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# Export Propensity, Export Intensity and Firm Performance: the Role of the Entrepreneurial Founding Team

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**Abstract**
We investigate how the characteristics and experience of the entrepreneurial founding team (EFT) affect the export orientation and subsequent performance of the businesses they establish, while allowing for the mutually-reinforcing relationship between exporting and productivity. Using a sample of UK technology based firms, we hypothesize and confirm that the set of EFT human capital needed for entering export markets is different from that required for succeeding in export markets. Commercial and managerial experience helps firms become exporters, but once over the exporting hurdle it is education, both general and specific, that has a substantially positive effect. The overall pattern of human capital effects on productivity are similar to those for export propensity. We also find evidence that productive firms are more likely both to enter export markets and to be export intensive, and that exporting boosts subsequent firm productivity.

**Key words:** exporting; export intensity; entrepreneurial founding team; human capital; productivity.

## 1. Introduction

This paper considers jointly two major issues in international business and international entrepreneurship: first, how the characteristics and experience of the entrepreneurial founding team (EFT) affect the export orientation and subsequent performance of the businesses they establish, and second, the relationship between exporting and productivity at the firm level. As we show below, these issues are closely related both theoretically and empirically: although each has a considerable academic literature, the two issues are rarely considered in tandem, and as a result our understanding of the relationship between entrepreneurship, exporting and performance is less complete than it could be. EFTs are defined as those individuals who own part of a firm's equity and are responsible for making strategic decisions at the firm's incorporation date (Ucbasaran et al, 2003; Wright et al., 2007).

The issue of how firms acquire the knowledge and skills necessary to make the transition into operating in international markets is a key theme within IB research. The view of internationalization as a sequential process, as described originally by Johanson and Vahlne (1977), sees the firm's experience in international markets as crucial in driving further international expansion, with a corresponding emphasis on gradually building firm-level experience. By contrast, the international entrepreneurship (IE) literature has generally been more concerned with the nature of the human capital needed by entrepreneurs to both enter and succeed in international markets (Westhead et al 2001; Wright et al 2007). A related strand has been especially concerned with the ability of relatively young firms to become international without the lengthy period of developing suitable experience implied by the process model (Oviatt and McDougall 1995; Knight and Cavusgil 2004). Our theoretical and empirical analysis helps to show that there is some degree of complementarity between these two approaches with respect to internationalization through exporting.

While we now understand much of the way in which human capital affects exporting and performance, major gaps still exist in the literature, both theoretical and methodological. This paper addresses two of these gaps. The major theoretical gap lies in identifying which aspects of human capital are relevant at different stages of the process of internationalization through exporting. We directly address this shortcoming in the theoretical literature building on human capital theory (Becker 1964) and its subsequent applications to IE. Specifically, we develop theory suggesting that human capital gained though experience has an effect through the decision to become an exporter,

while human capital gained through education operates principally through enhancing export performance (i.e. makes the firm more export intensive). In the case of the exporting decision, attitudes and perceptions of the risks and costs associated with exporting that are among the main determinants behind a strategic decision to become an exporter: experiential learning significantly reduces negative attitudes and perceptions towards the risks of operating abroad. By contrast, human capital gained through education is more geared towards problem solving and assisting entrepreneurs to develop appropriate management and operational practices necessary for reaching higher levels of export performance once the initial exporting decision is made. Educational aspects of human capital therefore operate principally through their effect on export intensity. This theoretical development helps bridge the gap identified between the IB and IE literatures, by providing more integrative theory (Keupp and Gassman, 2009; Bruneel et al 2010).

The main methodological contribution of the paper lies in considering the impact of the EFT while allowing fully for the relationship between exporting and productivity. Exporting help boost productivity in a variety of ways. First, the stronger competition in foreign markets forces firms to improve both products and processes and thus remain competitive. Second, there is the possibility of 'learning by exporting', principally involving being exposed to superior foreign knowledge and technology which also helps to boost the productivity of exporting firms (Kobrin 1991; Grossman and Helpman 1991). Finally, scale effect may be important. Exporting extends the market over which margins may be earned, and since many costs, such as R&D, are largely fixed, such investments may be recouped over a larger sales volume. This aids productivity, and provides greater incentives to invest in R&D and innovation. However, highly productive firms may also be more likely to become exporters. The rationale for this is that firms contemplating entry to foreign markets have to engage in market research, set up new distribution networks, negotiate with potential new partners, and may have to modify their product range, all of which incur costs. Only those with sufficiently low marginal costs have the profits large enough to cover these fixed costs of entry (Roberts and Tybout ;1997; Clerides et al 1998; Helpman et al 2004). Thus exporters are more productive than non-exporters not specifically because of benefits derived from exporting, but because they are more productive firms to begin with, and can therefore overcome the fixed costs of entering foreign markets.

While empirical studies increasingly recognize the endogenous nature of this relationship (Bernard and Jensen 1999; Baldwin and Gu 2004; Love and Mansury 2009), this has not previously been fully integrated into studies of the performance and exporting implications of EFT human capital. Allowing for these joint effects is an important element in distinguishing the true effects of the EFT. Since human capital of the EFT can affect both exporting and productivity, allowing fully for endogeneity between them increases the accuracy of empirical estimation, and enhances our understanding of the importance of the EFT.

Empirically, our analysis focuses on a specific group of firms for which aspects of EFT human capital and internationalization are of particular interest. Much recent attention has been focused on the internationalization of either 'born globals' or international new ventures, and more specifically to a subgroup of those firms – young, entrepreneurial, high-tech SMEs that start exporting from the early stages of their lives – and to the exporting activities of more established entrepreneurial high-tech SMEs. The main aim of this research stream is the uncovering of patterns associated with the successful internationalization of both sets of firms. Both of these groups of firms are characterized by the development of innovative products/services through the application of scientific/technological knowledge and can be described as entrepreneurial technology based firms (ETBFs) (Filatotchev et al, 2009; Weerawardena et al 2007; Neergaard, 2003; Zahra and Gravis, 2000; Oviatt and McDougall, 1994; 1997).

ETBFs achieve higher rates of growth in relation to SMEs that operate in other industrial sectors mainly due to their ability to successfully introduce often radically new and innovative products/services to the market (Wright et al, 2008; Marvel and Lumpkin, 2007; Lynskey, 2004). The development of those innovative products/services requires a large and continuous R&D investment to be made by ETBFs immediately from their inception, which means that entering large enough markets that can allow them to offset high R&D expenditure is vital (Lynskey, 2004; Acs and Audretsch, 1987). Moreover most ETBFs operate in industrial sectors characterized by fast product obsolescence and often focus on specific market niches, which means that their targeted customers can be spread all over the world (Zou et al, 2010; Preece et al, 1998). It is evident therefore that entering a foreign market is very important for those firms and it is a strategic decision that once made can enhance their future survival and growth (Saemundsson and Dahlstrand, 2005; Neergaard, 2003).

However, the very nature of technological radical innovations creates a number of problems that ETBFs have to overcome in order to start exporting. First there is the problem of identifying an appropriate group of foreign-based customers, something that becomes even harder when a product is new-to market as marketing data for such products typically do not exist. In addition, because of the large R&D investment that often needs to be made ETBFs are frequently financially constrained, making investment in human and other intangible resources more difficult (Autio and Yli- Renko, 1998; Lofsten and Lindelof, 2005).

What an entrepreneurial firm lacks in resources it may make up for in specialized expertise (Manolova et al, 2002). More specifically the entrepreneur, or the EFT, is the key variable in a ETBF's internationalization process, as an entrepreneur is the main decision-maker and therefore the quality of decisions made by a firm is regarded as a reflection of its top management team (Oviatt and McDougal, 1994; 1997; McDougal and Oviatt, 2000; Casson, 2005; Leonidou and Katsikeas, 1996; Bloodgood et al, 1996; Westhead et al, 2001; 2002; Filatotchev et al, 2009). It is the entrepreneurial team that is responsible for gathering information, identifying/accessing opportunities and selecting appropriate business strategies which makes entrepreneurs responsible not only for the exporting behavior of their firms but also for their subsequent export and overall firm performance (Wright et al, 2008; Weerawardena et al, 2007; Zucchella et al, 2007; Ibeh, 2003; Kundu and Katz, 2003; Westhead et al, 2001). Thus high levels of appropriate education and knowledge derived from experience can allow entrepreneurs to discover and filter export opportunities, interpret and construct meaning and ultimately exploit these opportunities, leading to higher levels of exporting and in turn firm performance (McDougall et al, 1994; Bloodgood et al, 1996; Kundu and Katz, 2003; Jones and Coviello, 2005; Mtigwe, 2005; Filatotchev et al 2009).

In addition to the theoretical and methodological contributions outlined above, our analysis of UK ETBFs responds to calls for research to move beyond early-stage entrepreneurship and internationalization. Several authors, among them Zahra and George (2002), Dimitratos and Jones, (2005) and Filatotchev et al (2009), point out that although a number of studies have investigated the internationalization of smaller firms, most have focused on the internationalization of early-stage or 'born globals' ignoring more mature high-tech SMEs. They therefore call for research in the field to also concentrate on already established entrepreneurial firms (especially those operating in high-tech sectors); such firms engage in entrepreneurial activities in international markets and their exclusion

ignores the fact that entrepreneurial activities are ongoing processes that unfold over time. Our sample of ETBFs fits this call for a wider consideration of firm types, as it includes both relatively young and also more established firms.

