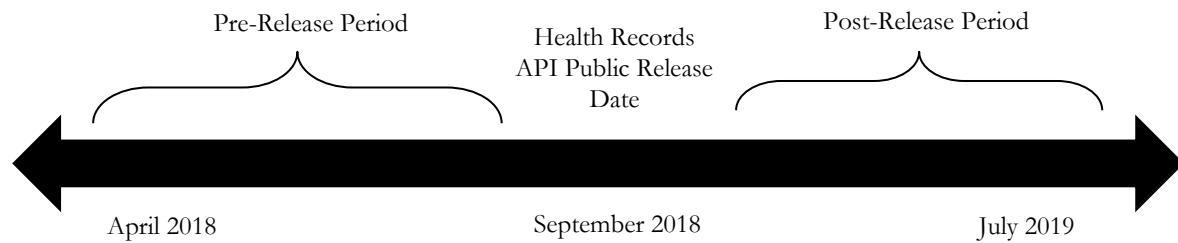


Online Appendices

Online Appendix A. Research Design



Online Appendix B. Key Variables and Definitions

Abbreviation	Variable	Definition
ReviewsDiff	Reviews Monthly Difference	The monthly difference in the number of consumer reviews. We logged the difference to reduce skewness
RatingDiff	Average Rating Monthly Difference	The monthly difference in the consumer average rating
Major Update	Major Update	Equal 1 if a major update is released in a given month, and 0 otherwise
Minor Update	Minor Update	Equal 1 if a minor update is released in a given month, and 0 otherwise
After	After	Equal 1 if a given month is after the release of iOS 12, and 0 otherwise
Openness	FPA's openness	Equal 1 if a TPA belongs to the treatment group, and 0 otherwise
SameMarketAlternativesDiff	Differentiation of Same-Market Alternatives	1 minus the cosine similarity between a focal TPA and same-market alternatives in a given month. Same-market alternatives are alternatives that have a primary market same as the focal TPA's primary market.
OtherMarketAlternativesDiff	Differentiation of Other-Market Alternatives	1 minus the cosine similarity between a focal TPA and other-market alternatives in a given month. Other-market alternatives are alternatives that have a secondary market same as the focal TPA's primary market.
SameMarketAlternatives	Number of Same-Market Alternatives	The number of same-market alternatives created in a given month. We logged the number to reduce skewness
OtherMarketAlternatives	Number of Other-Market Alternatives	The number of other-market alternatives created in a given month. We logged the number to reduce skewness

Online Appendix C. Pre-Release Balance

	Treatment vs no PSM	Treatment vs PSM
Release month*	-0.9389 (s)	-0.0951 (ns)
Pricing	0.1502 (s)	0.0395 (ns)
Major update	0.0097 (s)	0.0005 (ns)
LOG (Number of ratings)	0.0214 (s)	0.0076 (ns)
Average rating	0.3286 (s)	0.0192 (ns)

t-tests for differences in means between the groups.

PSM = control group obtained using propensity score matching

ns: Not significant at the 5% level.

s: Significant at the 5% level.

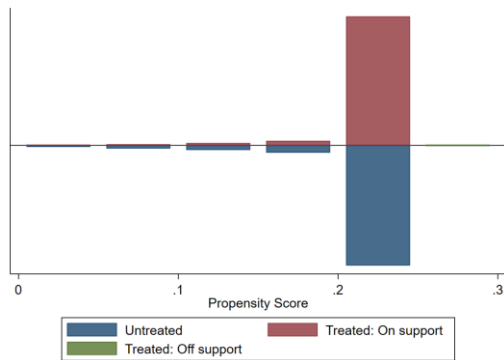


Figure 1. Visualization of Propensity Scores

Below is the econometric specification of the probit model to calculate pre-release matching.

$$Treatment = ReleaseMonth + Price + MajorUpdates + ReviewCount + AvgRating$$

Online Appendix D. Identification of Major and Minor Updates

We developed a supervised machine learning to distinguish major and minor app updates. The technique provides a high accuracy level of above 93%. A sample of more than 10,000 app updates is classified by a research assistant and compared with the classification of one of the authors to ensure high inter-coder reliability. The sample is split randomly into training (80%), validation (10%), and testing (10%). We compare several text classifiers by varying the vectorizer, the number of features, and n-grams, excluding, and including word-embedding, tagging, lemmatization, and stemming. Also, we tried several classifiers including Logistic Regression, Linear SVC, Multinomial NB, Ridge Classifier, Passive Aggressive Classifier, Bernoulli NB, AdaBoost Classifier, Perceptron, and Nearest Centroid. We select a Logistic Regression classifier that requires unigram, tfidf vectorizer, and all features (i.e., the stem of words that are tagged nouns) of the corpus as it provides the highest accuracy. The classifier returns the classification (0 = minor update, 1 = major update) and the probability that the prediction is accurate.

Below is the confusion matrix of the classifier.

	Predicted Major	Predicted Minor	Total
Major	316	43	359
Minor	19	622	641
Total	335	665	1000

Online Appendix E. Sensitivity Check 4 Months before and 4 Months after – 1st Quasi-Experiment

We ran sensitivity checks by changing the specification of the quasi-experiment. This Online Appendix indicates that the results are consistent with the main findings when the pre- and post-periods are 4 months before and after the public release of Apple Health Records API in September 2018.

	Major Update	
	M1	M2
After x Openness	0.0024* (0.0011)	0.0021* (0.0011)
ReviewsDiff		0.0462*** (0.0121)
RatingDiff		-4.10E-04 (0.0021)
Incumbents	0.0011 (0.0015)	0.0014 (0.0015)
Exits	-0.0016 (0.0025)	-0.0017 (0.0025)
Constant	9.2201*** (0.7900)	9.3014*** (0.7851)
Time fixed effects	Yes	Yes
App fixed effects	Yes	Yes
N	123,344	123,344
N of groups	15,418	15,418
R2	0.0350	0.0402

+ p<0.1, * p<0.05, ** p<0.01, *** p<0.001

Estimator = fixed effects with robust standard errors, i.e., standard errors clustered by app.

	ReviewsDiff				
	M1	M2	M3	M4	M5
After x Openness	0.0033* (0.0017)	0.0011 (0.0019)	0.0028+ (0.0017)	0.0018 (0.0018)	0.00002 (0.0044)
SameMarketAlternativesDiff		-0.5550** (0.1712)	-0.3872*** (0.1173)		-0.2914* (0.1262)
OtherMarketAlternativesDiff			0.0924* (0.0462)		0.0178+ (0.0076)
SameMarketAlternatives		-0.0074** (0.0026)		-0.0183** (0.0067)	-0.0225*** (0.0061)
OtherMarketAlternatives				0.0168** (0.0062)	0.0179** (0.0058)
LastUpdate	-0.0017 (0.0019)	-0.0024 (0.0018)	-0.0026 (0.0018)	-0.0029 (0.0019)	-0.0027 (0.0018)
Incumbents	0.0017 (0.0022)	0.0103** (0.0033)	0.0061* (0.0025)	-0.0014 (0.0025)	0.0044+ (0.0024)
Exits	-0.007* (0.0019)	-0.017*** (0.0018)	-0.0141*** (0.0018)	-0.0017 (0.0019)	-0.0005 (0.0018)

	(0.0031)	(0.0041)	(0.0037)	(0.0036)	(0.0018)
Constant	-1.5801	-2.2803+	-2.0902+	-2.4804*	-2.3301+
	(1.2804)	(1.2402)	(1.2021)	(1.2602)	(1.2703)
Time fixed effects	Yes	Yes	Yes	Yes	Yes
App fixed effects	Yes	Yes	Yes	Yes	Yes
N	123,344	123,344	123,344	123,344	123,344
N of groups	15,418	15,418	15,418	15,418	15,418
R2	0.0011	0.0013	0.0012	0.0013	0.0014

+ p<0.1, * p<0.05, ** p<0.01, *** p<0.001

Estimator = fixed effects with robust standard errors, i.e., standard errors clustered by app.

	SameMarket Alternatives	OtherMarket Alternatives	SameMarket AlternativesDiff	OtherMarket AlternativesDiff
	M1	M2	M3	M4
After x Openness	0.0545***	0.0091***	-0.0117***	0.0047***
	(0.0003)	(0.0003)	(0.0001)	(0.0001)
LastUpdate	0.0001**	0.0001**	0.0013***	0.0011***
	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Incumbents	0.0385***	-0.0035***	-0.0034***	0.0037***
	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Exits	0.0105***	0.0326***	0.0118***	0.0026***
	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Constant	3.6203***	4.4704***	-0.1501***	3.6404***
	(0.0027)	(0.0028)	(0.0008)	(0.0131)
Time fixed effects	Yes	Yes	Yes	Yes
App fixed effects	Yes	Yes	Yes	Yes
N	123,344	123,344	123,344	123,344
N of groups	15,418	15,418	15,418	15,418
R2	0.9991	0.9992	0.9613	0.3992

+ p<0.1, * p<0.05, ** p<0.01, *** p<0.001

Estimator = fixed effects with robust standard errors, i.e., standard errors clustered by app.

