The Inventors' Life Cycle

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Research productivity over the life cycle is an important issue, as scientists' productivity declines with age in a number of disciplines (Oster and Hamermesh, 1998; Levin and Stephan, 1991). Little is known, however, about *inventors' productivity*.

By using detailed information on individual characteristics of a large sample of European inventors (i.e. their age, education, carrier, affiliation, etc.), the characteristics of the innovation process, and the innovations that they produce, this paper describes the inventors' productivity cycle, and tries to understand the determinants of such productivity in different fields, countries and types of organisations. The results provide interesting suggestions for policies that aim at fostering research productivity.

The empirical analysis is based on the PatVal-EU database, which was constructed by using the results of a survey – the PatVal-EU survey – funded by the European Commission and conducted by six partner institutions in 6 EU countries (Italy, UK, Germany, the Netherlands, Spain and France) in 2003-2004. By interviewing more than 9,000 European inventors with a patent priority date in 1993-1997, the PatVal-EU database provides novel and detailed data about the characteristics of the inventors that take part in the development of a European patent, the sources of knowledge they use, the importance of formal and informal collaborations among researchers and institutions, the motivations to invent, and the actual use and economic value of patented innovations.

The empirical work uses information on 1,000 PatVal-EU inventors who produced innovations in 5 technological classes: Information Technology, Optics, Biotechnology, Chemical Engineering, Civil Engineering. We also searched the EPO database for all the patents applied by our inventors in the period 1988-1999, when the EPO system was fully working, and we added to the database the information on all the patents applied at the EPO by our 1,000 inventors in the 12 years window.

Based on these data, the empirical analysis developed through the following two steps:

a) First, we looked at the age-productivity relationship. Research productivity is measured by the number of patents applied by our inventors during their research life. The research productivity of our inventors is also described by weighting the patents for the number of citations they received. Moreover, since we do not observe the entire research life of the inventors but only a 12 years window, we estimate the slope of the research curve for inventors belonging to different age cohorts.

In the second stage of the study we estimated the determinants of the inventors' productivity. Specifically, we study three types of research productivity: i) the number of patents the inventors produce; ii) the average "importance" or the value of the innovations they develop; iii) the probability of inventing a "technological hit". Personal characteristics, love for "research", industry characteristics, firm characteristics, and a number of controls are included to derive the net effect of each variable by means of maximum likelihood estimations. Trend variables, dummy variables for technologies and countries, and a sample selection bias correction (i.e. Olsen, 1980) are also included in the regressions..