WHO JUMPS INTO THE SEA AND WHEN?: ENTREPRENEURSHIP AND POLICY CHANGE IN CHINA

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Abstract

We present a unique dataset of entrepreneurs from a prestigious technology-based university in China. This paper examines trends in entrepreneurship among alumni graduating from a technical university from the 1950s up to 2007. This timeframe permits us to analyze patterns in the human capital and work history characteristics of those becoming entrepreneurs in response to important policy changes during market reform. Utilizing survey responses from almost 1,000 alumni we analyze how policy changes may have been associated with differing work histories for the individuals engaging in entrepreneurial behavior over time. New company formation rates by Chinese university alumni have grown dramatically over the past several years and with policy changes, the backgrounds of those entrepreneurs have changed to include broader segments of society. The results suggest that for those deciding to form companies in recent years (after the 1999 policy changes), relatively fewer were transitioning straight from academia and there was more entrepreneurship among those who have held academic jobs in the past. In addition, the more recent founders were individuals who tended to hold jobs for longer periods, they were more likely to have achieved higher salary levels, and more of them grew up in lower economic status families.

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Introduction

There is an argument that organizations create their own competition (Freeman, 1986, p. 39). Most new ventures are founded by teams and individuals with some prior employment experience (Cooper, 1985; Robinson & Sexton, 1994). Employment in existing organizations gives workers a chance to know about opportunities for un-served markets, to investigate existing technology and its limitations, and to gain the skills and capabilities to commercialize technology to serve those markets better than existing firms. Scholars have theorized about the conditions under which employees choose to commercialize their ideas in external spin-offs and start-ups rather than within the firm (Anton & Yao, 1995; Klepper & Sleeper, 2002; Klepper, 2001; Klepper & Thompson, 2006).

This paper proposes to build on the stream of literature examining career history and entrepreneurship by examining the impact of human capital generated through education and work history, and specifically how policy changes influence the work history of those choosing to become entrepreneurs. There is a longer tradition that has emphasized both the characteristics of the individuals (Evans & Leighton, 1989; Shane & Khurana, 2003) as well as parent firms (e.g., Gompers et al., 2005) as important determinants of the likelihood to spin off new ventures. Taking a broader view, there are four classes of explanations for why certain individuals become entrepreneurs while others do not.

The first class of explanations focuses on demographic factors, and spans areas such as religious background (McClelland, 1961) and the presence of self-employed parents (Blau & Duncan, 1967; Dunn & Holtz-Eakin, 2000; Roberts, 1991; Sørensen, 2007b; Utterback, Meyer, Roberts, & Reitberger, 1988). Other factors include ethnic and immigration status (Saxenian,

2002; Utterback, Meyer, Roberts, & Reitberger, 1988) gender (Buttner & Moore, 1997), and age (Levesque & Minniti, in press; Roberts, 1991). A second set of explanations (which we will have less to say about in this work) for individual differences in transitioning into entrepreneurship emphasizes cognitive factors (Mitchell, Smith, Seawright, & Morse, 2000). There is a literature on cognitive ability in particular as it relates to entrepreneurs (Frese, Krauss, Escher, Grabarkiewicz, Friedrich, & Keith, 2004; Hunter, J.E. and Hunter, R.F., 1984; Ray & Singh, 1980). A recent edited book provides a summary of the historical literature on personality traits and entrepreneurship, previous work, and current methodologies (Baum, Frese, & Baron, 2007). A third class of explanations has dealt with opportunity costs and access to financing. We defer discussion of this area to later in the section on controls.

Another class of explanations for transitioning into entrepreneurship and a focus of this study has emphasized training and career histories. Recent studies have connected educational training with entrepreneurship (Baumol, 2004; Murphy, Shleifer, & Vishny, 1991).[2] Roberts (1991) shows a curvilinear relation between education level of high-tech entrepreneurs and their firms' overall performance, with Master's degree recipients doing best. Previous work has also shown a link between education as human capital and survival of entrepreneurial firms (Bates, 1990). Within this literature on training and prior experience, a rapidly growing area of literature examines prior career experience and its impact on the likelihood of transitioning to entrepreneurship and on performance (Beckman & Burton, 2007; Boeker, 1989; Haveman, 1993; Haveman & Cohen, 1994; Phillips, 2002). A large section of this work has been interested in the knowledge, skills, or routines that employees inherit from their firms (Agarwal, Echambadi, Franco, & Sarkar, 2004).

[2] The authors acknowledge that the direction of causality may be reversed here, however: countries with faster growth may provide more engineering jobs and may support more engineering education.

This paper builds on these particular lines of work and pursues the question of what types of work experience result in entrepreneurs emerging from certain types of work experiences and not others. We are particularly interested in how the result changes over time and with governmental policy intervention. To be able to begin to move towards disentangling the causal mechanisms, we need an empirical setting where individuals are randomly assigned to different work experiences and then tracked over time. Lacking such an ideal experimental setting, we will largely be limited to examining patterns and correlations in the data of what types of people select into certain types of organizations. Fortunately, in the Chinese context, we can exploit a number of major policy changes over the years which have largely had the effect of legitimating entrepreneurial activity and of moving towards a more market-oriented economy. While we lack an experimental design with a natural control group, such as if we had a regional level policy change, we can explore the effects of national level policy changes over time. Also, we have a set of controls and unique data which will allow us to build on the existing literature in this area and add measures that the theoretical literature and previous empirical work has identified as important. An important question is why should China's institutional and entrepreneurial environment yield different results than that of the US or Europe?

