JENA ECONOMIC RESEARCH PAPERS

2008 – 060

Foundations of High Impact Entrepreneurship

by

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www.jenecon.de

ISSN 1864-7057

The JENA ECONOMIC RESEARCH PAPERS is a joint publication of the Friedrich Schiller University and the Max Planck Institute of Economics, Jena, Germany. For editorial correspondence please contact m.pasche@wiwi.uni-jena.de.

Impressum:

Friedrich Schiller University Jena
Carl-Zeiss-Str. 3
D-07743 Jena
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Kahlaische Str. 10
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Jena Economic Research Papers 2008 - 060

Foundations of High Impact Entrepreneurship

March 2008

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Abstract

This survey reviews the theoretical literature on high impact entrepreneurship. The survey is guided in part by the recent classification changes at the *Journal of Economic Literature* (JEL) regarding entrepreneurship. The board voted to create a new classification code, L26, for entrepreneurship. The JEL intends to use this code for all articles and books that focus on economic questions related to entrepreneurial activity. Publications related to questions on occupational choice issues will be cross classified with J23; those focusing on innovation and entrepreneurship will be cross classified with O31; those focusing on finance will be cross classified with G24 Investment Banking, venture capital, brokerage and rating agencies; those focusing on new firms, start ups; and business related publications on how to be an entrepreneur will be cross classified (or solely classified) with M13. What does this economic literature tell us about entrepreneurship? In order to answer the questions this review covers the intersection of entrepreneurship with labor markets, innovation and capital markets—the three pillars of high impact entrepreneurship.

JEL-classification: L26; O31; J23, G24

Keywords: Entrepreneurship, High Impact Firms, Occupational Choice, Innovation, Finance, Policy, leveraged startups.

Acknowledgement: This project was conceived while I was a scholar in residence at the Kauffman Foundation. I would like to thank Robert E. Litan, Robert J. Strom, William J. Baumol, and Carl J. Schramm for valuable insights on the early stage of this project and Alyse Freilich for valuable assistance with the manuscript. Sameeksha Desai, Lawrence Plummer, Siri Terjesen and Robert Wuebker assembled the literature and offered valuable insights on several drafts of the manuscript. Chapter four has benefited greatly from my long-term collaboration with David B. Audretsch and our recent project on entrepreneurship and growth with Bo Carlson and Pontus Braunerhjelm. The policy chapter draws heavily on the Kaufman Roadmap for Entrepreneurship Policy. The Kauffman Foundation provided generous financial support.

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Table of Contents

Chapter 7. Conclusions

Introduction

Entrepreneurs recognize the latent power and utility of inventions and play a crucial role in bringing those inventions to market. These entrepreneurs—those that Schumpeter described as "the promoters of new combinations"—are individuals who can both see new possibilities and assess market needs (Acs and Audretsch, 2003). *High Impact entrepreneurship* (HIE) is fundamentally the study of the actions of individuals responding to market opportunities by bringing inventions to market that create wealth and growth. These entrepreneurs are distinct from mere creators of new firms, those that replicate thousands of other establishments. According to Leibenstein (1968:72-73, emphasis added):[1]

> "We may distinguish two broad types of entrepreneurial activity: at one pole there is routine entrepreneurship, *which is really a type of management*, and for the rest of the spectrum we have Schumpeterian or "new type" entrepreneurship… By routine entrepreneurship we mean the activities involved in coordinating and carrying on a well established, going concern in which the parts of the production function in use (and likely alternatives to current use) are well known and which operates in well-established and clearly defined markets." By high impact entrepreneurship "…we mean the activities necessary to create or carry on an enterprise where not all the markets are well established or clearly defined and/or in which the relevant parts of the production function are not completely known."

It is certainly the case that replicative entrepreneurs can be of great social significance. However, innovative entrepreneurs—the focus of this essay—ensure the

[1] This review therefore does not cover studies on JEL M13.

utilization of invention, contribute to increased productivity, and both facilitate and contribute to economic growth. Again Leibenstein (1968:79-80):

> The input-completing and gap-filling capacities of the potential entrepreneurial pool determines the response of members of this pool to changes in opportunities and motivational states. An important aspect of the abilities involved is both the perception of economic opportunities and the capacity to assess such opportunities. These are presumably determined in part by factors exogenous to the system such as those involved in nurture, informal training, experience, as well as formal education of individuals.

In recent years, economists have come to recognize the crucial role of entrepreneurs in innovation and growth and the significant contribution of innovation and growth to prosperity and economic welfare (Acs and Armington, 2006; Schramm, 2006; Audretsch, 2007). Innovation and growth—much more than state-guided efforts to ameliorate static "market failures" such as monopoly power—allow economies to lift individuals out of poverty and to provide for growing and aging populations. Leibenstein goes on: (1978:50).

> [only] those individuals who have the necessary skills to perceive entrepreneurial opportunities, to carry out the required input gap filling activities, and to be input-completers can be entrepreneurs.

Indeed, for developed countries high impact entrepreneurship has become the main form of entrepreneurship driving their economies. With this recognition has come a growing interest by the economics profession in the phenomenon of entrepreneurship: the role it plays in the economy, the process of new and innovative business creation, the personal attributes of entrepreneurs, and the public policies that encourage entrepreneurial success.

While this essay will explore and summarize the theoretical literature on high impact entrepreneurship, it is important to note upfront that economics lacks a body of formal theory that corresponds to the other three factors of production – land, labor and capital (Baumol, 1968, 2005).[2] The absence of the entrepreneur from value theory does not mean that the study of entrepreneurship is void of theory. While no formal value theory exists a large body of literature on labor markets, technological change, and capital markets—the three pillars of high impact entrepreneurship—makes our understanding of the economic landscape far from incomplete. Thus, this essay for the first time seeks to survey the theoretical literature on high impact entrepreneurship in order to address these issues and reveal the policies that do the most to encourage high impact entrepreneurship. [3]

This survey proceeds as follows. After defining the concept, the second chapter frames our discussion of entrepreneurship through the exposition of a collection of stylized facts concerning the rate of entrepreneurship, focusing our attention on high impact entrepreneurship. In the third chapter, we examine the question "why do people choose to become entrepreneurs" from the perspective of labor market theories on occupational choice. The fourth chapter examines the role of entrepreneurship and innovation, paying particular attention to the various modes of available entrepreneurial activity. Chapter five examines the financing of entrepreneurial firms: the resources to them and the issues and limitations associated with various financing options. Finally, we

[2] For an up to date discussion of this issue see Bianchi and Henrekson (2005).

[3] For a review of the broader theoretical and historical literature on entrepreneurship see Parker (2004, 2005), Hebert and Link (2007), Acs and Audretsch (2003) and Casson, Young and Wadeson (2006). For a review of the empirical literature on high impact entrepreneurship, see van Praag and Versloot (2007).

close with a discussion of the policies that theory suggests will enhance entrepreneurial activity and where researchers should, therefore, focus their efforts. While the policy section is written with the United States in mind and focuses on ways to improve the functioning of the three pillars of high impact entrepreneurship in the United States, the lessons from this analysis should be applicable to other countries, both developed and developing.

Chapter 1. Definition of High Impact Entrepreneurship

The domain of high impact entrepreneurship (HIE) is parallel to the development of other entrepreneurship literatures - social entrepreneurship, ethnic entrepreneurship, family-owned business, international entrepreneurship, gender and entrepreneurship, self-employment. HIE is a "class" of entrepreneurship. As you might expect there are similarities between types, and important differences. The important differences can be best distinguished by examining the literatures that have floated around HIE but have yet to be integrated as a distinct domain: innovation, occupational choice, human capital, venture capital, endogenous growth, knowledge spillovers, capital markets, entrepreneurial rents, and even the personality bits of traditional entrepreneurship. The goal of HIE is more than growth and change - it is different from other domains primarily because it operates with leverage as its outcome.[4]

We have been poking around like “blind men examining an elephant”, touching upon risk-bearing preferences of entrepreneurs, uncertainty, the magic of technical innovation, and the intermediaries that have emerged to finance these special firms. HIE is innovation driven, operates in a highly uncertain environment and is Schumpeterian in outcome. Integrating these various literatures gives us a clear picture of what HIE is, where it is aligned with other types of entrepreneurship, and where it is not. HIE is a distinct domain of entrepreneurship research. When seen from this perspective one can surmise that many of the confounds in existing entrepreneurship research are the result of conflating different types of entrepreneurs.

From the new venture process springs the new business forms with which we are familiar: a local clothing boutique; a boulangerie; a local fast-food franchise; Google.

[4] I would like to thank Robert Wuebker for the following definition of HIE.

The focus of this paper is the latter form at the earliest stage of its development: a sub-specie of entrepreneurial new venture known as a leveraged startup. Leveraged startups are distinct from other types of businesses that get lumped into discussions about other nascent ventures: potential lifestyle businesses, a service business, a franchise, or anything else related to job replacement or job substitution. A company has to be more than small and newly founded to be a leveraged startup. In this context, a leveraged startup is a firm engaged in the act of innovation: the development and commercialization of disruptive breakthroughs that shift the wealth creation curve at the industry and the individual level. Often, those participating in a new venture fail to understand the distinction, and there are many entrepreneurs who think that they are engaged in a "leveraged startup" when they are not: these companies are lifestyle businesses, franchises, consulting firms, and (eventually) venture capital funded zombie companies (Shane, 2008). The latter, however, is in part facilitated by the fact that, "….some percentage of those individuals that form firms to generate and appropriate economic rents do so because they believed they possessed rare knowledge about a market opportunity. Given this belief, these individuals may have behaved in way perfectly consistent with the theory developed here, only to discover that their knowledge was not valuable or not rare or both (Alvarez and Barney, 2004, 633.)."

Leverage is a key component of any high impact startup, and entails *being a product business and not a service business.* To be a leveraged startup you have to be interested in selling one thing to a lot of people rather than a lot of different or semi-custom products to individual clients. This isn't a strict dichotomy: products and services business range along a continuum. It is a state of mind, an intention implicit in the notion

of being a product business is that startups are growth businesses, not job replacement businesses.

Recent research has done a decent job of unpacking the previously confounded distinction between different types of entrepreneurial ventures. Entrepreneurs do not form leveraged startups as a substitute for a day job! That's because leveraged startups have nothing to do with job replacement. The essence of a leveraged startup is the opportunity to shift the wealth curve, compress time, and get paid a multiple in the future for doing so. As Alvarez and Barney (2004, 633) point out, "…this entire analysis is based on the assumption that economic actors are seeking to generate and appropriate economic rents in their organizing decision, and that they are interested in minimizing the costs of doing so."

Understanding the essential nature of the leveraged startup exchange – *building a growth business and shifting the wealth creation curve* – helps to explain why those engaged in the process of building new ventures and those studying them encourage individuals to start early (Reynolds, 2003). There are some times that are more advantageous than others to be an entrepreneur. How an entrepreneur frames risk is not the issue here. How much attention an entrepreneur can devote to the business, and how aligned their life is for the single-minded pursuit of business success is the crucial success factor.

The leveraged startup by definition is a new organization founded by an entrepreneur who has identified an opportunity and has decided to act on it. In other words, the opportunity is objective and the recognition of the opportunity is subjective consistent with the theories of Schumpeter, Knight and Hayek. This de novo start up rests

on the three foundations of high impact entrepreneurship. First, occupational choice explains how people choose to become entrepreneurs, why human capital matters, what kind of jobs do they leave and what kind of education do they have. Second, technological change explains how leveraged startups impact the economy through innovation by focusing on the knowledge spillover theory of entrepreneurship. In this theory agents in the possession of new knowledge is exogenous to the model and the agent endogenously engages in a leveraged startup. The firm does not exist exogenously as it does in strategy and most theories of the firm—resourced based theory, agency theory or transaction cost economics. Finally, how leveraged startups are financed is the final pillar that is examined. Again, venture capital is most applicable for the startup firm. If the firm is exogenous to the model and endogenously engages in HIE there is no need for the study of leveraged startups. We now turn to the stylized facts.

Chapter 2. Stylized Facts

What data are available for the study of leveraged startups? The succinct answer is: not enough, and the data that is available is fraught with statistical difficulties. A recent, comprehensive study on U.S. government data collection conducted by the National Research Council of the National Academies confirms this shortage of data for the study of entrepreneurship, concluding that current U.S business data are inadequate for the study of productivity, innovation, and firm creation. A central recommendation of the authors of the study was that there is a "need to increase the statistical system's capacity to measure activities of nascent and young businesses—especially those positioned in fast-growing and innovative sectors of the economy—that are central to understanding business dynamics" (NRC, 2007: 4). With this challenge in mind, I present our perspective on the best data available for the study of high impact entrepreneurship.

2.1 Entrepreneurship data over time

If one is interested in leveraged startups that grow and shift the wealth curve, ex post initial public offerings gives us a good rear view mirror (Plummer, Mosakowski and Acs, 2008). Table 1 contains data on initial public offerings (IPOs). The data on IPOs is interesting because it comes closer to what we want to measure in terms of leveraged startups, and the data is not that different from startups in the ICT or the biotechnology sector. However, IPOs exhibit much more variation over the same time periods from a low of 81 in 2000 to a high of 672 in 1995. Going public is influenced by, among other

things, the state of the stock market and the state of the economy.[5] Of course this does not include the many leveraged startups that do not go public or are bought by other firms.

