Buy, Invent or Both?

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Outline

1. Main Results

2. Models Setup

3. Do Startup Patent Acquisitions Affect Inventor Productivity?

Main Results

Main Results

- 1. For high-profit firm, in a more volatile environment, there is less R&D relative to acquisitions.
- 2. While only high-profit forms make acquisitions, the lower-profit end of this group favors acquisitions that squelch competition over those that provide synergies.
- 3. Both synergy and competition acquisitions play a crucial role in developing corporate innovation

Models Setup

Acquirer V.S. Target

- This model is a game between acquirers and targets.
- Acquirer is the company who may consider acquire other firms(targets).
- Targets can bargain and decide whether to accept the acquisition.
- Both parties goal is to maximize their profit
- Problem: The model only considers that acquirers can never be the targets. Acquirer may consider be acquired if it's better.

Key objective Functions

- Firms' production function: $y_t(k_t, h_t, z_t) = e^{z_t} h_t^{\Phi} (1 - m_c) k_t^{\alpha}$
- $z_t = \rho_z z_{t-1} + \sigma_z \epsilon_t$ is a random process of market profit shock.
- $h_t = \rho_h h_{t-1} + \omega_t$ is the firm's stock of patents, where ω_t is the random process of R&D project.
- m_c is the market shares of your competitor.
- $k_t = (1 - \delta)k_{t-1} + I_{t-1}$ is the capital.
- Acquirer' decision: 1. internal R&D project: ω_t 2. Investment of capital: I_t 3. Acquisition: m_t.
- Target's decision: Accept the contract if $P_t \geq (1 + \mu)V_T$.
- Problem: 1. Target should compare acquisition with non-acquisition. 2. Assuming target quits the market once be acquired.

Synergy v.s Competition

- Basic production: $y_t(k_t, h_t, z_t) = e^{z_t} h_t^{\Phi}(1 - m_c)k_t^{\alpha}$
- After synergy acquisition: $\Pi(k_t, h_t, z_t) = (1 - \tau_c)e^{z_t} h_t^{\Phi+m_s}(1 - m_c)k_t^{\alpha}$
- After competition acquisition: $\Pi(k_t, h_t, z_t) = (1 - \tau_c)e^{z_t} h_t^{\Phi} k_t^{\alpha}$
- Maximization: $V(k_t, h_t, z_t) =$
  $max_{I_t, \omega_t, m_t}\{e(.) + \phi(e(.)) + \frac{1}{1+r}\int V(k_{t+1}, h_{t+1}, z_{t+1})dF(z_{t+1})\}$
- Red part is the financing and its interest (debts)
- Problem: What does V contain? $k_t + 1_{m_t} \times V_T + h_t + \Pi_t...$

Estimation

- SMM: The estimation determines the parameter values that minimize the distance between the model-generated moments and the corresponding real moments from the empirical data.
- Question: Over-fitting and out sample test?
- Question: Most of the results coming from model simulation, can we design an experiment with simple regression to confirm these results?

Repeated Game?

- In Table 1, final sample includes 738 completed deals and 681 unique firm-year deals.
- That indicates some acquirers acquire repeatedly.
- Question: If this is the situation, the firm's production should be updated after 1st synergy acquisition. $e^{z_t} h_t^{\Phi}(1 - m_c)k_t^{\alpha} \rightarrow e^{z_t} h_t^{\Phi + m_s}(1 - m_c)k_t^{\alpha}$
- Maybe they should drop duplicated acquirer.

Fixed searching cost?

- The price of acquisition is: $P_t = V_T + \eta(V_{A,t+1} - V_{A-,t} - V_T - D \times k_{A,t})$
- It assumes the searching cost for a company is fixed given its capital k_A.
- In table 6 panel B, they argue that the increasing bargaining power η attracts more targets on the market which leads to higher synergy acquisition.

Panel B:Target Bargainning Power

Target Bargaining Power
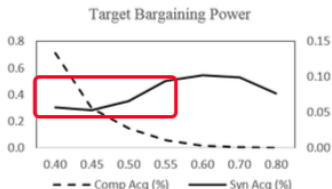
- Question: if that is the situation, the acquirers' searching cost should also negatively related to η.
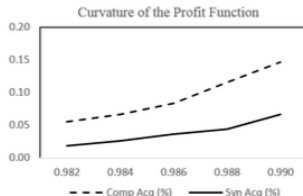
Figure Mistakes?

- Figure 5 Panel B draws the one of the main results: when profit of physical investment is low, firm reduces synergy acquisitions but increases competition acquisitions instead.

Panel B: Curvature of the Profit Function
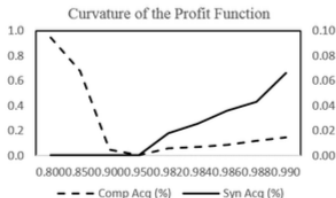
Panel A: Curvature of the Profit Function

- Question: for a same graph, patterns are different in Figure 4 Panel A?

Thanks!

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Do Startup Patent Acquisitions Affect Inventor Productivity?

