The Indian Innovation Puzzle

Namrata Kala, Josh Lerner, and Junxi Liu *

June 14, 2026

Preliminary and Incomplete

Abstract

Despite recent increases in some measures of innovation, India continues to have very modest levels of domestic patenting, contradicting standard views of the importance of property rights in economic development. Using a novel, newly constructed dataset of Indian patent grants, we explore why Indian patenting has been so low. We examine whether an absence of non-patented innovation, differences in industry composition and public attitudes, and a lack of public market reactions to patent awards can explain these differences, and find only modest support for these explanations. We then show evidence of long delays in patent examination, and examine whether delays in patent examinations reduced the incentives to file applicants. We show that a 2016 reform by the Indian Patent Office increased examination speeds for technology-office pairs that gained access to more same-field examiner capacity. In response, the mixture of applicants shifted away from applicants with very low success rates and towards high-quality filers. These results underscore the importance of institutional quality in facilitating innovation.

*MIT Sloan School of Management; Harvard University; University of Warwick. Kala and Lerner are affiliates of the National Bureau of Economic Research. Seminar participants at the Harvard Kennedy School and the India Policy Forum provided useful comments. We thank the Harvard Business School Division of Research and Doctoral Programs, and the MIT Sloan School of Management for financial support. Brooke Jones, Shambhavi Sinha, Zhaoying (Laura) Wang, and Austin Zhu provided very valuable research assistance in this effort. Lerner has received compensation for advising limited partners in venture funds, venture capital groups, and governments designing policies relevant to venture capital. All errors and omissions are our own.

1 Introduction

Historically, a very small set of high-income countries have undertaken the bulk of investment in innovation, resulting in large global differences in income and productivity (Keller, 2004). One widely acknowledged impediment to knowledge accumulation and innovation in many developing nations has been the absence of strong intellectual property rights, especially patents, to incentivize firms to invest in the development and commercialization of novel products and services. Economists long argued (e.g., North (1990), Romer (1990), and Landes and Posner (2003)) that intellectual property rights promote growth in emerging countries by preventing free riding on innovative efforts, thus encouraging private sector investment in R&D. Lai (1998) and Branstetter et al. (2006) provide careful empirical corroboration of these claims.

At the same time, patent systems are imperfect mechanisms to promote innovation. Both the design (for instance, Scotchmer (2004) and Budish et al. (2015)) and the implementation of patent systems (e.g., Feng and Jaravel (2020) and Freilich and Kim (2026); for an overview, see Scott Morton and Shapiro (2016)) can lead to distortions. While these issues have been extensively scrutinized in the U.S. context, there has been little prior exploration of the impact of patent system effectiveness on domestic innovation in emerging economies. The impacts of mitigating constraints to patenting may be larger or smaller in developing economies. For instance, since constraints may be more likely to bind, facilitating patenting could increase innovation. Conversely, if multiple frictions impede innovation, then policies to facilitate patenting may not increase aggregate innovation.

This study focuses on India, one of the world's largest economies and one with a significant policy focus on innovation. The importance of greater innovation has been articulated in numerous speeches by Prime Minister Modi and other leaders. This policy priority has also manifested itself in large public spending on facilities such as the Micron semiconductor plant in Gujarat.[1]

But despite this policy focus, India has lagged substantially behind its peers in patenting activity. Figure 1(a) plots the number of patents filed by domestic residents as a share of GDP for a range of countries over the 2005–2023 period. India's domestic patenting rate is only a tenth that of China and substantially below the rates observed in advanced economies. While India is similar or better than some developing countries when normal-

[1]Examples include https://dst.gov.in/pm-launches-rs-1-lakh-crore-research-development-and-innovation-scheme, https://www.pmindia.gov.in/en/news_updates/pm-addresses-the-emerging-science-technology-and-innovation-conclave-2025/, and https://www.pmindia.gov.in/en/news_updates/india-should-be-among-the-top-three-ai-superpowers-globally-pm-modi-sets-2047-vision/.

izing by GDP, Figure 1(b) normalizes patenting by the number of STEM graduates. On this measure, India is among the very lowest of the major nations; only Mexico ranks comparably among large economies. Figure 1(c) presents a similar picture when normalizing by the number of STEM PhDs, reinforcing that the low patenting rate is particularly striking given the level of human capital that India possesses.

Moreover, when we look at the Indian organizations filing the most patents, the picture is puzzling as well. Table 1 lists the top 20 Indian patent applicants by total applications over application years from 2005 to 2022, compiled from our own disambiguated dataset combining granted patents and non-granted applications. The list features on the one hand large firms and public research bodies and on the other, a set of small-to-mid-size private universities. The contrast in *realized grant rates* is stark: established applicants such as the IITs (collectively 84.2%), TVS Motors (89.3%), and Samsung's India R&D center (98.7%) convert the large majority of their filings into grants, whereas the five private universities among the top twenty applicants only have a success rate of 8.6% in their patent filings. The inclusion of these private universities among the top applicants is surprising, as none of the five appear on the 2025 Nature Index of the 500 leading global academic research institutions. Moreover, Lovely Professional University and Chandigarh University have been identified as among the four universities worldwide with the most problematic research practices Meho and Akl (2025).[2]

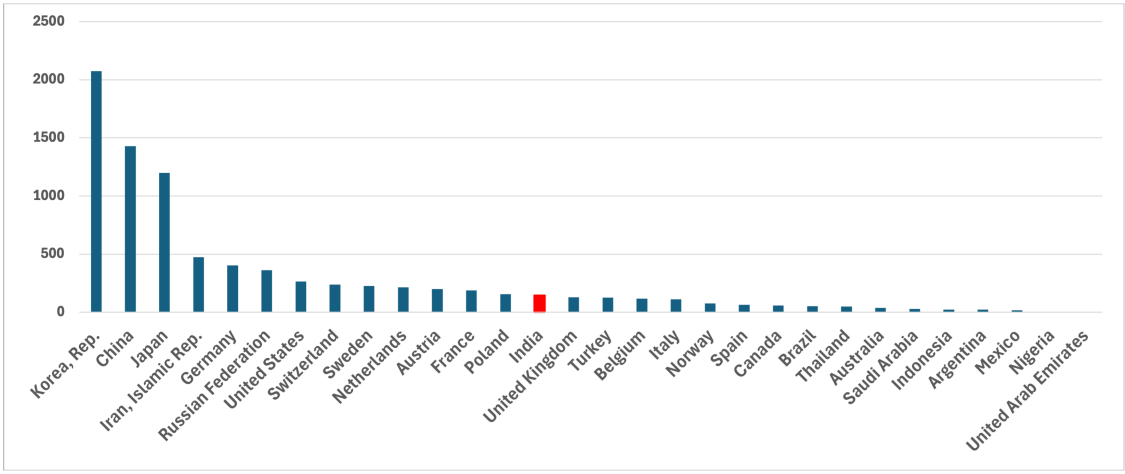
Numerous media accounts highlight the substantial incentives that the National Institutional Ranking Framework and National Assessment and Accreditation Council accreditation provide for private Indian universities to file patents.[3]. As noted above, very few of these institutions' applications are ever granted, which may reflect both their quality and the presence of incentive schemes based on applications and not awards. This pattern suggests that a substantial share of recent Indian domestic applications comes from institutions for which patenting is plausibly incentive-driven rather than a reflection of underlying R&D. The contrast with realized grants is instructive: the leading domestic recipients of granted patents are dominated by established firms and public research

[2]The Nature Index is at https://www.nature.com/nature-index/research-leaders/2025/institution/academic/all/global and is based on top-tier journal publications. Problematic research universities are identified by Meho and Akl (2025) using indicators such as decreases in the share of first-author listings and increases in the count of "hyper-prolific" authors (those with implausible large number of publications). Another high-filing school, Galgotias University, was the center of high-profile scandal involved a mischaracterized robot: see https://www.bbc.com/news/articles/cge8nd5ve00o.

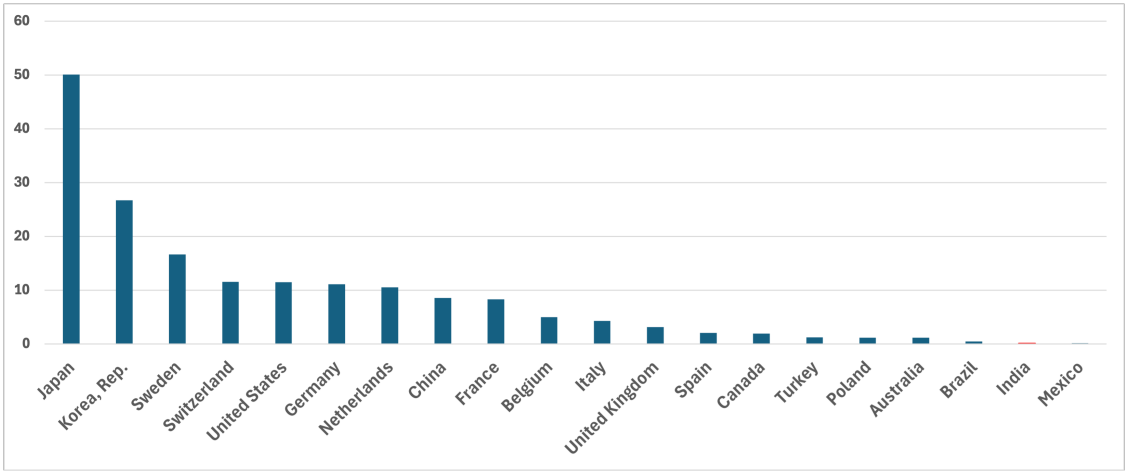
[3]See, for instance, https://www.msn.com/en-in/news/India/the-indian-patent-story-why-private-universities-file-more-patents-than-iits-combined/ar-AA1WQs3k#:~:text=That%20last%20line%20is%20critical,of%20parameters%2C%22%20he%20says.&text=Achal's%20comparison%20of%20the%20NIRF,strong%20allegation:%20gaming%20the%20system

Figure 1: Indian Patenting Is Low: International Comparisons

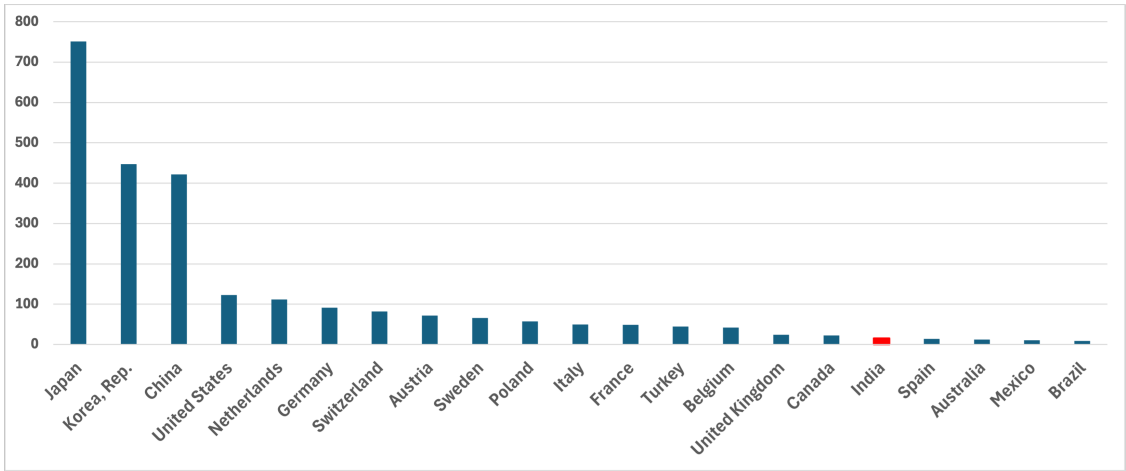
(a) Patents by Domestic Residents as a Share of GDP



(b) Patents per STEM Graduate



(c) Patents per STEM PhD



Notes: Panel (a) plots the number of patents filed by domestic residents as a share of GDP (constant 2015 USD) over the 2005–2023 period. Panels (b) and (c) normalize domestic patent filings by, respectively, the number of STEM graduates and STEM PhDs awarded. Patent counts are from WIPO IP Statistics; STEM graduate and PhD data are from the UNESCO Institute for Statistics.

organizations, such as the Council of Scientific and Industrial Research and the Tata group companies (Appendix Table A.1 lists the top twenty domestic grantees by grant year; Appendix Table A.2 reports the same ranking by the application year of granted patents). We will analyze the behavior of these "unserious" applicants below.

