 (0.090) [0.206]
Project Size	0.105 (0.051) [0.041]
Assumed Project Size	-0.424 (0.083) [0.000]
Cut Point 1	0.736 (0.109)
Cut Point 2	1.626 (0.109)
Observations	1,865
Year Dummies	YES

Notes. Robust standard errors clustered by developer and reported in ( ), p values reported in [ ]; outcome is homing strategy of the unique title (1= Single Homing, 2= Sequential Multihoming, 3= Simultaneous Multihoming).

Creating Clusters of Games Based on BERT Model Vectorization of the Game Synopsis Text Data

Given our theory rests on comparativeness of adjustment and opportunity costs, we aimed to cluster comparable games into fine grained categories, and control for cluster level fixed effects. To do so, we used textual descriptions of the games provided on the Mobygames and utilized BERT (Bidirectional Encoder Representations from Transformers), a state-of-the-art NLP model, for generating embeddings. The descriptions include information on graphics, gameplay mechanics, storylines, character development, and thematic elements, providing a comprehensive overview of each game's unique features and innovations which are directly related to firms' capabilities. These embeddings are high-dimensional representations of the text, capturing the semantic essence of each game's description in a form that can be mathematically analyzed. After converting all game descriptions into their embedding vectors, we employed the k-means algorithm to group these embeddings into 100 clusters. This step aims to categorize games into groups based on the similarity of their descriptions, thereby highlighting underlying patterns or themes in video game innovation. We then incorporated cluster fixed effects into our regressions. This allowed us to control firm-level capabilities in terms of their innovation content, as content is directly related to the complexity, coding base, and graphics of the game. Thus, we more accurately isolated the effect of our variables of interest on the homing strategy outcomes. The results, shown below in Table A6, remained consistent with the baseline analyses.

Table A6. Multinomial Logit Regression Results with Cluster FE Based on BERT Model Vectorization of the Text Data (Game Synopses)

	Base Outcome: Single Homing	Outcome: Sequential Multihoming	Outcome: Simultaneous Multihoming
Independent Variables			
Breadth of Unique Consoles		0.597	0.218
		(0.043) [0.169]	(0.060) [0.000]
PC Specialization		2.040	1.531
		(0.218) [0.000]	(0.252) [0.000]
Licensed Title		0.522	1.199
		(0.171) [0.002]	(0.186) [0.000]
Cult Game Specialization		-0.597	-0.796
		(0.274) [0.029]	(0.342) [0.020]
Console-Specific Programming		-0.292	-1.210
Specialization		(0.217) [0.178]	(0.254) [0.000]
Game Engine Use		0.972	0.725
		(0.260) [0.000]	(0.302) [0.016]
Control Variables			
Bleeding-edge game		0.024	-0.231
		(0.228) [0.916]	(0.250) [0.356]
Cult game		0.086	-0.152
		(0.228) [0.706]	(0.276) [0.581]
Physics Engine Use		1.426	1.786
		(0.680) [0.036]	(0.635) [0.005]
Minor Middleware Use		0.883	0.206
		(0.277) [0.001]	(0.334) [0.537]
Bleeding-edge Game Specialization		-0.386	0.181
		(0.306) [0.207]	(0.346) [0.602]
Sequel		-0.027	-0.210
		(0.164) [0.871]	(0.218) [0.335]
Inhouse		0.314	0.151
		(0.180) [0.081]	(0.207) [0.464]
Project Size		-0.040	0.315
		(0.118) [0.733]	(0.134) [0.019]
Assumed Project Size		-1.039	-0.968
		(0.272) [0.000]	(0.219) [0.000]
Observations		1,839	1,839
Cluster FE (100 Clusters)		YES	YES
Year Dummies		YES	YES

Notes. Robust standard errors clustered by developer and reported in ( ), *p* values reported in [ ]; results show effects compared to the base outcome (single homing).

