

Panel Study of Entrepreneurial Dynamics Program Rationale and Description

Paul D. Reynolds and Richard T. Curtin
October 2007

This research effort has and will continue to provide two major contributions.

The first is a significant resource for advancing scholarly understanding of the firm creation process, as reflected by the attention to the initial data set, the growth in similar projects in other countries, and the unique information on firms that is not available in other data sets. The PSED research paradigm covers all types of firm creation drawn from a representative sample of nascent enterprises, and includes a wide range of independent variables that tracks the initiatives from inception into the early years of an operational new firm. It complements, but does not replace, other research paradigms for the study of new firm creation. The absence of such a data set has been a major impediment to the development of a full understanding of the firm creation process.

The second, and closely related contribution, is information on the extent to which firm creation is a major activity in the United States, the nature and extent of the resources brought to bear on this activity and the proportion of efforts that succeed in launching a new firm. Because the PSED II cohort represents all business start-up activity in the US, inferences about the entire population of 12 million nascent entrepreneurs that are creating 7 million nascent enterprises are justified. This information has considerable relevance for public policies related to the maintenance of a vigorous entrepreneurial sector in the U.S.

The following will summarize evidence on the importance of firm creation to the economy, the different conceptions of entrepreneurship within different research paradigms, the available sources of data on business dynamics including the initial studies in this research program [PSED I] and the unique design of PSED II.

Why care about firm creation?

Why is firm creation important? The most significant reason is that new firms replenish and maintain the population of operating firms. There is considerable evidence that firm creation is associated with a number of other important contributions to the economy. First, it is clear that the emergence of new sectors or markets—from automobiles, to computers, to consumer services—has been associated with an initial period of multiple founding of new firms competing to provide the new product or service. Over time there is consolidation as some firms begin to dominate the markets, but the establishment of new sectors is due to new firm creation (Hannan and Freeman, 1989; Carroll and Hannan, 2000; Klepper, 2002.)

Second, initial assessments focused on net job gains by size (Armington and Odle, 1982; Birch, 1981; Schreyer, 1966) which led to substantial controversy of the level of small versus large firm impact (Davis, Haltiwanger, and Schuh, 1996). The most recent evidence, however, indicates that new independent firms are the source of half of all net new job creation; the other half is accounted for by new branches and subsidiaries, reflecting expansion of existing firms. In fact, the net job creation for all firms, branches, and establishments more than a year old is negative. After one year of age, losses from contractions and quits are greater than the job gains from expansions (Acs and Armington, 2004).

Third, recent advances in consolidated longitudinal data sets on US firms have made it possible to estimate the labor productivity of new, existing, and discontinuing businesses. It turns out that new firms have the highest labor productivity and are responsible for a major share of increases in sector productivity. While this varies by sector—almost 100% of the productivity gains are in retail, perhaps 30% are in manufacturing—new firms are clearly critical to the production of more goods with less labor input (Foster, Haltiwanger, and Krizan, 2002; Foster, Haltiwanger, and Syverson, 2005). More efficient new firms displace less efficient existing firms.

Fourth, new and small firms are clearly a major source of technical and market innovations. One of the more careful efforts to track the source of technical innovation by firm size found that half of new innovations were produced by small firms (Audretsch, 1995).

Fifth, there have been a number of efforts to consider the relationship between measures of new firm creation and the economic growth of markets, geographic regions, or countries. Modest positive associations are almost always found between the level of new entries or firm births in markets, regions or countries and economic growth in subsequent periods. While the causal mechanisms have yet to be clarified, the association is a robust finding (Acs and Armington, 2006; Audretsch, Keilbach, & Lehmann, 2006; van Stel and Thurik, 2004).

Entrepreneurship represents more than the pursuit of economic benefits, as the participation in new firm creation is far more popular than is generally realized. The capacity to create a business is an important career goal for a substantial number of those in the work force. Estimates from the PSED samples suggest that in 2006 about 12.6 million U.S. nascent entrepreneurs were involved in about 7.4 million nascent enterprises (Reynolds and Curtin, 2007). By the time they reach retirement, almost half of all men in the work force will have a period of self-employment (Reynolds and White, 1995, pg 5).

Finally, but not least, new firm creation is a major mechanism used by immigrants to integrate themselves into the economy (Aldrich and Waldinger, 1990; Light and Bonacich, 1988; Portes and Rumbaut, 2006), and, for many, a major route for status enhancement. It seems particularly popular for well educated, high energy individuals that may see promotions in established work organizations as problematic, such as minorities and women (Reynolds, et al 2004).

Conceptions of Entrepreneurship

Few concepts reflect more scope and ambiguity than “entrepreneurship.” The origin of the French word “entrepreneur” was the development of a phrase to describe an individual (Say, 1816) “who unites all means of production and who finds in the value of the products ... the reestablishment of the entire capital he employs, and the value of the wages, the interest, and rent which he pays, as well as profits belonging to himself.” In other words, the person or team that puts together the deal is “entrepreneurial.” [Early translators did not know whether to use the term “undertaker” or “adventurer” to refer to such individuals.] This concept reflects the idea of opportunity recognition and success as coordinator and administrator but does not necessarily imply creating something new or innovative. It does imply that the entrepreneur may bear some risk or uncertainty (Cantillon, 1730, Knight, 1921).

The idea that creating these new production activities leads to shifts in the goods and services available in the marketplace, as a positive contribution to adaptation and change, was conveyed by the idea of “creative destruction” (Schumpeter, 1934). It was suggested that the creation of new productive activities leads to the destruction of existing firms, displacing them by providing new goods and services or by using new productive mechanisms to provide established commodities more efficiently. Some now consider “innovative entrepreneurship” as the only form worthy of serious attention (Baumol, Litan, and Schramm, 2007). The challenge of identifying the level of “innovation” or the amount of impact on markets has not been resolved—conceptually or operationally.

The focus on creating markets for new goods or services has led to discussions of how such new markets are identified, frequently referred to as “opportunity recognition” (Penrose, 1959; Kirzner, 1979). It has been suggested that opportunity recognition should be the central feature of entrepreneurial research (Shane and Venkataranam, 2001). Opportunities, however, are difficult to define until they are recognized through exploitation. It is even harder to classify the quality of an opportunity in the absence of an organized effort to take advantage of them. It is possible to assume that a new venture that grows quickly is exploiting a “major opportunity,” leading to a tendency to reserve the label “entrepreneurial” for only those new productive activities that rapidly expand. A focus on recognizing and exploiting opportunities allows the concept of entrepreneurship to be applied to any active participant in any market, such managers in commercial firms, now referred to as “intrapreneurs,” or even administrators or officials in government organizations or not-for-profits, often referred to as “social entrepreneurs.”