Table 1: Top Indian Patent Applicants and Their Grant Rates

Rank by Apps	Applicant	Apps	Granted	Grant %
1	Indian Institute of Technology (Collectively)	5,158	4,342	**84.2**
2	Council of Scientific and Industrial Research (CSIR)	3,349	2,313	69.1
3	Tata Consultancy Services Limited	2,224	1,647	74.1
4	Bharat Heavy Electricals Limited	2,202	1,833	**83.2**
5	TVS Motor Company Limited	1,926	1,719	**89.3**
6	Chandigarh University	1,902	182	**9.6**
7	Lovely Professional University	1,563	144	**9.2**
8	Bosch Limited (India)	1,483	120	**8.1**
9	Defence Research and Development Organisation (DRDO)	1,396	1,149	**82.3**
10	Amity University	1,361	349	**25.6**
11	Mahindra & Mahindra Limited	1,350	1,110	**82.2**
12	Tata Motors Limited	1,230	1,041	**84.6**
13	Tata Steel Limited	1,222	1,077	**88.1**
14	Samsung R & D Institute India-Bangalore Private Limited	1,153	1,138	**98.7**
15	Wipro Limited	983	725	73.8
16	Larsen & Toubro Limited	938	401	42.8
17	Chandigarh Group Of Colleges	894	65	**7.3**
18	Hindustan Unilever Limited	861	639	74.2
19	Maruti Suzuki India Limited	847	631	74.5
20	Sanskriti University	810	22	**2.7**

Note: The unit of observation is an Indian patent applicant. This table reports the top 20 Indian lead applicants by total applications filed over application years 2005–2022, compiled from our disambiguated dataset combining granted patents and non-granted applications. Grant status as of June 2024. *Apps* is the number of applications, *Granted* the number subsequently granted, and *Grant %* their ratio. Indian lead applicants are identified from the first applicant listed on each application; applicant names are normalized and obvious institutional variants (such as the IITs) are aggregated into a single row. Cells are shaded by grant rate (green high, red low).

India's innovative growth at a time when patenting is seemingly of peripheral importance presents a substantial puzzle. Certainly, many of the past periods of rapid acceleration of innovation, such as those in Great Britain, the U.S., Japan, Korea, and China, have been associated with an increasingly important role of patents, even though the precise institutional structures and use of awards have differed. In this paper, we seek to understand this apparent contradiction. To do so, we draw on an Indian patent dataset that we constructed in Kala, Lerner, and Liu (2025).[4] Section 2 briefly describes how we

[4]We constructed this data using the methodology pursued with the U.S. patent data since the inception of the first patent project at National Bureau of Economic Research (Griliches, 1984). It emulates many

construct our patent dataset.

In Section 3, we seek to understand the low level of patenting. We examine in turn five explanations.

We first consider the possibility that the paucity of patenting reflects a failure of India to pursue innovation. In contradiction of this claim, we find that India has experienced a rise in innovative spending in recent years, driven both by local firms, government spending, and foreign expenditures. More persuasively, Indian innovation has climbed using metrics as diverse as venture capital investment, scientific publications, and GitHub repository commitments.

A second explanation is industry mix. A growing literature suggests that the mixture of Indian economy is quite different from China and the U.S., with a much greater emphasis on services (e.g., Fan et al. (2023), Peters et al. (2026)). We show that that were the mixture of Indian industry to mirror that of the U.S. and China, the volume of patenting would only be 12% and 47% higher, respectively. Thus, the industry mixture does not fully explain this discrepancy seen in Figure 1.

A third explanation may be popular attitudes. As we discuss below, patents in India have had a fraught history, having been used during the British Raj as a mechanism to protect United Kingdom-based exporters from local competition. It is plausible to speculate that negative attitudes toward intellectual property may have carried into the current era. In contradiction of this hypothesis, surveys of consumer attitudes, suggest that Indian attitudes toward intellectual property are similar to other countries. Moreover, the temporal changes in attitudes towards intellectual property bear little relationship with changes in patenting.

Fourth, we examine the returns to patenting to estimate to what extent patents, once issued, are rewarded by the public market. Were these awards not to affect market valuations, it might be natural to conclude that they are not particularly helpful in creating additional revenues and profits, whether due to low grant quality or an inability to enforce awards. We link the patent records to the Prowess database[5], and examine the market reaction to issued patents following Kogan et al. (2017). The evidence suggests that issued

of the key steps undertaken in the literature using the U.S. Patent and Trademark Office (USPTO) data, such as the compilation of citations (e.g., Jaffe and Trajtenberg (2002)), the calculation of measures of patent importance (Kelly et al., 2021), the analysis of patent text (Myers and Lanahan (2022); Kalyani et al. (2025)), the construction of international patent families (Putnam, 1997), the disambiguation of assignees (e.g., Jaffe and Trajtenberg (2002); Magerman et al. (2006), and the identification of venture-backed patents (Bernstein et al., 2016).

[5]The linkage combines exact and fuzzy name matching with extensive manual review; every business grantee with more than ten granted patents is individually verified, and the matched firms account for 85.5% of all granted patents whose first grantee is a business. For full documentation of the Prowess matching, see the data appendix of Kala et al. (2025).

patents are indeed associated with an increase in market value, especially awards to firms who had a established record of patenting. This indicates that the returns to high-quality patents are high.

Finally, we examine the role institutional frictions in the process though which patents are issued, and how they impact the quantity and quality of patenting. We show that Indian patent applications have been historically characterized by extremely long processing times, several times longer than the US or China. To help understand the potential importance of these delays, we use a natural experiment in Indian patent policy in 2016.

Previous to that year, the regional patent office responsible for the applicant's city would process the application. After the reform, IP India began reassigning patent awards in this year across the four patent offices across India. This reform was explicitly motivated in the hopes of reducing the time until issuance.

We show that the reform had a material impact. Applicants in technology field-by-office cells where the reform made available more examiners in the same field but in other offices experienced faster application processing times after the reform.

Not only did the reform affect processing times, but it shifted who applied subsequently for awards. More specifically, there was a quality effect: applications in the treated areas after the reform were disproportionately likely to be ones with historical high success rates in filings. Meanwhile, these reforms do not appear to have incentivize a similar boost in applications by "unserious" applicants.

This work relates to several strands of the literature. The first is the substantial literature on institutions, technology adoption, and long-run growth, reviewed in Acemoglu et al. (2005) and Akcigit et al. (2026). A second strand is the growing body of work on innovation in developing countries. While much work has focused on China (e.g., König et al. (2022), Colonnelli et al. (2024), and Bai et al. (2025)), the importance of appropriate technology that meets local needs in other economies is attracting interest (recent examples include Moscona and Sastry (2025) and Lerner et al. (2024)). Finally, a literature examines the impact of the TRIPS accords in the early 2000s on pharmaceuticals in developing nations. These works focus on the changes in pricing and availability of drugs, the considerable majority of which were originally developed in the West. Examples include Chaudhuri et al. (2006), Cockburn et al. (2016), and Duggan et al. (2016).

In addition to shedding light on important academic discussions, this work is relevant to current policy debates. The intense focus of Indian policymakers in recent years on promoting innovation has been alluded to above. U.S. policymakers have long promoted the strengthening of patent rights around the world, a thrust that has been re-energized under what U.S. Patent and Trademark Office Director John Squires has termed "American

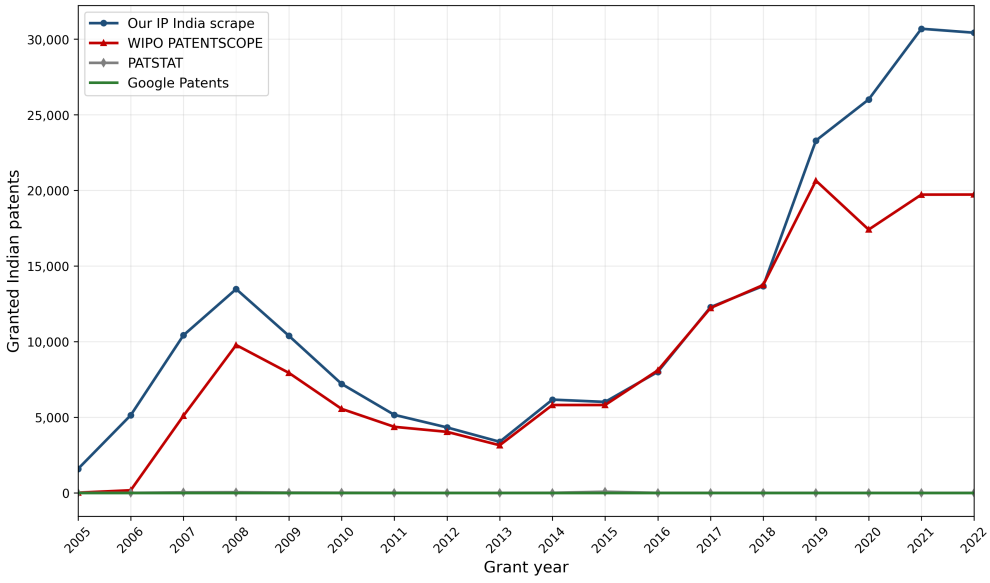
First IP agenda."[6] These efforts have been frequently justified with the argument that stronger patent protection also facilitated innovative growth in emerging economies.

2 Data

Our analysis draws on a new, patent-level dataset of Indian patenting that we construct in Kala et al. (2025). We summarize its construction here and provide additional detail in Appendix A.

Why a new dataset is needed. Standard international patent databases cover Indian patenting poorly. The World Intellectual Property Organization's PATENTSCOPE database reports only limited bibliographic information and is incomplete at the start and end of our window. The European Patent Office's PATSTAT database (also the foundation for many commercially available databases) misses nearly all Indian grants. Finally, Google Patents does not provide Indian patent documents. Figure 2 compares the coverage of Indian grants across these sources and motivates the need for a purpose-built collection.

Figure 2: Coverage of Indian Patent Grants Across Data Sources



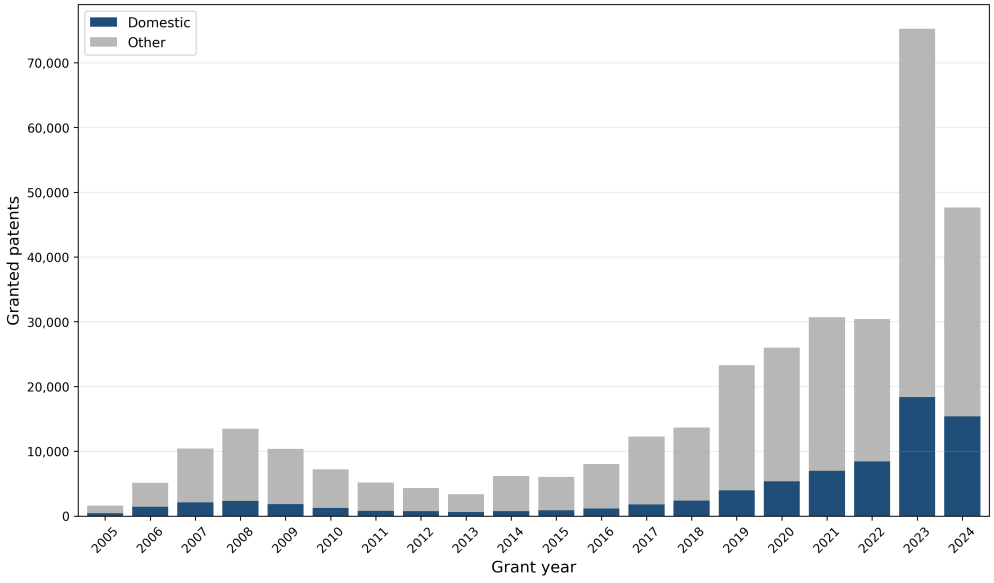
Note: This figure compares coverage of Indian patent grants across major international data sources and our own collection. WIPO reports only limited bibliographic information and lacks coverage at the start and end of the window; PATSTAT misses nearly all Indian grants; and Google Patents does not provide Indian grant documents.

[6] https://www.uspto.gov/about-us/news-updates/opening-statement-director-squires-house-judiciary-oversight-hearing.

Construction. We scrape the India Patent Office (IP India)'s official application pages and the documents linked to each patent, record by record, covering applications filed between 1995 and 2022. From the raw pages and attached PDFs, we parse applicants, inventors, legal status, first examination reports (FERs), backward citations, controller (examiner) information, and examination timing. We then geolocate applicants and grantees, disambiguate names into consistent entities, classify applicant types, compute textual quality (KPST) scores, and link applicants to firm-level data. In total we obtain 761,734 applications filed between 1995 and 2022, of which 343,618 have been granted as of June 2024.

Basic trends. To be sure, we have seen a growth of domestic Indian filings. Although domestic grants have risen, they remain a modest share of all Indian grants. Figure 3 splits granted patents into domestic and foreign grantees by grant year. The share of successful patent applications that are by domestic entities (22.6% between 2005-2024) stays low relative to the levels seen in China or the United States, which in recent years have been roughly 90% and 50% domestic in origin respectively.[7]

Figure 3: Domestic versus Foreign Indian Patent Grants, by Grant Year



Note: Indian patent grants by grant year, split into domestic and foreign grantees. A patent is classified as domestic if at least one grantee or inventor has an address in India. Domestic grants have risen over time but remain a modest share of all Indian grants relative to the levels seen in China or the United States.

[7]The Chinese and U.S. estimates are from https://link.epo.org/ip52024stats and earlier reports in this series.

Complete specifications. A distinctive feature of the data is the full text of each patent's complete specification, that is, the document giving the invention's technical disclosure. Most databases do not provide complete specifications for Indian grants, and even IP India's own web field is unusable for roughly 16% of grants. We supplement the web-scraped text with the downloaded specification PDFs, using OCR and large language models to reach about 95.5% coverage of granted patents filed between 1995 and 2022.

Citations are uninformative in this setting. A stylized fact worth noting is that Unlike in the U.S. or European settings, Indian patents are rarely cited in Indian filings. Only 0.58% of the 675,740 backward-citation entries we extract (3,947 entries) cite an Indian patent document, and only 1.40% of the 233,319 citing applications cite at least one Indian patent. This fact motivates our reliance on textual (KPST) quality measures rather than citation-based measures of patent importance. It also underscores the importance of studying patent systems in developing countries to develop and use appropriate quality measures.