## 2. Theory and Hypotheses

This section develops hypotheses on the expected effect of different aspects of entrepreneurial human capital on export propensity, export intensity, and subsequent firm performance and on the relationship between exporting and performance. The conceptual background is provided by the general model of entrepreneurial internationalization introduced by Jones and Coviello (2005) who consider four key constructs; the external environment, a firm's internal environment or resources, the entrepreneur (or entrepreneurial team) and a firm's performance, alongside two primary process dimensions; time and internationalization behavior. Drawing from this general model, we investigate the relationship between entrepreneurial human capital (of the EFT) and a firm's exporting activity and subsequent performance while also taking into account a firm's resource base and the endogeneity between exporting and productivity.

The theoretical basis of how entrepreneurial capabilities can be measured is provided by Becker's (1964) human capital theory. First applied to employees, human capital theory states that the economic performance and productivity of an individual will depend on their level of investment in each of their capabilities and skills. This investment may occur through formal education and training, or through relevant experience, and may be expected to result in enhanced performance of the organisation or firm employing the individual (Teixeira 2002).

Bruderl et al (1992) first fitted this theory in the entrepreneurial context. According to this theory entrepreneurial characteristics are divided into general and specific human capital, and entrepreneurs with higher levels of general and specific human capital (i.e. higher quality inputs) can be expected to show higher levels of performance (i.e. superior outputs) in relation to those with lower human capital in a variety of contexts including firm survival, growth and performance. General human capital refers to generic skills acquired through formal education, training and work experience and which are useful and easily transferable across a wide range of occupational alternatives and economic settings. On the other hand, specific human capital has a more limited scope, as

investments in specific human capital create value in a particular business context and have a narrower scope of applicability. In the current context specific human capital refers to the attributes, skills and experience of the EFT which is of direct use in entering and exploiting export markets and in enhancing firm performance.

This study will focus on human capital which is based on the entrepreneurs' accumulated knowledge and experience, both of which have been argued to play a major role in the internationalization of high-tech firms (Bloodgood et al 1996; Westhead et al, 2001; Brush et al 2002; Zucchella et al, 2007). In accordance with Becker's human capital theory, we differentiate between general and specific human capital available among the EFT, but extend the theoretical analysis to consider the differential effects of human capital acquired through experience and that acquired through education at different stages of the exporting process. More specifically we argue that the relationship between human capital and exporting propensity and intensity is not as obvious as is assumed by the human capital theory (i.e. greater inputs equals greater outputs regardless of the context), and we develop theory suggesting that experience aspects of human capital matter for overcoming the exporting hurdle, but once over that hurdle it is educational aspects of human capital that matter more. We are also able to consider several different dimensions of specific human capital in the analysis: business and technical education; and commercial, managerial, technical and same-sector experience.

***Experiential versus educational human capital and their relationship with export probability and export success***

Our concern here is with how firms accumulate the knowledge and skills required for internationalization via exporting, and in particular, how these skills and knowledge are encapsulated in the cognitive knowledge base of the entrepreneurial founding team.

While Becker (1964) and subsequent analysis (Bruderl et al 1992; Bruderl and Preisendorfer 2000) makes an important distinction between general and specific aspects of human capital, theories of human capital tell us relatively little about which aspects of human capital are relevant at different stages of the process of internationalization. For example, the decision to engage in exporting is a fundamental one for any business, and is quite different from deciding the extent to which the firm is involved in exporting. The first of these is a strategic – possibly entrepreneurial – decision (Wright

et al 2008), while the extent of exporting is more an issue of managing the firm's exposure to export markets once the initial internationalization decision has been made. It is likely, therefore, that different skills and dimensions of human capital will be important for these two aspects of the internationalization process. In other words, the set of human capital skills needed for *entering* and *succeeding* in export markets are likely to be somewhat different. We therefore hypothesize that some aspects of human capital will be more applicable to the exporting decision, while others will operate principally through increasing export intensity. Specifically, we differentiate conceptually between the effects of human capital gained through experience, and human capital gained through education.

Although all firms are exposed to factors that can stimulate exporting, not all firms make the decision to start exporting. This behaviour is most often attributed to the perception that companies have towards exporting risk; for example Simpson and Kajuwa (1974) found that firms that initiated exporting had a lower perception of exporting risk in relation to non-exporters. It is the attitudes, perceptions and predispositions that deci sion makers have towards the risks and costs associated with exporting that are among the main determinants behind a firm's strategic decision to trade in foreign markets (Tihanyi et al., 2000; Reid, 1981; Gray, 1997). Experience is particularly useful in helping decide on fundamentally new and risky enterprises, such as entering export markets for the first time. The perceptions, attitudes and even expectations of decision makers towards exporting are affected by the skills that they have accumulated through experience, whether export-related or not (Reid, 1981; Shrader et al 2000). Experiential learning significantly reduces negative attitudes and perceptions towards foreign markets, and leads to more realistic expectations of the effects of exporting on the growth and development of the firm (Gray, 1997; Shrader et al 2000).

The benefits of experiential learning in aiding risk perception applies both to general and specific aspects of human capital. High levels of general experience allow entrepreneurs to recognize and evaluate information related to a foreign market opportunity quickly, something vital for a complex high-tech environment characterized by products with short life cycles and continuous technological change (Wright et al 2008). In addition, more experienced entrepreneurs are more likely to capitalize on their existing wide business and social networks. These skills allow experienced entrepreneurs not only to assess risk in export markets effectively, but also permits them to mitigate perceived risk

through accumulated networks, skills that can be used to stimulate export activity (Westhead et al, 2001; Brush et al, 2002; Filatotchev et al 2009).

Specific human capital also has an important role to play. Functional experience – commercial, technical and managerial – contributes directly to the improvement of expectations and to the reduction of risk perception in exporting (Bantel and Jackson, 1989; Tihanyi et al., 2000; Hambrick and Mason, 1984; Gupta and Govindarajan, 1984; Shrader et al 2000). The technical experience that an entrepreneur has prior to starting the firm has been linked with exporting in a number of studies (e.g. Leonidou et al., 1998). For example, knowledge in production technologies that assist small-scale but low-cost manufacturing allow a firm to serve the needs of specialised customers in niche markets across the globe, therefore reducing the levels of perceived costs and risks associated with the manufacturing aspect of exporting (Knight and Cavusgil, 2004; Simpson and Kujawa, 1974). Prior commercial experience has been related with the pursue of market growth strategies such as exporting (Finkelstein and Hambrick, 1990; Gupta and Govindarajan, 1984) as it assists in the development of skills needed for external industry monitoring and analysis (Gupta and Govindarajan, 1984), further leading to the reduction of perceived uncertainty and risk associated with the commercial aspects of exporting. Finally, entrepreneurs with prior managerial experience are typically more confident in decision making and more likely to overcome perceived barriers and take action in order to exploit identified opportunities (Ucbasaran et al, 2008): specifically, managerial and commercial experience has been found to be among the main differentiating factors between exporting and non-exporting firms (Wiedersheim-Paul et al., 1978; Cavusgil and Nevil, 1981; Westhead et al 2001).

Along similar lines, industry-specific experience has been found to be a key factor for the internationalization of SMEs and to reduce entrepreneurs' perceived risk of carrying out business in foreign markets. This occurs by allowing them to become easily acquainted with local, national and internationally based customers and to better evaluate the outcomes and future profit of their strategic decisions by generalising and transferring experience gained in industry sectors at a national level to similar newly-targeted foreign market sectors (Oviatt and McDougal, 1994; Gelderen et al 2000; Chandler, 1996; Westhead et al, 2001).

Skills gained from functional and industry-specific experience can therefore significantly reduce negative perceptions and attitudes towards the risks and costs allied with exporting. We expect their (positive) effect to be concentrated on export *propensity* rather than on export *performance* for two reasons. First, the perception of exporting risk does not differ by level of export performance (Gray, 1997), suggesting that risk, and therefore the general and functional experience that determines perception of risk, is unlikely to influence export performance as opposed to entry into export markets. Second, cognitive theorists suggest that experienced entrepreneurs can fall into mental ruts that might cause failure to adapt to environmental changes or requirements, and therefore may not be able to transform experience-based knowledge into the expected levels of greater performance (Ucbasaran et al., 2008). For these reasons we expect high levels of experience aspects of human capital to be closely linked to the exporting decision:

Hypothesis 1: *Experience dimensions of EFT human capital positively influence exporting propensity.*

By contrast, human capital acquired through educational attainment (general, business or technical) typically provides skills of a different sort, which are more suited to the successful running of a business once the basic export decision is made. Entrepreneurs with high levels of general education have enhanced problem-solving skills through the identification and evaluation of feasible solutions (Bantel and Jackson, 1989), which can increase the chances of the successful exploitation of foreign market opportunities (Cooper et al 1994).

Moreover, the skills acquired through a business education are frequently geared more towards running a business than with acts such entering a new export market. This in turn suggests that specific business and technical educational aspects of human capital tend to operate most effectively after the initial export-entry decision has been made, a view supported by previous research. For example, Beamish and Calof (1989) found that education which provides international business skills is more effective after relevant experience has been gained, while Samiee and Walters (2000) found that firms with significantly higher levels of export performance regarded business education as a complement of the knowledge already gained from experience, and was vital in gaining an ongoing competitive edge in foreign market after the initial entry decision.

While both business and technical education may help in boosting export performance, the mechanisms by which they do so may be subtly different. The mechanism by which business education has this effect is through assisting the entrepreneur to develop the appropriate management operational practices necessary for reaching higher levels of export performance (Gray, 1997; Samiee and Walters, 2000; Contractor et al., 2005). For example, Cerrato and Piva (forthcoming) found that although managerial experience was significantly linked with export propensity, it had little effect on the extent of exporting: this was determined by skills derived from education that in turn influence the organizational structure and practices necessary for operating successfully and developing a competitive advantage in foreign markets, as these operating practices are different from those that create competitive advantage in domestic markets (McDougal et al., 1994). Indeed, commercial knowledge gained through business education has been identified by Eyre and Smallman (1998) to be one of the three key competencies of export managers.