	Major Update							
	Low Div	High Div	Low Div	High Div	Low Size	High Size	Low Size	High Size
After x Openness	0.0012	0.0027*	0.0011	0.0024*	0.002	0.0036**	0.0017	0.0033**
	(0.0013)	(0.0012)	(0.0013)	(0.0012)	(0.0019)	(0.0012)	(0.0019)	(0.0011)
ReviewsDiff			0.0286*	0.0611**			0.0358*	0.0833*
			(0.0126)	(0.02)			(0.0143)	(0.0333)
RatingDiff			-0.0034	-0.0061+			-0.0039+	-0.0064
			(0.0021)	(0.0035)			(0.0024)	(0.0048)
Incumbents	0.0012	0.0009	0.0013	0.0011	0.0005	-0.0015	0.0007	-0.0013
	(0.0024)	(0.0016)	(0.0024)	(0.0017)	(0.0029)	(0.0017)	(0.0029)	(0.0017)
Exits	-0.0043	-0.0009	-0.0041	-0.0006	-0.0028	0.0066*	-0.0026	0.0064*
	(0.0035)	(0.0031)	(0.0035)	(0.0031)	(0.0051)	(0.0026)	(0.0051)	(0.0026)
Constant	0.1573	0.1852*	0.1567	0.1732+	0.133	-0.116	0.128	-0.116

	(0.122)	(0.0931)	(0.122)	(0.0915)	(0.156)	(0.103)	(0.156)	(0.103)
Time fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
App fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	69,162	39,142	69,162	39,142	47,940	40,598	47,940	40,598
N of groups	8,672	4,910	8,672	4,910	6,016	5,082	6,016	5,082
R2	0.001	0.001	0.002	0.008	0.001	0.001	0.003	0.012

+ p<0.1, * p<0.05, ** p<0.01, *** p<0.001

Estimator = fixed effects with robust standard errors, i.e., standard errors clustered by app.

Online Appendix F. Different Matching (Coarsened Exact Matching) – 1st Quasi-Experiment

We demonstrate that the results remain consistent with the main findings when using coarsened exact matching.

	Major Update	
	M1	M2
After x Openness	0.0037* (0.0017)	0.0034* (0.0017)
ReviewsDiff		0.0315*** (0.0082)
RatingDiff		-0.0002 (0.0013)
Incumbents	0.0015* (0.0006)	0.0014* (0.0006)
Exits	-0.0001 (1.0012)	0.0001 (1.0012)
Constant	-0.0253* (0.0126)	-0.0246* (0.0125)
Time fixed effects	Yes	Yes
App fixed effects	Yes	Yes
N	231,042	231,042
N of groups	15,418	15,418
R2	0.001	0.002

+ p<0.1, * p<0.05, ** p<0.01, *** p<0.001

Estimator = fixed effects with robust standard errors, i.e., standard errors clustered by app.

	ReviewsDiff				
	M1	M2	M3	M4	M5
After x Openness	0.011*** (0.0031)	0.0068** (0.0024)	0.0047* (0.0023)	0.0025 (0.0026)	8.50E-04 (0.0023)
SameMarketAlternativesDiff		-0.441* (0.186)	-0.482* (0.19)		-0.446* (0.188)
OtherMarketAlternativesDiff			0.164* (0.0831)		0.157* (0.0791)
SameMarketAlternatives		-0.119*** (0.0321)		-0.137*** (0.0368)	-0.0301* (0.0119)

OtherMarketAlternatives				0.0526**	0.0282***
				(0.0194)	(0.0085)
LastUpdate	-0.0026**	-0.0027**	-0.0029***	-0.0033**	-0.0031***
	(0.0009)	(0.0008)	(0.0008)	(0.0011)	(0.0009)
Incumbents	0.0022*	0.0038**	0.0005	0.0028**	0.0002
	(0.0009)	(0.0013)	(0.0008)	(0.0012)	(0.0007)
Exits	-0.0105***	0.0009	-0.0027	-0.0057*	-0.0006
	(0.0023)	(0.0031)	(0.0021)	(0.0023)	(0.0023)
Constant	-0.0045	0.483***	-0.0362	0.453***	0.0026
	(0.0218)	(0.13)	(0.0536)	(0.128)	(0.0615)
Time fixed effects	Yes	Yes	Yes	Yes	Yes
App fixed effects	Yes	Yes	Yes	Yes	Yes
N	231,042	231,042	231,042	231,042	231,042
N of groups	15,418	15,418	15,418	15,418	15,418
R2	0.002	0.002	0.002	0.002	0.002

+ p<0.1, * p<0.05, ** p<0.01, *** p<0.001

Estimator = fixed effects with robust standard errors, i.e., standard errors clustered by app.

	SameMarket Alternatives	OtherMarket Alternatives	SameMarket AlternativesDiff	OtherMarket AlternativesDiff
	M1	M2	M3	M4
After x Openness	0.038***	0.0307***	-0.0044***	0.0016***
	(0.0003)	(0.0002)	(0.0001)	(0.0001)
LastUpdate	0.00004+	0.00005*	0.0014***	0.0011***
	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Incumbents	0.0296***	0.0015***	-0.0001***	0.0023***
	(0.0001)	(0.0000)	(0.0000)	(0.0000)
Exits	-0.0021***	-0.0049***	0.0112***	0.0021***
	(0.0001)	(0.0001)	(0.0001)	(0.0001)
Constant	4.66***	4.91***	-0.253***	-0.26***
	(0.0015)	(0.0013)	(0.0004)	(0.0009)
Time fixed effects	Yes	Yes	Yes	Yes
App fixed effects	Yes	Yes	Yes	Yes
N	231,042	231,042	231,042	231,042
N of groups	15,418	15,418	15,418	15,418
R2	0.998	0.996	0.947	0.778

+ p<0.1, * p<0.05, ** p<0.01, *** p<0.001

Estimator = fixed effects with robust standard errors, i.e., standard errors clustered by app.

	Major Update							
	Low Div	High Div	Low Div	High Div	Low Size	High Size	Low Size	High Size
After x Openness	0.0024	0.005*	0.0022	0.0046+	0.003	0.0049*	0.0024	0.0048*
	(0.0016)	(0.0025)	(0.0016)	(0.0025)	(0.0029)	(0.0019)	(0.0029)	(0.0019)
ReviewsDiff			0.028*	0.0308**			0.0198+	0.0408**
			(0.0136)	(0.0118)			(0.0116)	(0.0132)

RatingDiff			0.00017	-0.0013			-0.00025	-0.0014
			(0.002)	(0.002)			(0.0022)	(0.0011)
Incumbents	0.0006	0.0017*	0.0005	0.0016*	0.0013	0.0009+	0.0011	0.0009+
	(0.0005)	(0.0008)	(0.0004)	(0.0008)	(0.0008)	(0.0005)	(0.0008)	(0.0005)
Exits	0.0001	-0.0049**	0.0003	-0.0047**	0.0013	0.0003	0.0019	0.0003
	(0.0017)	(0.0016)	(0.0017)	(0.0017)	(0.0026)	(0.0009)	(0.0026)	(0.0009)
Constant	-0.0094	-0.0532+	-0.0086	-0.051+	-0.0325	-0.0214+	-0.0288	-0.0212+
	(0.0127)	(0.0274)	(0.0125)	(0.0271)	(0.0271)	(0.0131)	(0.027)	(0.013)
Time fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
App fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	121,158	68,528	121,158	68,528	84,066	71,144	84,066	71,144
N of groups	8,726	4,932	8,726	4,932	6,064	5,098	6,064	5,098
R2	0.001	0.001	0.002	0.003	0.001	0.001	0.003	0.002

+ p<0.1, * p<0.05, ** p<0.01, *** p<0.001

Estimator = fixed effects with robust standard errors, i.e., standard errors clustered by app.

Online Appendix G. Different Distance of Matching (e.g., Mahalanis) – 1st Quasi-Experiment

We demonstrate that the results remain consistent with the main findings when using Mahalanis distance.

	Major Update	
	M1	M2
After x Openness	0.0038*	0.0035+
	(0.0019)	(0.0019)
ReviewsDiff		0.0401***
		(0.0078)
RatingDiff		-0.0008
		(0.0013)
Incumbents	0.0014*	0.0013+
	(0.0007)	(0.0007)
Exits	0.0001	0.0003
	(0.0013)	(0.0013)
Constant	-0.0221	-0.0222+
	(0.0139)	(0.0139)
Time fixed effects	Yes	Yes
App fixed effects	Yes	Yes
N	231,042	231,042
N of groups	15,418	15,418
R2	0.001	0.003

+ p<0.1, * p<0.05, ** p<0.01, *** p<0.001

Estimator = fixed effects with robust standard errors, i.e., standard errors clustered by app.

	ReviewsDiff				
	M1	M2	M3	M4	M5
After x Openness	0.0124***	0.008**	0.0051*	0.0021	1.20E-03
	(0.0033)	(0.0027)	(0.0025)	(0.0028)	(0.0026)

SameMarketAlternativesDiff		-0.498*	-0.497*		-0.451*
		(0.217)	(0.219)		(0.214)
OtherMarketAlternativesDiff			0.18*		0.16*
			(0.087)		(0.0824)
SameMarketAlternatives		-0.146***		-0.164***	-0.0322*
		(0.0375)		(0.0425)	(0.0127)
OtherMarketAlternatives				0.0745**	0.031**
				(0.0236)	(0.0096)
LastUpdate	-0.0029**	-0.0029**	-0.0032***	-0.0036**	-0.0035***
	(0.0009)	(0.0009)	(0.0009)	(0.0011)	(0.0009)
Incumbents	0.0029*	0.0056**	0.0005	0.0042**	0.0003
	(0.0013)	(0.0018)	(0.0010)	(0.0016)	(0.0010)
Exits	-0.0101**	0.0065	.0017	-0.0054+	0.0032
	(0.0031)	(0.0042)	(.0031)	(0.0031)	(0.0033)
Constant	0.0139	0.626***	-0.0207	0.508***	0.0136
	(0.0184)	(0.153)	(0.0568)	(0.14)	(0.0663)
Time fixed effects	Yes	Yes	Yes	Yes	Yes
App fixed effects	Yes	Yes	Yes	Yes	Yes
N	231,042	231,042	231,042	231,042	231,042
N of groups	15,418	15,418	15,418	15,418	15,418
R2	0.002	0.002	0.002	0.002	0.002

+ p<0.1, * p<0.05, ** p<0.01, *** p<0.001

Estimator = fixed effects with robust standard errors, i.e., standard errors clustered by app.