China's Technical and Entrepreneurial Labor Market

Despite the fact that the U.S. share of the world's science and engineering graduates is rapidly declining (a 15% reduction in world share by 2010) and the greatest growth is in China, the vast majority of the related literature on entrepreneurship and innovation focuses on the U.S. and Europe. Further, it is clear from work in institutional economics and cross-cultural psychology that the levels and modes of entrepreneurial activity should be affected by the surrounding institutions, norms, and legal systems (Busenitz, Gomez, & Spencer, 2000; Licht &

Siegel, 2006). High-tech entrepreneurship and innovation in transitional and developing countries are rarely part of the scholarly dialogue of the field (Lu 1997, 2000 are notable exceptions). Puga and Trefler (2005) in the course of their discussion on the rise of incremental innovation in low-wage countries point out that much of our current thinking is influenced by Vernon's (Vernon, 1966) product-cycle model where products are developed in rich countries and moved off-shore to low-wage countries. However, massive changes are under way in international trade and development. China went from almost no science and engineering doctorates in 1975 to over 9,000 science and engineering PhDs in 2003 (Freeman, 2005). At that rate, by 2010, China will produce more technically-trained doctorates than the US. So while the current state of scientific research in emerging disciplines such as stem-cell research may be marginal, it is an up-and-coming player with a burgeoning pool of talent even in areas that are cutting-edge in the US (Murray & Spar, 2006).

Obviously it would be remiss to fail to note that institutional change and economic development has not been uniform across China (Nee, 1996). Certain geographic areas, such as Zhejiang and Jiangsu provinces have a long history of private enterprise. Coastal regions and the Special Economic Zones were targeted by the central government for market reforms. Combined with the fact that enforcement of reforms has not been immediate or uniform either makes using China's economic reforms as natural experiments as many social scientists have advised, challenging to say the least.

Such changes are happening rapidly especially in China's policies regarding property rights and institutions with important and as yet rarely documented implications for firm strategies, innovation and entrepreneurship (Cull & Xu, 2006; Nee, 1998; Nee, 1992; Nee, 1996; Peng & Heath, 1996; Steinfeld, 2007). Interestingly, China's new private entrepreneurs appear

to have different values (Holt, 1997) and some influence on the political process and debate within the country (Roberts, Unpublished doctoral dissertation). Greater property rights protection and greater fairness (less corruption) in 33 emerging markets in Europe has been found to increase new firm founding and firm growth rates (Desai, Gompers, & Lerner, 2003). However, their analysis shows that the institutional effects appear to be of second order in more developed economies. In post-soviet and formerly-communist countries, insecure property rights have been argued to be more inhibiting to entrepreneurship than capital constraints (Frye & Shleifer, 1997; Johnson, McMillan, & Woodruff, 1999; Johnson, McMillan, & Woodruff, 2000; Johnson, McMillan, & Woodruff, 2002; Shleifer, 1997). Chinese entrepreneurs have been shown to use specific strategies to overcome limited property rights protection and constrained access to bank loans (Bai, Lu, & Tao, 2006). Obukhova (2007) finds that depending on their training and overseas work and educational experiences, Chinese entrepreneurs engaged in two different entrepreneurial strategies which she terms technological entrepreneurship and network entrepreneurship. These strategies for firm formation which hinge on whether innovation or the individual's business network is driving performance, she argues, resulted in important implications for the performance of these firms over time.

However, as noted above, innovation and high-tech entrepreneurship are rarely part of the discourse in relationship to China (for exceptions, see (Tan, 1996; Tan, 2001; Tan, 2007). For these reasons and the size of the Chinese market along with the important role it will continue to play in the world in coming decades (Shirk, 2007), we chose alumni of the top technical university in China as the empirical setting to test this research question. Our interviews suggested that investors in China see fewer experienced entrepreneurs and must rely more on pre-founding work experience outside of an entrepreneurial context to judge the quality

of entrepreneurs. It is not straightforward to assign a direction to how the impact of work experience may differ in China as compared to the West. Hopefully our results will inspire future scholars to examine these questions.

THEORY AND HYPOTHESES

The purpose of this study is to provide a rare view of entrepreneurship patterns among graduates of a technical university in China over several decades. This research serves to advance our knowledge of how founders have changed over time. Rather than generating empirical predictions from the literature, we focus on what we found in the data on the evolution of entrepreneurship over time and discuss implications for future research on technology entrepreneurship outside of the US and Europe.

Although one limitation of our data is that it is cross-sectional in the sense of coming from a survey given at one point in time, on the other hand, our respondents graduated from the university and founded companies over an impressive span of time. Such data allows us the opportunity to look at national level natural experiments over time. While none of these experiments are perfectly exogenous and we lack a true control sample, we can examine changes over time before and after such important policies as the 1998 promotion of venture capital and private equity investment, the Chinese Academy of Sciences innovation program starting in 1998, the 1999 legalization of private firm ownership, or joining the WTO in 2001. In general, there have been roughly five eras of Science and Technology policy reform since the "open door policy" began in 1978. These policy changes are generally seen to have had the effect of legitimating private entrepreneurship and moving from a government focus to a more firm and market centered innovation system (OECD Review, 2007). Thus, if entry is rational, then the

policy changes (if they provided legitimacy and increased the returns to entrepreneurship) should have had the effect of broadening the number of individuals engaged in entrepreneurship. Whether this broadening is among the same types of people who were already becoming entrepreneurs or whether it caused people with different human capital and work experiences to become entrepreneurs is largely an empirical question.