Entrepreneurs with business education have the necessary skills and knowledge related to management techniques that will allow them to deal with business operations more effectively in foreign markets (Knight and Gavusgil, 2004; Koh, 1991). For example, business education allows entrepreneurs to create specific marketing-related strategies that enable the firm to deal effectively with rapid technological change, shorter product life cycles and to successfully exploit opportunities in foreign markets. This can be achieved by gearing the firm towards offering differentiating products and services that buyers perceive to exceed the value of alternative offerings thereby facilitating superior export performance. Marketing scholars have long recognized the value in adopting a differentiation market-based export strategy through the offering of unique products (e.g., Cavusgil et al., 1993; Knight and Gavusgill, 2004; Gray, 1997). An EFT characterized by high levels of business education has a higher chance of being market oriented and therefore to have a higher commitment to internationalization and developing export markets.

While business education operates by improving the operational practices relevant to exporting success, technical education operates along a different, but related dimension. Technical education in the context of high-technology firms is strongly linked with willingness to be technologically innovative, the creation of unique products (Storey and Tether, 1998a; Marvel and Lumpkin, 2007) and with the general level of innovativeness present in a firm which in turn are all linked with higher levels of export performance (Kundu and Katz, 2003; Knight, 2001). Technical knowledge,

competence and innovativeness provide the basis for the creation of new ideas, creative business and operating methods and processes (i.e. information technology and e-commerce) that improve organizational performance and competitiveness in international markets (Marvel and Lumpkin, 2007; Knight and Cavusgil, 2004; Zahra et al., 2000). In addition, high level of knowledge intensity of products/technologies, as it is a mobile resource, can be combined relatively easily with fixed assets (manufacturing facilities in other countries, sales network) in order to create a cost-effective platform for international expansion (Autio et al., 2000, Yli- Renko et al, 2002), therefore improving exporting performance.

The role of technical education in enhancing innovation may be of great importance, because of the close link between innovation and export performance. For example, Lachenmaier and Wößmann (2006) employ a sample of 981 manufacturing firms in Germany to perform estimation of exporting with innovation as an endogenous determinant. They find that innovators have an export share on average 12.6 percentage points higher than those of non-innovators, and that slightly more than half of this can be attributed to the effect of innovation on exports. This effect is not restricted to manufacturing. Gourlay *et al* (2005) study the determinants of export behaviour for a panel of over 1000 UK service firms for the period 1988 to 2001, and find that innovation has a strong positive effect on export intensity.

In summary, both general and specific human capital gained through education assists in the development of suitable operating systems and the necessary innovative product portfolios for international expansion, leading to the second hypothesis:

Hypothesis 2*: Education dimensions of EFT human capital positively influence export intensity.*

***Human capital and firm performance***

In addition to having an effect on exporting behaviour, the human capital of the EFT can be expected to have a direct effect on the performance of the firm. This applies to both general and specific aspects of human capital.

General human capital enhances entrepreneurs' problem solving ability and allows for the accumulation and assimilation of new knowledge and skills, in turn facilitating effective adaptation

to external environmental changes (Dimov and Shepherd, 2005; Wright et al 2007; Ucbasaran et al 2008). In more detail, general experience increases firm productivity by improving entrepreneurs' strategic decision making and the identification of viable business opportunities (Boeker and Karichalil, 2002), and by assisting entrepreneurs' adaptation to new situations (Wright et al, 2008; Marvel and Lumpkin, 2007; Shrader and Siegel 2007). Similarly, high levels of general education enhance a firm's performance by increasing an entrepreneur's learning ability, which in turn improves the acquisition of information and skills that enable the identification and successful exploitation of entrepreneurial opportunities (Avermaete et al, 2004; Marvel and Lumpkin, 2007). Moreover highly educated entrepreneurs are also perceived to be better in dealing with complex problems and therefore achieving higher levels of performance (Cooper et al, 1994; Ucbasaran et al, 2008).

More specific aspects of human capital are also closely linked to performance. In a recent meta-analysis investigating the association between entrepreneurial human capital and firm performance Unger et al (2011) found that this relationship was particularly high in the case of specific human capital. For example, same sector experience has been associated with higher levels of firm performance (Bosma et al 2004) as it provides specialised understanding and knowledge of the products and associated technologies as well as of the key success factors that characterise a certain industry (Cooper et al 1994). Moreover entrepreneurs with such experience will be more aware of any underdeveloped technological and marketing opportunities in a specific sector that provide a good potential for market exploitation (Shane 2000).

Entrepreneurs with managerial experience are more equipped to respond to market change, to make more informed strategic decisions and identify appropriate opportunities (Newbert et al, 2007; Ucbasaran et al, 2008) all of which lead to higher levels of firm performance. Similarly, business education and specific commercial experience have been found to be important for a firm's overall success and performance, and their absence can restrict the performance and growth of an ETBF. This is because such education and experience contribute to strategy formulation, vital for the successful exploitation of technological opportunities as well as for the identification of markets that can allow a firm's products to be competitive in relation to those of rivals (Park, 2005; Berry, 1996; Delapierre et al, 1998).

Finally, technical education and experience are important, especially for the case of high-tech sectors where technology is advancing rapidly (Barkham, 1994). A concrete technological knowledge base can allow a firm to develop products with higher levels of technological performance and to cut a product's development time, allowing the firm to charge higher sales price and generate sales more rapidly (Sapienza et al 2004). This leads to the third hypothesis:

Hypothesis 3: *EFT human capital positively influences firm productivity.*

***Exporting and productivity***

The final element of the theoretical nexus involves the endogenous relationship between exporting and productivity at the firm level. Consideration of this relationship is an important element in distinguishing the true effects of the EFT on exporting and performance. Highly productive firms are more likely to become exporters because only those with sufficiently low marginal costs have the profits large enough to cover the fixed costs of international market entry, and to bear the costs of further expansion into foreign markets. Evidence for this 'self-selection' effect is widespread, and is found with regard to exporting for a number of countries: Wagner (2007) reviews fifty-four micro-based empirical studies on exporting published between 1995 and 2006, and finds overwhelming support for the existence of this self-selection mechanism.

However, there is also evidence that exporters have higher levels of survival, productivity and growth in relation to non-exporters even after taking into consideration the self selection of more productive firms into foreign markets (Bernard and Jensen, 1999; Love and Mansury, 2009; Baldwin and Gu 2004; Van Biesebroeck, 2005; Aw et al 2007; Wagner, 2007). This is achieved partly through market scale effects as exporting extends the market over which margins can be earned which allows firms to recoup the investment made in innovation over a larger sales volume (Love and Mansury, 2009). Other reasons include learning by exporting which, apart from the benefits of exposure to superior foreign knowledge and technology, enables firms to acquire commercial information on foreign customers' preferences and on methods through which operational efficiencies can be achieved (Blalock and Gertler, 2004; Fafchamps et al, 2007). Therefore:

Hypothesis 4a: *Productive firms are more likely to export and to be export intensive.*

Hypothesis 4b: *Exporting has a positive effect on subsequent firm productivity.*

A schematic of the hypotheses and the relationships between them is given in Figure 1.

## 3. Dataset

The empirical analysis is based on data from a representative survey of ETBFs. These are defined as firms that are independently owned (i.e. the founder(s) owns at least 50% of the company), are less than 25 years old and belong to a high technology sector[1] (Storey and Tether, 1998b; Colombo and Grilli, 2005). The survey gathered information on the exporting and innovation activities of the firms, as well as performance data and information on the backgrounds of the founders.

In order to identify the UK high technology sectors an approach similar to that used by Butchard (1987)[2] was followed, based on the twin criteria of firms with high R&D intensity (measured as R&D expenditure over the amount of sales or value added) and firms with a high proportion of scientists and engineers who spend the majority of their time in R&D activities. By using the OECD STAN indicators and the 'Research & Development in the UK' (2002) published by the Office of National Statistics (ONS MA14), the expenditure over sales as well as the R&D expenditure over value added criterion was used, for each sector according to the UK SIC classification[3]. The ratio of scientists and engineers who spend the majority of their time in R&D activities over total employment was also calculated by using the ONS MA14 reports and the STAN indicators. The categorization of companies according to the independence criterion was done by using FAME (Financial Analysis Made Easy), a database that contains contact details of all the limited UK companies and their directors, which can also be used to isolate the companies where owners own more than 50% equity.

[1] Terminology in the literature varies somewhat here, including new technology-based firms (Storey and Tether 1998b), and new venture firms (Zahra et al 2000).

[2] Butchard (1987) identified 15 manufacturing and 4 service sectors as high technology, based on two criteria. Firms with high R&D intensity (measured as R&D expenditure over the amount of sales, or value added) and firms with a high proportion of scientists and engineers who spend the majority of their time in R&D activities, in relation to the rest of the industries. However, this classification could not be adopted here as the categorization was carried out according to the NACE-70 four digit system which has now been replaced by the ISIC Rev.3, or for the case of the UK the UK SIC classification. Most importantly, the adoption of a high-tech sector categorization based on data more than 20 years old (the time of the time of Butchard's survey) would not have picked up the creation and expansion of new industrial sectors.

[3] The latter was also compared with the DTI innovation report: 'Competing in the global economy: The innovation challenge' (December 2003).