	SameMarket Alternatives	OtherMarket Alternatives	SameMarket AlternativesDiff	OtherMarket AlternativesDiff
	M1	M2	M3	M4
After x Openness	0.038***	0.0307***	-0.0044***	0.0016***
	(0.0003)	(0.0002)	(0.0001)	(0.0001)
LastUpdate	0.00004+	0.00005*	0.0014***	0.0011***
	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Incumbents	0.0296***	0.0015***	-0.0001***	0.0021***
	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Exits	-0.0018***	-0.0049***	0.0112***	0.0021***
	(0.0001)	(0.0001)	((0.0000)	(0.0001)
Constant	4.66***	4.91***	-0.253***	-0.26***
	(0.0015)	(0.0013)	(0.0004)	(0.0009)
Time fixed effects	Yes	Yes	Yes	Yes
App fixed effects	Yes	Yes	Yes	Yes
N	231,042	231,042	231,042	231,042
N of groups	15,418	15,418	15,418	15,418
R2	0.998	0.996	0.947	0.778

+ p<0.1, * p<0.05, ** p<0.01, *** p<0.001

Estimator = fixed effects with robust standard errors, i.e., standard errors clustered by app.

	Major Update							
	Low Div	High Div	Low Div	High Div	Low Size	High Size	Low Size	High Size
After x Openness	0.0019	0.0048+	0.0018	0.0047+	0.0012	0.008**	0.0006	0.0079**
	(0.0029)	(0.0026)	(0.0029)	(0.0027)	(0.004)	(0.0027)	(0.004)	(0.0026)
ReviewsDiff			0.0329**	0.0552***			0.0268*	0.0385**
			(0.011)	(0.0162)			(0.0125)	(0.0123)
RatingDiff			0.0018	-0.0046+			0.0014	-0.0014
			(0.0019)	(0.0023)			(0.0021)	(0.0018)
Incumbents	5.3e-04	.0017+	5.4e-04	.0015	0.0005	0.0019*	0.0004	0.0019*
	(9.7e-04)	(9.9e-04)	(9.7e-04)	(9.7e-04)	(0.0013)	(0.0008)	(0.0013)	(0.0008)
Exits	-8.6e-04	-.0055*	-7.4e-04	-.0061*	-0.0003	0.0013	0.0001	0.0015
	(.0022)	(.0025)	(.0022)	(.0025)	(0.0033)	(0.0010)	(0.0032)	(0.0010)
Constant	-0.0031	0.113***	-0.0043	-0.0294	0.0002	-0.0449*	0.0007	-0.0446*
	(0.0172)	(0.0254)	(0.0173)	(0.0219)	(0.0277)	(0.0186)	(0.0278)	(0.0184)
Time fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
App fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	121,948	68,912	121,948	68,912	84,080	71,338	84,080	71,338
N of groups	8,792	4,962	8,792	4,962	6,076	5,110	6,076	5,110
R2	0.001	0.001	0.002	0.003	0.001	0.001	0.003	0.003

+ p<0.1, * p<0.05, ** p<0.01, *** p<0.001

Estimator = fixed effects with robust standard errors, i.e., standard errors clustered by app.

Online Appendix H. Different Similarity Measure – 1st Quasi-Experiment

We show that our results are robust when using a different measure of similarity. Specifically, in a given month, we create two documents: the first document contains the aggregated description of alternatives that enter the market, and the second document contains the description of a rival. We follow standard text cleaning and processing approaches before calculating cosine similarity. The results support our main findings.

	ReviewsDiff				
	M1	M2	M3	M4	M5
After x Openness	0.0121***	0.0081**	0.00063	0.0027	1.50E-03
	(0.0031)	(0.0026)	(0.0022)	(0.0024)	(0.0022)
SameMarketAlternativesDiff		-0.0298**	-0.0235**		-0.0319***
		(0.0092)	(0.0089)		(0.0094)
OtherMarketAlternativesDiff			0.0361*		0.0385*
			(0.0177)		(0.0177)
SameMarketAlternatives		-0.145***		-0.152***	-0.0265**
		(0.0348)		(0.0361)	(0.0102)
OtherMarketAlternatives				0.0572**	0.0364***
				(0.0183)	(0.0099)
LastUpdate	-0.0031***	-0.0037***	-0.0042***	-0.0039***	-0.0038***
	(0.0008)	(0.0009)	(0.0011)	(0.0010)	(0.0010)
Incumbents	0.0027**	0.0048***	-0.0008	0.0037**	0.0006

	(0.0009)	(0.0014)	(0.0008)	(0.0012)	(0.0009)
Exits	-0.0108***	-0.0018	-0.0074**	-0.0055*	-0.0116***
	(0.0023)	(0.0023)	(0.0024)	(0.0022)	(0.0028)
Constant	-0.0179	0.697***	0.0852***	0.495***	0.0163
	(0.0215)	(0.16)	(0.0182)	(0.124)	(0.0484)
Time fixed effects	Yes	Yes	Yes	Yes	Yes
App fixed effects	Yes	Yes	Yes	Yes	Yes
N	231,042	231,042	231,042	231,042	231,042
N of groups	15,418	15,418	15,418	15,418	15,418
R2	0.002	0.003	0.003	0.003	0.003

+ p<0.1, * p<0.05, ** p<0.01, *** p<0.001

Estimator = fixed effects with robust standard errors, i.e., standard errors clustered by app.

We control for the number of months since the last major update, the number of alternatives incumbent and exit.

	SameMarket Alternatives	OtherMarket Alternatives	SameMarket AlternativesDiff	OtherMarket AlternativesDiff
	M1	M2	M3	M4
After x Openness	0.0381***	0.0307***	-0.0236***	0.0131***
	(0.0003)	(0.0002)	(0.0004)	(0.0003)
LastUpdate	0.0001*	0.0001**	-0.0001	0.0001***
	(0.0000)	(0.0000)	(0.0001)	(0.0000)
Incumbents	.0296***	.0015***	-0.0034***	0.0066***
	(0.0001)	(0.0001)	(0.0001)	(0.0001)
Exits	-.0021***	-.0049***	0.0139***	0.0018***
	(0.0001)	(0.0001)	(0.0003)	(0.0002)
Constant	4.6602***	4.9102***	-0.0839***	-0.241***
	(0.0015)	(0.0013)	(0.0026)	(0.0026)
Time fixed effects	Yes	Yes	Yes	Yes
App fixed effects	Yes	Yes	Yes	Yes
N	231,042	231,042	231,042	231,042
N of groups	15,418	15,418	15,418	15,418
R2	0.9982	0.9963	0.113	0.124

+ p<0.1, * p<0.05, ** p<0.01, *** p<0.001

Estimator = fixed effects with robust standard errors, i.e., standard errors clustered by app.

We control for the number of months since the last major update, the number of alternatives incumbent and exit.

Online Appendix I. Test of the Assumption of Parallel Trends

We performed several analyses to test DiD assumptions. DiD assumes that the treatment and control groups have parallel trends before the event (Bertrand et al. 2004). We create a continuous time trend variable and assess its interaction with the treatment before the release of the Apple Health Records API. This Online Appendix shows that none of the interaction terms is significant, thus confirming that the parallel trends assumption is valid.

	Major Update
	M1
Trend	-0.0001

	(0.0016)
Trend * Treatment	0.0002 (0.0016)
Incumbents	0.0019 (0.0096)
Exits	0.0104 (0.0113)
Constant	-0.0808 (0.4)
Time fixed effects	Yes
App fixed effects	Yes
N	61,672
N of groups	15,418
R2	0.001

+ p<0.1, * p<0.05, ** p<0.01, *** p<0.001

Estimator = fixed effects with robust standard errors, i.e., standard errors clustered by app.

We control for the number of months since the last major update, the number of alternatives incumbent and exit.

Online Appendix J. Results of the Relative Time Models

We performed several analyses to test DiD assumptions. DiD assumes that the treatment and control groups have parallel trends before the event (Bertrand et al. 2004). We estimate the relative time models. We replace the After dummy with several dummies representing each month in the pre-release and post-release periods. The interactions between the Treatment dummy and the month dummies represent monthly differences between the treatment and control groups. Because we use the month of April 2018 as the base month, these differences are relative to that of April 2018. We describe the relative time models in the equations below. The results in this Online Appendix indicate that the interactions between time dummies and treatment dummy are non-significant before the release of Apple Health Records API. Differences between the treatment and control groups appear after the release of Apple Health Records API.

$$MAJOR\ UPDATE_{i,t} = \beta_0 + \beta_1(T_t \times TREATMENT_i) + \mu_i + \theta_t + \varepsilon_{i,t} \quad (7)$$

Where T_t is a dummy representing the distance from the month of the release of Apple Health Records API.