3 Explanations

We now turn to several possible explanations for why Indian patenting has been so low despite substantial innovative activity in other dimensions.

3.1 India as an Innovator

One possibility is the low level of patenting reflects a dearth of innovation in India. There is substantial evidence, however, that innovative activity in India is vibrant and has grown substantially in recent decades, as we discuss here.

Increasing R&D spending. Indian R&D expenditures have climbed twenty-five fold in rupee terms (though only six times over in U.S. dollars) between 1990-91 and 2020-21 (Department of Science and Technology, Ministry of Science and Technology, Government of India, 2023). The private sector share's of research spending over the same period rose from 24% to 41%. As a share of GDP, however, India's R&D expenditures remain modest (0.64% in 2021-22).

High and rising scientific publication output. Scientific publications are a well-established indicator of innovative capacity. Figure 4(a) shows trends in science and engineering publications for India and a range of comparator countries, normalized by GDP. India's output

has grown substantially over the 2005–2023 period. Figure 4(b) further shows that the share of Indian publications in the global top 1% by citation impact has also risen, indicating that this growth reflects quality as well as quantity.

Venture capital investment is substantial and growing. One of the most direct indicators of private-sector innovation activity is venture capital financing, which targets firms pursuing novel, scalable ideas. Figure 5 plots the aggregate level of venture capital and GDP per capita for China, India, and the U.S., using all years (through 2022) for which data are available. It shows that India has experienced a marked increase in venture capital investment in recent decades. If we compare the GDP per capita when the three nations reached a given level of venture investment, we see India is shifted to the left: it has achieved a given level of venture activity while considerably poorer than its two peers.

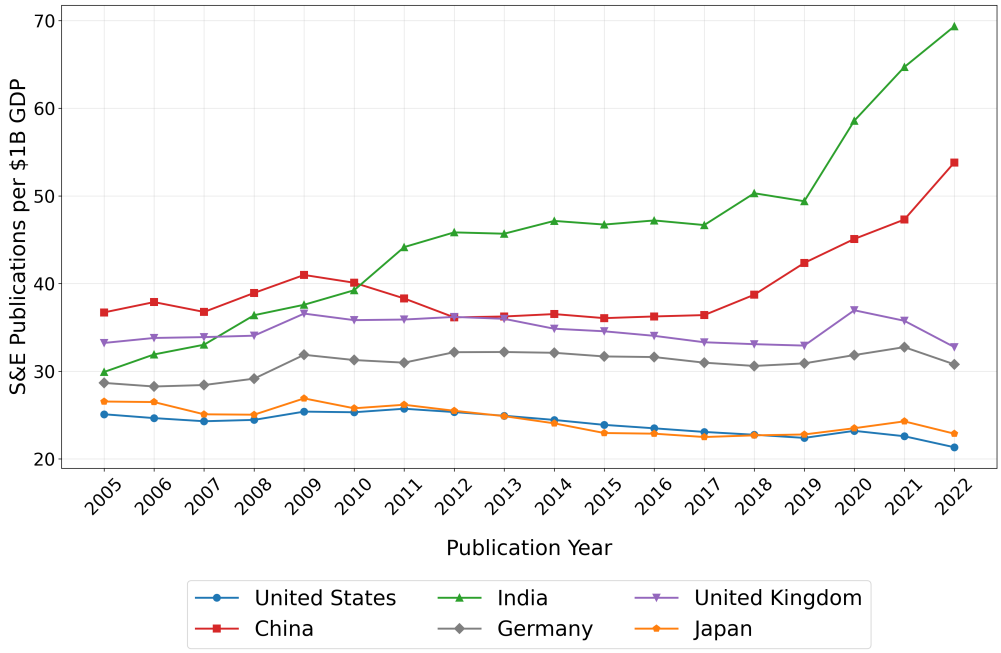
Active participation in global open-source development. Beyond traditional innovation metrics, a novel measure of innovative output comes from open-source software development. Participation in platforms such as GitHub captures technical creativity and output that bypasses the patent system entirely. Figure 6 shows that India is one of the top contributors to GitHub among major economies when normalizing by GDP, placing India's software innovation on a par with, or ahead of, many countries that patent at far higher rates.

Indian inventors invent high quality patents in the U.S. While the level of patenting in India is low, Indian innovators do file patents in the in U.S., which allows us to compare how innovative activity from Indian inventors compare with others in the US patent system. To examine this, we use the KPST textual novelty scores from Kelly et al. (2021). We construct two measures of quality for each patent from these scores, both of which are measures of how much a patent influences future innovation relative to how much it draws on prior art. These are the ratio of the one-year forward textual similarity of the patent to its five-year backward similarity and the ratio of the five-year forward similarity to the five-year backward similarity. (The second measure should be more accurate, but of necessity uses a smaller sample.) Following KPST, we define a "breakthrough" patent as one in the top 10% of this ratio.

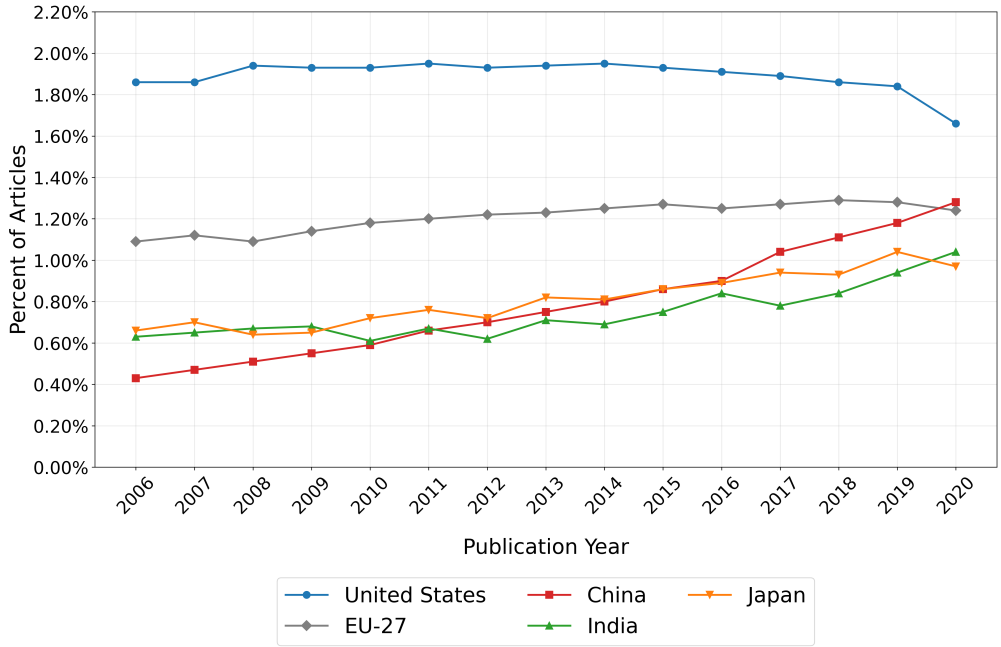
Table 2 reports the results of analysis of innovator nationality and high-quality U.S>-filed patents. Having an Indian inventor is associated with a 3.8 percentage point higher probability of being a breakthrough patent. This is comparable in magnitude to the U.S. inventor coefficient (4.2 pp) and roughly twice the China coefficient (0.9 pp). The last

Figure 4: Science and Engineering Publications, Selected Countries

(a) S&E Publications per $1B GDP

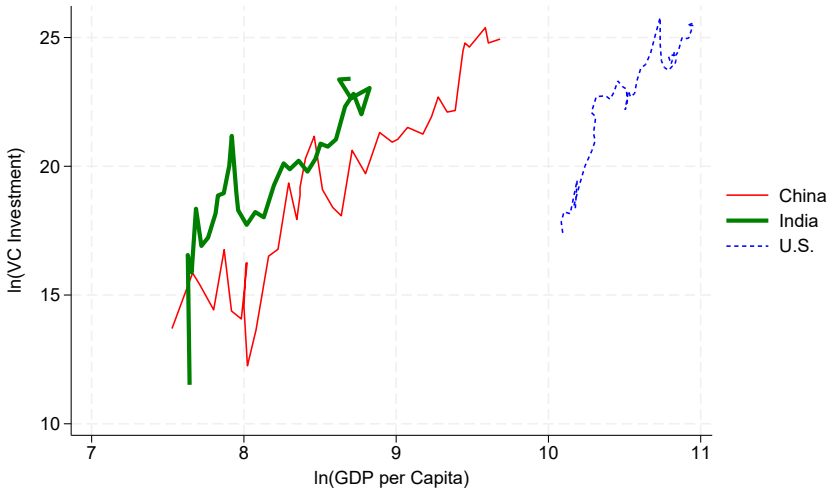


(b) S&E Publications in Top 1% by Citation Impact



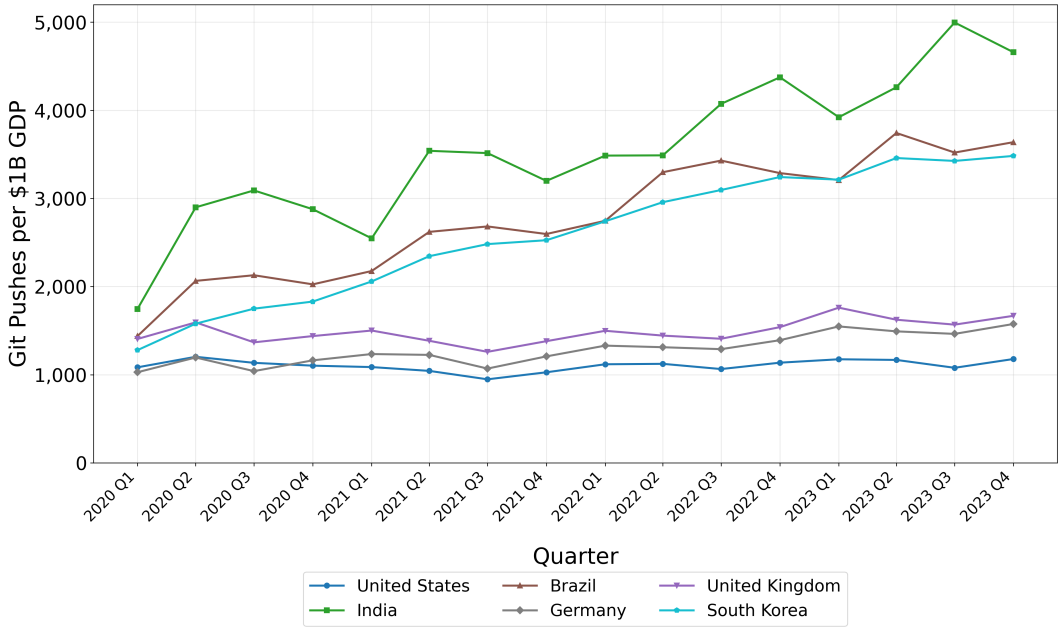
Notes: Panel (a) plots science and engineering publications per $1 billion GDP (constant 2015 US dollars) for the United States, China, India, Germany, the United Kingdom, and Japan. Publication counts come from NSF Science and Engineering Indicators Figure PBS-3 (https://ncses.nsf.gov/pubs/nsb202333/figure/PBS-3). GDP values come from World Bank GDP series. Panel (b) plots the share of all S&E journal articles that fall in the global top 1% most-cited articles for the United States, the EU-27, China, India, and Japan, from 2006 to 2020, using NSF Science and Engineering Indicators data on the impact of published research (https://ncses.nsf.gov/pubs/nsb202333/impact-of-published-research).

Figure 5: Venture Capital Investment, Selected Countries



Notes: This figure plots trends in venture capital investment for selected countries. VC investment data are sourced from PitchBook.

Figure 6: GitHub Pushes per $1B GDP, Selected Countries



Notes: This figure plots quarterly GitHub pushes per $1 billion GDP (constant 2015 US dollars) for the United States, India, Brazil, Germany, the United Kingdom, and South Korea. GitHub activity data come from the GitHub Innovation Graph https://innovationgraph.github.com/global-metrics/git-pushes. Quarterly git pushes are divided by annual GDP for the corresponding calendar year. GDP values come from the World Bank.

column confirms that this pattern is not driven by the choice of reference group: when the sample is restricted to India- and U.S.-inventor patents only, Indian inventors remain at

Table 2: Probability of Breakthrough Patent by Inventor Nationality

	Pooled regression				Separate sample	
	India	U.S.	China	Other Developing	India vs. Non-U.S.	India vs. U.S.
Panel A: 1-year forward and 5-year backward KPST score						
U.S. patents, 1995–2022	0.0384***	0.0460***	0.0191***	0.0002	0.0557***	0.0121***
	[0.0013]	[0.0003]	[0.0006]	[0.0004]	[0.0016]	[0.0013]
U.S. patents, 2005–2022	0.0382***	0.0415***	0.0088***	0.0039***	0.0571***	0.0137***
	[0.0013]	[0.0003]	[0.0006]	[0.0004]	[0.0016]	[0.0013]
Panel B: 5-year forward and backward KPST score						
U.S. patents, 1995–2016	0.0594***	0.0671***	0.0213***	−0.0039***	0.0785***	0.0197***
	[0.0026]	[0.0004]	[0.0015]	[0.0006]	[0.0029]	[0.0026]
U.S. patents, 2005–2016	0.0669***	0.0642***	0.0266***	−0.0035***	0.0923***	0.0292***
	[0.0027]	[0.0005]	[0.0015]	[0.0007]	[0.0032]	[0.0027]

Notes: OLS regressions with robust standard errors clustered at the patent level in brackets. Each patent-inventor pair is used as an observation. The dependent variable in each case is an indicator for whether the patent is in the top 10% of the respective KPST score measure. The first four columns ("Pooled regression") report coefficients from a single specification with all four inventor-nationality dummies; the omitted category is other developed-country inventors. The last two columns ("Separate sample") report the India coefficient from specifications run on restricted subsamples: column (5) excludes U.S.-inventor patents so that the India coefficient compares India with the remaining non-U.S. inventors (China, other developing, and other developed), and column (6) restricts the sample to India- and U.S.-inventor patents so that the India coefficient compares India with the United States. All regressions include controls for CPC section and year of award. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

least as likely as U.S. inventors to produce breakthrough patents, with the India coefficient positive and statistically significant across all specifications (1.2–2.9 pp). This indicates the Indian inventors undertake innovation which compares favorably in quality with US and Chinese inventors in the US patent system. Thus, lack if innovative capacity does not explain the low patenting rates in India.