The next section describes the empirical context and the variables used followed by the analysis and results and finally the discussion and conclusion sections.

METHODOLOGY

The empirical context for our study is a sample of alumni from a prestigious university in China. Research universities are important institutions for educating technologists and providing a setting for students and faculty to exchange ideas on entrepreneurial opportunities. In the U.S., alumni from leading research universities are responsible for numerous new ventures. A survey of alumni has the advantage of being a well-defined population, not selected based on success in entrepreneurship or in traditional employment. Such a survey allows us to track the work experiences after graduation of both entrepreneurs and non-entrepreneurs.

We have undertaken a survey of alumni from the top engineering university in China, Tsinghua University. Located in Beijing, China and established in 1911, Tsinghua University is regarded as one of the best and most selective universities in China. The Tsinghua Alumni Association has assisted with endorsing, mailing, and collecting the survey results. A survey was sent to all Tsinghua University alumni with an address on record (a total of 30,000 according to the alumni association). Our dataset includes alumni across all schools at Tsinghua. The respondents could mail back the paper copy or complete the survey online. In the initial section,

completed by all alumni, a question was asked about participation in founding a firm. Currently, we have received 1,422 surveys online and via paper and email (341 entrepreneurs). Since the hard copy data is still being collected and compiled, the results below include 994 alumni responses received via the online survey. Of the 994, once we eliminate (for certain analyses) the alumni who started their firms outside of China, our final number of observations is closer to 500 alumni who responded to all of the variables used in the analysis. So we expect the sample sizes to increase significantly since our survey efforts are still underway. Nonetheless, the response rate is on the low side.[3] One approach to assessing nonresponse bias involves extrapolation. This method is useful when a survey of nonrespondents cannot be conducted. It rests on the assumption that individuals who respond less readily resemble nonrespondents, so a common method is comparing characteristics of respondents who answered quickly with those who answered following a reminder or stimulus at a later time.[4] Future drafts will also check for respondent bias between online survey respondents and the general characteristics of Tsinghua alumni.

In addition to the survey data, the Tsinghua data includes extensive notes from interviews with 42 people (including entrepreneurs, investors, and government officials). The interviews

[3] Organizational surveys often have low response rates, particularly those of top management members. While low responses rates can introduce bias, we examine specifically whether there is systematic bias in respondent characteristics (Tomaskovic-Devey, Leiter, & Thompson, 1994). Response rates to surveys of managers in China have, at the most, been in the 30-40 percent range (Peng & Luo, 2000; Tan & Litschert, 1994). Zhejiang University told us that when they survey their alumni response rates of 5% are average. In the US, response rates for entrepreneur surveys are often lower than those for managers.

[4] Appendix A shows *t*-tests of the null hypothesis that the average (observed) characteristics of the responders and non-responders are the same statistically. Only the variables *gpa rank* show statistically significant differences in means at below the 10% level. This variable does not become statistically significant in the analysis. Further analysis indicates that there are some differences in the entrepreneurs between those who responded to the Founder's survey and those who only responded to the alumni survey. However, since a future paper will examine heterogeneity in performance among the entrepreneurs, we defer the associated discussion. Thus far, lack of differences early respondents and those who responded after prompting gives us confidence that our results are not driven by respondent bias.

included 26 Tsinghua alumni entrepreneurs, 2 Tsinghua staff (TLO, Science Park), 5 Chinese venture capitalists (VCs), 2 Government officials, 3 Other Chinese entrepreneurs (non-Tsinghua), 2 MIT Alumni (non-entrepreneurs), and 2 Tsinghua alumni (non-entrepreneurs). Unfortunately the interview selection procedure could not be randomized. The Tsinghua Alumni Association set up interviews for us and we specifically asked to talk with high-tech entrepreneurs and some who were not successful. Undoubtedly our interview population is weighted towards more successful entrepreneurs and those whose ventures are more high-tech than the average alumni. In addition, the majority of our interviews were in Beijing, though some were in Shanghai and Xi'an as well.

Measures and Data

The dependent variable for our analysis is the event of an individual founding a firm for the first time. Figure 1 plots the percentage of respondents becoming founders by their graduation decade.[5]

Insert Tables 1 and 2 about here

Table 1 presents pair-wise correlations. Table 2 presents independent variable definitions and summary statistics. As one measure of a general human-capital investment we use *number of positions* which is defined as the number of different job functions the individual has worked in.[6] As an alternative measure we create *tech only* and *business only* as dummy variables indicating specialized technical work backgrounds and business backgrounds, respectively.

[5] Many of these individuals went on to receive graduate degrees as well. All of them received some degree from Tsinghua and the majority received a Bachelor's degree from Tsinghua.