Table A7. Logit Models with Only Two Homing Samples: Single vs. Simultaneous; Sequential vs. Simultaneous

	Logit: Single vs. Simultaneous	Logit: Sequential vs. Simultaneous
Base Outcome:	Single Homing	Sequential Multihoming
Independent Variables		
Breadth of Unique Consoles	0.226	0.185
	(0. 062) [0.000]	(0.045) [0.000]
PC Specialization	1.490	-0.365
	(0. 263) [0.000]	(0.227) [0.108]
Licensed Title	1.248	0.761
	(0. 164) [0.000]	(0.164) [0.000]
Cult Game Specialization	-0.808	-0.109
	(0. 350) [0.021]	(0.310) [0.724]
Console-Specific Programming Specialization	-1.131	-0.856
	(0. 257) [0.000]	(0.239) [0.000]
Game Engine Use	0.786	-0.304
	(0.327) [0.016]	(0.253) [0.230]
Control Variables		
Bleeding-edge game	-0.379	-0.375
	(0. 192) [0.048]	(0.227) [0.098]
Cult game	-0.378	-0.115
	(0.251) [0.132]	(0.255) [0.653]
Physics Engine Use	1.883	0.526
	(0.680) [0.006]	(0.458) [0.251]
Minor Middleware Use	-0.055	-0.605
	(0.331) [0.868]	(0.342) [0.077]
Bleeding-edge Game Specialization	-0.073	0.349
	(0.370) [0.843]	(0.316) [0.269]
Sequel	-0.215	-0.183
	(0.200) [0.282]	(0.179) [0.306]
Inhouse	0.124	-0.220
	(0.222) [0.578]	(0.190) [0.247]
Project Size	0.358	0.306
	(0.115) [0.002]	(0.156) [0.051]
Assumed Project Size	-0.879	0.192
	(0.189) [0.000]	(0.248) [0.440]
Observations	1,385	887
Year Dummies	YES	YES

Notes. Robust standard errors clustered by developer and reported in ( ), p values reported in [ ].

Controlling for Timed Exclusivity

One concern regarding our analysis relates to the potential influence of a game's popularity on its strategic responses across different platforms. It is reasonable to speculate that new gaming platforms might actively pursue popular and commercially successful games, possibly offering additional incentives to enhance their platform's appeal. These dynamics could significantly affect game developers' multihoming strategies.

To address this concern and better understand the dynamics at play, we created a variable that captured timed exclusivity. Timed exclusivity agreements, wherein a game is released exclusively on one platform for a set period before becoming available on others, can indeed reflect a title's appeal and the platform developer's strategy to leverage this appeal to attract users. However, identifying such agreements presents challenges, as the details of exclusivity are often not publicly disclosed.

To navigate this challenge, we employed a heuristic approach to infer potential timed exclusivity arrangements. Specifically, we examined games that transitioned from being exclusive to one console to being available on another, using a criterion of a 180-day (half-year exclusivity; plus or minus five day is included) or 365-day gap (full year exclusivity; plus or minus five day included) between releases on different platforms. This method provides an indirect measure of its strategic deployment across platforms, under the assumption that a delayed release on additional platforms may signify an initial period of exclusivity. Even after controlling for Console Timed Exclusive, results remained consistent with the baseline analyses.

Table A8. Multinomial Logit Regression Results with Timed Exclusive Control Variable