3.2 Industry Composition

Economists have increasingly appreciated the unique features of India as a services-based economy. One possibility is that the low level of patenting can be explained by industry mix: if India's economic activity is concentrated in sectors that tend not to patent (e.g., software services, business process outsourcing), then the low aggregate patenting rate may be a mechanical consequence of industrial composition rather than a reflection of low innovative effort.

To assess the extent to which the low level of Indian patenting reflects the composition of the Indian economy, we calculate the number of patents that would have been filed in

India had the distribution of economic activity by industry there mirrored that of the U.S. or Chinese economies.

For the universe of 77,821 Indian domestic patents filed between 1995 and 2022 and granted before 2024, we extracted the primary IPC subclass (e.g., A61K)[8] for each patent and assigned these to the European Union's NACE Rev. 2 primary industries using the Dorner and Harhoff (2018) probabilistic concordance, which relates IPC subclasses to NACE two-digit industry divisions. We then aggregated these assignments from two-digit divisions to one-letter sections.[9] This allowed us to classify patenting in India by broad industry.

We then obtained information about value added by NACE (equivalently, ISIC) section in China, India, and the U.S. for the year 2020, to facilitate comparisons (and the reflect the concentration of Indian patents in recent years). The U.S. data were obtained from the OECD STAN database; the Indian and Chinese data from the United Nations National Accounts database. The Chinese data were aggregated in several cases (notably, sectors M through T are reported as a single category), so we conducted the analysis using consolidated categories where necessary.

We computed the number of Indian patents that would have resulted had (a) the ratio of patenting to value added in each Indian sector remained the same but (b) the distribution of value added across industries mirrored that of the U.S. or China. More formally, across all NACE sections i, we compute:

$$\text{Counterfactual Patents} = \sum_i \text{Patents}_i^{\text{India}} \times \frac{\text{VA Share}_i^{\text{Foreign}}}{\text{VA Share}_i^{\text{India}}} \tag{1}$$

Table 3 reports the results. In both cases, the answer is that patenting would have modestly increased. Had the industry structure mirrored that of the U.S., Indian patenting would have been 12% higher. Had it mirrored that of China, patenting would have been 47% higher. The China result is larger primarily because China's manufacturing sector (NACE Section C) accounts for 25.6% of value added, compared to 15.4% in India—and manufacturing is by far the most patent-intensive sector, accounting for roughly two-thirds

[8] If there are multiple IPC codes for a patent, we determine the primary IPC subclass by truncating a patent's raw IPC codes to their 4-digit levels and selecting the most frequent subclass, resolving ties with the first-listed code.

[9] The industry-technology concordance tables were generated from comprehensive linked inventor-establishment data for Germany, using 235,933 patents registered between 1999 and 2011 at the European Patent Office by inventors residing in Germany. The NACE (Nomenclature statistique des Activités économiques dans la Communauté Européenne) is the European standard classification for economic activities, providing a four-digit framework for statistical data. It is directly derived from the United Nations' ISIC (International Standard Industrial Classification) scheme, and is identical at the highest levels that we use here.

Table 3: Counterfactual Indian Patenting Under Alternative Industry Structures

		India		U.S.	China
NACE	Industry	# Patents	VA Share (%)	VA Share (%)	VA Share (%)
A	Agriculture, forestry & fishing	274	20.3	0.9	7.9
B	Mining & quarrying	112	1.7	1.0	
C	Manufacturing	50,064	15.4	11.0	25.6
D	Electricity, gas & steam	679	2.2	1.5	4.7
E	Water supply & waste management	144	0.5	0.3	
F	Construction	658	7.4	4.4	7.0
G	Wholesale & retail trade	3,715	9.3	10.3	9.3
H	Transportation & storage	202	4.2	3.1	3.9
I	Accommodation & food services	52	0.5	2.2	1.5
J	Information & communication	2,600	6.7	7.3	3.7
K	Financial & insurance activities	158	6.0	8.6	8.1
L	Real estate	65	7.1	12.8	7.1
M	Professional & scientific activities	11,985	3.5	8.1	21.3
N	Administrative & support services	450	0.5	4.1	
O	Public administration & defence	174	6.6	8.8	
P	Education	1,810	4.6	5.6	
Q	Human health & social work	1,139	1.8	7.8	
R	Arts, entertainment & recreation	47	0.2	0.8	
S	Other service activities	350	1.3	1.4	
T	Household activities	3	0.2	0.1	
Total (weighted patent count)		74,681	100.0	100.0	100.0
Counterfactual total				**84,010**	**109,432**
Ratio to actual				**1.12**	**1.47**

Notes: This table reports the results of a counterfactual exercise assessing the role of industry composition in explaining India's low level of patenting. We assign each Indian patent to NACE Rev. 2 industry sections using its primary IPC subclass and the Dorner and Harhoff (2018) probabilistic concordance. Value added shares are for 2020; Indian and Chinese data are from the UN National Accounts database; U.S. data are from the OECD STAN database. Patent counts span filing years 1995–2022. The counterfactual total computes the number of Indian patents that would have resulted had the distribution of economic activity across industries mirrored that of the comparator country, holding the sector-specific ratio of patenting to value added constant.

of all Indian patents.

These magnitudes are far too small to explain the gap in patenting between India and its peers. Recall that India's domestic patenting rate as a share of GDP is roughly one-tenth that of China. Even under the most favorable counterfactual—adopting China's manufacturing-heavy industry structure—Indian patenting would increase by less than 50%. Industry composition thus explains only a modest portion of the shortfall, and the bulk of the gap must reflect other factors.

3.3 Attitudes towards Patenting

India has had a long history of skepticism about the value of intellectual property rights, dating back to before independence. In keeping with the literature on the long-lived consequences of institutional rigidities (Acemoglu et al., 2001), we might see a cultural reluctance to patent, even if it is economically attractive. We find limited support for this hypothesis, indicating that it is not the driver for low patenting rates.

3.3.1 A Brief History

The Indian patent system has a long history. The initial legislation was passed in 1856, modeled after the English Act of 1852.[10] Post-independence, there was a considerable degree of skepticism among the new political leadership about the effects of the patent system during the colonial era. In particular, the British colonial administration was perceived as having limited India's ability to design a patent policy favorable to local inventors, instead focusing on protecting the interests of exporters based in the United Kingdom.

In response, the process of establishing a patent system in India was a very slow one. The government established the Bakshi Tekchand Committee in 1949 and the Justice Rajagopal Ayyangar Committee in 1957. Both committees expressed deep skepticism about the advisability of any patent system for India.

While the Patents Act of 1970 did establish a patent system, it limited the awards in many important respects. Among other provisions, Chapter II, Article 5 stated that patents granted for "substances intended for use, or capable of being used, as food or as medicine or drug" or "relating to substances prepared or produced by chemical processes (including alloys, optical glass, semi- conductors and inter-metallic compounds)" would be limited to the protection of processes (rather than product patents). The food and medicine

[10]This account draws on the legal and political science literature on the Indian patent system, especially Halliburton (2017), Liu and Racherla, eds (2019), and Singh (2024)

process patents would only last for the lesser of five years from the patent issue or seven years from the application date (Chapter VIII, Article 53). Finally, Chapter XVI gave the government sweeping rights to revoke or compulsorily license patents for a variety of grounds, including not being "available at reasonably affordable prices to the public."[11]

The promulgation of the World Trade Organization's Trade-Related Aspects of Intellectual Property (TRIPS) agreement in the mid-1990s coincided with a period of economic liberalization in India. While India signed to the TRIPS agreement in 1994, it was not until 2005 that a patent law fully compliant with global standards (e.g., full patent protection for food and medicine, and patent terms of 20 years from the application date) was enacted.[12]

3.3.2 Evidence about Attitudes

Attitudes toward intellectual property. We draw on survey data from the World Economic Forum's Executive Opinion Survey (EOS) to examine perceptions of intellectual property protection. Figure 7a plots the average annual patent applications against the average EOS IP protection score for each country over 2008–2022. There is a strong positive cross-country relationship: countries with higher perceived IP protection tend to file more patents. India sits well below the fitted line, with an EOS score around four, suggesting that weak perceptions of IP protection may contribute to India's low patenting rate. Figure 7b shows that India's EOS IP score peaked around 2018 and has since declined, even as patent applications have risen steadily—indicating that perceptions of IP protection have not kept pace with the growth in patenting.

We additionally examine responses from the World Values Survey (WVS). Figure A.3a plots Indian responses to question E016, which asks whether "more emphasis on technology" is a good or bad thing. While a majority of respondents consistently view technology positively, the share saying "good thing" declined from about 85% in 1990 to roughly 50–65% in subsequent waves, indicating some ambivalence. Figure A.3b plots responses to WVS question F114B, which asks whether stealing property is justifiable. The overwhelming majority of Indian respondents (over 90%) view property theft as "never justifiable," and this share has remained stable across waves—suggesting that respect for property rights per se is a dominant cultural feature.

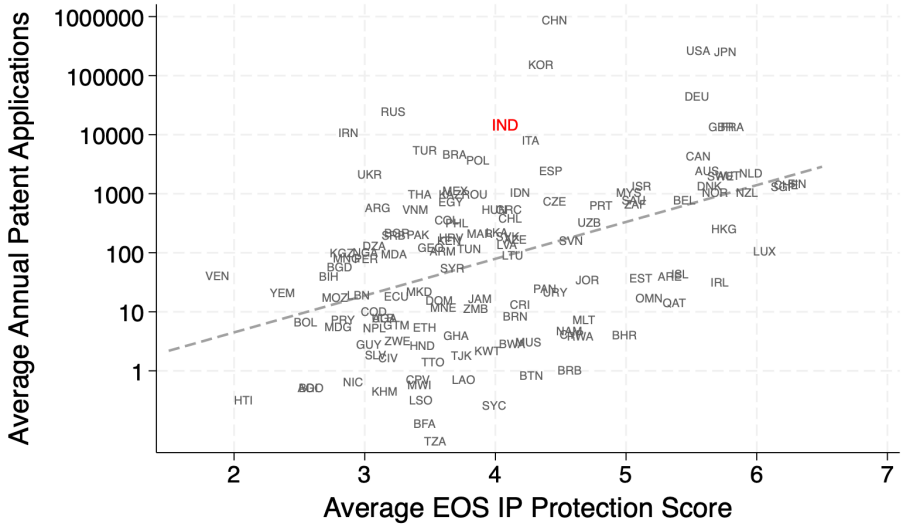
These patterns suggest that cultural attitudes toward technology and property are

[11] https://ipindia.gov.in/writereaddata/portal/ipoact/1_31_1_patent-act-1970-11march2015.pdf.

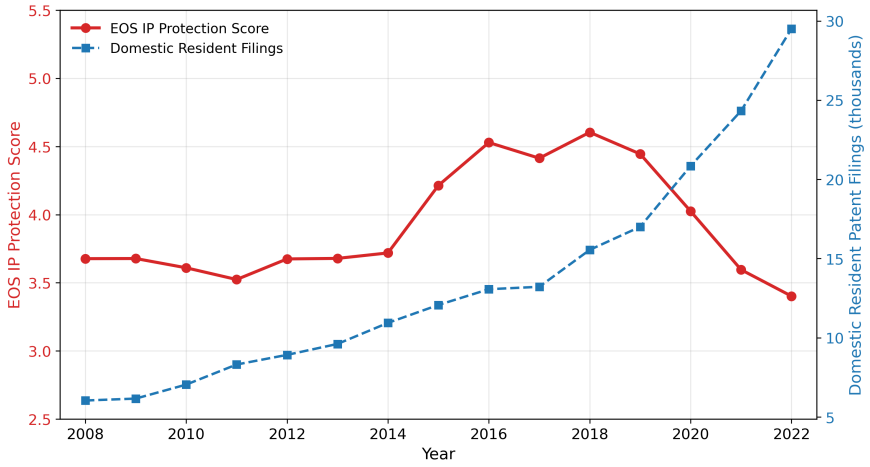
[12] In April 1995, the Indian government agreed to receive patent applications for pharmaceutical and agricultural products and to store them for processing once the Indian patent law to make such subjects patentable took effect. See for details, https://www.wto.org/english/tratop_e/dispu_e/79r.pdf

Figure 7: Patent Applications and WEF IP Protection Score

(a) Cross-Country: Patents vs. EOS Score



(b) India's EOS IP Score Over Time



Notes: Panel (a): each point represents a country, labeled by ISO3 code. The horizontal axis is the country's average WEF Executive Opinion Survey score for intellectual property protection (1 = not at all; 7 = to a great extent), averaged over 2008–2022. The vertical axis is the country's average annual resident patent applications over the same period (log scale). India is highlighted in red. The dashed line is the OLS fit in log-level space. Panel (b): India's annual EOS IP protection score from 2008 to 2022. Patent data are from WIPO; EOS data from the World Economic Forum Global Competitiveness Reports.

broadly supportive of innovation. This is consistent with the view that impediments to patenting lie more in institutional friction than in cultural resistance.

