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Contents

Small Firm Research Supported by the National Institutes of Health's National Cancer Institute

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ABSTRACT

The National Cancer Institute (NCI) is the oldest and largest (in terms of public sector financial support) Institute within the U.S. National Institutes of Health (NIH). To date, the research that the NCI sponsors in small firms has yet to be systematically studied. Using survey data collected by the National Research Council (NRC) within the National Academies of Sciences, Engineering, and Medicine from a random sample of Phase II research projects funded through the NCI's Small Business Innovation Research (SBIR) program, multiple dimensions of the economic and social outputs from those projects are considered in a descriptive manner. The outputs considered in this monograph relate to the legislated purposes of the SBIR program, namely to increase private sector commercialization of innovations derived from Federal research and development and to stimulate technological innovation.

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1

Introduction

The U.S. public sector's support of small firm research traces at least to the Small Business Mobilization Act of July 11, 1942 (Public Law 603).[1] As written in the Act of 1942:

> *Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled*, That [the Chairman of the War Production Board is] to mobilize aggressively the production capacity of all *small business concerns* [emphasis added], and [is] to determine the means by which such concerns can be most *efficiently and effectively* [emphasis added] utilized to augment war production.

The Congress was aware at that time of the Act of 1942 that small firms,[2] with small manufacturing and limited production plants, lacked the economies of scale needed to compete with businesses with large plants. Thus, for society to benefit "efficiently and effectively" from

[1] This discussion about small firms is based on a more detailed account of the history of small firms in the economy as reported in Link and O'Connor (*Forthcoming*, 2025).

[2] The terms *firm*, *business*, and *company* are used interchangeably throughout this monograph.

small business concerns, a price differential for manufactured parts and equipment might be needed to keep small businesses mobilized during the [World War II] efforts.[3] This Congressional perspective was reinforced through the passage of the Armed Services Procurement Act of 1947 (Public Law 413)[4] and the Defense Production Act of 1950 (Public Law 81-774):[5]

As written in the Act of 1950:

> It is the intent of Congress that the authority conferred by this title shall be exercised . . . so far as practicable, on the maintenance and furtherance of the American system of competitive enterprise, including independent small-business enterprises . . . [and] that small-business enterprises be encouraged to make the greatest possible contribution toward achieving the objectives of this Act . . .

Congressional emphasis on economic perspectives associated with small firms continued into the 1950s with the passage of the Small Business Act of 1953 (Public Law 163), which codified the economic and social importance of small firms to the U.S. economy. The Act of 1953 also created the Small Business Administration (SBA) as an independent agency of the federal government. As written in the Act of 1953:[6]

> It is the declared policy of the Congress that the Government should aid, counsel, assist, and protect insofar as is possible the interests of *small-business concerns* [emphasis added] in order to preserve free competitive enterprise, to insure [sic] that a fair proportion of the total purchases and contracts for supplies and services for the Government be placed with small-business enterprises, and to maintain and strengthen the overall economy of the Nation . . .

[3] See https://www.qualcomm.com/media/documents/files/the-history-of-small-business.pdf.

[4] See https://www.loc.gov/resource/llsalvol.llsal_062/?sp= 51&r=-0.099,-0.06,1.329,0.52,0.

[5] See https://govtrackus.s3.amazonaws.com/legislink/pdf/stat/64/STATUTE-64-Pg798b.pdf.

[6] See https://dair.nps.edu/handle/123456789/4010.

However, according to Blackford (1991), among others, the late 1950s, the 1960s, and part of the 1970s were periods of economic decline for most small firms. Blackford (1991, pp. 5–7) wrote that, "between 1958 and 1979 the share of business receipts received by small companies plummeted from 52 to only 29 percent of the total for all American firms." But, a "resurgence in small business occurred in the late 1970s and the 1980s . . . Small companies generated most of the new jobs in America—64 percent of the 10.5 million new jobs created between 1980 and 1986." In fact, Audretsch and Thurik (2004, p. 144) have suggested that small firm entrepreneurship emerged in the late 1970s "as the engine of economic and social development throughout the world."

In response to the productivity slowdown in the United States in the early and late 1970s—see Figures 1.1 and 1.2—President Jimmy Carter initiated a Domestic Policy Review prior to the promulgation of any legislation to reverse the slowdown.[7] And, the President emphasized the role of small firms in that regard. As recorded (Hearings, 1979, p. 65):

> Small innovative firms have historically played an important role in bringing new technologies into the marketplace. They are also an important source of new jobs. Although many of the initiatives in this Message will encourage such companies, I will also implement several initiatives focused particularly on small firms.

President Carter's Domestic Policy Review provided the foundation for the creation of the Small Business Innovation Research (SBIR) program through the passage of the Small Business Innovation Development Act of 1982 (Public Law 97-219).

With this small firm context in mind, the remainder of this monograph focuses on small firms that are publicly funded through the SBIR program. Motivating my focus on the SBIR program is the fact that the SBIR program is the largest (in terms of public sector financial

[7] Productivity is generally measured by a Total Factor Productivity (TFP) index. The Bureau of Labor Statistics (BLS) defines TFP as: "The efficiency at which combined inputs are used to produce output of goods and services." See https://www.bls.gov/productivity/glossary.htm. I am using a limited number of years in Figures 1.1 and 1.2 for visual emphasis on the productivity slowdown years.