	Major Update
	M1
[t - 4] * Treatment	0.001 (0.0015)
[t - 3] * Treatment	0.0015 (0.0015)
[t - 2] * Treatment	0.0002 (0.0015)
[t - 1] * Treatment	0.001 (0.0016)

t * Treatment	Omitted
[t +1] * Treatment	0.0044+ (0.0026)
[t +2] * Treatment	0.0037* (0.0016)
[t +3] * Treatment	0.0029* (0.0012)
[t +4] * Treatment	0.0017+ (0.001)
[t +5] * Treatment	0.0018 (0.0013)
[t +6] * Treatment	0.0035** (0.0013)
[t +7] * Treatment	0.0019+ (0.0011)
[t +8] * Treatment	0.0026* (0.0013)
[t +9] * Treatment	0.00091 (0.0011)
[t +10] * Treatment	0.0056* (0.0027)
Incumbents	0.0001 (0.0001)
Exits	-0.0033+ (0.0019)
Constant	0.0005 (0.004)
Time fixed effects	Yes
App fixed effects	Yes
N	231,042
N of groups	15,418
R2	0.001

+ p<0.1, * p<0.05, ** p<0.01, *** p<0.001

Estimator = fixed effects with robust standard errors, i.e., standard errors clustered by app.

We control for the number of alternatives incumbent and exit.

Online Appendix K-1. Test for Rival Explanations

We rule out rival explanations by assessing the plausibility of false positives (Bertrand et al. 2004). We restrict the sample of the control group. Next, we create the treatment and control groups by randomly assigning apps to each group. Because the two groups are not affected by the release of Apple Health Records API, we

expect no significant interaction between the treatment dummy and the after dummy. The treatment group operates as a placebo. The results further confirm the robustness of the main findings.

	Major Update
	M1
After * Treatment	-0.0003 (0.0008)
Constant	0.0039*** (0.0008)
Time fixed effects	Yes
App fixed effects	Yes
N	107,912
N of groups	7,708
R2	0.001

+ p<0.1, * p<0.05, ** p<0.01, *** p<0.001

Estimator = fixed effects with robust standard errors, i.e., standard errors clustered by app.

The number of alternatives incumbent and exit are omitted because (a) they correlate with month dummies and (b) the apps in the treatment and control groups belong to the same market.

Online Appendix K-2. Test for Rival Explanations

We rule out rival explanations by assessing the plausibility of false positives (Bertrand et al. 2004). We ensure that the long-term effect of FPA's entry is not an issue in our study. One may argue that our treatment group may still be affected by the long-term effect of FPA's entry. We assume a false exogenous shock happened in June 2018; hence our pre-treatment is April-May 2018, and post-treatment is July-August 2018. If we observe a significant effect, this may indicate that the effect of Health Records is delayed. The results indicate a non-significant effect, mitigating the issue of the long-term effect of FPA's entry.

	Major Update
	M1
After * Openness	-0.0006 (0.002)
Incumbents	0.00002 (0.0053)
Exits	0.0006 (0.0037)
Constant	11*** (2.09)
Time fixed effects	Yes
App fixed effects	Yes
N	61,672
N of groups	15,418
R2	0.027

+ p<0.1, * p<0.05, ** p<0.01, *** p<0.001

Estimator = fixed effects with robust standard errors, i.e., standard errors clustered by app.

We control for the number of alternatives incumbent and exit.

Online Appendix L. Results of 1st Quasi-Experiment

We controlled for the effect of app downloads and revenues, and the results are consistent with the main findings.

	Major Update			
	M1	M2	M3	M4
After x Openness	0.0035* (0.0017)	0.0032+ (0.0017)	0.0033* (0.0016)	0.0032+ (0.0016)
ReviewsDiff		0.0322*** (0.0087)		0.0324*** (0.0087)
RatingDiff		-0.00023 (0.0013)		-0.00025 (0.0013)
Downloads			-4.7E-06 (0.0033)	-0.00093 (0.0032)
Revenues			-0.00072 (0.0025)	-0.0008 (0.0025)
Incumbents	.0015* (0.0006)	.0014* (0.0006)	.0014* (0.0006)	.0014* (0.0006)
Exits	-0.0001 (.0012)	0.0001 (.0012)	-0.0001 (.0012)	0.0001 (.0012)
Constant	-0.0252* (0.0124)	-0.0245* (0.0123)	-0.0236+ (0.0124)	-0.0243* (0.0123)
Time fixed effects	Yes	Yes	Yes	Yes
App fixed effects	Yes	Yes	Yes	Yes
N	231,042	231,042	231,042	231,042
N of groups	15,418	15,418	15,418	15,418
R2	0.001	0.002	0.001	0.002

+ + p<0.1, * p<0.05, ** p<0.01, *** p<0.001

Estimator = fixed effects with robust standard errors, i.e., standard errors clustered by app.

	ReviewsDiff				
	M1	M2	M3	M4	M5
After x Openness	0.0121*** (0.0030)	0.0073** (0.0024)	0.0051* (0.0023)	0.0027 (0.0024)	0.0007 (0.0022)
SameMarketAlternativesDiff		-0.5501** (0.1803)	-0.5954** (0.1871)		-0.5582** (0.1863)
OtherMarketAlternativesDiff			0.1553* (0.0759)		0.1501* (0.0736)
SameMarketAlternatives		-0.1312*** (0.0314)		-0.1521*** (0.0361)	-0.0332** (0.0116)
OtherMarketAlternatives				0.0572** (0.0183)	0.0313*** (0.0084)
LastUpdate	-.0031*** (8.3e-04)	-.0032*** (8.2e-04)	-.0033*** (7.7e-04)	-.0039*** (9.9e-04)	-.0036*** (8.3e-04)
Incumbents	.0027** (0.0009)	.0045*** (.0013)	8.3e-04 (0.0007)	.0037** (.0012)	0.0006 (0.0007)
Exits	-.0108*** (.0023)	.0022 (.0029)	-.0019 (.0019)	-.0055* (.0022)	3.7e-04 (.0022)

Constant	-0.0179 (0.0215)	0.5001*** (0.1241)	-0.0744 (0.0527)	0.4951*** (0.1241)	-0.0327 (0.0598)
Time fixed effects	Yes	Yes	Yes	Yes	Yes
App fixed effects	Yes	Yes	Yes	Yes	Yes
N	231,042	231,042	231,042	231,042	231,042
N of groups	15,418	15,418	15,418	15,418	15,418
R2	0.0021	0.0030	0.0031	0.0032	0.0034

+ + p<0.1, * p<0.05, ** p<0.01, *** p<0.001

Estimator = fixed effects with robust standard errors, i.e., standard errors clustered by app.

95% confidence intervals are included.

	SameMarket Alternatives	OtherMarket Alternatives	SameMarket AlternativesDiff	OtherMarket AlternativesDiff
	M1	M2	M3	M4
After x Openness	0.0381*** (0.0003)	0.0307*** (0.0002)	-0.0044*** (0.0001)	0.0016*** (0.0001)
LastUpdate	0.0001* (0.0000)	0.0001** (0.0000)	.0014*** (0.0001)	.0011*** (0.0001)
Incumbents	.0296*** (0.0001)	.0015*** (0.0001)	-1.3e-04*** (0.0001)	.002*** (0.0001)
Exits	-.0021*** (0.0001)	-.0049*** (0.0001)	.0112*** (0.0001)	.0021*** (0.0001)
Constant	4.6602*** (0.0015)	4.9102*** (0.0013)	-0.2536*** (0.0004)	-0.2601*** (0.0009)
Time fixed effects	Yes	Yes	Yes	Yes
App fixed effects	Yes	Yes	Yes	Yes
N	231,042	231,042	231,042	231,042
N of groups	15,418	15,418	15,418	15,418
R2	0.9982	0.9963	0.9474	0.7783

+ + p<0.1, * p<0.05, ** p<0.01, *** p<0.001

Estimator = fixed effects with robust standard errors, i.e., standard errors clustered by app.

95% confidence intervals are included.

	Major Update							
	Low Div	High Div	Low Div	High Div	Low Size	High Size	Low Size	High Size
After x Openness	0.0029 (0.0023)	0.0053* (0.0025)	0.0028 (0.0017)	0.0049+ (0.0025)	0.0023 (0.0028)	0.0047* (0.0019)	0.0022 (0.0026)	0.0045* (0.0019)
ReviewsDiff			0.0281** (0.0095)	0.0288* (0.0129)			0.0217+ (0.0113)	0.0253* (0.0123)
RatingDiff			-0.0005 (0.0014)	-0.0012 (0.0021)			0.0006 (0.0022)	-0.0002 (0.0023)
Incumbents	0.0009 (0.0007)	0.0018* (0.0008)	0.0007 (0.0005)	0.0017* (0.0008)	0.0012 (0.0008)	0.0008 (0.0005)	0.0009 (0.0007)	0.0008 (0.0005)
Exits	0.0004 (0.0019)	-0.0049** (0.0016)	0.0013 (0.0028)	-0.0047** (0.0016)	0.0011 (0.0026)	0.0002 (0.0009)	0.0042 (0.0027)	0.0003 (0.0009)
Constant	-0.0184 (0.0193)	-0.0561* (0.0273)	-0.0151 (0.0143)	-0.0537* (0.0271)	-0.0298 (0.0265)	-0.0194 (0.0129)	-0.0225 (0.0235)	-0.0192 (0.0129)
Time fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
App fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	120,782	68,428	120,782	68,428	83,828	71,154	83,828	71,154
N of groups	8,706	4,926	8,706	4,926	6,048	5,098	6,048	5,098
R2	0.0011	0.0012	0.0013	0.0031	0.0012	0.0011	0.0014	0.0041

+ p<0.1, * p<0.05, ** p<0.01, *** p<0.001

Estimator = fixed effects with robust standard errors, i.e., standard errors clustered by app.

95% confidence intervals are included.