	Base Outcome: Single Homing	Outcome: Sequential Multihoming	Outcome: Simultaneous Multihoming
Independent Variables			
Breadth of Unique Consoles		0.067	0.230
		(0.044) [0.129]	(0.061) [0.000]
PC Specialization		1.922	1.549
		(0.201) [0.000]	(0.251) [0.000]
Licensed Title		0.423	1.250
		(0.150) [0.005]	(0.154) [0.000]
Cult Game Specialization		-0.497	-0.687
		(0.241) [0.039]	(0.338) [0.042]
Console-Specific Programming Specialization		-0.263	-1.219
		(0.200) [0.190]	(0.244) [0.000]
Game Engine Use		1.089	0.718
		(0.250) [0.000]	(0.281) [0.011]
Control Variables			
Console Timed Exclusive		17.221	0.196
		(0.343) [0.000]	(0.358) [0.584]
Bleeding-edge game		0.130	-0.295
		(0.172) [0.451]	(0.188) [0.116]
Cult game		0.006	-0.331
		(0.192) [0.977]	(0.240) [0.169]
Physics Engine Use		1.400	1.927
		(0.710) [0.049]	(0.650) [0.003]
Minor Middleware Use		0.631	0.101
		(0.269) [0.019]	(0.302) [0.738]
Bleeding-edge Game Specialization		-0.254	0.085
		(0.295) [0.390]	(0.354) [0.810]
Sequel		0.024	-0.199
		(0.155) [0.875]	(0.191) [0.297]
Inhouse		0.335	0.161
		(0.167) [0.044]	(0.211) [0.446]
Project Size		-0.040	0.285
		(0.112) [0.723]	(0.118) [0.016]
Assumed Project Size		-0.897	-0.779
		(0.197) [0.000]	(0.177) [0.000]
Observations		1,865	1,865
Year Dummies		YES	YES

Notes. Robust standard errors clustered by developer and reported in ( ), *p* values reported in [ ]; results show effects compared to the base outcome (single homing). Console timed exclusive is a dummy variable that takes the value of 1 if the title has 180 (+/- 5 days) or 365 (+/- 5 days) of release delay across two consoles. This does not preclude a game from simultaneously multihoming across a PC and a console, but by definition excludes simultaneously multihoming games across at least two consoles.

Table A9. Multinomial Logit Regression Results Controlling for the Previous Hit Titles by the Developer

	Base Outcome: Single Homing	Outcome: Sequential Multihoming	Outcome: Simultaneous Multihoming
Independent Variables			
Breadth of Unique Consoles		0.107	0.269
		(0.045) [0.018]	(0.055) [0.000]
PC Specialization		1.987	1.548
		(0.196) [0.000]	(0.252) [0.000]
Licensed Title		0.470	1.269
		(0.151) [0.002]	(0.156) [0.000]
Cult Game Specialization		-0.624	-0.753
		(0.243) [0.010]	(0.334) [0.024]
Console-Specific Programming		-0.315	-1.234
Specialization		(0.195) [0.106]	(0.241) [0.000]
Game Engine Use		1.062	0.766
		(0.252) [0.000]	(0.279) [0.006]
Control Variables			
Log Number of Previous Hit Titles		-0.306	-0.169
		(0.128) [0.017]	(0.147) [0.250]
Bleeding-edge game		0.075	-0.320
		(0.177) [0.673]	(0.190) [0.092]
Cult game		-0.043	-0.329
		(0.194) [0.825]	(0.241) [0.172]
Physics Engine Use		1.360	1.883
		(0.711) [0.056]	(0.650) [0.004]
Minor Middleware Use		0.718	0.104
		(0.269) [0.008]	(0.301) [0.731]
Bleeding-edge Game Specialization		-0.325	0.029
		(0.285) [0.254]	(0.355) [0.934]
Sequel		0.002	-0.197
		(0.157) [0.988]	(0.194) [0.309]
Inhouse		0.508	0.223
		(0.160) [0.002]	(0.212) [0.293]
Project Size		0.050	0.350
		(0.107) [0.637]	(0.116) [0.003]
Assumed Project Size		-0.966	-0.806
		(0.193) [0.000]	(0.177) [0.000]
Observations		1,865	1,865
Year Dummies		YES	YES

Notes. Robust standard errors clustered by developer and reported in ( ), *p* values reported in [ ]; results show effects compared to the base outcome (single homing). Previous hit titles by the developer is calculated based on Corts and Lederman (2009) – any title which its first year sales exceed the 90th percentile first year sales in the sales sample is considered a hit.

