The Locational Dynamics of the U.S. Biotech Industry: Knowledge Externalities and the Anchor Hypothesis[1]

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1. Introduction

One of the important motivations in economic geography is to understand the forces that contribute to the agglomeration of innovative activity and affect the growth potential of the firms and cities. A significant body of research examines this question in light of the concept of knowledge spillovers (see Feldman 2000 for a review). More recent work highlights the importance of industry life cycle (Duranton and Puga 2001), the composition of activities within an agglomeration (Glaeser et al. 1992; Henderson et al. 1995, Feldman and Audretsch 1999) and the influence of existing industrial structure (Klepper 2001; Rosenthal and Strange 2002). Together this work suggests a more nuanced understanding of the nature

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of agglomeration economies and the way in which the fortunes of firms and regional clusters are intertwined.

Biotechnology presents an opportunity to study the emergence and growth of a new industry. Biotechnology is the commercialization of scientific discoveries related to genetic engineering. The industry has captured the imagination of government officials who hope to garner the potential economic rents of the next important general purpose technology. Biotech, however, is still at an early stage of development and there are many competing hypotheses about its future development. While significant resources are spent trying to promote new firm formation and the development of biotech clusters, we have a limited understanding of the process by which clusters are formed, how new industries become anchored in a local economy and, as a result, how locations may reap the resulting economic rewards.

This paper uses a panel of firms to explore the locational patterns and place-specific evolution in the U.S. biotech industry. As predicted from prior studies of knowledge-intensive industries, the biotech industry is becoming more geographically concentrated and highly specialized in certain locations. While the existence of knowledge externalities contributes to geographic concentration the larger question of how regional specialization is determined and how this affects firm survival and growth and subsequently the viability of the regional cluster is relatively unexplored.

One answer may be that existing firms serve as anchors that attract skilled labor pools, specialized intermediate industries and provide knowledge spillovers that benefit new technology intensive firms in the region. Established firms may provide expertise and knowledge about specific applications, product markets, and technical developmental trajectories that move generic scientific innovations in a particular direction, which, over time, may distinguish the specialization of the industrial cluster. For example, if there is a regional anchor with a sophisticated expertise in vaccines, new start-up firms may be likely to specialize in that same or a related trajectory. Once the region is noted to have developed an expertise, others that work on the application or in the product market may be encouraged to start firms in the region. Over time, a cluster may develop around that specialized expertise. This implies a regional path dependency that stems from the existence of the anchor firm to the specialization of new entrepreneurial start-ups that enter the industry in that location. As a result, the fortunes of technologies, firms, and regions are jointly determined.

Section Two of the paper examines the historical development of the biotech industry while Section Three sets out some of the empirical patterns of geographic location and specialization in the biotech industry. Section Four considers this descriptive analysis in the context of the literature. Section Five develops the concept of the Anchor firm as an agglomerative force and provides hypotheses about the Anchors' relationship to the formation of new dedicated biotechnology firms, their growth and the technical specialization of clusters. Section Six concludes with some reflective conclusions and future areas of research.