ENTREPRENEURSHIP DYNAMICS:

Entry, Survival, and Firm Growth

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Tese de Doutoramento em Economia

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Biographical Note

Vera Rocha was born on November 30, 1987, in Oliveira de Azeméis, Portugal. She concluded her undergraduate studies in Economics in 2008, at the University of Aveiro, with the final grade of 18/20. In 2010, she concluded her Master studies in Economics in the same university, with the dissertation "Performance and Survival of Foreign and Domestic Firms during crises" and a final grade of 19/20. During her undergraduate and master studies, she received two merit awards from Bank of Portugal and BPI, and four merit scholarships from University of Aveiro for her academic achievement.

During her Master studies, Vera developed her research interests on the fields of empirical industrial organization, firm and industry dynamics, entrepreneurship and small businesses. Her Master dissertation resulted in some refereed publications in international journals, as Small Business Economics, Economics Letters and International Business Review.

In January of 2010, Vera joined CIPES (Centre for Research in Higher Education Policies) as a research assistant. Since then, she has been also doing research on Higher Education topics. Her research at CIPES has also resulted in some publications in international journals, as Higher Education, Applied Economics, Public Administration Review, Journal of Economic Issues and Cambridge Journal of Regions, Economy and Society.

In September of 2010, she started her PhD in Economics at the Faculty of Economics of University of Porto (FEP), under the supervision of Professors Anabela Carneiro and Celeste Varum. Her most recent research on entrepreneurship dynamics has been presented in scientific meetings and international conferences, as the 1st and 2nd International Entrepreneurship Autumn Schools (both in Évora, Portugal), the XXVIII Jornadas de Economía Industrial (Segovia, Spain), the 17th IZA European Summer School in Labor Economics (Buch/Ammersee, Germany) and the 2nd International Conference on the Dynamics of Entrepreneurship (ZEW, Mannheim, Germany).

Acknowledgements

Resumo

Esta tese inclui cinco ensaios sobre empreendedorismo. O primeiro ensaio descreve o modo como os tópicos relacionados com o empreendedorismo ganharam uma relevância crescente na investigação em economia ao longo do último século, e como a ciência económica contribuiu para o desenvolvimento gradual do empreendedorismo enquanto área de investigação. Os restantes quatro ensaios estudam diferentes questões relacionadas com as dinâmicas do empreendedorismo, com recurso a uma grande base de dados que combina informação detalhada do trabalhador e da respectiva empresa para Portugal.

No segundo e terceiro ensaios, o indivíduo é a unidade de análise. No segundo ensaio estudam-se as dinâmicas de entrada e saída de mais de 157,000 indivíduos que deixam o seu emprego por conta de outrem e se tornam empregadores durante o período 1992-2007. Destacam-se nomeadamente dois contributos: em primeiro lugar, este estudo avalia como determinadas experiências passadas no mercado de trabalho influenciam as decisões de entrada e saída dos empreendedores nascentes; em segundo lugar, a análise presta particular atenção à natureza heterogénea dos empreendedores e tenta explicar as suas diferentes escolhas no que respeita ao modo de entrada e de saída.

O terceiro ensaio analisa os efeitos de aprendizagem e de auto-selecção entre os "empreendedores em série", utilizando uma estratégia empírica inovadora baseada em modelos de duração em tempo contínuo com selecção. Tendo sido identificados aproximadamente 220,000 indivíduos que deixam a primeira experiência como empreendedores, entre os quais cerca de 35,000 reentram uma segunda vez no empreendedorismo, este estudo avalia se a experiência adquirida no primeiro negócio melhora a sobrevivência dos empreendedores na segunda empresa, tendo em consideração os potenciais efeitos de auto-selecção na amostra.

O quarto e quinto ensaios concentram-se nas empresas *start-up*, e em particular nas *spin-offs*. O quarto ensaio compara a sobrevivência das *spin-offs* de tipo *pushed* e *pulled*, tendo em conta um conjunto de condições iniciais onde estes dois tipos de empresas podem diferir. A análise cobre 50,656 *spin-offs* que entram durante o período 1992-2007 e utiliza técnicas de decomposição multivariada aplicadas a modelos de sobrevivência que permitem decompor o diferencial de sobrevivência observado entre as *pushed* e as *pulled spin-offs* em diferenças relacionadas com as suas

dotações/características observadas e diferenças relacionadas com os retornos das mesmas.

Por fim, o quinto ensaio estuda de que forma o crescimento do emprego, os fluxos de trabalhadores e a sobrevivências das *spin-offs* se relacionam com as suas dotações iniciais de capital humano. O estudo concentra-se em três medidas de capital humano à entrada – o nível médio de *skills* da força de trabalho, a dispersão de *skills* dos trabalhadores à entrada e a proporção de *co-workers* na força de trabalho inicial –, e mede os *skills* dos trabalhadores através de um índice multidimensional que tem em conta características observadas e não observadas do trabalhador.

Abstract

This thesis comprises five essays on entrepreneurship. The first essay describes how entrepreneurship topics gained an increasing importance within economic research over the last century and reviews how the gradual development of the entrepreneurship research field is backed in economic science. The remaining four essays study different issues on entrepreneurship dynamics, using a large longitudinal matched employer-employee dataset for Portugal.

The second and third essays consider the individual as the unit of analysis. The second paper studies the entry and exit dynamics of over 157,000 individuals who leave paid employment and become business-owners during the period 1992-2007. The contribution of this essay is two-fold: first, it evaluates how particular past experiences in the labor market influence the entry and exit decisions of nascent business-owners; second, it pays attention to the heterogeneous nature of business-owners and tries to explain their different modes of entry and exit.

The third essay analyzes learning by doing and self-selection effects among serial entrepreneurs, using a novel empirical strategy based on continuous time duration models with selection. After identifying about 220,000 individuals who have left their first entrepreneurial experience and over 35,000 ex-business-owners who reenter again and become serial entrepreneurs, the study evaluates whether entrepreneurial experience acquired in the previous business improves serial entrepreneurs' survival, after taking into account self-selection issues.

The fourth and fifth essays focus on start-up firms, particularly on spin-offs. The fourth essay compares the survival of pushed and pulled spin-offs, taking into account a set of start-up conditions where they may differ. The analysis covers 50,656 spin-offs entering during the period 1992-2007 and uses novel multivariate decomposition techniques applied to hazard models to decompose the pushed-pulled survival gap into differences in endowments and differences in effects.

Finally, the fifth essay investigates how spin-offs' employment growth, worker flows and survival are associated to their initial human capital endowments. The study focuses on three measures of human capital at entry – workers' average skills, their skill dispersion and the share of co-workers in the initial workforce –, and measures workers' skills through a multidimensional skill index that takes into account both observed and unobserved characteristics of the worker.

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Essay 1

May 30, 2014

Abstract

For long time, the entrepreneur was an invisible figure in the economics literature. The theoretical firm remained "entrepreneurless", and the terms "entrepreneur" and "entrepreneurship" were virtually nonexistent in the leading graduate textbooks in micro, macro and industrial organization. From the early 20th century onwards, owing to the works of some key economists on the importance of entrepreneurship phenomena, the entrepreneur has gained a more relevant space in economics. This paper thus aims at contributing to both economics and entrepreneurship literature, by outlining how the gradual development of the entrepreneurship research field is backed in economic science. Firstly, we provide a wider vision on the economists' necessity, over the last century, to include the entrepreneur figure as a potential explanatory agent of several economic phenomena. Secondly, by identifying the footprints of some key economists in subsequent developments of the field, we explore how the economists' (re)discovery of the entrepreneur during the last century may have worked as a platform to gradually develop a new, and increasingly independent, institutionalized and recognized field of research.

Keywords: Entrepreneurship, Entrepreneur, Economics, Economic Thought
JEL Codes: B1; L26

"(. . .) one can say of the role of the entrepreneur in the main-stream mathematical writings of the firm much what Mark Twain said of the weather – everyone talks about the subject but no one does anything about it. Every economist surely must be prepared to concede that entrepreneurs are (even if for reasons not fully specified) of great importance. But in standard microtheory they are completely invisible." Baumol (2003: 57)

1 Introduction

Most people who are not economists would probably expect to find economics literature full of analyses of entrepreneurship, as economics is, in fact, the social science that deals most directly with contemporary economic reality. However, for long time economics literature had relatively little to say about entrepreneurship. Rewording Baumol (2010: 11), "the really important part of the story of economic well-being. . . was exorcised from the (theoretical) literature". Despite the early attempts of Richard Cantillon to recognize the role of the entrepreneur figure to economic phenomena early in the 18th century, the entrepreneur had virtually disappeared from mainstream economics by the end of the 19th century (Baumol, 1993, 2010).

The theory's failure to include the entrepreneur in the mathematical representations of economic reality was a consequence of the extreme simplifying assumptions of neoclassical models, where all agents had perfect information and their economic objectives were clearly stated (Casson, 2003; Bianchi and Henrekson, 2005; Montanye, 2006). These assumptions, which reduced the economic process to clocklike mechanics, overlooked the need for specialized individuals to perform the discovery, coordination, decision-making and risk-bearing functions (Schumpeter, 1934; Barreto, 1989; Landström, 2005). As a result, the firm was assumed to run itself, leaving no room for the entrepreneur in those models (van Praag, 1999). The theoretical firm has, thus, remained *entrepreneurless* for long time (Bianchi and Henrekson, 2005), which was compared to a "performance of Hamlet with the Danish prince missing" in the words of Baumol (1968: 66).

As a natural consequence – and confirming that the ideas that cannot be modeled formally tend to be ignored in economics (Bianchi and Henrek-

son, 2005) – the terms "entrepreneur" and "entrepreneurship" are practically nonexistent in the leading graduate textbooks in micro, macro and industrial organization (Johansson, 2004). However, this neglect of the entrepreneur was often alleged to be a source of embarrassment to economists (Cosgel, 1996), as the importance of the entrepreneur in the real world became more and more difficult to ignore (Wennekers and Thurik, 1999).

From the early 20th century onwards, there was a "renaissance" of the entrepreneur figure within economics and academics started to look at entrepreneurship phenomena through different perspectives. Almost all the branches of economics had something to say about the entrepreneur and his respective importance for some economic problem. Even so, there is, perhaps, no other area of economic analysis where there still is less agreement than on the entrepreneurship definition, the identification of the entrepreneur figure and the nature of the entrepreneurial function.

In economic thought literature, we already find valuable interpretations of the ideas of particular economists about the entrepreneur figure (see, for instance, Martin, 1979; Kanbur, 1980; Santarelli and Pesciarelli, 1990) or even about the reasons behind the entrepreneur's disappearance from mainstream economic analysis (e.g., Barreto, 1989; Cosgel, 1996; Casson, 2003). Nonetheless, a deeper knowledge about how the entrepreneur (re)entered into economics through its several branches, and how the economists' (re)discovery of the invisible entrepreneur may have worked as a platform to build an increasingly autonomous and recognized field of research, is still lacking in the literature.

This paper, thus, aims at contributing to both economics and entrepreneurship literature, by outlining how the gradual development of the entrepreneurship research field is backed in economic science. More than focusing on

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particular visions of specific authors, or confronting similar or opposing views of different authors, this paper tries to, firstly, provide a wider vision on the economists' necessity, over the last century, to include the entrepreneur figure as a potential explanatory agent of several economic phenomena and, secondly, explore how early economists' research on entrepreneurship topics might have contributed to develop a new, and increasingly independent, institutionalized and recognized field of research.[1]

The following sections of the paper are organized as follows. As a starting point, section 2 pays homage to some of the most influential economists who helped to bring the entrepreneur back into economics over the 20th century, summarizing their main ideas and contributions in this regard. Section 3 goes through the main economics fields where the (re)discovery of the entrepreneur figure was most remarkable – namely Labor Economics; Microeconomics and Industrial Organization; and Macroeconomics, more precisely Economic Growth and Development – searching for the rationality to include the entrepreneur figure into the analyses of some economic problems. Section 4 provides a brief bibliometric analysis in order to provide a more quantitative overview of the evolution of entrepreneurship research and to highlight its roots in economics. More than showing the growing relevance of entrepreneurship research in economics journals, we identify the footprints of some key economists in subsequent developments of the field, besides uncovering the main signs of increasing institutionalization of entrepreneurship as an academic field. Section 5 concludes.

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[1]By an "increasing (...) institutionalized (...) field of research" we mean the development of an institutional infrastructure that comprises new institutes and foundations promoting research on entrepreneurship, new journals and outlets attracting and publishing entrepreneurship studies, and emerging mechanisms that recognize and reward individual research on entrepreneurship topics (see also Aldrich, 2012).

2 Economists founding fathers of entrepreneurship research

There are few issues in economics which are backed up by such a rich historical knowledge base as entrepreneurship (van Praag, 1999). The crucial role of the entrepreneur in economic theory was first and foremost recognized in the 18th century by Richard Cantillon (1755, 1931), who became the founding father of the ideas that subsequent economists explored. Cantillon recognized that discrepancies between demand and supply in a market create opportunities for buying cheaply and selling at a higher price, and that this sort of arbitrage would bring equilibrium to the competitive market. People who took advantage of these unrealized profit opportunities, even under the lack of perfect foresight of future impacts, were called "entrepreneurs" (Landström, 2005; Hébert and Link, 2006).

After Cantillon, throughout the 19th century, a number of economists recognized the merit of entrepreneurial activity and of the entrepreneur figure, in particular Mill, Say and Marshall (see, for instance, van Praag (1999) for a more detailed survey of these classic views on entrepreneurship). Nevertheless, even if the entrepreneur's appearance was frequent in the writings of classical economists, he remained a shadowy entity without clearly defined form and function, for whom there was no room in economic theories, namely in the theoretical firm (Baumol, 2010). In consequence, by the end of the 19th century, the entrepreneur had virtually disappeared from the sphere of economic debates and mainstream economics (Baumol, 1968; Swedberg, 2000; Landström et al., 2012).

However, the reason for this disregard of the entrepreneur by economists

was not a denial of his relevance for economic development, or for the organization of economic activity, but mainly the methodological difficulties associated to the lack of analytical tractability of the entrepreneur figure and his function(s) (Bianchi and Henrekson, 2005). Accordingly, from the early 20th century onwards, a number of valuable efforts were made in order to infuse some life to the "invisible entrepreneur" in the several branches of economics.

Hébert and Link (1989) suggest that the taxonomy of entrepreneurial theories in economics can be condensed into three major intellectual backgrounds – German, Chicago and Austrian traditions – each one tracing its origin to Richard Cantillon. Within each of them, we emphasize the contributions of Joseph Schumpeter, Frank Knight and Israel Kirzner, respectively. Additionally, we highlight the noteworthy work of William Baumol, who has been struggling over the most recent decades to develop a framework for introducing entrepreneurship into mainstream microeconomic theory. We may suspect that without these contributions and confronts of ideas, entrepreneurship would have not get its deserved space in economics.

2.1   Joseph Schumpeter

In the words of Reisman (2004: 3), Schumpeter means "entrepreneurship". In *The Theory of Economic Development* (1934), he unveiled his own concept of entrepreneurship by giving a particular role to the entrepreneur figure in the innovation process. The entrepreneur was, thus, treated as endogeneous for the first time. For Schumpeter, the economic system was regarded as a closed circular flow where the stationary equilibrium was attained through the continuous reiteration of the flows between buyers and sellers. Development, in

turn, was understood as a dynamic process that would require the disruption of the economic *status quo* – the so-called "creative destruction".

Basically, Schumpeter realized that economic growth and development resulted not from capital accumulation, but from innovation and "new combinations" (Landström, 2005; Hébert and Link, 2006). This fundamental role of innovating through the introduction of new products, markets or methods of production was given to the entrepreneur, who became responsible for the disturbance of the equilibrium in the economy. Precisely, he defended that "the carrying out of new combinations we call 'enterprise'; the individual whose function is to carry them out we call 'entrepreneurs'" (1934: 74).

In summary, for Schumpeter, entrepreneurship was the expression of the human impulse to be creative (Khalil, 2007), the prime endogenous cause of change (or, more precisely, development) in the economic system (van Praag, 1999), and, consequently, the source of permanent disequilibrium (i.e., crises) (Shane, 2003). Shumpeterian entrepreneurial rewards, however, are not permanent, flowing from the temporary monopoly rents that eventually arise from the successful introduction of those "new combinations" of ideas and resources. Following the same reasoning, entrepreneurship was understood by Schumpeter as a temporary condition for any person, unless s/he keeps on innovating.

2.2   Frank Knight

After Schumpeter, Frank Knight (1921) stimulated one of the pioneer economic approaches of entrepreneurship of the 20th century. With his thesis *Risk, Uncertainty and Profit*, strongly inspired by Cantillon (Hébert and Link, 2006), he stressed the distinction between risk, uncertainty and *true uncertainty*,

defending that entrepreneurship is mainly characterized by action under *true uncertainty*.[2]

In few words, the Knightian entrepreneur is the uncertainty-bearer and the judgmental decision-maker that assumes the uninsurable business hazard (van Praag, 1999). Opportunities arise out of the uncertainty related to change and entrepreneurs are assumed to receive a return for making decisions under conditions of true uncertainty (Landström et al., 2012). Knight's insights, hence, influenced many economists in their analyses of entrepreneurship as an occupational choice problem (Parker, 1996, 2005, 2009; Montanye, 2006).

In summary, Knight and Schumpeter had clearly contrasting interpretations of the entrepreneur, as well as of the risk and uncertainty he is exposed to. While the Knightian entrepreneur is essentially defined as the uncertainty-bearer, the Schumpeterian entrepreneur is the dynamic innovator. For Schumpeter, risk-taking is no case an element of the entrepreneurial function (Schumpeter, 1934: 137), and even though entrepreneurs may risk their reputation, the direct responsibility of failure never falls on them (Martin, 1979; Kanbur, 1980).

