

# Lessons from Innovation Economics for Digital Platform Policy

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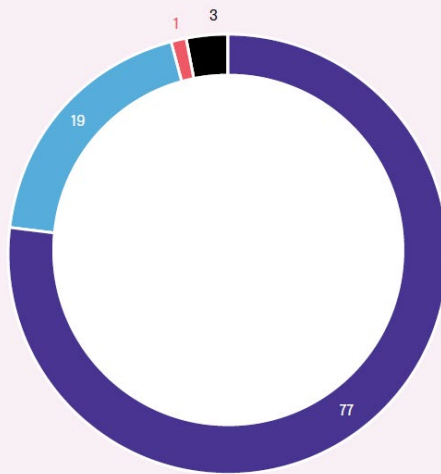
Paper and slides available at <https://quello.msu.edu/publications>

# Background and motivation

## Views on the Amount of Power Held by Internet and Technology Companies

Do you believe that major internet and technology companies like Facebook, Google, Amazon and Apple have --?

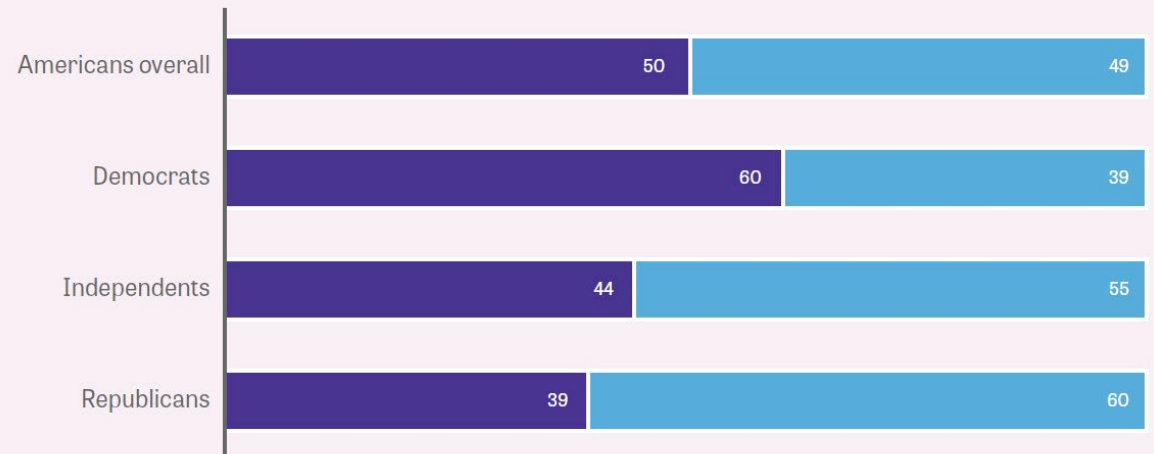
■ % Too much power ■ % The right amount of power ■ % Too little power ■ % No answer



## Should the Government Break Up Major Internet and Technology Companies?

Would you favor or oppose actions by the federal government that would require major internet and technology companies such as Amazon, Facebook, Apple and Google to break up into smaller companies?

■ % Favor ■ % Oppose



Source: Knight Foundation & Gallup, 2020

- Increasing concerns about platform power (e.g., abuse of dominance, negative effects on rate and direction of innovation, platform censorship)
- Many policy proposals, significant disagreement as to what should be done
- Incidents of violation of fair competition, little evidence on innovation impacts

# Plan of presentation

- Economics of complementary innovation
- Empirical analysis of platform roles in venture capital funding
- Preliminary policy implications