Perhaps because those focusing on organizing inputs to create a new good or service may seem very focused and busy compared to normal wage and salary employees, the idea that entrepreneurs would have unique dispositions or personalities has received substantial attention. Perhaps most widely known have been the propositions that they have a need for achievement (McClelland, 1961) or a preference for risk (Knight, 1921). Despite the substantial research effort to characterize an “entrepreneurial personality,” little in the way of stable empirical relationships (stylized facts or empirical generalizations) have resulted (Gartner, 1988). The situational demands of creating new productive

organizations may cause individuals to be focused and busy—perhaps compulsively for a time. However, not all focused and busy individuals will create new organizations.

Individuals generally pursue major life events—marriage, occupational choice—as part of a social network or group. Engaging in the creation of a new firm is generally done in a network of social relationships (Aldrich, 2005; Reynolds, 1991, Thornton, 1999); in that sense entrepreneurship can be considered a social phenomenon, rather than solely one of individual career choice.

Operational Measures of Entrepreneurship and Research Programs

Recognition of the important role that entrepreneurship may have in modern society and economic activity, a number of research traditions or paradigms have emerged to explore different aspects of the firm creation process. These have included reports of self-employment as a proxy for entrepreneurship, studies of new market entrants, analysis based on new listings in registries of business organizations, a focus on the emergence of new industries or types of organizations (organizational population ecology), retrospective histories, and a wide range of samples of convenience. Following a review of these paradigms, the major gap left from these approaches will be summarized; a gap well filled by the PSED research program.

Self-employment: The proportion of self-employed, those that chose to work on their own account rather than for some other person or an established work organization, has varied from 18% of the work force in 1948 (Bregger, 1996) to 12% in 2006 (Statistical Abstracts of the US, 2007, Table 590). One-third of these 16 million self-employed individuals reported they were incorporated. They are clearly a legitimate topic for serious study, and a substantial amount of research has been completed on the self-employed, both in the US and in other countries (Le, 1999; Blanchflower, 2000).

Considerable effort has been extended in the development of national representative samples of the labor force to provide reliable measures of labor force status. In the 2000 US Census (www.census.gov/dmd/www/pdf/d02p.pdr) this was determined for each person in the household by asking if the person was an employee in one of five types of organizations (private for-profit, private not-for-profit, local, state or federal government), working without pay, or self-employed in own business, professional practice, or farm (incorporated or not incorporated). In the monthly current population survey, self-employed are those that meet a very narrow definition (U.S. Department of Commerce, 2002, pg. 5-4): "... those who work for profit or fees in their own business, professions, trades, or farms. Only the unincorporated self-employed are include in the self-employed category since those whose businesses are incorporated are technically are wage and salary workers because they are paid employees of a corporation". Those who manage a business they own will be classified as "salaried administrators" working for their own business. It is not clear how two or more persons that have formed a legal partnership would be treated in this classification scheme. Further, "... individuals who are self-employed unincorporated on both of their jobs are not considered multiple jobholders". So a person that has developed two independent economic activities, such as translating German into English and giving private musical lessons, would not be considered a multiple job holder.

The National Longitudinal Surveys are designed to track "transitions to work" as well as "transitions out of work" (www.bls.gov/nls/nslview.htm). The major focus is on employment experiences, not the creation of new businesses. Self-employment has been inferred by identifying reports of self-employment income or efforts to form a corporation (Evans and Leighton, 1989, pg. 521). As a basis for studying self-employment, many of these procedures and definitions seem appropriate. But these operational definitions are widely used as proxies for entrepreneurial behavior. Indeed, the two terms "self-employment" and "entrepreneurship" are often used interchangeably (Fairlie, 2005), as in analysis of "entrepreneurship" among African Americans (Smith, 2005), the role of financial and human capital in the "entrepreneurial" process (Dunn and Holtz-Eakin, 2000), and the extent to which "entrepreneurship" is a financially profitable alternative to wage work (Hamilton, 2000).

Perhaps most distinctive is the effort to use changes in the month-to-month reports of efforts to create a business from the Current Population Surveys. Those respondents that reported a major change from no focus on self-employment to more than 15 hours a week between two monthly surveys were considered entrepreneurs, but for only that month (Fairlie, 2006). Only data on efforts to create a "new business" is available, no information is available on the success at creating a new firm, the scope of

activities (number of employees or sales volume) or even the nature of goods or services to be provided (Reynolds, 2007b, pg 22).

While these procedures and data sets may be useful for the study of self-employment, there are several major problems in using self-employment as a proxy for entrepreneurship. Perhaps most important is that the majority of activity devoted to new firm creation is never captured by these procedures because it is secondary to the primary labor force activity. About 80% of nascent entrepreneurs have a full-time or part-time job or are managing another business while they work on developing a new business (Reynolds, et al, 2004). They will never be identified with a procedure that focuses solely on current labor force activity. Second, as discussed below, the median time to reach a resolution of the start-up process is about two years. Behavior identified in a single month does not provide a good representation of the extent of efforts to create new firms.

Most importantly, assessments about entrepreneurship based on measures of self-employment can encourage conclusions that are, at best, misleading. For example, over half of all business start-ups are team efforts, while self-employment implies that only solo ventures qualify as entrepreneurial. Some conclusions are dramatically at odds with much direct experience with entrepreneurs, such as (Evans and Leighton, 1989, pg. 532): "The disadvantage theory which views entrepreneurs as misfits cast off from wage work is consistent with many of our findings." Almost all the data that has been collected on those creating new firms would suggest they are skilled, motivated and adaptive members of the work force, not losers that cannot hold a job.

Market Entry: A substantial research program has developed around the study of market entry and exit (Orr, 1974; Geroski, 1995). In this research protocol, a market is generally defined in terms of an economic sector classification and the number of producers, or sellers, are identified. Data on a number of different periods can be assembled and new entries into as well as exits from the sector in each period can be identified. Entry and exit rates use the total number of producers as the base. The major characteristics of the distinctive market—such as financial costs to create a new producer, presence of competitive advantages due to customer loyalty, or intellectual property rights—can be considered factors affecting the rate of entry or exit. A considerable amount of research has used this paradigm, most emphasizing comparisons among different sectors in manufacturing, leading to a range of "stylized facts" or empirical regularities in the major findings. Such that entry into markets is common but capturing a significant part of the market is not, that entry and exit rates are highly positively correlated, and that higher rates of entry seem to lead to greater sector efficiency.

Such research provides a great deal of information about the level and effects of turbulence and change on markets, but there are some issues associated with identifying the nature of the new entrants. They may represent independent and autonomous new firms (de novo entrants), a new venture developed as a branch or subsidiary of an existing business, or the expansion of a product line to enter a new market without the creation of any new productive venture. While it is possible to distinguish among these different forms of entry in some research, in others it is not.