[Insert Table 1 Here]

The U.S. Census Bureau, the U.S. Small Business Administration (SBA), and the U.S. Bureau of Labor Statistics (BLS) each offer longitudinal datasets related to new firm formation (startups) in the U.S.[6] While the advantages and disadvantages of these datasets continue to be debated, each clearly show that entrepreneurship rates do not vary significantly over time (Reynolds, 2007). Table 1 presents detailed information on firm formation from the SBAs Business Information Tracking System (BITS), including the number of firm births and the firm birth rate for the period between 1989 and 2003. The birth rate for employer firms is fairly consistent, and the overall rate fluctuates in the narrow range between 10.8 percent and 12.2 percent over the sample period with no clear statistical trend. Table 1 also examines the firm birth rate by sector for Manufacturing, Information and Communication Technologies (ICT), and Biotechnology. There is a clear decline in the firm birth rate in manufacturing, and a slight upward trend in Biotechnology.

2.2 High Impact Firms

[5] International data suggest that there is wide variation in entrepreneurial activity by country. These comparisons, however, are further complicated by different approaches to data collection, variations in definitions of entrepreneurial firms, and the wide range of reporting systems. Self-employment has historically been one of the most accessible data sources for international comparisons and has been used in a number of studies (Acs, Audretsch, and Evans 1994; Iversen, Jørgensen and Malchow-Møller (2007); Klapper, Laeven, and Rajan (2006).

[6] Other data sources also exist. For an overview of the major federal business data sources see National Research Council (2007) Appendix A. For limitations of the current data system for [measuring business dynamics see National Research Council (2007) Chapter 4, pp. 65-91.

Are we able to statistically separate high impact entrepreneurship from replicative entrepreneurship co-mingled in most census databases?[7] Several studies in the past have attempted to do this. Original attempts defined high impact entrepreneurship based on rates of revenue growth (Birch, 1982). The concept was developed to appeal to marketing executives at large enterprises seeking to sell their products and services to companies with substantial revenue. A crucial limitation of this conceptualization of high impact entrepreneurship is that it doesn't look at employment growth—an important policy consideration for government. Since a non-trivial number of traditional high impact firms, often referred to as gazelles, do not contribute to employment growth this initial conceptualization is insufficient.

Acs, Parsons and Tracy (2007) developed an alternative conceptualization of high impact firms that takes both sales and employment considerations into account. They define a high impact firm as an enterprise in which sales have doubled over the most recent 4-year period and which has an employment growth quantifier of 2 or greater over the same period. The employment growth quantifier (EGQ) is the product of the absolute and percent change in employment over a 4-year period of time, expressed as a decimal, and is used to mitigate the unfavorable impact of measuring employment change solely in either percent or absolute terms, since the former favors small companies and the latter large businesses. Of course while this conceptualization includes firm growth it does not include wealth creation. Acs, et al. (2007) also break the high impact firms out into three

[7] Above we were interested in two kinds of productive entrepreneurs—replicative and innovative. Both contribute to the economy and society in a positive albeit different way. However, entrepreneurs can also engage in unproductive activity that is neither replicative nor innovative. It merely engages in rent seeking activity (Murphy, Shleifer, Vishny, 1991; Acemoglu, Johnson, Robinson 2005 and Desai and Acs, 2007).

size classifications to compare with the U.S. Census Bureau / Small Business Administration classifications. They are 1-19 employees, 20-499 employees, and over 500 employees.

Table 2. **Ratio of High Impact Firms to Non High Impact Firms**
1994-1998 High-Impact Companies = 352,114
1998 All Other Companies = 5,579,117
U.S. High-Impact Company Rate = 6.3%
1998-2002 High-Impact Companies = 299,973
2002 All Other Companies = 5,697,579
U.S. High-Impact Company Rate = 5.2%
2002-2006 High-Impact Companies = 376,605
2006 All Other Companies = 5,787,631
U.S. High-Impact Company Rate = 6.5%

Source: Corporate Research Board, American Corporate Statistical Library (2007).

Table 2 presents summary statistics on the ratio of high impact firms to all other firms for the period 1994-2006. Between 2002-2006 there were 352,114 high impact firms giving us a U.S. HIF rate of 6.3%. Of these 376,605 were between 1-19, 16,523 were between 20-499 and 793 had over 500 employees at the beginning of the period. The high impact rate was 5.2% between 1998-2002 and 6.5% between 1994-1998. The HIF rate varies as much because the absolute number of high impact firms changes over time as it does because the total number of firms changes in the economy. The denominator used in Table 1 represents all employer firms in the U.S. SBA BITS data file. Of course using a different denominator would result in a different rate. For example, using the D&B data in Table 1, that includes the self-employed, would more or less half the high impact rate.

How much have HIFs grown over four years on average? Table 3 presents data on high impact firms for the 2002-2006 time periods for both the distribution of employment by firm size class and the average firm size. As shown in Table 3, for the 1-19 firm size class between 2002-2006 the average employment size in 1998 was 2.7 growing to 14 in 2006. For the 2002-2006-time period the average employment size increased from 61 to 182 with similar results for the other two time periods. For the over 500 firm size class average employment increased from 3,233 to 6,975.

The distribution of employment size between high impact and non-high impact firms is also interesting. While for the non high impact firms almost 70 percent remain in the 1-4 firm size class while for the high impact firms only 30 percent remain in the 0-4 firm size category. This result is robust throughout the whole time period. The results are even more startling for the 20-499 firm size class: for the non high-impact firms, employment size decreased slightly from 58 to 56.

Table 3.
Number of High Impact Firms, by Employment Size for Period 2002-2006

Average number of emmployees	1-19		20-499		500+	
	Start of Period	End of Period	Start of Period	End of Period	Start of Period	End of Period
0-4	87.21	25.55				
5-9	8.22	34.38				
10-24	4.56	27.66	22.24			
25-49		8.62	41.60	20.76		
50-99		2.99	20.52	36.76		
100-249		0.62	11.80	27.54		
250-499		0.11	3.85	9.01		
500-999		0.04		3.82	38.59	12.74
1000-2499		0.02		1.62	32.41	32.03
2500-4999		0.01		0.24	14.88	23.96
5000-9999				0.15	7.57	15.64
10000-24999				0.09	5.42	10.21
25000-49999				0.01	0.76	3.40
50000+					0.38	2.02
Average Size	2.70	14.00	61.70	182.90	3,233.80	6,975.10

Source: Corporate Research Board, American Corporate Statistical Library (2007).

As shown in Table 4 the average firm size for the non-high impact firms did not change materially. In effect, the employment change was virtually unchanged over the four-year period. While in 2002-2006 the non high impact firms in the 0-19 and the 20-499 firm size class exhibit either no change in average employment size or a slight increase, the average employment size for the over 500 firm size class exhibits a persistent and steady decrease in average firm size class by 62 percent.

Table 4.
Number of Non High Impact Firms, by Employment Size for Period 2002-2006

Average number of employeees	1-19		20-499		500+	
	Start of Period	End of Period	Start of Period	End of Period	Start of Period	End of Period
0-4	79.06	79.18		3.63		2.97
5-9	13.55	13.42		1.64		1.12
10-24	7.39	7.13	22.91	23.44		1.76
25-49		0.21	42.57	38.89		1.90
50-99		0.04	20.47	19.03		2.16
100-249		0.01	10.83	10.12		3.33
250-499			3.22	2.97		4.70
500-999				0.23	46.98	37.68
1000-2499				0.03	28.17	26.00
2500-4999				0.01	10.41	8.96
5000-9999					6.18	4.68
10000-24999					4.52	2.70
25000-49999					2.03	1.22
50000+					1.71	0.81
Average Size	3.30	3.50	58.02	56.80	5,199.90	3,153.10

Source: Corporate Research Board, American Corporate Statistical Library (2007).

These results also point to a crucial distinction between high impact entrepreneurship and high technology firms. High technology firms only represent about 10 percent of high impact firms. Using a standard definition of high technology based on

SIC codes we can identify 38,780 firms as high tech out of the 376, 605 high impact firms in the above study. High tech firms are also slightly younger with about half under eleven years old. It is clear that high technology firms are too narrow a definition to use when studying high impact entrepreneurship.

Chapter 3. Entrepreneurship and Occupational Choice (J24-L26)

Why do people choose to be entrepreneurs? This question, examined in great detail in the entrepreneurship literature, gives way to a more specific question: why do people choose to be high impact entrepreneurs? Thus we are interested in a subset of the group of entrepreneurs, those that choose to found high impact firms. Given that most people who become productive entrepreneurs are employed at the time of the decision to become entrepreneurs (studies suggest close to 80% of people that start businesses are employed) theories of occupational choice are a useful perspective from which to address our question of interest. In this view, the decision to become an entrepreneur hinges on the opportunities the individual has for salaried work. These opportunities are shaped by the skill of the individual and the economy in which they work, including its incentive structure.

3.1 Occupational Choice

Evans and Leighton (1989) approach the entrepreneurship-as-occupational-choice question using data on self-employment from the National Longitudinal Survey (NLS). In their analysis, they use a simple time-homogeneous Markov model for first approximations, where e denotes the probability of entering self-employment, and x is the probability of exiting self-employment. The model assumes that e and x are independent of time or age and that the probability of being self-employed at time T years after entering the labor force is

$$e/x + e\{1-(1-x-e)^T\}. \qquad (3)$$

In this straightforward model the probability of entering self-employment increases as the utility of entrepreneurship exceeds wage work. The difference between these two depends on the earnings in the two occupations and the preferences of the agents. Expected wage earnings depend on current wage earnings, education, job tenure, and wage experience. Expected entrepreneurial earnings, however, depend only on education and experience. Evans and Leighton explain that (525), "…the probability of switching into self-employment will decline with current wage earnings but may increase or decrease with education and experience depending upon whether these characteristics are more important in self-employment or wage work."

The findings of Evans and Leighton (1989) offer some insight into the general characteristics of entrepreneurs. Using data on self-employment from the National Longitudinal Survey (NLS), the authors consider the probability of entering or exiting self-employment based on various characteristics. They find, for example, that the probability of switching into self-employment is independent of age and total labor market experience and that the fraction of the labor force that is self-employed increases with age up to the 40s and is constant up to retirement. They also find that men with greater assets are more likely to switch to self employment and that poorer wage workers are more likely to enter self-employment at some point in time. Finally, men with a greater internal locus of control are more likely to start a business.

Many of the findings of this study are consistent with a theory of disadvantaged entrepreneurship, suggesting that those that start their own businesses represent those who cannot or will not perform general wage work. These findings do not support the

idea that U.S. entrepreneurs are the best and brightest in a society. Of course, when looking at a large sample of the self-employed the best and the brightest are lost in the sands of data.

3.2 Non-financial factors in occupational choice

It is also possible that non-financial factors drive occupational choice. While economists can model the financial aspects of the decision to start a new business, the non-pecuniary benefits of self-employment pose a significant challenge to the creation of a theory of entrepreneurship in economics. These benefits are not only difficult to measure, but the potential set of non-pecuniary benefits across the population of entrepreneurs is vast and idiosyncratic, disallowing some approximation of a general theory of the entrepreneur. Hamilton (2000), among others, finds empirical evidence that is consistent with notion that self-employment offers non-pecuniary benefit, such as "being your own boss."

If it is true that individuals make the decision to enter self-employment based on economic factors, advocates for this position need to make sense of puzzling findings suggesting that for most individuals self-employment is not more remunerative than wage work. Investment and agency models suggest that these differentials result from individual earning profiles (i.e., returns to self-employment vs. paid profiles) across sectors. In contrast, matching and learning models propose that these differentials result from the sorting of workers into paid and self-employment based on individuals' heterogeneous sector-specific abilities and skills (Jovanovic, 1979; Jovanovic, 1982). From this perspective, individuals with high abilities earn more in self-employment

because productivity returns are not shared with the employer. In recent empirical work, Hamilton (2000) finds that entrepreneurs have both lower initial earnings and lower earnings growth, demonstrating that the present value to the median entrepreneur of a business lasting twenty-five years is over twenty-five percent less than the value of a paid job of the same duration. Interestingly, Hamilton's work does show some support for the "superstar" conjecture—that some highly skilled entrepreneurs buck the general trend and earn substantial returns in self-employment.

Perhaps individuals are engaging in a risk-reward calculation for entrepreneurship, but the calculator is broken in a systematic way that drives people to choose to become entrepreneurs. Hayward, Shepherd, and Griffin (2006) address the entrepreneur's decision to embark on an endeavor fraught with risk with their Hubris Theory of Entrepreneurship. In this theory, the authors explain why entrepreneurs remain undeterred by high firm failure rates by incorporating three separate and potentially independent psychological processes: overconfidence in knowledge, overconfidence in prediction, and overconfidence in personal abilities. This theory is consistent with the learning model presented by Jovanovic (1982) in which entrepreneurs learn about their abilities that cannot be known *ex ante*.

3.2 Human capital theories and the decision to become an entrepreneur

While the occupational choice model offered us a way to think about how ordinary people enter entrepreneurship the model did not focus on high impact entrepreneurship. Building on the occupational choice models, a more recent body of research has focused on high potential entrepreneurs. High potential entrepreneurs are

defined as individuals with intellectual human capital that have the potential to start high impact firms. The focus is frequently on agents with high levels of human capital, leaving an existing firm with the intention of engaging in a start-up. A revolutionary and controversial concept when first introduced as a major topic of inquiry, human capital theory has evolved into one of the most universally accepted concepts in economics and other social sciences, especially as a driving force in the new information economy and startups. In effect, the human capital revolution has shifted the center of attention away from focusing solely on investment in physical capital and physical capital accumulation human capital investments and how those resources are allocated.

The work that a researcher conducts for a firm increases both the firm's stock of innovations and the human capital of the researcher. This increase in human capital has significant implications for the researcher's decision to leave the firm and start a spin-off. Not only does the immediate increase in human capital affect the wage that the researcher expects from the incumbent firm, but also the potential for future increases in human capital as the researcher continues to conduct research and development work.

