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Research Statement

I specialize in the development and use of patent statistics to answer questions on the economics of innovation. My primary research maps the characteristics of U.S. small patenting entities and the benefits and costs they face while innovating. About 30 percent of patents filed at the U.S. Patent and Trademark Office are from small entities. Yet, their incentives to innovate and the costs they face are not fully understood and characterized. In my job market paper, I contribute to bridging this gap by studying the patents by small entities around a significant change in patenting rule in the United States, the America Invents Act (AIA) of 2011. My secondary research focuses on the development of patent datasets to study innovation originating from the Global South. India represents a significant proportion of patents that are filed in the developing world — accounting for about 10 percent of all patents filed at the United States Patent and Trademark Office (USPTO). However, the patent office in India, also called Intellectual Property India (IPI), remains under-explored in the innovation literature. The main constraint is its poor coverage in the existing patent databases. My project bridges this gap by collecting and documenting a novel patent dataset that contains information that previously did not exist in the public domain. This dataset allows us to map the distribution and progression of inventions originating in different parts of India over time. I have explained my two projects in detail below.

America Invents Act and innovation by small entities

My job market paper studies the patenting activity of small entities relative to large entities before and after the passage of a Patent Reform Act that brought substantial changes to the U.S. patent system — the America Invents Act (AIA) of 2011. The AIA harmonized the patent system of the United States with the rest of the world by changing its patenting rules from First-to-Invent (FTI) to First-Inventor-to-file (FITF). FTI provided room for flexibility on the date of filing by allowing an inventor to invent first and file later. However, this flexibility came at an increased cost of litigation as the date of invention would be uncertain and hard to prove. The AIA aimed to reduce such uncertainty and discouragement that originates due to patent litigation and make the patenting process less ambiguous by granting patent rights to the first filer of an invention as opposed to the first inventor. However, this also meant that inventors would have to rush to the patent office to secure a first filing date. Small entities would particularly be affected by this change, and late Senator Dianne Feinstein argued at a hearing that:

> "This presents a particular hardship for independent inventors, for startups, and for small businesses, which do not have the resources and volume to employ in-house counsel but must instead rely on more-costly outside counsel to file their patents. This added cost and time directed to filing for ideas that are not productive will drain resources away from the viable ideas that can build a patent portfolio–and a business."

Even though the legislation mandated a study to be conducted on its effect on small entities, evidence remained inconclusive, partly due to limitations in the data and partly because a lot of questions involving small entities remain unexplored. Because new and established entities have different patenting strategies, it is possible that changing the incentives to patent could have differential effects based on the types of entities and the invention categories in which they specialize. My paper tries to disentangle these and provides evidence of the effects of the AIA on patenting activity by small entities. Using patent-level information and augmenting it with applicant-level characteristics, I find a drop in the quantity of patents filed by small entities relative to larger entities, measured by the number of patents filed before and after the AIA. However, the average quality of inventions for small entities relative to large entities does not change significantly after the AIA's enactment, measured by citations adjusted by technology and year. My JMP provides an initial set of analyses of the AIA and indicates that AIA contributed to widening the gap in innovation that already existed between small and large entities. This was previously seen in an AIA-like legislation enacted in Canada.

Legislative support and its role in the proliferation of an innovative environment is relatively understudied. The AIA is an important legislation that can highlight the effectiveness of legislative support on innovation. My job market paper acts as a first step in understanding the total effect of AIA and also highlights the legislation's complexity. Multiple sub-points of the AIA remain to be studied. One of those is its effect on first-time patentees, who are known to bring revolutionary inventions to signal their inventive capabilities to the market. As a part of my immediate future agenda, I aim to study the following sub-point of the AIA — did the AIA encourage first-time patentees to file for patents, and were those patents "market disrupting"? The AIA created a subgroup of small entities, called "micro entities", who would receive a 75 percent discount on all filing fees. First-time patentees at the USPTO were on the decline since 2006, and their number dropped from 10.17 percent in 2006 to 7.74 in 2011. However, since 2012, they have steadily increased and are now at 19.2 percent, which is the highest after the passage of the Bayh-Dole Act of 1980.

Geography of innovation in India

Patent applications filed at the Indian Patent Office, also called Intellectual Property India (IPI), remain under-explored in the innovation literature due to lack of data and detail per patent in existing patent databases (PATSTAT, Derwent Innovation, etc.). My project constructs a novel patent dataset for patents filed in India using the Intellectual Property of India public search tool. This dataset contains the following new information — first, it has better coverage of patent applications filed in India that were not previously found in the popular databases. Second, every patent contains additional details that were previously unknown.

The most popular worldwide patent database among researchers is the European Patent Office's (EPO) PATSTAT. I use this as a benchmark to compare it with the patent dataset I develop. Here are two examples of the data gaps that are in PATSTAT that my project bridges — first, I recovered

over 80 percent of patent abstracts, full applicant and inventor addresses, and patent legal events. This, in PATSTAT, is only available for 15 percent of the patents for the period of 2000-2008 and the legal event for any patent is unavailable in PATSTAT. Second, the number of patent applications covered by PATSTAT is much lower than IPI. For example, in the year 2000 PATSTAT reported 417 patents filed in India while for IPI it is 3556.

There are a range of questions pertinent to the Global South that could be answered if we had richer data. A few of them are — how are inventions from and to developing countries adopted in the country of origin and elsewhere? How did the international patent law harmonization exercise – the Trade Related Intellectual Property Rights (TRIPS) agreement – influence the proliferation of collaboration among inventors within and across countries, and did it in turn correspond to an increase in follow-on and original inventions?

Complete patent data would allow researchers to study the aforementioned and a range of other questions, and importantly — adequately control for applicants' and patent office's strategies and minimize measurement error. An example of this is the *request for an examination date* that accounts for the time taken between an application's filing and the actual start of the examination of that patent application, which is governed by an applicant's strategy, either to delay, or expedite the patent application's prosecution. This, if not taken into consideration would introduce bias to the conclusions of any study involving this measure.

Until now measures like this were an impediment to studies focusing on patenting strategy, patent examiners' efficacy, and related areas. My project bridges the data gap. Using this data, I study the geographical spread of inventions in India over time. Descriptive evidence shows that over the years patents and inventors have emerged from areas of India from where there were no patents filed previously. This seems to be a "green shoot" in the innovative environment in India. However, this "green shoot" does not seem to grow beyond a few patent applications. In most cases, patent applications from locations remain as stray cases of invention. Historically inventive areas of India — the large cities such as Chennai, Mumbai, Delhi, Hyderabad, and Bengaluru continue to dominate the innovative landscape of India with the highest number of patent applications. My future agenda is to study why participation in the patenting process has been concentrated and limited to a few areas within India historically.