While this is a useful paradigm for the study of markets and the survival of the participants and the conditions that may facilitate higher rates of entry (such as lower barriers), it provides very little information about the start-up process itself—those events that precede entry into the market—or the nature of the founding team that has created the new entrant.

Comprehensive Firm Registries: There are two federally sponsored efforts to maintain a complete census of employee establishments (each unique location where productive activity takes place with employees) or employee firms (one or more establishments coordinated as a single business activity). The first reflects state unemployment insurance filings and is organized at the national level by the US Bureau of Labor Statistics (Speltzer et al, 2004). The other reflects a combination of social security payments coordinated with tax returns received by the Internal Revenue Service administered by the U.S. Census (U.S. Small Business Administration, 2004). A third nationally comprehensive business census is represented in a commercial credit rating program, organized as the Dun's Market Identifier file [DMI] by Dun and Bradstreet. In this case the focus is on business activity, regardless of whether or not the establishment has employees. In all three cases, coverage of well established firms is almost universal, which provides confidence that new entries into the data sets, with some exceptions, can be assumed to reflect the creation of a new business.

The first major use of such data sets involved reorganization of the DMI file such that multi-establishment firms could be identified and separated from single-establishment firms; this allowed identification of new listings that could be considered autonomous or de novo start-ups from new branches or subsidiaries created by established firms. The major, and unexpected, finding was the discovery that the majority of new jobs were created by the smaller, autonomous firms, not the established multi-unit firms (Birch, 1979). It was later discovered that small versus large was a misspecification, it was the new entries into the data files, either de novo start-ups or branches and subsidiaries, that were the major source of new jobs (Acs and Armington, 2004).

As the geographic location of these establishments is usually part of these data sets, they can be used for analyses that compare the level of new firm creation in different regions, usually measured as prevalence rates using existing businesses (number per 100 existing firms) or the human population (number per 1,000 employed persons) as the dependent variable. In turn, the characteristics of regions with high or low levels of new firm creation have been explored, with substantial regularity in the findings. Two large scale studies have been completed in the US, one emphasizing new firm birth rates from 1976-1988 (Reynolds, Maki, and Miller, 1995) and for the year 1996 (Armington and Acs, 2002). In addition, a harmonized set of cross national comparisons involved the US, UK, Sweden, Germany, Italy, France, and Northern Ireland (Reynolds, Story, and Westhead, 1994). The linear regression analysis from these studies have accounted for 60% or more of the explained variance and generally found the same set of regional characteristics useful in predicting new firm births (higher levels of in-migration and personal income; greater presence of early career adults 25-40 years old; higher proportions of small businesses; higher levels of educational attainment in the population, greater levels of economic diversity); a number of other factors seem to have limited or no independent impact, such as the cost structure, population density, or, in the U.S., the unemployment rate.

Organizational Population Ecology, Industry Studies: A major effort among organizational scholars in sociology has emphasized the longitudinal patterns of organizational populations, groups of similar organizations—leading to the label of “organizational population ecology” (Hannan and Freeman, 1977; Klepper, 2002). The research strategy has been to use historical records to trace the emergence and operation of all organizations in a country with a similar focus or purpose—such as newspapers, mortuaries, telephone companies, semiconductor firms, automobile manufacturers, commercial banks, breweries, labor unions, and on and on (Carroll and Hannan, 2000). The primary research objective has been to describe and then explain the character of the population, firm birth and death rates, number of operational firms, etc. The conditions under which the population emerges and the competition among firms in the population are proposed as the primary factors affecting the size of the firm population. Despite some success at developing formal models that describe the temporal changes in the population of organizations, and the survival patterns following entry into a historical record, there is limited data on the start-up efforts prior to their occurrence in the historical record. The “firm birth” is treated as a spontaneous event.

Retrospective Firm, Industries Histories: Accounts of the histories of successful firms are in the hundreds. Recent exemplars would include Federal Express (Trimble, 1993), Microsoft (Ichbiah and Knepper, 1991), and WalMart (Vance and Scott, 1994). Some may even focus on an entire sector, such as the development of oil production (Knowles, 1959). While these may provide useful information about production and marketing strategies utilized by the surviving firms and rich details of the careers and lives of the founders, they seldom provide information about the early entrants that do not survive and a considerable bias may develop in the efforts to reconstruct the early years of the firm, when survival was problematic.

Samples of Convenience: There is a great deal of material on “entrepreneurs” based on samples of convenience. Samples that are easy to access but for which the population represented by the sample is either unknown or very distinctive, such as alumni of MBA programs (Lazear, 2005). Studies of firms applying for venture capital support are often based on material taken from the applicant pool of venture capital firms; there are a large number of such studies (Kaplan, Sensoy, and Stromberg, 2005). The total number of venture capital deals is less than 3,000 a year (NVCA, 2007), and only several hundred involve new firms. Given that over half a million new firms with employees are created every year (U.S. Small Business Administration, 2004), these few start-ups are a very distinctive category.

One solution is to focus on all new incorporations in an industry where the funding requirements are so high that all new entrants are incorporated and the total number is not large, such as the development of the semiconductor industry (Eisenhardt and Schoonhoven, 1990; Schoonhoven and Eisenhardt, 1990). While no sampling may be required within the industry sector, the chosen sector may not be representative of all sectors.

There are a number of assessments of firms on the INC 500 list of high growth new firms (Bhide, 2000) which can provide some interesting descriptions, but both the regional bias in such lists and the active effort of some candidates to avoid being listed substantially reduces confidence in the representativeness of such samples. In other studies, usually emphasizing technologically based start-ups, the files of a university technology transfer office may be used to develop a sample (Roberts, 1991). In some cases new incorporations located in state registries may be utilized as a registry of new firms, which may provide complete coverage for some sectors, but in many sectors legal incorporation is rare at the beginning of the start-up stage and may not be widespread. The same issues occur if new applications for “fictitious names” are the basis for a sample of new firms. There are some earlier efforts based on new listings in the phone book yellow pages (Shapero and Giglierano, 1982). Other studies have utilized participation in “business start-up” seminars or attendance in college courses on entrepreneurship to develop samples of “entrepreneurs.”

In almost all these instances, analysis of the sample may help test relationships among variables associated with a conceptual framework or theory, but application beyond the sample or the extent to which the sample represents a known population is problematic.

Potential for Understanding Firm Creation: The ideal data set for the study of business creation would provide complete coverage of all types of business creation, provide details on the entire process from conception through firm birth to growth trajectories, be a representative sample (or a complete census), and provide a broad range of factors or variables reflecting all processes considered to have an impact. Perhaps most important, it should include initiatives that do and do not complete the start-up process to allow assessment of the unique features of those start-ups that become new firms (Davidsson, 2006). While each of these existing research traditions has the capacity to provide a contribution to understanding the business creation process, in every case these studies provide data on only a narrow part of the phenomena. None provide systematic accounts of the earliest stage of the firm creation process, before the initiative is operational and is added to any type of business registry.

