Research Proposal: Patient Capital
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Most empirical work testing agency-based theories of corporate short-termism (see Stein (1989)) explore the effect of increased failure tolerance by the principal on agents' marginal investments. By now, there is sufficient evidence that reductions in short term accountability of managers encourage innovation on the margin.[1]

An issue that has received much less attention is the potential negative effect on innovation from the adoption of failure tolerant strategies. Nanda and Rhodes-Kropf (2014) argue that principals face a fundamental trade-off when choosing an innovation strategy. A strategy that is more failure tolerant may encourage the agent to innovate, but simultaneously destroys the value of the real option to abandon the project by the principal. Thus, in equilibrium, principals that choose a more failure tolerant strategy will also choose to back less radical innovations (i.e., those innovation for which the value of abandonment option is low). The overall effect on innovation from choosing innovation strategies that reduce short-term accountability of managers is thus ambiguous. While it can increase innovation by extending the runway of existing projects, it can also reduce innovation by changing the rate of direction towards safer, potentially less welfare improving research.

In this project we explore at length the relation between failure tolerance and innovation, particularly the potential negative effect at the extensive margin unexplored by prior empirical work. We focus on innovation in the Life Science sector, in particular, pharmaceutical companies backed by Venture Capital and Corporate Venture Capital investors.

The idea that failure tolerant strategies by principals may generate underinvestment in the more radical and potentially more welfare improving innovation – while intuitive – is difficult to test empirically. The key prediction is that there is "missing" private Research and Development (R&D) on scientifically feasible, but, radical projects by failure tolerant principals, which would have developed these ideas but for their low abandonment option. In practice, we do not observe the failure tolerance of principals, nor the abandonment option of projects that are not developed. In addition, "missing" private R&D is hard to distinguish from alternative explanations such as a lack of market demand or a lack of scientific opportunities (Budish, Roin and Williams (2014)).

Two features of CVC and VC investments in pharmaceuticals can allow us to make progress on testing this idea. First, while it is generally hard to measure the failure tolerance of principals, the organizational differences between VC and CVC allow us to non-ambiguously rank the patience of their innovation strategies. CVC funds are structured as subsidiaries of corporations, whereas VC funds are structured as limited partnerships with a 10-year lifespan. CVCs thus have a longer investment horizon, and thus, presumably, a more failure tolerant innovation strategy (see: Chemmanur, Loutskina and Tian (2014)).[2] Second,

[1] See among many others: Lerner and Wulf (2007), Aghion, Reenen and Zingales (2009), Acharya and Subramanian (2009), Azoulay, Zivin and Manso (2011), Ferreira, Manso and Silva (2011), Tian and Wang (2012), Chemmanur, Loutskina and Tian (2014), Asker, Farre-Mensa and Ljungqvist (2014) and Gonzalez-Uribe and Xu (2014))

[2] The differences in their compensation structure also point to CVC being more failure tolerant than VC. VCs have a performance-based compensation structure (i.e., 2% of management fees and 20% of carried interest) whereas CVC fund managers are compensated by a fixed salary and corporate bonuses that are tied to their parent company's financial performance

pharmaceutical development is organized around diseases (e.g., Diabetes, type I), therapeutic class (e.g., Antipsoriasis), mechanisms of action (e.g., Insulin secretagogue), delivery route (e.g., injectable) and biological target (e.g., calcitonin receptor), which provides a rich characterization of observed and potential R&D. In addition, the participation of CVC in venture capital investments in Life Science has seen a rapid increase in the last 5 years, almost doubling and reaching an all-time peak of 14% in 2014, which makes our focus relevant for current policy.

Preliminary tests using proprietary data on New Drug Applications (NDAs) filed for approval at the Food and Drug Administration (FDA) are consistent with the predictions of the theory: applications by CVC-backed companies generally take more time to reach the market, but are also of lower novelty (as measured by how many other drugs, are acting in the same mechanistic/therapeutic way to treat a certain disease(s)) than approved applications by Non-VC backed firms. One difficulty with these data is that by observing only drugs that are approved we are unable to calculate the abandonment option. In addition, only very few of the drugs are only financed by CVCs as these funds tend to syndicate with VCs in the latest stages of their companies' development.

In order to proceed with our project, we have purchased additional proprietary data from Pharmaprojects, which includes information on all compounds filed as Investigational New Drug (IND) applications with the FDA. In this proposal, we are seeking funds to hire an RA that can help us 1. Clean the files and identify for each record its company sponsor, which is not a trivial exercise (because companies are bought throughout the sample it is difficult to distinguish who originated the drug; also drugs are abandoned and later their development is continued by other companies, hence tracing history of a drug can be complex). 2. Matching the files with information on CVC and VC investment deals in the sector. 3. Classifying drugs according to novelty, a rating available until 2009 but discontinued by the provider and missing for the last part of the sample. An estimated amount of USD 16,000 from the NBER will constitute a significant contribution to fund the above mentioned activities and allow us to move forward with this project.

At present, a data processing firm is cleaning the files from Pharmaprojects. This initial job is expected to cost USD 2,000 and to be completed by late February this year. During March we expect to clean extensively the information on sponsoring companies in order to match it with the already assembled dataset on CVC and VC investments in the sector. This process is expected to take an additional 15 days and cost a similar amount, as two RAs will be engaged to help in the process of cleaning the approximately 12,000 records of clinical trials and NDA data. Finally, we would need to hire the services of a chemistry PhD student to assist us in classifying the matched sample of drugs (i.e., those filed by CVC and/or VC backed companies) according to their scientific novelty. A budget of USD 12,000 is reserved for this task. We expect to work on the analysis of the data starting in late May, and continue throughout the summer. Realistically, the first draft of the project will only be available by the end of the summer.

Lora Dimitrova is a Lecturer at the University of Exeter. Her research focuses on entrepreneurial finance and innovation and has been awarded prizes by the Coller Institutes of Venture and of Private Equity. Juanita Gonzalez-Uribe is an assistant professor at the London School of Economics. Her work on entrepreneurship and innovation has won several prizes including the Kauffman Dissertation Award. Ramana Nanda Ramana is an Associate Professor at Harvard Business School. His most recent prize is the 2015 Kauffman Prize Medal for Distinguished Research in Entrepreneurship.