The second step in the sampling frame involved the stratification of companies according to age and size for each high-tech sector[4]. This led to an initial calibrated semi-proportional random sample of 4000 companies selected from the high-tech sector population[5] (see Table 1 column 1). Data were collected by postal questionnaires between April and July 2005, following first discussions with a number of academics with extensive experience of carrying out surveys of SMEs, in order to identify questions that could perhaps bias the study and second, face-to-face interviews with five entrepreneurs (five companies) in order to receive feedback on the clarity of the questions included in the questionnaire and to therefore ensure that unfamiliar and ambiguous terms were not included in any of the questions and that the questionnaire was as concise as possible. From the feedback received appropriate alterations were made. Finally a pilot study of 100 ETBFs was carried out before the main survey in order to investigate whether an acceptable response rate could have been achieved. Respondents were promised both confidentiality and anonymity and that results will be presented purely in an aggregated form.

A customized survey was the most appropriate manner in which to collect data because comprehensive and detailed archival information on ETBFs was not (and still is not) available from secondary sources, especially on their innovative and exporting activity. However, it must be recognized that, in general, studies using questionnaires to collect data at the same point in time and from single respondents in each firm can suffer from common method variance or bias (Podsakoff and Organ, 1986). Podsakoff et al (2003) point out six situations that can lead to common method bias namely; self-reporting, the survey being carried out at a single point in time, measures that are based on respondents' perception, single respondents, the entire data being collected from one source and item social desirability. In order to tackle this problem, a number of steps were taken.

First, the survey did not include questions measuring perceptions of individuals in the traditional form of Likert scales, therefore removing the bias that can be introduced by respondents' perceptions and to a certain degree reducing the effect of item social desirability. The questionnaire included

[4] We are grateful to the ONS for providing the table for each sector according to companies' size and age.

[5] Given that 66% of the population of UK companies have less than 5 employees and 81% have less than 9 (ONS, 03/92), the sample was calibrated with higher weight to the larger companies in order to have a statistically representative sample of that class. The 'other software and supply' sector was also calibrated in order to reduce the 0-4 size categories as it accounted for 76% of the total number of companies in that category. That was done as a large number of single-person consultants operate in that sector and it was not possible to identify them ex ante.

questions related to accounting-based and different forms of economic/statistical data such as turnover, profit, number of employees, sources of finance used, whether a firm has exported, innovated and the percentage of sales derived from selling to foreign markets and by selling innovative products/services. Questions on exporting and firm performance were similar to those used in official surveys such as the Community Innovation Survey (CIS), completion of which is mandatory for a sample of UK SMEs.

Second, efforts were made to assess the accuracy of the answers given and therefore to check for any evidence of self-reporting bias. The information provided by respondents on firm age, turnover, profit, number of employees, group membership and financial sources used was double checked with the information that those firms provided in their published accounts, and which was accessed by using the FAME dataset. Although SMEs are not always required to disclose such information (hence the need to collect it by survey) this check could be performed for over 50% of the firms in the sample and no serious inaccuracies were found. The data provided on export intensity was checked for a smaller subsample (around 11%) of responding companies for which both export and turnover data were reported in FAME, and the correlation between them was 97.8%. Furthermore, the background of some entrepreneurs (e.g. age, education) was checked by using FAME (age) and company websites (where available) and again responses appeared to be accurate. The fact that respondents overall provided accurate information for sensitive issues such as a firm's size and financial state and personal information about themselves increases confidence that the answers given to questions that could not be double checked (e.g. collaborative agreements, innovative activity) are unlikely to suffer from systematic bias.

Finally, bias introduced by common method variance can be further minimized in this study as it is unlikely that the respondents were able to cognitively link the ideas behind the purpose of this paper, i.e. whether exporting in a previous time period affects the performance of a firm in a subsequent period or whether their characteristics will have an effect on exporting performance. In addition, the estimated model is relatively complex in terms of the number of independent variables used. Finally data related to entrepreneurial characteristics, exporting and firm performance was gathered at different points in the questionnaire.

We therefore believe that in the process followed prior, during and after the survey reasonable steps were taken to minimize any bias that CMV can introduce into the study. In order to test further for the presence of CMV the marker variable technique was used (Lindell and Whitney, 2001). In this approach a variable (marker variable) that is theoretically unrelated to at least one variable in the study is used, and CMV is assessed based on the correlation between the marker variable and the theoretically unrelated variable (for examples see Lindell and Whitney, 2001; Malhotra et al 2006). A marker variable can be identified both prior or after the survey has taken place (Lindell and Brandt, 2000). The percentage of purchases made by the company through EDI or other similar network was used as the marker variable in this study as no theoretical connection was evident between it and other variables, for example with internal R&D for the creation of products/services or with the percentage of sales derived from exports. The lowest two correlations between the marker variable and all the theoretical unrelated variables used in this study was with number of founders (0.008) and average years of technical education (0.018) and can be taken as indicators of CMV. In order to have a more conservative estimate of the presence of CMV the second smallest of those correlations was used in the CMV adjustment process (0.018).

The marker variable method allows for the impact of CMV on the magnitude and significance of a correlation to be investigated. Out of the 14 significant correlations between dependent and independent variables (e.g. between exporting and internal R&D), all 14 remained significant following CMV adjustment. In addition, the average CMV-adjusted correlation was 0.1696, very close to the average value of the original correlations (0.1845). Together these findings imply an absence of CMV (Malhotra et al 2006).

Of the original sample of 4000 companies 412 companies took part in the survey. The distribution of the response rate across the industries identified as high-tech is illustrated in Table 1a. On initial examination a chi-square test appears to show that the distribution of the original population and the sample significantly differ ($\chi^2(9)= 31.546$ and $p=0.000238$). However, this is due to the high incidence of consultants in the lowest employment band-size of just two sectors. The ONS data do not distinguish between consultants and (genuine) R&D-intensive businesses within the software and telecommunication sectors. Consultants in these sectors could not be excluded ex-ante from the population count provided by the ONS, but were excluded from the survey. As the study concentrates exclusively on R&D intensive businesses, any comparisons between the ONS figures

and the study's sample proportions for these sectors would be misleading. When they are omitted from the count, the relative distribution provided by the ONS and that of the respondents to the survey does not significantly differ ($\chi^2(9)= 4.049$ and $p=0.77$) confirming the representativeness of the study's survey. As indicated in Table 1b, the sample was also representative of the population in terms of employee sizebands ($\chi^2$ (2) = 3.8).

Table 2a describes the variables used in the analysis, and shows descriptive statistics for each variable (reference year is end of 2004 except for exporting which has as a reference point end of 2001). Correlations between the main variables are shown in Table 2b. General education was measured by taking the average of the years of any formal education that entrepreneurs in a founding team had (each entrepreneur with education up to high-school was assigned 12 yeas of formal education and then additional years were allocated depending on futher qualifications: HNC (1 year), HND (2 years), Degree (3 years), MSc-MBA (1 year), Mphil (2 years), PhD (3 years)). General experience was measured by considering the years of *any* working experience that each entrepreneur in a team had and taking their average.

In terms of specific human capital variables; technical or business[6] education were estimated by considering the years that each entrepreneur in a team had spent gaining a technical or business related qualification and calculating the average (entrepreneurs were allocated years depending on qualification as for the case of general education – but excluding high school years). Specific experience variables (technical, commercial[7], managerial and sector) were all defined in a similar way: the percentage of entrepreneurs in a team with a specific type of experience (similar definitions were adopted in Westhead et al 2001; Ucbasaran et al. 2003, 2008; Colombo and Grilli, 2005)[8]. On average EFT in the sample have 13.9 and 19.7 years of general education and experience respectively over half of the entrepreneurs in a team have managerial experience, sampled firms have close to 16 employees on average and are almost 11 years old, their productivity rate is relatively high at almost £90K per employee and on average 14.65 % of their sales comes from exports.

[6] Technical education includes education in engineering, science, bioscience and IT disciplines and business education in a variety of business specializations such as marketing, accounting/finance, business and management, international business.
[7] Technical experience includes experience in R&D, engineering, manufacturing, IT and commercial experience includes experience in sales/marketing.
[8] In order to test the robustness of the variable specifications, apart from the proportion of entrepreneurs in an EFT with technical, commercial, managerial and sector experience, dummy variables on whether each of the above types of specific experience existed in an EFT were also used. The results remained unchanged and are available upon request.

## 4. Method

The empirical approach involves estimating a model of the determinants of exporting activity and a model of the determinants of productivity. In addition to the influence of the measures of human capital in the EFT (Hypotheses 1-3), the estimation procedure must allow for the effects of productivity on exporting, and of exporting on productivity (Hypothesis 4a and 4b).

The dependent variable that refers to export activity is expressed as the proportion of total sales derived from exporting. Models of this type are typically estimated either by tobit (e.g. Love and Mansury 2007; Roper et al 2008) or by the quasi-likelihood estimation method for fractional dependent variables suggested by Papke and Wooldridge (1996) (Wagner, 2001)[9]. However, this modeling approach makes the implicit assumption that the signs of the coefficients of the explanatory variables are the same both for the probability of being an exporter and for the extent of exporting (Cragg, 1971). Since we are interested in how a range of variables affects export propensity and intensity separately, we test the implicit assumption of sign equality on those coefficients against the unrestricted form which does not make this restriction. This is done by estimating export propensity by probit (where the dependent variable is a dummy exporter variable) followed by a truncated regression of export intensity applied only to exporters, and conducting a likelihood ratio test against the restricted (Tobit) model. In the analysis discussed below the resulting test statistic[10] for all model specifications (different combinations of entrepreneurial human capital) shows that the restriction is invalid, and we therefore report the results from the probit and truncated regression models[11]. In the case of productivity, OLS estimation is used.

There are two possible econometric issues arising from estimations of this type. In order to have confidence in the results of these models, we must first be sure that there is no self-selection effect among exporters. In other words, modelling export intensity needs to take into account the possibility that exporters are not a random sub-set of all firms, and may have certain characteristics that are also linked to how intense is their export activity. We therefore use the Heckman (1979) approach which

[9] In practice, Roper et al (2006) observe that the signs and significance levels obtained using the fractional response model are very similar to those obtained using Tobit.