2.3 Israel Kirzner

The Austrian School also made a notable effort to introduce the entrepreneur in mainstream economics. Restating Baumol (2003), all economists recognized the importance of entrepreneurship, but until the work of the Austrians, little

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[2]According to Knight (1921), risk exists when outcomes are uncertain but can be predicted with some probability, being insurable; uncertainty arises when the probability of outcomes cannot be calculated; *true uncertainty,* instead, occurs when the future is not only unknown, but also unknowable with unclassifiable instances and a non-existent distribution of outcomes.

was done about it. Early inspired by the Knightian uncertainty, the Austrians' view on entrepreneurship (e.g., von Mises, 1949; Menger, 1950; Kirzner, 1973) also defended that the entrepreneur's success or failure depends on the precision of his anticipation of uncertain events. Therefore, entrepreneurial profits would be the result of entrepreneurs' "ability to anticipate better than other people the future demand of consumers" (von Mises, 1949: 290).

Later, Kirzner (1973, 1997), one of von Mises' students, introduced the key concepts of "spontaneous learning" and "alertness", two requirements for the "entrepreneurial discovery" to occur. He explored the entrepreneurial element in a Crusoe situation (Kirzner, 1979: 168-169) in order to illustrate both concepts – as Robinson Crusoe (and every entrepreneur) becomes aware of his so-called entrepreneurial vision, he learns. However, this learning is not planned, but subconscious, and the state of mind that enables this "spontaneous learning" about the unrecognized entrepreneurial vision (what Kirzner calls the "subconscious hunch") is *alertness*. This refers to an attitude of receptiveness and preparedness to recognize unnoticed or unexploited profitable exchange (i.e., arbitrage) opportunities, corroborating the importance of the entrepreneur's "information-transforming" function already defended by Hayek (1948).

In addition, for the Austrian School, the opportunities for entrepreneurial profit are only available in disequilibrium, and the attainment of market equilibrium requires entrepreneurial action (Kirzner, 1971; Hébert and Link, 1989; Casson 2005; Endres and Woods, 2006; Khalil, 2007). Hence, the Austrian entrepreneur – understood as the equilibrating force in the economic system – is the antithesis of the Schumpeterian entrepreneur, who instead destroys the equilibrium and moves the economy towards a higher equilibrium position (Shane, 2003).

2.4 Towards a theory of entrepreneurship – William Baumol

After the insights of Schumpeter, Knight and Kirzner (among others), the importance of the entrepreneur became more and more difficult to ignore in economics. The peak of the discussion was achieved by William Baumol in a highly influential article published in the American Economic Review, in 1968. His often quoted observation that "the theoretical firm is entrepreneurless – the Prince of Denmark has been expunged from the discussion of Hamlet" (Baumol, 1968: 66) became the classic statement of the gap in economic theory regarding the (in)attention paid to the entrepreneur figure.

Baumol's view on entrepreneurship pays homage to the insights of Schumpeter, namely on his ideas about the entrepreneur as an innovator and as the potential source of disequilibrium. Throughout his career, Baumol has urged the economists to pay attention to the instrumental role of entrepreneurship in economic renewal and growth (Elliasson and Henrekson, 2004), which may be both positive (productive) and negative (destructive), depending on the social benefits of entrepreneurs' innovations (Baumol, 1990, 1993, 2003).

This led Baumol to work for years on the incentives under which judgmental decision-making takes place, with special reference to the issue of how far "rent-seeking" dominates entrepreneurial motivation under perverse incentive systems (Casson, 2005). His most recent works have been emphasizing the need for the correct incentives and the right institutional environment to promote productive and creative entrepreneurship – understood as the ultimate determinant of economic growth (Baumol, 2010).

Over the most recent decades, Baumol has succeeded where many generations of economists since Richard Cantillon have failed – finding the entre-

preneur's rightful place in economic theory. The last chapter of his recent book "The Microtheory of Innovative Entrepreneurship", published in 2010, perfectly summarizes his achievement – *Yes, the theory of entrepreneurship is on its way.*

3 (Re)Discovering the invisible entrepreneur in different fields of economics

During the second half of the 20th century, many other economists started paying an increasing attention to the entrepreneurship phenomena. In this section, we highlight three economics fields where the entrepreneur has been gaining a more relevant space over time – labor economics, microeconomics and industrial organization, and finally macroeconomics, particularly economic growth and development. In each case, we identify a different unit of analysis – the individual entrepreneur, the entrepreneurial firm and the entrepreneurial function, respectively. Relying on the occupational, structural and functional approaches proposed by Klein (2008), we summarize the main paths through which the entrepreneur has been gaining ground in each of the aforementioned fields of economic research over the last decades.

3.1 Labor Economics – the "occupational approach"

Greater efforts to formally include the entrepreneur in economic models became more visible from the late 1970s onwards, firstly by focusing the attention on the individual deciding between remaining employed (or eventually unemployed) and becoming self-employed (Parker, 2009: 31). Entrepreneurship

was, hence, first understood as a matter of choice, an activity where individuals work for themselves and trade-off risks and returns, rather than opting for safer revenues in a different occupation – typically, paid employment.[3]

It was mainly Frank Knight and his concepts of risk and uncertainty that motivated economists' attention to the problem of the individual – to be or not to be an entrepreneur, considering that every entrepreneurial decision is risky and that individuals must respond to the risk-adjusted relative earnings opportunities associated with employment and self-employment (Evans, 1949; Parker, 1996, 2005, 2009). The first occupational choice models, thus, emerged, using the prospective entrepreneur as the unit of analysis and assuming homogeneous agents – an assumption later relaxed in order to account for individuals' heterogeneity in entrepreneurial ability or risk attitudes. Lucas (1978), Kihlstrom and Laffont (1979) and Holmes and Schmitz (1990) were among the classic occupational choice models forming the foundations of entrepreneurship as an occupational choice problem in economic theory, particularly in labor economics.

Using individuals' skills (in particular, innate entrepreneurial ability) as the source of individual-level heterogeneity, Lucas (1978) established that the less talented individuals remain as employees, while the most able (i.e., those positioned above a certain ability threshold level) become entrepreneurs. Kihlstrom and Laffont (1979), inspired by Knight, instead modeled entrepreneurial choice as a trade-off between higher returns with greater levels of risk, and safer but lower earnings. By assuming that individuals are heterogeneous in their risk aversion, they predicted that more risk-averse individuals become

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[3]These ideas on occupational choice problems had some roots in Roy's (1951) sectoral choice model, according to which people predict the earnings on two alternative sectors and choose the one that provides a higher utility.

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employees, while more risk-tolerant agents enter entrepreneurship.

Holmes and Schmitz (1990), in turn, assessed the circumstances under which an entrepreneur should continue operating a venture or transfer it to a possibly less able entrepreneur in order to release time and resources to explore new opportunities. Individuals were, over again, assumed to be heterogeneous in their ability, which affects the survival of new ventures. Their seminal results postulate that the least able individuals manage existing firms, while the most able ones specialize in setting up new businesses. Those with intermediate ability are indifferent between managing the business they have started and replacing them by higher quality businesses acquired from more able entrepreneurs.

Subsequent contributions, besides formalizing the occupational choice of heterogeneous individuals, have also started analyzing potential factors influencing such decision. The role of credit rationing and financial constraints was one of the first real forces that economists tried to introduce in their models on entrepreneurs' entry (see, for instance, Stiglitz and Weiss (1981), de Meza and Webb (1987) and Evans and Jovanovic (1989)). In summary, all these models were crucial to stimulate the economists' interest on particular questions such as why do some people become entrepreneurs and others do not (see, for instance, Blanchflower and Oswald, 1998; Blanchflower, 2000; Parker, 1996, 2009).

3.2 Microeconomics and Industrial Organization – the "structural approach"

Alongside the increasing attention devoted to the entrepreneur, microeconomists and industrial organization (IO) specialists also started to be concerned

with the entrepreneur's firm itself, namely with its success, survival and growth. More than looking at the entrepreneurs as those who leave paid employment (or unemployment) to create their own job, run risks and exploit a (potentially profitable) business opportunity, the economic literature also started to see the entrepreneur as the small firm's owner, the responsible for establishing new firms and the job creator, thus having a more *structural* concept of entrepreneurship in mind (Klein, 2008).

In this regard, Lucas's (1978) seminal paper had a twofold influence – besides calling the economists' attention to the occupational choice problem of the entrepreneur, he also put forward the first theory of the size distribution of firms based on the relative endowment of entrepreneurial talents, establishing that the most talented entrepreneurs employ others and end up running the largest firms (Santarelli and Vivarelli, 2007). Since then, and also owing to the subsequent work of Jovanovic (1982) on the post-entry evolution of newborn firms, economics literature started to redirect the attention from the entrepreneur to his firm.

Jovanovic's (1982) model is surely amongst the most influential studies on firm growth and survival, by linking innovation, entry, exit and the evolution of the industry in the same model. Entrepreneurs are assumed to have incomplete information at the start-up and to learn about their efficiency as they operate in the industry. Able entrepreneurs' firms grow and survive, while those owned by less able entrepreneurs decline and fail. In line with Lucas (1978), Jovanovic showed that firm size and entrepreneurial talent are not independent. His results propose that firms differ in size not because of any fixed capital accumulation *per se*, but due to some learning that they are more efficient (and owned by more talented entrepreneurs) than others. Jovanovic's premises that newer and smaller firms have higher and more variable growth

rates, and also higher exit rates than older and larger firms, have also opened the doors to the entrepreneur and his firm(s) in IO.

By that time, the first signs of the declining interest in the entrepreneurs' personal characteristics and intentions became evident, in favor of a growing focus on their outcomes at the firm and industry-levels, the contextual aspects surrounding entrepreneurs' entry and the entrepreneurial process itself (Landström, 2005; Landström et al., 2012). Gartner (1988) explicitly claimed that "Who is the entrepreneur?" was the wrong question and that there were more relevant and unanswered questions as "How are new organizations created?". The economic context of the late 1970s, namely the "twin oil" crises – after which many large companies were hit by severe economic difficulties, being gradually understood as inflexible and slow to adjust to new market conditions (Landström, 2005: 48) – has also motivated the discussion around small firms and entrepreneurship more than ever.

In addition, the pivotal work of David Birch – *The Job Generation Process* (1979) –, proposing that the majority of new jobs were created by young firms with twenty or less employees, was published under this turbulent environment. This report, only sold in twelve copies, had a huge influence both on policy makers and the research community, providing the intellectual foundation for researchers throughout the world to incorporate smaller firms into their analyses of industrial evolution and economic development. Margaret Thatcher in the UK and Ronald Reagan in the US also contributed to this shift in the economists' mindset, by changing their political ideology and pursuing policies strongly in favor of small business and entrepreneurship (Landström, 2005; Landström et al., 2012). Accordingly, besides innovators, risk-takers and arbitrageurs, entrepreneurs started being viewed as job creators and small businesses' owners as well.

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New areas of interest emerged after the second half of the 1980s. The relationship between entrepreneurship, innovation, industrial dynamics and job creation started to dominate the public debate. The increasing access to firm-level data contributed to the development of Empirical Industrial Organization (Einav and Levin, 2010), where entrepreneurship started occupying a greater room over the most recent decades.[4] Policy-oriented work on entrepreneurship and small businesses' dynamics (e.g., Storey, 1994; Storey and Tether, 1998; van Stel et al., 2007; Audretsch et al. 2007) and the relationship between small firms and innovation (e.g., Acs and Audretsch, 1988, 1990) were among the most common entrepreneurship-related topics under a more structural approach over the subsequent decades.

3.3 Macroeconomics: Economic Growth and Development – the "functional approach"

A third line of analysis has been rather concerned with the entrepreneurial function as the basis for economic change and progress. Since Schumpeter (1934), the entrepreneur emerged as the *persona causa* of economic development (Hébert and Link, 1989; Santarelli and Pesciarelli, 1990). Among the several profiles attributed to the entrepreneur figure, two main functions had been highlighted as the key ones linking entrepreneurship to economic growth and development – innovation and the creation of new firms and jobs. First, by innovating and transforming inventions and ideas into economically viable products and services, entrepreneurs were expected to push technological

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[4]Meanwhile, "entrepreneurship" entered the list of Journal of Economic Literature (JEL) classification system and was precisely included in the sub-field Industrial Organization (L26-Entrepreneurship).

progress, promote growth and improve economic development (e.g., Wennekers and Thurik, 1999). Second, by founding and operating new businesses – even if there is nothing innovative in these acts – the entrepreneur was also expected to create value and new jobs, intensify competition and potentially increase productivity, which in turn may impact positively on the overall economy (e.g., Acs, 2006).

However, despite this widespread belief that entrepreneurship was a key factor in economic growth and development, few attempts were made to incorporate entrepreneurship – and the entrepreneurial *function* in particular – in formal growth and development models until the early 1990s. Entrepreneurship did not fit in theoretical neoclassical growth models not only because perfect competition assumptions implied that there was no profit opportunities for entrepreneurs left, but also because the models of general equilibrium did not take into account the dynamics of the Schumpeterian – i.e., innovator – entrepreneur (Schmitz, 1989; Wennekers and Thurik, 1999).

Endogenous growth theory has created new possibilities for fitting entrepreneurship (or entrepreneurial activities) into growth models, namely by emphasizing the role of knowledge and innovation for the growth of nations (e.g., Romer, 1986, 1990; Lucas, 1988). Knowledge externalities and increasing returns to scale were two of the key cornerstones of those new endogeneous growth models. These two processes appeared as a black box in the mainstream growth theory, which did not go very far toward illuminating the process by which knowledge externalities produce growth, or by which increasing returns can be manifested in the production process. The discovery of the crucial entrepreneurs' functions in the market process thus filled this gap (Holcombe, 1998; Acs et al., 2004).

More precisely, knowledge and innovation spillovers were recognized to not

befall automatically, requiring instead some channel(s) through which they could work and promote growth. Some mechanism was necessary to serve as a conduit for the spillover to occur. Hence, the entrepreneurial *function* – in particular, entrepreneurs' innovation and start-up activities – started being introduced in endogenous growth models. Entrepreneurs, by being responsible for the conversion of knowledge into economically relevant knowledge, were thus declared to be the missing link in earlier models (Acs et al., 2004, 2009). Schmitz (1989) and Aghion and Howitt (1992) provided key advances by that time. The former developed a theory where the activity of entrepreneurs – and particularly the activities of imitating, rather than innovating – was shown to drive the growth of nations. The latter, instead, showed that industrial innovations conducted by entrepreneurs, by leading to quality improvements of products, were the key channel to induce progress and growth in the economy.

In summary, incorporating entrepreneurship into the framework of economic growth helped to develop endogenous growth theory mainly by shedding some light on the nature of increasing returns to scale, knowledge externalities and the role of human capital. Knowledge externalities arise when the entrepreneurial insights of some individuals produce entrepreneurial opportunities for others; increasing returns occur because the more entrepreneurial activity an economy displays, the more entrepreneurial opportunities it creates (e.g., Holcombe, 1998). Moreover, the new focus on entrepreneurship pushed the economic growth theory forward, towards the institutional setting within which growth occurs (Baumol, 1990), and away from neoclassical theories that focused on production process' inputs, as labor and capital.

Entrepreneurship is already considered one of the key growth components in "new growth theory" (e.g., Audretsch et al., 2006; Henrekson, 2005). More recent concerns on the entrepreneurship-growth relationship have been related

to the quality of the entrepreneurship. Some of the latest extensions to existing models have been suggesting the need to encourage high-ability entrepreneurs, as low quality entrepreneurship is argued to retard growth (e.g., Jiang et al., 2010; Jaimovich, 2010). These new results stress the need to provide the right incentives to the most able entrepreneurs, in order to promote productive and growth-enhancing entrepreneurship, and avoid unproductive or even destructive entrepreneurial activities, in line with Baumol (1990, 2010).

4 Tracing the recent development of Entrepreneurship research

This section provides a brief quantitative overview of the evolution of entrepreneurship research over the last decades, highlighting its roots in Economics. The analysis is based on thousands of articles from Scopus database published since the early 1970s and explores: i) how entrepreneurship topics have been achieving their space in Economics academic research over the years; ii) how the insights of some of the economists "founding fathers" of the entrepreneur have remained influent in more recent entrepreneurship research; and iii) how fragmented entrepreneurship research currently is as a new research field.

4.1 Entrepreneurship research in Economics journals

According to Landström et al. (2012), the recent evolution of entrepreneurship research can be described in three phases: a first *take-off phase* during the 80s, a second *growth phase* after the early 1990s, and a final phase mainly

characterized by a *search for the maturity* of the field since the early 2000s. In order to illustrate this evolution, we started by performing a search in the Scopus database, by requiring the appearance of, at least, one of the following words or expressions in the publications' title, abstract and/or keywords: "entrepreneur", "entrepreneurship", "small firm", "start-up", "self-employment", "new venture" and "new firm".[5] This allowed us to identify a total of 42,593 articles published between 1970 and 2013. Out of these, 15,701 belong to the Scopus subject area "Economics, Econometrics and Finance" (or 8,444 articles if we exclude those who are also classified in "Business, Management and Accounting").[6]

Figure 1.1 illustrates the overall evolution of the total number of articles satisfying the criteria imposed in the search, both in absolute and relative terms. Figure 1.2 provides comparable data for the subject area of "Economics, Econometrics and Finance". Overall, we confirm that, despite the early efforts of a significant number of economists to claim for more attention to the entrepreneur figure, research on entrepreneurship topics remained

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[5]Despite this seems to be somewhat restrictive, by imposing these criteria on the search process we are allowing to capture two particular aspects. First, by using these different combinations of keywords, it is more likely to include a wider number of studies using different definitions of entrepreneurship. As previously discussed, many studies have been linking entrepreneurship either to self-employed individuals (i.e., the entrepreneur in particular), or to the entrepreneurial firm – which is commonly understood as being a small firm, a start-up or a new venture, or even to innovation activities conducted by entrepreneurs and their firms. Besides this, it is possible that different Economics fields give a different relative importance to these different perceptions of the entrepreneurship phenomenon (for instance, IO may be more concerned with the new/start-up firm, while Labor Economics may be more focused on the entrepreneur in particular), so by imposing these wider criteria we try to avoid a potential overrepresentation of one of these visions about entrepreneurship. Second, by imposing these keywords to appear in the publications' title, abstract and/or keywords, we are increasing the probability of collecting the publications that are really dealing with entrepreneurship topic, thus minimizing the inclusion of marginal publications (i.e., publications whose main focus is not directly related to entrepreneurship phenomena).