Table A10. Multinomial Logit Regression Results for Generation 6 Games Released in Japan

	Base Outcome: Single Homing	Outcome: Sequential Multihoming	Outcome: Simultaneous Multihoming
Independent Variables			
Breadth of Unique Consoles		-0.043	0.220
		(0.059) [0.461]	(0.0900) [0.015]
PC Specialization		1.575	2.133
		(0.321) [0.000]	(0.453) [0.000]
Licensed Title		0.582	1.292
		(0.244) [0.017]	(0.270) [0.000]
Cult Game Specialization		-0.719	-1.366
		(0.426) [0.091]	(0.561) [0.015]
Console-Specific Programming		0.330	-1.110
Specialization		(0.358) [0.357]	(0.455) [0.015]
Game Engine Use		0.892	1.156
		(0.399) [0.025]	(0.559) [0.039]
Control Variables			
Bleeding-edge game		0.147	-0.293
		(0.278) [0.598]	(0.269) [0.277]
Cult game		-0.578	-1.122
		(0.318) [0.069]	(0.383) [0.003]
Physics Engine Use		0.619	2.100
		(1.470) [0.674]	(0.937) [0.025]
Minor Middleware Use		0.747	0.237
		(0.344) [0.030]	(0.409) [0.563]
Bleeding-edge Game Specialization		-0.552	0.011
		(0.468) [0.238]	(0.578) [0.984]
Sequel		0.099	0.196
		(0.238) [0.679]	(0.271) [0.471]
Inhouse		0.211	0.280
		(0.261) [0.420]	(0.274) [0.307]
Project Size		0.064	0.435
		(0.155) [0.681]	(0.159) [0.006]
Assumed Project Size		-0.670	-0.808
		(0.259) [0.010]	(0.300) [0.007]
Observations		1,057	1,057
Year Dummies		YES	YES

Notes. Robust standard errors clustered by developer and reported in ( ), *p* values reported in [ ]; results show effects compared to the base outcome (single homing).

Table A11. Multinomial Logit Regression Results for 2000-2002 (Early Period) and 2003-2005 (Later Period)

	2000-2002 Sample		2003-2005 Sample	
	Outcome: Sequential Multihoming	Outcome: Simultaneous Multihoming	Outcome: Sequential Multihoming	Outcome: Simultaneous Multihoming
Independent Variables				
Breadth of Unique Consoles	0.056	0.229	0.014	0.232
	(0.053) [0.295]	(0.071) [0.001]	(0.071) [0.845]	(0.083) [0.005]
PC Specialization	2.022	1.350	1.950	1.661
	(0.247) [0.000]	(0.353) [0.000]	(0.309) [0.000]	(0.337) [0.000]
Licensed Title	0.419	1.223	0.489	1.311
	(0.188) [0.026]	(0.242) [0.000]	(0.224) [0.029]	(0.212) [0.000]
Cult Game Specialization	-0.545	-0.611	-0.534	-0.761
	(0.304) [0.073]	(0.491) [0.213]	(0.376) [0.156]	(0.445) [0.088]
Console-Specific Programming Specialization	-0.208	-0.781	-0.457	-1.530
	(0.257) [0.419]	(0.331) [0.018]	(0.320) [0.154]	(0.342) [0.000]
Game Engine Use	1.232	0.488	0.980	0.814
	(0.340) [0.000]	(0.508) [0.337]	(0.386) [0.011]	(0.397) [0.040]
Control Variables				
Bleeding-edge game	0.056	-0.511	0.098	-0.257
	(0.199) [0.778]	(0.291) [0.080]	(0.290) [0.737]	(0.262) [0.327]
Cult game	0.235	0.166	-0.419	-0.671
	(0.231) [0.309]	(0.336) [0.622]	(0.325) [0.197]	(0.306) [0.028]
Physics Engine Use	-1.124	15.223	1.362	1.758
	(0.342) [0.001]	(1.115) [0.000]	(0.743) [0.067]	(0.683) [0.010]
Minor Middleware Use	0.480	0.361	0.847	0.082
	(0.425) [0.259]	(0.574) [0.530]	(0.337) [0.012]	(0.380) [0.830]
Bleeding-edge Game Specialization	-0.386	-0.101	-0.215	0.134
	(0.395) [0.329]	(0.552) [0.855]	(0.429) [0.615]	(0.451) [0.767]
Sequel	0.079	-0.014	-0.165	-0.342
	(0.190) [0.678]	(0.224) [0.950]	(0.224) [0.463]	(0.245) [0.163]
Inhouse	0.415	-0.004	0.357	0.217
	(0.217) [0.056]	(0.284) [0.988]	(0.249) [0.152]	(0.272) [0.424]
Project Size	-0.036	0.274	0.096	0.402
	(0.123) [0.772]	(0.150) [0.068]	(0.215) [0.654]	(0.183) [0.029]
Assumed Project Size	-0.860	-0.281	-1.050	-1.089
	(0.228) [0.000]	(0.281) [0.317]	(0.316) [0.001]	(0.230) [0.000]
Observations	994	994	871	871
Year Dummies	YES	YES	YES	YES