[10] Defined as $\lambda = 2(\ln L_{probit} + \ln L_{truncation} - \ln L_{tobit})$. Test statistics were found to be 43.04 and 53.06, with critical values at the 5 % level of 38.89 and 41.34 respectively.

[11] Data come from a truncated distribution if values in a certain range are not observed, such as data for non-exporters in the export intensity equation. In such circumstances, simply using OLS regression on the non-limit observations is inconsistent, and a maximum likelihood estimator is therefore used.

tests for any selection bias. In all versions of the Heckman estimation test (for both model specifications) the inverse Mills ratio (λ) is highly insignificant, indicating an absence of selection effects[12]. We are therefore able to report the results from the standard probit and truncated regression estimations.

Second, there is the possibility of endogeneity between the key variables exporting and productivity. This arises from the discussion of Hypotheses 7a and 7b above, which suggest that exporting and productivity tend to be mutually reinforcing. This issue is dealt with by having a carefully-constructed lag between exporting and productivity built into the estimation. Exporting data are available as at 2001, while productivity data are available for both 2001 and 2004. This allows contemporaneous productivity to be included in the exporting estimations, and lagged exporting to be included in the productivity estimations. The firm resource and characteristic variables reflect this time pattern: those used in the exporting models are measured on or before 2001 and those used in the productivity models were measured on or before 2004, enabling therefore causality arguments between the independent and dependent variables in all models to be made, as well as between exporting and productivity. Since exporting activity corresponds to the end of 2001 (with the variables that determine exporting measured up to that date) and as productivity has as a reference point end of 2004 (with the variables that explain productivity measured up to 2004), the possibility of endogeneity between those two variables is minimized by design[13].

All entrepreneurial human capital variables are measured having as reference point the firm's founding date[14]. Entrepreneurial human capital characteristics at the firm's founding point have been argued and proven in a number of studies to be among the main determinants of strategic choice, opportunity identification and of a variety of performance measures throughout a firm's life (Cooper, 1981; Roper, 1998; Westhead et al , 2001; Colombo and Grilli, 2005; Casson, 2005; Ucbasaran et al, 2008). The effect that these have on export propensity and intensity at the end of 2001 as well as the effect that they have on a firm's productivity at the end of 2004 is investigated[15].

[12] p-values: 0.62 and 0.47 for the two models in the order they appear.
[13] Note that the standard Hausman endogeneity tests often used in cross-sectional studies are meaningless here as the explanatory variables for exporting that correspond to 2001 are different in terms of the values that the same variables have in 2004. Endogeneity is removed by design from the current study.
[14] In order to take into account that entrepreneurs can acquire general experience and related skills after foundation of the firm, general experience was also defined as the average number of years of general experience in an EFT up to the point of the survey rather than up to a firm's incorporation date. Results remained unchanged and are available upon request.
[15] There is also the issue of the human capital of individuals subsequently joining the EFT. We considered this possibility in detail by collecting information in the survey on the number of individuals that entered the entrepreneurial team; only 0.5% of the sample (two

As relatively high significant correlations were observed between general and specific education and general and specific experience human capital variables (e.g. correlation between general education and technical and business education was 77 % and 22 % respectively), in order to avoid multicollinearity problems the empirical analysis for predicting export propensity, intensity (Table 3) and overall firm productivity (Table 4) was carried out by using two different models. In each case the first model combines general experience and specific education variables whereas the second combines general education with specific experience variables: a similar approach to dealing with the issue is used by Ma (2002) and Qian (2010).

***Control variables***

In the empirical analysis we also allow for a number of control variables which both theory and empirical evidence suggests have an influence on both exporting and firm performance.

A firm's demographic characteristics such as its size and age have been considered to be important determinants of export propensity and success (Lefebvre and Lefebvre, 2001). Larger firms have access to more resources (including dedicated R&D, and marketing departments) that can be used to successfully penetrate foreign markets. Larger size also means that any fixed costs will be spread over a larger number of units, something that produces economies of scale in R&D, production and marketing (Wagner 1995; 2001; Oviatt et al, 1995). A substantial body of literature argues for a positive relationship between a firm's age, export orientation and performance. Older firms tend to have had more time to establish and expand their distribution networks, as well as strengthen their presence in foreign markets (Roper et al, 2006). This greater experience can allow them to sustain high levels of export performance (Autio et al, 2000).

Corporate group membership will also be investigated in this paper since being a member of a group can further improve a firm's financial and commercial capabilities and, therefore, its chances of successful internationalization and overall performance (Lefebvre et al, 1998; Sterlaccini, 2001; Roper and Love, 2002; Roper et al, 2006). By adopting e-commerce ETBFs can gain instant access to international markets at a low cost (Fillis et al., 2003; 2004), while at the same time mitigating the

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firms) each reported just a single member entering the team. Therefore this is not a cause for concern.

cost and resource advantages that larger companies enjoy (Santarelli and Altri, 2003). This allows ETBFs to compete with larger companies directly in both domestic and foreign markets by bypassing some of the intermediary linkages to the customer, thereby reducing the need to invest in the development of expensive marketing/distribution channels or use the services of specialized dealers (Dandridge and Levenburg, 2000; Molla and Licker, 2005; Morgan-Thomas and Jones, 2009).

Firms that are located at a science park have been noted to be more likely to export due to increased information sharing of intelligence about foreign markets with other park firms, which can lead to a reduction in foreign market entry costs (Sterlaccini, 2001; Harris and Li, 2008). In terms of a firm's performance a number of studies have found that firms located in science parks outperform those outside (Colombo and DelMastro, 2002; Ferguson and Olofsson, 2004). Therefore a positive relationship between science parks and firm performance is expected.

The formation of formal commercial collaborative agreements with other domestic or foreign based customers/suppliers or with other companies can provide ETBFs with complementary knowledge, resources and capabilities that are not internally available, and reduce any information asymmetries related to entering foreign markets, thereby enhancing the probability to export and subsequent export performance (Westhead et al 2001; Lefebvre and Lefebvre, 2001; Harris and Li, 2008; Ulubasoglu et al, 2009). The presence of internal R&D indicates a firm with the capacity both to generate knowledge internally and to absorb knowledge from outside (Cohen and Levinthal 1990). R&D expenditure is consistently found to be positively related both to export performance (Girma et al 2008; Harris and Li 2009) and to firm performance generally (Roper et al 2008), and so a measure of R&D is included in both the exporting and productivity estimations.

ETBFs face higher financial constraints in relation to other SMEs especially due to the continuous R&D investment that is required in order for them to remain competitive, something that constraints their ability to pursue an export strategy (Zou et al, 2010; Carpenter and Petersen, 2002). By receiving external equity, in addition to accessing additional financial resources ETBFs also benefit from the managerial acumen of those investors, a factor that can play an important role on a firm's ability to export as well as its future performance and growth (Zou et al, 2010; Cassar, 2004; Bruneel et al, 2006; Westhead et al 2001).

ETBFs can be established by a lone entrepreneur or by a team of entrepreneurs, with the latter generally argued to benefit a firm in a number of ways. Firms that have been created by EFTs are expected to have developed a broader network of prospective customers and suppliers and be characterised by a greater degree of specialization in decision making, as larger EFTs are usually associated with a higher level of often complementary resources, both financial and skill related (Kor and Mahoney, 2000; Ucbasaran et al., 2003; Marvel and Lumpkin, 2007). Teams with a variety of complementary but heterogeneous skills are more likely to react to environmental changes, to contribute to the successful completion of complex commercial projects (including exporting) and to reach creative solutions after gathering information from a greater range of resources (Aspelund et al., 2005; Ucbasaran et al, 2003). In general team heterogeneity enables a group to explore different alternative solutions to a problem which can lead to superior and more innovative decision making (Eisenhardt and Schoonhoven, 1990). It is therefore suggested that ETBFs formed by an entrepreneurial team rather than a lone entrepreneur will reach higher levels of performance (Oakey, 2003; Storey, 2004).

Particularly in the case of ETBFs that operate in a turbulent environment characterised by continuous change in technology and consumer preferences, the information processing demands on the EFT multiply significantly. Greater amounts of information have to be processed by decision makers in order for opportunities to be identified, necessary strategic adaptations to be made and higher levels of performance to be achieved. It should therefore be expected that larger teams will be able to deal more effectively with environmental uncertainties and in turn help their firms to achieve higher levels of export and firm performance (Haleblian and Finkestein, 1993). In addition a number of studies (Eisenhardt and Bourgeois, 1988; Eisenhardt 1989) have shown that constructive conflict is more likely to develop within larger teams, as is faster decision making through functional specialization; when combined, both factors result in the efficient identification of opportunities that can rapidly appear and disappear in high–tech industries (Eisenhardt and Schoonhoven, 1990). We therefore allow for the size of the EFT.

We also take into account a firm's skill base - the proportion of the workforce with degrees - since a number of studies have found a positive relationship between the level of employee skills and export probability and firm performance (e.g. Wagner, 1995; Roper and Love, 2002; Girma et al 2008). Finally the productivity model will also control for two dimensions of a firm's marketing strategy,

the first capturing whether a firm targets a niche market and the second the dependence of sales in the main two customers.

## 5. Results

### 5.1 Export propensity and intensity

Table 3 shows the results of the probit and truncated regression estimations for export propensity and export intensity respectively (the latter estimated only for exporting firms).