# Economics of complementary innovation

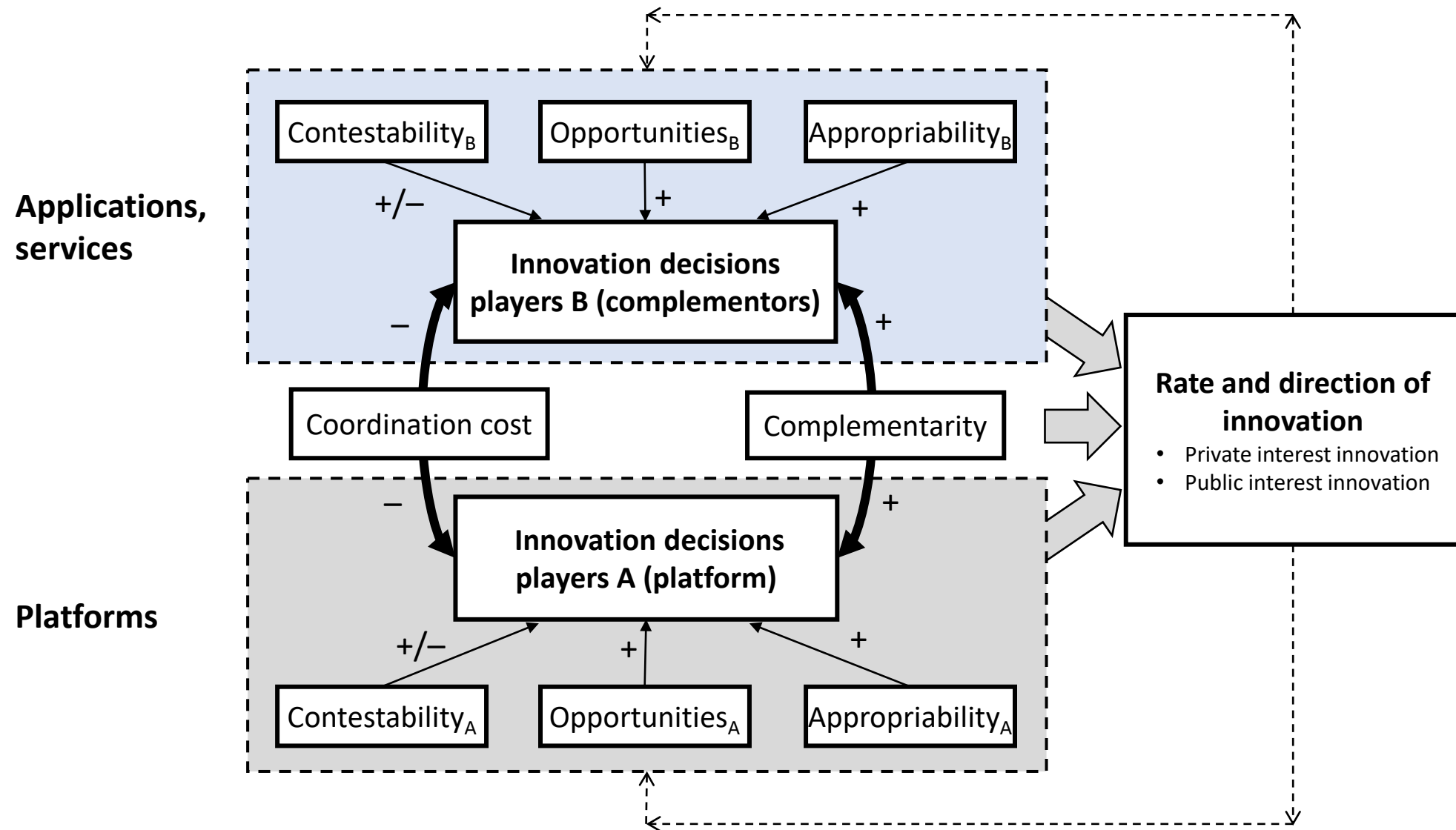
# Innovation as evolutionary search

- Traditional approach to innovation distinguishes product, process, service, design, business model innovations (e.g., OECD, 2010)
- Newer approaches emphasize “creation of novelty that contributes to sustainable increases in efficiency” (Antonelli, 2011) and wellbeing
- Digital markets allow continuous process of experimentation, real-time feedback on outcomes, selection of successful models, and their replication and scaling (e.g., Brynjolfsson, 2011)
- Essentially an evolutionary search process for new combinations and re-combinations of knowledge, an expansion into the “adjacent possible” (Kauffman, 1993)

# Management of innovation ecosystems

- Platforms are institutional solutions that unlock new forms of value co-creation (e.g., allow internalization of some externalities)
- Need to overcome several management challenges (Williamson & De Meyer, 2020)
  - Pinpointing the added value
  - Structuring differentiated partner roles
  - Stimulating complementary partner investments
  - Reducing transaction costs
  - Enabling flexibility and co-learning
  - Engineering value capture mechanisms
- Non-myopic “ecosystem leaders” seek to grow the revenues and profits of the entire network of partners and complementors