3.4 Lack of Patent Value

Another possibility is that the returns to high-quality patents are low i.e. it is too difficult to realize value from patents in India once they are issued. We focus on one manifestation of value realization: the extent to which patents are rewarded by the equity markets. If Indian capital markets do not reward patenting, firms' incentives to seek patent protection may be substantially reduced. Such an absence of a reaction might reflect that the private returns to patenting are low to justify the costs of filing, for instance, due to an inability to license, litigate, or otherwise monetize awards effectively.

To test this hypothesis, we match Indian patents grantees to firms listed on the National Stock Exchange (NSE) and the Bombay Stock Exchange (BSE) through the Prowess database, and estimate abnormal returns and share turnover patterns for firms around the publishing of granted patents[13].

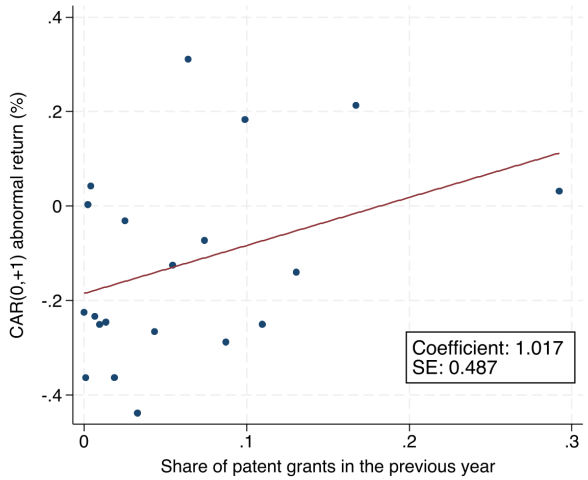
Figure 8 plots binscatters of stock-market reactions against the firm's patenting footprint upon the publication of new patent grants for the firm[14], weighted by the number of grants published for the firm on that Monday. Figure 8a shows the day-of-publication cumulative abnormal return CAR(0,+1) (in percent): the slope is positive and significant at the 5% level (coefficient 1.017, SE 0.487), implying positive responses from the stock market. Figure 8b shows raw day-0 share turnover (in percent), and the relationship is also positive and significant (coefficient 0.612, SE 0.098), with more patent-active firms experiencing greater trading activity around grant publication. For U.S. patent grants, Kogan et al. (2017) document a mean market-adjusted return of 0.07% over the three-day issuance window. In India, the mean CAR(0,+1) across grant-publication events is -0.12% overall, but 0.12% for firms in the top decile of the previous year's share of patent grants, suggesting a positive response to patent filings for the most established patent filers. Thus, the market seems to recognize and reward high-quality patents.

[13]While the patent applicants know the result of a grant on the grant day, the public will only know new granted patents every Friday around 6 PM from Indian Patent Office's journal, and thus only able to respond the next Monday.

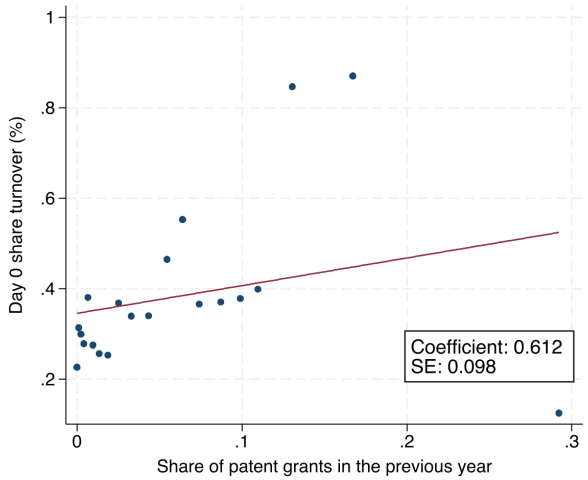
[14]It is reasonable to assume that stock markets will have higher reactions to patents from already established patent applicants. Therefore, we use the share of total patent-grant publications in the previous year, a rolling sum over trading days -246 to -6, divided by the corresponding total across all firms, to measure how established a given firm is in patenting.

Figure 8: Stock-Market Reaction to Patent Grant Publication

(a) Day-of-Publication CAR(0,+1)



(b) Day-0 Raw Share Turnover



Note: This figure plots binscatters of stock-market reactions on patent grant publication days (the Monday following Friday gazette publication by the Indian Patent Office) against the firm's share of total patent-grant publications in the previous year, weighted by the number of grants published on that Monday for the firm, conditional on the firm having any patents being granted on that event. Figure 8a plots the day-of-publication cumulative abnormal return CAR(0,+1), where abnormal returns are computed as raw returns net of the value-weighted market return. Figure 8b plots share turnover on day 0. The sample includes all publicly listed Indian firms in the Prowess database matched to Indian patent grants over 2005–2022, including both National Stock Exchange (NSE) and Bombay Stock Exchange (BSE) listings. For dual-listed firms, we use NSE as the preferred measure given its higher liquidity.

3.5 Difficulty in Getting Patents Issued

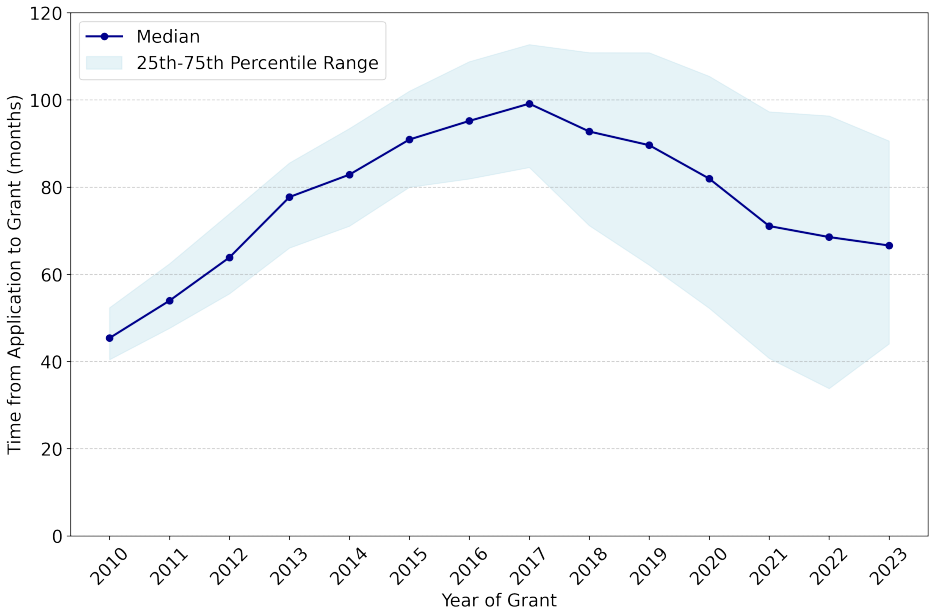
A final set of explanations focuses on the supply side: frictions in the issuing process which may impede the quantity and quality of patenting. In this section, we test whether an important feature of the issuing process, namely, the delay involved in obtaining a patent, acts as a barrier to patenting.

3.5.1 Long Delays in Patent Processing

The basic fact. Figure 9 shows the time from application to grant for Indian patents, by grant year. The median wait time peaked at nearly 100 months (over eight years) for patents granted around 2016–2017, before declining to approximately 68 months for patents granted in 2023. Even at its recent lows, the wait time in India far exceeds that of peer countries.[15]

[15] Schultz and Madigan (2016) compared patent processing times in 2015 across a wide variety of developed and emerging economies, and found that only Brazil and Thailand consistently exceeded India on this metric.

Figure 9: Time from Application to Grant, Indian Patents



Notes: This figure plots the median time from application to grant (in months) for Indian patents, by year of grant. The shaded band shows the 25th–75th percentile range.

Not simply a staffing problem. A natural conjecture is that India's patent office is simply understaffed. Table 4 compares patent office statistics across India, the United States, and China. Panel A shows that circa 2017, India had approximately 83 applications per examiner—comparable to the U.S. ratio of 80 per examiner and well below China's 120 per examiner. Yet India's average pendency (85 months) was roughly four times that of the U.S. (24 months) and China (22 months). By the most recent available data (Panel B), India's pendency has improved to 38 months, but it remains well above the U.S. (26 months) and China (16 months). These comparisons suggest that the delay problem may indicate lack of institutional capacity rather than a simple lack of manpower.

These concerns have been echoed by the Indian government's own analyses of its patent system. For instance, a 2022 report by the Economic Advisory Panel to the Prime Minister (Sanyal and Arora, 2022) highlighted comparative statistics similar to those we reported above. They highlighted both the desirability of increasing patent office staffing and the need to increase productivity. Among their recommendations were the hiring of more controllers (or senior examiners) responsible for the final approval of patent grants, the imposition of deadlines for each stage of the review process, and the reduction of cumbersome compliance requirements.

Table 4: Patent Office Comparison: India, United States, and China

	India	**United States**	**China**
Panel A: Circa 2016			
Number of patent examiners	580	8,160	11,600
Patents applied	45,444	607,753	1,339,000
Patents processed	30,271	645,907	675,000
Applications per examiner	78	74	115
Patents processed per examiner	50	79	58
Average pendency (months)	84	25.3	22
Panel B: Most Recent Available (Circa 2024)			
Number of patent examiners	626	8,599	16,000
Patents applied	110,375	598,982	1,678,000
Patents processed	40,606	577,135	921,000
Applications per examiner	176	70	105
Patents processed per examiner	65	67	58
Average pendency (months)	37.8	26.3	16
Patent office budget	$38M	$4.20B	$933M
Budget per patent processed	$936	$7,244	$1,013

Notes: Panel A covers data around 2016 (India FY 2016-17, U.S. FY 2016, China 2016) and Panel B covers the most recent year available at compilation (India FY 2024-25, U.S. FY 2024, China 2023, the last available Chinese patent examiners information). India reports on April–March fiscal years, the U.S. on October–September fiscal years, and China on the calendar year. *Patent examiners*: For the U.S., the number of examiners covers utility, plant and reissue (UPR) examiners only. For China, the figure aggregates headquarters and regional patent examiners. *Patents applied*: U.S. — utility applications only. China — invention-patent applications (comparable to U.S. utility patents) only. *Patents processed*: India — applications disposed of. U.S. — UPR applications allowed plus abandoned. China — examined-and-concluded invention applications in 2016; granted invention patents only in 2023 due to reporting limitation. *Average pendency (months)*: average time from filing (or request for examination, where applicable) to final disposition. Each office's own reported pendency is used where available; for India the WIPO figure is used. Patent office budget: total agency appropriation. India covers the Intellectual Property sub-head in Demand No. 30 (DPIIT). U.S. covers total USPTO obligations. China covers the CNIPA final-accounts total. USD equivalents use the annual-average exchange rates (83.682 INR/USD in 2024; 7.077 CNY/USD in 2023). For India, Number of examiners, patents applied, and patents processed come from the Office of the Controller General of Patents, Designs and Trade Marks (CGPDTM) Annual Reports 2016-17 and 2024-25 respectively;for the U.S., from the USPTO FY 2016 Performance and Accountability Report and the USPTO FY 2024 Workload Tables respectively; for China, from the SIPO 2016 Annual Report and the CNIPA 2023 Annual Report respectively, with the 2023 China examiner count taken from a CNIPA press release dated 13 June 2024. Average pendency for India is from the WIPO World IP Indicators 2017 (Panel A) and the WIPO IP Statistical Country Profile 2024 (Panel B); pendency for the U.S. and China is from the same USPTO and CNIPA Annual Report sources cited above. Patent office budget is from the Union Budget of India 2024-25; from the USPTO FY 2024 Agency Financial Report for the U.S.; and from the CNIPA 2023 final-accounts disclosure for China.

3.5.2 The 2016 Auto-Allocation Reform

Given the evidence that institutional frictions—particularly long processing delays—are a major impediment to Indian patenting, a natural question is whether efforts to reduce these frictions have had any effect. We focus on a significant reform to the Indian patent examination system that began around 2016.

Institutional background. Prior to 2016, the Indian Patent Office operated under a system in which patents filed in a given regional office (Delhi, Mumbai, Chennai, or Kolkata) were examined by examiners within that office. Within each office, there were distinct examination groups. While nominally there were four broad groups, IP India has recruited individuals with 14 distinct skill clusters, such as Chemistry and Electrical Engineering.[16] This approach created substantial heterogeneity in pendency across offices and technology groups: some offices-by-technology groups accumulated large backlogs, while examiners elsewhere had shorter queues.