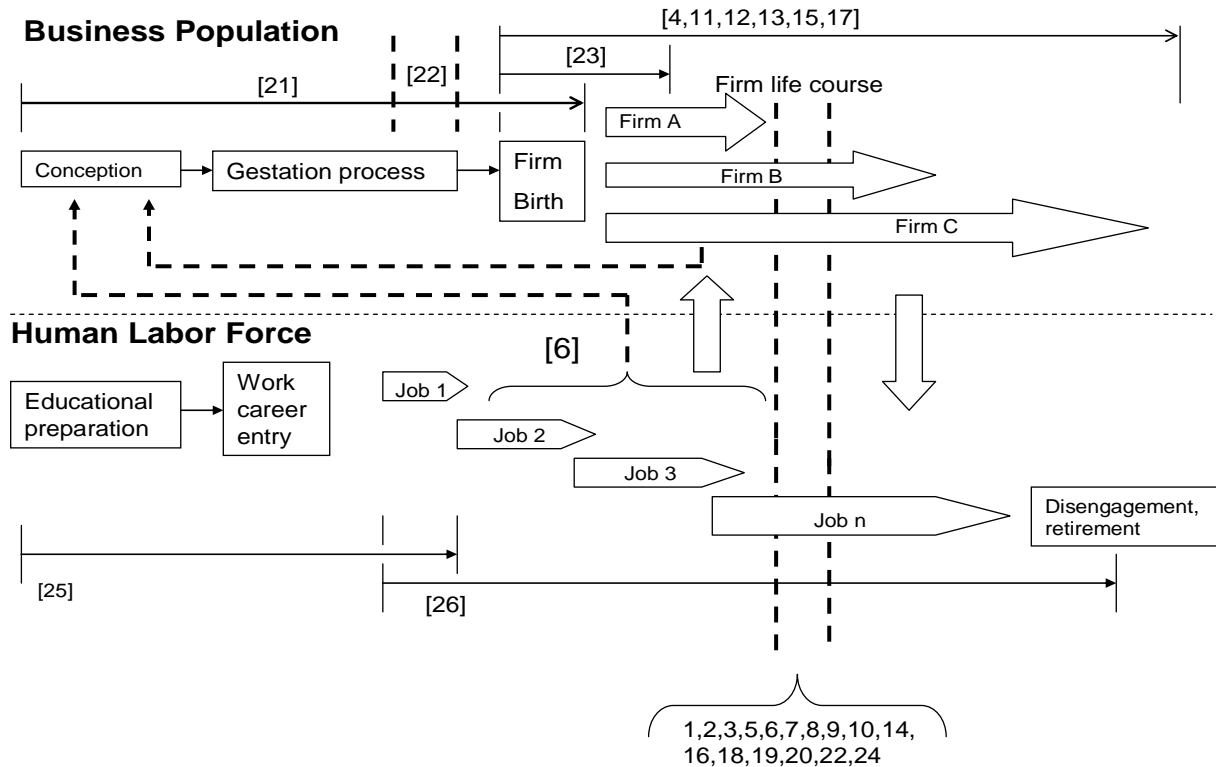
Perhaps equally important, most either provide rich details on a small number of interesting success stories or are associated with a limited number of variables on large samples or, in the case of business registries, the entire population. When variables are associated with different data sets—such as the self-employed from household surveys and firm characteristics from business registries—it is not possible to directly assess the relative impact of different factors. Conclusions regarding the relative importance of different processes must rely on informed speculation. This is not a satisfactory solution to an important issue.

Descriptions and information based on a representative sample of those in the early stages of the business start-up process require a different strategy for approaching this phenomenon. The research protocol developed for the Panel Study of Entrepreneurial Dynamics provides this type of information on a representative sample. The benefits of this procedure are the capture of all types of new firm creation, substantial details on start-up process, a representative sample, wide range of independent variables, and tracking the initiatives from conception into the early years of an operational new firm, when they are incorporated into business registries. The PSED research protocol provides unique data about firm start-ups; it is a valuable complement to the other major research paradigms to facilitate a comprehensive understanding of the entrepreneurial process.

Understanding Business Dynamics: Available Data Sets

What resources for systematic understanding of the firm creation process might be available? It is of some interest to consider the availability of data that would lead to understanding of the critical factors affecting the emergence of successful new enterprises. Such an assessment was recently completed by a panel of experts convened to report on this issue within the National Academy of Science (Haltiwanger, Lynch, and Mackie, 2007). A summary of the conceptualization of business dynamics is presented in Figure 1. The presentation is organized around two phenomena, presented horizontally. The top portion

represents the business life course and the bottom the work career of typical individuals. The dotted lines leading to the “conception” box indicate the two major processes associated with becoming involved in the conception of a new business. One process covers individuals shifting into the start-up mode after a work career holding jobs; the other covers individuals initiating new firms as part of the current job requirements, representing a start-up sponsored by an existing firm.



Key to Numbered Data Sets

1	BLS, Business Establishment List	14	Dun & Bradstreet Duns Market Identifier File
2	BLS, Quarterly Census of Employment and Wages	15	NSF [U.S. Census] Longitudinal Research Database
3	BLS, Current Employment Statistics	16	SBA Statistics of US Business
4	BLS, Business Employment Dynamics	17	Business Information Tracking Series [BITS]
5	BLS, American Time Use Survey	18	FRB Survey of Small Business Finances
6	BLS-Census: Current Population Surveys	19	IRS Survey of Income
7	U.S. Census Business Register	20	Standard & Poor's Compustat
8	U.S. Census Company Organization Survey	21	Kauffman Foundation Panel Study of Entrepreneurial Dynamics [U of Michigan]
9	U.S. Census, Economic Census	22	Kauffman Foundation and Others: The Global Entrepreneurship Monitor [GEM]
10	U.S. Census, Survey of Business Owners	23	Kauffman Firm Survey [Mathematica]
11	U.S. Census Longitudinal Business Database	24	Kauffman Financial and Business Databases
12	U.S. Census Integrated Longitudinal Business Database	25	National Longitudinal Survey of Youth [BLS, conducted by Ohio State/NORC]
13	U.S. Census Longitudinal Employer-Household Dynamics	26	Panel Study of Income Dynamics [U Michigan]
BLS = Bureau of Labor Statistics			
IRS = Internal Revenue Service			
NORC = National Opinion Research Center, Affiliated with the U of Chicago			
NSF = National Science Foundation			
SBA = Small Business Administration			
From Table 4.1, page 68, from Haltiwanger, Lynch, and Mackie, 2007.			