Zucker, Darby, and Brewer (1998) have called the knowledge that resides in economic agents "intellectual human capital." Intellectual human capital is human capital that can earn a monopoly rent because the knowledge is not publicly available or perfectly protected. These features distinguish it from ordinary human capital, which is the widely diffused knowledge that can be acquired at a cost and earns a normal rate of return on the implied investment. It is, in fact, these monopoly rents that motivate investments in research and development in the first place.

Human capital theory suggests that the valuable knowledge to which research and development employees has access will affect their wage expectations in the present and the future. From this perspective, employees may be willing to accept lower wages because they are also acquiring valuable knowledge as part of their employment. They will, however, expect higher wages in the future, as they will then possess valuable intellectual human capital that cannot be found elsewhere. Rosen (1972) and Pakes and Nitzan (1983) develop models of labor mobility that seek to explain how human capital affects an agent's decision about starting a new firm.

Møen (2005) tests both the Rosen (1972) and the Pakes and Nitzan (1983) models using data from Norwegian firms and finds that technical workers in R&D intensive firms pay for the knowledge they accumulate on the job through lower wages early in their careers. They later earn a return on these implicit investments through higher wages. This finding suggests that potential externalities associated with labor mobility are, at least partially, internalized in the labor market. It also suggests that if the innovation would make the firm a monopolist, the firm will be willing to increase the worker's wages such that the worker will not leave. It will never be profitable for the firm and the scientist to split, in this case, as the rents in a duopoly will always be less then the monopoly rent. The Pakes and Nitzan model predicts that firms are able to avoid worker mobility by sharing the monopoly rents with workers.

The decision to start a new firm also depends on the intellectual property environment. When the intellectual property that results from an incumbent firm's investment in research and development is protected by patents or other legal means, the incumbent firm appropriates the returns on its investments in R&D, and the researcher

does not have the option of appropriating the intellectual property and starting a new firm. If the intellectual property cannot be protected, however, the research and development capital that is embodied in the employees influences the decision to start a new firm. This perspective, modeled by Hellmann (2007) also generates new insights about intellectual property rights and the importance of the external environment. If the employee owns the intellectual property, the external environment becomes more attractive. If the firm owns the intellectual property then the external environment only constitutes an opportunity for the firm.

Are entrepreneurs largely generalists, or are they specialists requiring specific human capital? In addition to specialized knowledge in the field of the new business, entrepreneurs must be able to obtain funds, hire workers, choose location and decor, obtain food supplies at a reasonable cost, keep the books, and market the restaurant. Even when these tasks are outsourced, the entrepreneur must possess enough basic knowledge to choose good vendors. Following from this line of reasoning, entrepreneurs do not need to be experts in any single skill but they must be sufficiently good at a wide range of things (Lazear, 2005). A theory of entrepreneurs as generalists, while those that are employees should be specialists, implies that human capital investment patterns should differ between those who choose entrepreneurship and those who work for others. This does not seem to be the case. While Lazear's analysis seems to apply for a "salary substitution" or "lifestyle" small business owner, this "generalist" view of human capital investment is less likely to hold for the launching of high-growth new ventures or "gazelles.' Perhaps in these high impact firms the specialized—yet pooled—skills of a founding team of entrepreneurs may be the dominant pattern.

The size of the incumbent firm may also have an impact on the decision to leave the firm and start a new business. Hvide (2005) conducts an analysis of firm size (large vs. small), finding that small firms are able to implement wage policies that are 'fine-tuned to workers' external options, while large firms have more rigid wage policies. As a consequence, workers' decisions to leave small firms are not influenced by economics. Instead, these workers start new firms to achieve private benefits, such as more flexible work hours or a sense of freedom. The more rigid wage policies at large firms, however, result in a loss of the best workers and ideas who will make more money as entrepreneurs. Entrepreneurs emerging from large firms, therefore, are of higher quality then entrepreneurs emerging from small firms.

As the opportunity cost of entrepreneurship increases, individuals have less incentive to accumulate entrepreneurial human capital. Iyigun and Owen (1998) develop a model that highlights the shift in the balance of entrepreneurial human capital and professional human capital in the evolution of an economy. According to this model, economic development may lead to more entrepreneurs in total, but it also results in a decrease in the proportion of the population engaged in entrepreneurship compared to the share engaged in "professional" activities. In other words, economic development brings a greater number of professional activities that involve relatively less risk relative to the number of more uncertain entrepreneurial activities. A comparison of descriptive statistics from the Penn World Tables and the Yearbook of Labor Statistics supports this conclusion, showing that professional human capital is more abundant in richer countries.

This model has three implications for development: 1) Entrepreneurial human capital is more important in intermediate income countries that need entrepreneurship for

further economic growth. 2) Sufficient initial levels of both types of human capital are key determinants of development. Economies with too little of either form of human capital may become "trapped" by little investment by individuals in either form of human capital. 3) Since the social returns to work and education likely differ from the private returns, the allocation of resources to schooling and working will be inefficient. In particular, if entrepreneurial skills are relatively more (less) important in determining technology, the steady state will have too much (not enough) education. The inefficiency does not result from too much human capital, but a misallocation of professional versus entrepreneurial human capital.

3.4 Likelihood of entrepreneurial success

While these factors may influence the decision to become an entrepreneur, Carroll and Mosakowski (1987) find that those factors that account for one stage of the self-employment experience do not necessarily account for others. More substantively, the findings of this study point to the strong effects of social structural variables, especially those related to the family, as well as to the effects of previous self-employment experience.

Several authors have examined founders of entrepreneurial companies in order to discover factors that influence entrepreneurial success. Cooper, Gimeno-Gascon and Woo (1994), for example, seek to predict the performance of new firms utilizing longitudinal data on more than one thousand new ventures that are representative of all industry sectors and geographical regions. This study considers the probability of firm success based upon factors that can be observed at the time of start-up, and it goes

beyond previous studies in differentiating firms with marginal survival from those that have achieved high growth.

The authors found, unsurprisingly, that industry-specific knowledge contributed to both survival and growth. The amount of initial financial capital was also correlated with survival and growth. While most measures of general human capital influenced both survival and growth, gender had a mixed impact, with women-owned ventures less likely to grow, but just as likely to survive. Similarly, the number of partners contributed to growth, but not to survival. And, conversely, having parents who owned a business contributed to marginal survival, but not to growth. Management know-how variables had a more limited impact. In addition, the founder's management level, prior employment in non-profit organizations or not having been in the labor force, and the use of professional advisors did not have significant effects.

The occupational choice models discussed above provide important insight into the structural conditions that encourage entrepreneurship at a macro level. However the mode of entrepreneurship discussed in these models is replicative entrepreneurship rather than high impact entrepreneurship. This focus on replicative entrepreneurship, in part, leads to a primary emphasis on liquidity constraints. Thus these models fail to explain, from a behavioral perspective, why high impact entrepreneurs choose to start new businesses.

4. Entrepreneurship, Innovation, and Technological Change (O3-L2)

This chapter examines the question, "When entrepreneurs engage in high impact activity what is the principal mode through which they impact the economy?" The

answer to that question is, more often then not, through innovative activity. Innovation is defined as the introduction into the market of a new good or service that is a quality improvement and results in an economic rent. In this chapter we first outline the starting point for most theories of innovation, knowledge production function and propose the knowledge spillover theory of entrepreneurship. This theory suggests that entrepreneurship serves as a conduit for knowledge spillovers and that a set of institutions—the knowledge filter—stands in the way of commercializing new knowledge.

4.1 The knowledge production function

The starting point for most theories of innovation is the firm (Baldwin and Scott, 1987; Cohen and Levin, 1989; Dosi, 1988). Conventional wisdom has long held that large enterprises able to exploit at least some market power serve as the engine of technological change. Schumpeter articulated this view in *Capitalism, Socialism and Democracy* (1942, p. 101): "The monopolist firm will generate a larger supply of innovations because there are advantages which, though not strictly unattainable on the competitive level of enterprise, are as a matter of fact secured only on the monopoly level." In this view, large enterprises are uniquely endowed to exploit innovative opportunities because market dominance allows these enterprises to undertake the risks and uncertainties associated with innovation. The possibility of acquiring quasi-rents is the catalyst for large-firm innovation. Galbraith (1956, p. 87) takes a similar view: "Because development is costly, it follows that it can be carried on only by a firm that has the resources which are associated with considerable size."

Economists' emphasis on large investments in research and development as the primary strategy for generating innovation is reflected in the model of the *knowledge production function*, formalized by Griliches (1979). Firms that exist exogenously generate innovative activity through a knowledge production function in which a wide range of inputs contributes to the process of generating innovative activity. The most decisive input in this process is the new economic knowledge pursued by the firm. And, as Cohen and Klepper conclude, the greatest source of new economic knowledge is research and development (Cohen & Klepper, 1991, 1992). Linking large investments in research and development to innovation, this model supports the view that large firms have the competitive advantage in knowledge investment and innovation.

Empirical work has shown that the relationship between knowledge generating inputs and innovative outputs suggested by the knowledge production function holds most strongly at broad levels of aggregation, such as entire industries or even countries. The most innovative industries tend to be characterized by considerable investments in research and development and the pursuit of new economic knowledge. The computer, pharmaceutical, and instruments industries, for example, each have substantial research and development inputs that generate new economic knowledge and highly innovative outputs. The wood products, textiles, and paper industries, by contrast, invest little in research and development and largely contribute only a negligible amount of innovative output. A consideration of research and development investments and innovative output among nations also supports the model of the knowledge production function. The most innovative countries are those with the greatest investments in research and development;

those countries in the developing world that produce very little new economic knowledge also produce little innovative output.

Analysis at the disaggregated microeconomic level of enterprises, establishments, or even lines of business, however, renders the model of the knowledge production function less compelling. Acs and Audretsch (1990) found, for example, that the correlation between research and development inputs and innovative output for large U.S. corporations (0.40) was much weaker than the strong correlation (0.84) at the industry level. Furthermore, empirical evidence concerning the important role of small enterprises in innovative activity in certain industries casts both the knowledge production function and the conventional wisdom concerning the competitive advantage of large corporations in innovation into doubt (Jovanovic and Lash, 1989; Hobijin and Jovanovic, 2001; Jovanovic, 2001; Aghion, Blundell, Griffith, Howitt and Prantl, 2006). These small firms are, however, responsible for a very small share of industrial research and development (Scherer, 1991). These case studies cast doubt on the model of the knowledge production function in which large enterprises investing in the bulk of research and development are expected to be more innovative, and it challenges the very idea that large companies are the primary drivers of innovation.

4.2 The Knowledge Spillover Theory of Entrepreneurship

The Knowledge Spillover Theory of Entrepreneurship relaxes two central (and unrealistic) assumptions of the endogenous growth model. The first is that knowledge is automatically equated with economic knowledge. In fact Kenneth Arrow (1962) emphasized knowledge as inherently different from the traditional factors of production,

resulting in a gap between knowledge (K) and what he termed economic knowledge (K^c). The second assumption involves the assumed spillover of knowledge. In the endogenous growth model the existence of the factor of knowledge is equated with its automatic spillover, yielding endogenous growth. In the Knowledge Spillover Theory of Entrepreneurship, *institutions* impose a gap between new knowledge and economic knowledge ($0< K^c/K<1$), which results in a lower level of knowledge spillovers.

The Knowledge Spillover Theory of Entrepreneurship captures this spillover process, reversing the knowledge production function (Audretsch, 1995 and Acs, et al 2006). In this view, the firm is created endogenously through the agent's effort to appropriate the value of his knowledge through innovative activity. The degree to which economic agents recognize entrepreneurial opportunities emanating from knowledge spillovers and the decision to commercialize them through the startup of a new firm is captured by the equation reflecting occupational (or entrepreneurial) choice,

$$E = \gamma(\pi^* - w) \qquad (1)$$

where E reflects the decision to become an entrepreneur (generally stated in terms of probabilities), π^* is the profits expected to be earned from entering into entrepreneurship, w is the wage that would be earned from employment in an incumbent enterprise and γ represents all other variables that influence entrepreneurship (Parker, 2004).

Since the expected profit opportunities accruing from entrepreneurship are the result of knowledge not commercialized by the incumbent firms, entrepreneurial opportunities will be shaped by the magnitude of new knowledge but constrained by the

commercialization capabilities of incumbent firms.[8] Knowledge opportunities can be expressed as K^{θ}, where K is the aggregate stock of knowledge and θ $(0 < \theta < 1)$ refers to the share of knowledge not exploited by incumbents,

$$E = \gamma(\pi^*(K^{\theta}) - w). \qquad (2)$$

The opportunity space for potential entrepreneurs is thus dependent on the efficiency of incumbents in exploiting new knowledge who are assumed incapable of fully exhausting the opportunities provided by new knowledge. In the knowledge spillover theory of entrepreneurship (Audretsch, 1995; and Acs et al, 2005) the focus is on the interaction between incumbent firms and entrepreneurs when institutional factors generate opportunities for arbitrage in commercializing new knowledge. But who is right, the departing agents or those agents remaining in the organizational decision making hierarchy who, by assigning the new idea a relatively low value, have effectively driven the agent with the potential innovation away? *Ex post* the answer may not be too difficult. But given the uncertainty inherent in new knowledge, the answer is anything but trivial *a priori*. Audretsch (1995, 48), "proposed shifting the unit of observation away from exogenously assumed firms to individuals—agents confronted with new knowledge and the decision whether and how to act upon that new knowledge."

In the model, knowledge spillovers from new technology give rise to new opportunities (Shane and Venkataraman, 2000; Casson, 2003). Institutional constraints result in a subset of these opportunities not being exploited by incumbent firms, leaving a role for the entrepreneur (Acemoglu, Simon and Robinson, 2005).

