Why are some graduate entrepreneurs more innovative than others?

The effect of human capital, psychological factor and entrepreneurial rewards on entrepreneurial innovativeness

Highly educated graduate entrepreneurs can be 'high quality entrepreneurs' with substantial growth potential (OECD, 2014). Education contributes to the development of human capital (Becker, 1964), and provides students a set of opportunities and resources unavailable to those less qualified (Rosa, 2003). People with high human capital have been found to be more likely to identify more entrepreneurial opportunities (Ucbasaran et al., 2008), to exploit opportunities (Shane, 2003), and to have better performance of their new ventures (Unger et al. 2011). As such, university graduates have been encouraged to consider entrepreneurship as a career option and are supported by their universities one way or another (Volkmann et al., 2009; Anderson, 2011; Bernhofer and Li, 2014). There is high hope that when university graduates are successful in starting new businesses, they increase innovation, job opportunities, competition in the market place, and the likelihood of increased self-reliance and wellbeing (Blanchflower and Oswald, 1998). Probably, Larry Page and Sergey Brin are two of the most high profile graduate entrepreneurs who showed extraordinary abilities to create and build Google into a world-class business. They are innovative entrepreneurs who exploit an "imprecisely-defined market need, or un- or under-employed resources or capabilities" (Kirzner, 1997: 60), using routines and competencies significantly different from those of incumbents in the particular market they enter. However, this type of innovative entrepreneurs is rare. The majority of highly educated graduate entrepreneurs are actually not so innovative. In his analysis of a sample of Scottish graduate enterprises, Rosa (2003) suggested that people's beliefs in graduate entrepreneurs as high-impact entrepreneurs may have been misplaced. The businesses they started were "unimaginative, routine and far removed from the ideal of high performing firms" (p.451). Equally surprisingly, even for those who received intensive support and training to start businesses, except only a handful

of very successful businesses, most of the businesses started were not imaginative 'cutting edge' businesses either. Recent nation-wide surveys on the destinations of university graduates in China echo Rosa's (2003) findings. The businesses started by graduate entrepreneurs were mostly low-tech, imitative, and in the sectors of education services and retailing (Mycos, 2016). Imitative entrepreneurs start businesses in an established market whose routines, competencies, and offers vary only minimally from those of existing organizations; they bring little or no incremental knowledge to the populations they enter and organize their activities in the same way as their predecessors (Aldrich, 1999). Accordingly, the impact of imitative entrepreneurs is limited.

China has placed entrepreneurship and innovation firmly at the centre of its new growth policies and seeks to use entrepreneurship and innovation as a vehicle to quantum leap to a new growth model. Massive resources have been made available to support entrepreneurs, including graduate entrepreneurs, in their entrepreneurial endeavor. The effort appears to have boosted the number of start-ups. In 2015, for example, China witnessed a record number of 14.8 million new registered firms, an increase of 20 per cent over the previous year.[1] Yet, many new businesses tend to be imitative. The Global Entrepreneurship Monitor (GEM) China survey find that 16 per cent of new businesses admitted that there is nothing new in what they offered to their customers and that 67 per cent of new businesses claimed that what they offered is only new to the firm and to the local market (Ding & Li, 2015). Clearly, getting economic growth and jobs creation from entrepreneurship schemes is not a numbers game (Shane 2009). What matters most is the "quality" of entrepreneurship not the 'quantity' of entrepreneurship (Stam 2015). However, we know very little about the propensity of individuals to go into innovation-driven entrepreneurship

[1] See news release "new business registration reform stimulated a new wave of entrepreneurship" by State Administration for Industry & Commerce on 23 February 2016 at http://www.saic.gov.cn/ywdt/gsyw/mtjj/201602/t20160223_166769.html (accessed 18/06/2016)

(González-Pernía et al., 2015). It is therefore important to ask: Why are some graduate entrepreneurs more innovative than others?

There is only limited empirical evidence to answer this question (Block et al. 2017). Among the small number of research on innovation behavior of start-ups at the individual level, the extent of innovation is found to be positively related to the entrepreneur's education level (Koellinger, 2008; Robson et al, 2009), prior entrepreneurship experiences (Cliff et al, 2006; Ucbasaran et al, 2008; Robson et al. 2012; Gruber et al, 2013; Simmons et al, 2014), orientation toward risk (Hsieh and Kelley, 2016), personality traits (Marcati et al., 2008), and a high degree of self-confidence (Koellinger, 2008; Bayon et al., 2016). None of these studies used student entrepreneur samples except Ucbasaran et al (2008).

Shane (2003) proposes a framework for investigating the individual-opportunity nexus and argues that individual differences, both psychological and demographic, influence significantly over who exploits entrepreneurial opportunities and who does not. Shane (2003) refers to psychological and demographic differences as those in demographic characteristics, such as age or education, or in psychological make-up, such as motivations, personalities, core self-evaluation or cognitive processing. Building on Shane's (2003) framework on the individual-opportunity nexus, we put forward three arguments to explain why graduate entrepreneurs differ in their innovation behaviours when they start businesses.

First, we argue that individual differences in human capital not only influence over *who* exploits entrepreneurial opportunities but also *how* one exploits opportunities. Previous research tends to associate human capital with knowledges and skills and asserts that people with high human capital are more capable of identifying and exploiting opportunities (e.g. Shane, 2003). Supplementing to the argument, we anchor our argument on the link between opportunity costs and innovation behavior, which is derived from the human capital theory's human capital investments and

earnings nexus. Students come to universities to invest in human capital. As a result of differences in the length and quality of formal education, participation in extracurricular activities and work placement, and engagement in entrepreneurship education and activities, students diverge in their human capital. Those with high human capital would expect to earn high graduate level income when they join the labour market. If they decide to swap a high paid job to self-employment, they do so by bearing high opportunity costs. Rational graduates would proceed to exploit entrepreneurial opportunities only if the rewards could justify the opportunities costs. In other words, graduates have individual performance thresholds that must be met for the justification of the opportunity costs in accordance with the human capital they have (Huggins et al. 2017). High rewards are generally associated with high innovation behavior in opportunity exploitation, suggesting that students with high human capital need to act on opportunities more innovatively.