[6]These results were last accessed in February 2014.

relatively scarce until the late 1980s.

After the mid-90s, we observe a "boom" in entrepreneurship research, over-all and in Economics journals in particular. By 2000, around 1,400 articles fulfilling the criteria described above were published (about 300 in Economics journals). Ten years later, the respective numbers had already doubled. More than 4,000 articles (almost 800 in Economics journals) were published only in 2013.
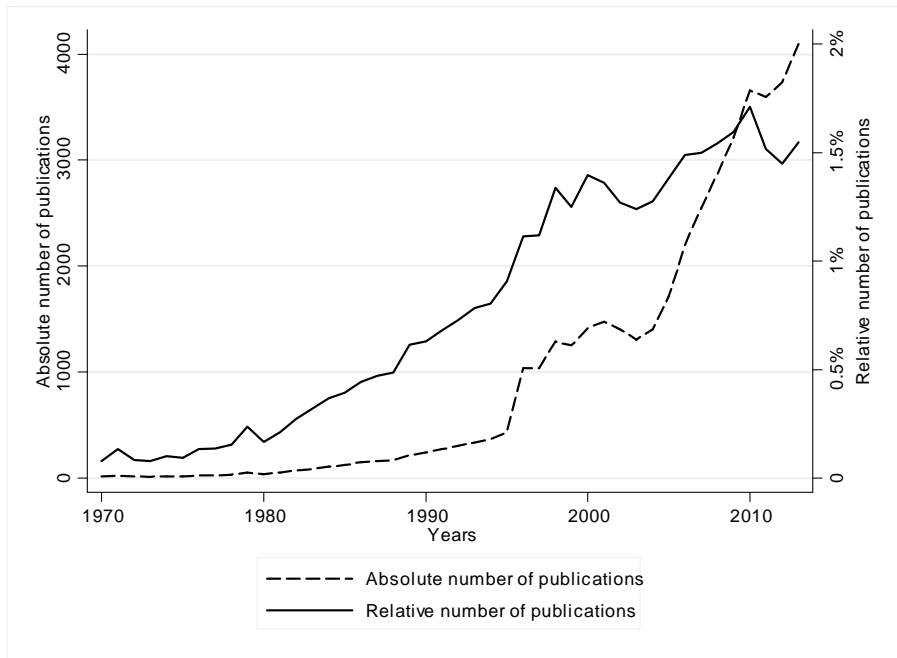
Fig. 1.1. Evolution of entrepreneurship research in absolute and relative terms - All Subject Areas (42,593 articles)

In relative terms, we also confirm that entrepreneurship topics have been occupying a more relevant space in academic research, and especially in Eco-nomics. By the early 80s, the articles focused on entrepreneurship topics

accounted for less than 1% of all publications in Economics journals. In most recent years, about 4% of all Economics articles have been concerned with the entrepreneurship phenomena, a much more significant share than that observed in other areas (see Figure 1.1).
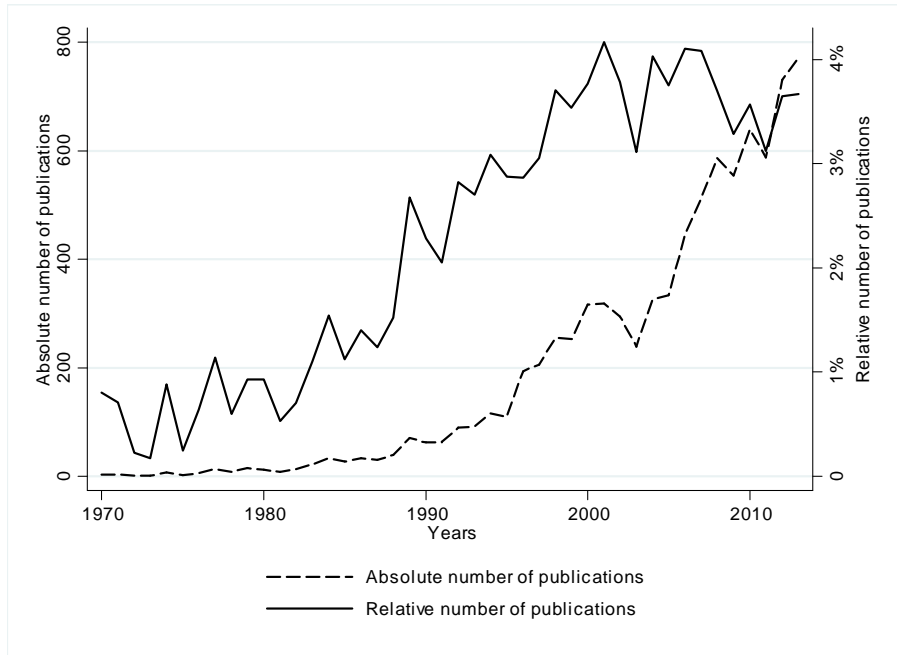
Fig 1.2. Evolution of entrepreneurship research in absolute and relative terms - Economics, Econometrics and Finance (8,444 articles)

Table 1 reports the journals identified in Scopus database publishing the largest number of articles on entrepreneurship since 1970. The leading Economics journal publishing on entrepreneurship is *Small Business Economics* (SBE), a journal founded by David Audretsch and Zoltan Acs in the late 1980s. SBE has become one of the outlets of recognized reputation for researchers interested in entrepreneurship topics, currently presenting a broad scope that includes multiple analyses and perspectives of entrepreneurship phenomena.

The foundation of SBE is actually recognized as one of the first signs of the gradual institutionalization of entrepreneurship as a field of research (Landström et al., 2012).

Table 1. Economics journals publishing more papers on entrepreneurship

Journal	Total # Articles	Share
Small Business Economics	503	6.0%
Journal of Banking and Finance	220	2.6%
World Development	205	2.4%
Industrial and Corporate Change	193	2.3%
International Journal of Industrial Organization	145	1.7%
Applied Economics	137	1.6%
European Economic Review	134	1.6%
Economics Letters	124	1.5%
Journal of International Economics	116	1.4%
Journal of Development Economics	110	1.3%
Journal of Public Economics	100	1.2%
Applied Economics Letters	97	1.1%
Journal of Comparative Economics	79	0.9%
Total	2163	25.6%

Notes: All articles (8,444) published in 1970-2013, in the Scopus category "Economics, Econometrics and Finance" (excluding "Business, Management and Accounting"), with at least one of the following expressions in their title, abstract or keywords: entrepreneur, entrepreneurship, small firm, start-up, self-employment, new venture, new firm.

Besides SBE and some general-interest journals (as Applied Economics, EER and Economics Letters), we identify a number of more specialized jour-

nals – particularly in the areas of economic development (e.g., World Development and JDE), industrial organization (e.g., ICC and IJIO) and even finance (namely the Journal of Banking and Finance) and international economics – accounting for a significant part (over 25%) of the entrepreneurship research published in Economics journals over the last decades.

Table 2 complements these data and summarizes the total number of articles on entrepreneurship published, so far, in some highly ranked general-interest Economics journals, as well as in some relevant field journals.[7] The results confirm that entrepreneurship questions have deserved significant attention within top academic journals, as American Economic Review, Review of Economics and Statistics, Review of Economic Studies, Journal of Economic Theory and Quarterly Journal of Economics, among others. Even during the last decade, a very significant number of articles dealing with entrepreneurship issues were published in these journals, confirming that the entrepreneur figure, the entrepreneurial firm and/or the entrepreneurial function have, finally, found its deserved space in mainstream Economics journals.

At the same time, since the early 2000s a number of specialized Economics journals started to pay a greater attention to entrepreneurship. Development Economics and IO journals have played a prominent role, with Labor Economics journals somewhat lagging behind. These patterns may actually confirm the aforementioned shift in the economists' research interests from the individual entrepreneur towards the entrepreneurial firm and the aggregate outcomes of entrepreneurial process.

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[7]Among the journals identified in Scopus database, we tried to identify both generalist and specialized highly ranked-journals following some of the most known international rankings, as Thompson Reuters JCR Impact Factor, ISI Web of Science h-index and SJR (SCImago Journal & Country Rank).

Table 2. Top Economics journals publishing on Entrepreneurship (generalist and specialized/field journals)

Selective Top Journals	# Papers 1970-2013	# Papers 2000-2013
Journal of Economic Theory	73	45
Economic Journal	52	40
Review of Economics and Statistics	46	39
American Economic Review	42	36
Review of Economic Studies	40	33
Economic Theory	37	31
Quarterly Journal of Economics	31	25
Journal of Political Economy	27	22
Econometrica	18	17
Labor Economics Journals		
Labour Economics	45	37
Journal of Labor Economics	33	20
Industrial Organization Journals		
Industrial and Corporate Change	193	152
J. of Econ. Behavior & Organization	155	96
Intern. J. of Industrial Organization	145	72
Review of Industrial Organization	111	68
RAND Journal of Economics	69	52
Journal of Industrial Economics	61	51
Macroeconomics and Economic Development Journals		
World Development	205	101
Journal of Development Economics	110	79
Journal of Comparative Economics	79	48
Economic Development Quarterly	76	64
Journal of Macroeconomics	38	26
Developing Economies	14	13

Notes: The first column reports the total number of articles published in each journal, out of the 8,444 articles included in the Scopus category "Economics, Econometrics and Finance" (excluding "Business, Management and Accounting"). The total number of articles published since 2000 in the same category (last column) was 6,658.

Finally, Figure 2 summarizes the main keywords of the entrepreneurship publications identified in Scopus database since the early 70s.[8] As expected, "Entrepreneurship" and "Entrepreneur" are two of the most frequent keywords of those publications, confirming that the criteria that we impose in the search is mostly picking up those publications closely related to entrepreneurship topics – either in a more occupational approach, or following a more structural or functional approach. Actually, the three approaches discussed above seem to be clearly identified.
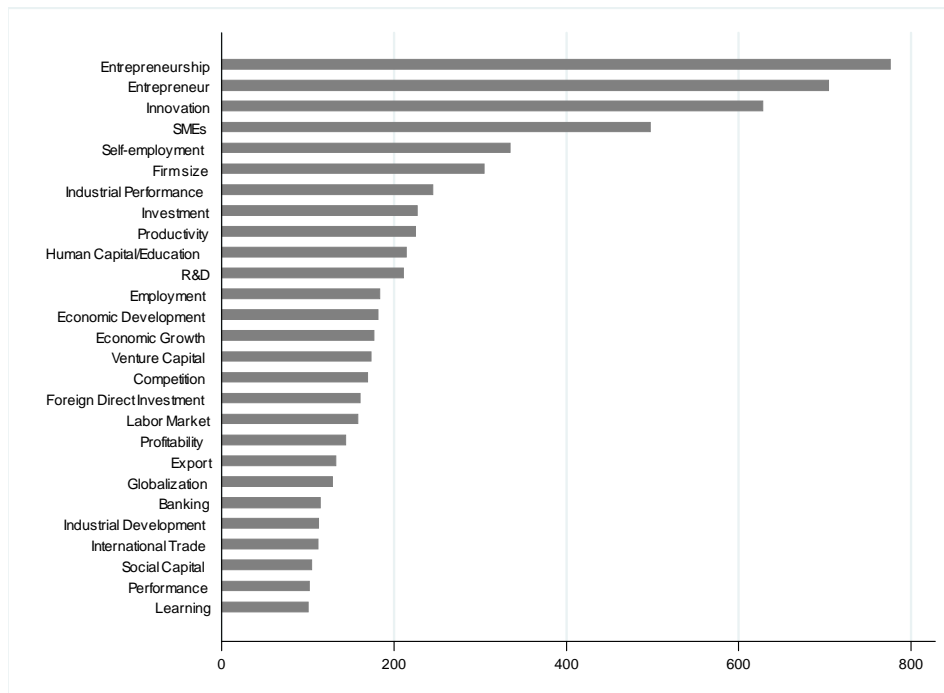
Fig. 2. Top keywords of economics articles on entrepreneurship

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The high frequency of particular keywords as "self-employment" or "human capital/education" indicates the existence of a line of research mainly focused on the individual, the entrepreneur's traits and the occupational choice problem of the prospective entrepreneur, thus confirming the strong presence of the "occupational approach" in the economists' analyses of entrepreneurship phenomena. The great incidence of the terms "SMEs", "firm size", "employment" and "industrial performance", in turn, fits the more "structural approach" typically followed in IO research. The "functional approach" more frequently followed in economic development and growth studies is also evident, given the regular use of keywords as "innovation", "R&D", "economic development" and "economic growth".

Finally, new questions seem to have emerged over the last decades, with different Economics fields becoming concerned with entrepreneurship phenomena. From Figure 2, we would point out that Financial Economics and International Economics are two of the fields where such concern is becoming obvious. While entrepreneurs' or small businesses' investment decisions, credit risks, relationships with banks and venture capital funders are probably interesting research questions for the former, the latter are surely paying an increasing attention to born-global firms and to the internationalization of small/new firms.

In summary, the evolving patterns identified for the last four decades leave no doubt that entrepreneurship studies gained a considerable sway within Economics. We find strong concerns with the entrepreneur individually, with the entrepreneurial firm and its financial and global challenges, as well as with the effects of entrepreneurial action in the labor market, in industries, regions and in the economy as a whole. Very different questions have been addressed, very diverse approaches have been employed and, overall, entrepreneurship

phenomena have been studied from many different angles in Economics. This confirms the (still) high degree of fragmentation in the entrepreneurship field (Teixeira, 2011; Aldrich, 2012; Landström et al., 2012; Rehn et al., 2013).

4.2 The footprints of economists founding fathers in entrepreneurship research

From the previous discussion, we are now aware of the increasing relevance of entrepreneurship in Economics journals. In this section, we look at overall entrepreneurship research, in order to appraise whether and how those key economists who, throughout the 20th century, helped to infuse some life and to give a shape to the invisible entrepreneur, have remained influent in more recent developments of this new research field. Besides the founding fathers identified in Section 2 (Schumpeter, Knight, Kirzner and Baumol), we also explore the influence of Lucas, Birch and Jovanovic.

We started by analyzing the volume of articles that have been linking the entrepreneur figure to the insights of each of those economists. Using again Scopus database, we have identified the total number of articles, in each year, using the term "entrepreneur" jointly with each author's name throughout the article (e.g., "entrepreneur" AND "Schumpeter"; "entrepreneur" AND "Knight"). Figure 3 illustrates the pattern identified in the search.

The results suggest that Joseph Schumpeter has been, by far, the most influent founding father of the entrepreneur figure, followed by Frank Knight. The association of the entrepreneur to Israel Kirzner seems now to be as frequent as the connections made to William Baumol, possibly due to Baumol's recent attempts to establish a microtheory of entrepreneurship (e.g., Bau-

mol, 2010). Entrepreneurship research published during the last decade seems to link the entrepreneur figure relatively less frequently to Lucas, Birch and Jovanovic, as their insights are more recent and more focused on the entrepreneurial firm. However, the footprints of each of these economists may be more prominent in particular journals, in specific lines of study within entrepreneurship research, and among some groups of researchers, as we next explore.

Fig. 3. Number of articles associating the entrepreneur figure to particular economists

Table 3 lists the ten journals publishing the largest number of articles linking the entrepreneur figure to each of those key economists. In all cases, we verify that most of the journals specialized in entrepreneurship topics are included in this top 10, as JBV, SBE, ET&P, among others.[9] The fact that

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[9]In alternative, we have checked, whenever possible, which journals present the greatest

the footprints of those economists are relatively more evident on these specialized journals – whose foundation was relatively recent – actually confirms that entrepreneurship research has becoming an increasingly independent and recognized field of research with strong roots in Economics. Moreover, we verify that while the insights of some of those economists about the entrepreneur figure are much more concentrated in journals specialized in small businesses and entrepreneurship topics (e.g., Kirzner or Birch), the ideas of others seem to be more dispersed across different types of journals (e.g., Lucas or Jovanovic), thus suggesting that their seminal works have been equally important in other fields than entrepreneurship.