[8] Since we are not interested in arbitrage, prices can be viewed as constant, e.g. monopolistic competition leads to equalized prices on differentiated products within an industry.

4.3 Entrepreneurship as a conduit for knowledge spillovers

A recent wave of studies suggests that small enterprises serve as the engine of innovative activity in certain industries (Acs and Audretsch, 1987, 1988). Responding to the empirical evidence of innovation in smaller enterprises, researchers have suggested several reasons for the innovative advantages of these companies, at least in certain industries. Many of these theories suggest, as Rothwell (1989) hypothesizes, that the factors yielding small firms with the innovative advantage generally emanate from the differences in management structures between large and small firms. The bureaucratic organization of large firms, for example, is seen by many to impede innovation.

Link and Bozeman (1991) concur that bureaucratic constraints impede innovative activity, suggesting that innovative researchers often feel constrained by the management structures of larger firms. And Link and Rees (1990) theorize that bureaucracy actually creates diseconomies of scale in producing innovations in large firms. They conclude that large firms are plagued by an "inherent bureaucratization process that inhibits both innovative activity and the speed with which new inventions move through the corporate system towards the market" (Link and Rees, 1990, p. 25).

Scherer (1991) suggests that smaller firms may have an advantage in innovation because larger enterprises may lose the innovative potential of their leading researchers by promoting them to management positions. Small firms, by contrast, are more likely to place innovative activity at the center of their competitive strategy (Scherer, 1991). Scherer (1988, pp. 4-5) summarizes the advantages that small firms may have in innovative activity:

> Smaller enterprises make their impressive contributions to innovation because of several advantages they possess compared to large-size corporations. One important strength is that they are less bureaucratic, without layers of "abominable no-men" who block daring ventures in a more highly structured organization. Second, and something that is often overlooked, many advances in technology accumulate upon a myriad of detailed inventions involving individual components, materials, and fabrication techniques. The sales possibilities for making such narrow, detailed advances are often too modest to interest giant corporations. An individual entrepreneur's juices will flow over a new product or process with sales prospects in the millions of dollars per year, whereas few large corporations can work up much excitement over such small fish, nor can they accommodate small ventures easily into their organizational structures. Third, it is easier to sustain a fever pitch of excitement in small organization, where the links between challenges, staff, and potential rewards are tight. "All-nighters" through which tough technical problems are solved expeditiously are common.

While there is debate concerning the innovative capacity of small firms, entrepreneurial enterprises may also play important roles in the commercialization of innovation that occurs at larger firms. Small firms are, in fact, often born when a researcher at a large firm sees the power and utility of an innovation that is undervalued by the larger firm (Klepper, 2006). The tendency of knowledge to be valued differently

by different parties is, in fact, one way in which knowledge differs from the traditional factors of production: physical capital and labor (Arrow, 1962). This capacity of knowledge to spill over into the creation of a new firm is a second way in which knowledge differs from the traditional factors of production (Arrow, 1962). Arrow first explained that knowledge is both non-excludable and non-exhaustible, and the Romer (1990) model of endogenous growth incorporated these ideas, assuming technological knowledge to automatically spill over.

In addition to serving as the mechanism by which knowledge spills over from large firms, small entrepreneurial firms play a similar role in commercializing innovation-generating knowledge that was developed in university research. Jaffe (1989) and Acs, Audretsch, and Feldman (1992) have documented spillovers from university laboratories that have contributed to the generation of commercial innovations by private enterprises. While the knowledge from university laboratories is available for commercialization to both small and large firms, Acs, Audretsch, and Feldman (1994) found persuasive evidence that spillovers from university research contribute more to the innovative activity of small firms than to that of large corporations. A similar study by Link and Rees (1990) found that large firms are more active in university-based research, but that small- and medium-sized enterprises are able to exploit their university-based associations and generate innovations more successfully.

While the phenomenon of knowledge spillover is rarely disputed, the geographic range of such knowledge spillovers is the subject of much debate. Many researchers argue that knowledge externalities cannot explain the geographic concentration of economic activity, as they see such knowledge externalities as so important and forceful

that there is no compelling reason for a geographic boundary to limit the spatial extent of the spillover (Jaffe, Trajtenberg and Henderson 1993; Thomson and Fox-Kean, 2005). According to this line of reasoning, knowledge spillovers are not limited by geographic borders, such as a city limits, state lines, or national boundaries. Implicit in this model, then, is the assumption that innovative activity will take place in those regions where the direct knowledge-generating inputs are the greatest, and where knowledge spillovers are most prevalent (Audretsch and Feldman 1996; Anselin, Acs and Varga 1997). Audretsch and Stephan (1996) link the propensity for innovative activities to cluster together to industry-specific characteristics, most notably the relative importance of knowledge spillovers.

4.4 The Knowledge Filter

These inherent conditions of new knowledge are responsible for the discrepancies in different economic agents' assessments of the potential values of an innovation. Acs et al (2004) and Carlsson et al (2007) account for these discrepancies with what they call the *knowledge filter*. Furman, Porter and Stern (2002) arrive at a similar idea to the knowledge filter in *national innovative capacity*. This concept draws on Paul Romer's ideas-driven endogenous growth model (1990), the cluster-based theory of national industrial competitive advantage (Porter, 1990), and research on national innovation systems (Nelson, 1993). Acs and Varga (2002) develop an analogous formulation, drawing on the work of Romer (1990), Paul Krugman (1989), and Richard Nelson (1993)

The Knowledge Filter is a subset of institutions that hinder the commercialization of knowledge. The knowledge filter K^c/K is the gap between new knowledge (K) and

what Arrow (1962) referred to as economic knowledge K^c. A greater knowledge filter indicates a more pronounced gap between new knowledge and economic or commercialized knowledge. As the value of any new idea is inherently uncertain and asymmetric, the mean expected value of any new idea will vary across economic agents, and the *variance* will also differ across economic agents. Moreover, the costs of transacting the perspectives of these individuals are often prohibitively high, making it nearly impossible to achieve consensus regarding the value of a new idea. It is the uncertainty inherent in new economic knowledge, combined with asymmetries between the agent possessing that knowledge and the decision-making vertical hierarchy of the incumbent organization with respect to its expected value that potentially leads to a gap in the valuations of that knowledge. A large and compelling literature has documented decision after decision reached at large corporations not to pursue new ideas that ultimately led to valuable innovations and, in some cases, triggered entirely new industries.

It is this knowledge filter that creates a space for entrepreneurship in bringing new innovations to market. In fact, in a model in which there is no knowledge filter and perfect information (with no agency costs), any positive economies of scale or scope would ensure that the appropriability problems of the firm and individual converge, leaving the individual with no need to start a new business. If an agent presents an innovation—a new product, process, or organization—to the incumbent enterprise, the firm (in this world of perfect knowledge) would agree with the agent's expected value of the innovation. To the degree that any economies of scale or scope exist, the expected value of implementing the innovation within the incumbent enterprise would exceed that

of taking the innovation outside of the incumbent firm to start a new enterprise. The incumbent firm and the inventor, therefore, would be expected to reach an agreement sharing the value that the innovation would add to the firm. The inventor's share—collected either in a higher wage or some other means of remuneration—would be bounded on the lower end by the return that the agent could expect to earn if he launched a new enterprise for the innovation and on the upper end by the expected value of the innovation if implemented by the incumbent enterprise (Audretsch, 1995). In a world of imperfect information, however, there are inevitably divergences in the expected value of new knowledge. These divergences can impede the spillover of knowledge for commercialization and innovation when neither the incumbent firm nor the inventor pursues the innovation. But these divergences can also inspire the creation of new businesses when the economic agent chooses to leave the firm and start a new business. As Albert O. Hirschman (1970) explains, an agent will, under certain conditions, exercise what he has termed as *exit* rather than *voice*, and depart from an incumbent enterprise to launch a new firm – a spin-off.

In practice, an innovation spills from a large corporation to a new small business when an employee (typically a scientist or engineer in a research laboratory) conducting research and development work for a large firm comes upon an innovation. When presented with this idea, the knowledge filter suggests that the incumbent firm is unlikely to assign the same expected economic value to the innovation as the employee. If the firm assigns a lower expected economic value to the innovation than the employee, the firm may not be prepared to compensate the employee at the level expected for the work involved in developing the idea, or the firm may choose not to pursue its

commercialization at all. Even if the there is little divergence in the expected values of the idea, the firm may conclude that the expected value of the new idea is not sufficiently high to warrant its development and commercialization. In these cases, the researchers, or other economic agents inside or outside the firm, may choose to pursue the innovation outside of the firm. Spin-offs are formed when researchers leave the corporation and establish new enterprises to appropriate the value of the knowledge that was undervalued by the corporation. Since the knowledge inducing the decision to start the new firm is generated by investments made by an incumbent firm, the startup serves as the mechanism by which knowledge spills over from the sources producing that knowledge to the (new) organizational form in which that knowledge is actually commercialized.

The Knowledge Spillover Theory of Entrepreneurship's explanation for an agent's decision to start a new business represents a subset of the vast literature addressing the factors that influence the decision to become an entrepreneur, a central question in labor economics (Lazear 2004). The theory connects endogenous technological change with models of occupational choice in labor economics resulting in the creation of new firms and to liquidity constraints or the debate between Knight and Schumpeter on financing innovative entrepreneurship (Evans and Jovanovic, 1989). To these questions we now turn.

5. High Impact Entrepreneurship and Capital Markets (G24-L26)

Early theoretical literature provides three historical perspectives on the financing of new firms. Knight (1921) and Schumpeter (1934) draw different conclusions about firm financing due to their differing perspectives on who bears risk. Knight suggests that entrepreneurs bear the risk of their inventions, while Schumpeter maintains that the capitalist bears the financial risk for new ventures. The Austrians offer a more nuanced view, making a distinction between the financing of innovative firms and replicative firms. From this perspective, *innovative entrepreneurs*—those who stand to reap economic rents—will be financed by the capitalist, while *replicative entrepreneurs*—those who dissipate economic rents—will finance their own innovations (Kirzner, 1973).

Financial economists have given substantial thought to the relationship between finance and economic growth, seeking to determine if the financial system promotes economic growth or if financial development simply follows economic growth. King and Levine (1993b) support the view that financial systems promote growth, providing evidence that higher levels of financial development are positively associated with faster rates of economic growth, the accumulation of physical capital, and improvements in economic efficiency, both before and after controlling for numerous country and policy characteristics.

Entrepreneurship, in fact, is key to King and Levine's (1993a) explanation of the role that financial systems play in affecting economic growth. King and Levine (1993a) construct an endogenous growth model in which financial systems evaluate prospective entrepreneurs, mobilize savings to finance the most promising productivity-enhancing

activities, diversify the risks associated with these innovative activities, and reveal the expected profits from engaging in innovation rather than the production of existing goods using existing methods. From this perspective, better financial systems improve the probability of successful innovation and thereby accelerate economic growth.

Taken as a whole, the broader literature on entrepreneurship reflects this view. The literature on liquidity constraints (discussed in detail below) is largely concerned with replicative entrepreneurs, or simply the self-employed. A second literature, however, has developed with a focus on the financing of innovative entrepreneurship. These firms are characterized by significant intangible assets, expect years of negative earnings, and have highly uncertain prospects.

5.1 Liquidity Constraints

Evans and Jovanovic (1989) assume that a person's decision to become an entrepreneur is almost entirely financial. Individuals compare the expected net income from entrepreneurial activity to their current wages, and they choose the more lucrative profession. Wages, in this line of thinking, are dependent on work experience and income. In contrast, entrepreneurial earnings depend on entrepreneurial ability and the amount of capital invested. Agents with more entrepreneurial ability, then, will have a higher total and marginal product of capital at all levels of capital. This finding is consistent with Lucas (1978) and Jovanovic (1982).

The decision to become an entrepreneur is also determined, in part, by liquidity constraints. Evans and Jovanovic explain that an entrepreneur's net income is

$$y + r(z-k). \qquad (1)$$

In this setup r is one plus the rate of interest, and z is the entrepreneur's beginning-of-period wealth. If $z < k$, the entrepreneur is a net borrower. Each person can borrow up to the amount that is proportional to her wealth; the factor of proportionality is denoted by $\lambda - 1$. Since the amount borrowed cannot exceed $(\lambda - 1)z$, the most that a person can invest in the business is $z + (\lambda - 1)z = \lambda z$. The entrepreneur therefore faces the constraint

$$0 \leq k \leq \lambda z \qquad (2)$$

where the parameter $\lambda \geq 1$ and is equal for everyone.

This model is designed in part to test the assumptions of Knight and Schumpeter concerning liquidity constraints. The empirical findings side with Knight: an entrepreneur faces liquidity constraints and therefore must bear the risk of the venture. They also reject the idea that the wealthy make better entrepreneurs. Their findings point to liquidity constraints and these constraints tend to exclude those with insufficient funds at their disposal. This line of research on liquidity constraints has produced a host of studies (Holtz-Eakin, Joulfaian, and Rosen, 1994; Blanchflower and Oswald 1998; Dunn and Holtz-Eakin, 2000; Parker, 2004). Liquidity constraints have also been examined for African-Americans (Bates, 1985), ethnicity (Fairlie and Meyer, 1996), gender (Hundley, 2000) and immigrants (Borjas, 1986). While the relationship between wealth and entrepreneurship is essentially flat over the majority of the wealth distribution, recent research suggests that at the very top of the distribution—above the 95th percentile—a positive relationship can be found (Hurst and Lusardi, 2004).