Online Appendix M. Results of 1st Quasi-Experiment Examining the Mediation of External Knowledge

In the paper, we present reasons why FPA's open resources may cause product expansion leading to positive market growth. Because publicly accessible knowledge about integrating FPA's open resources could be one of these reasons, we collected posts from the Apple Developer Forum and StackOverflow about Health Records API. Following Soh and Grover (2022), we created two variables (number of resolved posts, and resolved post novelty) to measure external knowledge. We tested the impact of external knowledge on product expansion (i.e., the four mediators), and found that external knowledge is positively associated with same-market alternative, other-market alternative, same-market alternative imitation, and other-market alternative imitation. These results show that external knowledge on developer forums is associated with product expansion (i.e., creation of alternatives).

	SameMarket Alternatives	OtherMarket Alternatives	SameMarket AlternativesDiff	OtherMarket AlternativesDiff
	M1	M2	M3	M4
After x Openness	0.235*** (0.00003)	0.189*** (0.00003)	-0.0288*** (0.0005)	0.0173*** (0.0004)
Resolved Posts Count	3.67*** (0.0016)	4.21*** (0.0238)	-0.209*** (0.0064)	-0.0778*** (0.0045)
Resolved Posts Novelty	30*** (0.0198)	33.3*** (0.19)	-1.89*** (0.0488)	-0.476*** (0.0344)
LastUpdate	0.0002+ (0.0001)	0.00001 (0.0001)	-0.0001 (0.0001)	0.0002*** (0.0000)
Incumbents	0.053*** (0.0000)	0.0595*** (0.0000)	-0.0043*** (0.0002)	0.0087*** (0.0002)
Exits	-0.22*** (0.0000)	-0.372*** (0.0000)	0.0168*** (0.0004)	0.0024*** (0.0002)
Constant	-26*** (0.0199)	-29.7*** (0.19)	1.74*** (0.048)	0.125*** (0.0345)
Time fixed effects	Yes	Yes	Yes	Yes
App fixed effects	Yes	Yes	Yes	Yes
N	231,042	231,042	231,042	231,042
N of groups	15,418	15,418	15,418	15,418
R2	0.879	0.905	0.112	0.124

+ p<0.1, * p<0.05, ** p<0.01, *** p<0.001

Estimator = fixed effects with robust standard errors, i.e., standard errors clustered by app.

We control for the number of months since the last major update, the number of alternatives incumbent and exit.

Online Appendix N. Results of 1st Quasi-Experiment with Alternative Measures of Major Updates

We ensure that our results are robust after using a different measure of innovation. We adopt two alternative measures for major updates based on the app version number. The first alternative measure of major update classifies an update into a major update if the update and the previous update have different version numbers' 1st digits (e.g., 3.0.0 and 4.0.0) while the second alternative measure classifies an update into a major update if (a) the update and the previous update have different version number's 1st digits (e.g., 3.0.0 and 4.0.0), or (b) the update and the previous update have same version number's 1st digits, but different version number's 2nd digits (e.g., 3.1.0 and 3.2.0).

	Major Update			
	1 st Alternative Measure ^a		2 nd Alternative Measure ^b	
	M1	M2	M3	M4
After x Openness	0.0128***	0.0126***	0.0097**	0.0092*
	(0.002)	(0.002)	(0.0037)	(0.0037)
ReviewsDiff		0.021***		0.0747***
		(0.0044)		(0.0122)
RatingDiff		0.00019		-0.0039+
		(0.0008)		(0.0021)
Incumbents	0.0045***	0.0044***	0.0042**	0.0041**
	(0.0006)	(0.0006)	(0.0013)	(0.0013)
Exits	0.0049***	0.005***	0.0037+	0.0039+
	(0.0012)	(0.0012)	(0.0022)	(0.0022)
Constant	-0.0887***	-0.0891***	-0.0611*	-0.0629*
	(0.0127)	(0.0126)	(0.0272)	(0.0272)
Time fixed effects	Yes	Yes	Yes	Yes
App fixed effects	Yes	Yes	Yes	Yes
N	231,042	231,042	231,042	231,042
N of groups	15,418	15,418	15,418	15,418
R2	0.009	0.010	0.005	0.007

+ p<0.1, * p<0.05, ** p<0.01, *** p<0.001

Estimator = fixed effects with robust standard errors, i.e., standard errors clustered by app.

We control for the number of alternatives incumbent and exit.

^aDifferent 1st digit of version number

^bDifferent 1st digit of version number or [same 1st digit and different 2nd digit]

Online Appendix O. Results of 1st Quasi-Experiment with Additional Control Variables

We also rule out the possibility that observed effects are driven by rivals' responses to sharing TPAs. It is possible that the characteristics (e.g., number of reviews, ratings, updates) of sharing TPAs influence rivals (e.g., mediators (consumer demand and ratings), and outcome (updates)). We include sharing TPA's characteristics (i.e., sharing TPAs' monthly major updates, monthly minor updates, monthly average rating difference, and monthly reviews count difference) as control variables when assessing rivals' outcomes and mediators to mitigate the issue of potential alternative explanations. The results are consistent with our main findings.

	Major Update	
	M1	M2
After x Openness	0.0063**	0.0061**
	(0.002)	(0.002)
ReviewsDiff		0.0344***
		(0.0078)
RatingDiff		-0.0004
		(0.0012)
Sharing TPAs Major Updates	-0.0124	-0.0125
	(0.01)	(0.01)
Sharing TPAs Minor Updates	0.0021	0.0027
	(0.0068)	(0.0068)
Sharing TPAs Avg Ratings	-9.50E-06	-0.0001
	(0.0018)	(0.0018)

Sharing TPAs Review Count	3.90E-06	-9.30E-07
	(9.60E-05)	(9.60E-05)
Incumbents	0.0019***	0.0019**
	(0.0006)	(0.0006)
Exits	-0.0012	-0.0011
	(0.0013)	(0.0013)
Constant	-0.052**	-0.0529**
	(0.0174)	(0.0174)
Time fixed effects	Yes	Yes
App fixed effects	Yes	Yes
N	231,042	231,042
N of groups	15,418	15,418
R2	0.001	0.003

+ p<0.1, * p<0.05, ** p<0.01, *** p<0.001

Estimator = fixed effects with robust standard errors, i.e., standard errors clustered by app.

We control for the number of alternatives incumbent and exit.

	ReviewsDiff				
	M1	M2	M3	M4	M5
After x Openness	0.0079*	0.0031	0.0034	0.0042	0.0033
	(0.0038)	(0.003)	(0.003)	(0.0031)	(0.0031)
SameMarketAlternativesDiff		-0.0203*	-0.0226**		-0.0267**
		(0.0079)	(0.0079)		(0.0082)
OtherMarketAlternativesDiff			0.0382*		0.0325*
			(0.0156)		(0.016)
SameMarketAlternatives		-0.0067*		-0.0111**	-0.0128***
		(0.0034)		(0.0038)	(0.0039)
OtherMarketAlternatives				0.011*	0.01*
				(0.0056)	(0.0055)
Sharing TPAs Major Updates	0.0245	0.051+	0.0263	0.142**	0.154***
	(0.0241)	(0.0275)	(0.0223)	(0.0457)	(0.0457)
Sharing TPAs Minor Updates	-0.0304*	-0.0315*	-0.0244*	-0.0476**	-0.0509***
	(0.0142)	(0.0135)	(0.0122)	(0.0151)	(0.015)
Sharing TPAs Avg Ratings	0.0018	0.0011	0.0027	-0.0035	-0.0042
	(0.0027)	(0.0026)	(0.0024)	(0.003)	(0.003)
Sharing TPAs Review Count	2.00E-04	3.2e-04+	1.60E-04	0.0012***	0.0012***
	(1.60E-04)	(1.70E-04)	(1.50E-04)	(3.10E-04)	(3.00E-04)
LastUpdate	-0.0037*	-0.0031**	-0.0037**	-0.0031**	-0.0031**
	(0.0015)	(0.0011)	(0.0013)	(0.0012)	(0.0012)
Incumbents	0.0008	0.0033**	-0.0005	0.0028*	0.0028*
	(0.001)	(0.0013)	(0.0008)	(0.0011)	(0.0011)
Exits	-0.0026	-0.0067*	-0.0043	-0.0079*	-0.0094**
	(0.0028)	(0.0028)	(0.0027)	(0.0031)	(0.0031)
Constant	0.0827+	0.112***	0.0928***	0.0007	0.0143

	(0.0492)	(0.0299)	(0.0264)	(0.0448)	(0.0465)
Time fixed effects	Yes	Yes	Yes	Yes	Yes
App fixed effects	Yes	Yes	Yes	Yes	Yes
N	231,042	231,042	231,042	231,042	231,042
N of groups	15,418	15,418	15,418	15,418	15,418
R2	0.002	0.002	0.002	0.002	0.002

+ p<0.1, * p<0.05, ** p<0.01, *** p<0.001

Estimator = fixed effects with robust standard errors, i.e., standard errors clustered by app.

We control for the number of months since the last major update, the number of alternatives incumbent and exit.

