

An Investigation of Patents for Telecom R &D: Their Effect on Revenues and Stock Prices in Telecom Industry

Abstract:

It is widely known that the telecom industry is the hub of innovation starting from the early days of Bell Labs, and that these companies garner a substantial number of patents every year. However, there is little in terms of research on the effect of patents on the revenues and stock prices of respective telecom companies. This paper investigates the effect of patents (granted) on the sales revenues and stock prices of the top three telecom companies in the US.

We developed several models using longitudinal data for these companies, which reveal interesting observations of the lagged effect of patents on revenues and stock prices. The models included the following sets of independent variables: a) the number of patents (and the lagged numbers from prior four years), b) cumulative sum of patents, c) rate of change of patents, and d) moving sum of patents (over 5 years). Each of these models involved running multiple regressions to determine the effect of patents on the level of sales revenues and stock prices, separately. Finally, to de-trend the sales revenue from the overall growth of the industry, we also ran each of these models on the rate of change of sales revenue instead of using the level of sales.

The regressions for these models produced significant results on the basis of R^2 . Furthermore, the independent variables showed statistical significance using t-statistic and p-value measures. While these results confirm our hypothesis of the lagged effect of patent grants on the sales revenues and stock prices of major US telecom companies, future work would investigate modeling this effect in overseas markets and also smaller US telecom companies.

Keywords:

Telecommunications Companies, Innovation, R&D investment, Patents, Sales Revenue, Stock Price

Background

It is well established that technological change impacts the aggregate production function as shown by Solow (1957). More importantly, there is ample research that R&D investment impacts the corporate revenues and profit growth demonstrated by Morbey (1989). The early work on the effect of R&D investment was published in semiconductor industry by Hall and Ziedonis (2001).

There are also models, which show the effect of R&D investment on the corporate performance by Ko, et al. (2005) and Kaiser (2006).

Model

It is widely known that the telecom industry is the hub of innovation starting from the early days of Bell Labs, and that these companies garner a substantial number of patents every year. However, there is little in terms of research on the effect of patents on the revenues and stock prices of respective telecom companies. This paper investigates the effect of patents (granted) on the sales revenues and stock prices of the top three telecom companies in the US.

We developed several models using longitudinal data for these companies, which reveal interesting observations of the lagged effect of patents on revenues and stock prices. The following show the different versions of the model:

- a) The number of patents (and the lagged numbers from prior four years)

The regression equation is given below for estimating the sales revenue based on the number of patents for the current year and those granted in the previous four years.

$$R_1 = \alpha_0 + \beta_0 P_0 + \beta_1 P_1 + \beta_2 P_2 + \beta_3 P_3 + \beta_4 P_4$$

R_1 = Net sales revenue for the year, taking thousand as a unit

P_0 = No. of patents granted in current year

P_1 = No. of patents granted - 1 year lag

P_2 = No. of patents granted - 2 year lag

P_3 = No. of patents granted - 3 year lag

P_4 = No. of patents granted - 4 year lag

- b) Cumulative sum of patents

This model involves using the cumulative sum of patents granted for the company along with lagged variables from the prior four years.

- c) Annual rate of change of patents

This model involves using the annual rate of change of patents granted for the company along with lags over the prior four years.

This is intended to control all other variables such as the number of employees, firm size, over all industry growth, etc. Thus, we anticipate this model to be a benchmark for measuring the impact of patents on the growth rate of sales. Specifically, our focus would be to determine

the impact of patents not only from the current year, but also from the lagged effect of prior years.

d) Moving sum of patents (over 5 years)

This model involves using a moving sum of patents granted for the company along with lags over the prior four years. This is to provide a smoothing of patents over a time span of 5 years to eliminate spikes in specific years. However, this is expected to be less significant for estimating revenues as product cycle may be shorter than the time window of the moving sum (5 years).

Each of these models involved running multiple regressions to determine the effect of patents on the level of sales revenues. Then, the models were run using stock price, instead of revenues. Finally, to de-trend the sales revenue from the overall growth of the industry, we also ran each of these models on the rate of change of sales revenue instead of using the level of sales. By using the rate of change of sales instead of levels, it allows us to use several lags of patents granted and avoid the problem of co-linearity. However, we published both sets of the results for comparison in terms of: i) levels, and ii) rate of change of sales.