Notes. Robust standard errors clustered by developer and reported in ( ), *p* values reported in [ ]; results show effects compared to the base outcome (single homing).

Table A12. Second Stage Multinomial Logit Regression Results

	Base Outcome: Single Homing	Outcome: Sequential Multihoming	Outcome: Simultaneous Multihoming
Independent Variables			
Breadth of Unique Consoles		0.029	0.224
		(0.041) [0.478]	(0.045) [0.000]
PC Specialization		2.059	1.582
		(0.203) [0.000]	(0.211) [0.000]
Licensed Title		0.462	1.267
		(0.126) [0.000]	(0.140) [0.000]
Cult Game Specialization		-0.564	-0.705
		(0.262) [0.031]	(0.342) [0.039]
Console-Specific Programming Specialization		-0.305	-1.241
		(0.200) [0.128]	(0.237) [0.000]
Game Engine Use		0.501	0.270
		(0.112) [0.000]	(0.127) [0.034]
Control Variables			
Bleeding-edge game		0.128	-0.288
		(0.169) [0.451]	(0.163) [0.078]
Cult game		-0.012	-0.312
		(0.189) [0.948]	(0.178) [0.079]
Physics Engine Use		1.447	1.938
		(2.892) [0.617]	(2.822) [0.492]
Minor Middleware Use		0.794	0.161
		(0.249) [0.001]	(0.307) [0.600]
Bleeding-edge Game Specialization		-0.232	0.109
		(0.293) [0.428]	(0.318) [0.732]
Sequel		-0.021	-0.208
		(0.144) [0.882]	(0.143) [0.146]
Inhouse		0.425	0.177
		(0.141) [0.003]	(0.186) [0.342]
Project Size		0.020	0.332
		(0.095) [0.830]	(0.128) [0.010]
Assumed Project Size		-0.963	-0.810
		(0.193) [0.000]	(0.217) [0.000]
Observations		1,865	1,865
Year Dummies		YES	YES

Notes. Robust standard errors clustered by developer and reported in ( ), p values reported in [ ]; results show effects compared to the base outcome (single homing).

Table A13. First Stage Probit Regression Results

	Engine Use
Instruments	
Distance to Closest Engine Provider	-0.009
	(0.002) [0.000]
Independent Variables	
Breadth of Unique Consoles	-0.039
	(0.037) [0.294]
PC Specialization	0.020
	(0.190) [0.915]
Licensed Title	-0.006
	(0.114) [0.959]
Cult Game Specialization	0.221
	(0.208) [0.286]
Console-Specific	-0.186
Programming Specialization	(0.165) [0.259]
Control Variables	
Bleeding-edge Game Specialization	0.503
	(0.211) [0.017]
Bleeding-edge game	0.182
	(0.145) [0.211]
Cult game	0.105
	(0.152) [0.491]
Physics Engine Use	0.177
	(0.240) [0.460]
Minor Middleware Use	0.428
	(0.155) [0.006]
Sequel	0.031
	(0.097) [0.745]
Inhouse	0.254
	(0.118) [0.032]
Project Size	-0.015
	(0.072) [0.831]
Assumed Project Size	-0.127
	(0.158) [0.423]
Constant	-1.293
	(0.219) [0.000]
Observations	1,865
Year Dummies	YES

Notes. Robust standard errors clustered by developer and reported in ( ), *p* values reported in [ ]; outcome is game engine use by the unique title.