5.2. Information asymmetries

Why do entrepreneurs face liquidity constraints? The key factor leading to the higher cost of external capital in models of debt and equity financing is *asymmetric information*. If markets are efficient, the sources of financing and the instruments used are irrelevant to the value of the firm and to its investment decisions. Modigliani and Miller (1958) demonstrated that under these conditions, the firm would be expected to issue securities, in the form of either debt or equity, and invest at the optimal rate. Even if taxes and bankruptcy exist in this scenario, the firm's investment decision is independent of the source of capital.

In a world with asymmetric information, however, there may be conflict between entrepreneurs and investors. Jensen and Meckling (1976) demonstrate that conflict between entrepreneurs and outside investors to the firm results in a higher cost of capital for both debt and equity financing. In firms financed by outside equity, the entrepreneur has an incentive to engage in wasteful expenditures because he does not bear the entire cost. Similarly, entrepreneurs with firms financed by outside debt may increase risk. Providers of capital recognize these agency problems and the lack of alignment between their own incentives and those of entrepreneurs. The price of outside financing, therefore, has a higher cost of capital than internally generated funds.

Even if entrepreneurs are motivated to maximize shareholder value, information asymmetries may make external capital more expensive or even preclude it altogether. In the case of equity, both Myers and Majluf (1984) and Stiglitz and Weiss (1983) demonstrate that equity offerings of firms may be associated with a 'lemons' problem

(Akerlof, 1970). If the entrepreneur is better informed about the investment opportunities of the firm and acts in the interest of current shareholders, then entrepreneurs only issue new shares when the company's stock is overvalued. New investors, therefore, risk purchasing overvalued stock, and current shareholders experience stock price declines at the announcement of equity issues because of the negative signal it sends to the market. Information asymmetries also have been shown to exist in debt markets (Stiglitz and Weiss, 1981). In this model, credit restrictions take the form of limiting the number of loans the bank will make, rather than limiting the size of each loan, or making the interest rate charged an increasing function of the magnitude of the loan.

This reasoning leads Myers (1984) to propose a pecking order theory of financing. Firms tap the cheapest sources of capital first. Internally generated capital is cheaper than debt issues, which are cheaper than equity issues.

De Messa and Southey (1996) reverse these information asymmetries, arguing that, in fact, lenders are better informed than entrants and that entrants have biased expectations. They suggest that entrepreneurs' liquidity constraints, relatively low interest rate margins, and over reliance on bank credit rather than equity finance are best explained by the tendency of those who are excessively optimistic to engage in the entrepreneurial process.

The consequence of information asymmetry in the entrepreneurial context is the inability to verify the outcomes of the actions of the entrepreneur and, therefore, the inability to write contracts contingent on future states of the world. Many of the models of ownership (Grossman and Hart 1986; Hart and Moore, 1990) and financing choice (Hart and Moore, 1998) rely on the inability of investors to verify that certain actions

have been taken or certain outcomes have occurred. While actions and outcomes might be observable, meaning that investors know what the entrepreneur did, they would not be verifiable.

Venture capitalists can, in fact, provide an important role in easing these information asymmetries. Eliminate information asymmetries and the financing constraint disappears (Gompers and Lerner 2003b: 277):

> *Financial economists argue that specialized financial intermediaries, such as venture capital organizations, can address these problems. By intensively scrutinizing firms before providing capital and then monitoring them afterwards, they can alleviate some of the information gaps and reduce capital constraints. Thus, it is important to understand the tools employed by venture investors….It is the non-monetary aspects of venture capital that are critical to its success.*

5.3 Debt vs. equity financing

Research indicates that innovative entrepreneurial firms, even those in the high-tech industry, have a balanced capital structure. The proportion of debt in the capital structure of small businesses in the U.S. is close to fifty percent and, therefore, similar to the proportion of debt in the capital structure of all U.S. businesses. This proportion also holds for the youngest firms in the country (those less than two years old), in which debt represents approximately 52 percent of the capital structure. And while private equity financing dominates the earliest growth stages of high-growth start-ups, debt financing

assumes a major role in the capital structure of these firms by the time they go public (Berger and Udell, 1998).

In fact, entrepreneurs may prefer external debt to external equity when external funds are needed. External debt does not dilute ownership, and debt conveys less control to outsiders than equity, although covenants and other contractual features of debt may cede some control to external creditors. Investors, too, may prefer debt to equity in some cases. According to Diamond (1984), debt reduces verification costs. An outside debt holder may only have to verify a firm's cash flow, while an outside equity holder may have to bear the costs of verifying cash flows under a much more stringent set of circumstances. Moreover, *adverse selection* favors debt over equity. Firms with poor prospects are more likely to agree to share poor expected profits, whereas firms with good prospects are more likely to agree to pay off a fixed loan and reap the residual of the expected high profits for themselves. Nachman and Noe (1994) have argued that when investors know that firms have poor prospects *ex ante* (privately), they offer debt contracts instead of equity contracts.

In cases of significant moral hazard, however, investors may prefer external equity to external debt. While external debt holders are exposed to the risk that the firm will pursue a high-risk strategy after funds have been injected, outside equity holders are not subject to this risk of opportunistic behavior. These moral hazard problems are more likely to occur when the external funds (debt or equity) are relatively large compared to internal funds, as the firm itself has less at stake. Berger and Udell (2003: 302) see the high proportion of equity to debt in entrepreneurial firms as evidence of investor concern for moral hazard problems: "The fact that high-growth, high-risk new ventures often

obtain external equity…before obtaining significant external debt suggests that the moral hazard problem may be particularly acute for these firms."

The problem of asymmetric information in small business lending has been studied in detail and will not be reviewed here. The tools of small business private debt contracting include collateral (Berger and Udell, 1995; Swary and Udell, 1988), debt covenants and maturity; Hart and Moore, 1998), and menu pricing (Boot, Thakor, and Udell, 1987; Thakor and Udell, 1987; Berkovitch and Greenbaum, 1991). Small business lenders use a variety of different lending technologies to overcome information problems, representing different approaches to gathering information. These include financial statement lending (Orgler, 1970; Avery, Bostic, and Samolyk, 1998), relationship lending (Berger and Udell, 1995; Petersen and Rajan, 1994), asset-based lending (Swary and Udell, 1988), credit scoring (Acs, 1999), and trade credit (Petersen and Rajan, 1997).

5.4 Private equity and venture capital

Private equity is a broad term that refers to any type of equity investment in an asset for which the equity is not freely tradable on a public stock market. Private equity investment, then, includes leveraged buyouts, venture capital, growth capital, angel investing, and mezzanine capital, among other types. For the purposes of this essay, we focus on angel investment and venture capital.

In its most general form, angel investing is the practice of individuals providing funds to entrepreneurs. This practice has a long history, with evidence of entrepreneurs raising capital from financiers as far back as Babylon, Medieval Europe, and Arabia.

Today, angel investors offer start-up funds in return for equity stakes in fledgling companies.

The visibility and efficacy of professional venture capital organizations notwithstanding, angel investment is the largest single source of private equity capital available to innovative entrepreneurs. While 36,000 companies received $20 billion dollars of angel funding in 2002 only 3000 companies received venture capital financing and only 22% of that capital was invested in early-stage companies (NVCA, 2002). While there are few sources of data on this practice, estimates indicate that the United States may have over 250,000 angel investors investing as much as 80 billion dollars each year. Research suggests that these investors are dispersed, that they tend to be reluctant to share information, and that individual investments are typically around $100,000 (Acs and Tarpley 1998; Freear, Sohl, and Wetzel, 2002).

Start-ups searching for larger infusions of capital must turn to the formal venture capital markets. Venture capital is defined as "independently managed, dedicated pools of capital that focus on equity or equity-linked investments in privately held, high-growth companies." The venture capital industry has experienced explosive growth over the last two decades, developing into an important financial intermediary facilitating the start and growth of innovative, high-growth firms (Gompers and Lerner, 2004). Despite its relatively modest size, venture capital has an outsized impact on the economy by encouraging innovative activity (Khortum & Lerner, 1998). Venture capital invested in the United States between 1970 and 2000 created 7.6 million new jobs and over $1.3 trillion in revenue. At the end of 2000, venture capital-backed companies accounted for 13.1 percent of GRP and 20.6 percent of publicly listed companies. Venture capitalists

have backed nearly all of the significant information technology and biotechnology firms established in the past four decades including Apple Computer, Facebook, Google, Genentech, Intel and Microsoft. This growth has led to increasing attention from the popular press, executives of major corporations, and policy-makers around the world. The impact of venture capital and its capacity to initiate and shape innovative activity is responsible for a substantial and thriving stream of cross-disciplinary research (Cornelius & Persson, 2006). This attention is due in no small part to the belief that this specialized type of entrepreneurship will be responsible for future long-term economic growth, especially in the developed world (Acs, 2006; Baumol, 2007; Audretch, 2007)

The importance of the venture capital industry on entrepreneurship has led increasing number of researchers to investigate how the venture capital market functions. As a result, we have gained significant insight into how venture capital firms raise the funds they invest (Gompers and Lerner, 1996) screen prospective projects (MacMillian, Siegel et al. 1985; Shepherd 1999) make investments (Gompers 1995; Hellmann 1998) and exit portfolio firms (Lerner 1994; Brau, et al. 2003). And we have a clear picture of the venture capitalist as an active investor who assumes a monitoring role for the innovative entrepreneurial firm (Sapienza and Gupta 1994; Lerner 1995) and uses specialized knowledge to add value to venture-backed firms (Sapienza and Manigart 1996; Gifford 1997; Hsu, 2004, 2006).

A striking aspect of venture capital investment is how little the practice has changed over the last 500 years. The risks faced by the three seed investors in Gutenberg's movable type press are largely the same risks noted by the first investors in Apple Computer. Venture investments are by nature made under unusually high levels of

uncertainty. Companies receive venture financing at early stages of development and may pursue unproven business models, novel technologies, or untapped markets. Additionally the entrepreneur inevitably possesses private information about capabilities and effort levels than the investor. As a result, one of the central concerns of entrepreneurial finance has been the examination of the appropriate incentives and controls to mitigate internal risk between the entrepreneur and venture capitalist. The structural and contractual mechanisms used by venture capitalists in Babylon, Asia, and Medieval Europe centuries ago are strikingly similar to those used today. In order to minimize *ex post* contracting problems from information asymmetries venture capitalists screen, monitor, and control their investments through a combination of staged financing, preferred stock, board seats, negative covenants, and specific exit rights. Agency theory has emerged as the dominant theoretical perspective used to examine the relationship between the venture capitalist and the entrepreneur (Arthurs & Busenitz, 2003). Empirical work in a venture capital context confirms the potent effect of intensive monitoring, staged infusions of capital, syndication as methods to mitigate entrepreneurial opportunism (Gompers, 1995; Lerner, 1994). Today's archetypal venture capital organization is a U.S.-style limited partnership, embedded in a local entrepreneurial ecosystem, and investing in technology-related deals close to home. The contracts are slightly more sophisticated, but the risks and the mitigation strategies are largely the same.

If information gathering and monitoring are important, as suggested by the theoretical literature (Chan 1983; Amit, Glosten and Muller 1990; Admati and Pfleiderer 1994), one could hypothesize that venture capitalists would invest in firms and industries where asymmetric information is the greatest. The presence of an inside investor such as

a venture capitalist can lessen some of the agency costs that arise when the entrepreneur's effort level is unobservable. This is especially true in early-stage companies that lack historical performance data and, therefore, are difficult to evaluate. Venture capital investment, therefore, is expected to be directed at early-stage, high-tech companies where the technology is fluid, i.e. not routine. Gompers (1995) tests these predictions and finds support for early stage investments in firms with intangible assets. Kaplan and Stromberg (2004) find similar evidence.

5.5. Exit strategies for innovative entrepreneurial firms

While previous research has explored the role of venture capitalists in the process of taking innovative entrepreneurial firms through the initial public offering process (e.g., Gompers and Lerner, 1999; Megginson and Weiss, 1991), the complete class of venture capital exits has only limited underpinnings in previous theoretical or empirical research. This lack of attention is, in part, due to the nature of the instrument itself. A private equity security is exempt from registration from with the Securities and Exchange Commission. Thus, information about private transactions is often limited and analyzing developments in the market is difficult.

Exit strategies include initial public offerings, the sale of the company to other entities, liquidation, management buy-outs or buy-ins, or even filing for bankruptcy. Among all the vehicles to exit, initial public offerings generate most profit and have received the lion's share of theoretical and empirical treatment. A $1 investment in a firm that goes public provides an average cash return on $1.95 in excess of the initial investment, with an average holding period of 4.2 years. The next best alternative, an

investment in an acquired firm, yields a cash return of 40 cents over a 3.7 year mean holding period (Venture Economics, Exiting Venture Capital Investments, Wellesley, Venture Economics, 1988). Brau et. al (2003) investigate the choice to going public via an initial public offering or being acquired by a public company. They find that generally industry characteristics, role of market timing, demand for funds by private firms and deal specific factors are important determinants in the choice of exit.

The presence of a venture capitalist during the IPO process confers a number of advantages for innovative entrepreneurial firms. According to Megginson and Weiss (1991), the presence of a venture capitalist in the issuing firm serves to lower the costs of going public and to maximize the proceeds to the offering firm. In a seminal paper on the IPO process for innovative entrepreneurial firms Barry et. al. (1990) find that the capital market responds to the intensive monitoring by venture capital firms through lower IPO underpricing in comparison to non-venture backed companies. Less underpricing may reflect a certification premium— reputable VCs do not bring lemons to market—as well as the value of the VC‘s ongoing management activities. Both Gompers (1996) and Lee and Wahal (2004) document a “grandstanding” effect of venture capital firms, finding that IPO firms backed by younger venture capital firms are underpriced more compared with firms backed by more established venture capital firms.