Beginning around 2016, IP India introduced an auto-allocation system that reassigned patents across offices, with an aim to increase the speed of processing. As the 2016-17 *Annual Report* of IP India explained, the reform "has brought into a single group-wise queue of Requests of Examination to have uniform examination at all Patent Office locations with respect to date of filing of Request of examination. The system has removed anomaly of different time of examination at different locations."[17]

Figure 10 illustrates the resulting change in the geographic patterns of patent examination. The first panel shows that essentially no applications were examined outside their origin office before 2016, after which the cross-office share rises sharply. The second panel summarizes the resulting flows of applications across offices. We net examine whether the reform successfully reduced pendency in patent process, and its impact on patenting filing.

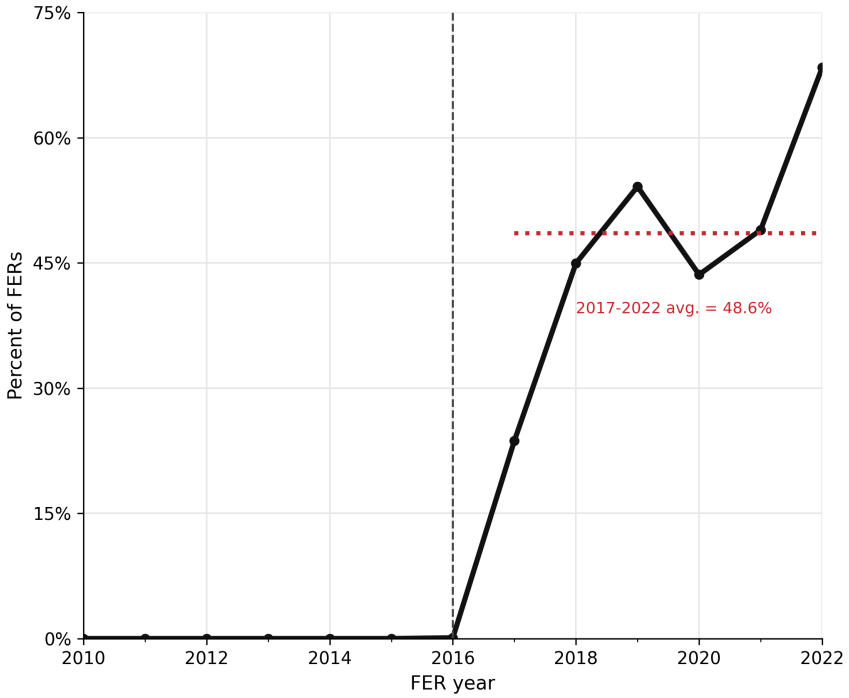
Identification strategy. We use a DID design to estimate the impacts of the 2016 reform. Since patent officers are specialized in particular fields, the unit of analysis is a field-of-invention by origin-office by year cell. Our main exposure measure is the amount of same-field examiner capacity outside the origin office in 2015, with examiner-years assigned fractionally across fields.

[16] While the patent data does not record examiner's skill group directly, a related variable from patent data, "field of invention", closely mirrors the skill clusters, and is used in the empirical analysis.

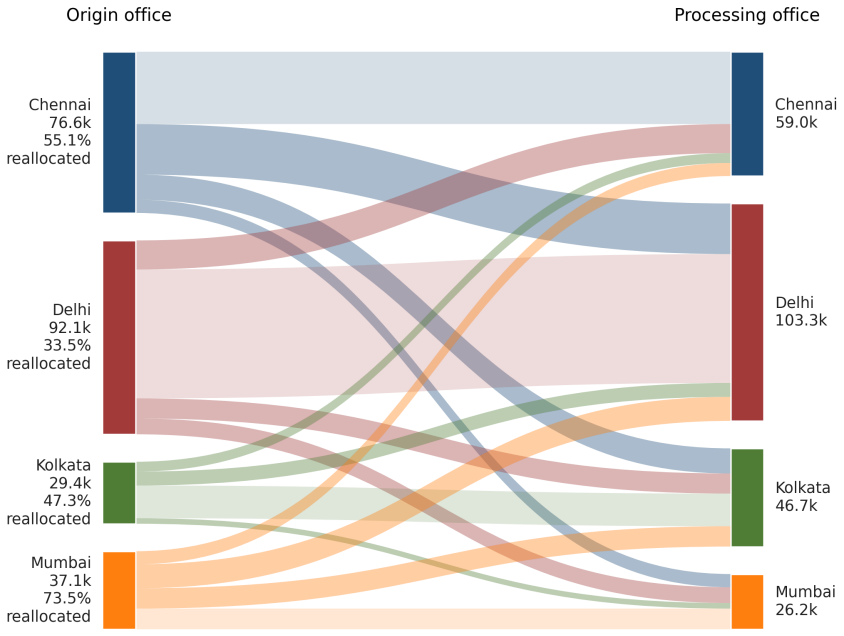
[17] https://ipindia.gov.in/storage/uploads/docs-operator/d87014ba-d805-4b5c-bb4e-dd0e9061a318.pdf, page 18.

Figure 10: Patterns of Patent Reallocation Across Offices

(a) Share examined outside origin office, by FER year

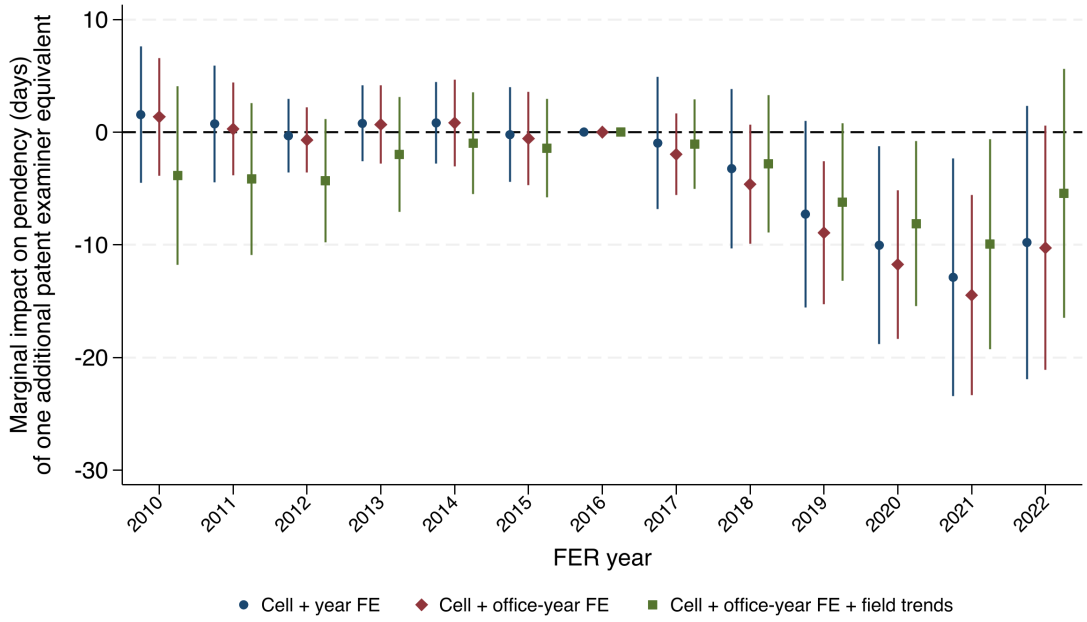


(b) Aggregate cross-office flows of applications, FER years 2017-2022



Note: Panel (a) plots the share of applications examined outside their origin office by year of first examination report (FER); essentially no applications were examined outside the origin office before 2016, after which the cross-office share rises sharply. Panel (b) summarizes the resulting flows of applications across the four patent offices.

Figure 11: Examiner Capacity Reallocation and RFE-to-FER Pendency



Note: This figure reports event-study coefficients from field-of-invention by origin-office by year cells. Treatment is 2015 outside-office same-field examiner capacity, with examiner-years assigned fractionally across fields. The dependent variable is mean RFE-to-FER pendency in days. The omitted year is 2016; standard errors are clustered by field-office cell and 90% confidence intervals are shown.

We measure examiner capacity from the First Examination Reports themselves: each FER names the issuing office and the controller (examiner) who signed it, which we extract from the scanned PDFs using a combination of OCR and large language models and then disambiguate into consistent examiner identities (Appendix Figure A.1 shows an example). A cell's 2015 outside-office same-field capacity is the examiner-equivalent capacity working in that field in offices other than the origin office, with each examiner's unit of capacity split across the fields she examined in proportion to her caseload.

Specifically, we estimate:

$$Y_{fot} = \sum_{\tau \neq 2016} \beta_\tau \left(\text{OutsideCapacity}_{fo,2015} \times 1[t = \tau] \right) + \alpha_{fo} + \delta_{ot} + \epsilon_{fot}, \tag{2}$$

where f indexes field, o indexes origin office, and t indexes year. The fixed effects absorb time-invariant field-office differences and office-specific annual shocks.

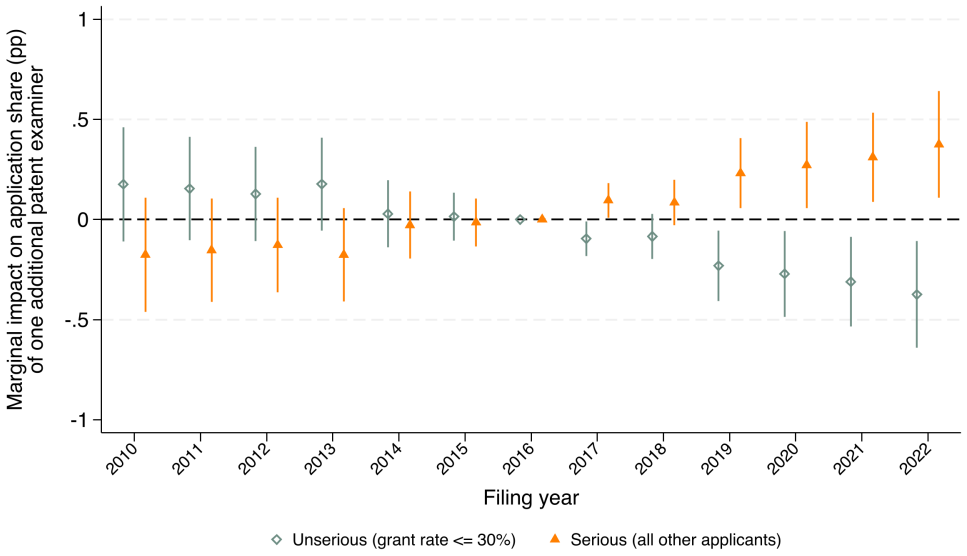
Figure 11 shows that cells with more newly accessible same-field examiner capacity experienced larger post-2016 reductions in RFE-to-FER pendency. The pre-reform coefficients are small relative to the post-reform decline.

The event-study coefficients imply a similar magnitude. Taking the 2019 estimate, one

additional outside-office same-field examiner-equivalent of capacity is associated with about 8.9 fewer RFE-to-FER days. Because a one-standard-deviation increase in outside-office capacity across cells is 8.8 examiner-equivalents, this corresponds to roughly 79 fewer days, or about 0.20 standard deviations of the pre-reform pendency distribution—an economically meaningful reduction of roughly two and a half months in examination delay.

The pendency result is robust to a range of alternative choices. Appendix Figure A.2 reports event studies under alternative definitions of the capacity measure (fractional versus threshold-count assignment of examiners to fields), an office-by-office breakdown, alternative samples (the full set of cells versus the larger main fields), and alternative treatment definitions. The negative post-reform effect on pendency is present throughout. The result also survives the inclusion of field-specific linear trends and bootstrap standard errors over the modest number of field-office cells.

Figure 12: Examiner Capacity Reallocation and Applicant Composition



Note: This figure reports event-study coefficients for application shares by applicant quality category, measured as shares of named filings. Applicant quality is defined using pre-reform disposal histories: "unserious" applicants have at least three pre-reform disposals and a realized grant rate of 30% or below, while "serious" applicants are all other applicants; the two groups are complements. Treatment is 2015 outside-office same-field examiner capacity, with examiner-years assigned fractionally across fields, and coefficients are percentage-point changes per one additional examiner-equivalent. Estimates include cell and office-year fixed effects plus field-specific linear trends. The omitted year is 2016; standard errors are clustered by field-office cell and 90% confidence intervals are shown. Recent filing cohorts, especially 2020–2022, are still maturing.

3.6 The Consequences of the Reform

If the delays in patent processing were an important consideration, the 2016 reforms—which as shown above, accelerated the consideration of certain awards—should have had real consequences. We focus in the analysis below on one dimension: the changing mixture of applicants.

In particular, as highlighted in Table 1, domestic applicants vary wildly in success rates. The low success rate of certain applicants, particularly private universities, suggest that they were motivated primarily by a desire to fulfill quotas or rating schemes based on the number of patent filings, rather than desire to obtain formal property rights. We might anticipate that these applicants would be far less likely to respond to a change in patent processing times than those applicants who have traditionally had much more success, and are presumably filing patents for reasons not unlike those in other geographies.

To do this analysis, we divide the applicants by their success rate in applications prior to the 2016 reform. We identify a subset of applicants that we term "unserious": those with at least three patent applications that were filed in 2010-2015 and a success rate of applicants 30% or below.[18] We compare these applicants to all others, whom we refer to as "serious."