	SameMarket Alternatives	OtherMarket Alternatives	SameMarket AlternativesDiff	OtherMarket AlternativesDiff
	M1	M2	M3	M4
After x Openness	0.0729*** (4.50E-05)	0.0162*** (0.0003)	-0.0139*** (0.0005)	0.0265*** (0.0005)
Sharing TPAs Major Updates	0.798*** (9.50E-05)	3.06*** (0.0006)	0.136*** (0.0029)	-0.0263*** (0.0019)
Sharing TPAs Minor Updates	0.193*** (0.0001)	-0.177*** (0.0004)	-0.113*** (0.0021)	-0.0605*** (0.0018)
Sharing TPAs Avg Ratings	0.255*** (7.40E-06)	0.368*** (0.0002)	0.0196*** (0.0007)	-0.0067*** (0.0003)
Sharing TPAs Review Count	-0.0053*** (1.60E-06)	0.0127*** (4.40E-06)	0.0027*** (5.50E-05)	-0.0014*** (2.50E-05)
LastUpdate	0.00004 (0.0000)	0.0011*** (0.0000)	-0.00004 (0.0000)	0.0002*** (0.0000)
Incumbents	0.0229*** (0.0000)	0.0704*** (0.0001)	-0.0031*** (0.0002)	0.0055*** (0.0002)
Exits	-0.296*** (0.0000)	-0.223*** (0.0001)	0.0373*** (0.0005)	0.0005+ (0.0003)
Constant	5.04*** (8.10E-04)	2.6*** (0.0022)	-0.335*** (0.0063)	-0.343*** (0.0047)
Time fixed effects	Yes	Yes	Yes	Yes
App fixed effects	Yes	Yes	Yes	Yes
N	231,042	231,042	231,042	231,042
N of groups	15,418	15,418	15,418	15,418
R2	0.955	0.958	0.148	0.146

+ p<0.1, * p<0.05, ** p<0.01, *** p<0.001

Estimator = fixed effects with robust standard errors, i.e., standard errors clustered by app.

We control for the number of months since the last major update, the number of alternatives incumbent and exit.

Online Appendix P. Results of Heckman Approach in 1st Quasi-Experiment Examining the Effect of FPA's Openness on Rivals' Innovation

We further address issues related to self-selection bias in the decision to integrate or not FPA's open resources. Although our main analyses use a DiD + PSM setting –a commonly used design to address this type of bias (Kumar et al. 2018)–, we propose an alternative remedy based on the Heckman approach. We model the selection process using a Probit equation that calculates a latent variable. A unit is incorporated in

the treatment group if the latent variable is above 0, and not otherwise. The variables used in the selection equation include secondary market dummy, age of the developer, and control variables including number of incumbents and exits in the primary market, and the monthly dummies. We conducted the analyses with the newly created treatment and control groups and found consistent results.

	Major Update	
	M1	M2
After x Openness	0.0032*	0.0028+
	(0.0015)	(0.0015)
ReviewsDiff		0.0302**
		(0.0097)
RatingDiff		7.70E-05
		(0.0014)
Incumbents	0.0013*	0.0012*
	(0.0006)	(0.0005)
Exits	-0.0002	-0.00003
	(0.0011)	(0.0011)
Constant	-0.0232*	-0.0217+
	(0.0115)	(0.0114)
Time fixed effects	Yes	Yes
App fixed effects	Yes	Yes
N	209,102	209,102
N of groups	14,940	14,940
R2	0.001	0.002

+ p<0.1, * p<0.05, ** p<0.01, *** p<0.001

Estimator = fixed effects with robust standard errors, i.e., standard errors clustered by app.

We control for the number of alternatives incumbent and exit.

	ReviewsDiff				
	M1	M2	M3	M4	M5
After x Openness	0.0099**	0.0062*	0.0037+	0.0012	-2.00E-04
	(0.0031)	(0.0025)	(0.0022)	(0.0023)	(0.002)
SameMarketAlternativesDiff		-0.554**	-0.604**		-0.585**
		(0.205)	(0.22)		(0.219)
OtherMarketAlternativesDiff			0.197**		0.193**
			(0.0725)		(0.0692)
SameMarketAlternatives		-0.137***		-0.154***	-0.0312**
		(0.0369)		(0.0416)	(0.0121)
OtherMarketAlternatives				0.0664**	0.0307**
				(0.0216)	(0.0094)
LastUpdate	-0.0029**	-0.003***	-0.0033***	-0.0038***	-0.0036***
	(0.0009)	(0.0009)	(0.0009)	(0.0011)	(0.0009)
Incumbents	0.0024*	0.0052**	0.0005	0.004*	0.0003
	(0.0012)	(0.0018)	(0.0009)	(0.0016)	(0.0009)
Exits	-0.0117***	0.0047	0.0003	-0.0074**	0.002

	(0.0028)	(0.0039)	(0.0028)	(0.0026)	(0.0031)
Constant	0.0037	0.555***	-0.0604	0.482***	-0.032
	(0.0166)	(0.145)	(0.0561)	(0.132)	(0.0632)
Time fixed effects	Yes	Yes	Yes	Yes	Yes
App fixed effects	Yes	Yes	Yes	Yes	Yes
N	209,102	209,102	209,102	209,102	209,102
N of groups	14,940	14,940	14,940	14,940	14,940
R2	0.002	0.003	0.003	0.003	0.003

+ p<0.1, * p<0.05, ** p<0.01, *** p<0.001

Estimator = fixed effects with robust standard errors, i.e., standard errors clustered by app.

We control for the number of months since the last major update, the number of alternatives incumbent and exit.

	SameMarket Alternatives	OtherMarket Alternatives	SameMarket AlternativesDiff	OtherMarket AlternativesDiff
	M1	M2	M3	M4
After x Openness	0.0412***	0.0285***	-0.0059***	0.0015***
	(2.80E-04)	(2.00E-04)	(0.0001)	(0.0000)
LastUpdate	-4.2e-05	-5.1e-06	0.0013***	0.0011***
	(3e-05)	(2.0e-05)	(0.0000)	(0.0000)
Incumbents	.037***	.0011***	-0.0007***	0.0025***
	(6.0e-05)	(5.0e-05)	(0.0000)	(0.0000)
Exits	.0032***	5.6e-04***	0.0122***	0.0031***
	(7.6e-05)	(6.6e-05)	(0.0000)	(0.0000)
Constant	4.81***	4.93***	-0.242***	-0.249***
	(0.0013)	(0.0011)	(0.0003)	(0.0007)
Time fixed effects	Yes	Yes	Yes	Yes
App fixed effects	Yes	Yes	Yes	Yes
N	209,102	209,102	209,102	209,102
N of groups	14,940	14,940	14,940	14,940
R2	0.998	0.996	0.957	0.773

+ p<0.1, * p<0.05, ** p<0.01, *** p<0.001

Estimator = fixed effects with robust standard errors, i.e., standard errors clustered by app.

We control for the number of months since the last major update, the number of alternatives incumbent and exit.

Online Appendix Q. Results of 1st Stage of Two-Stage Least Squares

	SameMarket Alternatives	OtherMarket Alternatives	SameMarket AlternativesDiff	OtherMarket AlternativesDiff
Complementary Market Complexity	0.0163***	0.0177***	-0.0013**	-0.0015***
	(0.0001)	(0.0002)	(0.0005)	(0.0001)
Complementary Market Dynamism	0.491***	0.354***	-0.012***	-0.0083***
	(0.004)	(0.0015)	(0.0015)	(0.00035)
Complementary Market Growth	-0.0551***	-0.0354***	0.0079***	0.0012***
	(0.0005)	(0.0003)	(0.0004)	(0.0001)
LastUpdate	-0.00001	0.00001	0.0001***	0.0002***
	(0.00001)	(0.00001)	(0.0000)	(0.0000)

Incumbents	.0176***	-.0079***	0.0007***	0.0006***
	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Exits	0.0339***	0.1112***	0.0038***	-0.0012***
	(0.0003)	(0.0002)	(0.0002)	(0.0001)
Constant	5.45***	5.31***	-0.345***	-0.203***
	(0.0023)	(0.0025)	(0.0059)	(0.0014)
Time fixed effects	Yes	Yes	Yes	Yes
App fixed effects	Yes	Yes	Yes	Yes
N	1,997,736	1,997,736	1,997,736	1,997,736
N of groups	55,198	55,198	55,198	55,198
R2	0.891	0.923	0.029	0.036

+ p<0.1, * p<0.05, ** p<0.01, *** p<0.001

Estimator = fixed effects with robust standard errors, i.e., standard errors clustered by app.

Online Appendix R. Results of 2nd Quasi-Experiment

We matched the treatment group with a different control group, thus designing an alternative quasi-experiment. The control group consists of TPAs in the Sports category. We focus on this category because some workout TPAs also appear in the Sports category. We follow a procedure similar to the one described in the paper to identify the Sports category. Specifically, we find that the Sports category is the most popular secondary category, besides the Medical category, listed by workout TPAs (i.e., TPAs whose primary category is Health & Fitness and more specifically, workout). We use the Sports category because (a) it is the closest category to workout that is not listed under the Health & Fitness category, and (b) and it is further distant from the Medical category, hence overlap with the treatment group is less likely. We ensure that all Sports TPAs in our sample do not integrate Health Records API. We also ensure that in the post-release period, no other significant Health-related API and feature was released by either Apple or Google on their platforms. Finally, we use propensity score matching (PSM) to ensure that TPAs in control and treatment groups match during the pre-release period using one-on-one nearest neighbor matching without replacement. The variables used for PSM include average ratings, the logarithm of the number of reviews, the number of months since the release of the app, pricing, and major updates.

	Major Update	
	M1	M2
After x Openness	0.026*	0.0254*
	(0.0119)	(0.0119)
ReviewsDiff		0.0495**
		(0.0186)
RatingDiff		0.0001
		(0.0026)
Incumbents	0.0223*	0.0217+
	(0.0111)	(0.0112)
Exits	0.0059	0.0066
	(0.0189)	(0.0189)
Constant	0.0847***	0.0737***
	(0.0112)	(0.0119)
Time fixed effects	Yes	Yes

App fixed effects	Yes	Yes
N	13,016	13,016
N of groups	918	918
R2	0.007	0.011

+ p<0.1, * p<0.05, ** p<0.01, *** p<0.001

Estimator = fixed effects with robust standard errors, i.e., standard errors clustered by app.