Several other studies examine the role of venture capital in the IPO process, with much of this research focusing on the comparison between venture-backed and non venture-backed IPO firms. This empirical work has found evidence of the certification role of the venture capitalist (Megginson and Weiss, 1991). The credibility of venture capitalists’ information is enhanced by the fact that they are major shareholders prior to

the IPO and retain a significant portion of their holdings in the firm after the IPO. This supports the idea that venture capitalism can reduce information asymmetries in high-tech startups. Also of value in the process of going public is a VC partnership‘s ability to time the market. Lerner (1994b) examines the behavior of prices of biotechnology shares around the IPO issue dates for venture-backed biotechnology firms. He documents a strong run-up in share prices before the offering date and a fall in prices after the offering date, with more experienced VCs showing a greater ability to time the market peak.

Sometimes a VC will exit via an acquisition exit in which the entire firm is purchased by a third party. From the mid 1990s, start-up entrepreneurs eyed the IPO as the most preferred route to liquidity. However, following the collapse of the internet stock bubble in 2000 and the stock market crash the IPO market diminished significantly As a result, acquisitions became an increasingly important avenue providing liquidity and continuity for innovative entrepreneurial firms. Regulations under the Sarbanes Oxley Act and higher costs for being a listed company may also play a role in the rise of M&A deals. There are a variety of means for affecting an acquisition exit: a sale of shares, a merger, or a sale of the assets of the firm. In some cases, the purchaser will be another VC.

Two important motives for choosing an IPO or an acquisition may be the level of liquidity and ownership insiders (entrepreneurs and VCs) require following the completion of the transaction. The acquisition arrangement may make cashing out (or significantly increasing liquidity) more efficient than an IPO for the insiders of the firm. Leland and Pyle (1977) argue that insiders who sell large portions of their firm in the IPO send a signal that the firm is overvalued. Insiders who attempt to liquidate by selling a

large amount of personally owned (i.e., secondary) shares in the IPO might depress the price of their firm and decrease both the amount raised in an IPO and the probability of full subscription through the negative signal they convey. These negative signaling effects are less likely in takeovers, since acquiring firms might face fewer information asymmetries relating to the target firm's value. Thus, takeover offers give insiders the ability to divest the entire firm by selling to an existing company that may not interpret the exit as a negative signal.

Closely related to the issue of liquidity is that of ownership and control. Insiders who wish to maintain a controlling ownership in the firm while obtaining access to capital markets may prefer an IPO. Relative to target insiders, IPO insiders do not have an acquiring firm to deal with in matters of control, and depending on the proportion of primary to secondary shares, may retain effective ownership after the IPO.

In addition to examining the liquidity and ownership effects of the IPO versus takeover decision, external factors that can influence the relative attractiveness of IPOs and acquisitions for private firms can be related to certain macroeconomic, stock market and industry factors that are important determinants in a private firm's exit decision. Brau, Francis, and Kohers, (2003) show that the degree of concentration of the private firm's industry, the high-tech industry affiliation of the firm, the "hotness" of the IPO market relative to the takeover market, and the current cost of debt are positively related to the probability that a firm will conduct an IPO. Brau et al. (2003) also provide an analysis of the influence of certain deal-related factors on the IPO versus takeover decision. They find that larger private firms are more likely to choose IPOs, and the level of post deal insider ownership tends to be higher for IPOs than for takeovers. They

further show that private companies in high market-to-book industries, in financial service industries, and in high debt industries show a stronger likelihood for takeovers.

5.6 The globalization of the venture capital market

Recent research on international patterns of venture capital investment has generated two contrasting perspectives on how capital market integration and the globalization of innovation and entrepreneurship will affect the venture capital market. One perspective suggests that venture capital will remain local, with continued growth in financing, but with this growth occurring in largely segmented national markets and invested by venture capital firms embedded in a local entrepreneurial ecosystem (Megginson, 2004). A contrasting outlook argues that venture capital will follow entrepreneurial talent and innovation as it diffuses globally, and a global market for venture capital will emerge (Kenney et al, 2007). Given the fact that entrepreneurial firms financed by venture capital are critical to the U.S. position in the global economy, the globalization of the venture capital industry is an important topic. Examining existing patterns of cross-border venture capital investment is notoriously difficult (Baygan, and Freudenberg, 2000). Less than five years ago, it was nearly impossible to measure the extent and impact of globalization on the venture capital industry due to the lack of comparable statistics and collection standards. Increased demand for standardized information—driven by the emerging global venture capital market—has dramatically improved the quality of data. What that data means is still open for debate. Of primary interest are the conditions that are driving cross-country venture capital allocations: whether investments go to regions where technology, talent, and entrepreneurial creativity are highest (Lee, Florida and Acs, 2004) and the extent to which the existing

legal and financial frameworks do (or do not) influence investment (Jeng and Wells, 2000).

While venture capital scholars have sketched out contrasting positions concerning the impact of the global capital markets, the impact of the globalization of innovation and entrepreneurship has not been as carefully thought through. Two years ago, the suggestion that global-class technology could be developed elsewhere that would rival the dominance of the U.S. national innovation system and, thus, shape investment patterns would have seemed both contrarian and naïve. The conventional wisdom argues that the information technology and biotechnology fields have been the core business of venture capital investment, will continue to be dominated by U.S. firms, and that no other business field will displace these sectors in the near future in terms of the size and speed of capital gains generation (Kenney et al, 2007). Recent data on the patterns of venture capital investment in the energy sector provide an intriguing alternative to this perspective.

Chapter 6: Public Policy in an Entrepreneurial Economy

This chapter examines the public policy and high impact entrepreneurship, concentrating primarily on those policies conducive to advancing what we have labeled *high impact entrepreneurship*—the formation and growth of enterprises built on new products, services or processes—rather than *replicative* entrepreneurship which engages in activities very similar or identical to those already in place. This is not because replicative entrepreneurship is unimportant; it is often essential as a means for individuals and families to sustain themselves economically, and can be an effective route out of poverty for individuals who may be outside the economic or social mainstream. But because our primary interest in entrepreneurship arises from our interest in economic growth—a supposition we presume many readers of this survey share—we naturally focus our attention on how best to promote the formation and growth of innovative entrepreneurial enterprises.

We choose to focus here primarily on policies at the national or federal level, which have the broadest impact. However, there is also a limited but growing literature on appropriate local, state and regional policies for promoting new business formation and, indeed, for fostering more localized economic growth that we touch on below. We also focus on the United States because that is what we know best. Table 5 provides an overview of policies at the federal level in the managed economy and the entrepreneurial Society.

6.1. Defining "Entrepreneurship Policy":

The notion that promoting entrepreneurship is a separate policy goal to be achieved by specific policy tools is a relatively recent one and, as such, the subject has not yet clearly been defined. For example, does "entrepreneurship policy" entail refining of existing policy instruments such as regulatory, tax or trade policies, or does it mean designing entirely new, but targeted policies specifically designed to promote entrepreneurship? The only comprehensive work addressing these issues so far is contained in two edited volumes published earlier this decade. The editors of both books, however, refrain from choosing between these two different approaches to defining entrepreneurship policy.

The first volume, edited by Hart (2003) takes a relatively expansive view of entrepreneurship, but limits its focus to those policies that are likely to have a more immediate impact on entrepreneurial activity than variations in macroeconomic policy. Among the topics included in Hart's survey are policies aimed at promoting university-industry collaboration with specific focus on startups (Auerswald and Banscomb 2003; Feldman 2003; Rosenberg 2003); they also deal with questions of equity (Greene et al. 2003; Bates 2003) and policies aimed at promoting entrepreneurship within specific industries or sectors, for example information technology or biotechnology (Toole, 2003; Mayer-Schonberger, 2003; Noam, 2003). The volume also contains three contributions on the role of entrepreneurship in advancing regional, state and local economic development (Audretsch 2003; Florida 2003; Pages et al. 2003).

The second volume, edited by Holtz-Eakin and Rosen, takes an eclectic, but also implicitly broad, view of what constitutes entrepreneurship policy (Holtz-Eakin and Rosen 2004). It covers issues as the design impact of health insurance availability on

entrepreneurial activity (Craig Perry and Rosen 2004); the impact of banking deregulation in the United States on entrepreneurial activity (Black and Strahan 2004); issues of equity, with a focus on entrepreneurship for minorities in particular (Moehling and Steckel 2004; Fairlie 2004). Like the Hart volume it also contains one sector-specific analysis, this one examining to entrepreneurship and innovation in the pharmaceutical industry (Lichtenberg 2004).

In short, to date there are no bounds on "entrepreneurship policy." We make an effort in the balance of this concluding section to bring greater focus to this topic by concentrating on policies that affect incentives of individuals to form and grow innovative, for-profit enterprises.

6.2. Policies Relating to Fostering Occupational Choice

At its most fundamental level, entrepreneurship is about the successful development and commercialization of novel ideas. This process requires highly educated individuals who will refine and improve the new products and processes provided to them by the nation's inventors and their entrepreneurial partners. A strong educational system—primary, secondary, college, and post-college—plays a vital role in the creation of the human capital necessary to ensure the availability of the requisite talent. There is good reason to conclude that the U.S. owes much of its economic success to its enviable record in providing universal primary and secondary education to its citizens and, perhaps even more important, to its university system and the postgraduate education that it offers not only to its own community but to the leaders in research throughout the world.

There are three issues that have a direct bearing on occupational choice and its impact on entrepreneurial activity. First, is the issue of immigration. It is now well documented that immigrants, especially highly educated foreign-born scientists and engineers increase the talent pool and create potential entrepreneurs. For example, some of the founders of the largest U.S. businesses were foreign born. Second, the regional aspect of startup's of both occupational choice directly and indirectly through knowledge spillovers. The occupational choice decision and new firm formation is a local decision and involves not only issues of agglomerations but also questions of culture and creativity (Lee, Florida and Acs, 2004). Finally, the question of the quality of U.S. education and training raise important policy questions.

6.2.1 An Entrepreneurship-Friendly Immigration Policy.

Immigration represents an opportunity to bring additional talent into the country. Foreign-born scientists and engineers historically have contributed significantly to the growth of U.S. high-tech industries. The U.S. nuclear and space programs, for example, benefited enormously from the immigration of foreign scientists both before and after World War II.

The United States continues to attract foreign-born scientists today, often through the science programs in American universities. In the last several decades, in fact, roughly half of all those who earned an undergraduate or graduate degree from American universities in science, engineering, computer science, and other technology-related fields were foreign students.[9] But with Asia and Europe now wooing highly qualified students

[9] Freeman, December 2006.

(and even senior level researchers) from other countries to their universities and easing restrictions on the entry of skilled workers,[10] the United States faces increased competition in drawing the world's best and brightest to study, work, and start businesses here.

Immigrants, especially those already with or those just seeking technical skills in the United States, already play a key entrepreneurial role in the U.S. economy. This is indicated by some evidence:

- Census data indicate that immigrants as a group have had consistently higher rates of business formation than native-born individuals for many years.[11]
- Immigrants from China and India helped create 24 percent of technology companies launched in Silicon Valley between 1980 and 1998.[12]
- According to the National Venture Capital Association (NVCA), since 1990, one in four venture-backed firms in the entire country has been started by immigrants. The NVCA estimates that these firms have created more than 400,000 jobs and collectively represent a market capitalization of roughly $500 billion.[13]
- Most recently, a team of researchers at Duke University and the University of California at Berkeley found that between 1995 and 2005, immigrants founded or co-founded 25 percent of all the high-tech firms in the United States, and accounted for 24 percent of international patent applications from the United States in 2006.[14]

Despite the clear importance of skilled immigrants for technical progress and the generation of new firms in this country, even before September 11, the U.S. has tightened legal immigration in the name of national security and on other grounds. In 1990, for

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[10] *Economist*, p. 12.
[11] Robert W. Fairlie, *Kauffman Index of Entrepreneurial Activity: National Report*, *1996-2005*, Ewing Marion Kauffman Foundation, 2006.
[12] AnnaLee Saxenian, *Silicon Valley's New Immigrant Entrepreneurs* (San Francisco, CA: Public Policy Institute of California, 1999).
[13] Stuart Anderson and Michaela Platzer, "American Made: The Impact of Immigrants and Professionals on US Competitiveness." http://www.nvca.org/pdf/AmericanMade_study.pdf
[14] Vivek Wahwha, AnnaLee Saxenian, Ben Rissing and Gary Gereffi, *America's New Immigrant Entrepreneurs* (Master of Engineering Management Program, Duke University and School of Information, University of California at Berkeley, 2007).

example, Congress imposed an annual ceiling of 65,000 skilled foreign workers for temporary periods (up to six years) under the H1-B visa program. But *any* such ceiling imposes a self-inflicted wound on our economy. Already there is evidence that entrepreneurial firms have put more of their personnel abroad because of an inability to obtain H1-B visas for foreign workers.[15] Further, because the H1-B visa is of limited duration, it makes it practically impossible for workers who come into the United States to work at starting their own companies.

One measure that would address this difficulty, without costing the federal government much in the way of additional resources, would grant permanent residency and work status, and perhaps even automatic citizenship, to those immigrants who come here to study mathematics, engineering, or the sciences upon receipt of their degrees from qualified institutions of higher learning.[16] The promise of a permanent work permit and perhaps citizenship upon satisfactory completion of their studies may prove to be a powerful incentive for many to come. Even if some decide to return to their home countries—as increasing numbers appear to be doing, which is also a good thing for these economies—the United States would have the benefit of their skills and entrepreneurial energy for as long as they remain here.[17]

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[15] Anderson and Platzer, 2006.