Figure 1 Business Dynamics and Available Data Sets

The major purpose of this conceptualization is to assist in identifying existing data sets and their utility for research on different aspects of business and career dynamics. A total of 26 different data sets were identified as relevant to some aspect of firm creation and business dynamics; they are listed at the bottom of Figure 1. Fifteen of the 26 provide for cross sectional information about existing firms at one point in time, but without any capacity for tracking the firms over time [1,2,3,5,6,7,8,9,10,14, 16,18, 9,20,22,24]. Seven provide for longitudinal analyses of existing firms once they are included in an existing firm registry, such as the unemployment insurance files maintained by the Bureau of Labor Statistics, the Longitudinal Business Database maintained by the U.S. Census, or a sample drawn from the Dun and Bradstreet data files [4,11,12,13,15,17,23]. Three data sets track the labor force activities of persons, either as individuals or as members of households, but the focus is on the nature of the jobs that they may hold and the shifts between jobs over the life course. Other than reports of “self-employment,” there is little attention to creating new businesses and the descriptions of the “self-employment” activity is brief and basic [6, 25, 26]. One data set, the Global Entrepreneurship Monitor, provides annual comparisons of national measures of firm creation activities, but does not track nascent enterprises over time [22].

Only one extant research program, the Panel Study of Entrepreneurial Dynamics [21], provides detailed information on a representative national sample involved in the firm creation process. The PSED research program provides data describing the start-up phase of the business dynamic processes. This allows attention to the following wide range of issues:

- Who gets involved in creating a new business?
- How many nascent entrepreneurs/nascent enterprises exist?
- What do nascent entrepreneurs do to create a new firm?
- To what extent are new firms based on advances in technology and science?
- What proportion of nascent enterprises complete the process to become a new firm?
- How long does it take to reach a resolution—a new firm or disengagement, from entry into the start-up process?
- What is unique about nascent enterprises that become a new business, compared to those that do not make the firm birth transition?
- What is the social cost, in terms of sweat equity and personal investments, associated with the firm creation process?
- What is unique about those new firms expecting to have a substantial growth trajectory after launch?
- How many individuals must implement how many firms to create one firm with substantial growth potential?
- How does the start-up procedure and strategy affect the trajectory of firms once they are launched?

All of these issues have great relevance for efforts to promote new firm creation and improve the efficiency of the process. Without information on these issues, policies designed to increase the level of entrepreneurial activity could be ineffective or counterproductive.

The PSED Research Program

The PSED I cohort was selected in 1998-2000. After the first detailed interview there were three additional follow-ups (Reynolds, 2000; Gartner, et al, 2004). Based on the PSED I paradigm, other longitudinal studies were implemented in Canada (Diochon, Menzies, & Gasse, 2007; Menzies, et al, 2002), the Netherlands (Wolters, 2000), Norway (Alsos and Kolvereid, 1998), and Sweden (Delmar and Davidsson, 2000). The PSED I screening procedure was adopted and modified for a major research program emphasizing cross national comparisons of the prevalence rates of participation in the firm creation process. Between 1998 and 2003, The Global Entrepreneurship Monitor research program has involved locating nascent entrepreneurs in representative samples of the adult population in over 40 countries in 138 national surveys (Reynolds, 2007b, Reynolds, et al, 2005). The PSED II research design was an improved version of the procedures utilized in these projects.

These data sets have been the basis for three types of analyses:

- what types of individuals and teams enter the firm start-up process
- what happens during the start-up process

- what features of the individuals (or teams) and their activity are associated with different outcomes—new firm, disengagement, or continuation of the start-up effort (Davidsson, 2006, provides an excellent overview)

As it takes over five years for the majority of the start-up efforts to achieve a resolution (Reynolds, 2007b), the majority of the analyses have focused on the first two issues, who elects to pursue new firm creation and how do they go about creating a new business.

Why PSED II?

There are several reasons for implementing PSED II. First, the PSED I cohort was identified in 1998-2000 during the height of attention to firm creation during the dot.com frenzy; the PSED II cohort was identified in 2005-2006, a more typical period. Second, a number of methodological improvements, based on the substantial experience with PSED I and the GEM national projects, led to a considerably improved research protocol that is more efficient, provides more reliable measures, and improved measures on critical topics. Third, the differences found in the participation and experiences of different ethnic groups—higher entry into the process by African Americans and less success in developing a new firm—warranted more attention. Finally, the large number of factors affecting the outcomes suggested that a larger sample of nascent enterprises would be of considerable value in multi-variate analysis. The PSED II cohort more than doubles the sample of nascent entrepreneurs, from 830 to 2,044).

PSED II Research Design

The research procedure consists of three phases. The first is identifying a representative sample of those actively involved in the new firm creation process, the nascent entrepreneurs. They are identified from phone interviews completed with adults from a representative sample of households that meet four criteria: 1) they consider themselves as involved in the firm creation process, 2) they have engaged in some start-up activity in the past 12 months, 3) they expect to own all or part of the new firm, and 4) the initiative has not progressed to the point it may be considered an operating business.

For PSED II, 31,845 individuals were screened to locate 1,214 nascent entrepreneurs from October 2005 to January 2006. The average time required for this screening module was 2 minutes. These nascent entrepreneurs represent 12 million individuals between the ages of 18 and 74 years old.

The second phase involved the completion of a 60 minute phone interview that covers a wide range of topics related to the initiation of a new firm. While the screening was completed by a commercial survey firm, the detailed data is collected by the University of Michigan Institute for Social Research. The topics covered are summarized in the “Wave A” column in Table 1 and include information on the nature of the business, start-up activities implemented on behalf of the new firm, incorporation into business registries, the nature of the start-up team and helping networks, sources and amounts of financial support, evaluations of the immediate context, competitive strategy and growth expectations, along with details of the motivations, perspectives, self-descriptions, background, and family context of the responding nascent entrepreneur.

The third phase involved the follow-up phone interviews, also about 60 minutes long. Careful scheduling has allowed the initial contact for the first follow-up to occur 52 weeks following completion of the initial detailed interview, the second follow-up 104 weeks, and so forth. The topics of the interview are listed in the “Wave B” column in Table 1 and vary depending on the status of the initiative at the time of the follow-up. Those nascent entrepreneurs that report they have disengaged from the initiative (quit) receive a few questions about start-up activity and a few items about the reasons for their decision. All others receive most of the same interview schedule provided in the first interview, which provides them with a chance to update their case file with reports of new activity or changes in the start-up team or financial structure. They do not receive most of the modules related to enduring features of the responding nascent entrepreneur (self-descriptions, family background, etc.) covered in the first detailed interview.