	ReviewsDiff				
	M1	M2	M3	M4	M5
After x Openness	0.0784** (0.0254)	0.0088 (0.0192)	0.0184 (0.0186)	0.0727*** (0.0166)	5.10E-03 (0.0194)
SameMarketAlternativesDiff		-4.24*** (1.01)	-3.03*** (0.777)		-5.67*** (1.28)
OtherMarketAlternativesDiff			1.35* (0.558)		2.25** (0.817)
SameMarketAlternatives		-0.0433* (0.0191)		-0.0933* (0.0482)	-0.0695** (0.0246)
OtherMarketAlternatives				0.084* (0.042)	0.0493* (0.0255)
LastUpdate	-0.0071*** (0.0016)	-0.0017 (0.0027)	-0.006* (0.0028)	-0.007*** (0.0016)	0.0002 (0.0027)
Incumbents	0.0181** (0.0056)	-0.014 (0.010)	-0.0066 (0.0117)	0.0236*** (0.0055)	-0.0091 (0.0083)
Exits	0.0033 (0.0126)	-0.0013 (0.0105)	0.0217 (0.0139)	-0.0082 (0.0139)	-0.0097 (0.0113)
Constant	-0.279 (0.18)	-1.96 (1.21)	-3.23* (1.49)	-0.111 (0.141)	-1.64 (1.19)
Time fixed effects	Yes	Yes	Yes	Yes	Yes
App fixed effects	Yes	Yes	Yes	Yes	Yes
N	13,016	13,016	13,016	13,016	13,016
N of groups	918	918	918	918	918
R2	0.008	0.008	0.008	0.009	0.009

+ p<0.1, * p<0.05, ** p<0.01, *** p<0.001

Estimator = fixed effects with robust standard errors, i.e., standard errors clustered by app.

	SameMarket Alternatives	OtherMarket Alternatives	SameMarket AlternativesDiff	OtherMarket AlternativesDiff
	M1	M2	M3	M4
After x Openness	0.0083*** (0.0013)	0.0069*** (0.001)	-0.0011*** (0.0001)	8.8e-04*** (0.0002)
LastUpdate	-0.00003 (0.0000)	0.00002 (0.0000)	0.0013*** (0.0000)	0.0011*** (0.0000)
Incumbents	0.0219*** (0.0003)	0.0047*** (0.0003)	-0.0009*** (0.0000)	0.0016*** (0.0001)
Exits	-0.0019***	-0.0044***	0.0111***	0.0021***

	(0.0004)	(0.0004)	(0.0000)	(0.0001)
Constant	4.88***	5.1***	-0.284***	-0.249***
	(0.0103)	(0.0082)	(0.0013)	(0.0029)
Time fixed effects	Yes	Yes	Yes	Yes
App fixed effects	Yes	Yes	Yes	Yes
N	13,016	13,016	13,016	13,016
N of groups	918	918	918	918
R2	0.998	0.996	0.972	0.828

+ p<0.1, * p<0.05, ** p<0.01, *** p<0.001

Estimator = fixed effects with robust standard errors, i.e., standard errors clustered by app.

Online Appendix S. Results of 3rd Quasi-Experiment

We matched the treatment group with a different control group, thus designing an alternative quasi-experiment. The control group consists of medication management TPAs on the Android platform. We use the concept of statistical twins used in other studies (e.g., (Chen et al. 2022)). The idea is to identify the same rival on the Android platform and the rival must be developed by the same developer. Obviously, because the rivals are on a different platform, they are not affected by Apple Health Records API, and they do not overlap with the treatment group. Google does not have an equivalent to the Apple Health Records API. Google Health was discontinued in 2012.

	Major Update	
	M1	M2
After x Openness	0.0047*	0.0001
	(0.0019)	(0.0018)
ReviewsDiff		0.0216**
		(0.0082)
RatingDiff		0.0016
		(0.0017)
Incumbents	0.0056*	0.0018
	(0.0028)	(0.0027)
Exits	-0.0005	-0.0011
	(0.0014)	(0.0013)
Constant	-0.0435	-0.0099
	(0.0274)	(0.0256)
Time fixed effects	Yes	Yes
App fixed effects	Yes	Yes
N	151,356	151,356
N of groups	11,296	11,296
R2	0.001	0.001

+ p<0.1, * p<0.05, ** p<0.01, *** p<0.001

Estimator = fixed effects with robust standard errors, i.e., standard errors clustered by app.

	ReviewsDiff				
	M1	M2	M3	M4	M5
After x Openness	0.0038*	0.0006	0.0005	0.0019	3.30E-04

	(0.0015)	(0.0017)	(0.0017)	(0.0013)	(0.0017)
SameMarketAlternativesDiff		-0.0161*	-0.0235**		-0.0186*
		(0.0079)	(0.0087)		(0.0081)
OtherMarketAlternativesDiff			0.0362*		0.0118*
			(0.0362*)		(0.0118*)
SameMarketAlternatives		-0.003*		-0.0024*	-0.0038**
		(0.0013)		(0.0012)	(0.0013)
OtherMarketAlternatives				0.0027*	0.0057***
				(0.0012)	(0.0014)
LastUpdate	-0.0038***	0.0004	0.0003	0.0001	0.0004
	(0.0010)	(0.0004)	(0.0005)	(0.0004)	(0.0004)
Incumbents	-0.0014	-0.0013	-0.0014	-0.0016	-0.0014
	(0.0017)	(0.0009)	(0.0009)	(0.0012)	(0.0009)
Exits	-0.0032**	-0.0004	0.0003	-0.0001	-0.0007+
	(0.001)	(0.0004)	(0.0004)	(0.0004)	(0.0004)
Constant	0.0676***	-0.539***	-0.468***	-0.341**	-0.638***
	(0.0097)	(0.133)	(0.133)	(0.112)	(0.137)
Time fixed effects	Yes	Yes	Yes	Yes	Yes
App fixed effects	Yes	Yes	Yes	Yes	Yes
N	151,356	151,356	151,356	151,356	151,356
N of groups	11,296	11,296	11,296	11,296	11,296
R2	0.001	0.001	0.001	0.001	0.001

+ p<0.1, * p<0.05, ** p<0.01, *** p<0.001

Estimator = fixed effects with robust standard errors, i.e., standard errors clustered by app.

	SameMarket Alternatives	OtherMarket Alternatives	SameMarket AlternativesDiff	OtherMarket AlternativesDiff
	M1	M2	M3	M4
After x Openness	0.234***	0.658***	-0.0211***	0.0138***
	(0.0002)	(0.0001)	(0.0007)	(0.0003)
LastUpdate	-0.0005**	-0.0003*	-0.0004***	-0.0002***
	(0.0001)	(0.0001)	(0.0001)	(0.0000)
Incumbents	-0.184***	-0.0809***	-0.0148***	0.0099***
	(0.0003)	(0.0002)	(0.0009)	(0.0003)
Exits	-0.0448***	-.125***	-0.0057***	0.0008***
	(0.0003)	(1.8e-04)	(0.0004)	(0.0001)
Constant	7.76***	5.86***	0.0551**	-0.361***
	(0.0071)	(0.0052)	(0.0172)	(0.0055)
Time fixed effects	Yes	Yes	Yes	Yes
App fixed effects	Yes	Yes	Yes	Yes
N	151,356	151,356	151,356	151,356
N of groups	11,296	11,296	11,296	11,296
R2	0.723	0.843	0.180	0.246

+ p<0.1, * p<0.05, ** p<0.01, *** p<0.001

Estimator = fixed effects with robust standard errors, i.e., standard errors clustered by app.