Table 3. The footprints of key economists in entrepreneurship research

Journal	# Articles	Share
"Entrepreneur" & "Schumpeter" - 2598 articles		
Journal of Business Venturing	100	3.8%
Small Business Economics	98	3.8%
Research Policy	62	2.4%
Entrepreneurship Theory & Practice	56	2.2%
International Journal of Entrepreneurship and Small Business	51	2.0%
Entrepreneurship and Regional Development	50	1.9%
Journal of Evolutionary Economics	37	1.4%
Journal of Small Business Management	36	1.4%
International Entrepreneurship and Management Journal	36	1.4%
Technovation	33	1.3%
Total	559	21.5%

(It continues in the next page)

Table 3. The footprints of key economists in entrepreneurship research

Journal	# Articles	Share
"Entrepreneur" & "Knight" - 1898 articles		
Journal of Business Venturing	59	3.1%
Journal of International Entrepreneurship	40	2.1%
Entrepreneurship Theory & Practice	39	2.1%
Small Business Economics	35	1.8%
International Journal of Entrepreneurship and Small Business	34	1.8%
Entrepreneurship and Regional Development	33	1.7%
International Business Review	28	1.5%
Journal of Small Business and Enterprise Development	28	1.5%
Journal of World Business	24	1.3%
International Small Business Journal	22	1.2%
Total	342	18.0%
"Entrepreneur" & "Kirzner" - 1049 articles		
Journal of Business Venturing	63	6.0%
Small Business Economics	54	5.1%
Entrepreneurship Theory & Practice	44	4.2%
Review of Austrian Economics	34	3.2%
International Journal of Entrepreneurship and Small Business	31	3.0%
International Small Business Journal	25	2.4%
Entrepreneurship and Regional Development	24	2.3%
Journal of Management Studies	24	2.3%
Journal of Small Business Management	22	2.1%
International Entrepreneurship and Management Journal	19	1.8%
Total	340	32.4%
"Entrepreneur" & "Baumol" - 892 articles		
Small Business Economics	66	7.4%
Journal of Business Venturing	40	4.5%
Entrepreneurship Theory & Practice	34	3.8%
Entrepreneurship and Regional Development	22	2.5%
International Journal of Entrepreneurship and Small Business	15	1.7%
Foundations and Trends in Entrepreneurship	14	1.6%
International Entrepreneurship and Management Journal	14	1.6%

(It continues in the next page)

Table 3. The footprints of key economists in entrepreneurship research

Journal	# Articles	Share
Journal of Management Studies	13	1.5%
Journal of Evolutionary Economics	12	1.3%
Industrial and Corporate Change	12	1.3%
Total	242	27.1%
"Entrepreneur" & "Lucas" - 818 articles		
Small Business Economics	43	5.3%
Journal of Economic Dynamics and Control	11	1.3%
Entrepreneurship Theory & Practice	10	1.2%
Journal of Evolutionary Economics	10	1.2%
International Journal of Entrepreneurship and Small Business	10	1.2%
Journal of Business Venturing	9	1.1%
World Development	8	1.0%
Foundations and Trends in Entrepreneurship	7	0.9%
Review of Economic Dynamics	7	0.9%
Industrial and Corporate Change	7	0.9%
Total	122	14.9%
"Entrepreneur" & "Birch" - 451 articles		
Small Business Economics	30	6.7%
Entrepreneurship Theory & Practice	15	3.3%
Entrepreneurship and Regional Development	14	3.1%
Journal of Business Venturing	14	3.1%
Journal of Small Business Management	13	2.9%
International Journal of Entrepreneurship and Small Business	12	2.7%
International Journal of Entrepreneurial Behaviour and Research	12	2.7%
International Entrepreneurship and Management Journal	11	2.4%
Foundations and Trends in Entrepreneurship	11	2.4%
International Small Business Journal	10	2.2%
Total	142	31.5%
"Entrepreneur" & "Jovanovic" - 774 articles		
Small Business Economics	101	13.0%
Journal of Business Venturing	28	3.6%
Industrial and Corporate Change	17	2.2%

(It continues in the next page)

Table 3. The footprints of key economists in entrepreneurship research

Journal	# Articles	Share
Economic Journal	15	1.9%
Entrepreneurship and Regional Development	14	1.8%
Management Science	13	1.7%
Labour Economics	13	1.7%
Foundations and Trends in Entrepreneurship	10	1.3%
International Journal of Entrepreneurship and Small Busines	10	1.3%
International Small Business Journal	10	1.3%
Organization Science	10	1.3%
Total	231	29.8%

A brief analysis of the keywords mostly used in each case confirm the legacy left – in terms of lines of research – by each of those economists. Most of the articles linking the entrepreneur figure to Schumpeter deal with topics related to innovation, economic growth and development. Those relying more on the Knightian entrepreneur frequently include "uncertainty" and "decision making" in their keywords. Moreover, more recent research on international entrepreneurship, small businesses' internationalization and globalization also seems to be inspired by Knightian uncertainty – not only due to the profusion of these keywords in the articles referring to the Knightian entrepreneur, but also due to the Knightian footprints identified in journals as Journal of International Entrepreneurship and International Business Review (see Table 3).

"Opportunity recognition", "knowledge" and "innovation" are among the keywords of those linking the entrepreneur to Kirzner, while those stimulated by Baumol typically pay attention to innovation, economic development, growth and the importance of the institutional framework. Lucas' followers, in turn, are more concentrated in self-employment and occupational choice

problems, besides their attention paid to human capital, education and labor market issues. Last but not least, both Birch's and Jovanovic's ideas about the entrepreneur and the entrepreneurial firm seem to have stimulated new lines of research more concerned with Small and Medium Enterprises, firm growth and the industrial performance of small businesses.

Finally, we identify a number of authors who have been contributing to the development of the entrepreneurship research field and who have been relatively more inspired by the insights of those key economists – given the volume of articles where they associate the entrepreneur figure to particular founding father(s) (see Figure 4). Following the taxonomy of Landström (2005), we can classify these authors as belonging to the *Core Group* of researchers, as they became over the last decade highly productive researchers in entrepreneurship and whose work has a substantial impact in the field.[10]

Zoltan Acs and David Audretsch are two of those "core researchers" – or "stars", as Teixeira (2011) designates – in the entrepreneurship field. Besides the foundation of Small Business Economics journal, they have been working for several years on small firms and innovation, as well as on regional policy and on the role of entrepreneurship to economic growth. Their works are frequently based on the Schumpeterian – innovative – entrepreneur, and their analyses of small firms also follow the insights of more recent influential economists as Lucas and Jovanovic, as Figure 4 illustrates.

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[10] According to Landström (2005: 67), the researchers who have been publishing about entrepreneurship constitute a rather heterogeneous group, being possible to identify *Ad-hoc transients*, i.e., researchers who appear only once and whose publication within the field of entrepreneurship is a one-off event; *Influential transients*, i.e. transient researchers who appear only once, but whose work is influential for entrepreneurship research; *Craftsmen*, which are the researchers whose names tend to appear more frequently in entrepreneurship articles, meaning that they have stayed within the field for a longer period of time; and finally a *Core Group* of high-impact researchers.

Similarly, Roy Thurik has been mainly focused on small businesses and industrial dynamics, as well as the link between entrepreneurship and the macro economy – thus following the approaches of several economists as Schumpeter, Baumol, Lucas and Jovanovic. Magnus Henrekson's research interests, in turn, include the relationship between entrepreneurship, economic growth, and structural and technical change, which justifies his relatively stronger reliance on the ideas of Schumpeter and Baumol.
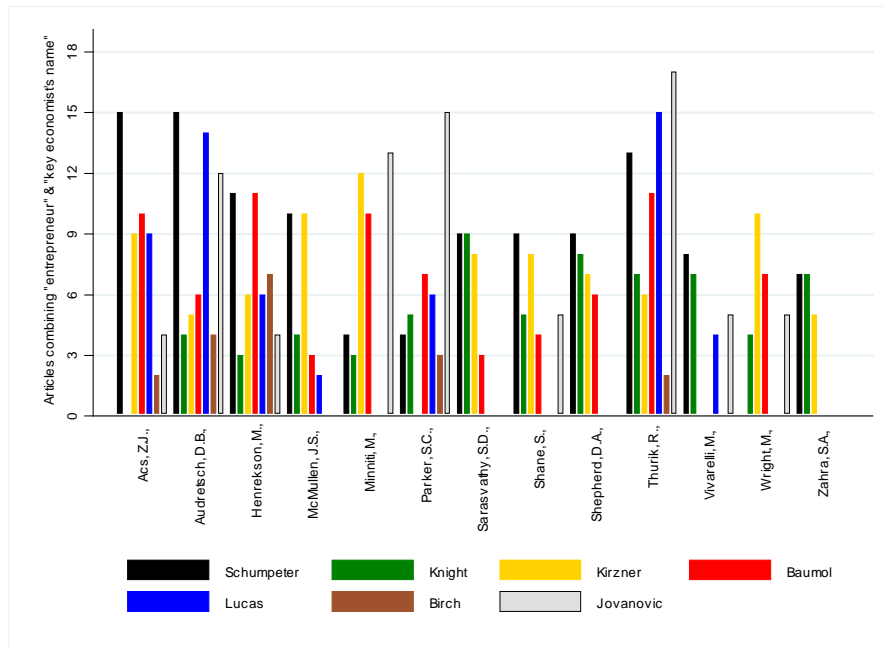
Fig 4. Researchers from the *Core Group* following the footprints of key economists

Some of these "core researchers" have been working on several different questions at the same time. Maria Minnitti has been concerned with entrepreneur's entry decision among women and minority groups, as well as with

the relationship between entrepreneurship, economic growth and institutions, being thus inspired by different seminal works. Scott Shane, instead, has been working on theory building and in the conceptualization of the entrepreneurship field, virtually covering all major aspects of the entrepreneurship phenomena – the individual(s), the opportunity, the organizational context, the environment and the entrepreneurial process – thus relying on the insights of many influential economists in his works. Simon Parker, despite having been relatively more interested in individual-level analyses of the entrepreneurship phenomena for long time, has been providing diverse contributions to the development of the field with strong roots in Economics, as his recent book Economics of Entrepreneurship (Parker, 2009) confirms.

From our analysis, these were among the "core researchers" following more closely the footprints left by some of the key economists discussed throughout the paper. A number of other "stars" in entrepreneurship research also seem to frequently rely on some of those economists' views about the entrepreneur and the entrepreneurship phenomena. From Figure 4, we still identify the works of Mike Wright, Dean Shepherd, Marco Vivarelli, Jeffery McMullen, Saras Sarasvathy and Shaker Zahra. Wrigth's research has been concerned with venture capital, buyouts, habitual entrepreneurs and related topics. Shepherd's research interests include entrepreneurial opportunity, entrepreneurial strategy and the failure of entrepreneurial businesses, while McMullen and Sarasvathy have been more concerned with the cognitive aspects of entrepreneurial action. Vivarelli has been covering several aspects of the dynamics and the innovation of newborn firms and, finally, Zhara has been provided important contributions on entrepreneurial knowledge and capability development in emerging

global industries, and, more recently, on international entrepreneurship.[11]

The list of "core researchers" or "stars" in the entrepreneurship field is far from being completed, as other names would deserve to be mentioned, as Mirjam van Praag, André van Stel, Per Davidsson, among many others. According to Teixeira (2011), entrepreneurship is an increasingly autonomous, legitimate and cohesive (in)visible college that may encompass from 50 ("stars" and "influential") up to 99 (reasonably influential, including some "stars") researchers. Some of them are among the winners of the Global Award for Entrepreneurship Research, others have been emerging over the most recent years, making the entrepreneurship field increasingly formalized and anchored in a small set of intellectual bases (Aldrich, 2012). One of them is certainly Economics.

4.3 The increasing institutionalization of entrepreneurship as a research field

The growth of entrepreneurship as an academic field has been furthermore supported by the emergence of institutes and foundations promoting research on entrepreneurship topics, the creation of specialized entrepreneurship journals, the establishment of research awards distinguishing academic "superstars" doing research on entrepreneurship and small businesses, as well as the development of high-profile conferences encouraging further research on this subject.

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[11]This information was collected, whenever possible, from the authors' personal webpages and CVs, and/or by inspection of their main publications.

Not only scholars, but also governments and policy systems became increasingly interested in entrepreneurs and small firms over the last years. In 2011, OECD launched "Entrepreneurship at a glance", a new yearly publication that collects and discusses a number of indicators measuring the state of entrepreneurship around the world. European Commission has also been extremely attentive to entrepreneurship issues, continuously developing new programs and funding mechanisms to support small businesses and to encourage further research on the topic.[12] In the United States, Kauffman Foundation has been playing a crucial role over the last decades, by increasing funding and creating new opportunities for the development of institutional structures supporting entrepreneurship research and collecting high quality data.[13] Since 2008, U.S. Small Business Administration has also been conducting and promoting research on entrepreneurship topics.

Several international institutions and research centers became aware of the importance of entrepreneurship and started promoting research on the topic. NBER created an Entrepreneurship Working Group in 2003, with the support of Kauffman Foundation, to conduct several projects related to the so-called "economics of entrepreneurship". In Europe, the ZEW's Industrial Economics research group has been strongly involved in the study of start-ups and entrepreneurship dynamics, promoting regular workshops and conferences on the topic. Max Planck Institute of Economics had also a temporary research group focused on entrepreneurship, growth and public policy, where both Zoltan Acs and David Audretsch played key roles as founders and directors, respectively. Some research centers specialized in entrepreneurship research have also been

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[12]See, for example, the Entrepreneurship and Innovation Program, recently launched under the Competitiveness and Innovation Framework Program running since 2007.

[13]For instance, the recent efforts of The World Bank to construct The Entrepreneurship Database have been highly supported by Kauffman Foundation.

emerging around the world, as the Center for Entrepreneurship and Public Policy in US; the LMU Entrepreneurship Center and the TUM Entrepreneurship Research Institute, both in Germany; the Amsterdam Center for Entrepreneurship and the Erasmus Center for Entrepreneurship Research, both in the Netherlands; and the Entrepreneurship and Small Business Research Institute in Sweden, just to name a few.

As entrepreneurship research became more institutionalized and sophisticated, new academic journals dedicated to entrepreneurship research started being established from the early 80s onwards, becoming the main outlet for entrepreneurship papers. If, in the past, there were several journals in mainstream economics publishing about entrepreneurship issues, during the 90s and 2000s most of them either disappeared or declined in the rankings as new specialized journals have been founded. As Table 4 shows, at least 20 journals specialized in entrepreneurship and small businesses issues were launched during the last three decades.

High-quality works also started being prized. The best-known award is the Global Award for Entrepreneurship Research (early known as the International Award for Entrepreneurship and Small Business Research), granted by the Swedish Entrepreneurship Forum since 1996. Table 5 lists the winners of the 19 prizes bestowed so far. Some of the aforementioned founding fathers and core researchers were already distinguished by this prize, namely Baumol, Kirzner, Birch, Acs, Audretsch, Shane and Zahra.

Other core researchers have been contributing to the development of entrepreneurship as an academic field, either by highlighting the macro importance of new and small firms (namely Storey, Reynolds, Beccatini and Sabel, Klepper and Feldman), or for their micro-level analyses of entrepreneurship and small businesses (in particular, Cooper, MacMillan, Aldrich, Gartner, Johannisson,

the Diana group, Lerner and Eisenhardt). Despite, overall, they come from an eclectic mix of disciplines (including management, sociology, political science and psychology), the great majority of them have their roots in economics. This confirms, once more, the significant contribution of economic science in the gradual development of the entrepreneurship research field.

Table 4. Selected journals specialized in entrepreneurship research

	Foundation Year	Impact Factor
Journal of Small Business Management[a]	1962	1.333
International Small Business Journal	1982	1.469
Journal of Small Business & Entrepreneurship	1983	n.a.
Journal of Business Venturing	1986	2.976
Entrepreneurship Theory & Practice	1988[b]	2.242
Small Business Economics	1989	1.130
Entrepreneurship and Regional Development	1989	1.333
Journal of Entrepreneurship	1992	n.a.
Academy of Entrepreneurship Journal	1995	n.a.
Journal of Development Entrepreneurship	1996	n.a.
International Journal of Entrepreneurship	1996	n.a
Journal of Entrepreneurship Education	1997	n.a.
Int. J. of Entrepren. and Innovation Management	2001	n.a.
Journal of International Entrepreneurship	2003	n.a.
Int. J. of Entrepreneurship and Small Business	2004	n.a.
Int. Entrepren. and Management Journal	2005	5.053
Foundations and Trends in Entrepreneurship	2005	n.a.
Strategic Entrepreneurship Journal	2007	1.205
Journal of Social Entrepreneurship	2010	n.a.
Journal of Innovation and Entrepreneurship	2012	n.a.

Notes: [a]Journal published on behalf of The International Council for Small Business (ICSB). [b]In 1988, the American Journal of Small Business changed its name to Entrepreneurship Theory & Practice. n.a.: not applicable.

In summary, entrepreneurship started out as a young – and even mar-

ginalized – field, where a mix of economists, psychologists, geographers and also the occasional anthropologist came together to study the wonder and weirdness that is entrepreneurship, in a wide range of fashions and with a few prior assumptions (Rehn et al., 2013), being thus considered to be a mere sub-discipline of management or economics (Teixeira, 2011). Nowadays, despite the field still shows strong signs of eclecticism and fragmentation, it has matured and became popular and increasingly institutionalized, revealing a greater legitimacy as a valid academic research area.

Table 5. Winners of the Global Award for Entrepreneurship Research

Year	Winner
1996	David Birch
1997	Arnold Cooper
1998	David Storey
1999	Ian MacMillan
2000	Howard Aldrich
2001	Zoltan Acs and David Audretsch
2002	Giacomo Becattini and Charles Sabel
2003	William Baumol
2004	Paul Reynolds
2005	William Gartner
2006	Israel Kirzner
2007	The Diana Project[a]
2008	Bengt Johannisson
2009	Scott Shane
2010	Josh Lerner
2011	Steven Klepper
2012	Kathleen Eisenhardt
2013	Maryann Feldman
2014	Shaker Zahra

Notes: [a]The Diana Project was composed by Candida Brush, Nancy Carter, Elizabeth Gatewood, Patricia Greene and Myra Hart.

5 Concluding Remarks

Entrepreneurship is a concept that has gone through many changes, developed greatly during the last decades, and achieved an exceptionally important place both in contemporary academia and in modern public discourse (Rehn et al., 2013). In this paper, we have reviewed the main paths through which the entrepreneur figure entered into Economics throughout the 20th century, outlining how the gradual development of the entrepreneurship research field is backed in economic science.