Table 1 Overview of Interview Schedule Modules

Topic Modules	Screening	Wave A	Wave B (1,2)	Wave C (1,2)
Screening questions	All			
Assessment of criteria for nascent entrepreneur	All			
Socio-demographic	All			
A.1: Why involved, business opportunity (open ended)		All		
A.2: Confirm same business activity			All	All
A.3: Determine status: new firm, quit, continue			All	All
B: Type of business, location		All	NF,SU	NF,SU
C: Legal form		All	All	All
D: Start-up activities		All	All	All
E.1: Start-up finances, entry into firm registries (3)		All	All	All
E.2: Confirm quit, exit interview			Quits	Quits
F: Orientations toward competition		All	NF	NF
G: Owners, key non-owners, & helpers inventory		All	NF,SU	NF,SU
H: Owner demographics		All	NF,SU	NF,SU
J: Relationships among owners		All	NF,SU	NF,SU
K: Juristic (legal entity) owners		All	NF,SU	NF,SU
M: Key non-owner demographics		All	NF,SU	NF,SU
N: Helper demographics		All	NF,SU	NF,SU
P: Community resources, support for new firms		All	NF	NF
Q: Informal start-up financial support		All	NF,SU	NF,SU
R: Legal entity start-up investments, debts, net worth		All	NF,SU	NF,SU
S: Competitive strategy and target markets		All	NF	NF
T: Growth expectations		All	NF	NF
U.1: Respondent's motivation		All		
U.2: Employment structure (3)			NF	NF
V.1: Expense structure: summary (3)			NF	
V.2: Expense structure: detailed (3)				NF
X: Respondent's career background		All	SU	SU
Y: Respondent's self-descriptions		All		
Z: Respondent & household socio-demographics		All	NF,SU	NF,SU
NOTES: (1) After wave A, modules are provided to All respondents, only those that Quit, or those with a new firm (NF), or still active in the start-up process (SU).				
(2) After initial interview, modules are repeated to capture changes or new information about the activity or details on the current status.				
(3) Based on Kauffman Firm Survey interview schedule (Mathematica Policy Research, 2007).				

In the second follow-up, wave C, those that reported they were managing a new firm in the previous follow-up, wave B, are provided with some additional modules. These cover the nature of the cost structure that can be used to estimate labor productivity. These modules, as well as those related to the organizational structure of the firm, have been designed to facilitate comparison with similar modules in the Kauffman sponsored panel study of new businesses (Haltiwanger, Lynch, and Mackie, 2007, Pg. 138-139; Mathematica Policy Research, 2007).

With input from the 16 members of the advisory committee,¹ all interview schedules were designed, field tested, and implemented. The work completed and scheduled is summarized in Table 2.

¹ Howard Aldrich, U. of North Carolina; Diane Burton, MIT; Nancy Carter, Catalyst, Inc.; Per Davidsson, Queensland U. of Technology, Australia; William Gartner, Clemson U.; John Haltiwanger, U. of Maryland; Benson Honig, Waterloo U., Canada; James Johnson, U. of North Carolina; Philip Kim, U. of Wisconsin;

The initial screening and waves A and B have been completed. Wave C data collection is scheduled for October 2007 through February 2008. Funding is requested to complete three additional waves of data collection, identified as D, E, and F, to be completed 36, 48, and 60 months after the initial detailed interview.

The cohort can be considered as two panels. The original panel is of nascent entrepreneurs involved in the start-up process. This group is interviewed repeatedly until either of two events is reported. If they indicate they quit and are no longer active in the start-up process they are dropped from the panel. If they indicate they have successfully implemented a new firm, they are considered part of a second panel and these new firms are then re-interviewed each year.

The total number of completed interviews for Wave C can be estimated based on a number of assumptions. Most important is success at contacting respondents for additional interviews. This is assumed to occur for 80% in the following year and 50% for those that miss a year. After two years, follow-ups are available for 90% of the cases. The proportion reporting different outcomes is also relevant. In wave B, 12 months after the first detailed interview, 13% of those contacted reported an operational new firm, 24% reported they had disengaged, and 63% were continuing with the start-up effort.

Table 2 Project Data Collection Schedule and Estimated Case Counts

Current study, fully funded	Screening	Wave A	Wave B	Wave C
Proposed extension, funding requested				
Dates: completed or scheduled	Oct 05-Jan 06	Oct 05-Feb 06	Oct 06-Feb 07	Oct 07-Feb 08
Dates: anticipated				
Number of cases				
Initial screening	31,845			
Identified and initial interview		1,214		
Actual completion: start up panel			972	
Expected completion: start-up panel				612
Expected completion: new firm panel				103
Total completed			972	715
Quits dropped from the start-up panel			229	373

Some only consider new ventures that emphasize innovation or high growth to be entrepreneurial (Baumol, Litan, & Schramm, 2007). Based on results from analysis of the Swedish panel study (Samuelson, 2004), nascent entrepreneurs are asked a series of questions that can be used to identify those that expect their efforts to provide market innovation and change, and about 10% would expect to have some influence (Reynolds and Curtin, 2007). Other items are related to expectations for growth in the first five years, about 6% expect to have over \$4 million in sales or provide 50 or more jobs (Reynolds and Curtin, 2007). Those that wish to focus only on these extreme cases—in terms of expected market innovation or growth—have a representative sample for analysis. Comparisons with the remainder of the cohort allow assessment of the unique properties of these market innovation or growth oriented nascent enterprises.

Data obtained on that stage in the process, when the nascent enterprise is incorporated into firm registries (Table 1, Row E.1), facilitates correspondence with firm registries (new EIN number, unemployment insurance, federal social security, federal tax return, and Dun and Bradstreet listings) which will allow extrapolation from these data bases to estimates of the numbers of nascent enterprises in the US.

Charles Matthews, U. of Cincinnati; Michael Meeks, San Francisco State U.; Simon Parker, U. of Durham, UK; Martin Ruef, Princeton U.; Claudia Schoonhoven, U of California, Irvine; Scott Shane, Case Western Reserve U.; Kelly Shaver, College of Charleston; Per Stromberg, U. of Chicago.

Harmonized Projects: Australia and People's Republic of China

A comparable project, the Comprehensive Australian Study of Entrepreneurial Emergence [CAUSEE], has been implemented in Australia, which initiated initial screening for nascent entrepreneurs in late summer 2007 [www.causee.bus.qut.edu.au]. While it has a slightly different focus, as it also includes a sample of new firms in high potential sectors, much of the procedure has been harmonized with PSED I and PSED II. This has been facilitated by the Principal Investigator's experience; Per Davidsson was part of the team implementing a Swedish panel study [Delmar and Davidsson, 2000], serving as an elected member of the PSED I executive committee, and is currently a member of the PSED II advisory committee.

Funding for a panel study in the People's Republic of China was approved in September 2007. The project, involving researchers from the Chinese University of Hong Kong and Nankai University will make extensive use of the experience developed in the US PSED initiatives.