[6] The way the variable *number of positions* is constructed actually biases the results in favor of confirming Lazear's theory since it could include positions the individual held after becoming an entrepreneur. For the vast majority of cases, the most recent job the individual held was as entrepreneur

ANALYSIS AND RESULTS

In order to better understand the comparative importance of these factors in firm formation, we turn to a multivariate regression analysis.[7] The empirical strategy is to look at changes over time, as China implements policies aimed at market reform, in which types of people begin to become entrepreneurs. Therefore, our empirical approach is two-fold. First, we examine birth year cohorts to see how changing economic and policy conditions may have affected who became an entrepreneur (regardless of when the founder occurred) for three roughly equal sized Bachelor's graduation year cohorts from 1947 to 1992, 1993 to 1999, and 2000 to 2007. Second, regardless of graduation year cohorts, the characteristics of those founding companies in more recent years (such as after policy changes) may be different from those who founded companies in earlier years. To examine this aspect, we do a second analysis using multinomial logit to examine results by the founding year. The specification of the first logit model is as follows:

$$\text{Prob (founded a firm=1)/Prob(founded a firm=0)} = \exp(\alpha + \beta_1\text{'techonly}_i + \beta_2\text{'bizonly}_i + \beta_3\text{'numpos}_i + \beta_4\text{'avg\_tenure}_i + \beta_5\text{'lastjob\_acad}_i + \beta_6\text{'lastjob\_bus}_i + \beta_7\text{high\_gov}_i + \beta_8\text{low\_gov}_i + \beta_9\text{num\_positions}_i + \beta_{10}\text{everjob\_acad}_i + \gamma'X_i + \eta + \varphi + \varepsilon_i) \quad (1)$$

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so we do not believe this is biasing our results heavily, but for cases where individuals returned to regular employment it could bias the results in favor of confirming a generalist theory of entrepreneurship.

[7] Initially, we employed Cox (1972) hazard regression models for two reasons. First, the model is semi-parametric, so that we can estimate the impact of independent variables on the hazard of founding a firm while being agnostic about the baseline hazard function. Second, the model explicitly takes the timing of events into account (by estimating the probability of founding a firm in a given year conditional on not having founded a firm up until that time period), and adjusts for the right-censoring of the data. However, seminar participants encouraged the use of a simpler, more transparent analysis strategy so for this version we use logit and multinomial logit regressions.

Equation (1) specifies the probability of becoming an entrepreneur as a function of the observable characteristics and controls, denoted by the vector $\boldsymbol{X}$. We include $(\eta + \varphi)$ current region and size of city of birth fixed effects.

Insert Table 3 about here

Table 3 shows the results of three roughly equal sized Bachelor's graduation year cohorts. All models include dummy variables for the Bachelor's degree academic major, current region (state) and controls for the size of the city of birth (urban, rural, etc.).

Insert Table 4 about here

Table 4 shows regression results examining how individuals founding firms in more recent years differ in work experience from those founding firms in years prior to the most recent round of significant economic policy changes. Table 4 shows a similar set of three models to Table 3 in terms of the covariates, however we first run a multinomial logit, then report the elasticities since the coefficients are difficult to interpret, and finally run a simple probit as a robustness check. The specification for the multinomial logit is as follows in equation 2:

$$\text{Prob}\ (Y = j \mid X) = \Phi(\alpha + \beta_1\text{'techonly}_i + \beta_2\text{'bizonly}_i + \beta_3\text{'numpos}_i + \beta_4\text{'avg\_tenure}_i + \beta_5\text{'lastjob\_acad}_i + \beta_6\text{'lastjob\_bus}_i + \beta_7\text{high\_gov}_i + \beta_8\text{low\_gov}_i + \beta_9\text{num\_positions}_i + \beta_{10}\text{everjob\_acad}_i + \gamma' X_i + \eta + \varphi + \varepsilon_i) \quad (2)$$

Where *Y* equals 0 if the individual never founded a firm, equals 1 if the founding occurred prior

to 2000 and equals 2 if the founding occurred in the year 2000 or after.[8] The vector $\boldsymbol{X_i}$ includes our control variables including Bachelor's degree academic major. We include ($\eta + \varphi$) founding region and industry sector dummies. Even more than in the binary probit and logit models, these coefficients for the multinomial logit are difficult to interpret so following McFadden (1982) we report elasticities. Model 4-3 and 4-4 show the elasticities for Model 4-1 and 4-2 respectively. The elasticities are calculated at the means except in the case of dummy variables where they are calculated in going from 0 to 1. It appears clear that the segment of society engaging in entrepreneurship in more recent years has been expanding rapidly and in particular, identifiable directions.

In Models 4-5 and 4-6, we run probits as an alternative to the multinomial logit analysis. The results should be very similar for running probits on the sub-samples (for before 2000 and after 2000) and indeed we find very similar results.

DISCUSSION

Overall the results support the main thesis of this paper that with policy changes, the backgrounds of those entrepreneurs have changed to add specific, yet broader segments of society. The results suggest that for those deciding to form companies in recent years (after the 1999 and 2000 policy changes), relatively fewer were transitioning straight from academia and there was more entrepreneurship among those who have held academic jobs in the past (perhaps due to spinning off research organizations as a result of CAS reform). In addition, the more recent founders were individuals who tended to hold jobs for longer periods (higher average tenure at each job), they were more likely to have achieved higher salary levels during their

[8] Some might suggest that this type of choice model is inappropriate for this setting where those who graduated after 2000 could not possibly have started a firm before 2000. However, one can think of utility as being highly negative for those graduating in recent years to start a firm before 2000 and the model should go through fine assuming the disturbances are independent and have the appropriate distribution.

careers (perhaps more talented individuals), and more of them grew up in lower economic status families. This last point implies that there may have been greater access to capital and less need to rely on financing from the family for entrepreneurs in recent years when more private equity and venture capital funding became available.

