From Private to Public: Pharmaceutical R&D and Hiring Patterns Post-IPO

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Motivation

- In capital-intensive industries, public financial markets are important for new product development [Hsu et al. 2014; Kerr & Nanda 2015; Levine 1997]
- Yet the impact of these markets on R&D outcomes is unclear

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- Alleviate financing constraints
- Improve access to strategic resources by signaling firm quality

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IPOs *increase* innovation

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IPOs *decrease* innovation

- Disrupt organizational structures
- Reduce managerial risk tolerance & increase short-termism
- Exacerbate agency conflicts

Prior literature

- A large empirical literature has examined this trade-off in cross-industry studies
  - IPOs associated with *no change or decline* in patenting [Bernstein 2015; Dambra & Gustafson 2021]

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- However...
  - External financing needs can vary across industries [Acharya and Xu, 2017; Rajan and Zingales, 1998]
  - Patenting may not be an accurate proxy for firm-level investments in innovation [Higham et al., 2021; Lerner and Seru, 2021; Moser, 2016]
  - Cross-industry studies may mask significant heterogeneity in the response across different types of R&D investments

This paper

Setting: Pharmaceutical industry

- Capital-intensive; long development timelines (8–12 years); risky (only 9% of drug candidates reach market)
- Financial capital *and* skilled human capital are essential inputs
- Rich project-level data let us go beyond patents

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Two main contributions:

1. **Innovation:** Use Cortellis clinical trial data to measure the *quantity, quality, and direction* of R&D—more precise than patents alone
2. **Labor:** Link firms to Revelio Labs workforce data to examine how hiring flows drive R&D outcomes

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Preview of findings

IPOs **increase** both R&D activity (quantity & quality) *and* employment, but innovation investment concentrated in **existing disease areas**

→ Consistent with heightened public scrutiny reducing risk tolerance

Data

Dataset	Source	Content
Drug project & pipeline	Cortellis	>240,000 firms; >500,000 global trials; all drug stages & trial design
Workforce	Revelio Labs	24M+ companies; 1.1B individuals; worker histories & job titles
IPOs	S&P Capital IQ, SDC, Zephyr	Filing & withdrawal dates

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Sample construction:

- Research-intensive pharma/biotech firms (sponsor ≥ 1 trial)
- IPO filing years **2000–2019**; at least one clinical trial *before* filing
- Linked via exact + fuzzy matching across all datasets
- Stacked cohort dataset: **3,432** firm-year-cohort observations

Empirical design

Identification challenge

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Solution (following Bernstein 2015): Consider the set of private firms that file for an IPO with the SEC

- **Treated:** Firms that *file and complete* an IPO
- **Control:** Firms that *file and withdraw*—same revealed intent to go public

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Regression specification:

$$Y_{ict} = \beta \cdot \underbrace{Post_t \times IPO_{ic}}_{\text{treatment}} + \delta_{ic} + \delta_{tc} + \varepsilon_{ict}$$

- "Stacked" DiD across filing-year cohorts [Cengiz et al. 2019; Gormley and Matsa, 2011]
- Window: ± 5 years around filing date ($t = 0$)
- Firm-cohort & cohort-year FE; Robust standard errors clustered at the firm level

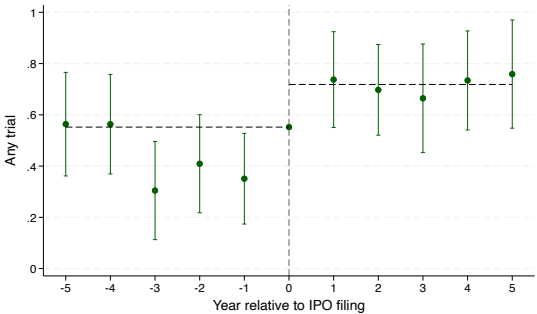
IPOs increase R&D levels across the drug development process

	Any Patent	Phase I Trial	Phase II Trial	Phase III Trial	Any Trial	Drug Approval
Post×*IPO*	**0.119****	**0.100*****	**0.207*****	**0.102*****	**0.253*****	0.029
	(0.052)	(0.037)	(0.044)	(0.039)	(0.048)	(0.030)
Mean of DV	0.590	0.254	0.340	0.185	0.552	0.115

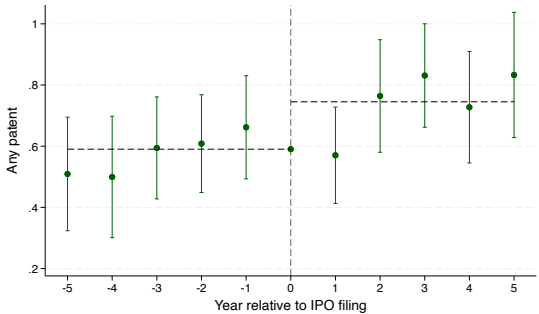
- IPO raises probability of **any clinical research** by **46%**
- Positive and significant across *all* pre-market development stages
- No effect on drug approvals—expected given development timeline & 5-year window

No differential pre-trends; R&D rises immediately and persists

(a) Any Clinical Trial



(b) Any Patent



Quality of clinical trials increases . . .