In spite of its rich historical base (van Praag, 1999), entrepreneurship remains the phenomenon which is most emphasized but least understood by economists (Kanbur, 1980; Montanye, 2006). Though the first debates about the entrepreneur figure have emerged in the 18th century, mainstream economics – and microeconomic theory in particular – omitted the entrepreneur figure for long time, leaving no room for an active entrepreneur in neoclassical models (Baumol, 1993; Johansson, 2004). However, throughout the 20th century, the relevance of the entrepreneur became more difficult to ignore, especially after a number of highly influential economists have recognized his role in the labor market and industry dynamics, innovation, economic development and growth. The entrepreneur, by being endowed with creative talent and innate ability (Lucas, 1978; Jovanovic, 1982), learning capacity and alertness (Kirzner, 1979, 1997) to the profitable opportunities in the market, started being understood as the responsible for economic progress (Schumpeter, 1934) and job creation (Birch, 1979), though facing true uncertainty and uninsurable risks (Knight, 1921).

As a result, the entrepreneur – hitherto treated as an invisible figure in economic models – has gradually gained a more significant space of analy-

sis in several fields of Economics, as labor economics, industrial organization and development economics. From the late 1970s onwards, none of these fields remained indifferent to the entrepreneur figure and each of them started studying entrepreneurship phenomena in a serious way, though from different perspectives. Over the last two decades, entrepreneurship research not only has experienced an exponential growth, as also became more institutionalized, independent and legitimate. Entrepreneurship studies have gained considerable respect, new mechanism have emerged to recognize and reward individual contributions to the field, reinforcing the identity of entrepreneurship as a research field and attracting new scholars into it. Nevertheless, the footprints of those key economists who helped to bring the entrepreneur figure back to economic debates and economic theory, and the legacy that they left in terms of particular lines of research, are obvious. The economists' (re)discovery of the entrepreneur during the last century may actually have worked as a platform to build a progressively autonomous and recognized research field.

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Nascent Entrepreneurship Dynamics: Entry Routes, Business-Owner's Persistence and Exit Modes*

Essay 2

May 29, 2014

Abstract

This paper uses a large longitudinal matched employer-employee dataset to conduct a comprehensive study on the dynamics of nascent business-owners. We identify and follow about 157,500 individuals who leave paid employment and become business-owners during the period 1992-2007. The aim of the paper is two-fold. First, we evaluate how particular labor market experiences in the past influence the entry and exit decisions of nascent business-owners. Second, we pay attention to the heterogeneous nature of business-owners and try to explain their different modes of entry and exit. At entry, we distinguish between start-up entrepreneurs, acquisition entrepreneurs and intrapreneurs. At exit, we use discrete-time hazard models to study two cause-specific hazards: dissolutions and ownership transfers. We find that start-up entrepreneurs entering alone are more prone to dissolve the business, while ownership transfers are more incident among acquirers and shared ownerships. A recent job loss is found to push individuals into entrepreneurship and to improve their survival in the firm. A past job in a large or foreign-owned firm, instead, seems to increase the opportunity cost of entering and persisting in entrepreneurship. Business-owners' unobserved heterogeneity is also found to play a relevant role, particularly in the duration dependence of each exit mode.

Keywords: Entrepreneurship, Business Ownership, Entry, Exit
JEL Codes: J24, L26, M13

1 Introduction

The widespread belief that entrepreneurs are the engine of the market economy, by introducing new innovations, fostering economic growth and creating new jobs (e.g., van Praag and Versloot, 2007), has been motivating great waves of government support around the world encouraging entrepreneurship and the creation of new businesses (e.g., Román et al., 2013). This trend became even more evident during the most recent years, especially since the financial and economic crisis of 2008, under a general consensus among academics and policy makers that entrepreneurship may be a promising response to the growing unemployment rates, particularly among the youth (Congregado et al., 2010; Fairlie, 2013; Millán et al., 2014a).

Nevertheless, many policies have been focused on the necessity to "produce" more entrepreneurs, but not so much on the necessity to preserve the stock of entrepreneurs (European Commission, 2011). Moreover, while there is already widespread scientific research on entrepreneurial entry decision (Parker, 2009a), data limitations have forced most of this literature to disregard what happens after entry, thus leaving out the dynamic aspects of entrepreneurship (Parker and Belghitar, 2006; DeTienne, 2010; DeTienne and Cardon, 2012).

Besides, there still are two particular gaps in this scarce literature on nascent entrepreneurship dynamics. First, despite seminal theories claim that prior labor market experience may motivate entrepreneurial entry (e.g., Lucas, 1978; Lazear, 2004), little is known about how particular experiences in paid employment may shape nascent entrepreneurs' entry and exit decisions. To date, the literature has been mostly concerned with the effect of past unemployment experiences (see Evans and Leighton, 1990; Carrasco, 1999; Earle and Sakova, 2000; Reize, 2000; Millán et al., 2014b). However, as the entrepreneurial process consists of distinct activities, including opportunity identification and resource mobilization (Shane and Venkataraman, 2000), we also expect that individuals' path in the labor market might enable them to accumulate specific knowledge and resources, to recognize market opportunities

and, consequently, to engage in entrepreneurial initiatives. Job shifting and past employment experiences in large-sized and/or foreign-owned firms are two of the aspects of individuals' career history that may affect entrepreneurship dynamics, and about which we still have limited knowledge from the literature.

Second, most of the entrepreneurship literature has been treating nascent entrepreneurs as a homogenous group of individuals, with entrepreneurial entry commonly corresponding to the start-up of a new venture (with or without employees) (see Parker, 2009a; Parker and van Praag, 2012), and considering entrepreneurial exit to be equivalent to firm exit. However, starting a new firm is not the only way individuals can become entrepreneurs – they can also take over an existing firm –, and entrepreneur's exit does not necessarily correspond to firm closure, as entrepreneurs can exit their business while the firm continues operating under the ownership of other entrepreneur(s).

Hence, this paper contributes to the existing literature in a number of ways. First, we overcome most of the data limitations faced by previous studies by using Quadros de Pessoal (henceforth, QP), a large longitudinal matched employer-employee administrative dataset that allows us to track 157,587 individuals who have left paid employment and became business-owners (BOs) during the period 1992-2007.

Second, we pay particular attention to the role played by individuals' past experiences in the labor market in their entrepreneurial entry and exit decisions. Finally, we analyze both entry and exit dynamics and recognize that nascent BOs are not homogeneous, by allowing their entry and exit to assume different forms. At entry, we distinguish between BOs entering via start-up and those entering by acquiring an existing business. Among these, owing to the linked employer-employee nature of our data, we also distinguish between entrepreneurs and intrapreneurs. At exit, we employ discrete-time duration models to study cause-specific hazard rates – namely dissolutions and ownership transfers.

The remaining sections of the paper are structured as follows. Section 2 summarizes prior findings of existing literature on entrepreneurs' entry and exit

and establishes the objectives of the paper. Section 3 describes the data, the methodological procedures to identify BOs' entry and exit, and the empirical strategy. Empirical results on BOs' entry and exit are presented and discussed in sections 4 and 5, respectively. Section 6 concludes.

2 Previous research on entrepreneurial entry and exit

2.1 Past experiences in the labor market and BOs' dynamics

The decision of entering entrepreneurship has been analyzed during the last decades by an extensive literature under the framework of occupational choice models (see Parker, 2009a). More recent studies have been emphasizing the importance of several variables that may affect the decision of running a business instead of receiving a more stable wage in paid employment, including numerous individual-level specificities as gender, age, education (e.g., Livanos, 2009; Berglann et al., 2011) or ability (e.g., Joona and Wadensjö, 2013; Poschke, 2013), unemployment episodes (e.g., von Greiff, 2009), prior employer's characteristics (e.g., Hyytinen and Maliranta, 2008; Parker, 2009b) and macroeconomic conditions (e.g., Koellinger and Thurik, 2012).

Entrepreneurial exit, in turn, was a topic systematically disregarded in many studies for long time, not only due to data limitations, but also because a great part of entrepreneurship literature suggested that the entrepreneurial process is complete as soon as the new venture is created and ready to operate in the market (DeTienne, 2010). However, the entrepreneurial process is more than just the creation (or acquisition) of a business and does not end with entrepreneur's entry, but rather with entrepreneur's exit.

Over the last years, a number of studies have been trying to fill this gap by searching for potential explanations on why some entrepreneurs survive longer

in the business than others, using the individual as the unit of analysis. Entrepreneurs' age, gender and education (e.g., Block and Sandner, 2009), their past experiences in unemployment (e.g., Carrasco, 1999; Taylor, 1999; Andersson and Wadensjö, 2007), some characteristics of their businesses (Parker and Belghitar, 2006; Stam et al., 2010) and the overall economic environment (e.g., Haapanen and Tervo, 2009; Millán et al., 2012) are some of the determinants that have been found to affect the length of time an individual persists as an entrepreneur.

Even so, we still lack substantial knowledge on other types of determinants, as those related with individuals' past experiences in the labor market. Individuals' career history, by allowing the absorption of specific knowledge, the accumulation of contacts and networks, and by potentially affecting both future labor market prospects and the identification of business opportunities, may also shape entrepreneurial entry and exit.

So far, the literature has paid particular attention to unemployment experiences, arguing that entrepreneurship is frequently regarded as an alternative to uncertain future career prospects or even to escape from unemployment (Evans and Leighton, 1990; Storey, 1991; von Greiff, 2009; Millán et al., 2014b). However, while there is widespread evidence that unemployment episodes push individuals towards entrepreneurship, many studies have also reported that entrepreneurs with past unemployment periods are more likely to fail (e.g., Carrasco, 1999; Taylor, 1999; Andersson and Wadensjö, 2007; Millán et al., 2012). Thus, in this study, we analyze how a recent job loss (caused by previous employer's closure or significant downsizing) affects nascent BOs' entry and exit decisions.

Additionally, we pay particular attention to the role of job shifts in the past and employment experiences in large-sized or foreign-owned firms. There is already evidence that the flow of people between organizations and different contexts works as an important mechanism for knowledge transfers and skill development (e.g., Song et al., 2003; Frederiksen and Wennber, 2011). In view of that, job shifting may endow individuals with a more diversified

set of skills, information and social capital, which not only may make them more likely to become entrepreneurs (Lazear, 2004), but also more able to survive longer in the business. Conversely, a larger number of different employers in the past may, instead, signal an unstable or unsuccessful path in paid employment, possibly associated to low human capital or ability, which may also motivate entrepreneurial entry, but possibly harm post-entry persistence if entrepreneurship is viewed as a *last resort* solution (Millán et al., 2014b).[1] Accordingly, we test whether and how the number of different jobs/employers in the past influences the individuals' probability of entering into and exiting from entrepreneurship.

Finally, we also explore the role of previous jobs in large-sized or foreign-owned companies. Though the literature has been suggesting that previous employer's size matter, with smaller firms being understood as places of entrepreneurial learning (e.g., Hyytinen and Maliranta, 2008; Parker, 2009b), other studies also argue that entrepreneurial opportunities and resources accrue to incipient entrepreneurs as a function of the structural position and visibility of their prior employers (e.g., Burton et al., 2002).

Accordingly, on the one hand, we could expect that an employment experience in a large or foreign firm, by possibly providing the new entrepreneur more knowledge, reputation and legitimacy, supports entrepreneurial entry and improves post-entry persistence. On the other hand, such type of experiences in the labor market, by frequently being appreciated by subsequent employers (Sørensen, 2007; Sørensen and Phillips, 2011; Balsvik, 2011), may increase the opportunity cost of leaving paid employment, thus reducing the propensity of entering entrepreneurship and/or accelerating nascent BOs' exit. The lack of empirical evidence on these relationships does not allow the formulation of precise expectations on the effect of these variables.

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[1] In this regard, there is increasing evidence that both high-ability and low-ability agents become BOs (e.g., Joona and Wadensjö, 2013; Poschke, 2013).

2.2 The heterogeneous nature of nascent BOs: entry routes and exit modes

The literature has been largely defining entrepreneurship as self-employment or new venture creation. However, starting a new firm from scratch is not the only way individuals can get into entrepreneurship. Budding entrepreneurs can also take over an existing firm, though very few studies have been concerned with this issue.

Nonetheless, there are good reasons to believe that entrepreneurs entering via start-up differ from those entering by acquiring an existing business. Acquisition can be viewed as an easy mode of penetrating a new market, besides allowing the potential entrant to take advantage of existing facilities, customer base and networks. In contrast, those who decide to install a new venture are faced with time-consuming and risk-taking activities, like building plants, learning the market or training employees (Tarola et al., 2011; Tarola, 2013), besides being more exposed to the liability of newness and smallness (Brüderl and Schüssler, 1990). Also, problems of asymmetric information are more acute in new venture start-ups compared with established firms, which can be acquired by an outside investor or even by one of the firm's employees (Parker and van Praag, 2012). Furthermore, we may also expect that different learning opportunities (Jovanovic, 1982) about the whole entrepreneurial process are associated to each of those entry alternatives.

Accordingly, entrepreneurial entry should not be understood as a homogeneous phenomenon, as different entry routes may signal different profiles of BOs, driven by different motivations and having distinct post-entry behaviors. A few recent studies actually show that the mode of entry into entrepreneurship is influenced by individual characteristics, as human, social or financial capital (see Parker and van Praag, 2012; Bastié et al., 2013; Block et al., 2013). Thus, in this paper, we distinguish between new entrepreneurs entering via start-up or acquisition, also paying attention to intrapreneurs, a particular group of BOs more frequently neglected by the literature on entrepreneurial entry (see

Parker, 2011; Martiarena, 2011).

Similarly, regarding BOs' exit, most of the existing studies on entrepreneurial survival have been conceptualizing exit as a utility-maximizing choice and, consequently, have associated exit with the failure of firms or individual entrepreneurs (DeTienne and Cardon, 2012). Nonetheless, influential models on entrepreneurship and business transfers have early recognized that many individuals may successfully develop a business and leave it to another BO later on for other reasons than failure (Holmes and Schmitz, 1990, 1995).

Those theories suggest that the decision behind small business dissolution or sale may be, in part, a problem of match between each firm and each BO. While good matches make BOs to persist longer in their businesses, bad matches typically make individuals to leave their firms earlier, either by closing them or by selling them to others. In this regard, the models developed by Holmes and Schmitz (1990, 1995) and, more recently, by Plehn-Dujowich (2010) propose that high-quality businesses owned by low-quality BOs tend to be sold, while low-quality businesses owned by low-skill BOs tend to be shut down. However, the lack of empirical evidence on these relationships does not allow, so far, the confirmation of these results.

In summary, though there is an increasing recognition that exit is not always a negative outcome (see also Wennberg et al., 2010; Yusuf, 2012), only a few studies have allowed entrepreneurs' exit to assume other modes than firm closure (see, for instance, Taylor, 1999; Stam et al., 2010). Therefore, we pay attention to the way nascent BOs leave their businesses and to which factors may contribute to explain their exit mode. We distinguish exits by dissolution from exits by ownership transfer (OT), and evaluate how past experiences in the labor market and entry choices impact on BOs' exit decision. Furthermore, we take into account BOs' unobserved heterogeneity, which, according to the aforementioned theories, may also influence the way individuals leave their firms.

3 Data and Methodological Issues

3.1 Data

This study uses data from QP, a matched employer-employee administrative dataset from the Portuguese Ministry of Employment. QP is an annual mandatory employment survey that all firms in the private sector employing at least one wage earner are legally obliged to fill in. Requested data cover the establishment (e.g., location, employment and economic activity), the firm (e.g., location, employment, sales, economic activity, ownership, number of establishments and legal setting) and each of its workers (e.g., gender, age, education, qualifications, occupational category, employment status, earnings, tenure and hours of work).

All firms, establishments and workers entering QP dataset have a unique identification number. Data are available for the period 1986-2009. Owing to the longitudinal dimension of the dataset, we can track firms/establishments and workers over time and match workers with their respective employers. Thus, the longitudinal nature of the dataset, besides its high degree of coverage and reliability, makes QP a suitable database for a comprehensive study on entrepreneurship dynamics.

For the years 1990 and 2001, data on workers are not available. As this missing data poses some limitations in the identification of individuals' entry into entrepreneurship, we have restricted our analysis to transitions from the "paid employee" status to the "business-owner" category occurring during the period 1992-2007, excluding 2001 and 2002.[2] Data for the period 1986-1991 was only used to characterize workers' past experiences in the labor market.

Finally, we must recognize two limitations of QP data. First, self-employed

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[2]We restrict our analysis to transitions occurring from 1992 onwards because we need data on the year prior to transition to verify where each worker comes from. For the same reason, we have to exclude from our analysis all the transitions occurring in 2002. Besides, we exclude transitions occurring after 2007 because, given the criteria adopted to identify business-owners' exits, we need at least two years of available information after they enter to clearly identify their exit from the firm.

individuals without employees are not covered by QP, as the survey is mandatory only for firms employing at least one paid employee. Accordingly, the entrepreneur definition used in this study corresponds to BOs of firms with at least one wage earner (i.e., employers). Second, exits of workers from the dataset are possible, but we are not able to precisely identify the reason for these absence periods. They may correspond to periods of unemployment, inactivity, self-employment without employees, or transitions into the public sector. We will adopt particular procedures in order to better identify unemployment experiences caused by recent displacements.

3.2 Identifying transitions from paid employment into business-ownership

We started by working with raw data files covering the period 1986-2009. Individuals were classified according to their employment status at each moment in time: BO or paid employee.[3] Individuals with no record as BOs during the whole period covered by QP were classified as "Never BOs", corresponding to our control group when analyzing the determinants of transitions into business-ownership.