Validity of the Exclusion Restriction

The exclusion restriction assumption states that the instrumental variable (Z) should affect the dependent variable (Y) only through its effect on the independent variable (X). In other words, Z should not have a direct effect on Y, nor should it be correlated with any other unobserved factors that influence Y.

In our setting, the use of game engines began to surge dramatically for consoles starting in 2001, following the introduction of official licensing programs by Sony at the end of 2000, and by its competitors in 2001. The original purpose behind launching of the three game engines during this period - Renderware by Criterion Software, Unreal Engine by Epic Games, and idTech/Quake Engine by id Software - was not to license these technologies to other companies, but rather to utilize them in-house. For instance, Epic Games, initially established as Potomac Games in 1991, released its first Unreal Engine for PC games in 1998. Consequently, firms located near these engine providers are not necessarily superior, nor are these areas necessarily dense with talent. This assertion is corroborated by data in Table A14, which reveals no correlation between a firm's proximity to an engine provider and game revenues, or between the average experience and tenure of the core development team.

On the other hand, distance to the engine providers mattered, especially when the adoption of licensed technology began to pick up. Many developers initially approached these technologies with a "not-invented-here" syndrome. However, having a major engine provider in close proximity was beneficial for both understanding the engine, and receiving support from on-site designers and programmers (McDonald, 1998; Lightbown, 2018).

Despite these arguments, it is difficult to definitively establish that exclusion restriction is not violated. Recently, researchers have developed diagnostic tests to assess if there are signs of such violations. Although these tests do not offer definitive proof or proof of the restriction, they do offer some insights into the credibility of the analysis.

Two popular approaches have emerged in recent years to detect and investigate sensitivity to violations of the exclusion restriction in instrumental variable (IV) estimation. The first approach, the zero-first-stage test, uses an auxiliary regression to informally test the exclusion restriction. Researchers select a sub-sample where the endogeneous treatment variable is zero (i.e., X = 0) and run a regression on the dependent variable by including the instrumental variable (Z) and other control variables. If the exclusion restriction is satisfied, the reduced form effect should be zero when the first stage effect is zero (e.g., Altonji et al., 2005; Angrist et al., 2010). Although this test cannot verify the exclusion restriction, it helps build confidence in its satisfaction. The second approach, the "plausibly exogenous" method, allows for a robustness investigation of the IV estimator based on prior information about the violation of the exclusion restriction (Conley, Hansen & Rossi, 2012). This approach provides estimates of whether the statistical analysis would hold if we allow for correlation between the exogenous instrument and the outcome variable (i.e., if we violate the exclusion restriction). This method requires us to specify a “modest” range of γ which indicates the correlation (effectively the regression coefficient between y and Z, i.e., $y = \alpha + \beta X + \gamma Z + \epsilon$). This method corrects for such violations of the exclusion restriction within this range.

Both approaches have limitations when applied independently. The zero-first-stage test may require dropping a promising IV if a violation is detected, while the plausibly exogenous method relies on prior information about the violation, which may not always be available. van Kippersluis and Rietveld (2018) propose a synthesis of the two approaches, overcoming their individual limitations. The zero-first-stage test provides a direct estimate of the input parameter required for the plausibly exogenous approach, and the plausibly exogenous approach can correct for violations detected by the zero-first-stage test. This combined method allows for informed sensitivity analyses in IV estimation which we also adopt in this paper.