In recent graduation year cohorts (changes due more to cultural/psychological effects?), there appear to be relatively more individuals with government (high or low levels) experience and with experience in business roles (but not technical roles) deciding to become entrepreneurs. In more recent cohorts, there appear to be fewer individuals becoming entrepreneurs who held academic jobs in the past (perhaps because they have not had sufficient time to become academics), and fewer who have overseas educational or work experience.

The results suggest that in addition to more immediate effects of the policy changes there are also cultural or psychological legitimating processes that are also impacting the human capital characteristics of those deciding to leave traditional employment and enter entrepreneurship in this setting. Also, in China entrepreneurship has been a relatively new phenomenon so it may be more important for certain individuals from certain backgrounds to wait until that activity gains more widespread legitimacy. The results are consistent with a story that those combining business experience with more technical experience are more likely to become entrepreneurs in recent years. However, it appears that those specializing in business roles may have been more likely to become entrepreneurs in the past. This effect may be because in the past those with specialized technical skills had good, stable job opportunities and would not opt for a risky, less prestigious position as an entrepreneur.

In our interviews, a number of entrepreneurs indicated that increasing competition was leading to a greater focus on R&D and innovation than in previous years when competition was

less fierce so this finding of differences over different time periods may be due to start-up opportunities requiring more sophisticated technical skills.

Robustness and Limitations

Our results are robust to a number of controls and model specifications. Academic department dummy variables and a well-defined sample population help alleviate concerns that various sources of unobserved heterogeneity are driving our findings. However, we lack data on some measures that the literature has suggested are important. In particular, we have no data on psychological measures of self-efficacy, risk-tolerance, or on macroeconomic variables and industry concentration (these industry and macroeconomic variables will be added in future drafts).

In interpreting the results from this study, it is useful to keep in mind three data-related issues: representativeness, response rates and self-reporting.

While these limitations may provide reason for caution on making generalizations from the data, we believe that the trends and correlations reported are large enough that such bias is not significant. Also, during our interviews we were assured by many older alumni that they feel a very strong bond with Tsinghua and the Alumni Association which reassures us that there were not large biases in the age of respondents.

CONCLUSIONS

In this exploratory analysis of entrepreneurs from a technology-based university in China, we find differing effects when looking at graduation year cohorts compared with those who chose to found firms in more recent years as opposed to before the policy changes around the end of the 1990s. While the results are preliminary, it appears in the Chinese context, in more recent years government workers are more likely to leave their posts and become entrepreneurs and that

coming from a family with money is less important. The results suggest that for those deciding to form companies in recent years (after the policy changes), relatively fewer were transitioning straight from academia and there was more entrepreneurship among those who have held academic jobs in the past (perhaps due to spinning off research organizations as a result of CAS reform). In addition, the more recent founders were individuals who tended to hold jobs for longer periods (higher average tenure at each job), they were more likely to have achieved higher salary levels during their careers (perhaps more talented individuals), and more of them grew up in lower economic status families. This last point implies that there may have been greater access to capital and less need to rely on financing from the family for entrepreneurs in recent years when more private equity and venture capital funding became available.

In recent graduation year cohorts (changes due possibly to age or cultural/psychological effects), there appear to be relatively more individuals with government (high or low levels) experience deciding to become entrepreneurs in the most recent cohort. In more recent cohorts, there appear to be fewer individuals becoming entrepreneurs who held academic jobs in the past (perhaps because they have not had sufficient time to become academics), and fewer who have overseas educational or work experience. Interestingly, we do not find that individuals with parents who were entrepreneurs are more (or less) likely to become entrepreneurs themselves. This result has been found repeatedly in the US and Europe, but does not appear to hold in the Chinese context regardless of the time period we examine.

In addition, in recent years, those who have achieved higher salaries are more likely to become entrepreneurs. In all years those with high salaries (and presumably higher opportunity costs) are less likely to found firms, but there appears to be a lessening of this effect over time. The results are robust to a large number of controls previously identified in the literature. Future

work should take into account that the properties of different roles and functions (ie. R&D and sales & marketing) may condition the benefit from different career experiences in contributing to a start-up venture.

More broadly, cross-national research on determinants of entrepreneurial activity and performance lies at the intersection of important trends in management and economics research (McDougall & Oviatt, 2000). The results of such studies are of interest not only to academics but also of vital importance to governments, policy-makers, potential entrepreneurs, and those funding high growth companies and international development efforts. To examine the generality of findings and the validity of interpretations from research on the US and Europe, as well as other findings in the entrepreneurship literature, it is necessary to undertake cross-national research (Kohn, 1987). Differences in results between countries can then be the catalyst to either rethinking the scope of our claims or of generating more general theoretical insights. Indeed, it has been shown that existing managerial theories often need significant adjustment to be properly applied in the study of the structure and processes of Chinese enterprises (Shenkar & von Glinow, 1994). Some have argued that China's rapid economic development and the decentralization of the economy is leading to the rise of distinctive institutions and ways of organizing transactions in the absence of strong legal and institutional frameworks that are novel and undoubtedly worthy of further study of its implications for firm strategy (Boisot & Child, 1988; Boisot & Child, 1996).