Second, we argue that entrepreneurial innovativeness is also conditional on psychological factors such as students' managerial self-efficacy and overconfidence. Innovation behavior of start-ups is associated with high return, yet high risk. Graduate entrepreneurs with high human capital would exploit highly innovative, risky opportunities if they feel confident that they have what it takes to pull it off (Liñán et al., 2011). Third, we argue that the nonlinear relationship between entrepreneurial innovativeness and entrepreneurial rewards drives nascent entrepreneurs to exploit even riskier opportunities in search for high rewards.

We propose our theoretical framework and estimate it using a Chinese graduate entrepreneur sample. Following Rosa (2003), we define graduate start-ups as businesses being started by graduates within the first five years of leaving higher education.

Our study contributes to the graduate entrepreneurship literature by supplementing the individual-opportunity nexus with the opportunity costs-innovation behaviour

relationship to explain the innovation behaviour of graduate start-ups at the individual level. First, we contribute to the innovative entrepreneurship literature from a graduate entrepreneurship perspective by linking human capital investments, earnings expectations and opportunity costs to explain why graduate entrepreneurs with high human capital will be more motivated to exploit opportunities innovatively. Second, we contribute to the innovation behaviour-performance literature by proposing and empirically verifying the U-shaped relationship between entrepreneurial innovativeness and entrepreneurial rewards. We argue that graduate entrepreneurs with high human capital would be even more motivated to exploit opportunities innovatively in the realisation that financial rewards to entrepreneurship are generally lower than to paid employment. Third, we contribute to the graduate entrepreneurship literature with new empirical evidence by confirming that graduate entrepreneurs are not always rational in their innovation behaviour. They are influenced by their psychological make-up.

Theoretical background

Human capital

The modern human capital theory is based on the rational choice assumption to explain people's decision to invest in their own human capital (Folloni & Vittadini, 2010). Human capital is referred to as 'the knowledge, skill, competencies and attributes embodied in individuals that are relevant to economic activity' (OECD, 1998: 9). The human capital theory argues that the individual's 'quantity' of human capital is the result of voluntary investment in acquiring skills and abilities by the individual or his/her family (Schultz, 1961). People invest in human capital through schooling and on-the-job learning (apprenticeship, internship, on-the-job training, etc.)(Becker 1962). The acquisition of knowledge through the school system is regarded as general training, resulting in general human capital; conversely, the majority of on-the-job learning is at least partially specific, leading to specific human capital (Becker 1962). Entrepreneurship research makes a further distinction of

specific human capital between industry-specific human capital and entrepreneurial human capital (Wennberg, 2010).

Human capital is not a fixed set of knowledge, skills and experiences. There is a difference between human capital investments and human capital assets. Assets do not derive automatically or uniformly from human capital investments (Unger et al., 2011). Individuals of different innate capacities and learning motivations may experience the same investment, but extract different assets.

Human capital theory predicts that individuals who invest more in schooling and the development of specific human capital can expect to earn more than those who invest less (Schultz, 1961; Becker 1962). Human capital theory also predicts that individuals who possess greater levels of knowledge, skills, and other competencies will achieve greater performance outcomes than those who possess lower levels (Ployhart and Moliterno, 2011).

Entrepreneurship research tends to support the existence of a positive relationship between human capital and entrepreneurial activity (Davidsson & Honig, 2003). First, people with high human capital are equipped with the information and analytical skills that improve entrepreneurial judgment and understanding of the entrepreneurial process (Shane, 2003). Human capital investments increase a person's stock of information and skills, including those needed to pursue an entrepreneurial opportunity successfully. Second, human capital also provides a signal to potential investors and other stakeholders that influence the possibilities of entrepreneurs to mobilise the necessary resources (Unger et al., 2011). Hence, human capital investments increase nascent entrepreneurs' expected returns to opportunity exploitation (Shane, 2003).

Entrepreneurial innovativeness

The new ventures entrepreneurs use as vehicles to exploit entrepreneurial opportunities are heterogeneous, knowledge-bearing entities (Dosi et al., 1992). Consistent with March (1991), people act upon knowledge creation and application through the exploration of new possibilities and/or the exploitation of old certainties. Both represent utterly different nature of knowledge learning and applications that serve different goals, display different associations with the present competence of the people, and produce outcomes in varying certainties. We define entrepreneurial innovativeness as an exploratory behaviour characterised with doing something different rather than imitations and variants of what others are also offering (McGrath, 2001). Exploration (or exploiting opportunities innovatively as we refer to it throughout the paper) represents entrepreneurial actions in anticipation of shaping future demand and the environment (Lumpkin and Dess, 2001). Exploration also aims to reap benefits that come from developing knowledge breakthrough, which is more likely to lead to a sustainable competitive advantage for the business the entrepreneur starts (Long et al., 2017). Exploration in search of novel opportunities and radical new knowledge, however, is inherently costly, less certain in return on investment, and has a higher probability of failure (March, 1991). All is because knowledge generated by exploration activities is often distant from the existing knowledge base of the entrepreneur and all others involved.

