



# An examination of the intertemporal returns of patented inventions



Jesse Giummo\*

Department of Economics, Dartmouth College, 6106 Rockefeller Hall, Hanover, NH 03755, USA

## ARTICLE INFO

### Article history:

Received 25 October 2011

Received in revised form 4 March 2014

Accepted 20 March 2014

Available online 20 April 2014

### JEL classification:

L20

O30

O31

O34

O38

### Keywords:

Patents

Innovation

Intellectual property rights

## ABSTRACT

This paper examines the intertemporal returns of patented inventions using estimates of patent value obtained from German employee inventors' compensation records. The paper finds heterogeneity in the mean age and dispersion of the annual returns by technology and cumulative patent value. While the returns earned by most patents dissipate rapidly, high valued patents tend to receive significant returns through the latter part of the patent term. These high valued patents which account for the vast majority of the realized returns, further can be identified based on past returns, relatively early in the patent term. These findings suggest that while shortening the length of the patent term could substantially reduce realized returns, graduated maintenance fees may not adversely affect returns, as firms would be able to identify and selectively renew the subset of high valued patents.

© 2014 Elsevier B.V. All rights reserved.

## 1. Introduction

A central concern of the patent literature has been the incentives to innovate created by the patent system, the returns to patented inventions, and how patent policy affects the incentives to innovate. The incentives to innovate and the effect of modifications to patent policy shall not only depend on the cumulative returns from the patented invention, but as well on the timing of the returns. Unfortunately, there exist no direct measures of the intertemporal returns to individual patents and even obtaining estimates of individual patent value has proved difficult (Austin, 1993; Cutler, 1984; Gambardella et al., 2008; Harhoff et al., 1999; Sanders, 1964). This paper examines the intertemporal returns to patented inventions using estimates of patent value from compensation records for German employee inventors. A unique feature of employee inventors' compensation records is that returns are recorded on a periodic basis, providing the returns earned by an invention over the patent term. This paper contributes to the research on patent value by empirically examining the intertemporal distribution of the returns to patented inventions and the patent holders' ability to predict future returns.

The German Employees' Inventions Act (GEIA) requires German enterprises and affiliates of foreign companies operating in Germany to provide employees compensation beyond their normal salary and wages for inventions made in the course of their employment. Compensation for employee inventors under the act is regulated by the Guidelines for the Remuneration of Employees' Inventions in Private Employment (GREIPE). The guidelines specify that the employee's compensation is to be proportional to the realized private value of the invention. Compliance with the act necessitates that German employers maintain records of the returns derived from each employee invention over the patent term. These records have allowed estimates of patent value for the first time to be differentiated along two dimensions: the total returns earned by the patented invention or the patent's *cumulative value* and the timing of the returns earned by the patented invention or the *intertemporal returns* of the patented invention.

The paper finds heterogeneity in the mean age and dispersion of the annual returns by technology and cumulative patent value. High valued patents tend to earn returns later in the patent term and, unlike low value patents, receive significant returns through the latter part of the patent term. Based on past returns these high valued patents can be identified relatively early in the patent term. If such patent attributes persist, it would suggest that shortening the patent term could more adversely affect the returns on innovation than graduated maintenance fees.

\* Tel.: +1 603 646 2538; fax: +1 603 646 2122.  
E-mail address: [giummo@dartmouth.edu](mailto:giummo@dartmouth.edu)

The remainder of the paper is organized as follows. Section 2 outlines the German Employee Inventors' Compensation Act and the calculation of invention value under the guidelines of the act. Section 3 describes the construction of the dataset. Section 4 empirically examines the intertemporal returns of patented inventions and the ability to predict future returns. Section 5 discusses implications of the findings for patent policy. Section 6 concludes.

## 2. Estimation of value under the German Employee's Inventor Act

The GREIPE which regulates employee compensation and the determination of invention value under the GEIA outlines methods for the calculation of invention value (§3–§18). The vast majority of inventions are estimated through the use of a licensing analogy. The licensing analogy calculates the value of the invention based on the product of a representative royalty rate for a third party license of the non-exclusive right to use the invention and the relevant value of production associated with the invention. The value of invention externally utilized (such as inventions licensed or sold) is set equal to the net earnings of the invention, where net earnings are equal to earnings net the costs of developing the invention, preparing the invention for exploitation, potentially defending the protective right, and the transaction costs associated with the licensing or sale of the invention (§14 and 16). When the calculation of such costs is infeasible, the employer may resort to the use of a licensing analogy (§15). The invention's valuation is derived from returns earned both domestically in Germany and internationally. Employee compensation is set as a percentage of each inventor's share of the invention value and increases the greater their initiative setting the technical problem, the greater their contribution to solution, and the lower their expected performance given their duties in the firm. This paper does not address the compensation paid to employees, but instead focuses on the estimate of patent value used to calculate such compensation.<sup>1</sup>