This paper provides a step toward better knowledge of entrepreneurial careers in China. It also provides evidence that high tech entrepreneurship in other institutional environments may have different drivers. Returning more specifically to the Chinese context, we provide a unique dataset with detailed work history and university training information and one of the initial

systematically-collected large scale datasets of technically trained entrepreneurs which covers the period of time when entrepreneurship (especially technology-based) began to emerge across China. Over the period our data covers, high tech industries, particularly related to information and computer technology as well as the internet were just emerging in China. The results have implications for all of those who are interested in entrepreneurial labor market and entrepreneurial careers in developing economies, particularly those beginning to develop a manufacturing sector and to begin to see the emergence of technology-based entrepreneurship as a driver of economic growth. Our findings point to the fact that for policy-makers, entrepreneurs, and university officials to blindly apply theories tested in developed country contexts is fraught with danger. Our results show that it is not enough for a country to produce more graduate students in science and engineering disciplines. For successful entrepreneurs to develop after graduation, training and certain types of work experience are important as well and in a developing institutional context, advice and findings for young aspiring entrepreneurs still need to be developed. Our results imply that these policy changes have impacted who becomes an entrepreneur. Our findings also help guide those in larger organizations as to which entrepreneurial teams and which employees they may be most interested to meet or to watch out for in the future. With the expansion of outsourcing of R&D functions and growth in science and engineering graduates, there is a great deal of interest and there should continue to be interest in technology-based entrepreneurs in the developing world. However, our results show that university or government policies using limited funds to encourage entrepreneurship would do well to be nuanced as to how to craft policies and institutions to encourage more successful new firm creation. We hope this study takes a step towards advancing our knowledge of entrepreneurship especially that connected with technical universities. **[Word length=4,759]**

Figure 1

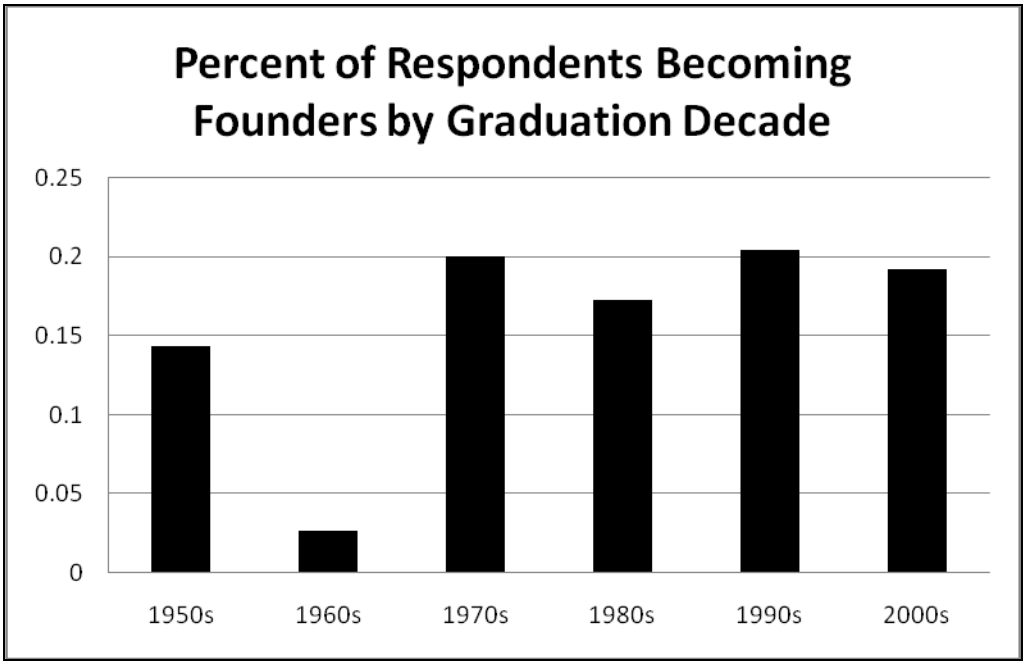
Percent of Respondents Becoming Founders by Graduation Decade
0.25
0.2
0.15
0.1
0.05
0
1950s
1960s
1970s
1980s
1990s
2000s

Table 1

Pairwise Correlations

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
1	*Last job academia*	1																				
2	*Last job business*	-0.689	1																			
3	*High government*	-0.045	-0.120	1																		
4	*Low government*	-0.118	-0.357	-0.048	1																	
5	*Ever job academia*	0.411	-0.141	0.049	0.045	1																
6	*Business only*	-0.023	0.013	0.063	0.077	0.131	1															
7	*Tech. only*	0.163	-0.089	0.062	-0.011	0.139	-0.131	1														
8	*Number of Positions*	-0.160	0.122	0.002	0.128	0.150	-0.146	-0.463	1													
9	*Avg. Tenure*	0.016	-0.057	-0.024	0.117	-0.055	-0.029	-0.038	0.109	1												
10	*Gender*	-0.126	0.137	-0.023	0.031	-0.011	-0.087	-0.087	0.185	0.030	1											
11	*Entrepreneur Parents*	-0.051	-0.026	-0.026	0.036	-0.077	-0.004	0.004	0.025	-0.085	-0.012	1										
12	*High Salary*	-0.146	0.260	-0.020	-0.107	0.165	-0.015	-0.060	0.161	-0.129	0.061	-0.055	1									
13	*Family economic status*	0.020	0.006	0.028	-0.004	-0.023	0.053	-0.018	-0.026	0.075	0.131	-0.142	-0.145	1								
14	*Student Leader*	0.052	-0.103	0.073	0.165	0.200	0.189	0.122	0.024	-0.068	-0.022	-0.010	0.035	-0.047	1							
15	*Communist Party*	-0.060	0.121	0.049	-0.135	0.034	0.001	0.037	-0.018	-0.122	0.006	0.007	0.084	-0.086	-0.182	1						
16	*GPA Rank*	-0.127	0.099	-0.016	0.013	-0.024	0.003	-0.073	0.085	-0.016	0.086	-0.011	0.028	0.005	-0.098	0.138	1					
17	*Master's*	0.079	-0.017	0.079	0.147	0.342	0.208	0.220	0.055	-0.137	-0.011	-0.077	0.185	0.012	0.396	-0.067	-0.199	1				
18	*PhD*	0.331	-0.238	0.034	0.043	0.208	-0.064	0.237	-0.032	-0.080	0.061	0.026	0.050	-0.012	0.201	-0.047	-0.192	0.239	1			
19	*Overseas Experience*	-0.002	0.013	-0.012	-0.051	0.050	-0.049	0.042	0.007	0.124	0.022	0.028	0.227	-0.115	-0.017	0.070	-0.053	0.047	0.125	1		
20	*Bachelor's Grad Year*	-0.072	0.115	0.039	-0.130	-0.168	0.097	-0.001	-0.219	-0.431	0.013	0.073	0.030	-0.021	0.094	0.057	0.051	0.083	-0.042	-0.171	1	
21	*Age*	0.019	-0.110	0.008	0.097	0.060	0.016	0.038	-0.031	0.037	-0.065	-0.058	-0.048	0.065	-0.003	0.046	-0.032	-0.009	-0.039	-0.016	-0.306	1