Hypothesis development

Students come to universities to invest and develop human capital through formal education. The individual differences in human capital can be affected by the years of education and quality of education. Quality of education can be an elusive concept depending on the views of different groups of stakeholders, namely providers (e.g. funding bodies and higher education institutions, HEIs), users of products (e.g. students), users of outputs (e.g. employers), and employees (e.g. academics and administrators) (Srikanthan & Dalrymple, 2003). Owing to our interest in student human capital, we define quality of education from a student-centric perspective and view quality as the desired input (e.g. responsive faculty and staff) and outputs in

terms of increase in knowledge, skills, and abilities that lead to gainful employment (Schindler et al., 2015). More specifically, we anchor the quality of education on employability that is defined as a set of skills, understandings and personal attributes that make individuals more likely to gain employment and be successful in their chosen occupations (Yorke and Knight 2006). Thus, quality of education is firstly determined by how well the university supports students to enable them to achieve their award by the means of learning, teaching and assessment (QAA, 2015). Quality of education is also affected by how well the university offers extracurricular learning and enterprise-based training to help students progress and fulfil their potential (Gibb, 2002).

Due to the differences in educational attainment and quality of education received, university graduates diverge in their abilities, career prospects and expected earnings. The more investments students make in human capital, the better career prospects they have, and the higher incomes they expect to earn. Likewise, the higher human capital they have obtained from higher quality of education, the better career prospects they have, and the higher incomes they expect to earn. When choosing one over all other options, students face opportunity costs. Opportunity costs refer to the next best alternative forgone in one's choice (Krugman & Wells, 2015). When agonising over career options, students benchmark their earnings expectations against not just the norm but also their direct peer groups. When they settle on an option, they would anticipate that the returns are high enough to match earning expectations and justify the opportunity costs.

When entrepreneurs decide to exploit entrepreneurial opportunities, they do so in the belief that the expected value of exploitation (both monetary and psychic) exceeds the opportunity costs for alternative use of their time plus the premiums that they expect for bearing uncertainty (Shane, 2003). Because students always have an alternative use for their human capital, the exploitation of entrepreneurial opportunities has positive opportunity costs (Hamilton and Harper, 1994). When deciding to exploit

opportunities, the nascent entrepreneur implicitly compares the value of his utility from engaging in entrepreneurial activities with his opportunity costs of engaging in other activities (Johnson, 1986). People are most likely to decisde to exploit opportunities when the gap between expected utility of exploiting opportunities and the alternative use of their human capital is larger (Shane, 2003). The gap is larger if a person has a lower opportunity costs to alternative use to his human capital. In comparing expected utility and opportunity costs, for a given opportunity, those individuals with higher opportunity costs could justify their decisions only if they would manage to raise the expected utility of exploiting opportunities. To achieve that objective, they would need to exploit opportunities more innovatively, since higher return comes from taking more chances.

Apart from formal education from the degree programme, students can increase their human capital by taking part in extracurricular activities, ranging from sports, cultural activities and etc. Through participation in such activities, students may practise knowledge and skills they learn from the curriculum, they may learn new transferable skills such as networking skills, and they may develop their social networks. Engagement with the outside world can improve a person's self-confidence and mental and physical health. All this will enhance a person's human capital, raise earnings expectations, and increase opportunity costs when the person makes a career choice. Moreover, students at universities also have opportunities to develop their leadership skills by taking a leadership role in extracurricular activities. Students with leadership skills will have higher human capital than those people who are lack of such skills. Lau et al. (2014) examined the relationship between university student employability skills and their participation in various extracurricular activities including being a core member of: (a) student councils, (b) service (such as scouts clubs), (c) sports, (d) music, and (e) arts clubs. Using a sample of 28,768 business school graduates in Taiwan, they found that students who had been core members of extracurricular activities were more likely to positively evaluate their communication, leadership, creativity and self-promotion skills. Similarly, Stuart et al. (2011)

examined the effect of extracurricular activity on students' experiences and future job prospects in the UK. They found that employers stressed the value of extracurricular activity for 'distinguishing' candidates in terms of cultural fit, leadership, commitment, and 'selling' original activities. Therefore, people who have developed skills through widening participation will have higher human capital, higher earnings expectations, and higher opportunity costs. They will need to exploit opportunities more innovatively in order to gain rewards that match their earnings expectations and the lost opportunities for the alternative use of their time and human capital.

At universities, students are in their formative period of career development. Many universities now offer students opportunities to develop career experience through internship, work placement and other employability initiatives. By taking up such opportunities, students first develop general business experience and learn the basic aspects of business that are relevant to opportunity exploitation. General business experience may provide training in many of the skills needed for exploiting the opportunity. They may also develop functional experience and industry experience. The information and skills they learn may facilitate the formulation of entrepreneurial strategy, the acquisition of resources, and the process of organising (Shane 2003). Again, a person's enhanced specific human capital and increased opportunity costs will push the person to exploit opportunities more innovatively.

Also, the 'quantity' of human capital can result from enterprise-based training (OECD, 1998). As part of the employability initiative, many universities in China offer different forms of entrepreneurship education, training and engagement in entrepreneurship activities (Li et al., 2002; Anderson & Zhang, 2015). Entrepreneurship education and engagement equips students with the information and skills that are likely to increase their ability to assembly resources, develop a strategy, organise, and exploit opportunities (Martin et al., 2013). Moreover, prior entrepreneurial experience increases students' entrepreneurial human capital. Martin et al. (2013) find a significant relationship between entrepreneurship education and

training and entrepreneurial human capital. They may also be more successful in opportunity identification tasks than those who have not received entrepreneurship education or training (DeTienne and Chandler, 2004). So, people with high human capital will be more capable of identifying high quality opportunities and exploiting them more innovatively.