[16] This idea would constitute one "national strategic plan" for recruiting international students, a central conclusion of a recent report by the Government Accountability Office on consensus recommendations by a panel of national education experts. See Government Accountability Office, *Global Competitiveness: Implications for the Nation's Higher Education System*, Highlights of a GAO Forum, January 2007, www.gao.gov/new.items/d07135sp.pdf.

[17] The McKinsey report commissioned by the Mayor of New York on the financial services industry in that city also highlighted among its recommendations the need to attract and retain highly skilled immigrants to work in that industry in particular. McKinsey & Co., *Sustaining New York's and the US' Global Financial Services Leadership*, January 2007, www.nyc.govt/html/om/pdf/ny_report_final.pdf.

In short, in a world where brainpower and skills lead to economic power, it is difficult to defend a policy that discourages talented, skilled workers from coming to the United States, to study, work, or launch new companies.

6.2.2 Agglomeration Economics

Just as immigrants are important for high impact entrepreneurship so are the places where start-ups originate (Acs and Armington, 2006). In fact the Hart volume discussed above had three papers on regional policies to promote HIE (Audretsch 2003; Florida 2003; Pages et al. 2003).[18] While Thomas Friedman suggested that the world is flat, Richard Florida, among others, argues that the world is spiky. In terms of sheer economic power cutting edge innovation exists in surprisingly few regions of the world, or for that matter the United States. Moreover, the tallest peaks, or the most innovative regions of the world are growing taller. Much of the world's population is clustered in cities, over fifty percent at last count, and creative people cluster to be around other creative people (Lucas, 1988). The concept of the Creative Class, as a plausible paradigm for contemporary economic growth, awakened significant interest among academics and the civic leadership community. In his book, The Rise of the Creative Class (Florida, 2002), Richard Florida correlates a region's economic development with its share of creative talent, tolerance towards diversity, capacity to invent or improve technology, and richness of public amenities.

[18] Also see Kauffman, 2008.

In a nutshell, amenity-rich communities with a high degree of diversity attract young, educated, and creative people that contribute directly to economic growth. Members of the Creative Class—including: scientists, engineers, architects, designers, educators, artists, musicians, entertainers, etc.—stimulate a region's economy by introducing new ideas, new technology, or new content. Knowledge workers who engage in complex problem solving that involves a great deal of independent judgment also belong to this category.

Today, broadly defined, the creative sector of the U. S. economy employs more than 30% of the workforce and accounts for nearly 50% of all wages and salary income. This ratio becomes increasingly important considering that lack of diversity, tolerance, and a knowledge-based economy leads to an out-migration of creative people, or brain-drain, to other regions.

Human creativity, the driving force in contemporary urban development, is a consequence of nurturing and stimulating environments. Talented people are highly mobile and attracted to regions that offer not only economic opportunities, but also amenities for a variety of lifestyles. Key to understanding the new economic geography of creativity and its effects on economic outcomes are the 3Ts of economic development:

- *Talent*: or creative share of the workforce, based largely on demographic, educational, and occupational characteristics
- *Tolerance*: or diversity, based on indexes related to sexual orientation and bohemianism culture
- *Technology*: or innovation, measured by patent activity and the high technology share of the economic base

Each T dimension is a necessary—and by itself insufficient—condition to attract creative people, generate innovation, and stimulate economic growth. Richard Florida combines the 3Ts into a Creativity Index, to rank the creative potential of metropolitan regions. Additionally, this expands on a fourth T—*Territory*—to account for territorial and communal amenities.

While for Florida high impact entrepreneurship that leads to economic growth is fueled by Talent, tolerance and technology, including knowledge spillovers, for Edward Glaeser (2005), it is human capital not creativity that drives urban growth. When one includes the 3Ts in a regression along with human capital the creativity variables become insignificant. The policy conclusion from this is that once you control for human capital in the growth of cities other things matter much less. In fact education becomes the most important variable, much more important than a funky downtown. As such mayors are much better off focusing on human capital, education and training than on a quick fix creating a funky, hip Bohemian downtown.

6.2.3 Entrepreneurial Skills and Human Capital

There are, however, attributes of American education—principally at the primary and secondary level—that have led to concern about the future prospects of the U.S. economy and its continued leadership in innovation. As a number of recent reports have documented:[19]

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[19] See, e.g. National Center on Education and the Economy, *Tough Choices For Tough Times: The Report of the New Commission on the Skills of the American Workforce* (Washington, D.C.: National Center on Education and the Economy, 2006) and National Academy of Sciences, *Rising Above The Gathering*

- American pre-college students lag well behind students in other countries in international tests in mathematics and science.

- Nearly one-third of high school students in this country do not finish within the standard four years or drop out altogether.

- There are wide and, by some accounts widening, disparities in educational achievement among students of different racial, ethnic, and socioeconomic backgrounds in this country.

These trends have raised doubts in the United States about the continued ability of the U.S. economy to prepare a creative and skilled workforce that will generate future innovation and growth. But, at the same time, there is also reason for concern that educational systems in the rest of the world – where students may be outperforming U.S. students on standardized tests – may be ineffective in fostering the imagination and creativity that are indispensable for invention and innovative entrepreneurship. The fact is there is no systematic information that tells us how these abilities can be imparted effectively by the educational process. Indeed, there is evidence suggesting that many current educational practices in the United States, and perhaps so in many other countries, inhibit the heterodox thinking that such progress requires.[20]

This important issue – exactly how education should be structured to maximize creativity, skills and knowledge of students all at the same time -- has not been adequately explored and is characterized by divergent conclusions. On the one hand,

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Storm: Energizing and Employing America for a Brighter Economic Future (Washington, D.C. : The National Academy of Sciences, The National Academy of Engineering and The Institute of Medicine, February 2006).

[20] We are grateful to Professor Melissa Schilling of NYU for the material in the following paragraphs.

there are studies suggesting that before being able to contribute a significant insight to a field, an individual must first have substantial preparation in that field, and have built huge reservoirs of discipline-relevant information (Simonton 1999a, 1999b). Simon and Chase even quantified the required expertise by studying chess grand masters and other experts, concluding that individuals need approximately 50,000 "chunks" of richly connected information before making a fruitful discovery (Simon and Chase 1973). Other researchers have observed that individuals typically require at least a decade of intense study in a particular domain of knowledge before they can provide any significant contribution in that domain (Gardner 1993; Hayes 1989;). The more knowledge individuals possess in a particular domain, the more likely they are to understand the nature of the relationships among different ideas. As associations within the domain are challenged or reinforced over time, the more accurate recognition of the pattern of associations should become, and the more efficient the individual should be in searching for relationships among them (Dosi 1988; Harlow 1959).

On the other hand, there are studies suggesting that an individual's substantial previous experience in a domain can also inhibit creative problem solving (Wertheimer 1945/1959). Individuals who acquire highly specialized knowledge within a particular domain are prone to "einstellung," whereby learners who have earlier learned to solve a problem in a particular way will adopt a pattern that mechanizes their problem solving, inhibiting them from arriving at creative solutions (Luchins 1942; Mayer 1995). Many forms of learning can become routinized to an extent that, when faced with a variant issue, individuals automatically recall and tend to use a representative approach; indeed, it is difficult for them not to do so (Gick and Lockhart 1995). When individuals have

well-reinforced expectations about the direction a search path should take, this constrains their ability to explore different possibilities, and may prevent them from generating "pre-inventive forms" with a more natural or universal structure (Finke 1995: 262). Similarly, individuals who are deeply immersed in the established orthodoxy of a field of study may find their creativity stifled by extant paradigms and institutional pressures to conform (McLaughlin 2001).[21]

Extensive training in a particular field can thus impede cognitive insight. Here it is notable that both Einstein and Piaget claimed that formal schooling detracted from their intellectual development (Feldman 1999). Sociologically inspired work on the "marginal man" provides support for that contention. This work argues that marginal intellectuals (those who may participate in multiple intellectual domains but are central to none) are more likely to introduce creative breakthroughs than well-established experts in those fields (Ben-David and Collins 1966; Dogan and Pahre 1990; Edge and Mulkay 1976; Martindale 1995:252; McLaughlin 2001). The two primary theoretical explanations for this relationship between marginality and innovation are that marginal scientists use different assumptions or skills than specialists in the field, permitting more novel outcomes, and marginal scientists are motivated to undertake riskier areas of research as a faster route to recognition and resources (Gieryn and Hirsh 1983).

Consistent with this line of reasoning, an early study by Channon (1979) observed that entrepreneurs were likely to come from relatively humble origins, and receive an education through secondary school only. Similarly, a study by Collins and Moore (1970)

[21] This is also argued by Simonton, who pointed out that excessive specialization can inhibit cognitive insight: "Too often, persons fail to make significant insights because they exclude whole domains of elements from entering into the combinative hopper. Yet what appears logically irrelevant may actually provide the missing piece of the puzzle" (1995:473).

concluded that it was common for entrepreneurs from relatively disadvantaged backgrounds to pursue aggressive, often flamboyant strategies, presumably in order to achieve recognition and esteem. Earlier writings, some of them also rather dated, also support the idea that individuals who are "self made" are more risk prone and more likely to pursue innovation than people who receive a professional education in management (such as an MBA) (Collins and Moore 1970; Hambrick and Mason 1984).

In any event, the U.S. educational system is a long way from embracing entrepreneurship and innovative thinking as central organizing principles.[22].At best, it seems generally agreed that a central task for educators and policymakers is to give students the key skills to thrive in any work environment—reading, math, science, technology and history—and, where possible, also to nurture whatever creative and entrepreneurial skills each of us has by birth. Programs that teach basic entrepreneurial skills to middle and high school students may be especially valuable for children from disadvantaged backgrounds, and may be one way to encourage their interest in academic achievement more generally. At the college level, more universities have been attempting to infuse entrepreneurship and creativity more deeply into their curricula, for both students majoring in business and those in other subjects.

But the conclusion suggested by the preceding review of the evidence is that we do not yet have adequate information on the best ways to organize a comprehensive educational system that best prepares future inventors and innovative entrepreneurs. This, surely, is an arena in which the gathering of evidence and rigorous research is a priority.

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[22] For an excellent set of papers on how to enhance entrepreneurship in K–12 education, see Frederick Hess, ed., *Educational Entrepreneurship: Realities, Challenges, Possibilities* (Cambridge, Mass.: Harvard Education Press, 2006). See also Gordon, Robert, et al., "Identifying Effective Teachers Using Performance on The Job," Hamilton Project White Paper 2006-01, The Brookings Institution www.brookings.edu.

Arguably, the federal government has the resources and is in the best position to fund this research, while taking additional steps – such as funding higher salaries for math and science teachers – to help reverse the disappointing national trends in math and science achievement by students in primary and secondary schools.

6.3. Policies Promoting Innovation and Entrepreneurship

Even when invention is abundant, innovative entrepreneurship is at its most effective when there are strong incentives for the effective utilization and commercialization of new products, new productive techniques and new forms of organization. This requires institutions, such as the patent system, that ensure that inventors and their entrepreneur partners are not precluded from appropriate compensation by unrestricted and rapid imitation. But, at the same time, it is important that dissemination and widespread utilization of significant novelties not be handicapped and delayed. Unimpeded entry is particularly critical to advancing innovation, given such evidence that firms with less than 500 employees produce 13–14 times more patents per employee than larger firms, and that these patents are twice as likely as patents taken out by large firms to be among the 1 percent most cited (citations being a good measure of the commercial importance of a patent).[23]

At the same time, it is essential that *only truly non-obvious innovations* receive patent protection and that period of exclusive property protection is not too long. Otherwise, the legal system will enable patent-holding firms to impose legal roadblocks in the way of new entrants, effectively handing out monopolies in exchange for little public benefit and making the economy less competitive and less innovative.

[23] See SBA Office of Advocacy, "Frequently Asked Questions," available at www.sba.gov/advo.

There is mounting, though not yet irrefutable evidence, that intellectual property protection, particularly patents, may have tilted too far in the monopoly direction—that is, toward creating inappropriate roadblocks that impede the competition that entrepreneurs and other entrants into a field can provide (Jaffe and Lerner 2004). [24]

A significant problem here is the enormous pressure on an overburdened and overworked patent examiner staff at the United States Patent and Trademark Office (USPTO) to review the increasing number of patent applications—expected to top 400,000 in 2007—that are filed each year. With limited resources, patent reviewers have little time to do a thorough search of "prior art" to make well-informed decisions in every case as to whether a patent application represents something that is truly novel. This can lead to the grant perhaps of even an increasing number of undeserving applications, a problem exacerbated by the fact that patent examiners' decisions have a legal presumption of validity if later challenged in court, an expensive and time-consuming process. Indeed, the profusion of patent applications in the U.S. is perhaps ascribable to the ease with which the low invention standard enables them to be obtained.

Various proposals for improved effectiveness of patent systems in promoting innovation have been under discussion. These include increased funding for the Patent Office; allowing third-party challenges to applications at some point *before* the patents are actually awarded (on the assumption that such challenges will be less costly and time consuming than post-award lawsuits); adoption in the U.S. of the "first to file" system for awarding patents that is prevalent in most countries rather than the "first to invent" standard applicable in the United States; limiting "patent trolls" (firms that acquire

[24] Acs and Sanders (2008) develop a model that supports Jaffe and Lerner like conclusions about intellectual policy protection.

patents solely for the purpose of licensing them rather than commercially developing patented technologies) to obtaining damages, but not injunctions, for infringement; and changing the measure of damages for infringement from lost profits to loss of reasonable royalties.