# Complementary innovation



# Ambiguous effects of platforms

Innovation drivers	Positive effects	Negative effects
Coordination costs	Reduction of coordination costs of complementary innovators	Increased coordination costs for non-affiliated players
Complementarity	Enhance potential synergies (e.g., by platform design choices and available developer services)	Weaken potential synergies (e.g., by imposing highly selective selection criteria for affiliation)
Contestability	Design platform ecosystem to optimize degree of contestability	Adopt overly restrictive or overly permissive conditions for affiliation
Opportunities	Broaden innovation opportunities for complementors with transparency (e.g., funding, access to users)	Overly restrictive conditions for participation, control over partner innovation decisions
Appropriability, financial sustainability	Sharing of service revenues designed to improve appropriability conditions for complementors, support for start-ups and provision of venture capital	Revenue sharing biased in favor of platform revenues and profitability, pre-emptive policies toward start-ups (“kill zones”)



# Empirical analysis of platform roles in venture capital activity

# Platforms and start-up funding

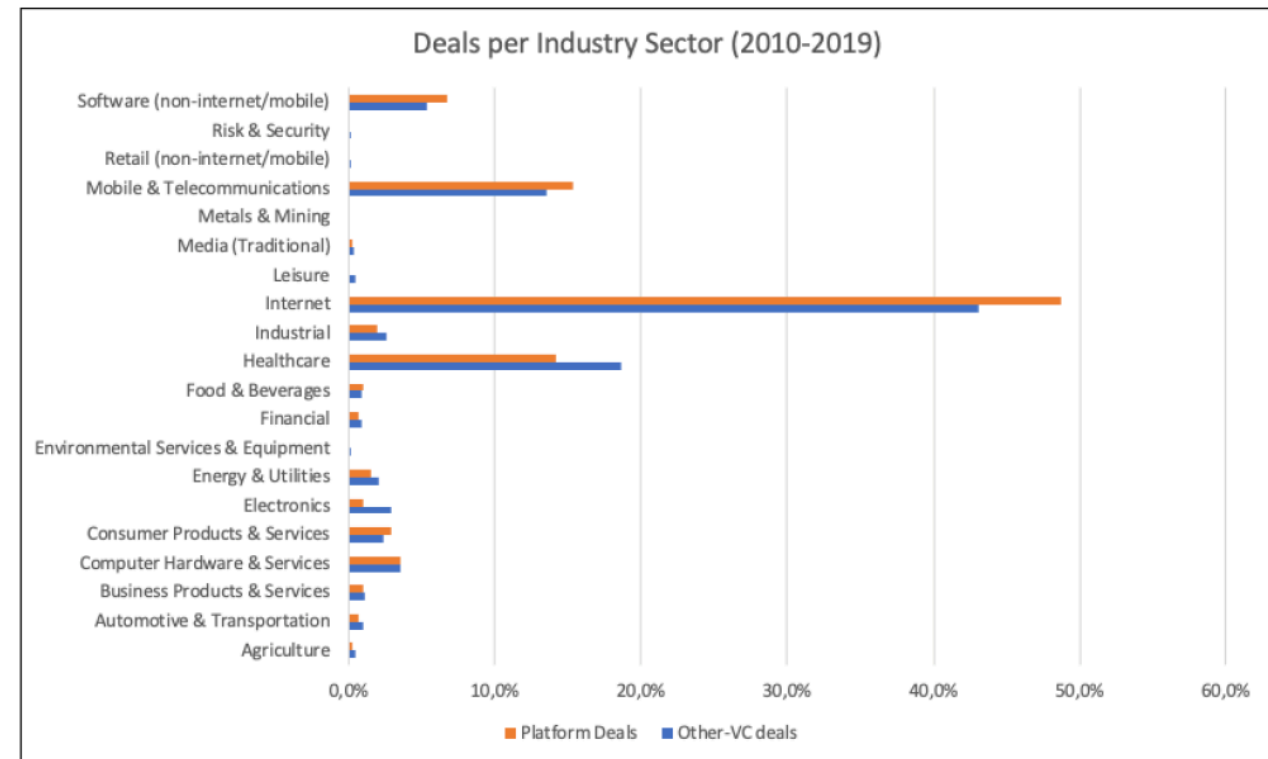
- The research literature provides evidence of a positive, causal association between venture capital activity and innovation
- Platforms have many ways to affect innovation (e.g., by influencing the ability of start-ups to appropriate innovation rewards, providing start-up capital, biasing innovation in certain directions)
- Empirical research questions for this paper
  - Do venture capital investments of digital platforms drive other venture capitalists to invest in startups in the same niches?
  - Does the presence of a platform in a deal attract additional venture capitalists to that deal?
  - Does the presence of a platform in a deal attract more funding to that deal?