For our zero-first stage, we selected U.S. firms that did not use Engine (i.e., Engine = 0; Country = US) from which we obtained the standard errors of our instrumental variable, distance to middleware providers (S_0). We repeated the same step for the remainder of the sample and similarly obtained standard errors (S_{-0}). Following the suggestion by van Kippersluis and Rietveld (2018), we used Imbens and Rubin (2015) rule to define the uncertainty around $\hat{\gamma}$ as $\Omega_\gamma = [0.125\sqrt{S_0^2 + S_{-0}^2}]^2$, We report the coefficients of the plausibly exogenous IV approach using several different parameter values in Table A15. Our analyses suggest that our findings are robust to potential violations of the exclusion restriction condition under different parameters.

Table A14. Title-platform Revenues and Title Team Industry Tenure and Experience in Relation to Distance to Closest Engine Provider

	(1) DV= Title-platform Logged First 12 Months Revenue	(2) DV= Title Average Industry Tenure (in Years) of the Development Team	(3) DV= Title Average Title Experience of the Development Team
Distance to Closest Engine Provider	-0.006	0.006	-0.015
	(0.008) [0.475]	(0.006) [0.306]	(0.014) [0.260]
Sequel	0.686	0.116	0.323
	(0.074) [0.000]	(0.074) [0.118]	(0.151) [0.033]
Inhouse	0.117	-0.084	-0.494
	(0.203) [0.565]	(0.203) [0.679]	(0.324) [0.127]
Project Size	0.334	-0.450	-0.756
	(0.056) [0.000]	(0.062) [0.000]	(0.138) [0.000]
Assumed Project Size	-0.349	0.131	-0.105
	(0.099) [0.000]	(0.139) [0.347]	(0.247) [0.670]
Constant	14.833	3.935	5.851
	(0.523) [0.000]	(0.431) [0.000]	(0.851) [0.000]
Observations	2,795	1,576	1,576
R-squared	0.308	0.282	0.133
YearFE	YES	YES	YES
GenreFE	YES	YES	YES
DeveloperFE	YES	YES	YES
PlatformFE	YES	Not Applicable	Not Applicable

Notes. Robust standard errors clustered by developer and reported in ( ), p values reported in [ ]; Model 1 is based on title-platform observations with the sum of first 12 months of revenue (logged) as the dependent variable and a OLS estimation with fixed effects; Models 2 and 3 are based on unique title observations with the Model 2 having the average of the industry tenure (years since the first game in the industry) of the development team as a dependent variable, and Model 3 having the average unique title experience of the development team as a dependent variable, with both models being OLS estimation with fixed effec

Table A15. Sensitivity to violation of Exclusion Restriction

Parameters	Coef.	S.E.	z-value
$\mu = 0; \Omega_\gamma = [0.125\sqrt{S_0^2 + S_{-0}^2}]^2$	6.71	1.695	3.96
$\mu = \hat{\gamma}; \Omega_\gamma = 0$	139.68	1.656	84.35
$\mu = \hat{\gamma}; \Omega_\gamma = [0.125\sqrt{S_0^2 + S_{-0}^2}]^2$	139.68	5.403	25.85

Robustness of Results to a Different Instrument Functional Form

A weakness of the first stage Probit model is that the comparable F-test for linear regression is not available, which limits out ability to evaluate instrument strength. To counter this weakness, we used a different instrument functional form to evaluate the instrument. Using a generating regression, we generated a so-called "weak" instrument from a Probit estimation of set of exogenous variables, and used the estimated probability as an instrument in the IV estimation with a linear first stage (See Wooldridge 2010, chapt. 6.1; Xu 2021). Even when the functional form of the generating regression is incorrectly specified, the estimates are reliable. For the first stage regression, the instrument F-statistic is much larger than the baseline analyses (65.018 > 14.020; Kleibergen-Paap LM Chi-Squared Statistic p = 0.000). Table A16 reports coefficient estimates for the second stage ordered multinomial logit regression. These results are again qualitatively similar to our other findings.