The implications of these reforms for innovation, especially by entrepreneurs, at this point are unclear. For while strong patent protection can help entrepreneurs, it also can deter them from entering fields where incumbents have patent protection that may be of dubious merit but deep pockets to prosecute any litigation for infringement. Given the uncertainties, such ideas require further scrutiny before policymakers embrace them.

Moreover, these proposals do not seem to address the fundamental dilemma – provision of protection incentives to the innovator while not at the same time inappropriately impeding dissemination and rapid replacement of the obsolete. The remarkably rapid rate of expansion of voluntary (and compensatory) licensing in practice suggests that this merits encouragement as a means to overcome the basic conflict between invention incentives and facilitation of dissemination. One heterodox proposal may be worth considering here: differential taxation of the earnings of intellectual property, favoring the earning of license fees, particularly if they are set to cover no more than the opportunity cost of the grant of a license fee by the IP holder.[25]

6.4 Capital Markets Regulation and Finance

It is well accepted that access to finance is critical for most, if not all, entrepreneurial ventures. This is the rationale for the creation for the Small Business Administration, which guarantees loans for smaller enterprises. Over the years, however,

[25] On this, see Baumol and Daniel Swanson (2005).

financial markets and credit in particular have been "democratized" by the increased availability of financing through mortgages and credit cards, which provide many start-ups with their initial financing. In addition, the business lending market too has been the subject of much innovation, as well. In light of these developments, the continued role for the SBA is a subject of some debate**.** [26]

Focusing on innovative entrepreneurs, policy-related financing issues are not so much related to launch – there has been explosive growth in the amounts of venture and angel capital over the past several decades – but to the cost of public financing versus other sources. During the Internet boom of the 1990s, the favored course of financing for successful entrepreneurs, and the venture capitalists who often backed them, was "going public" through an initial public offering (IPO). The "bust" of this boom, reflected in the peaking of stock prices for technology companies in particular in the spring of 2000 has changed both the venture capital market as a source for early stage financing, as well as the preferred means of "exit" for initial equity funding sources of innovative start-ups. And here, there are ample public policy issues that remain to be explored.

The main issues relate to the policy reforms that were enacted in the wake of the various corporate financial reporting scandals that surfaced shortly after the Internet bust: the Sarbanes-Oxley Act of 2002 enacted by the Congress and related changes in listing requirements by the various public company exchanges. Among the reforms were new corporate governance rules (such requiring majorities of boards of directors to be "independent"); new certifications required of chief executive officers relating to the

[26] One particularly important aspect of the financial system is the law. A large literature has examined the relationship between law and finance and its effects on firm performance (Rafael La Porta, Florencio Lopez-de-Silanes, Shleifer, and Vishny 1998; Asli Demirguc-Kunt and Vojislav Maksimovic 1998; La Porta, Lopez-de-Silanes, Shleifer, and Vishny 2000; Hernando de Soto 2002).

reliability of their companies' financial statements, and substantial criminal penalties in the event those financial statements are in error; new obligations for auditors to review companies' internal controls; and a new system for overseeing auditors, as well as restrictions on the activities of auditing firms designed to ensure their independence.

Space does not permit a full review of the extensive and growing literature on the wisdom and effects of these reforms. Three of the most widely publicized and debated assessments, released in late 2006 and early 2007, separately addressed the question whether the combination of the recent reforms, coupled with trends in shareholder litigation and SEC enforcement were driving U.S. and foreign companies to list their shares on exchanges outside the United States, to the detriment of the securities and related industries in New York in particular.[27] Whatever one may believe about the appropriateness of this particular goal, these reports raise several important questions about the impact of these recent reforms on innovative entrepreneurship.

In particular, the founders and initial investors in highly innovative and successful entrepreneurial endeavors in the 1990s often liquefied their initial investments through initial public offerings, or IPOs. Since the bursting of the "Internet bubble" in stock prices in April 2000, other forms of "exit" – sales to other large companies or to private equity firms – have become increasingly popular. To what extent have the recent corporate governance and accounting reforms contributed to this trend? And regardless of the cause, what has been and is likely to be the effect of this shift in exit patterns for entrepreneurial companies? Specifically, does the sale of a young innovative company to a more established company dull its entrepreneurial spirit, or does it provide the talent and capital that the enterprise requires to grow and more rapidly reach its potential?

[27] Citation to reports to come [Capital Markets Commission, Schumer-Bloomberg; Chamber of Commerce]

Similar questions can be asked of the impact of sales of companies to private equity firms. Although it is likely that several more years of market experience will be required to yield the data to permit definitive answers to these questions, it is not too early to begin tackling them.

6.5. Regulation, Litigation, and the Rule of Law

All economies and the actors within them need rules of the road to guide behavior. In market economies, legal protections of property and contract are critical, especially to entrepreneurs who could not and would not undertake the risks of launching their enterprises without such protections.

At the same time, even with secure rights of property and contract, markets can fail to deliver efficient outcomes. Information about product or workplace risks may not be voluntarily disclosed. Firms can pollute, safe in the knowledge that it is generally too expensive and time-consuming for those harmed to negotiate a better outcome collectively. These are among the reasons governments regulate the activities of private firms and why the legal system permits victims of negligence, whether committed by individuals or companies, to seek compensation for their harm.

Entrepreneurship and business activity generally can suffer, however, if regulation and litigation are carried too far or pursued in ways where costs outweigh benefits. An oft-cited illustration is provided by the liability rules, resulting in verdicts that set norms for behavior by firms and individuals throughout the economy. An inherent difficulty besetting such “regulation-by-litigation” is that the rules that emerge from individual fact-specific litigated cases are decided by randomly chosen juries, in

cases that are randomly filed across the country, or are filed in strategically selected locations by attorneys. In a national economy, it is thus somewhat anomalous that a jury in one particular location can effectively set national norms, with the most restrictive venue thereby effectively setting the national norm. Enterprising plaintiffs can take advantage of this decentralized legal system and find hospitable locales for suing companies doing business nationwide, thereby engaging in a process of "forum shopping." It serves to encourage the activities of enterprising law firms whose rent-seeking takes the form of launching litigation with financially promising prospects.

Steps have been taken in recent years to reduce uncertainties about firms' exposures to liability awards, thus improving the climate for entrepreneurial endeavors. Although, in 2005, the U.S. Congress enacted legislation to limit forum shopping in class actions filed in state courts, it is possible that some degree of forum shopping will persist in federal courts. Various states have enacted caps on damage awards and other liability-related reforms that have taken some of the uncertainty out of liability litigation.

To conclude our discussion of pertinent policy analyses found in the literature, we must recognize that the preceding listing may well appear to be a somewhat disjointed and weakly interrelated miscellany of issues. But there is a critical common element-- the focus on the institutional arrangements so effectively pointed out in the work of Douglas North, and the significance of the resulting structure of the available incentives that is emphasized by William Easterly.[28] Accordingly, all of the proposals described here share this basic purpose, modification of the institutions that constrain and drive the economy and that induce its entrepreneurs, in order to focus their activities even further upon

[28] Also see Acemoglu and Johnson, 2005.

achievements that contribute effectively to economic growth and to the public interest more generally.

7. Concluding Observations on the Literature on Entrepreneurship

The standard body of economic literature has long suffered from a bifurcated attitude toward entrepreneurship. On the one side, it has long treated entrepreneurs, as it were, with deference and respect. Frequently we have been told that the economy is driven by four "factors of production:" land, labor, capital and entrepreneurship. It is even hinted that among these the entrepreneurs are the leaders, for to them fall the tasks of getting things started, of formation of the firms that are the sources of all output, and the introduction of invention into practical activity, surely the primary source of the economy's growth. But for a long period after Schumpeter's contribution, having conceded this, the literature erased the entrepreneur from further consideration. He was relegated to the role of invisible man in the writing of our colleagues. Admittedly, this was not caprice or prejudice, but the difficulty of providing any generalizations about a subject so inherently heterogeneous.

But all this has changed in the past few decades. There has emerged a torrent of empirical analysis of the entrepreneur's attributes and activities, on business dynamics and employment growth. This essay has dealt with the theoretical incursions, and has focused on the literature accumulated to date about the three pillars of high impact entrepreneurship—labor, innovation and finance—and its implications for policy. We trust that far more work will be done on entrepreneurship – theoretically, empirically, and in the policy realm – in years to come. There are even signs of the beginnings of a formal micro-theory of entrepreneurship that promises to incorporate the subject into the body of

value theory, and makes it possible to derive formal theorems, its behavior, its revenues and its pricing equilibria.

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Table 1: Firm Births and Firm Birth Rates; by Industry; 1990 to 2003

	1989-1990	1990-1991	1991-1992	1992-1993	1993-1994	1994-1995	1995-1996	1996-1997	1997-1998	1998-1999	1999-2000	2000-2001	2001-2002	2002-2003
IPOs[b]														
Total IPOs	103	278	392	487	405	457	672	472	283	476	380	81	66	63
IPO Rate	0.002%	0.006%	0.008%	0.009%	0.008%	0.009%	0.012%	0.009%	0.005%	0.009%	0.007%	0.001%	0.001%	0.001%
Manufacturing[d]														
Firm Births	32,600	29,821	29,590	31,320	30,141	29,847	29,703	28,810	26,032	22,263	21,586	20,918	19,687	20,008
Birth Rate	0.6%	0.6%	0.6%	0.6%	0.6%	0.6%	0.6%	0.6%	0.5%	0.4%	0.4%	0.4%	0.4%	0.4%
Information and Communications Technology[d]														
Firm Births	1,243	1,125	977	1,142	1,002	907	930	1,108	882	778	840	562	513	486
Birth Rate	0.02%	0.02%	0.02%	0.02%	0.02%	0.02%	0.02%	0.02%	0.02%	0.02%	0.02%	0.01%	0.01%	0.01%
Biotechnology[d]														
Firm Births	46	70	80	86	67	76	129	146	122	106	117	93	93	106
Birth Rate	0.001%	0.001%	0.002%	0.002%	0.001%	0.002%	0.003%	0.003%	0.002%	0.002%	0.002%	0.002%	0.002%	0.002%
Total[a]														
Firm Births	584,892	541,141	544,596	564,504	570,587	594,369	597,792	590,644	589,982	579,609	574,300	585,140	569,750	612,296
Birth Rate	11.6%	10.8%	10.7%	10.9%	10.9%	11.2%	11.0%	10.7%	10.6%	10.4%	10.2%	10.4%	10.0%	10.7%
Existing Firr	5,031,094	5,012,911	5,067,190	5,159,826	5,240,658	5,330,130	5,435,232	5,510,418	5,547,310	5,575,064	5,617,507	5,621,295	5,669,415	5,732,755

Notes:

Existing firms and births are based on establishment data covering the continental U.S. excluding Montana, Idaho, South Dakota, North Dakota, Kansas, and Nebraska.

Firm births are original (i.e., single) establishment births based on payroll activity betw een mid-March of the beginning year and mid-March of the ending year of the period.

Existing firms are employer firms based on mid-March payroll at the first quarter of the beginning year of the period.

Birth rate is the number of firm births divided by the number of existing firms.

Because of the methodology used in determining firm births, the US Census Bureau considers these figures to be estimates.

Manufacturing is defined as SIC 20 (i.e., SIC 2000 - 3999) for ending years 1990 to 1998 and as NAICS 31-33 for ending years 1999 to 2003.

ICT is defined as SIC 357, 366, and 367 for ending years 1990 to 1998 and as NAICS 3341, 3342, and 3344 for ending years 1999 to 2003.

Biotech is defined as SIC 2833, 2834, 2835, and 2836 for ending years 1990 to 1998 and as NAICS 3254 for ending years 1999 to 2003.

Data sources:

[a]Small Business Administration, "U.S. births, deaths and job creation, 1989-2003", http://w w w .sba.gov/advo/research/dyn_b_d8903.pdf

[b]Professor Jay R. Ritter, 2007, "Some Factoids About the 2006 IPO Market", http://bear.cba.ufl.edu/ritter/New %20Folder/IPOs2006Factoids.pdf

[c]Small Business Administration, "Employer Firms, Establishments, Employment, and Annual Payroll by Firm Size, and State, 2004", http://w w w .sba.gov/advo/research/st_04.pdf

[d]US Census Bureau, "County Business Patterns", custom unpublished tabulations, Larry Plummer's dissertation

Table 5: Policies in the Managed and Entrepreneurial Economy

Federal Policy	Managed Economy	Entrepreneurial Economy
Tax Policy	High marginal taxes Income tax High capital gains tax	Low marginal taxes Consumption tax Low capital gains tax
IP Policy	No markets for IP	Very important as markets for knowledge have been created
Barriers to Entry	High	Barriers to entry are not as important since lower capital requirements have made easier to enter business.
Technology Transfer Policy	Mostly in large firms	Bayh-Dole needs to be more effective International technology transfer
Health Policy	Employer provided health care	Universal coverage at the state level
Regulation/Litigation	High regulation	Deregulation Regulatory flexibility Sarban-Oxley exemption for small firms ($125 million)
Finance	Mostly for large firms	Financial system works well Large source of private equity, some liquidity constraints and some pockets of discrimination need to be addressed.
K-12	Basic skills Choice not important	More math and science Choice is crucial
Higher Education Policy	Entrepreneurship education in business school only	Entrepreneurship education spread across university
Science/R&D Policy	Federal R&D high Decline in federal funding	Access to R&D by small firms More funding for universities
Immigration Policy	Not very important	Very important at the low education and the very high education level
Trade Policy	Protection Little outsourcing	Free trade Lots of outsourcing
Social Policy	Government constraints on wealth and income through regulation, anti-trust and government ownership at the firm level. High levels of income redistribution and wealth tax.	The focus needs to be on the individual. Wealth needs to be reconstituted through philanthropy to create knowledge, opportunity, and equity.