Consistent with the theory outlined earlier, the most noticeable finding is the difference in the patterns of the human capital effects on exporting and export intensity, suggesting that the human capital attributes required to become an exporter are quite different from those required for exporting success. In line with expectations, commercial and managerial experience are found to operate through the probability of exporting, with a 1 % increase in the percentage of entrepreneurs with commercial and managerial experience associated with a 0.25 % and 0.26% increase in the probability of exporting respectively. It appears therefore that commercial and managerial experience can enhance entrepreneurial awareness in regards to foreign market opportunities by providing entrepreneurs with the skills necessary to gather, evaluate and act upon information regarding opportunities that might exist in foreign markets, and to mitigate perceptions of risk in international markets. These effects are absent in the case of export intensity. By contrast, general experience is not found to exert a significant effect on export propensity. Although this appears to contradict initial expectations previous literature provides some explanation for this result. More experienced and therefore older entrepreneurs might perceive that their extensive experience provides them with all the information needed to make decisions, which stops them from gathering information from other sources which in turn can reduce the likelihood of opportunity identification (Ucbasaran et al, 2008). This result is in line with arguments that older entrepreneurs are risk averse, less comfortable with ambiguity and uncertainty and less likely to be attracted to fresh ideas as they usually resist adoption of processes that can lead to radical changes to existing practices (Hambrick and Mason, 1984; Roper, 1998; Lynskey, 2004; Casson, 2005).

However, for the case of export intensity general education and experience are both found to exert a positive effect, with the education effect predominating: an extra year of general education and

experience will increase export intensity by 6.6 and 1.5 percentage points respectively. It appears therefore that although general education does not increase the probability of exporting, once firms have exported, skills such as enhanced learning and problem-solving ability as well as ability of dealing with complex scenarios and the accumulation of industry and managerial expertise that high general education can provide prove vital for success in foreign markets (Cooper et al, 1994; Westhead et al, 2001; Ucbasaran et al, 2008; Filatotchev et al, 2009).

A similar contrast occurs with respect to the impact of specific education. Although specific education (business and technical) does not influence export propensity, high levels of both technical and business education have a significant effect on export intensity. More specifically, one extra year of technical and business education in an EFT leads to an increase of 9 and 23 percentage points respectively in export intensity. For the case of technical education, these results are in line with past studies that suggest that innovative products, linked with high levels of entrepreneurial technical education (Storey and Tether, 1998a), are associated with high levels of export performance (Lachenmaier and Woßmann, 2006). Results also suggest that once a firm has started exporting, technical skills enable innovate products to be further adapted to specific market needs, differentiating them further from competitors and so enhancing export performance (Bloodgood et al, 1996; Zahra et al, 2000). It also appears that it is managerial and marketing skills derived from formal education that are vital for commercial success at foreign markets, in agreement with suggestions that business education can assist in the formulation of appropriate operating practices that are necessary for the commercial exploitation products in the marketplace (Berry, 1996; McDougal et al, 1994; Tether, 1997; Jones and Coviello, 2005).

As anticipated, highly productive firms are much more likely to export and tend to be more export intensive. This is in line with the suggestion that only productive firms can overcome the hurdle of entering, and succeeding in, export markets.

In terms of the control variables, both the percentage of sales from e-commerce and collaboration with other companies were found to have a strong positive effect on both the probability of exporting and on export intensity, as expected. Firm age has an interesting effect: older firms are much more likely to become exporters, but firm age has a slightly negative effect on export intensity. Finally, the presence of in-house R&D is positively associated with the likelihood of exporting, but has no effect

on export intensity. Interestingly, once other influences are allowed for, neither size of the firm nor the size of the EFT (number of founders) has any effect on exporting propensity or intensity[16].

Overall, the results of the exporting estimations suggest that specific experience, especially in terms of commercial and managerial experience, helps ETBFs become exporters, but once over the exporting hurdle the beneficial effects of education, both general and specific, begin to become apparent. By contrast, productivity is strongly positively associated with both the likelihood of exporting and with exporting intensity

### 5.2 Firm performance (productivity)

Moving to the determinants of productivity, the results suggest that the overall pattern of human capital effects are similar to those for export propensity (and correspondingly different from those for export intensity). For example, commercial and managerial experience both enhance a firm's productivity, just as they are associated with an increase in export propensity. Managerial experience has been connected with leadership, ability to effectively coordinate available resources and ability to respond to environmental changes all contributing to higher levels of performance (Aspelund et al, 2005; Ucbasaran et al, 2008). The skills of commercial opportunity recognition for technological innovations and the ability to identify suitable markets for related products have also been argued to enhance not just ETBFs' export activity but also overall firm performance (Aspelund et al, 2005; Park, 2005).

By contrast, general education is found to have no effect on productivity, while technical education appears to have a (marginally) negative effect. Although apparently counterintuitive, previous research has suggested the possibility of such an effect. Ucbasaran et al (2008), for example, argue that high levels of general education in an EFT might not always translate into enhanced performance as such entrepreneurs might fall in the trap of not collecting information that can assist them in making better informed managerial decisions, something that can reduce their ability to react and respond to environmental changes. High levels of technical education, although of course vital for the survival of a ETBF, can hamper its performance: such entrepreneurs have been found to put most of their attention in producing a technologically sophisticated product while ignoring the

[16] We also estimated all equations replacing the 'number of founders' variable with a dummy variable for firms founded by a single entrepreneur. The coefficient on this dummy variable was insignificant, and other coefficients in the estimations were unaffected.

commercial and management side of running a company with detrimental effects (Oakey, 2003; West and Noel, 2009).

The finding that the human capital determinants of productivity are similar to those for export propensity is perhaps unsurprising. Exporting at the end of 2001 has a significantly positive effect on firm productivity at the end of 2004, verifying the benefits that exporting brings to a firm's productivity in terms of market scale effects that allows ETBFs to recoup investment in R&D over a larger sales volume and through learning by exporting (Love and Mansury, 2009; Blalock and Gertler, 2004). Thus experience aspects of human capital in the EFT have both a direct and an indirect effect (through the likelihood of exporting) on subsequent firm performance as measured by productivity.

Very few of the control variables have significant coefficients in the productivity estimations. Predictably, larger firms tend to be more productive, at least up to an employment level of around 50, when the benefits of larger size cease to be evident. There is also a positive association between location in a science park and productivity, and some suggestion that being dependent on one or a few major customers is negatively linked to productivity.

## 6. Conclusions and Discussion

The purpose of the research has been to consider jointly two issues: first, how the characteristics and experience of the EFT affects the export orientation and subsequent performance of the businesses they establish, and second, the relationship between exporting and productivity at the firm level. Theses issues are generally considered in isolation, but we argue that they must be considered together if we are to develop a fuller picture of the role of EFTs. The principal contributions of the paper therefore lie in two areas. The first is developing theory on the differential effect of educational and experience aspects of human capital on exporting and export intensity respectively. The second lies in considering the impact of EFT human capital while allowing fully for the endogenous relationship between exporting and productivity and for possible sample selection effects. To our knowledge, this relationship has not previously been fully integrated into empirical research in the international entrepreneurship literature. The key findings and their implications are considered below.

The pattern of results for exporting propensity and intensity show systematic differences, and are in line with our theoretical development. Commercial and managerial experience help ETBFs become exporters, but once over the exporting hurdle it is education, both general and specific, that has a substantially positive effect. This may be one reason why SMEs in general, and ETBFs in particular, find it difficult to persistently succeed in export markets once they have entered the exporting phase; the set of human capital skills needed for *entering* and *succeeding* in export markets are quite different, and not all SMEs will have the full set of complementary human capital assets required to perform both functions effectively. Specifically, the role of education in promoting export intensity is very marked, suggesting that ETBFs which want to be successful in export markets, rather than merely being present in them, have an incentive to invest in the technical and business education of their EFT.

This has implications for firm strategy. Small firms, especially those in hi-tech industries, show a tendency to engage in relatively intermittent exporting for extended periods (Welch and Welch 2009), and sporadic exporting is commonplace among UK SMEs without either entry or exit from export markets being a coherent strategy (Crick 2003; Love and Ganotakis 2012). There is also evidence that high-tech SMEs typically begin to internationalize on the basis of geographically dispersed niche markets on an opportunistic basis, relying largely on unsolicited orders from abroad (Bell et al 2001) or as a result of family or other ties in foreign countries (Van Biesebroeck 2005). Sporadic exporting may persist for extensive periods, with SMEs taking time to build up the internal assets necessary to make export market entry a clear strategic decision (Bonaccorsi 1992).

Our findings suggest that it is education rather than experience which is the key to building up the human capital assets required for success in export markets. Although entrepreneurs with high levels of general education and experience are no more likely to export, those entrepreneurs can achieve higher levels of export performance in relation to their less educated colleagues. A high level of technical education, which can lead to the creation of technologically advanced innovative products, is an important element of export success. We also find evidence that once managerial and especially commercial experience has assisted in the internationalization of an ETBF, high levels of business as well as technical education provide the skills necessary for an export strategy to be successful. One of the reasons can be that high technical education provides entrepreneurs with skills that allow them to alter existing products according to foreign demand and customer specifications. Business

education appears to be important for the development of appropriate management techniques for the consistently successful exploitation of high-tech products.

This may give rise to something of a strategic dilemma within the hi-tech SME. It is experience rather than educational dimensions of EFT human capital which is the key both to becoming an exporter and ultimately to increased productivity performance. On the other hand, better general and specific education provides the platform for export success. Moving from intermittent or sporadic exporting to a more strategic approach may therefore require the firm to acquire educational human capital which the EFT currently lacks, either by adding new members to the management team or by investing in the education of existing EFT members. Neither option is costless: the former clearly has a financial cost as well as the implications for coherence of the management team, while the latter option may involve a diminished input from a key (experienced) member of the team for a period of time. However, the pay-off in terms of increased export sales and the possibility of learning-by-exporting effects may be great, leading to the need for ETBFs to consider carefully how important is substantial foreign market penetration to their overall strategy.