Despite the positive effect of enterprise-based training on students' 'quantity' of human capital, the quality of entrepreneurship education and uptake of such training may vary. On the one hand, Anderson & Zhang (2015) find that ordinary HEIs in China are over-represented in providing entrepreneurship teaching but are markedly under-represented in entrepreneurship research. This mismatch raises a significant problem concerning the quality of entrepreneurship education, that is, from what sort of knowledge, if not research or practice led, these universities use to teach entrepreneurship. On the other, there are cultural artefacts in China, including ideology, that indicate entrepreneurship may not appeal to all (Liao and Sohmen, 2001). Additionally, due to China's one-child policy, the sense of self and privilege of younger generations are antithetical to the risks and efforts required for entrepreneurship (Anderson & Zhang, 2015). For most graduates, the job security of working for a large Chinese firm or becoming a public servant is preferred over the appeal of an entrepreneurial career, and starting one's own business is seen as a last resort (Bernhofer and Li, 2014; Yao et al., 2016). Thus, students will differ in their human capital, owing to the varying quality and uptake of entrepreneurship education.

Combining the human capital and knowledge/abilities link with the opportunity costs and innovation behaviour relationship from the human capital theory, we posit the following hypotheses:

Hypothesis 1. Students with high human capital are more likely to exploit opportunities innovatively.

Hypothesis 1a. Students with high general human capital from educational attainment and quality of education are more likely to exploit opportunities innovatively.

Hypothesis 1b. Students with high general human capital from participation in extracurricular activities and work experience development are more likely to exploit opportunities innovatively.

Hypothesis 1c. Students with high entrepreneurial human capital from entrepreneurship learning and activities are more likely to exploit opportunities innovatively.

Managerial self-efficacy

Innovation behaviour of start-ups at the individual level is not only influenced by abilities, earnings expectations and opportunity costs, but also by the nascent entrepreneur's psychological make-up. Self-efficacy is the belief in one's own ability to perform a given task (Bandura, 1997). Self-efficacy acts as a self-regulating mechanism that determines whether individuals will initiate actions, how much effort they will expend, and how long their effort will sustain in the face of obstacles and failures (Bandura, 1989). Self-beliefs are instrumental in determining what individuals do with the capacities and skills they possess. In starting businesses, graduate entrepreneurs need to interact with the environment to acquire and utilise resources (Chandler and Hanks, 1994). They must be confident in their abilities to develop budgets, coordinate activities, motivate others and evaluate performance. All these are typical managerial roles. Consistent with Bandura (1997), managerial self-efficacy is an individual's belief in one's own ability to complete managerial tasks effectively within the new venture he or she starts. Students who have high managerial self-efficacy will have more confidence in their own judgement about uncertain opportunities (Wu, 1989) and are more likely to exploit entrepreneurial opportunities innovatively. Thus,

H2: Students with high managerial self-efficacy are more likely to exploit opportunities innovatively.

Overconfidence

The decision to start a new venture is complex. It is noted that in order to reduce the stress and ambiguity associated with the decision to start a business, entrepreneurs employ cognitive heuristics that simplifies their information processing (Schwenk, 1986). Yet, information simplifying strategies may lead to cognitive biases, such as overconfidence, defined as thought processes that involve erroneous inferences or assumptions on one's own abilities and limits of his or her knowledge (Forbes, 2005). Cognitive biases such as overconfidence play an important role in risky decision making. High levels of overconfidence give rise to an overestimation of one's own ability relative to others (Camerer and Lovallo, 1999) and result in the perception of more internal control (Harper, 1998). When entrepreneurs exhibit high levels of overconfidence, they may not further test their initial optimistic assessments of business situations (De Carolis and Saparito, 2006); they may overestimate their ability to correctly assess and/or to correctly determine how things are (Simon and Houghton, 2003); they are more likely to believe that they have acquired enough knowledge and personal ability to solve the difficulties that they will face and to beat the odds of failure (Griffin and Tversky, 1992). Windschitl et al. (2003) suggest that when entrepreneurs judge their likelihood of success, their assessment of their own strengths and weaknesses have greater impact than their assessments of their competitors' strengths and weaknesses. Consequently, entrepreneurs with high levels of overconfidence are more likely to treat their assumptions as fact (De Carolis and Saparito, 2006). Also, they are more likely to take an optimistic view of their prospects, to overestimate their chance of success, and to take entrepreneurial actions through exploration of entrepreneurial opportunities. There is evidence that entrepreneurs with overconfidence seek to generate value through exploration and risk taking (Bernardo and Welch, 2001) and that overconfidence is positively related to introducing products that are more pioneering (Simon and Houghton, 2003).

Subsequently, we maintain that students with high levels of overconfidence engage more in exploiting opportunities innovatively than those with low levels of overconfidence. Thus,

H3: Students with overconfidence are more likely to exploit opportunities innovatively.

Entrepreneurial innovativeness and entrepreneurial rewards

As explained earlier, the human capital theory predicts that high human capital investments lead to more abilities, high earnings and high opportunity costs. People with high human capital thus are more likely to exploit entrepreneurial opportunities more innovatively in order to gain rewards. However, plenty of evidence in entrepreneurship research has suggested that entrepreneurs may anticipate the dramatic and sustained loss of income if they opt for a career of entrepreneurship against paid employment (Blanchflower & Shadforth, 2007; Hamilton, 2000; Shane, 2008). Median incomes from entrepreneurship are lower than equivalent incomes from employment, and the earnings difference increases over time (Hamilton, 2000).