The patent value estimates from GEIA records are calculated using a common set of guidelines, providing a methodologically consistent measure of value. The heavy reliance on the licensing analogy and net earnings to calculate invention value, however, results in patent value estimates from GEIA records that primarily provide a measure of the realized value from the use of the invention as an asset or a measure of the *private invention value*, and generally do not directly capture the value of the patent right. Further, licensing estimates of patent value shall under-estimate the value of an invention, as the licensor in a licensing contract will not appropriate the full value of the invention to the licensee. Thus, estimates of value from GEIA records should not be viewed as accurate measures of the value of patented inventions as they generally do not measure the value of patent protection and under-estimate the invention value, but instead provides a measure of value proportional to the invention value.<sup>2</sup>

## 3. Data

The dataset is composed of inventions with priority years from 1977 to 1982, originating from Germany that were granted a German and U.S. patent, and for which employee inventor compensation records were obtained. In this study compensation records were used from Robert Bosch GmbH, Degussa AG, the Max Planck

Institute, Henkel KgaA, M.A.N. Roland AG, Röhm GmbH, Siemens AG, and Volkswagen AG. The selection of inventions granted a U.S. patent from organizations with large patent portfolios is anticipated to result in high valued patents being oversampled.

For each invention the dataset contains estimates of the annual returns, the number of years the German patent was renewed, an indicator variable if the German patent was renewed full term, the technological field of the invention, the adjusted generality of the patent classification, the acceleration in patenting for the patent classification, and the backward citation lag for the U.S. patent grant.

An invention is categorized into the technological class of Chemical, Computers & Communications, Drugs & Medical, Electrical & Electronics, Mechanical or Other using the categorization of the U.S. patent grant from the National Bureau of Economic Research Patent Citation Data File (see Hall et al., 2001). Acceleration in patenting was measured as the percentage change in the level of patenting activity in the patent's U.S. patent class over the ten-year period beginning in the priority year of the patent.

The annual returns to the invention were obtained from the employee compensation records. Compensation is generally assessed on an annual or bi-annual basis for the period succeeding the last compensation payment. The returns earned by an invention are assigned to the calendar year that the returns were estimated or compensation was calculated.<sup>3</sup> Annual returns are classified by the age of the return, where the patent's priority year is year zero and represents the earliest year for which a patent application was filed for the invention.

Estimates of value obtained using a licensing rate under the law incorporate reductions in the licensing rates as the value of production increases. While such reductions are not uncommon in observed license contracts such reductions appear unwarranted for the estimation of value; and the value of the use of the invention should not in general decrease as the relevant production increases. Therefore, annual returns calculated using a licensing analogy have been re-calculated to eliminate the reductions in the licensing royalty rate. The returns were then discounted to 1977 Deutsche Marks (DM) using the annual GDP price deflator for Germany over the period to adjust for changes in the price level (I.M.F., 1997, 2002 and 2004). Each German 1977 Deutsche Mark is equivalent to approximately 0.9 U.S. 2000 dollars.

The dataset consists of a panel of the annual returns of 1101 patents from patent year zero to patent year 20.<sup>4</sup> The resulting discounted annual returns provide for each invention a measure of the total returns earned by the patented invention from year 0 to 20, which is the *cumulative value* of the patented invention and the timing of the returns earned by the patented invention, which are the *intertemporal returns* for the patented invention.

## 4. Distribution of the intertemporal returns

The use of employee inventor compensation records to estimate invention value enables an examination of both the distribution of the cumulative value of patented inventions and the distribution of the returns over time. Prior research on the distribution of the returns to patented invention has focused on the distribution of the cumulative value of patented inventions, finding that

<sup>1</sup> A more in depth description of the GEIA, its historical context and employee inventor incentives for innovation created by the act is provided by Harhoff and Hoisl (2007).

<sup>2</sup> An examination of the construct of patent value measured by employee inventor records and potential biases in these measures is provided by Giummo (2010).

<sup>3</sup> As compensation is not calculated on an annual basis in some instances, a portion of the returns will be assigned to a later year than the returns were earned. If, for example, returns are calculated biannually and the returns were evenly distributed over the life of the patent, half the returns would be reported a year later than they were earned, resulting in a half a year lag on average between the that date the return was earned and was reported.

<sup>4</sup> Excluded from the sample were 71 patents for which the available compensation records only contained compensation payments paid over extended intervals.

Download English Version:

<https://daneshyari.com/en/article/984548>

Download Persian Version:

<https://daneshyari.com/article/984548>

[Daneshyari.com](https://daneshyari.com)