References

- Acs, Zoltan. J. and Catherine Armington. (2004). Employment Growth and Entrepreneurial Activity in Cities. Regional Studies, 38(9):911-927.
- Acs, Zoltan. J. and Catherine Armington. (2006). Entrepreneurship, Geography, and American Economic Growth. Cambridge, UK: Cambridge U. Press.
- Aldrich, Howard E. (2005). Entrepreneurship. Chapter 20 in N.J. Smelser and R. Swedberg (eds). Handbook of Economic Sociology. Princeton: NJ: Princeton U Press, Pp. 451-477.
- Aldrich, Howard E. and R. Waldinger. (1990). Ethnicity and entrepreneurship. Annual Review of Sociology 16:111-135.
- Alsos, G. A. and L. Kolvereid. (1998). The business gestation process of novice, serial and parallel business founders. Entrepreneurship Theory and Practice 22(4):101-114.
- Armington, Catherine and Zoltan Acs. (2002) The Determinants of Region Variation in New Firm Formation. Regional Studies 36(1):33-45.
- Armington, Catherine and Majorie Odle. (1982). Small Business: How many jobs? Brookings Review 20:14-17.
- Asterbro, Thomas and Peter Thompson. (2007). Entrepreneurs: Jacks of all Trades or Hobos? University of Toronto and Florida International University: Working paper.
- Audretsch, David B. (1995). Innovation and Industry Evolution. Cambridge, MA: MIT Press.
- Audretsch, David B., Max C. Keilbach, and Erik E. Lehmann. (2006). Entrepreneurship and Economic Growth. New York: Oxford U. Press.
- Baumol, William J. (1993) Entrepreneurship, Management, and the Structure of Payoffs. Cambridge, MA: MIT Press.
- Baumol, William J., Robert E. Litan, and Carl J. Schramm. (2007). Good Capitalism, Bad Capitalism, and the Economics of Growth and Prosperity. New Haven: Yale U Press.
- Bhide, Amar V. (2000). The Origin and Evolution of New Business. New York: Oxford U. Press.
- Birch, David A. (1979). The Job Generation Process. Cambridge, MA:MIT Program on Neighborhood and Regional Change. Report prepared for the U.S. Department of Commerce, Economic Development Administration.
- Birch, David. (1981). Who Creates Jobs? The Public Interest 6:3-14.
- Blanchflower, David G. (2000) Self-Employment in OECD Countries. Cambridge, MA: NBER Working paper 7486.
- Bregger, John E. (1996). Measuring self-employment in the United States. Monthly Labor Review January/February: 3-9
- Caroll, Glenn R. and Michael T Hannan. (2000) The Demography of Corporations and Industries. Princeton, NJ: Princeton U Press.
- Cantillon, Richard. (1730). Essai sur la Nature du Commerce in General [Essay on the Nature of Trade in General]. Henry Higgs [translator and editor]. London: Frank Cass and Company, Ltd.
- Davidsson, Per. (2004). Researching Entrepreneurship. New York: Springer.
- Davidsson, Per. (2006). Nascent Entrepreneurship: Empirical Studies and Developments. Hanover, MA: now Publishers: Foundations and Trends in Entrepreneurship 2(1):1-76.
- Davidsson, Per, P. D. Reynolds, D. Hechavarria. 2007. Publications and papers based on the Panel Study of Entrepreneurial Dynamics protocol. Bibliographic Listing. 'www.psed.isr.umich.edu'.
- Davis, Steven J., John Haltiwanger, and Scott Schuh. 1996. Job Creation and Destruction. Cambridge, MA: MIT Press.
- Delmar, F., & Davidsson, P. (2000). Where do they come from? Prevalence and characteristics of nascent entrepreneurs. Entrepreneurship & Regional Development, 12, 1-23.
- Diochon, Monica, Teresa V. Menzies, and Yvon Gasse. (2007) "From Becoming to Being: Measuring Firm Creation." Journal of Enterprising Culture 15(1):21-42.
- Dunn, Thomas, and Douglas Holtz-Eakin. (2000). Financial Capital, Human Capital, and the Transition to Self-Employment: Evidence from Intergenerational Links. Journal of Labor Economics 18(2):282-305.
- Eisenhardt, K. M and C. B. Schoonhoven. (1990) Organizational growth: Linking founding team, strategy, environment and growth among U.S. semiconductor ventures: 1978-1988. Administrative Science Quarterly 35:504-529.

- Evans, David S. and Linda S. Leighton (1989). Some Empirical Aspects of Entrepreneurship. American Economic Review 79(3):519-35.
- Fairlie, Robert W. (2005) Self-employment, entrepreneurship, and the NLSY79. Monthly Labor Review. 128(2): 40-47.
- Fairlie, Robert W. (2006). Kauffman Index of Entrepreneurial Activity: National Report 1996-2005. Kansas City, MO: Ewing Marion Kauffman Foundation.
- Foster, Lucia, John Haltiwanger, and C. J. Krizan. (2002) The Link between Aggregate and Micro Productivity growth: Evidence from Retail Trade. (NBER Working Paper Series #9120). Cambridge, MA: National Bureau of Economic Research.
- Foster, Lucia, John Haltiwanger, and Chad Syverson (2005) Reallocation, Firm Turnover, and Efficiency: Selection on Productivity or Profitability? (NBER Working Paper Series #11555). Cambridge, MA: National Bureau of Economic Research.
- Gartner, William B. (1988). "What is an entrepreneur" is the wrong question. American Small Business Journal (Spring): 11-31.
- Gartner, W.B., K.G. Shaver, N. M. Carter, and P. D. Reynolds (Eds). 2004. Handbook of Entrepreneurial Dynamics: The Process of Business Creation. Thousand Oaks, CA: Sage Publications.
- Geroski, Paul. (1995). What do we know about entry? International Journal of Industrial Organization 13:421-440.
- Hamilton, Barton H. (2000) Does Entrepreneurship Pay? An Empirical Analysis of the Returns to Self-Employment. Journal of Political Economy 108(3): 604-631.
- Hannan, Michael T. and John Freeman. (1989) Organizational Ecology. Cambridge: Harvard University Press.
- Hannan, Michael T. and John Freeman. (1977) The Population Ecology of Organizations. The American Journal of Sociology 82:929-964.
- Haltiwanger, John, Lisa M. Lynch, and Christopher Mackie [eds]. (2007). Understanding Business Dynamics: An Integrated Data System for America's Future. Washington, D.C.: National Academies Press.
- Ichbiah, Daniel and Susan L. Knepper. (1991) The Making Microsoft. Rocklin, CA: Prima Publishing.
- Kaplan, S.N., B.A.Sensoy, and P. Stromberg. (2005). What are Firms? Evolution from Birth to Public Companies. (NBER Working Paper Series #11581). Cambridge, MA: National Bureau of Economic Research.
- Kirzner, Israel M. (1979). Perception, opportunity, and profit: studies in the theory of entrepreneurship. Chicago: U Chicago Press.
- Klepper, Steven. (2002) The capabilities of new firms and the evolution of the U.S. automobile industry. Industrial and Corporate Change 11(6):645-666.
- Knight, Frank H. (1921). Risk, Uncertainty, and Profit. New York: A. M. Kelly (1964 reprint).
- Knowles, Ruth S. (1959) Greatest Gamblers: The Epic of American Oil Exploration. Norman, OK: U of Oklahoma Press.
- Lazear, Edward P. (2005). Entrepreneurship. Journal of Labor Economics 23(4): 649-681.
- Le, Anh T. (1999). Empirical Studies of Self-Employment. Journal of Economic Surveys 13 (4): 381-386.
- Light, Ivan and Edna Bonacich. (1988). Immigrant Entrepreneurs: Koreans in Los Angeles, 1965-1982. Berkeley, CA: U of California Press.
- Mathematica Policy Research. (2007). Building and Sustaining Innovative Companies: The Kauffman Firm Survey. 'www.mathematica-mpr.com/surveys/kauffmanfirm.asp'.
- McClelland, David C. (1961). The Achieving Society. NY: Van Norstrand.
- Menzies, T. V., Y. Gasse, M.Dichon, and D. Garand. Nascent entrepreneurs in Canada: An empirical Study. Paper presented at the 47th Meeting of the ICSB World Conference, San Juan, PR, June.
- NVCA, National Venture Capital Association (2007). National Venture Capital Association Yearbook 2007. Arlington, VA: National Venture Capital Association.
- Orr, D. (1974) The determinants of entry: A study of the Canadian Manufacturing Industries. Review of Economics and Statistics 61:58-66.
- Penrose, Edith T. (1959). The Theory of the Growth of the Firm. Oxford, UK: Blackwell.
- Portes, Llejandro and Ruben G. Rumbaut. Immigrant America: A Portrait. Berkeley, CA: U of California Press.
- Reynolds, Paul D. (2007a). Entrepreneurship in the US: The Future is Now. New York: Springer.
- Reynolds, Paul D. (2007b). New Firm Creation in the U.S.: A PSED I Overview. Hanover, MA: now Publishers: Foundations and Trends in Entrepreneurship 3(1):1-149.