# Platforms and start-up funding ...

Table 1 - Descriptive statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
amount	24,428	39.14538	142.59	7.5	14000
n_new_invest	24,428	3.868266	2.691216	1	92
platform_part	24,428	.0285738	.1666087	0	1
usa	24,428	.6063124	.488577	0	1
china	24,428	.1379564	.3448613	0	1
other_c	24,428	.2557311	.4362803	0	1
internet	24,428	.4326183	.495449	0	1
mobtel	24,428	.1356231	.3423949	0	1
healthcare	24,428	.1850336	.3883327	0	1
software	24,428	.0537089	.2254469	0	1
other	24,428	.1930162	.3946737	0	1
phi	24,428	5.688963	6.13285	0	93
y2010	24,428	.0458081	.2090729	0	1
y2011	24,428	.0612412	.2397771	0	1
y2012	24,428	.0569429	.2317381	0	1
y2013	24,428	.0642296	.2451665	0	1
y2014	24,428	.0900606	.2862744	0	1
y2015	24,428	.1117979	.3151241	0	1
y2016	24,428	.1063124	.3082434	0	1
y2017	24,428	.1312019	.3376279	0	1
y2018	24,428	.1639103	.3702017	0	1
y2019	24,428	.1684952	.3743131	0	1

Figure 3: Deals per industry sector



# Platforms and start-up funding ...

Figure 4: Deals per industry sector

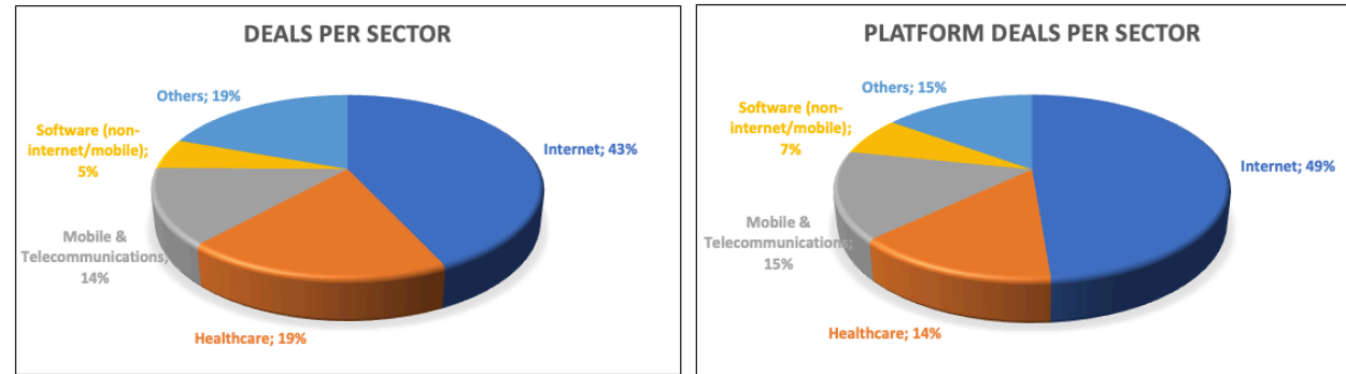
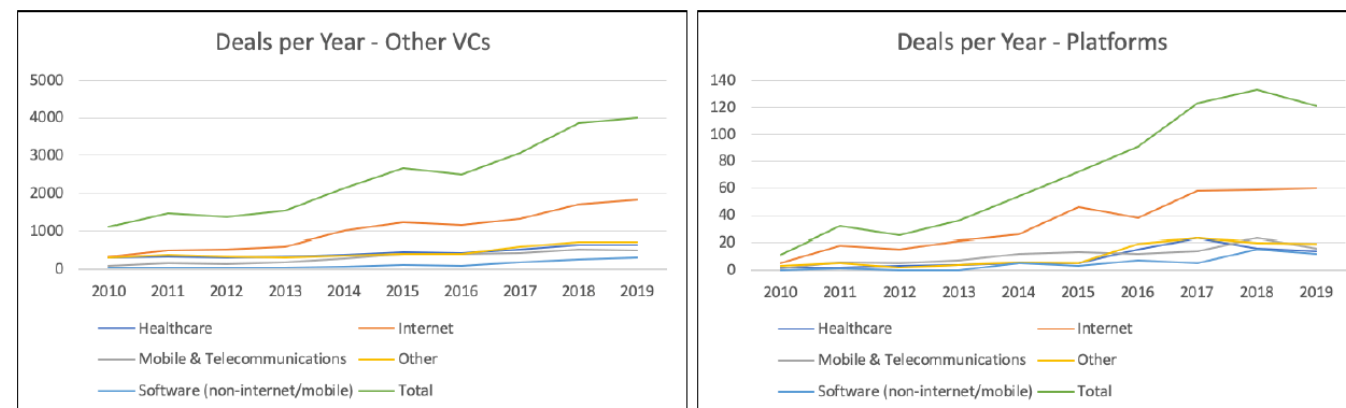


