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Persistence and Uncertainty in the Academic Career

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Understanding how institutional changes within academia may affect the overall potential of science requires a better quantitative representation of how careers evolve over time. Since knowledge spillovers, cumulative advantage, competition, and collaboration are distinctive features of the academic profession, both the employment relationship and the procedures for assigning recognition and allocating funding should be designed to account for these factors. We study the annual production n_{i}(t) of a given scientist i by analyzing longitudinal career data for 200 leading scientists and 100 assistant professors from the physics community. We compare our results with 21,156 sports careers. Our empirical analysis of individual productivity dynamics shows that (i) there are increasing returns for the top individuals within the competitive cohort, and that (ii) the distribution of production growth is a leptokurtic "tent-shaped" distribution that is remarkably symmetric. Our methodology is general, and we speculate that similar features appear in other disciplines where academic publication is essential and collaboration is a key feature. We introduce a model of proportional growth which reproduces these two observations, and additionally accounts for the significantly right-skewed distributions of career longevity and achievement in science. Using this theoretical model, we show that short-term contracts can amplify the effects of competition and uncertainty making careers more vulnerable to early termination, not necessarily due to lack of individual talent and persistence, but because of random negative production shocks. We show that fluctuations in scientific production are quantitatively related to a scientist's collaboration radius and team efficiency.

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