For young graduate entrepreneurs who have recently left universities and have just started their first ventures, other forms of entrepreneurial rewards such as high levels of household assets and total net worth, as highlighted in previous research (Carter, 2011), may not be relevant. The apparently precarious nature of entrepreneurship rewards means that graduate entrepreneurs with high human capital and high opportunity costs can expect to earn less than what they could have expected from paid employment.

Some may decide the entrepreneurship dream is not worth pursuing. For those who keep their dreams alive, they would need to exploit entrepreneurial opportunities even more innovatively in order to narrow or reverse the gap between expected earnings of being an entrepreneur and the opportunity costs to alternative use of their human

capital,. To do so, they are less likely to comply with the established dominant logic and the established mental models in opportunity exploitation. Instead, they are more likely to search novel opportunities and exploit them more radically in anticipation of higher entrepreneurial rewards.

Nonetheless, radical opportunity exploration is inherently riskier and less certain in return on investment (March, 1991). This is because the way to exploit opportunities radically is distant from the existing knowledge and competence, markets are less clearly defined, and exploration has many trajectories (Utterback, 1994). Thus, due to the risky and highly uncertain nature of exploration, entrepreneurial innovativeness takes longer to see efforts pay off. Opportunity exploitation very innovatively may in fact result in low entrepreneurial rewards until a point when new knowledge is learned, new skills developed, initial setbacks overcome, and anticipated returns materialised. Technology S-curve illustrates this pattern (Afuah, 2003). Thus, paradoxically, students who have high human capital exploit opportunities innovatively to counter the norm of low entrepreneurial rewards will not see high rewards immediately. Instead, they will have to put up with volatile, often meager returns first until they can see their endeavor fully rewarded. As such, we propose the following hypothesis:

Hypothesis 4: There is a U-shaped relationship between entrepreneurial innovativeness and entrepreneurial rewards.

Our full model is shown in Figure 1.

Figure 1 inserted here

Data and methods

Sample

We obtained data for this study through a survey instrument. Research on graduate start-ups confronts a widely-noted difficulty in identifying the population of new firms started by university graduates. There is no exception in China as no official statistics concerning this specific cohort of entrepreneurs have been gathered. In the meantime, in response to the call of Chinese government for support of graduate entrepreneurship, science parks in China, majority of which have close links to universities, have set up new incubators specifically for attracting university students to launch their student projects and graduate ventures there. Our survey was conducted in two such incubators - Shanghai Zizhu Enterprise Incubator (SZEI) and Shanghai Yangpu Graduate Venture Incubator (SYGVI). Both incubators are graduate venture-focused and have gained a nation-wide reputation for pioneering such infrastructural support. SZEI was established in Shanghai's Zhizhu District in May 2006 and has since become the first choice for business venturing by graduates from universities located in the district. SYGVI was established in the Yangpu District in January 2009 to cater to the needs of graduate entrepreneurs from universities located in the north of Shanghai.

To obtain the study sample, we first contacted Shanghai Science and Technology Commission (SSTC) whose responsibility it was to oversee all university student venture incubators in Shanghai. We then contacted the managing directors of both SZEI and SYGVI with the assistance from SSTC and obtained a full list of student entrepreneurs who ran their businesses in both incubators. At the time of survey, there were 141 graduate-run companies in SZEI and 29 in SYGVI. From the list of student entrepreneurs, we identified the founding entrepreneurs as the key informant because only they possessed well-rounded knowledge about the topic that we would examine.

Hoskisson et al. (2000) suggest that in emerging economies, collaboration with local authorities as we did is a key means of obtaining reliable and valid information and that face-to-face interviews are desirable because they increase response rates and generate more valid information. In our survey, all respondents were sent an official university letter that explained the academic purpose of this project and a letter from the managing director of each incubator that endorsed their support to the project.

Also, all respondents were informed of the confidentiality of their responses. Two research assistants called the targeted respondents before and after sending emails and conducted face-to-face interviews. Only 14 entrepreneurs in the list could not participate in the survey either because they were on business trips abroad or they were not available due to business scheduling reason. After face-to-face interviews with all confirmed respondents, we obtained a total of 156 completed surveys, 130 from Yangpu and 26 from Zhizhu, representing a response rate of 91.8 per cent.

Measures

In our survey, we first designed a questionnaire and conducted a pilot survey with nine graduate entrepreneurs selected from the above-mentioned list with support from the officials of both incubators. In the pilot survey, we asked them to evaluate the questionnaire's relevance and clarity and then revised several items in accordance with their feedback. The final survey was conducted in May 2010. Questionnaire items, unless stated otherwise, were measured using a five-point Likert scale in which 1 represents "strongly disagree" and 5 represent "strongly agree".

Entrepreneurial innovativeness. In this paper, we use March's (1991) definition of exploration to conceptualise entrepreneurial innovativeness. Prior research has shown that start-ups rely mainly on their founders' knowledge to innovate (Cummings and O'Connell 1978). Consistent with previous studies (Katila and Ahuja 2002; He and Wong 2004), we adopted four items to measure how graduate entrepreneurs devote attention and resources to exploit opportunities innovatively (Cronbach alpha = 0.82).