Figure 5: Deals per industry sector per year



# Analysis of quarterly venture capital deals per sector

*Table 2: Analysis of deals per quarter per sector - descriptive statistics*

Variable	Obs	Mean	Std. Dev.	Min	Max
n_deals_vc	686	34.59184	70.48091	1	518
n_deals_plat	686	1.017493	2.670682	0	23
internet	686	.058309	.2344979	0	1
mobtel	686	.058309	.2344979	0	1
healthcare	686	.058309	.2344979	0	1
software	686	.058309	.2344979	0	1
other	686	.7667638	.4231999	0	1

*Table 3: Analysis of deals per quarter per sector - correlation matrix*

	n_deal~c	lag_n~c	n_deal~t	lag_n~t	internet	mobtel	health~e	software	other
n_deals_vc	1.0000								
lag_n_deal_vc	0.9865	1.0000							
n_deals_plat	0.8794	0.8607	1.0000						
lag_n_deals_plat	0.8879	0.8784	0.7925	1.0000					
internet	0.7866	0.7788	0.7208	0.7037	1.0000				
mobtel	0.1562	0.1563	0.1562	0.1537	-0.0666	1.0000			
healthcare	0.2627	0.2652	0.1086	0.1102	-0.0666	-0.0666	1.0000		
software	-0.0187	-0.0210	0.0109	0.0089	-0.0666	-0.0666	-0.0666	1.0000	
other	-0.6633	-0.6590	-0.5569	-0.5458	-0.4473	-0.4473	-0.4473	-0.4473	1.0000

# Analysis of quarterly venture capital deals per sector ...

*Table 4: Analysis of deals per quarter per sector – results*

Variable	Model_1	Model_2	Model_3	Model_4	Model_5	Model_6
n_deals_vc	(DV)	(DV)	(DV)	.03585287***	.03443506***	
n_deals_plat	13.84573***	12.703131***		(DV)	(DV)	(DV)
lag_n_deals_vc						.03229329***
lag_n_deals_plat			14.266537***			
mobtel	-93.414051***	-100.18395***	-95.13409***	.36538615	.11663147	-.54069329
healthcare	-55.816186***	-63.15738***	-58.370047***	-1.2344007***	-1.439664***	-2.0223126***
software	-120.79931***	-129.31167***	-122.69839***	.57925038	.26173194	-.5282207
other	-129.81228***	-139.95975***	-131.70243***	.39956633	.04362379	-.8520944
y2010		(omitted)			(omitted)	
y2011		1.5376685			.17837083	
y2012		1.3951111			.11743851	
y2013		1.8082255			.19697404	
y2014		7.2141076			.16582916	
y2015		11.218948**			.17054485	
y2016		6.0302712			.52490025*	
y2017		8.1426078			.68808854**	
y2018		16.539551***			.43838949*	
y2019		20.225386***			.22145685	
_cons	135.78444***	138.25673***	137.9994***	-.51220109	-.42007912	.77445849
Adj_r2	.88317955	.88972132	.89969412	.78931883	.79180016	.75618778
N	686	686	625	686	686	625