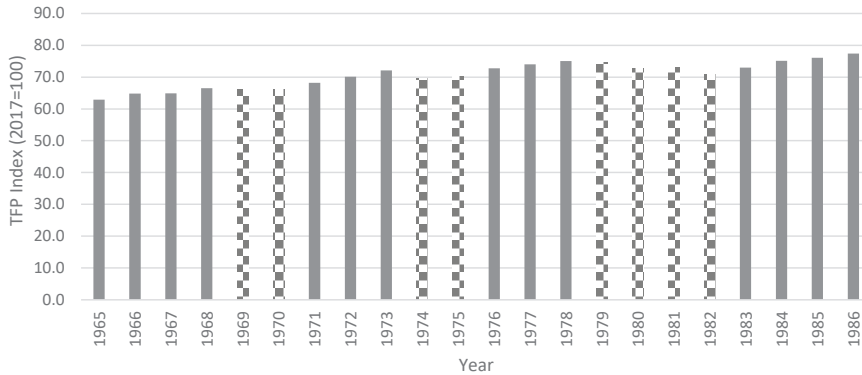

Figure 1.1: Total Factor Productivity index, Private Business Sector, 1965–1986.

Source: https://www.bls.gov/productivity/ (see historical tables).
Notes: The data in Figure 1.1 and in the following Figure 1.2 represent the Private Business Sector. The Bureau of Labor Statistics (BLS) definition of the Private Business Sector is: "The sector that includes privately-owned (non-government) establishments that are operated for profit. Equals the business sector minus government enterprises." See https://www.bls.gov/productivity/glossary.htm.

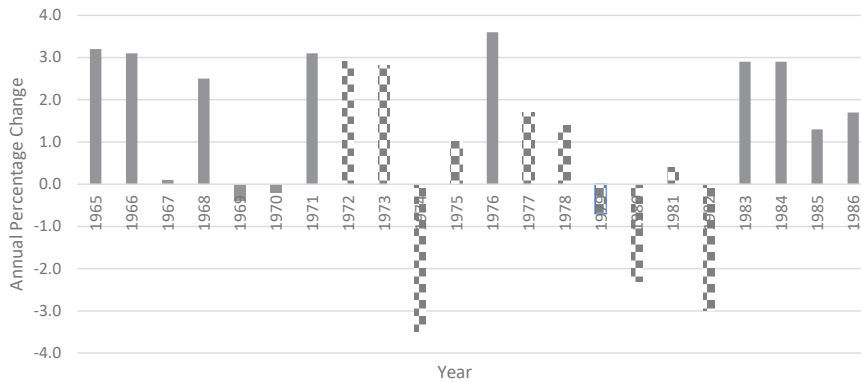

Figure 1.2: Annual percentage change in the Total Factor Productivity index, Private Business Sector, 1965–1986.

Source: https://www.bls.gov/productivity/ (see historical tables).

support) U.S. publicly funded program legislated specifically to support small firm research.

While there is a rich literature related to small firms and various dimensions of their research and innovation-related activity (e.g., Link,

1980; Acs and Audretsch, 1988, 1990; Khan and Manopichetwattana, 1989; Arvanitis, 1997; Mairesse and Mohnen, 2004; Freel, 2005; Audretsch and Belitski, 2020; Saunila, 2020), the primary purpose of this monograph is not to review that literature but rather to focus on and describe dimensions of research and innovative behavior in a unique sample of small firms publicly funded through the SBIR program and to discuss the policy implications from the descriptive findings. This focus relates to the small firm institutional emphasis from above, and it adds an empirical perspective to the larger and the smaller firms that are supported by the SBIR program.

The remainder of this monograph is organized as follows. Section 2 briefly overviews the history of the National Institutes of Health (NIH) and its oldest Institute, the National Cancer Institute (NCI). My focus on the NIH, the nation's medical research agency, is motivated by its broad socially focused mission: "NIH's mission is to seek fundamental knowledge about the nature and behavior of living systems and the application of that knowledge to enhance health, lengthen life, and reduce illness and disability."[8] And my specific focus on the NCI is justified in terms of that Institute being the oldest and largest Institute of the 21 NIH Institutes.

Section 3 describes the NCI's SBIR program.

Section 4 offers a roadmap for the study of small firm research funded through the NCI's SBIR program.

Section 5 describes the data used to explore dimensions of small firm SBIR funded research. These data were collected by the National Research Council (NRC) within the National Academies of Sciences, Engineering, and Medicine. The dimensions of small firm SBIR funded research that I consider in the following sections of the monograph are varied. The scope of dimensions considered is delimited by the information available on SBIR funded research projects. In all cases, my descriptive data presentations are intended to describe what is rather than to proffer what should have been.

The findings from the empirical analysis of the data described in Section 5 that are related to the commercialization of NCI-funded new

[8] See https://www.nih.gov/about-nih/what-we-do/mission-goals.

technologies are presented in Section 6. A stated purpose of the SBIR program is: "to increase private sector commercialization of innovations derived from Federal research and development."

The findings from the empirical analysis of the data described in Section 5 that are related to the outflow of technical knowledge through technology transfer metrics from NCI-funded new technologies are described in Section 7.

Technology relationships are the focus of Section 8. My emphasis on these relationships is not only an extension of the outflow of technical knowledge emphasis from Section 7, but also my emphasis illustrates to some extent the use of external technical knowledge from other firms and organizations as well as the sharing of internal technical knowledge with other firms and organizations.

In Section 9, I explore dimensions of funded firms that responded on the NRC survey that they would have pursued their Phase II project in the absence of SBIR funding, and I compare those counterfactual responses to firms that would not have so proceeded.

In Section 10, I consider the social impact of the NCI as quantified through the producer surplus and consumer surplus generated from the sale of NCI funded research projects.

Section 11 concludes the monograph with a discussion of the findings from the analyses related to the NCI's support of small firm research, and it offers a clarion call for future studies that address this topic from the perspective of other NIH Institutes and Centers, in particular, and from the perspective of U.S. research agencies, in general.

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