Online Appendix T. Mechanisms Testing

Path	Test	Interpretation
1	<ul style="list-style-type: none"> The effect of <i>AFTER x OPENNESS</i> on <i>MAJOR UPDATE</i> is positive (Table 2 – M1) The magnitude of <i>AFTER x OPENNESS</i> reduces and becomes non-significant in the presence of <i>REVIEWSDIFF</i> and <i>RATINGDIFF</i> as mediators (Table 2 – M2) The effect of <i>REVIEWSDIFF</i> is positive (Table 2 – M2) The effect of <i>RATINGDIFF</i> is negative but nonsignificant (Table 2 – M2) The effect of <i>AFTER x OPENNESS</i> on <i>REVIEWSDIFF</i> is positive (Table 3 – M1) 	<ul style="list-style-type: none"> There is no support for the existence of competitiveness enhancement. There is support for the existence of positive market growth. Hence, path 1 is not supported.
2a	<ul style="list-style-type: none"> The effect of <i>AFTER x OPENNESS</i> on <i>REVIEWSDIFF</i> is positive (Table 3 – M1) The magnitude of <i>AFTER x OPENNESS</i> reduces and becomes non-significant in the presence of <i>SAMEMARKETALTERNATIVESDIFF</i>, <i>SAMEMARKETALTERNATIVES</i>, <i>OTHERMARKETALTERNATIVESDIFF</i>, <i>OTHERMARKETALTERNATIVES</i> as mediators (Table 3 – M5) The effect of <i>AFTER x OPENNESS</i> on <i>REVIEWSDIFF</i> is positive but not significant after controlling the mediators (Table 3 – M5) The effects of <i>OTHERMARKETALTERNATIVESDIFF</i>, <i>OTHERMARKETALTERNATIVES</i> are positive (Table 3 – M5) The effects of <i>SAMEMARKETALTERNATIVESDIFF</i>, <i>SAMEMARKETALTERNATIVES</i> are negative (Table 3 – M5) The effects of <i>AFTER x OPENNESS</i> on <i>SAMEMARKETALTERNATIVESDIFF</i>, <i>SAMEMARKETALTERNATIVES</i>, <i>OTHERMARKETALTERNATIVESDIFF</i>, <i>OTHERMARKETALTERNATIVES</i> are significant (Table 4 – M1, M2, M3, and M4) 	<ul style="list-style-type: none"> There is support for the existence of the indirect spillover effect because the effects of <i>OTHERMARKETALTERNATIVESDIFF</i>, <i>OTHERMARKETALTERNATIVES</i> on <i>REVIEWSDIFF</i> are positive (Table 3 – M5) Hence, path 2.a. is supported The effects of <i>SAMEMARKETALTERNATIVESDIFF</i>, <i>SAMEMARKETALTERNATIVES</i> on <i>REVIEWSDIFF</i> are negative (Table 3 – M5). This is consistent with the idea that product expansion may reduce consumer demand when competition is intense.
2b	<ul style="list-style-type: none"> The effect of <i>AFTER x OPENNESS</i> on <i>REVIEWSDIFF</i> is positive (Table 3 – M1) The magnitude of <i>AFTER x OPENNESS</i> reduces and becomes non-significant in the presence of <i>SAMEMARKETALTERNATIVESDIFF</i>, <i>SAMEMARKETALTERNATIVES</i>, <i>OTHERMARKETALTERNATIVESDIFF</i>, <i>OTHERMARKETALTERNATIVES</i> as mediators (Table 3 – M5) The effects of <i>OTHERMARKETALTERNATIVESDIFF</i>, <i>OTHERMARKETALTERNATIVES</i> are positive (Table 3 – M5) The effects of <i>SAMEMARKETALTERNATIVESDIFF</i>, <i>SAMEMARKETALTERNATIVES</i> are negative (Table 3 – M5) The effects of <i>AFTER x OPENNESS</i> on <i>SAMEMARKETALTERNATIVESDIFF</i>, <i>SAMEMARKETALTERNATIVES</i>, <i>OTHERMARKETALTERNATIVESDIFF</i>, <i>OTHERMARKETALTERNATIVES</i> are significant (Table 4 – M1, M2, M3, and M4) The effect of <i>AFTER x OPENNESS</i> on <i>REVIEWSDIFF</i> is positive but not significant after controlling the mediators (Table 3 – M5) 	<ul style="list-style-type: none"> There is no support for the existence of the spillover effect because the effect of <i>AFTER x OPENNESS</i> on <i>REVIEWSDIFF</i> is positive but not significant after controlling the mediators (Table 3 – M5) Hence, path 2.b. is not supported

Online Appendix U. Comparison with Closest Literature

	Foerderer et al. 2018	Wen and Zhu 2019	This study
Type of entry	FPA with closed resources	FPA with closed resources	FPA with open resources
Competitiveness enhancement	No empirical evidence was found for the racing mechanism	Competitiveness enhancement is not discussed as a potential mechanism	No empirical evidence that competitiveness enhancement is the dominant mechanism explaining the impact of opening FPA's resources on rivals' innovation
Positive market growth	The presence of the spillover effect suggests the presence of positive market growth	Positive market growth is not discussed as a potential mechanism	Empirical evidence that positive market growth is the dominant mechanism explaining the impact of opening FPA's resources on rivals' innovation
Spillover effect	FPA with closed resources generates attention spillover	No testing of spillover effect for FPA with closed resources	FPA with open resources does not generate direct attention spillover, but only indirect attention spillover

Online Appendix V. Review of Prior Literature on the Impact of First-Party Components on Third-Party Components (e.g., Apps, Stores)

Paper	Platform owner's entry	Identification approach	Context	Types of effects	Third-party's outcomes	Heterogenous effect	Overall finding
(Foerderer <i>et al.</i> , 2018)	Closed	Exogenous shock (quasi-experiment)	Photography apps	Spillover and racing effects	App updates	Yes Complement characteristics: portfolio size and diversification	Google's entry into the photography category stimulated rivals' innovation due to the attention spillover effect (i.e., Google's entry attracts consumers and provides rivals with new demand and feedback to innovate).
(Wen and Zhu, 2019)	Closed	Exogenous shock (quasi-experiment)	Android apps	Competition effect	App updates	Yes Complement characteristics: popularity	Google's entry reduces rivals' innovation as rivals shift their innovation to non-rival apps. Moreover, it raises rivals' prices.
(He <i>et al.</i> , 2020)	Closed	Exogenous shock (quasi-experiment)	Store	Competition effect, spillover effect, and disintermediation effect	Consumer demand	Yes Complement characteristics: size	The entry of first-party stores decreases the offline customer demand of rivals due to the disintermediation effect (i.e., rivals encourage their customers to transact outside the platform to retain their customers).
(Sharma and Mehra, 2021)	Closed	Modeling	Access products (i.e., smartphone, etc.)	Competition effect	Quality, profits, welfare	None	Platform's entry provides a higher quality access product than the rivals at a lower price. Moreover, it increases consumer surplus and stimulates higher-quality access products by both the platform and rivals.
(Cenamor and Frishammar, 2021)	Closed	Regression	Video games	Unclear effects	Sales	Yes Platform characteristics: age	The proprietary (i.e., development and commercialization by platform sponsors), outbound (i.e., development by platform sponsors and commercialization

							by third parties), and inbound (i.e., development by third parties and commercialization by platform sponsors) strategies have higher app sales than third-party strategy (i.e., development and commercialization by third parties).
This study	Open	Exogenous shock (quasi-experiment)	Medical apps	Competitiveness enhancement, positive market growth, direct and indirect spillover	App updates	Yes Complement characteristics: portfolio size and diversification	Opening FPA's resources is associated with positive market growth. Moreover, findings support the indirect spillover effect. This implies that rivals receive greater consumer demand as a result of an increase in the number and differentiation of other-market alternatives.

Online Appendix W. Review of Prior Literature on the Impact of Platform Openness

Paper	Platform-level openness, i.e., FPAs do not share resources with TPAs	App-level openness, i.e., FPAs share resources with TPAs	Focus on Rivals (i.e., same-market TPAs not integrating FPAs' resources)	Arguments Explaining the Impact of Openness on TPAs	Comparison with our Study
(Cenamor and Frishammar, 2021)	Yes	No	No	Platform sponsors have access to unique platform resources that allow the creation of high-quality complementary products.	The main perspective discussed is the competitiveness enhancement perspective. Our study examines both competitiveness enhancement and positive market growth perspectives.
(Boudreau, 2010)	Yes	No	No	Platform openness (granting access) accelerates the rate of new handheld device development (i.e., complementary innovation). Plausible factors include strategic interactions and spillovers among complementors, transaction and coordination costs between the platform owner and complementors, and the diversity of suppliers.	Several alternative explanations are proposed but not tested. Our study examines both competitiveness enhancement and positive market growth perspectives, as well as direct and indirect spillover effects.
(Parker and Van Alstyne, 2018)	Yes	Yes	No	Opening the platform enhances third-party developer ability to build upon it. The longer third-party developers keep rights to their innovations, the more royalties they earn, but the sooner their rights expire, other third-party developers can build upon the innovations as they become public.	The explanations are not empirically tested. Moreover, the network effect that suggests that, after innovations become public, other third-party developers do not need to build upon the innovations to benefit is not considered. Our study examines both direct and indirect spillover effects. The network effect in

					Parker and Van Alstyne (2018) is the same concept as the indirect spillover effect in our study.
(Karhu, Gustafsson and Lyytinen, 2018)	Yes	No	No	Opening the platform enables anyone to fork the platform	The main perspective discussed is the competitiveness enhancement perspective. Our study examines both competitiveness enhancement and positive market growth perspectives.
(Song, Chen and Li, 2020)	Yes	No	No	Platform openness increases consumer awareness of third-party products	The main perspective discussed is the competitiveness enhancement perspective. Our study examines both competitiveness enhancement and positive market growth perspectives.
(Nambisan, Siegel and Kenney, 2018)	Yes	No	No	Platform openness creates entrepreneurial opportunities by providing inputs for innovation	The main perspective discussed is the competitiveness enhancement perspective. Our study examines both competitiveness enhancement and positive market growth perspectives.
(Eckhardt, Ciuchta and Carpenter, 2018)	Yes	No	No	Platform openness facilitates the development and commercialization of third-party products	The main perspective discussed is the competitiveness enhancement perspective. Our study examines both competitiveness enhancement and positive market growth perspectives.
(Cennamo and Santaló, 2019)	Yes	No	No	Greater generativity enhances and reduces user satisfaction for all complements through a positive reputation spillover effect, and negative free-riding	The focus is on user satisfaction. Our study investigates innovations.

				effect, respectively. Both mechanisms coexist.	
(Boudreau, 2012)	Yes	No	No	The number of developers increases and decreases innovation incentives when apps are differentiated and close substitutes, respectively.	The focus is on the network effect. Our study examines both direct and indirect spillover effects. The network effect in Boudreau 2012 is the same concept as the indirect spillover effect in our study.
This study	No	Yes	Yes	Opening FPA's resources to TPAs benefits rivals through the positive market growth mechanism. Competitiveness enhancement is not supported. Moreover, rivals receive more consumer demand not because of the direct spillover effect, but because of the indirect spillover effect. This suggests that the number and differentiation of other-market alternatives are necessary to receive greater consumer demand.	Not applicable

The papers do not include platform-to-platform sharing (e.g., Niculescu et al. 2018)
Qualitative studies are not included.