Human capital. Human capital is a complex, multifaceted phenomenon with various intangible dimensions that are not directly observable and cannot be measured with precision by a single attribute, a set of attributes, or their combined sum on individuals (Folloni & Vittadini, 2010). We measure three types of human capital. First, generic human capital is measured by educational attainment and quality of education. Levels of educational attainment are coded as follows: 1 for up to secondary school, 2 for high school, 3 for diploma, 4 for bachelor, 5 for master, and 6

for doctorate. Prior research finds that the quality ranking of universities is strongly connected with quality of an educational institution (Folloni & Vittadini 2010). China has three ties of universities, with the first tie being the most prestigious ones and the third tie being teaching universities. We use three ties of university rankings as a proxy of quality of education: 1 for Tie One national key universities, 2 for Tie Two universities, and 3 for Tie Three teaching universities. We use reverse coding when we enter the variable into the regression models. Second, we use three indicators to measure human capital resulting from participation in extra-curricular activities. They are binary variables. It is coded as 1 if the entrepreneur was a member of a student club, an executive member of a club, and had experience of internship or work placement, 0 otherwise. Third, we measure entrepreneurial human capital with three indicators: prior participation in entrepreneurship training, access to mentoring, and prior entrepreneurship experience. They are binary variables. It is coded 1 if the entrepreneur participated in in entrepreneurship education and training, had a mentor or had prior entrepreneurship experience before founding the new business, 0 otherwise.

Managerial self-efficacy. To measure the individual's belief in his or her managerial competencies, we adopt the six-item measures of managerial self-efficacy that Chandler and Hanks (1994) developed to capture the perceived competencies necessary to effectively fill the role of resource acquisition and use (Cronbach alpha = 0.73). Chandler and Hanks (1994) provided substantial evidence supporting the discriminant, convergent, and external validity of the self-evaluative scales.

Overconfidence. Following Simon et al. (2000), we adapted the same well-established format to the local context to measure overconfidence that asks the respondents to answer ten questions (Russo and Schoemaker, 1992). For each of the ten questions about general and not specific knowledge, there was only one correct numerical answer. The respondents were asked to indicate a confidence interval that they were 90 per cent certain would capture the correct answer. On average, they were expected to get 9 of 10 questions right. If more than 10 per cent of the correct answers fell outside of the range, the respondent was overconfident. Each correct answer that

fell outside of the range was scored as a one, otherwise a zero. We aggregated the scores for the 10 questions to measure overconfidence.

Entrepreneurial rewards. Shane (2003) argues that because entrepreneurs make decisions under uncertainty, they are expected to earn rewards for exercising judgment. Such rewards are conceptualized as entrepreneurial profit that is the difference between the ex-post value of a resource combination and the ex-ante cost of obtaining the resources and the cost of recombining them (Shane 2003). Carter (2011) rightly argues that the financial rewards of entrepreneurship are multifaceted and include different types and amounts of rewards at different stages of the business life cycle. She advocates that measurements of entrepreneurial rewards should focus on overall economic well-being that "comprises composite measures of financial rewards including earnings, wealth, assets, savings, and pensions, as well as highly subjective and individualized measures of consumption, lifestyle, and living standards" (p.46-47). Both entrepreneurial profit and economic wellbeing are difficult to measure directly. For most young graduate entrepreneurs at the start-up stage, financial reward arguably remains the most relevant indicator when they benchmark it with their direct peer groups and judge their own opportunity costs. So, in this paper we use financial rewards as our measures of entrepreneurial rewards. Since good new venture performance brings financial rewards to the entrepreneur, we use new venture performance as a proxy of entrepreneurial rewards. Wiklund and Shepherd (2003) showed that comparisons with competing businesses in the market reveal important information when assessing performance. In line with previous studies (e.g. Chandler and Hanks, 1993), three measures are used to capture graduate startup performance. Performance in terms of market share, revenue growth and pre-tax profit growth was measured as the relative change in preceding three years. Therefore, respondents were asked to rate their business growth performance relative to competitors on five-point scales from very good to very bad (1 = "very bad," 5 = "very good")(Cronbach alpha = 0.86). We combine the items into an overall performance scale, with higher scores indicating higher performance.

Control variables. In this study we control for potential differences that might

exist in gender, age, family business background, and industry sector. For young people, age is found to increase the likelihood that they will exploit opportunities because age is associated with acquisition of the information and skills necessary to exploit opportunities. Women may use different stocks of human capital to exploit opportunities. We used a dummy variable to control for gender difference. It was coded 1 if the entrepreneur was a male, 0 otherwise. Researchers have argued that the children of entrepreneurs should be more likely to exploit opportunities than other people. Observations of their parents' efforts to exploit opportunities provide the necessary tacit knowledge to engage in the same activity (Shane, 2003). We used a dummy measure to control for family business background. It was coded 1 if the entrepreneur had parents with family business, 0 otherwise. Finally, industrial sector is a binary variable. It was coded 1 if the graduate enterprise was in the IT sector, 0 otherwise.

Because we collected the information for the dependent and independent variables from the same respondent, a common method bias may occur. Harman's one-factor test is used to check for the presence of common method variance (Podsakoff et al., 2003). We subject all the key measures to a factor analysis and then determine the number of factors accounting for the variance in the measures. The first factor accounts for 16.36% of the variance. The results of the tests indicate no single factor accounted for a majority of the variance and thus common method bias is unlikely to be a concern for our data (Li and Zhang, 2007). To assess multicollinearity, we use the Variance Inflation Factor (VIF) as a collinearity diagnostic statistics. The VIFs of all variables are well below the cut-off point of 10, suggesting little multicolinearity in our data.

Hierarchical regression analysis is utilized as the main statistical procedure to test our hypotheses for human capital, managerial self-efficacy, overconfidence, entrepreneurial innovativeness, and entrepreneurial rewards. First, we test the hypotheses with hierarchical regression analyses for the effect of human capital, managerial self-efficacy and overconfidence on entrepreneurial innovativeness (Aiken and West, 1991). Second, a regression analysis is performed to test the relationship

between entrepreneurial innovativeness and entrepreneurial rewards.

Results

Graduate entrepreneurs in our sample were typically male (75.8%), aged 23-30 (68.5%), had a bachelor's degree (55.8%), started a business after 1-2 years of graduation (60.5%), and started the business in the IT sector (51%). They employed an average of nine people. Table 1 reports the descriptive statistics and bivariate correlations of all the variables.