Figure 12 shows how applications from these two parties change after the reform, again looking at location-by-technology cells that were more or less affected by the new policy. The share of applications from "unserious" applicants falls in more exposed cells after the reform, while the share from the "serious" applicants rises. Taking the 2019 estimate, one additional examiner-equivalent of newly accessible same-field capacity reduces the unserious share of filings by 0.23 percentage points; a one-standard-deviation increase in exposure (8.8 examiner-equivalents) thus implies a decline of about 2.0 percentage points, roughly one-tenth of the unserious share in the pre-period.

In the next version of the paper, we will examine other consequences of these reforms. First, we will examine licensing and litigation. To do so, we will use the (admittedly incomplete) collection of technology licensing agreements assembled by Capital IQ Pro and well as the records of both the Indian district-level commercial courts and the high courts, particularly the Intellectual Property Division of the Delhi High Court.

In addition, we will explore the broader economic effects of these changes. In particular, the literature examining the U.S. has highlighted two arenas where stronger patent rights

[18]Success rates are computed from eventual outcomes: for each application filed in 2010–2015, we measure its final legal status as of 2026. An application is disposed once it has been granted, refused, abandoned (including "deemed to be abandoned" by the Indian Patent office, if the applicant does not respond to the examiner report by the deadline), or withdrawn; the success rate is the number granted divided by the number disposed, with withdrawn and abandoned applications counting as failures.

appear to have translated into more economic activity: the ability of young firms to raise external financing and growth (for example, Farre-Mensa et al. (2020)), and the diffusion of academic knowledge to industry (e.g., Hausman (2022)). We will examine the Indian data for similar effects, again using the heterogeneity of the treatment of particular sectors and regions, as described above.

4 Conclusion

India's patent puzzle is not simply that patenting is low. It is that low patenting coexists with substantial innovative activity outside the domestic patent system: by measures ranging from scientific publications and venture capital to open-source software and the quality of Indian inventors' U.S. patents, India is highly innovative, yet its domestic patenting remains far below the levels its income and human capital would predict.

We have examined several explanations. Industry composition, popular attitudes toward intellectual property, and the difficulty of realizing value from issued patents each appear to account for, at most, only a portion of the gap. The evidence is most consistent with institutional frictions in the patent office—in particular, very long examination delays. Exploiting the 2016 auto-allocation reform, we find that field-office cells that gained access to more same-field examiner capacity saw substantially faster RFE-to-FER processing, and that the composition of applications shifted away from low-grant-rate ("unserious") filers toward more credible applicants.

More broadly, these results suggest that the value of patents in a developing economy depends not only on the formal strength of the law but also on the administrative capacity of the patent system to issue useful rights in a timely manner—a margin that has received little attention in the literature and that is directly amenable to policy reform.

References

Acemoglu, Daron, Simon Johnson, and James A. Robinson, "The Colonial Origins of Comparative Development: An Empirical Investigation," *American Economic Review*, 2001, *91* (5), 1369–1401.

_ , _ , and _ , "Institutions as a Fundamental Cause of Long-Run Growth," in Philippe Aghion and Steven N. Durlauf, eds., *Handbook of Economic Growth, Volume 1A*, New York: Elsevier, 2005, pp. 386–472.

Akcigit, Ufuk, Daron Acemoglu, and Simon Johnson, "Technology and Economic Development," in Pascaline Dupas, Pinelopi K. Goldberg, and Rohini Pande, eds., *Handbook of Development Economics, Volume 6*, New York: Elsevier, 2026.

Bai, Jie, Panle Jia Barwick, Shengmao Cao, and Shanjun Li, "Quid Pro Quo, Knowledge Spillover, and Industrial Quality Upgrading: Evidence from the Chinese Auto Industry," *American Economic Review*, 2025, *115* (11), 3825–3852.

Bernstein, Shai, Xavier Giroud, and Richard R. Townsend, "The Impact of Venture Capital Monitoring," *Journal of Finance*, 2016, *71* (4), 1591–1622.

Branstetter, Lee G., Raymond Fisman, and C. Fritz Foley, "Do Stronger Intellectual Property Rights Increase International Technology Transfer? Empirical Evidence from U. S. Firm-Level Panel Data," *Quarterly Journal of Economics*, 2006, *121* (1), 321–349.

Budish, Eric, Benjamin N. Roin, and Heidi Williams, "Do Firms Underinvest in Long-Term Research? Evidence from Cancer Clinical Trials," *American Economic Review*, 2015, *105* (7), 2044–85.

Chaudhuri, Shubham, Pinelopi K. Goldberg, and Panle Jia Jia, "Estimating the Effects of Global Patent Protection in Pharmaceuticals: A Case Study of Quinolones in India," *American Economic Review*, 2006, *96*, 1477–1514.

Cockburn, Iain M., Jean O. Lanjouw, and Mark Schankerman, "Patents and the Global Diffusion of New Drugs," *American Economic Review*, 2016, *106* (1), 136–164.

Colonnelli, Emanuele, Bo Li, and Ernest Liu, "Investing with the Government: A Field Experiment in China," *Journal of Political Economy*, 2024, *132* (1), 248–294.

Department of Science and Technology, Ministry of Science and Technology, Government of India, *Research and Development Statistics at a Glance*, Government of India, 2023. url{https://dst.gov.in/sites/default/files/Updated

Dorner, Matthias and Dietmar Harhoff, "A Novel Technology-Industry Concordance Table Based on Linked Inventor-Establishment Data," *Research Policy*, 2018, *47* (4), 768–781.

Duggan, Mark, Craig Garthwaite, and Aparajita Goyal, "The Market Impacts of Pharmaceutical Product Patents in Developing Countries: Evidence from India," *American Economic Review*, 2016, *106* (1), 99–135.

Fan, Tianyu, Michael Peters, and Fabrizio Zilibotti, "Growing Like India – The Unequal Effects of Service-Led Growth," *Econometrica*, 2023, *91* (4), 1457–1494.

Farre-Mensa, Joan, Deepak Hegde, and Alexander Ljungqvist, "What as a Patent Worth? Evidence from the U.S. Patent "Lottery"," *Journal of Finance*, 2020, *75* (2), 639–682.

Feng, Josh and Xavier Jaravel, "Crafting Intellectual Property Rights: Implications for Patent Assertion Entities, Litigation, and Innovation," *American Economic Journal: Applied Economics*, 2020, *12* (1), 140–81.

Freilich, Janet and Soomi Kim, "Is the Patent System Sensitive to Incorrect Information?," *Review of Economics and Statistics*, 07 2026, *108* (2), 1–38.

Griliches, Zvi, *R&D, Patents, and Productivity*, University of Chicago Press, 1984.

Halliburton, Murphy, *India and the Patent Wars: Pharmaceuticals in the New Intellectual Property Regime*, Cornell University Press, 2017.

Hausman, Naomi, "University Innovation and Local Economic Growth," *Review of Economics and Statistics*, 2022, *104* (4), 718–735.

Jaffe, Adam B. and Manuel Trajtenberg, *Patents, Citations, and Innovations: A Window on the Knowledge Economy*, MIT Press, 2002.

Kala, Namrata, Josh Lerner, and Junxi Liu, "Constructing the INdian Patent Dataset," Unpublished Working Paper, Massacusetts Instiutte of Technology 2025.

Kalyani, Aakash, Nicholas Bloom, Marcella Carvalho, Tarek A. Hassan, Josh Lerner, and Ahmed Tahoun, "Diffusion of New Technologies," *Quarterly Journal of Economics*, 2025, *140*, forthcoming.

Keller, Wolfgang, "International Technology Diffusion," *Journal of Economic Literature*, 2004, *42* (4), 752–782.

Kelly, Bryan, Dimitris Papanikolaou, Amit Seru, and Matt Taddy, "Measuring Technological Innovation over the Long Run," *American Economic Review: Insights*, 2021, *3* (3), 303–320.

Kogan, Leonid, Dimitris Papanikolaou, Amit Seru, and Noah Stoffman, "Technological Innovation, Resource Allocation, and Growth," *Quarterly Journal of Economics*, 2017, *132* (2), 665–712.

König, Michael, Kjetil Storesletten, Zheng Song, and Fabrizio Zilibotti, "From Imitation to Innovation: Where is All that Chinese R&D Going?," *Econometrica*, 2022, *90* (4), 1615–1654.

Lai, Edwin L.-C., "International Intellectual Property Rights Protection and the Rate of Product Innovation," *Journal of Development Economics*, 1998, *55* (1), 133–153.

Landes, William M. and Richard A. Posner, *The Economic Structure of Intellectual Property Law*, Cambridge: Harvard University Press, 2003.

Lerner, Josh, Junxi Liu, Jacob Moscona, and David Yang, "Appropriate Entrepreneurship? The Rise of China and the Developing World," Working Paper 32193, National Bureau of Economic Research 2024.

Liu, Kung-Chung and Uday S. Racherla, eds, *Innovation, Economic Development, and Intellectual Property in India and China: Comparing Six Economic Sectors*, SpringerOpen, 2019.

Magerman, Tom, Bart Van Looy, and Xiaoyan Song, "Data Production Methods for Harmonized Patent Statistics: Patentee Name Harmonization," SSRN Scholarly Paper 944470 2006.

Meho, Lokman I. and Elie A. Akl, "Using Bibliometrics to Detect Questionable Authorship and Affiliation Practices and their Impact on Global Research Metrics: A Case Study of 14 Universities," *Quantitative Science Studies*, 2025, *6*, 63–98.

Moscona, Jacob and Karthik Sastry, "Inappropriate Technology: Evidence from Global Agriculture," Working Paper 33500, National Bureau of Economic Research 2025.

Myers, Kyle R. and Lauren Lanahan, "Estimating Spillovers from Publicly Funded R&D: Evidence from the US Department of Energy," *American Economic Review*, 2022, *112* (7), 2393–2423.

North, Douglass C., *Institutions, Institutional Change and Economic Performance*, Cambridge: Cambridge University Press, 1990.

Peters, Michael, Youdan Zhang, and Fabrizio Zilibotti, "Skipping the Factory: Service-Led Growth and Structural Transformation in the Developing World," Working Paper 34692, National Bureau of Economic Research 2026.

Putnam, Jonathan, "The Value of International Patent Rights," Unpublished Working Paper, Yale University 1997.

Romer, Paul M., "Endogenous Technological Change," *Journal of Political Economy*, 1990, *98* (5), S71–S102.

Sanyal, Sanjeev and Aakanksha Arora, "Why India Needs to Urgently Invest in its Patent Ecosystem," EAC-PM Paper Series EAC-PM/WP/1/2022, Economic Advisory Council to the Prime Minister 2022.

Schultz, Mark and Kevin Madigan, *The Long Wait for Innovation: The Global Patent Pendency Problem*, Arlington, VA: Center for the Protection of Intellectual Property, Antonin Scalia Law School, George Mason University, 2016.

Scotchmer, Suzanne, *Innovation and Incentives*, Cambridge: MIT Press, 2004.

Scott Morton, Fiona and Carl Shapiro, "Patent Assertions: Are We Any Closer to Aligning Reward to Contribution?," *Innovation Policy and the Economy*, 2016, *16*, 89–133.

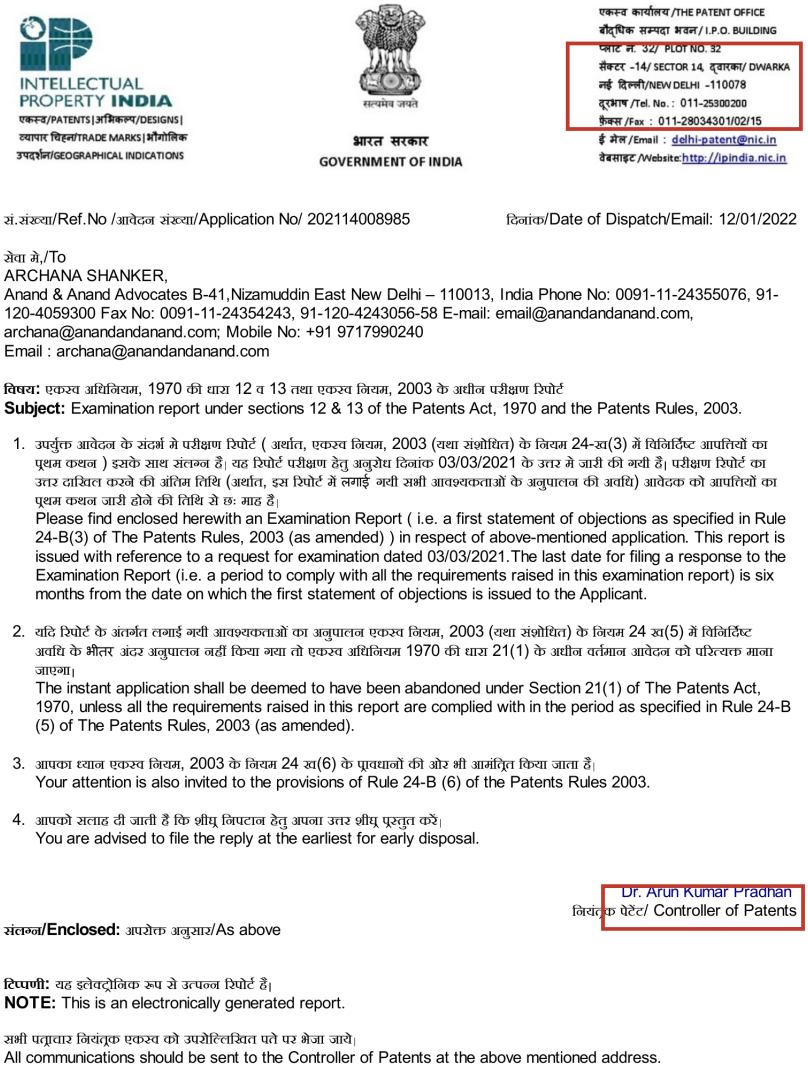
Singh, Pratiba M., *Patent Law*, Bangalore: Thomson Reuters, 2024.