Table 2
Summary Statistics and Variable Definitions

VARIABLE	DEFINITION	MEAN	SD
Panel A: Firm and Individual-level measures			
First start-up founded	Year in which first firm was founded (censored if not observed by 2007)	2003.48	2.97
Firm age	Age of the firm	3.50	2.44
Privatized	=1 if firm was privatized	0.07	0.42
Bought	=1 if firm was bought	0.004	0.07
Entrepreneur	=1 if the individual was an entrepreneur	0.28	0.45
Entrepreneur Parents	=1 if parents were entrepreneurs	0.12	0.32
Graduation year	Year of graduation (Bachelor's)	1994.14	9.16
Entrepreneur parents	Dummy = 1 if entrepreneur parents	0.12	0.32
Family economic status	Family's economic status in China during college, 1=top 10%, 2=top 10-25%, 3=top 25-50%, 4=bottom 50%	3.69	0.95
Age	Individual's age	36.42	9.95
Gender	Dummy = 1 if male	0.89	0.31
Student Leader	Indicates the level of leadership (1-4)	0.56	0.91
GPA Rank	1=top 10%, 2=top 10-25%, 3=top 25-50%, 4=bottom 50%	2.35	1.08
Panel B: Work history-level measures			
High Salary	Highest Salary achieved (5 categories)	3.55	1.36
Avg. Tenure	Average Number of years in each job	4.28	5.47
Number of Positions	Number of different positions (R&D, sales & marketing, general manager, etc.) that were held	2.60	1.35
Tech. only	=1 if worked in tech or R&D, but not in business	0.29	0.45
Business only	=1 if worked in business roles but not R&D or tech	0.13	0.33
High government	=1 if ever had job in government (minister, province, Bureau or municipal levels	0.03	0.16
Low government	=1 if ever had job in government (below municipal level)	0.07	0.27
Last job academia	= 1 if last job was in academia	0.16	0.37
Last job business	= 1 if last job was in business	0.72	0.45
Ever job academia	1 = if ever had job in academia	0.25	0.50

Table 3
Logit Regressions

	Dependent Variable = founded a company					
Independent Variables	**(3-1) Grad years 1947-1992**		**(3-2) Grad years 1993-1998**		**(3-3) Grad years 1999-2007**	
Last job academia	0.884	(3.468)	-2.082	(2.193)	2.681	(2.601)
Last job business	5.367	(3.419)	1.117	(1.610)	5.275**	(2.592)
High government	4.371	(3.828)	2.420	(2.067)	5.074**	(2.569)
Low government	0.743	(1.517)	-1.588	(1.246)	5.590**	(2.768)
Ever job academia	2.901**	(1.274)	1.992**	(0.860)	0.496	(1.000)
Business only	3.780*	(1.981)	-0.932	(0.931)	1.594	(1.306)
Tech. only	3.996*	(2.384)	-1.914	(1.194)	0.516	(1.084)
Number of pos.	2.962***	(0.847)	1.129***	(0.384)	1.258***	(0.442)
Avg. Tenure	-0.125	(0.100)	0.067	(0.095)	0.837***	(0.304)
Controls						
Gender	2.824*	(4.073)	dropped		1.054	(1.643)
Entrepreneur Parents	4.329	(4.696)	0.687	(0.994)	0.804	(1.128)
High Salary	-0.280	(0.539)	-0.707**	(0.356)	-0.497	(0.400)
Family Economic Status	-0.973*	(0.543)	-0.158	(0.473)	-0.908	(0.603)
Student leader	0.011	(0.607)	1.466***	(0.498)	0.585	(0.440)
Comm. Party	3.424***	(1.265)	0.996	(0.682)	3.567***	(1.036)
GPA Rank	0.321	(0.844)	0.315	(0.313)	-0.266	(0.363)
Master's degree	-0.646	(1.539)	0.419	(0.845)	0.665	(0.891)
PhD degree	2.792	(1.997)	0.098	(1.080)	0.444	(1.249)
Overseas Experience	2.967**	(1.186)	0.676	(0.672)	-1.438	(0.918)
Bachelor's grad year	0.084	(0.065)	0.127	(0.202)	-0.318	(0.274)
Constant	-208.564	--	-243.548	(402.980)	628.754	(549.414)
Log likelihood	-29.393		-50.652		-40.411	
Number of observations	110		121		142	

***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively. All regressions include academic degree, current region (state) dummies and controls for the size of the city of birth (urban, rural, etc.), though the coefficients are not shown.