Table 1 inserted here

Our results are reported in Tables 2. In Models 1, we test the effect of control variables on entrepreneurial innovativeness. In Models 2, we estimate the effect of human capital arising from years of education and quality of education on entrepreneurial innovativeness. Hypothesis 1a proposed that students with high general human capital from educational attainment and quality of education are more likely to exploit opportunity innovatively. Model 2 of Table 2 shows that quality of formal education is positively and significantly associated with entrepreneurial innovativeness (β = 0.46, p<0.10). We also find that years of education is significantly but negatively related to entrepreneurial innovativeness (β=-1.259, p<0.001), suggesting that students with high human capital are less likely to exploit opportunities innovatively. This may be because that over-investment leading to high levels of certification may discourage risk taking, while under-investment may encourage it (Davidsson & Honig, 2003). Overall, H1a receives partial support. Hypothesis 1b proposed that students with high general human capital from participation in extracurricular activities and work experience development are more likely to exploit opportunity innovatively. Model 3 shows that students who develop leadership experience and career experience through widening participation are more likely to exploit opportunities innovatively (β = 1.019, p<0.10; β = 0.842, p<0.10). However, participation in extracurricular activities in general is found to have no

effect on how students exploit opportunities. Again, H1b is partially supported. Hypothesis 1c proposed that students with high entrepreneurial human capital from entrepreneurship learning and activities are more likely to exploit opportunity innovatively. Model 4 shows that entrepreneurship education is significantly and positively associated with entrepreneurial innovativeness (β = 1.619, p<0.05), while mentoring support and prior entrepreneurial experience have no effect on how students exploit opportunities. Thus, H1c is partially supported. Overall, H1 receives partial support. Hypothesis 2 proposed that students with high managerial self-efficacy are more likely to exploit opportunity innovatively. Model 5 shows a significant and positive relationship between managerial self-efficacy and entrepreneurial innovativeness (β = 0.287, p<0.01). Therefore, the finding supports Hypothesis 2. Hypothesis 3 proposed that students with overconfidence are more likely to exploit opportunity innovatively. Model 5 shows that the relationship between overconfidence and entrepreneurial innovativeness is significant and positive (β = 0.566, p<0.01). The result supports Hypothesis 3.

Tables 2 inserted here

Model 6 in Table 3 is the base model that examines the effects of all control variables on entrepreneurial rewards. The model is not significant, indicating that none of the control variables has significant effect on entrepreneurial rewards. Hypotheses 4 proposed a curvilinear (U-shape) relationship between entrepreneurial innovativeness and entrepreneurial rewards. Model 7 displays the results of the regression model with entrepreneurial innovativeness as the independent variable, and entrepreneurial rewards as the dependent variable. Aiken and West (1991) suggest that a positive (negative) sign for coefficient of the squared term indicates a U-shaped (inverted U-shaped) relationship. In Model 7, the coefficient of entrepreneurial innovativeness is negative and significant (β=-0.023, p<0.01), and the coefficient for the squared term of entrepreneurial innovativeness is positive and significant (β=0.003, p<0.1), indicating a U-shape nonlinear relationship between entrepreneurial innovativeness

and entrepreneurial rewards. Thus, as exploration increases, entrepreneurial rewards decreases up to a point, after which entrepreneurial rewards increases as exploration increases. This finding supports hypothesis 4.

Table 3 inserted here

Discussion and conclusion

The intent of this research was to advance understanding of why some graduate entrepreneurs are more innovative than others. We bridge the graduate enterprise literature and innovation entrepreneurship literature and set out to explain why highly educated graduate entrepreneurs are not always innovative in starting new businesses. From the perspective of human capital theory, Shane (2003) and others mainly focus on the individual abilities-opportunity nexus to explain why some people exploit entrepreneurial opportunities and others do not. We supplement this argument with one that focuses on the individual opportunity costs-entrepreneurial rewards nexus to argue that graduate entrepreneurs will exploit entrepreneurial opportunities more innovatively if a) they expect the levels of entrepreneurial rewards that match their high human capital and high opportunity costs, b) they possess high managerial self-efficacy, and c) they are overconfident. We also argue that graduate entrepreneurs with high human capital would be even more motivated to exploit opportunities innovatively in the realisation that financial rewards to entrepreneurship are generally lower than to paid employment. We found that graduate entrepreneurs with greater 'quantity' of human capital, arising from quality of education, leadership experience from extracurricular activities, work placement experience, and entrepreneurship education and training, are more likely to exploit opportunities innovatively. This is because they do so in order to raise the expected utility of exploiting entrepreneurial opportunities to justify the high opportunity costs. We also found that graduate entrepreneurs' psychological make-up such as managerial self-efficacy and

overconfidence has a significant impact on the innovativeness of opportunity exploitation. Finally, we found that the precarious nature of entrepreneurial rewards drives graduate entrepreneurs with high human capital and high opportunity costs to exploit opportunities innovatively.