Table A16. Multinomial Logit Regression Results with a Different Instrument Functional Form

	Base Outcome: Single Homing	Outcome: Sequential Multihoming	Outcome: Simultaneous Multihoming
Independent Variables			
Breadth of Unique Consoles		0.059	0.216
		(0.037) [0.114]	(0.043) [0.000]
PC Specialization		1.906	1.383
		(0.170) [0.000]	(0.243) [0.000]
Licensed Title		0.460	1.262
		(0.146) [0.002]	(0.164) [0.000]
Cult Game Specialization		-0.465	-0.727
		(0.245) [0.058]	(0.316) [0.021]
Console-Specific Programming		-0.634	-1.170
Specialization		(0.189) [0.001]	(0.274) [0.000]
Game Engine Use (Instrumented)		0.951	0.613
		(0.229) [0.000]	(0.266) [0.021]
Control Variables			
Bleeding-edge game		0.103	-0.268
		(0.167) [0.537]	(0.182) [0.140]
Cult game		-0.046	-0.346
		(0.173) [0.788]	(0.217) [0.110]
Physics Engine Use		1.443	1.947
		(2.485) [0.561]	(2.473) [0.431]
Minor Middleware Use		0.855	0.182
		(0.239) [0.000]	(0.285) [0.522]
Bleeding-edge Game Specialization		-0.154	-0.025
		(0.281) [0.584]	(0.315) [0.938]
Sequel		-0.010	-0.218
		(0.112) [0.928]	(0.129) [0.091]
Inhouse		0.392	0.173
		(0.153) [0.010]	(0.180) [0.336]
Project Size		0.022	0.332
		(0.102) [0.831]	(0.099) [0.001]
Assumed Project Size		-0.945	-0.806
		(0.202) [0.000]	(0.191) [0.000]
Observations		1,865	1,865
Year Dummies		YES	YES

Notes. Robust standard errors clustered by developer and reported in ( ), p values reported in [ ]; results show effects compared to the base outcome (single homing).

Using Matched Sample

Coarsened exact matching offers an alternative methodology to an instrumental variable estimation strategy. To implement the estimation strategy, firms that adopted an engine were matched to those that did not adopt an engine. This matching was based on whether a game is cult or bleeding-edge, and on project size and assumed size. Estimation results, displayed in Table A17, are qualitatively similar to our previous findings.

Table A17. Multinomial Logit Regression Results with a Matched Sample

	Base Outcome: Single Homing	Outcome: Sequential Multihoming	Outcome: Simultaneous Multihoming
Independent Variables			
Breadth of Unique Consoles		-0.007	0.183
		(0.046) [0.878]	(0.065) [0.005]
PC Specialization		1.830	1.422
		(0.221) [0.000]	(0.278) [0.000]
Licensed Title		0.323	1.276
		(0.169) [0.056]	(0.176) [0.000]
Cult Game Specialization		-0.465	-0.742
		(0.278) [0.095]	(0.399) [0.063]
Console-Specific Programming Specialization		-0.166	-1.154
		(0.222) [0.455]	(0.280) [0.000]
Game Engine Use (Instrumented)		1.082	0.763
		(0.257) [0.000]	(0.284) [0.007]
Control Variables			
Bleeding-edge game		0.026	-0.292
		(0.180) [0.885]	(0.193) [0.130]
Cult game		-0.055	-0.242
		(0.212) [0.796]	(0.267) [0.365]
Physics Engine Use		1.456	2.159
		(0.771) [0.059]	(0.705) [0.002]
Minor Middleware Use		0.522	-0.155
		(0.337) [0.122]	(0.344) [0.652]
Bleeding-edge Game Specialization		-0.166	-1.154
		(0.222) [0.455]	(0.280) [0.000]
Sequel		0.048	-0.278
		(0.170) [0.779]	(0.214) [0.193]
Inhouse		0.375	0.176
		(0.182) [0.039]	(0.215) [0.413]
Project Size		0.082	0.208
		(0.139) [0.557]	(0.161) [0.196]
Assumed Project Size		-1.048	-0.879
		(0.207) [0.000]	(0.193) [0.000]
Observations		1,865	1,865
Year Dummies		YES	YES

Notes. Robust standard errors clustered by developer and reported in ( ), p values reported in [ ]; results show effects compared to the base outcome (single homing).

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