Note: These are robust to slight changes in the birth years.

Table 4
Multinomial Logit and Simple Probit Regressions

	Dependent Variable = founded a company (during the specified time period)									
Independent Variables	**(4-1) Founded yrs Before 2000 Multinomial logit**		**(4-2) Founded yrs After 2000 Multinomial logit**		**(4-3) Founded yrs Before 2000 Elasticities**	**(4-4) Founded yrs After 2000 Elasticities**	**(4-5) Simple Probit Founded yrs Before 2000**		**(4-6) Simple Probit Founded yrs After 2000**	
Last job academia	17.057	(8256.901)	-2.134**	(1.089)	2.510	-0.313	-0.928	(0.591)	6.271	(67.245)
Last job business	22.339	(8256.901)	0.074	(0.849)	16.300	0.054	0.274	(0.472)	9.397	(67.005)
High government	0.611	(1.605)	-1.075	(0.989)	0.030	-0.052	-0.815	(0.620)	1.547	(0.970)
Low government	-1.833	(1.419)	-0.638	(0.705)	-0.253	-0.088	-0.186	(0.401)	-1.950	(1.222)
Ever job academia	0.783	(0.686)	1.874***	(0.421)	0.343	0.822	0.976***	(0.231)	0.656	(0.515)
Business only	3.417**	(1.218)	0.453	(0.594)	0.434	0.057	0.217	(0.336)	2.115***	(0.687)
Tech. only	-0.428	(1.322)	-0.220	(0.591)	-0.106	-0.054	-0.127	(0.324)	-0.045	(0.917)
Number of pos.	0.725**	(0.294)	0.701***	(0.178)	1.990	1.930	0.409***	(0.101)	0.648***	(0.250)
Avg. Tenure	0.127*	(0.075)	0.185***	(0.050)	0.553	0.806	0.089***	(0.027)	0.162***	(0.061)
Controls										
Gender	18.196	(8256.900)	1.179	(0.895)	16.500	1.070	0.741	(0.495)	Dropped	
Entrepreneur Parents	-2.427	(1.432)	-0.294	(0.561)	-0.265	-0.032	-0.153	(0.300)	-1.725*	(0.941)
High Salary	-1.380***	(0.387)	-0.476***	(0.163)	-4.770	-1.640	-0.322***	(0.096)	-0.767***	(0.252)
Family Economic Status	0.781*	(0.405)	0.174	(0.227)	2.880	0.644	0.079	(0.126)	0.861***	(0.303)
Student leader	0.565*	(0.298)	0.179	(0.192)	0.487	0.154	0.043	(0.108)	0.556**	(0.242)
Comm. Party	2.135***	(0.720)	0.578	(0.372)	1.020	0.278	0.247	(0.212)	1.415***	(0.473)
GPA Rank	0.461	(0.340)	0.306	(0.180)	1.100	0.740	0.172*	(0.102)	0.183	(0.238)
Master's degree	1.331	(0.932)	0.067	(0.396)	0.855	0.043	0.014	(0.225)	0.467	(0.598)
PhD degree	-0.379	(1.382)	0.450	(0.591)	-0.053	0.060	0.196	(0.320)	-0.386	(0.803)
Overseas Experience	1.176	(0.790)	0.066	(0.396)	0.443	0.024	0.055	(0.224)	0.282	(0.514)
Bachelor's grad year	-0.099*	(0.055)	0.150	(0.038)	-197.000	299.000	0.071***	(0.018)	-0.026	(0.034)
Log likelihood	-170.031				-170.031		-32.168		-124.150	
Number of observations	448				448		265		379	

***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively. All regressions include academic degree, current region (state) dummies and controls for the size of the city of birth (urban, rural, etc.), though the coefficients are not shown.

Appendix A
Comparison of Key Demographic Characteristics by Survey Wave

Variable	Responded before Aug. 2007 (N=783)	Responded during/after Aug. 2007 (N=86)	*t*-stat for equal means
Age	36.85	35.7	0.720
Entrepreneur parents	0.11	0.14	-0.706
Entrepreneur	0.19	0.24	-1.227
Privatized	0.08	0.03	0.780
First start-up founded	2002.03	2001.55	0.468
Tech only	0.29	0.28	0.161
Business only	0.13	0.13	-0.073
Gender	0.80	0.89	-0.220
Family economic status	3.68	3.64	0.417
High Salary	3.58	3.63	0.307
Avg. Tenure	4.39	3.99	0.555
Overseas work exp.	0.44	0.46	0.391
Number of positions	2.63	2.64	-0.045
High government	0.04	0.07	-1.106
Low government	0.11	0.07	1.208
Last job academia	0.16	0.21	-1.101
Ever job academia	0.39	0.39	-0.036
Last job business	0.73	0.75	-0.217
Student Leader	0.93	0.97	-0.291
GPA Rank	2.35	2.56	-1.686**

***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

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