Shane's (2003) framework on individual-opportunity nexus suggests that people who are better educated, have higher self-efficacy and are overconfident are more likely to exploit entrepreneurial opportunities. In this paper, we build on his framework and move beyond the focus on *whether* one is to exploit opportunities to *how* one is to exploit opportunities. We contextualize our framework from the graduate entrepreneurship perspective to show why some graduate entrepreneurs are more innovative than others. Anchoring on the human capital investments and earnings nexus of the human capital theory, we argue that while university students commonly invest their money, time and emotion in human capital development, the output of their investments diverges as a result of the length and quality of education, participation in extracurricular activities and work experience activities, and engagement in entrepreneurship education and activities. Students who have developed high human capital have better career prospects and high opportunity costs, meaning a larger gap between expected utility of exploiting opportunities and the alternative uses of their human capital. High opportunity costs mean greater needs to exploit opportunities more innovatively. Hence, we argue that differences in graduate entrepreneurs' innovativeness can be explained by the differences in individuals' human capital and resulting opportunity costs in opportunity exploitation. We find evidence to support this argument. Overall, framing our argument on the opportunity costs-innovative baheviour relationship, this study contributes to the graduate entrepreneurship literature by demonstrating a clear link between human capital investments, opportunity costs, and needs for innovative opportunity exploitation in return for higher entrepreneurial rewards. More broadly, this study also contributes to the innovative entrepreneurship literature by demonstrating a clear relationship between the 'quantity' of human capital and entrepreneurial innovativeness.

In addition, we argue that innovative opportunity exploitation is also driven by psychological factors. We find that human capital is a necessary but not sufficient condition that influences students' decisions on innovative opportunity exploitation. Some students who have high human capital and high opportunity costs may never decide to exploit entrepreneurial opportunities. We find that students who possess high managerial self-efficacy are more likely to exploit opportunities innovatively. This is consistent with Bandura's (1997) social cognition theory that asserts that self-efficacy is task-related and is the belief in one's ability to perform a given task. Unger et al. (2011) identify 40 start-up related tasks from extant research and find that the acquisition of task-related knowledge is more important than past experiences. Our finding suggests that students who have high managerial self-efficacy are more confident with their abilities to acquire and utilize resources more effectively, thereby more likely to exploit opportunities innovatively. In addition, we find that cognitive characteristics such as overconfidence influence the innovation behavior of start-ups at the individual level. In this respect, our research contributes to the innovative entrepreneurship literature by providing clear empirical evidence to suggest that individuals' difference in entrepreneurial innovativeness is influenced by the difference in entrepreneurs' psychological make-up.

In our framework we also argue that graduate entrepreneurs' innovativeness is influenced by their anticipations of entrepreneurial rewards as embodied in the likelihood of new venture success. The human capital investments-earnings nexus suggests that students with high human capital and high opportunity costs are motivated to exploit opportunities innovatively. They would be even more highly motivated to exploit opportunities innovatively in the light of lower financial rewards from entrepreneurship than from paid employment. In opportunity exploitation, a more radical approach, if successful, may result in greater entrepreneurial rewards from venture success as afforded by first mover advantages (Lieberman & Montgomery, 1988). Nonetheless, innovativeness increases the probability of failure.

Paradoxically, taking more chances does not improve the prospects of entrepreneurial rewards in the short term. The odds of success would increase only if the entrepreneurs could be resilient enough to withstand early setbacks. This suggests a curvilinear (U-shaped) relationship between innovative opportunity exploitation and entrepreneurial rewards. Our finding supports this hypothesis. In their meta-analytical review of human capital and entrepreneurial success, Unger et al. (2011) confirm a significant and small overall relationship between human capital and success. They have also found the magnitude of the success relationship depends on contextualization of human capital, the context of the firm, and the choice of success measures. Our research contributes to the innovative behavior-performance literature by demonstrating that the innovative behavior-performance relationship is more complicated. We show that the relationship depends on the context of innovation behavior that is influenced by the interplay of opportunity costs and entrepreneurial rewards.

The findings of our study have implications for entrepreneurship educators. As students' entrepreneurial innovativeness is associated with their human capital and opportunity costs, the primary implication of this study is that universities will be more likely to see the emergence of more high quality entrepreneurs if they provide support to those who have high human capital to exploit entrepreneurial opportunities. More broadly speaking, as our research suggests that quality of education provision be of crucial importance in the formation of human capital, the essential measure universities should take is to place excellence in education at the centre of their education strategy. Our research also implies that students should be encouraged to develop their human capital using all channels available to them. More specifically, our research suggests that students be supported to develop leadership skills in combination with career experience and entrepreneurship knowledge and skills. In assessing the experience of Scotland's Graduate Enterprise Programme, Rosa (2003) echoed Gibb's (2000) argument that it is important to separate conceptually between 'enterprise' in the sense of entrepreneurial behavioural qualities and enterprise in the

sense of being 'business like'. He suggested that it would be much better designed to increase business competence than creative motivation and flair among graduates. Likewise, Unger et al. (2011) emphasized the importance in focus on task-specific human capital development. Our finding of the effect of managerial self-efficacy on entrepreneurial innovativeness is consistent with this line of argument, suggesting that entrepreneurship education needs to develop students' self-efficacy and address their deficit of knowledge and skills in finding and using resources in opportunity exploitation. Finally, our finding of the curvilinear (U-shaped) relationship between innovative opportunity exploitation and entrepreneurial rewards suggests that entrepreneurial rewards cannot be taken for granted when students exploit opportunities innovatively. Entrepreneurship education needs to help develop graduate entrepreneurs' resilience and provide coping support in order to help them navigate the uncharted waters of innovation and withstand setbacks.

This research has some limitations that need to be recognized. The first limitation of this study is that the result could not infer causal relationships due to its cross-sectional design. Further research might use a longitudinal design to examine these linkages more clearly. The second limitation is concerned with potential problems of self-reported data, such as limited retrospective recall by respondents. However, the post hoc examination with the Harman's one-factor analysis (Podsakoff and Organ, 1986) which indicated no serious common method problems provided evidence against the presence of common method bias. Third, further research should examine other dimensions of knowledge strategies such as absorptive capacity. Finally, we collected data from a sample of graduate enterprises located in two incubators in Shanghai, China, thereby the generalized level of our findings is limited.

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