Intriguingly, although technical skills enhance export performance, they appear to have a slight negative effect on productivity. The possible adverse effect of technical education occurs for a number of reasons connected with behavior patterns of highly technically-educated entrepreneurs. Suggestions have been made that the desire of those individuals to create a highly technologically sophisticated product (which this pursuit often ends in the creation of an overpriced product) gets in the way of actually finding a suitable market and ultimately running the business effectively (West and Noel, 2009; Oakey, 2003). Although the strength of this effect should not be over-stressed (the negative coefficient of technical education with respect to performance is both very small and only marginally significant) there may be both strategic and public policy-oriented reasons to attempt to lift these barriers or changing this behavior. The answer might lie again in the existence of practical commercial skills, which are not only associated with higher firm productivity, but also with the likelihood of exporting.

Of course entrepreneurs of ETBFs will only embark in an exporting strategy if they believe that this will lead to an increase in their firms' performance. But does exporting lead to higher levels of productivity? Results show that exporting at a specific time period does significantly enhance firm

performance at a later time period, and also that productive firms are more likely to export and to be export intensive. Since we have tested for self-selection effects and have designed the research to minimize the risk of endogeneity between exporting and productivity, we consider these effects to be both robust and significant.

While limited to the exporting aspects of internationalization, our analysis also contributes to bridging the gap between the IE and more general IB literatures (Keupp and Gassmann 2009). Internationalization as a sequential process focuses on experience in international markets in developing the skills and knowledge for incremental international expansion, leading to an emphasis on developing firm-level experience (Johanson and Vahlne (1977, 1990). By contrast, the IE literature has generally been more concerned with the nature of the human capital needed by entrepreneurs to both enter and succeed in international markets. Our analysis suggests that the process and IE literatures are more complementary than has hitherto been recognized, at least with respect to exporting. For the case of entrepreneurial technology-based firms, experience among the entrepreneurial founding team is indeed important, as implied by the internationalization process approach. But the effect of experience lies in helping firms overcome the hurdle to becoming an exporter, not in providing the basis for sustained success in international markets, suggesting that experience has a somewhat different effect from that envisaged in the process model. The knowledge base of the EFT acquired through both general and specific education matters more than experience for successful penetration of export markets once exporting is achieved, an insight gained from the IE approach, and which is not fully appreciated in the process model. The critical role played by the educational attainments of the EFT in promoting export intensity suggests that rather more emphasis could be placed in the IB literature on the underlying human capital attributes of entrepreneurial founding teams, and crucially on distinguishing between the differential effects of education and experience: successful internationalization through exporting is not *just* about experience.

***Limitations and scope for future research***

The use of any survey instrument inevitably involves trading off breadth and depth of data. Although we have carefully designed the survey to allow inferences of causation rather than merely correlation, an obvious drawback of any survey-based instrument is that little can be said about the mechanisms by which, for example, general and business education enhances the intensity of

exporting, or precisely why the human capital attributes of exporting and export intensity are so different. Although we can develop theoretical links suggestive of appropriate mechanisms, detailed analysis of these issues is likely to involve a different methodological approach to that used above, and may require the use of in-depth case studies to develop a more nuanced understanding of the link between human capital and exporting performance. In addition, although designed to be representative of the underlying population, we must acknowledge the potential for survivor bias present in any firm-level survey of this type.

This study has focused on the relationship between entrepreneurial human capital and a firm's exporting activity and overall performance. However a number of studies suggest that entrepreneurial human capital also affects the social ties (social capital) that entrepreneurs form, which in turn can affect a firm's exporting activity. More specifically, it is argued that the education discipline of entrepreneurs can influence the formation of social networks, and that entrepreneurs with commercial, prior entrepreneurship and same-sector experience are more likely to built social networks that provide them with easier access to information, resources and advice about foreign markets, leading to the identification and successful exploitation of foreign market opportunities and enhanced firm performance (Davidsson and Honig, 2003; Mosey and Wright, 2007; Mosey et al, 2006; Bosma et al 2004; Yli-Renko et al, 2002; Marvel and Lumpkin, 2007). A logical next step therefore would be to include the social capital of entrepreneurs in future studies of EFT human capital and exporting especially as the literature appears to suggest that social capital might mediate the relationship between EFT human capital and exporting[17].

The use of longitudinal data and/or case studies might also shed some light on the nature of the complementarities between different aspects of human capital. For example, do firms consciously substitute between different aspects of experience and education, or are these seen as complements in the strategic objectives of the individual firm? Finally, it would be instructive to discover if the links identified here between entrepreneurial human capital and performance hold in other national, institutional and cultural settings.

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**Figure 1: Schematic of hypotheses**

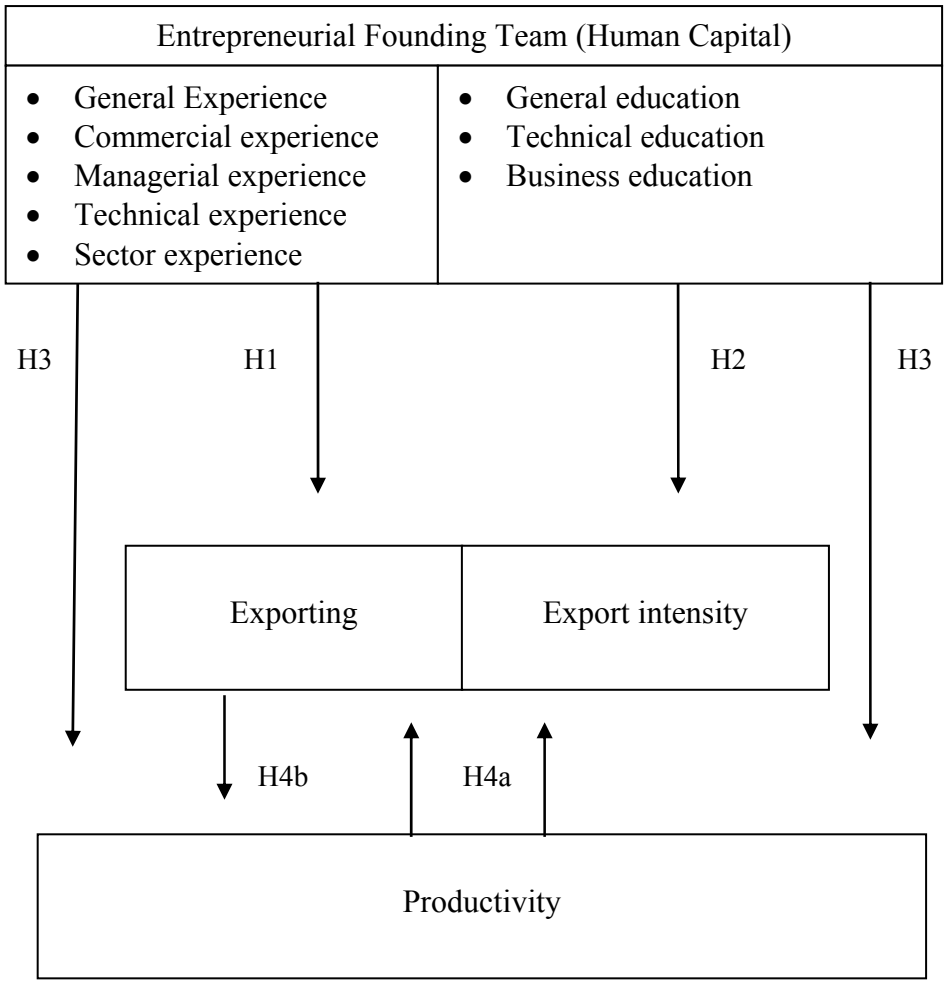

**Table 1a. Distribution of population and sample firms by industry**

| High Technology Sectors | Sampling frame (%) | Sample respondents (%) |
|---|---|---|
| Pharmaceutical | 1.19 | 3.16 |
| Computers | 2.82 | 4.87 |
| Electrical | 9.96 | 15.57 |
| TV and Radio | 7.88 | 11.44 |
| Medical, instrumentation, optical | 12.14 | 22.39 |
| Aerospace | 1.22 | 1.7 |
| Telecommunications | 13.71 | 5.84 |
| Software | 39.85 | 21.9 |
| R&D in natural sciences and engineering | 6.12 | 6.33 |
| Technical testing | 5.1 | 6.81 |
| **Total** | 100 % (4000 firms) | 100 % (412 firms) |

**Table 1b. Distribution of population and sample firms by size band**

| Size Categories (Number of employees) | Sampled Firms | Population |
|---|---|---|
| Small | 94 % | 95.7 % |
| Medium | 5.5 % | 3.7 % |
| Large | 0.5 % | 0.6 % |
| Chi-Square | 3.8 | |