For those workers who leave paid employment and become BOs, we have followed them in the dataset until the moment of their transition, in order to track their career history and identify where they come from.[4] During this procedure, we have identified two main cases:

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[3]We restrict the analysis to workers aged between 16 and 65 years old. However, in order to reduce potential left censoring issues regarding individuals' experiences in the labor market and/or eventual entrepreneurial experiences prior to 1986, we perform several robustness checks throughout the paper for a sub-sample of younger individuals with a maximum age of 30 years old.

[4]As we are interested in transitions from paid employment to entrepreneurship, we focus on transitions of individuals who become BOs in t and who were employed in the year(s) immediately prior to transition. We allow for a maximum interval of two years of absence between the last record in paid employment and the first record as BO, and adopt particular procedures to identify potential unemployment spells in between.

- Individuals who were paid employees in a particular firm and become BOs within the same firm were classified as "nascent intrapreneurs";[5]

- Individuals who were previously identified in paid employment and who become BOs in a different firm were classified as "nascent entrepreneurs".

Among these nascent entrepreneurs, we still identify two subgroups, according to the way they enter into entrepreneurship:

- If the firm's first record in QP files coincides with the individual's year of transition into entrepreneurship, the entrepreneur enters via start-up and is classified as a "start-up entrepreneur";

- If the individual becomes an entrepreneur in a pre-existing firm, the transition occurs via takeover and s/he is classified as an "acquisition entrepreneur".

Altogether, our criteria allowed the identification of 157,587 nascent BOs – 59,688 start-up entrepreneurs; 27,155 acquisition entrepreneurs and 70,744 intrapreneurs.[6] Young BOs (aged up to 30) account for 37% of all these transi-

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[5]The literature has been using the terms Intrapreneurship, Corporate Entrepreneurship and Corporate Venturing interchangeably, commonly referring to the practice of developing a new venture within an existing organization (see Parker, 2011; Martiarena, 2013). We use a wider definition of Intrapreneurship in this study: a worker becomes an intrapreneur if s/he becomes the unique BO of the firm where s/he was already employed (employee buyout), or if s/he leaves the "paid employee" status and enters the ownership of the business, becoming one of the BOs of the employer firm (partnership). A significant share of these transitions into intrapreneurship probably corresponds to ownership transfers within family firms. Unfortunately, QP data do not allow the identification of family businesses in particular.

[6]We have also identified a residual group of individuals who become BOs in two or more different firms in the same year (portfolio BOs). Such multiple entries could include both start-up and acquisition experiences, or simultaneous entrepreneurship and intrapreneurship transitions, which complicates any attempt of classification of these transitions into the groups of BOs previously identified. Given the relative few number of such multiple transitions (less than 1% of the total number of transitions identified for the period 1992-2007), we also prevented ourselves to extend the analysis in order to classify these "portfolio BOs" into an independent group of nascent BOs. For this reason, we have excluded these cases from the current analysis.

tions (26,920 entering via start-up; 10,777 entering via acquisition and 20,141 becoming intrapreneurs). Regarding the juridical nature of BOs' firms, about 95% of them are either limited liability companies (*Sociedades por Quotas*) or single ownerships (*Empresário em Nome Individual*), always employing at least one paid employee. Overall, our definition of BOs corresponds to owners of micro or small businesses.

3.3   Identifying the exit of business-owners and firms

Following the procedures of previous studies also using QP data (e.g., Blanchard and Portugal, 2001; Portugal and Cardoso, 2006), a firm was classified as an exiting firm in year *t* if it is present in QP files in year *t-1*, but absent in *t* and in all the subsequent years. Similarly, in order to identify BO's exit year, we have also required an absence of the BO from the firm (or from the BO category) larger or equal to two consecutive years.[7] These criteria explain why we restrict our analysis to BOs entering until 2007. Data for 2008 and 2009 were only used to check the presence/absence of each BO in the respective firm(s), as well as the presence/absence of each firm in QP files.

Each BO was then tracked over time, since the year of entry until his/her last record as BO in the firm, which may correspond to the year of BO's exit or,

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[7]Temporary exits from the dataset may occur for a number of reasons, a very likely reason being that the survey form was not received in the Ministry of Employment before the date when the recording operations were closed. Temporary absences of one year were, therefore, not classified as definitive exits of the BO. Such temporary exits were easily filled in, as most of the variables to be included in the empirical analysis are time-invariant. For time-varying variables (e.g., individual's age) the reconstruction of those particular missing records was possible owing to the available information for the adjacent years. For the sake of consistency, we have excluded from our database those BOs who were temporarily absent from the same firm for two or more years. On the one hand, these absence periods may have corresponded to periods of self-employment without employees, so they should not be considered as real exits. On the other hand, we prevented ourselves from filling individual-level gaps larger than one year. As a result, we restrict our analysis to the entry and exit of those BOs with complete spells, since their entry year until they leave the firm or until the end of the period covered by QP.

alternatively, to the last year with available information about the individual. This last case corresponds to a right-censored observation (Singer and Willett, 1993; Hosmer et al., 2008), thus requiring a proper empirical strategy that takes into account right-censoring issues.

Finally, besides identifying BOs' exits, we furthermore distinguish amongst two alternative exit modes – dissolution and ownership transfer. In the former case, the BO's exit year coincides with firm exit year. Exit by ownership transfer, in turn, is defined as the BO's exit from a firm (or from the BO category) that continues operating in the market after such exit.

3.4 Empirical strategy

3.4.1 The choice of becoming a BO

We use discrete choice models to study which factors may influence the decision of becoming a BO. Following most of the literature on entrepreneurial entry, the analytical framework used to identify the drivers of such decision is that of random utility, according to which an individual will transit into business-ownership if the expected utility of becoming a BO exceeds the expected utility of the other alternatives.

In this study, we focus primarily on the effect of individuals' previous experiences in the labor market while paid employees – namely employment experiences in large-sized and foreign-owned firms, job shifts between different employers and recent displacement events. In addition, following the previous literature (see, for instance, Uusitalo, 2001; Lazear, 2004; Hyytinen and Maliranta, 2008; Livanos, 2009; Parker, 2009b), we also control for the effect of particular individual characteristics (gender, age and education), a number of characteristics of the previous employer and of the last job (e.g., previous employer size and sector, tenure in the prior job, previous wage and management experience, among others) and macroeconomic conditions.

As some of these factors may affect individual's entry choice in a different

way depending on the type of BO they become, we estimate a multinomial logit model, where the outcome y for individual i may be one of four alternatives: 1) Never BO; 2) Start-up entrepreneur; 3) Acquisition entrepreneur; or 4) Intrapreneur. Thus, and assuming independent and identically distributed (i.i.d.) extreme value distributed error terms, the probability that the outcome for individual i is alternative j, conditional on a vector of variables X_i is

$$p_{ij} = \frac{e^{X_i' \beta_j}}{\sum_{l=1}^{4} e^{X_i' \beta_l}}, \qquad j = 1, ..., 4. \tag{1}$$

Table A.I in the Appendix provides a detailed description of the variables included in vector X_i.

3.4.2 The persistence and the exit mode of the BO

To study BOs' persistence and exit decisions, we rely on duration models to study cause-specific hazards (dissolution and OT). Over again, we focus on the effects arising from BOs' previous experiences in the labor market while paid employees, in addition to the BOs' entry mode. Individual-level characteristics and several characteristics of BOs' firms (namely size, sector, age and location) are also taken into account in our estimations (see Table A.I for a detailed description of these variables).

As survival spells are recorded in an annual basis, discrete time duration models were considered. The length of each individual's spell as BO (T_i) is therefore assumed to be a discrete non-negative random variable. Moreover, we go beyond most of the previous research on entrepreneurial survival using discrete hazard models (e.g., Carrasco, 1999; Taylor, 1999; Nziramasanga and Lee, 2001; Block and Sandner, 2009; Millán et al., 2012) by incorporating the effect of individuals' unobserved heterogeneity, which is known to mainly affect the influence of time dependence on the exit rate (e.g., Heckman and Singer, 1984; Lancaster, 1990; Jenkins, 2005).

Formally, we observe BO i's spell from period $j = 1$ (the year of BO's entry) until the end of the jth period, at which BO i's spell is either complete $(c_i = 1)$ or right-censored $(c_i = 0)$ (flow sample). The overall probability of exit at discrete time t_j, $j = 1, 2, \ldots$, given survival until time t_j, can be defined as

$$h_{ij} = \Pr(T_i = j | T_i \geq j) = F(\gamma(t) + X_i'(t)\beta + \varepsilon_i), \tag{2}$$

where h_{ij} is the probability of individual i persisting as BO in the firm for exactly j years; $\gamma(t)$ describes the pattern of duration dependence (the baseline hazard); $X_i(t)$ is the vector of time dependent and independent variables; β is a vector of unknown parameters to be estimated; ε_i is a disturbance term that includes the time-invariant unobserved heterogeneity (also known as individual "frailty") and that is assumed to be uncorrelated with the observable variables of vector $X_i(t)$ (Jenkins, 1995; Cameron and Trivedi, 2005: 613); and, finally, $F(\cdot)$ denotes the complementary log-logistic distribution function.

We do not impose any functional form for $\gamma(t)$. We instead estimate a piecewise constant hazard model, where exit rates are assumed to be constant within each interval (year) but different between intervals. Thus, in order to estimate the full set of γ's, we have added an indicator variable per duration time t to the model. This flexible (non-parametric) modeling has been recognized to be preferred in order to avoid serious misspecifications. Moreover, such hazard formulation with a flexible baseline hazard function makes an attractive model with which to combine a specific heterogeneity assumption (Cameron and Trivedi, 2005: 620). Accordingly, following usual conventions (e.g., Hougaard, 1995; Jenkins, 2005), we assume an Inverse Gaussian distribution for the unobserved heterogeneity term, so that ε_i is normally distributed with zero mean and unitary variance.

Summing up, the discrete time hazard function in (2) may be rewritten as follows:

$$h_{ij} = 1 - \exp\{-\exp[\gamma(t) + X_i(t)'\beta + \log(\varepsilon_i)]\}. \tag{3}$$

We then extend this model in order to estimate cause-specific hazards for dissolutions and OT. Following the procedures of some previous studies (e.g., Carrasco, 1999; Reize, 2000; Georgarakos and Tatsiramos, 2009), the parameters of a given cause-specific hazard are estimated by the single-risk methods exposed above, treating durations finishing in other states as right-censored at the last year of available information (Jenkins, 1995; 2005).[8]

4 Empirical results on entrepreneurial entry

4.1 Characterizing the different groups of BOs

Table 1 briefly characterizes the different types of BOs identified in the data, as well as the control group composed by Never BOs. The variables listed in the table correspond to the vector of variables included in the estimation of the multinomial logit model for BOs' entry.[9]

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[8]Narendranathan and Stewart (1993) show that, if distinct destination states depend upon disjoint subsets of parameters - which are functionally independent (so far as the inference about $\gamma_j(t)$ and β is concerned) - the parameters of a cause-specific hazard can be estimated by treating durations finishing into other states as censored at the time of exit. However, if the unobserved characteristics are common to or correlated across the states, this simplification may have an effect on the overall hazard rate. Even so, this is a minor issue in our analysis, as we are mainly interested in cause-specific hazards, rather than on the overall rate. Nevertheless, as a robustness check, we have alternatively estimated the competing-risks model proposed by Fine and Gray (1999), which did not produce qualitatively different results for the main variables of interest, comparatively to those obtained with the estimation of cause-specific hazard functions with unobserved heterogeneity. However, given the lack of available programs allowing the introduction of unobserved heterogeneity – which is shown to have significant effects on the duration dependence of dissolutions and OTs – in Fine and Gray's model, we decided to focus on the results from cause-specific hazard functions. All these additional results are available upon request from the authors.

[9]Additionally, estimation also includes the variable *Lagged Unemployment Rate* (with one-year lag), to take into account potential effects of the business cycle. Year dummies are also included in all estimations.

Table 1. Descriptive statistics, by groups of nascent BOs
(Portugal, 1992-2007)

	Never BOs	Start-up Entrepr.	Acquis. Entrepr.	Intra-preneur
(Number of cases)	(5,484,866)	(59,688)	(27,155)	(70,744)
Prior experiences in the labor market as paid employee				
Experience in a large firm (%)	0.343	0.229	0.279	0.118
Experience in a foreign firm (%)	0.121	0.118	0.127	0.061
Number of different employers	1.749	2.946	2.863	1.738
Recent displacement (%)	0.024	0.157	0.081	n.a.
Previous wage job characteristics				
Overeducation (%)	0.304	0.386	0.359	0.407
Tenure (months)	93.93	59.31	71.09	62.39
Management position (%)	0.018	0.053	0.064	0.257
Hourly wage (in logs, 2005 euros)	1.375	1.360	1.379	1.321
Foreign firm (%)	0.092	0.058	0.068	0.014
Micro firm (%)	0.197	0.407	0.309	0.671
Small firm (%)	0.274	0.327	0.318	0.248
Medium firm (%)	0.244	0.156	0.203	0.064
Large firm (%)	0.285	0.110	0.170	0.017
Urban location (%)	0.528	0.483	0.534	0.448
Primary sector (%)	0.024	0.017	0.022	0.029
Manufacturing (%)	0.338	0.254	0.284	0.235
Energy & Construction sectors (%)	0.118	0.129	0.110	0.122
Services sector (%)	0.520	0.600	0.584	0.614
Individual-level characteristics				
Male (%)	0.572	0.693	0.649	0.642
Age (years)	36.47	33.01	34.60	37.88
Less than 9 years of schooling (%)	0.628	0.492	0.515	0.537
9 years of schooling (%)	0.135	0.183	0.169	0.161
12 years of schooling (%)	0.162	0.208	0.183	0.173
College education (%)	0.075	0.117	0.133	0.129

Notes: n.a.: Not Applicable.

Regarding the key variables of interest, Never BOs had more frequently a past employment experience in a large-sized firm. In opposition, past experiences in large or foreign-owned firms were much less common among those becoming intrapreneurs. Both start-up and acquisition entrepreneurs seem to have more diverse past experiences while paid employees, by having worked in a larger number of different firms. Recent job losses were also more frequently suffered by those who became entrepreneurs, especially among those entering via start-up.

Nascent BOs overall come from micro and small firms with lower participation of foreign capital. This is particularly evident among intrapreneurs. Education-job mismatches, captured by overeducation in the previous job, were also more common among those becoming BOs.[10] Notable differences are also found regarding previous management positions, which were more usually occupied by workers becoming intrapreneurs. Data also show a larger proportion of males, as well as a larger share of individuals with higher educational attainment, among those who became BOs. Intrapreneurs are, on average, the oldest group of individuals, while start-up entrepreneurs are the youngest ones.

4.2 Empirical results

4.2.1 Multinomial logit estimation results

Table 2 reports the results for the final specification of the multinomial logit model, including all variables in Table 1 (except *Recent Displacement*)[11], as

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[10]Using one of the three most conventional ways of measuring overeducation (see, for instance, Kiker et al., 1997), an individual was considered to be overeducated if s/he had an educational attainment higher than the mode of the educational attainment of recently hired workers in the same occupation (according to the 3-digit International Standard Classification of Occupations) in the same year. These comparisons were performed after converting the years of schooling of each individual and the modal years of schooling in the respective occupation in categories of educational attainment (namely into 4, 6, 9, 12 years of schooling, plus college education).

[11]Given that, by definition, intrapreneurs never suffer a job loss immediately before their transition, we cannot include this variable in this specification. Otherwise, the model would

well as *Lagged Unemployment Rate.* Table A.II in the Appendix reports the estimation results obtained for the sub-sample of individuals aged up to 30 years old, as a robustness check. Never BOs are used as the reference group for the transitions occurring in each year.

After the estimation of this specification, we tested whether some of the different types of BOs under consideration could be pooled together into a common category. A Wald test – under the null hypothesis of equalizing the estimated coefficients associated with any given pair of outcomes or choices – strongly rejects the pooling of any of these categories of BOs. Therefore, these groups of BOs must be analyzed separately.[12]

Regarding the role of past experiences in the labor market, the results suggest that a past job in a large or in a foreign company reduces the individuals' propensity to leave paid employment and become entrepreneurs, regardless their mode of entry (start-up or acquisition). As expected, by potentially improving future labor market prospects, such experiences may increase by more the individual's expected utility of remaining in paid employment than that obtained as BOs. In contrast, an experience in a foreign-owned firm in the past increases the log-odds of choosing intrapreneurship rather than paid employment by about 0.08, suggesting that workers who have accumulated knowledge from foreign companies may have a better career progress inside subsequent firms (e.g., Balsvik, 2011). These results remain consistent for the sub-sample of younger individuals.

The diversity of experiences in the labor market also seems to matter, as a

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suffer from identification problems. We study the effect of recent displacement experiences in section 4.2.2, after excluding intrapreneurs from the estimation of the extended model.

[12]Additionally, we have also tested the validity of the Independence of Irrelevant Alternatives (IIA), one strong assumption of multinomial logit models. This assumption is less of a problem when the alternatives are reasonably distinct (Amemiya, 1981). The fact that, according to the Wald test, we are unable to combine any pair of choices emphasizes the dissimilar structure of the alternatives under study. Even so, we have performed a series of Hausman tests, by sequentially omitting each of the categories of BOs from the choice set, re-estimating the model, and then comparing the results from the full model and the several restricted models. We do not obtain systematic evidence to reject the IIA assumption.

larger number of job shifts in the past is found to increase individuals' propensity to become BOs, especially among the youngest individuals. On the one hand, the mobility of workers – especially at younger ages – across different firms may work as a mechanism for knowledge transfers, accumulation of specific skills, resources and networks, which may either help them to progress within a subsequent firm (by becoming intrapreneurs) or give them a more balanced and diversified skill mix that induce them into business-ownership, in line with the Lazear's (2004) Jack-of-all-trades theory of entrepreneurship.