Main Results

- Acquisition of a startup inventor's first patent has a negative effect on future productivity of the patent's inventor.
- Acquisition also leads the future patents' quality decreasing.
- In identification strategy, they use shared examiners as instrument variable.

Basic OLS Regression

- $Y = \beta X + \epsilon$, where Y represents the inventors' future productivity or patents quality, and X is an indicator variable of whether startup patent is acquired.
- There exists endogeneity issue which may cause $\hat{\beta}$ biased.
  (1) Acquirers are good in selection. ($\hat{\beta} > \beta$)
  (2) Or Only targets with limited innovation prospects are willing to being acquired. ($\hat{\beta} < \beta$)

Quasi-random Assignments in Patent Application

- Some interesting finding in patents application.
- The examiners of patent applications are assignment **randomly**. (robustness test, specialization)
- Examiners do some citations to the new patents. What's more, **examiners are more likely to add citations to patents that they recently reviewed**.
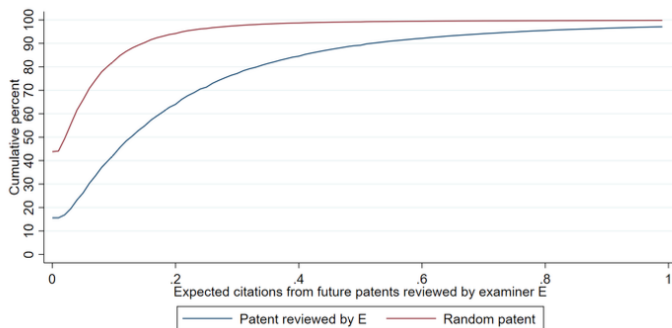
Citations associated with acquisitions?

- Potential acquirers: any firm that had been granted a patent in the same art unit that reviewed the startup patent within the 5 years prior to the startup patent's grant date.
- Question: Only competition acquisition?
- $\mathbf{1}_{Potential\,Acuqirer\,Aquire?} = \alpha \times \mathbf{1}_{HasCitationFromPotentialAcquirer} + \epsilon$

Table 3. Are examiner-added citations associated with more startup patent acquisitions?

| | Dep. var.: Startup's first patent acquired by incumbent? | | | | |
	(1)	(2)	(3)	(4)	(5)
Panel A: Full sample					
1{Examiner-added cite to startup}	1.440***	1.430***	1.376***	1.345***	1.304***
	(13.01)	(12.83)	(11.78)	(11.20)	(10.33)
Fixed effects:					
Incumbent firm	Y	N	N	N	N
Startup patent Art unit × Year	Y	Y	N	N	N
Incumbent firm × Year	N	Y	× Art	× Art	× Art
Incumbent firm × Tech. group	N	N	N	Y	× Year
N obs.	29,615,297	29,596,720	29,499,060	27,354,436	23,137,188
Adj. R^2	0.005	0.018	0.099	0.132	0.206

Sharing examiners associated with acquisitions?

- Does sharing examiners also increase the likelihood of acquisitions?

- $\mathbf{1}_{Potential\,Acuqirer\,Aquire?} = \alpha \times \mathbf{1}_{Sharing\,Examiners?} + \epsilon$

Table 4. Does sharing examiner with an incumbent increase the likelihood that a startup patent is acquired?

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
					Dep. var.: Startup's first patent acquired by incumbent?					
Panel A: Full Sample										
1{Same examiner}	0.052***	0.051***	0.030***	0.027***	0.027***	0.037***	0.036***	0.026***	0.023***	0.023***
	(17.29)	(16.95)	(12.62)	(10.40)	(8.35)	(14.61)	(14.45)	(10.89)	(8.73)	(7.22)
... × 1{Frequent acquirer}						0.056***	0.056***	0.019***	0.016**	0.014*
						(7.73)	(7.50)	(2.93)	(2.32)	(1.67)

Instrument Variable

- We just showed: Sharing Examiners with potential acquirers → Citation linkage with potential acquirers' patents ↑ → Acquired by potential acquirer ↑.

- Recall: the examiners assignments are random.

- $SharingExaminers \sim Acquisition$, but $SharingExaminers \nsim Productivty/FuturePatentsQuality$

- It can be applied as an IV.

2SLS

- First-stage: Linkages to incumbents via shared examiners as source of exogenous variation in startup patent acquisitions.
- $\hat{\mathbf{1}}_{PotentialAcuqirerAquire?} = \gamma \times N \; linked \; incumbents + \epsilon$
- Where "N linked incumbents" counts the number of incumbent firms with whom the startup patent is linked via a shared patent examiner.
- Question: maybe consider the ratio instead of absolute value?
- Second-stage: $Y = \beta \times \hat{\mathbf{1}}_{PotentialAcuqirerAquire?}$
- Main regression results: β are significant negative for both future patents' quantity & quality. Which is opposite to the OLS regression.

Conclusion

- Highlight: the IV selection
- Question: what's the mechanism behind potential acquirers $\rightarrow$ Acquired by potential acquirer $\uparrow$
- Question: acquirers outside of the same unit?

Thanks!

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