**Table 2a. Summary Statistics and variable description**

| Variable description | Mean | S.D. |
|---|---|---|
| Entrepreneurial Human Capital | | |
| General Education – Average years of formal general education in an EFT | 13.94 | 2.27 |
| General Experience – Average years of general experience in an EFT | 19.744 | 8.77 |
| Technical education – Average years of formal technical education in an EFT | 1.81 | 1.845 |
| Business education – Average years of formal business education in an EFT | 0.24 | 0.675 |
| Technical experience – Percentage of entrepreneurs in an EFT with technical experience (%) | 35.6 | 42.79 |
| Commercial experience – Percentage of entrepreneurs in an EFT with commercial experience (%) | 27.61 | 38.75 |
| Sector experience – Percentage of entrepreneurs in an EFT with different sector experience (%) | 32.39 | 42.09 |
| Managerial experience – Percentage of entrepreneurs in an EFT with managerial experience (%) | 53.05 | 43.84 |
| Firm Resources/Characteristics | | |
| Employment (number) | 15.56 | 25.5 |
| Firm age (years) | 10.64 | 6.758 |
| Part of a group (other company owns less than 50 % equity or firm is head of group, 0/1) | 0.07 | 0.261 |
| Percentage of employees with degrees (%) | 41.5 | 36.58 |
| External Equity – Whether a firm received during its start-up stage external equity finance (venture capital, corporate capital, funds from business angels) (0/1) | 0.103 | 0.304 |
| Founders – Whether a firm was founded by a lone entrepreneur or a team (0/1) | 0.649 | 0.477 |
| Founders (number) | 1.882 | 0.836 |
| Internal R&D – R&D expenditure in relation to total expenditure (%) | 22.41 | 31.9 |
| Percentage of sales from E-Commerce (%) | 6.67 | 20.58 |
| Location | | |
| Located in science park – Whether a firm is located in a science park (0/1) | 0.06 | 0.244 |
| Formal commercial collaborative agreements | | |
| With customers/suppliers – Whether a firm has formed formal commercial agreements with customers/suppliers (0/1) | 0.155 | 0.363 |
| With other companies - Whether a firm has formed formal commercial agreements with other companies (0/1) | 0.179 | 0.384 |
| Market Strategy | | |
| Exporter – Percentage of sales derived from exports in 2001 (%) | 14.64 | 26.35 |
| Niche market – Products are made to serve a specialist niche market (0/1) | 0.823 | 0.378 |
| Firm performance | | |
| Labor productivity (£K sales per employee) | 89.454 | 84.776 |

**Table 2b. Correlation coefficients**

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) | (13) | (14) | (15) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1. Export (0/1) | 1.000 | | | | | | | | | | | | | | |
| 2. Export (%) | 0.629 | 1.000 | | | | | | | | | | | | | |
| 3. Productivity | 0.284 | 0.239 | 1.000 | | | | | | | | | | | | |
| 4. General Exp. | -0.140 | 0.026 | -0.029 | 1.000 | | | | | | | | | | | |
| 5. General Ed. | 0.083 | 0.210 | -0.101 | -0.225 | 1.000 | | | | | | | | | | |
| 6. Technical Ed. | 0.085 | 0.212 | -0.075 | -0.060 | 0.767 | 1.000 | | | | | | | | | |
| 7. Business Ed. | -0.025 | 0.012 | 0.137 | -0.120 | 0.218 | -0.125 | 1.000 | | | | | | | | |
| 8. Technical Exp. | 0.088 | 0.062 | -0.027 | 0.036 | 0.095 | 0.249 | -0.158 | 1.000 | | | | | | | |
| 9. Commercial Exp. | 0.076 | 0.095 | 0.262 | -0.001 | -0.200 | -0.190 | 0.135 | -0.436 | 1.000 | | | | | | |
| 10. Managerial Exp. | 0.188 | 0.063 | 0.142 | 0.136 | -0.026 | -0.025 | 0.039 | -0.154 | 0.171 | 1.000 | | | | | |
| 11. Sector Exp. | 0.041 | 0.076 | -0.081 | 0.014 | 0.068 | -0.023 | 0.045 | -0.092 | 0.035 | -0.078 | 1.000 | | | | |
| 12. No. of founders | 0.033 | 0.066 | 0.019 | 0.037 | -0.069 | -0.102 | -0.014 | 0.030 | 0.055 | -0.092 | 0.015 | 1.000 | | | |
| 13. External Equity | 0.108 | 0.128 | 0.098 | -0.001 | 0.018 | 0.090 | 0.035 | 0.042 | 0.175 | 0.107 | 0.015 | 0.060 | 1.000 | | |
| 14. Firm age | 0.307 | 0.109 | 0.169 | -0.254 | -0.049 | 0.010 | -0.058 | 0.099 | -0.056 | 0.018 | 0.029 | -0.032 | 0.134 | 1.000 | |
| 15. Employment | 0.190 | 0.038 | 0.118 | -0.021 | -0.055 | -0.061 | 0.005 | -0.061 | 0.171 | 0.136 | -0.017 | -0.050 | 0.102 | 0.254 | 1.000 |

**Table 3** Determinants of export propensity and intensity

| | Export propensity | | Export intensity | |
|---|---|---|---|---|
| Variables | General experience with specific education | General Education with specific experience | General experience with specific education | General Education with specific experience |
| Constant | | | -459.02 (146.54) | -469.03 (158.3) |
| ***Human Capital*** | | | | |
| General Education | | 0.009 (0.022) | | 6.6** (3.14) |
| General Experience | -0.0043 (0.0052) | | 1.568* (0.917) | |
| Technical Education | 0.0045 (0.0.026) | | 9.249** (3.999) | |
| Business Education | -0.086 (0.075) | | 22.91** (11.5) | |
| Technical Experience | | 0.00122 (0.00123) | | -0.0046 (0.172) |
| Commercial Experience | | 0.0025* (0.0014) | | 0.181 (0.206) |
| Managerial Experience | | 0.0026** (0.0011) | | -0.35* (0.183) |
| Sector Experience | | -0.00007 (0.0011) | | 0.005 (0.16) |
| ***Firm Resources/Characteristics*** | | | | |
| Employment | 0.0026 (0.14) | -0.0003 (0.0144) | 1.036 (1.069) | 1.15 (1.05) |
| Employment squared | 0.0003 (0.0004) | 0.00033 (0.0004) | -0.014 (0.013) | -0.0141 (0.127) |
| Firm age | 0.0157** (0.0076) | 0.029*** (0.0084) | -1.04 (1.25) | -2.22* (1.15) |
| Part of group of firms | 0.0046 (0.223) | -0.191 (0.226) | 40.479 (26.22) | 51.76* (26.8) |
| Percentage employees with degrees | 0.171 (0.154) | 0.451*** (0.173) | 24.187 (26.02) | -0.682 (25.1) |
| External Equity | 0.1423 (0.1429) | 0.033 (0.146) | 36.791* (19.33) | 22.16 (18.05) |
| Number of founders | -0.034 (0.053) | -0.016 (0.056) | 1.061 (8.588) | -2.96 (8.64) |
| Percentage of sales from E-Commerce | 0.0057** (0.0023) | 0.0092*** (0.0028) | 0.498** (0.242) | 0.475** (0.232) |
| Ln Productivity | 0.163*** (0.0526) | 0.16*** (0.056) | 34.35*** (11.78) | 33.16*** (11.59) |
| Internal R&D | 0.304*** (0.879) | 0.398*** (0.09) | 25.57 (19.0) | 27.65 (20.39) |
| Located in science park | -0.105 (0.174) | -0.0545 (0.183) | -58.64 (35.94) | -40.52 (34.21) |
| ***Formal commercial collaborative agreements*** | | | | |
| With customers/suppliers | 0.081 (0.189) | 0.209 (0.178) | -24.637 (19.4) | -38.73* (19.88) |
| With other companies | 0.351*** (0.13) | 0.284* (0.151) | 30.29* (17.01) | 44.14*** (16.93) |
| Observations | 232 | 231 | 107 | 108 |
| Log-Likelihood | -110.79 | -99.24 | -456.43 | -455.31 |

Notes: Standard errors in parentheses, ***p<0.01, **p<0.05, *p<0.1. Coefficients are marginal effects.
Industry dummy variables included in all estimations (not shown)

**Table 4** Determinants of Productivity

| Variables | General experience with specific education | General education with specific experience |
|---|---|---|
| Constant | 11.554*** (0.29) | 11.24*** (0.411) |
| ***Human Capital*** | | |
| General Education | | -0.034 (0.025) |
| General Experience | -0.005 (0.0067) | |
| Technical Education | -0.0575* (0.0312) | |
| Business Education | 0.0338 (0.144) | |
| Technical Experience | | 0.00023 (0.0014) |
| Commercial Experience | | 0.0047*** (0.0016) |
| Managerial Experience | | 0.0022* (0.0012) |
| Sector Experience | | 0.000026 (0.00128) |
| ***Firm Resources/Characteristics*** | | |
| Employment | 0.0121** (0.006) | 0.0124* (0.0071) |
| Employment squared | -0.00011* (0.00006) | -0.00014* (0.000076) |
| Firm age | -0.005 (0.00875) | 0.00867 (0.0086) |
| Part of group of firms | 0.0214 (0.177) | 0.0838 (0.181) |
| Percentage employees with degrees | 0.0095 (0.23) | -0.157 (0.25) |
| External Equity | 0.187 (0.161) | 0.229 (0.157) |
| Number of founders | -0.0534 (0.0588) | 0.00958 (0.061) |
| Percentage of sales from E-Commerce | -0.00036 (0.0022) | 0.00007 (0.00255) |
| Internal R&D | -0.19 (0.129) | 0.045 (0.12) |
| Located in science park | 0.374* (0.212) | 0.363** (0.182) |
| ***Formal commercial collaborative agreements*** | | |
| With customers/suppliers | 0.071 (0.127) | 0.098 (0.106) |
| With other companies | 0.079 (0.145) | 0.0836 (0.141) |
| ***Market Strategy*** | | |
| Exporter | 0.005** (0.00214) | 0.0043* (0.0023) |
| Niche market | -0.0931 (0.129) | -0.153 (0.131) |
| Customer dependence | -0.079* (0.0474) | -0.028 (0.048) |
| Observations | 238 | 235 |
| R squared – | 0.177 | 0.230 |
| Adjusted R squared | 0.071 | 0.121 |

Notes: Standard errors in parentheses, ***p<0.01, **p<0.05, *p<0.1. Coefficients are marginal effects. Industry dummy variables included in all estimations (not shown)