



# Entrepreneurial orientation, technology transfer and spinoff performance of U.S. universities<sup>☆</sup>

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## Abstract

This paper adopts a resource-based perspective to understand why some universities are more successful than others at generating technology-based spinoff companies. In this respect, we derive eight hypotheses that link attributes of resources and capabilities, institutional, financial, commercial and human capital, to university spinoff outcomes. Using panel data from 1980 to 2001, our econometric estimators reveal evidence of history dependence for successful technology transfer to occur although faculty quality, size and orientation of science and engineering funding and commercial capability were also found to be predictors of university spinoff activity. We conclude by drawing implications for policy makers and university heads.

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## 1. Introduction

Given the difficulties of established firms in bringing new technologies to the market (Utterback, 1994), U.S. universities are increasingly viewed as a source

for the creation of high tech firms (Roberts, 1991). As a result, there is a growing need for universities to develop more 'rapid' linkages between science, technology and utilization (Allen and Cohen, 1969; Allen et al., 1979) and serve a 'third-mission' of contributing to local economic development (Etzkowitz, 2002). These developments are posing challenges to the traditional role of the university and its support practices towards entrepreneurial activities (Van Dierdonck and Debackere, 1988; Lerner, 2004).

The importance of the traditional university is well documented in the literature (Geiger, 1993; Bok, 2003).

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Their primary mission is to engage in research and disseminate knowledge across both academic and student communities. They also contribute indirectly to technology transfer activities by providing highly educated and qualified personnel to industry (Carayannis et al., 1998). According to Segal (1986), these universities not only provide a source of technical expertise for faculty members, but their students also acquire a wealth of codified and tacit knowledge through learning and living at the university.

However, across national economies there is a need for more emphasis to be placed on transferring and commercializing knowledge generated within universities (Cohen et al., 1998). More specifically, there is a growing need for universities to disseminate the knowledge generated beyond the narrow confines of the academic community itself (Mansfield and Lee, 1996; Branscomb et al., 1999; Hague and Oakley, 2000). As a result, many universities are now playing a third role in society through actively converting new scientific discoveries into spinoff opportunities (Kinsella and McBrierty, 1997; Leitch and Harrison, 2005). In essence, these 'entrepreneurial' oriented universities, as coined by Etzkowitz (1998), are proving key for regional economic development, going beyond the provision of graduates and research. Although some authors refer to the spinoff strategies of different European public research-based institutions (Klofsten and Jones-Evans, 2000; Davenport et al., 2002; Clarysse et al., 2005), the case of Massachusetts Institute of Technology (MIT) is the reference example (Roberts and Malone, 1996; Lüthje and Franke, 2003). By encouraging faculty members to pursue private ventures outside the research lab, Bank Boston Economics Department, 1997 has calculated that MIT start-up companies generate 232 billion dollars worth of sales per year to the U.S. economy. University spinoffs are an important subset of start-up firms because they are an economically powerful group of high technology companies (Shane and Stuart, 2002; Heirman and Clarysse, 2004). According to the Association of University Technology Managers (AUTM), spinoffs from American academic institutions between 1980 and 1999 have contributed 280,000 jobs to the U.S. economy.

The recent plethora of studies on university spinoffs can be divided into three main categories. The earliest research regarding the topic assesses the personal characteristics of academics that appear to

impact entrepreneurship. For example, Roberts (1991) found the average MIT technical entrepreneur typically exhibited a high desire for independence, a moderate need for achievement and a low need for affiliation. In a more recent exploratory study at MIT, Shane (2004a) uncovered motivational characteristics, such as (1) a desire to bring technology into practice; (2) a desire for wealth and (3) a desire for independence, as key 'pull' and 'push' factors impacting academic spinoff behavior. Furthermore, Zucker et al. (1998) found scientific 'stars' collaborating with firms had substantially higher citation rates than pure academic stars.

The second strand of spinoff literature assesses the influence of universities' policies, procedures and practices on commercialization. Some studies found that the perceived responsiveness of university policy may affect whether academics attempt to exploit intellectual property (IP) within or outside the perimeters of the university (Feldman et al., 2002; Degroof and Roberts, 2004). Beyond this, Clarke (1998) in a cross-national study of five highly successful European universities identified entrepreneurial culture as a key element for successful University Industry Technology Transfer (UITT, as coined by Siegel et al. (2003)). In addition, Siegel et al. (2004) propose that in order to foster a climate of entrepreneurship within U.S. academic institutions, university administrators should focus on five organizational and managerial factors. These are reward systems for UITT, staffing practices in the technology transfer office (TTO), designing flexible university policies to facilitate university technology transfer, devoting additional resources to UITT and working to eliminate cultural and informational barriers that impede the UITT process. Debackere and Veugelers (2005) also supports this view and postulates that universities should employ (1) incentive structures to reward academic entrepreneurial endeavors; (2) decentralized operating structures to provide greater autonomy to research teams and (3) a centralized staff of experienced technology transfer personnel to manage the 'contract' and 'training' issues associated with the technology transfer process.

A third strand of the spinoff literature explores environmental factors impacting academic innovations (Mowery et al., 2001). According to Shane (2004b), a significant impetus in the generation of spinouts in the U.S. was the enactment of the Bayh–Dole Act,

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