- Reynolds, Paul D. (1991) Sociology and entrepreneurship: concept and contributions. *Entrepreneurship Theory and Practice*. 16(2):47-70.
- Reynolds, Paul, Niels Bosma, Erkkö Autio, Steve Hunt, Natalie De Bono, Isabel Servais, Paloma Lopez-Garcia, and Nancy Chin. (2005) Global Entrepreneurship Monitor: Data Collection Design and Implementation: 1998-2003. *Small Business Economics*: 24: 205-231.
- Reynolds, Paul D. and Richard T. Curtin. 2007. Business Creation in the United States: Panel Study of Entrepreneurial Dynamics II First Wave Results. Hanover, MA: now Publishers: Foundations and Trends in Entrepreneurship (in press).
- Reynolds, P.D., Carter, N.M., Gartner, W.B. & Greene, P.G. (2004). The prevalence of nascent entrepreneurs in the United States: Evidence from the Panel Study of Entrepreneurial Dynamics. *Small Business Economics*, 23(4), 263-284.
- Reynolds, Paul D., Wilbur Maki, and Brenda Miller. (1995) Explaining Regional Variation in Business Births and Deaths: U.S. 1976-88. *Small Business Economics* 7:389-407.
- Reynolds, Paul D., David Storey, and Paul Westhead. (1994). Cross-National Comparisons of the Variaton in New Firm Formatin Rates. *Regional Studies* 28(4);443-456.
- Reynolds, Paul D. and Sammis B. White. 1997. The Entrepreneurial Process: Economic Growth, Women, and Minorities. Westport, CT: Greenwood Publishing Group, Inc.
- Roberts, Edward B. (1991) Entrepreneurs in high technology: Lessons from MIT and beyond. New York: Oxford U. Press.
- Samuelsson, M. (2004) Creating New Ventures: A Longitudinal Investigation of the Nascent Venturing Process. Doctoral dissertation. Jönköping, Sweden: Jönköping International Business School.
- Say, Jean-Baptist. (1984). A Treatise on Political Economy. New York: A. M. Kelley (1964 reprint).
- Schoonhoven, C. B. and K. M. Eisenhart. (1990). Speeding products to market: waiting time to first product introduction in new firms. *Administrative Science Quarterly* 35:177-207.
- Schreyer, Paul. (1996) SMEs and Employment Creation: Overview of Selected Quantitative Studies in OECD Member Countries. Paris, France: Organization for Economic Co-operation and Development, STI Working Papers 1996/4.
- Schumpeter, J. A. (1934). The Theory of Economic Development. Cambridge, MA: Harvard U. Press.
- Shane, S. and V.S. Venkataraman. (2001). The promise of entrepreneurship as a field of research. *Academy of Management Review*, 25(1):217-226.
- Shapero, Albert and Joseph Giglierano. (1982) Exits and entries: A study in Yellow Pages journalism. *Frontiers of Entrepreneurial Research: 1982*. Wellesley, MA: Babson College.
- Smith, Danielle Taana. (2005). Developing Self-Employment Among African Americans: The Impact of Household Social Resources on African American Entrepreneurship. *Economic Development Quarterly* 19(4):346-355.
- Speltzer, James R., R. Jason Faberman, Akbar Sadeghi, David M. Talan, and Richard L. Clayton (2004). Business enterprise dynamics: new data on gross job gains and losses. *Monthly Labor Review* (April):29-42.
- Thornton, Patricia H. (1999) The Sociology of Entrepreneurship. *Annual Review of Sociology* 25:19-46.
- Trimble, Vance H. (1993) Overnight success: Federal Express and Frederick Smith, its renegade creator. New York, NY: Crown.
- U.S. Census. (2007) The 2007 Statistical Abstract: The National Data Book. 'http://www.census.gov/compendia/'.
- U.S. Department of Commerce (2002, March). Current Population Survey: Design and Methodology. Technical Paper 63RV. 'www.bls.census.gov/cps/tp/tp63/htm'.
- U.S. Small Business Administration. (2004). The Small Business Economy: A Repot to the President. Washington, D.C.: U.S. Government Printing Office.
- Vance, Sandra S. and Roy V. Scott. (1994) Wall-Mart: A History of Sam Walton's Retail Phenomenon. New York, NY: Twayne.
- Van Stel, A. and R. Thurik. (2004). The effect of entrepreneurship on national economic growth: An analysis using the GEM database. Jena, DE: Max Planck institute for Research into Economic Systems Working Paper 3404.