	Randomized	Blinded	Controlled
$Post \times IPO$	**0.179*** **	**0.177*** **	**0.192*** **
	(0.042)	(0.037)	(0.044)
Mean of DV	0.408	0.344	0.395

- IPOs significantly increase investment in **higher-quality trial designs**
  - Randomized, blinded & controlled trials all rise ∼40–50% relative to mean

. . . but no impact to novelty of tested drugs

	Randomized	Blinded	Controlled	Novel MOA
Post×*IPO*	**0.179*** **	**0.177*** **	**0.192*** **	−0.011
	(0.042)	(0.037)	(0.044)	(0.014)
Mean of DV	0.408	0.344	0.395	0.041

- IPOs significantly increase investment in **higher-quality trial designs**
  - Randomized, blinded & controlled trials all rise ∼40–50% relative to mean
- **No change** in likelihood of testing drugs with novel MOA

Firms focus on existing research domains after an IPO

	Any trial in disease already in firm's R&D pipeline		Any trial in disease novel to firm R&D pipeline	
	3-digit MeSH	6-digit MeSH	3-digit MeSH	6-digit MeSH
Post×*IPO*	**0.158***** (0.034)	**0.157***** (0.034)	0.056 (0.037)	0.056 (0.037)
Mean of DV	0.470	0.466	0.252	0.263

- Post-IPO R&D *expansion* is driven entirely by diseases **already in the pipeline**
- No significant movement into novel disease areas
- Public scrutiny & short-termism incentivize risk mitigation → Firms "exploit" known disease areas rather than "explore" new ones

Post-IPO firms have larger employment levels across functions

	Total	Scientific	Regulatory	Operations	Commercial
$Post \times IPO$	**135.3****	**43.55*****	**18.68****	**51.29****	**25.25****
	(55.97)	(15.98)	(9.433)	(26.02)	(12.57)
Mean of DV	431.8	109.7	41.4	138.9	139.1

- Consistent with IPO providing both financial capital & reputational signal to attract talent

Larger employment comes from incumbent retention & new employee hiring

	Total Employees	Incumbents	New Hires
Post×*IPO*	**135.3****	**123.1****	**12.21****
	(55.97)	(55.67)	(5.790)
Mean of DV	431.8	377.4	54.4

- **Incumbents:** Firms going public have more incumbents
  - Separate analyses show both larger workforce in prior year + higher incumbent retention
- **New hires:** New employee hiring rises by **≈22%**
  - Event study shows hiring spike immediately in year 1, sustained through year 5

New scientific hires are more research active

	Publications among scientific employees		
	Total	Incumbents	New Hires
Post×*IPO*	7.052	6.301	**0.751****
	(4.924)	(4.823)	(0.353)
Mean of Dep. Var.	24.465	22.097	2.368

- Scientific publications rise among new hires, with no significant change for incumbents

New scientific hires are more research active

	Publications among scientific employees			Publications in prior 5 years, scientific new hires	
	Total	Incumbents	New Hires	Total	Average
Post×*IPO*	7.052	6.301	**0.751****	**3.086***	**0.602****
	(4.924)	(4.823)	(0.353)	(1.618)	(0.302)
Mean of Dep. Var.	24.465	22.097	2.368	8.353	1.806

- Scientific publications rise among new hires, with no significant change for incumbents
- New hires arrive with stronger prior research records
- Post-IPO rise in R&D is backed by an upgrade in research-active scientific talent, not just headcount

Summary

Innovation effects

- Increase in both patenting & clinical research
- Higher-quality trial designs (randomized, blinded, controlled)
- But R&D confined to **existing rather than novel disease areas**

Hiring effects

- Employment rises across job functions
- Growth comes from both incumbent retention and new hiring
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Two competing mechanisms

1. **Resource relaxation:** IPOs provide financial *and* human capital, enabling more and higher-quality R&D
2. **Shareholder scrutiny:** Transition to public ownership raises external pressure, directing new R&D toward *lower-risk*, familiar disease areas

Implications

1. **Beyond patents:** Project-level clinical trial data reveal dimensions of pharmaceutical innovation (quality, direction) that patent counts obscure
2. **Labor as a channel:** Workforce data show how human capital constraints—not just financial ones—shape the innovation response to going public
3. **Nuanced view of public markets:** Going public is neither uniformly good nor bad for innovation; it relaxes resource constraints while introducing risk-reducing pressures
4. **Policy dimensions:** Programs designed to broaden pharma R&D into underserved disease areas may need to address disincentives that public ownership creates

Thank you

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