On the other hand, as previously discussed, a larger number of different jobs may also indicate some instability in the labor market, which may motivate the transition into entrepreneurship as a solution for the lack of (stable) alternatives in paid employment. For prospective intrapreneurs in particular, the effect of such diversity of jobs apparently reverses with individuals' age – the effect of "number of different employers" is negative and statistically significant for entries into intrapreneurship in the global sample, which may actually suggest that individuals' mobility across different employers may be favorable at younger ages, though potentially indicating a more negative (i.e., unstable) employee profile at older ages.

Regarding the remaining variables, the results show that particular specificities of the previous job also influence BOs' entry decisions. Education-job mismatches related to overeducation, by potentially signaling some under-utilization of workers' knowledge and skills, increase the propensity to progress in the firm hierarchy through intrapreneurship, discouraging the exit towards entrepreneurship, especially among the youngest workers. Workers engaged in management positions in the previous job are also more likely to become BOs than those in other occupations. Exits from paid employment towards entrepreneurship become less likely as job tenure gets longer (the estimated effect is inverted U-shaped for transitions into start-up and acquisition entrepreneurship, with the estimated peak occurring after three months in the job), while the reverse effect is found for transitions into intrapreneurship.

Table 2. Multinomial logit estimation results (Portugal, 1992-2007)

	Start-up Entrepreneur	Acquisition Entrepreneur	Intrapreneur
Prior experiences in the labor market as paid employee			
Experience in a large firm	-0.6146***	-0.5501***	-0.1062***
	(0.0122)	(0.0163)	(0.0158)
Experience in a foreign firm	-0.1793***	-0.1605***	0.0822***
	(0.0151)	(0.0206)	(0.0203)
Number of different employers	0.8373***	0.8742***	-0.0263***
	(0.0034)	(0.0045)	(0.0053)
Previous wage job characteristics			
Overeducation	0.0081	-0.0575***	0.3148***
	(0.0101)	(0.0149)	(0.0101)
Tenure	0.0094***	0.0096***	-0.0019***
	(0.0002)	(0.0003)	(0.0002)
Tenure squared/100	-0.0018***	-0.0017***	0.0002***
	(0.0001)	(0.0001)	(0.0001)
Management position	0.6946***	0.7680***	3.0495***
	(0.0243)	(0.0341)	(0.0154)
Hourly wage	-0.0057	-0.1108***	-0.1969***
	(0.0130)	(0.0195)	(0.0125)
Foreign firm	-0.0075	-0.0192	-0.9288***
	(0.0189)	(0.0254)	(0.0356)
Small firm	-0.6005***	-0.3768***	-1.2394***
	(0.0107)	(0.0168)	(0.0106)
Medium firm	-1.1634***	-0.6867***	-2.4505***
	(0.0139)	(0.0196)	(0.0181)
Large firm	-1.4307***	-0.8183***	-4.0157***
	(0.0167)	(0.0221)	(0.0350)
Urban location	-0.1200***	-0.0220	-0.0408***
	(0.0097)	(0.0143)	(0.0096)
Primary sector	-0.4044***	-0.1267***	-0.3801***
	(0.0371)	(0.0486)	(0.0293)

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Table 2. Multinomial logit estimation results (Portugal, 1992-2007)

	Start-up Entrepreneur	Acquisition Entrepreneur	Intrapreneur
Previous wage job characteristics			
Energy & Construction sectors	0.0115	-0.0560**	-0.1467***
	(0.0159)	(0.0240)	(0.0164)
Services sector	0.1158***	0.1048***	-0.1033***
	(0.0117)	(0.0166)	(0.0118)
Individual-level characteristics			
Male	0.5596***	0.3028***	0.2897***
	(0.0107)	(0.0152)	(0.0104)
Age	-0.0278***	-0.0938***	0.1285***
	(0.0037)	(0.0048)	(0.0030)
Age squared/100	-0.0443***	0.0726***	-0.1376***
	(0.0050)	(0.0061)	(0.0037)
9 years of schooling	0.6765***	0.5324***	0.4172***
	(0.0142)	(0.0208)	(0.0143)
12 years of schooling	0.7083***	0.6277***	0.4028***
	(0.0139)	(0.0210)	(0.0149)
College education	1.2906***	1.4269***	0.5918***
	(0.0224)	(0.0327)	(0.0226)
Macroeconomic Environment			
Lagged unemployment rate	-0.0311***	-0.2845***	-0.1940***
	(0.0074)	(0.0096)	(0.0053)
Constant	-6.8725***	-5.2670***	-6.4640***
	(0.0801)	(0.1021)	(0.0633)
N		26,449,546	
Log Pseudo-likelihood		-838,135.9	
Pseudo R^2		0.1421	

Notes: *, **, and *** denote significant at 10%, 5% and 1%, respectively. Worker-clustered standard errors in parentheses. The model also includes time dummies. Reference categories: Micro Firms for firm size; Manufacturing for sector; "Less than 9 years of schooling" for individual's education.

Higher wages in the previous job seem to discourage entrepreneurial entry, by increasing the opportunity cost of leaving paid employment. For intrapreneurs, this result may rather confirm that the transitions into intrapreneurship identified in our data mainly correspond to ownership transfers within family firms, where wages tend to be lower.[13]

Our results also confirm that smaller firms spawn new entrepreneurs among their employees more often than larger firms do (see also Hyytinen and Maliranta, 2008; Parker, 2009b; Berglann et al., 2011). Large-sized firms, instead, by offering better opportunities for the development of internal labor markets (Brown and Medoff, 1989), reduce the workers' incentive to leave paid employment and become BOs. For intrapreneurs in particular, results show that firm size and foreign ownership both play a strong negative effect on their transition, confirming that intrapreneurship (as we define it) is more common within very small domestic firms – over again, the typical family firm. Individuals working in large urban centers also seem to be less prone to leave paid employment to become BOs, possibly because these regions are both characterized by relatively fierce market competition and better employment opportunities.

Regarding the set of individual characteristics that we control for, results confirm that men are more prone to become BOs – and especially start-up entrepreneurs – than women (e.g., Uusitalo, 2001; Livanos, 2009; Parker, 2009b). Individual's age, in turn, exerts different effects according to the entry route chosen – as workers become older, they are more likely to become intrapreneurs and less likely to become entrepreneurs. Education is also associated with a greater likelihood of transiting into business-ownership, in line with the argument that education enhances individuals' "entrepreneurial talent" (Lucas, 1978; Calvo and Wellisz, 1980), improving as well their ability to identify and evaluate business opportunities.

Finally, despite our results overall confirm the so-called "prosperity-pull"

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[13]Additional estimations using an alternative measure of hourly wages that also includes overtime payments (divided by the sum of normal and overtime hours of work) yielded qualitatively similar results.

hypothesis (Evans and Leighton, 1990; Carrasco, 1999; Parker, 2009a: 143-144), some types of BOs seem to be particularly sensitive to macroeconomic conditions. An increase of one percentage point in the aggregate unemployment rate decreases the log-odds between acquisition entrepreneurship (intrapreneurship) and paid employment by 0.28 (0.19), all other variables held constant. The effect of macroeconomic conditions seems to be weaker for start-up entrepreneurs – the log-odds between start-up entrepreneurship and paid employment is estimated to decrease only by 0.03 due to a one-unit increase in the unemployment rate. Younger start-up entrepreneurs seem to be even more reactive to the economic environment, apparently entering counter-cyclically (see Table A.II).

Overall, the results suggest that different motivations may propel individuals' transition into business-ownership, as well as the route they choose to become BOs. Some individuals may decide to run their own business due to the lack of better alternatives in the labor market, while others may decide to become BOs owing to the identification of a great business opportunity or of a better alternative to paid employment. An additional important driver that may contribute to explain such transitions may be a recent job loss. We extend the analysis in the next subsection in order to evaluate how recent unemployment episodes might have influenced the entry of individuals into entrepreneurship.

4.2.2 The effect of recent displacements

We now extend the previous estimated model with the inclusion of an indicator variable accounting for recent displacement events. In QP dataset, if a worker is temporally absent from the annual records, it is not certain that s/he is unemployed. Accordingly, for a worker to be classified as recently displaced, we have imposed that s/he definitively leaves the previous firm and that the firm simultaneously suffers a process of downsizing (larger or equal to 30% of its workforce, with a minimum of five separations – see OECD, 2013) or closes

operations (i.e., exits the dataset).

In Table 3, we summarize the results obtained from the extended model.[14] A recent displacement experience is found to significantly increase the probability of becoming an entrepreneur. Moreover, the effect is noteworthy for those becoming entrepreneurs by establishing a start-up venture. In particular, the results show that after a recent displacement episode, individuals are about six (three) times more likely to become entrepreneurs via start-up (acquisition) than to reenter into paid employment. Similar results were obtained for the sub-sample of young individuals. Our results are, thus, in line with the belief that entrepreneurship is frequently chosen as a solution for individuals' unemployment and uncertainty in the labor market (Carrasco, 1999; Uusitalo, 2001; Georgarakos and Tatsiramos, 2009; Berglann et al., 2011).

Table 3. The effect of a recent displacement on the transition into entrepreneurship

	Start-up Entrepreneur	Acquisition Entrepreneur
Recent displacement	1.9114***	1.1335***
	(0.0125)	(0.0212)
Prior experiences in the labor market	YES	YES
Previous wage job characteristics	YES	YES
Individual-level characteristics	YES	YES
Macroeconomic environment	YES	YES
N	26,378,802	
Log Pseudo-likelihood	-506,154.9	
Pseudo R^2	0.1390	

Notes: *** denotes significant at 1% level. Worker-clustered standard errors in parentheses.

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[14]Intrapreneurs were excluded from the estimation of this specification as, by definition, recent displacements are never verified before the transition of this particular group of BOs.

As a robustness check, given that our "recent displacement" variable mainly captures collective dismissals – implying that displaced individuals are not necessarily "lemons" – we have re-estimated the model using a broader definition of recent displacement, by considering as potentially unemployed workers all those individuals who were absent from the database in the two years after leaving the previous job. In this case, both collective and individual dismissals occurring during the years preceding the potential transition are certainly included in the set of individuals suffering a recent displacement. However, in this case, displacement episodes become over-estimated, as individuals being absent from the files for other reason than unemployment are also inevitably classified as unemployed. Even so, the results remained qualitatively unchanged even after enlarging the pool of potential unemployed individuals transiting into business-ownership (the estimated coefficients were 1.9102 for entries into entrepreneurship via start-up and 1.7803 for entries through acquisition, being both statistically significant at the 1% level), so we believe that the narrower definition of recent displacement used in this study does not significantly influence the results and the derived conclusions.

5 Empirical results on BOs' exit

5.1 Descriptive statistics and non-parametric analysis

Using Kaplan-Meier (KM) survivor function (Kalbfleish and Prentice, 1980), we start by estimating the unconditional probability of an individual surviving as BO beyond time t, regardless the exit mode chosen, as follows:

$$\widehat{S(t_j)} = \prod_{j=t_0}^{t} (1 - \frac{d_j}{n_j}), \tag{4}$$

where d_j is the number of exits in each time interval and n_j is the number of BOs at risk of exit. Figure 1 compares the estimated survivor function of

start-up entrepreneurs, acquisition entrepreneurs and intrapreneurs, without controlling for any differences in their observed and unobserved characteristics. In Figure 2 we adopt the same procedure to check whether any significant differences exist, unconditionally, among those who decide to enter in business-ownership alone and those who choose to share the ownership of the firm with other BO(s).
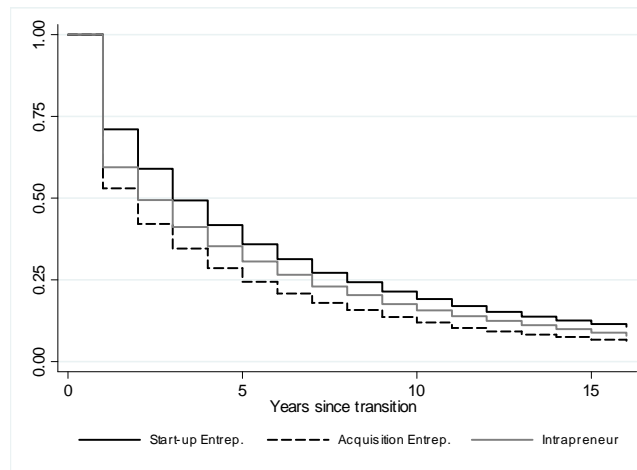
Fig. 1. KM survivor function, by BO type
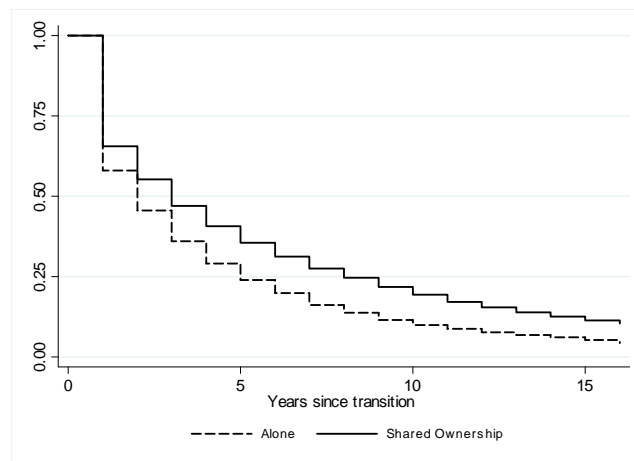
Fig. 2. KM survivor function, by mode of entry

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The median duration of nascent BOs' spells is just two years for intrapreneurs and acquisition entrepreneurs, and three years for start-up entrepreneurs. Figure 1 actually suggests that, on average, start-up entrepreneurs have higher survival rates and persist for longer periods in the same business comparatively to the other two groups of BOs. The differences are statistically significant at the 1% level according to both Log-rank and Wilcoxon tests. Figure 2 also indicates that, without distinguishing between alternative exit modes, sharing the risk with others may postpone the decision of leaving the business and thus increase BOs' persistence in the firm.

In order to distinguish exits by dissolutions from exits by OT, Figure 3 illustrates the estimated cumulative incidence function (CIF) (see Coviello and Boggess, 2004) for each alternative exit mode k and for each group of BOs. Formally, the non-parametric cumulative incidence for the exit mode k is estimated as:

$$\widehat{CIF_k}(t) = \sum_{j|t_j \leq t} \widehat{S}(t_j - 1)\frac{d_{kj}}{n_j}, \tag{5}$$

where $\widehat{S}(t_j - 1)$ is the Kaplan-Meier estimate of the overall survival function, and the second factor is an estimate of the cause-specific hazard of type k. Similarly, Figure 4 compares the dissolution and OT CIFs for single BOs and shared ownerships.

From Figure 3, we observe that, unconditionally, the incidence of exits by dissolution is larger in the group of start-up entrepreneurs. Even so, exits by OT seem to be relatively more frequent than exits by dissolution for the three types of BOs under analysis. The disparity between the two CIFs is particularly significant for acquisition entrepreneurs and intrapreneurs. The differences are statistically significant at the 1% level for all groups of BOs, according to the test of Pepe and Mori.
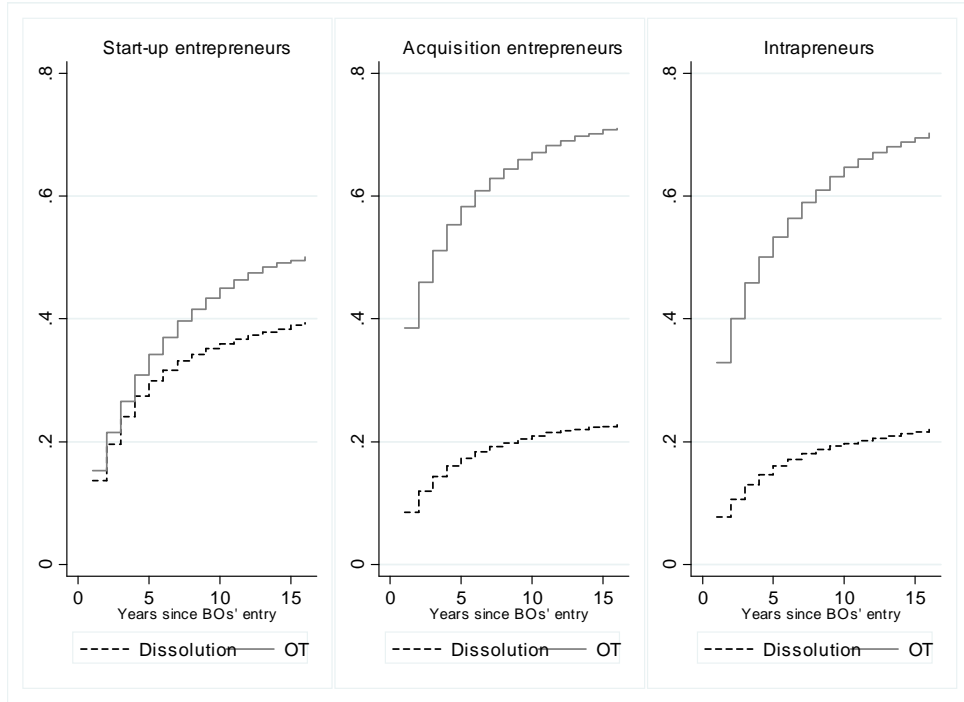
Fig. 3. Dissolution and OT Cumulative Incidence Functions, by BO type

Nevertheless, the incidence of each exit mode also seems to be affected by the ownership structure chosen at entry. From Figure 4 we verify that dissolutions (OT) are much more incident among single BOs (shared ownerships). Without controlling for any observed or unobserved characteristics of BOs, the probability of dissolving (transferring) the business before five years is about 29% (41%) for single BOs and 15% (50%) for those sharing the ownership of the business with others at the moment of entry.