legend: \* p<0.05; \*\* p<0.01; \*\*\* p<0.001

# Analysis of funding and investors per deal

Table 5: Analysis of funding and investors per deal - descriptive statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
amount	24,428	39.14538	142.59	7.5	14000
log_amount	24,428	3.060435	.8619405	2.014903	9.546813
n_new_invest	24,428	3.868266	2.691216	1	92
log_new_invest	24,428	1.13493	.6799042	0	4.521789
platform_part	24,428	.0285738	.1666087	0	1
usa	24,428	.6063124	.488577	0	1
china	24,428	.1379564	.3448613	0	1
other_c	24,428	.2557311	.4362803	0	1
phi	24,428	5.688963	6.13285	0	93
y2010	24,428	.0458081	.2090729	0	1
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y2017	24,428	.1312019	.3376279	0	1
y2018	24,428	.1639103	.3702017	0	1
y2019	24,428	.1684952	.3743131	0	1

Table 6: Analysis of funding and investors per deal - correlation matrix

	log_am~t	log_ne~t	have_p~m	usa	china	other_c	phi
log_amount	1.0000						
log_new_invest	0.1696	1.0000					
platform_part	0.0856	0.1241	1.0000				
usa	-0.0707	0.0957	0.0940	1.0000			
china	0.1739	-0.1377	-0.0641	-0.4941	1.0000		
other_c	-0.0555	-0.0007	-0.0558	-0.7390	-0.2206	1.0000	
phi	0.2449	0.0929	0.0899	0.1219	-0.0940	-0.0622	1.0000

# Analysis of funding and investors per deal ...

*Table 7: Analysis of funding and investors per deal - results*

Variable	Model_7	Model_8	Model_9	Model_10
log_new_invest	(DV)	(DV)	.22403086***	.21091706***
log_amount			(DV)	(DV)
platform part	.44549368***	.42995312***	.29816706***	.26706226***
usa	1.1231437***	1.0533895***	2.5232697***	2.3797083***
china	.86801058***	.77767761***	3.0742872***	2.8805416***
other_c	1.0858402***	.99946538***	2.5348388***	2.3462598***
phi	.00769802***	.00814841***	.03434918***	.03577949***
y2010		.00849334		-.03934741
y2011		.02116171		.01438672
y2012		(omitted)		(omitted)
y2013		-.02189036		-.03076356
y2014		.03059237		.08252205**
y2015		.08142264***		.18312318***
y2016		.08323891***		.13410646***
y2017		.09413119***		.17082399***
y2018		.11777276***		.2949979***
y2019		.1310697***		.35372989***
Adj_r2	.74588155	.74708942	.93624989	.93782375
N	24428	24428	24428	24428
legend: * p<0.05; ** p<0.01; *** p<0.001				



# Limitations and next steps

- The data shows a strong asymmetric interdependence and parallel development of venture investments by digital platforms and other venture capitalists.
- Insufficient to tell conclusively whether platforms boost or quench innovation (more data is needed for an industry-level analysis).
- Next steps and future research
  - Examining additional factors that influence the decision-making process followed by venture capitalists before a deal;
  - Investigating in more detail whether “kill zones” are created by digital platforms investment and acquisitions for smaller projects; and
  - Assessing in more detail the net economic impact of positive and negative influences of digital platforms on innovation and the role of platform policy.

Preliminary policy implications

# Lessons for platform policy

1. Non-myopic platforms have strong incentives to realize positive effects of complementary innovation
2. Given the many non-linear interdependencies, high uncertainty, and incomplete information, safeguards are desirable
3. Theory and empirical evidence caution against regulatory interventions such as breakups and structural separation
4. Functional and non-discrimination safeguards are better suited to protect the vibrancy of the overall innovation system
5. Where possible, institutional and organizational diversity and competition should be promoted
6. A framework of ex post regulation seems best able to achieve these goals

# Resources

- Bauer, J. M. and Prado, T. S. (2020). Lessons from innovation economics for digital platform policy. Quello Center Working Paper, available online at <https://quello.msu.edu/publications>.