Online Appendix for: The Indian Patent Puzzle

by Namrata Kala, Josh Lerner, and Junxi Liu

Appendix A Additional Figures and Tables

Figure A.1: Example First Examination Report (FER)



INTELLECTUAL PROPERTY INDIA
एकस्व/PATENTS|अभिकल्प/DESIGNS|
व्यापार चिह्न/TRADE MARKS|भौगोलिक
उपदर्शन/GEOGRAPHICAL INDICATIONS

सत्यमेव जयते
भारत सरकार
GOVERNMENT OF INDIA

एकस्व कार्यालय /THE PATENT OFFICE
बौद्धिक सम्पदा भवन/ I.P.O. BUILDING
प्लॉट नं. 32/ PLOT NO. 32
सेक्टर -14/ SECTOR 14, द्वारका/ DWARKA
नई दिल्ली/NEW DELHI -110078
दूरभाष /Tel. No. : 011-25300200
फैक्स /Fax : 011-28034301/02/15
ई मेल /Email : delhi-patent@nic.in
वेबसाइट /Website:http://ipindia.nic.in

सं.संख्या/Ref.No /आवेदन संख्या/Application No/ 202114008985 दिनांक/Date of Dispatch/Email: 12/01/2022

सेवा मे,/To
ARCHANA SHANKER,
Anand & Anand Advocates B-41,Nizamuddin East New Delhi – 110013, India Phone No: 0091-11-24355076, 91-120-4059300 Fax No: 0091-11-24354243, 91-120-4243056-58 E-mail: email@anandandanand.com, archana@anandandanand.com; Mobile No: +91 9717990240
Email : archana@anandandanand.com

विषय: एकस्व अधिनियम, 1970 की धारा 12 व 13 तथा एकस्व नियम, 2003 के अधीन परीक्षण रिपोर्ट
Subject: Examination report under sections 12 & 13 of the Patents Act, 1970 and the Patents Rules, 2003.

1. उपर्युक्त आवेदन के संदर्भ मे परीक्षण रिपोर्ट (अर्थात, एकस्व नियम, 2003 (यथा संशोधित) के नियम 24-ख(3) में विनिर्दिष्ट आपत्तियों का प्रथम कथन) इसके साथ संलग्न है। यह रिपोर्ट परीक्षण हेतु अनुरोध दिनांक 03/03/2021 के उत्तर मे जारी की गयी है। परीक्षण रिपोर्ट का उत्तर दाखिल करने की अंतिम तिथि (अर्थात, इस रिपोर्ट में लगाई गयी सभी आवश्यकताओं के अनुपालन की अवधि) आवेदक को आपत्तियों का प्रथम कथन जारी होने की तिथि से छः माह है।
Please find enclosed herewith an Examination Report (i.e. a first statement of objections as specified in Rule 24-B(3) of The Patents Rules, 2003 (as amended)) in respect of above-mentioned application. This report is issued with reference to a request for examination dated 03/03/2021.The last date for filing a response to the Examination Report (i.e. a period to comply with all the requirements raised in this examination report) is six months from the date on which the first statement of objections is issued to the Applicant.

2. यदि रिपोर्ट के अंतर्गत लगाई गयी आवश्यकताओं का अनुपालन एकस्व नियम, 2003 (यथा संशोधित) के नियम 24 ख(5) में विनिर्दिष्ट अवधि के भीतर अंदर अनुपालन नहीं किया गया तो एकस्व अधिनियम 1970 की धारा 21(1) के अधीन वर्तमान आवेदन को परित्यक्त माना जाएगा।
The instant application shall be deemed to have been abandoned under Section 21(1) of The Patents Act, 1970, unless all the requirements raised in this report are complied with in the period as specified in Rule 24-B (5) of The Patents Rules, 2003 (as amended).

3. आपका ध्यान एकस्व नियम, 2003 के नियम 24 ख(6) के प्रावधानों की ओर भी आमंत्रित किया जाता है।
Your attention is also invited to the provisions of Rule 24-B (6) of the Patents Rules 2003.

4. आपको सलाह दी जाती है कि शीघ्र निपटान हेतु अपना उत्तर शीघ्र प्रस्तुत करें।
You are advised to file the reply at the earliest for early disposal.

Dr. Arun Kumar Pradhan
नियंत्रक पेटेंट/ Controller of Patents

संलग्न/Enclosed: अपरोक्त अनुसार/As above

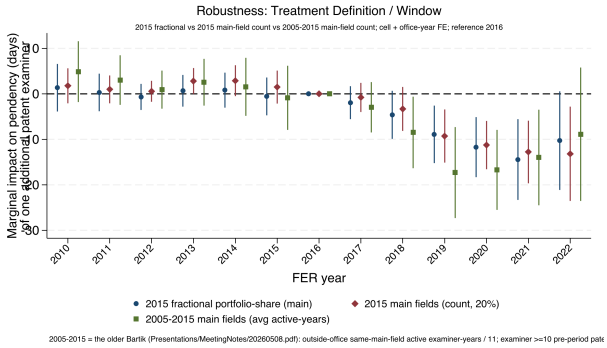
टिप्पणी: यह इलेक्ट्रोनिक रूप से उत्पन्न रिपोर्ट है।
NOTE: This is an electronically generated report.

सभी पत्राचार नियंत्रक एकस्व को उपरोल्लिखित पते पर भेजा जाये।
All communications should be sent to the Controller of Patents at the above mentioned address.

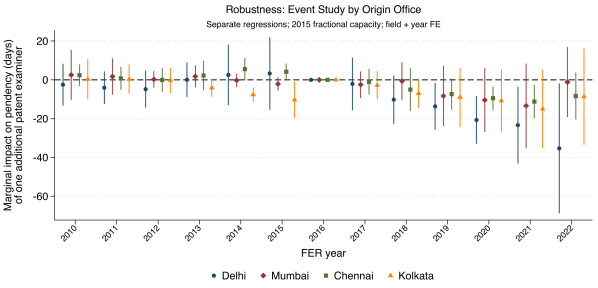
Note: Each application's First Examination Report is a scanned PDF that names the issuing office and the controller (examiner) who signed it, together with the dispatch date. We extract these fields using a combination of OCR (for printed documents) and large language models (for scanned or handwritten documents), and disambiguate controller names into consistent examiner identities.

Figure A.2: Robustness of the RFE-to-FER Pendency Effect

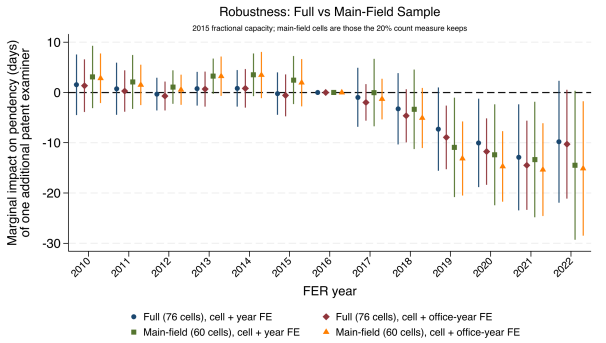
(a) Capacity definition



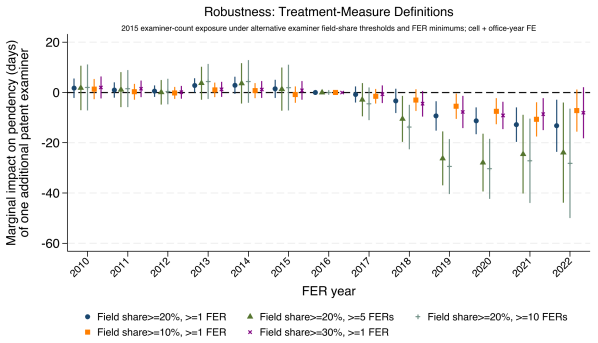
(b) By origin office



(c) Sample: all cells vs. main fields



(d) Treatment measure



Note: Each panel reproduces the main RFE-to-FER pendency event study under an alternative specification. Panel (a) varies the capacity definition (fractional versus threshold-count assignment of examiners to fields); panel (b) estimates the effect office by office; panel (c) compares the full set of field-office cells to the main-field sample; panel (d) varies the treatment measure. The omitted year is 2016, standard errors are clustered by field-office cell, and 90% confidence intervals are shown. Source: `Code/reallocation_analysis/3_robustness.do`.

Table A.1: Top Domestic Patent Grantees, Grant Year 2015-2022

Rank	Grantee	Total Patents
1	Council of Scientific and Industrial Research	1,503
2	Bharat Heavy Electricals Limited	1,038
3	Samsung R & D Institute India- Bangalore Private Limited	785
4	TVS Motor Company Limited	705
5	Director General, Defence Research & Development Organisation	698
6	Tata Consultancy Services Limited	696
7	Tata Motors Limited	567
8	Tata Steel Limited	485
9	Indian Institute of Technology Madras	448
10	Indian Institute of Technology Bombay	442
11	Larsen & Toubro Limited	356
12	Mahindra & Mahindra Limited	347
13	Reliance Industries Limited	327
14	Indian Council of Agricultural Research	265
15	Steel Authority of India Limited	259
16	Hindustan Unilever Limited	253
17	Indian Institute of Technology Delhi	236
18	Indian Institute of Technology Kanpur	231
19	Indian Institute of Technology Kharagpur	221
20	Schneider Electric India Private Limited	210

Notes: This table reports the top 20 domestic patent grantees in India by year of grant for 2015–2022. Indian patents are defined as either one of the inventors' or one of the grantees' address is in India.

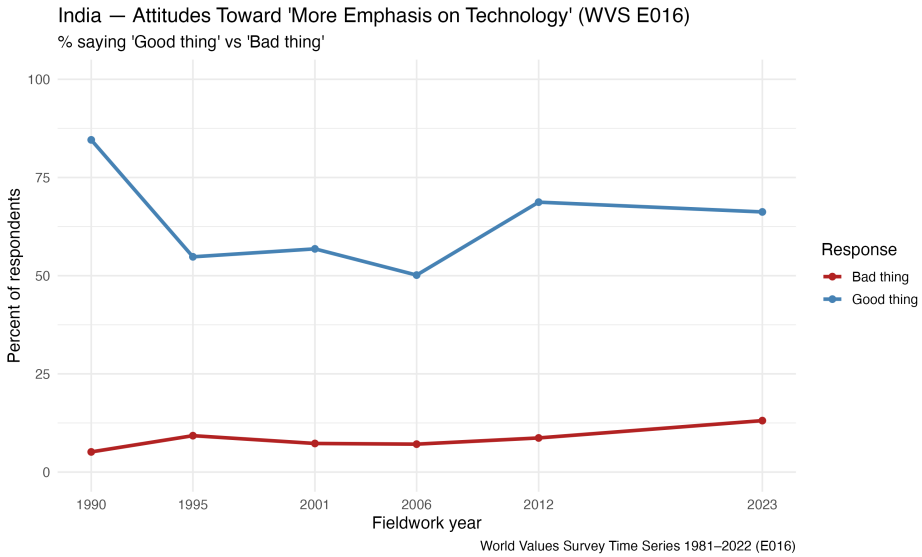
Table A.2: Top Domestic Patent Grantees, Application Year 2015-2022

Rank	Grantee	Total Patents
1	TVS Motor Company Limited	936
2	Tata Consultancy Services Limited	911
3	Council of Scientific and Industrial Research	855
4	Bharat Heavy Electricals Limited	818
5	Mahindra & Mahindra Limited	814
6	Indian Institute of Technology Madras	715
7	Indian Institute of Technology Bombay	660
8	Wipro Limited	606
9	Tata Steel Limited	562
10	Director General, Defence Research & Development Organisation	510
11	Maruti Suzuki India Limited	498
12	Indian Institute of Technology Delhi	433
13	SRM Institute of Science and Technology	406
14	Tata Motors Limited	402
15	Indian Institute of Technology Kanpur	336
16	Schneider Electric India Private Limited	328
17	Indian Institute of Science	294
18	Samsung R & D Institute India- Bangalore Private Limited	260
19	Indian Institute of Technology Kharagpur	219
20	Hero MotoCorp Limited	213

Notes: This table reports the top 20 domestic patent grantees in India by year of application between 2015–2022 for all the successful applications (granted patents). Indian patents are defined as either one of the inventors' or one of the grantees' address is in India.

Figure A.3: Indian Attitudes Toward Technology and Property Rights

(a) Attitudes Toward Technology (WVS E016)



(b) Is Stealing Property Justifiable? (WVS F114B)



Notes: Panel (a) plots responses to WVS question E016 ("More emphasis on technology development": good thing vs. bad thing) for India, 1990–2023. Panel (b) plots responses to WVS question F114B ("Is stealing property justifiable?") for India across available waves. Data from the World Values Survey Time Series 1981–2022.