NBER IPE project proposal: Do firms share rents with workers?

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A classic question in economics is whether firms share rents with workers. While a large literature has documented a positive correlation between firm profitability and workers' wages, very few papers have estimated rent-sharing using quasi-experimental variation in firm profitability (see, e.g., Abowd and Lemieux *QJE* 1993). This dearth of quasi-experimental estimates is unfortunate given that the magnitude of this rent-sharing elasticity has important implications for understanding wage determination at both the micro- and macro-level. In addition, rent-sharing behavior is of interest from an innovation policy perspective given that it reflects how patent-awarded monopoly rents are divided across inventors, employers, and coworkers.

In this project, we propose to estimate rent-sharing elasticities by analyzing the effects of US patent grants on German firms. Our key idea is to use "event study" specifications to investigate how firm profitability and – separately – the compensation of current, past, and future employees responds to patent grants. By scaling our compensation estimates by our firm profitability estimates, we can obtain an estimate of the elasticity between wages and quasi-rents. Because firms obtaining patent grants likely differ from firms not obtaining patent grants on both observable and unobservable dimensions, we will also take advantage of an instrumental variable for US patent grants developed in a previous IPE-funded proposal (Sampat and Williams mimeo 2013) – namely, variation in the 'leniency' of patent examiners at the US Patent and Trademark Office.

While our work on this project is still in the very preliminary stages, the results of several past studies suggest that our proposed empirical strategy will yield informative estimates. Specifically, several papers have documented that firms receiving patents experience increases in profitability, employment, and the wage bill (Van Reenen *QJE* 1996; Balasubramanian and Sivadasan *ReStat* 2011; Kogan et al. mimeo 2013). However, these studies have been limited in their ability to address the division of rents across market participants due to a lack of micro-data linking individual workers to firms. As a result of this data constraint, it is unclear whether observed wage increases associated with patenting constitute rent sharing with workers, or simply represent firms upgrading their labor force to higher-skilled (and higher wage) workers. While a recent study of Finnish employer-employee data (Tovainen and Vaananen *ReStat* forthcoming) provides some evidence that inventors receive a wage premia after being granted a patent, very little is currently known about how the rents generated by patents are divvied up among owners, incumbent workers, and new employees.

Data

Our analysis will take advantage of a new merge of several databases, which will provide us with a 12-year panel of data on the patent filings, patent grants, finances, employment, and wage bills of German firms.

Public-use administrative data on the universe of patent applications submitted to the US Patent and Trademark Office (USPTO) allow us to observe the full set of US patent applications filed by and US patents granted over the period 2001-2013. We can match these data to the public-use USPTO PAIR (Patent Application Information Retrieval) data, which records the key variables needed to construct our examiner leniency instrument – namely, filing year, the technology classes to which the application was assigned, and the USPTO examiner assigned to review the application.

In order to examine the impact of patent grants on firms, we then need to link this patent application data to two sets of outcome variables: firm-level measures of profitability, and firm-employee-matched data recording employee-level compensation.

While the heavily used NBER-Compustat data file provides firm-level measures of profitability for granted patents and North American firms, our research design requires a link that covers patent *applications* and *German* firms. In order to construct this link, we take advantage of the fact that the Bureau van Dijk (BvD) ORBIS data has linked US patent applications and granted patents to BvD firm identifiers. By taking advantage of this linkage, we can match our data on US patent applications to firm-level measures of profitability available in the BvD AMADEUS database.[1]

This firm-level panel data on patent filings, patent grants, and profitability measures will then be merged to employer-employee data from the German Integrated Employment Biographies (IEB). The IEB

[1] Given that we do not have detailed knowledge of how this BvD linkage was constructed, we also plan to check robustness to an alternative linkage by Delphion, which imputes assignees for ~80% of US patent applications.

provides longitudinal wage data on individuals covered by the German social security system. The data are at the spell level, consisting of the start and end date for each worker's employment at each establishment in each year along with the average daily wage during that spell. Exploiting the fact that firm names are encoded in the IEB establishment identifiers, the German Institute for Employment Research (IAB) has generated a crosswalk between IEB establishment identifiers and BvD firm identifiers for the cross-section of German firms in the BvD data in 2008. Using this crosswalk, we can merge our firm-level panel to establishments owned by firms that were active in 2008. In addition, because the IAB felt that this 2008 match was quite successful, they are planning to expand this linkage to other years of BvD data in 2014.

Given these data, we can then start by replicating previous firm-level studies documenting the effects of patent grants on firm-level outcomes such as profitability, employment, and the wage bill. To our knowledge, this will be the first ever longitudinally linked employer-employee panel containing individual wage data, firm balance sheet data, and patenting information.

Planned analysis

With these data, we hope to answer three broad questions. First, we seek to determine what fraction of the increase in profits associated with patenting is shared with employees who worked for the company before the patent was granted. To answer this question we plan to conduct a series of "event studies" that analyze the wages of a cohort of workers who were employed by firms in the year prior to a patent award. We will follow this cohort longitudinally in order to see whether they exhibit excess wage growth in the years following the patent relative to prior periods. We will then contrast any wage impacts with corresponding impacts on various measures of firm profitability. This approach mirrors the recent empirical literature on rent sharing (Guiso, Pistaferri, and Schivardi *JPE* 2009; Gurtzgen *ScJE* 2009; Carlsson, Messina, and Skans mimeo 2011; Card, Cardoso, and Kline mimeo 2013) but relies on the timing of patent grants – and the patent examiner instrument developed in Sampat and Williams (mimeo 2013) – for identification, whereas the past literature has relied on unverifiable restrictions on the stochastic process underlying firm productivity.

Our second question is whether firms engage in skill upgrading in response to being awarded patents. As discussed above, a concern with past studies such as Van Reenen (*QJE* 1996) that have estimated rent-sharing using aggregate data on wages is that it is unclear whether observed wage increases associated with patenting constitute rent sharing with workers, or simply represent firms upgrading their labor force to higher-skilled (and higher wage) workers. In our micro-data, we will be able to directly estimate how the education, experience, and "unobserved ability" of new hires changes in response to patenting, where unobserved ability will be proxied by statistical "person fixed-effects" as in Card, Heining, and Kline (*QJE* 2013). Though skill upgrading is one possibility, patenting may alternatively enable the creation of more routinized jobs that induce skill downgrading (Autor, Levy, and Murnane *QJE* 2003).

Our third question is whether new hires receive abnormally high wages when they join firms that have received a patent. Answering this question requires defining precisely what "abnormal" means. We plan to estimate a set of "firm fixed-effects" as in Card, Heining, and Kline (*QJE* 2013) that are allowed to vary pre- and post- patent award. Because the firm fixed effects are identified off of worker transitions between firms, a finding that post-patent firm effects are greater than pre-patent firm effects is an indication that new hires experience an excess return to joining firms that recently obtained patents. Such a finding would be consistent with standard rent sharing models based on Nash bargaining. However, it could also indicate inefficiencies in the market for innovation, as in standard models investors and inventors (as opposed to co-workers) would capture the full private returns to their efforts. We will conclude with discussions for innovation policy.

Requested funding for this proposal:

This funding would provide summer support for Kline and would cover the costs of a research assistant to work in the Berkeley data center, which provides access to the German IEB data.