Table 4 briefly characterizes BOs according to their exit mode. The variables listed in the table correspond to the vector of explanatory variables included in the estimation of cause-specific hazard models. Prior experiences in the labor market now additionally include the accumulated experience (in years) in the sector where BOs enter. Standard individual-level and firm-level characteristics of the new business are also controlled for (see Table A.I).
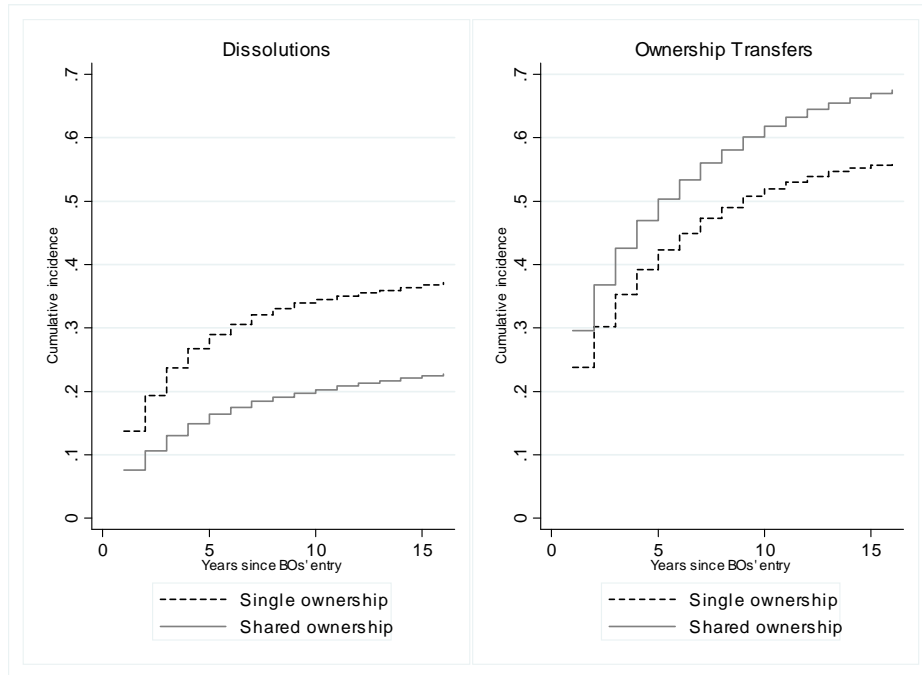
Fig. 4. Dissolution and OT Cumulative Incidence Functions, by ownership structure

Given the potential survival differences between single BOs and those sharing the ownership of their firm (Figures 2 and 4), we now split the three possible entry modes taking also into account the ownership structure chosen at entry (single or shared).[15] In our data, 58% of the individuals becoming BOs share the business with someone else by the time of their transition into entrepreneurship. The relative importance of shared ownerships seems to be even higher among younger BOs (about 61% of them share the firm with others at entry). Overall, the proportion of shared ownerships is larger in the subgroup of intrapreneurs (64%) and lower among start-up entrepreneurs (51%).

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[15]We did not take into account this disaggregation of BOs in Section 4, when studying entry patterns, because additional estimations showed that no significant differences exist between the entry determinants of BOs entering alone and those sharing the ownership of their business with others.

Table 4. Descriptive statistics, by BOs' exit mode (Portugal, 1992-2007)

	Survivors	Exits by Dissolution	Exits by OT
Entry mode			
Start-up entrepr. - single ownership (%)	0.228	0.294	0.119
Start-up entrepr. - shared ownership (%)	0.242	0.218	0.157
Acquisition entrepr. - single ownership (%)	0.054	0.079	0.079
Acquisition entrepr. - shared ownership (%)	0.084	0.068	0.139
Intrapreneur single ownership (%)	0.135	0.167	0.166
Intraprenener shared ownership (%)	0.257	0.174	0.340
Prior experiences in the labor market			
Experience in a large firm (%)	0.178	0.209	0.194
Experience in a foreign firm (%)	0.101	0.100	0.092
Number of different employers	2.584	2.179	2.267
Recent displacement (%)	0.150	0.120	0.087
Years of experience in the (2-digit) industry	3.240	2.179	2.561
Individual-level characteristics			
Male (%)	0.671	0.658	0.659
Age (years)	36.32	36.33	37.84
Less than 9 years of schooling (%)	0.454	0.514	0.519
9 years of schooling (%)	0.128	0.177	0.161
12 years of schooling (%)	0.248	0.208	0.180
College education (%)	0.170	0.101	0.140
Firm-level characteristics			
Firm age (years)	10.93	7.745	11.74
Micro firm (%)	0.777	0.853	0.719
Small firm (%)	0.205	0.132	0.229
Medium firm (%)	0.017	0.014	0.043
Large firm (%)	0.001	0.001	0.009
Urban location (%)	0.400	0.426	0.435
Primary sector (%)	0.018	0.015	0.020
Energy & Construction sectors	0.126	0.139	0.114
Manufacturing (%)	0.203	0.209	0.234
Services sector (%)	0.653	0.637	0.632
N	43,967	35,016	78,604

During the period under study, 72% of BOs have exited their business – 22% have dissolved it and 50% have left the business without closing it down, by transferring it to other BOs. In line with the CIFs estimated above, we find a higher proportion of start-up entrants among those dissolving the business. In contrast, we find a larger proportion of shared ownerships among those leaving by OT (see Table 4).

Survivors present a longer experience (from previous job(s) in paid employment) in the sector where they currently operate and seem to have more frequently suffered a recent job loss. Higher educational attainments are also more often among those who survive, and less frequent among those leaving by dissolving the firm. Lastly, the great majority of BOs' firms are micro-sized, particularly those owned by BOs who end up dissolving the business. These BOs also own, on average, the youngest firms.

5.2 Estimation results from cause-specific hazard models

Table 5 reports the results from the estimation of discrete time duration models for each specific exit mode. Table A.III, in the Appendix, reports the results obtained for the sub-sample of young BOs. Besides controlling for BOs' unobserved heterogeneity (or frailty), the estimations are also weighted by the number of BOs in each firm, at entry. Given that the literature has been suggesting that entrepreneurial teams outperform single entrepreneurs (see, for instance, Lechler (2001) for a brief review), non-weighted estimations could produce biased results by over-representing the businesses owned by two or more BOs. Accordingly, we take this aspect into account, in order to avoid giving a more relative importance to some observations over others.

By controlling for BOs' frailty, we are supposing that each individual might belong to one of a number of different types of BOs (for instance, in terms of BOs' entrepreneurial talent or ability), that each BO's type is unobserved

and that some types of BOs are more "frail" (i.e., more likely to exit) than others. Consequently, neglecting individuals' unobserved heterogeneity might have significant implications in our results, mainly in the duration dependence of the two exit modes under analysis. Typically, the non-frailty model tends to overestimate (underestimate) the degree of negative (positive) duration dependence, besides underestimating the magnitude of the coefficients (Jenkins, 1995, 2005).

Figure 5 illustrates the estimated duration dependence of dissolutions and OTs, after controlling for BOs' entry mode, past experiences in the labor market, and a number of individual and firm characteristics. We compare the results obtained from frailty and non-frailty models, as well as weighted and non-weighted estimations. Figure A.I in the Appendix shows comparable results for the sub-sample of young BOs.

Our results confirm that BOs' unobserved heterogeneity is significant in our data, playing a relevant role in the duration dependence of both exit modes. Exits by dissolution apparently have negative duration dependence – i.e., the risk of dissolving the business decreases as a BO's spell in the firm gets longer. However, as expected, neglecting BOs' frailty overestimates this negative duration dependence. Furthermore, for the whole sample, when estimations are weighted by the number of business partners at entry, the dissolution hazard becomes almost flat over time.

Ownership transfers, in turn, show a U-shaped duration pattern – i.e., BOs are less likely to exit by OT during their first years in business, becoming more prone to transfer the business to other BO(s) about five years after entering the firm. Over again, BOs' unobserved heterogeneity is shown to play a role by largely underestimating the positive duration dependence of exits by OT from the fourth/fifth year onwards.

Regarding the main variables of interest, the results confirm that entry mode significantly shapes BOs' post-entry persistence. On the one hand, after controlling for BOs' observed and unobserved characteristics, start-up entrepreneurs entering alone remain significantly more likely to dissolve the business

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earlier than all other groups of BOs. On the other hand, they also remain the less likely to exit by OT. So, despite BOs normally become more attached to a business started by them than to an acquired business, they face significantly higher failure risks during firm's infancy (Freeman et al., 1983; Brüderl and Schüssler, 1990). Overall, the results not only confirm that acquiring an existing firm is less risky than establishing a new start-up, but also that sharing the ownership of the firm with others contributes to share risks and resources, which probably reduce liquidity constraints and, consequently, dissolution hazards.

Concerning the effects arising from previous experiences in the labor market, a prior job in a foreign and/or large firm is found to accelerate BOs' exit, confirming that individuals with such employment experiences may become less committed to the firm, as they have higher opportunity costs of staying in entrepreneurship. Also, a larger number of job shifts in the past significantly hastens BOs' exit, whatever their exit mode. In contrast, individuals becoming BOs after losing their job in paid employment persist longer in the business and show lower exit risks. The effect is even larger for exits by dissolution, so our results do not support that individuals coming from unemployment are less able to run a business or more likely to fail as entrepreneurs (Carrasco, 1999; Hinz and Jungbauer-Gans, 1999; Shane, 2009).[16] Industry-specific knowledge also seems to improve BOs' survival prospects, reducing both exit risks.

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[16]However, we must underline that our analysis is confined to recent job losses. The literature often argues that nascent entrepreneurs coming from unemployment are more likely to fail because their human capital, knowledge and skills tend to depreciate during longer unemployment periods, or because they look at entrepreneurship as a last resort solution for their problems in finding a job. In contrast, individuals losing their job and immediately reacting by becoming BOs may correspond to high-ability unemployed individuals. For this reason, we should not generalize our results, given that we focus on the effect of recent displacement episodes and our data do not allow an accurate identification of all types of unemployed individuals (namely long-term unemployed individuals).

Table 5. Estimation results from the cause-specific hazard models (Portugal, 1992-2007)

	Exit by Dissolution	Exit by Own. Transfer
Entry mode		
Start-up entrepren. - shared ownership	-0.9158***	0.1625***
	(0.0320)	(0.0172)
Acquisition entrepren. - single ownership	-0.3326***	0.8513***
	(0.0444)	(0.0272)
Acquisition entrepren. - shared ownership	-1.2603***	1.0998***
	(0.0414)	(0.0228)
Intrapreneur single ownership	-0.3350***	0.7025***
	(0.0367)	(0.0227)
Intrapreneur - shared ownership	-1.2264***	0.9135***
	(0.0389)	(0.0209)
Prior experiences in the labor market		
Experience in a large firm	0.2770***	0.1327***
	(0.0228)	(0.0114)
Experience in a foreign firm	-0.0092	0.1109***
	(0.0293)	(0.0147)
Number of different employers	0.1149***	0.1460***
	(0.0078)	(0.0041)
Recent displacement	-0.3630***	-0.2007***
	(0.0270)	(0.0146)
Years of experience in the industry	-0.0434***	-0.0132***
	(0.0025)	(0.0012)
Macroeconomic environment		
Lagged unemployment rate	0.0098**	-0.2119***
	(0.0046)	(0.0028)
Individual-level characteristics		
Male	-0.1807***	-0.1956***
	(0.0174)	(0.0087)
Age	-0.0641***	-0.1434***
	(0.0053)	(0.0029)
Age squared/100	0.0770***	0.1750***
	(0.0063)	(0.0035)
9 years of schooling	-0.1002***	-0.1587***
	(0.0197)	(0.0105)

(It continues in the next page...)

Table 5. Estimation results from the cause-specific hazard models

(Portugal, 1992-2007)	Exit by Dissolution	Exit by Own. Transfer
Individual-level characteristics		
12 years of schooling	-0.1364***	-0.1338***
	(0.0193)	(0.0101)
College education	-0.4849***	0.0095
	(0.0265)	(0.0119)
Firm-level characteristics		
Firm age	-0.0396***	0.0152***
	(0.0014)	(0.0005)
Firm age squared/100	0.0085***	-0.0034***
	(0.0005)	(0.0002)
Small firm	-0.7423***	0.3540***
	(0.0229)	(0.0091)
Medium firm	-0.8524***	1.1900***
	(0.0431)	(0.0192)
Large firm	-1.9969***	1.6927***
	(0.1218)	(0.0350)
Urban location	0.3853***	0.0024
	(0.0177)	(0.0080)
Primary sector	-0.1298***	0.5682***
	(0.0594)	(0.0267)
Energy & Construction sector	0.6954***	-0.0041
	(0.0293)	(0.0134)
Services sector	-0.0355*	0.0968***
	(0.0208)	(0.0098)
N	444,497	444,497
Log Likelihood	-191,455.1	-367,763.6
σ_u	1.4143	1.2550
Rho	0.7799	0.4892
LR test of rho=0 (χ^2)	436.53***	2305.42***

Notes: *, **, and *** denote significant at 10%, 5% and 1% respectively. Cloglog model with inverse gaussian frailty, weighted by the number of BOs in the firm at entry. "Start-up entrepren. - single ownership" are the base category for entry mode. "Less than 9 years of schooling" is the base category for BOs' education. Micro Firms are the base category for firm size. Manufacturing is the base category for sector. Both specifications also include 16 duration dummies to study the duration dependence of each exit mode.
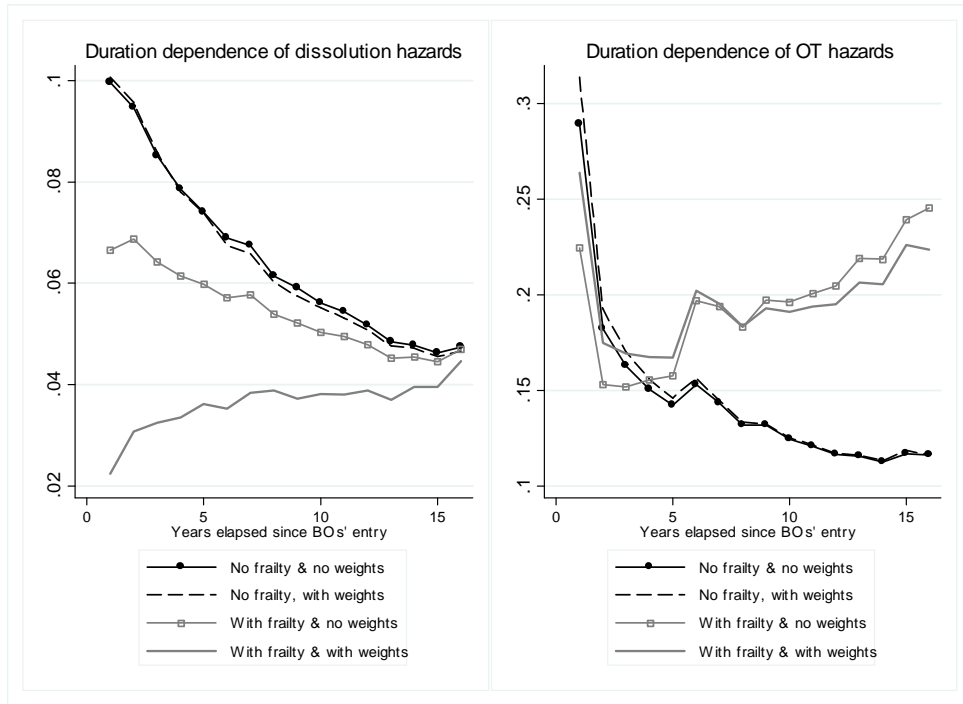
Fig. 5. The effects of BOs' frailty and weighted estimation on duration dependence

Adverse macroeconomic conditions seem to strongly discourage an exit by OT, in line with the evidence that firms become acquisition targets more frequently during more favorable economic periods (e.g., Bhattacharjee et al., 2009). Though the overall risk of dissolution seems to slightly increase when economic conditions worsen, younger BOs seem to resist to closing down their firms during periods of higher unemployment, probably because they will not find better alternatives in the labor market (see Table A.III).

Regarding the remaining variables, men are found to survive longer than women. Both exit risks seem to decrease with BOs' age, starting to increase after the forties. Higher levels of education are associated with lower exit rates, and especially dissolution rates, in line with previous studies that found that BO's human capital helps to prevent business closure (Bates, 1990; Headd,

2003). The smaller and the younger the firm, the more likely will be an exit by dissolution and the less likely will be an exit by OT. BOs operating in urban areas are also found to face higher risks of dissolution, possibly due to the pressure of competition.

6   Concluding Remarks

This paper studies the entry and exit of over 157,587 BOs, focusing on the effect of past experiences in the labor market, and identifying different entry routes and exit modes for nascent BOs. Concerning entry, our findings suggest that the several types of BOs may be driven by different motivations. Entrepreneurs seem to enter at younger ages and to be significantly pushed by more unstable trajectories in the labor market, namely by recent job losses and by a larger number of job shifts between different employers. In contrast, a previous job in a large-sized and/or a foreign-owned company apparently discourages transitions from paid employment to entrepreneurship. Intrapreneurs seem to emerge within very small domestic firms – the typical family firm –, especially at middle-ages (around the forties). Adverse macroeconomic conditions are found to discourage the entry of all BOs in general, though start-up entrepreneurs seem to be much more reactive, especially at younger ages, by entering counter-cyclically.

Regarding BOs' persistence and exit, our results show that different exit modes can be predicted by BOs' entry route. New BOs entering, alone, via start-up are more likely to dissolve the firm, but much less likely to leave by transferring the business to others. Industry-specific experience seems to significantly increase the persistence of BOs in the firm, supporting the importance of learning-by-doing and informational advantages gained through the accumulation of specific knowledge. Over again, employment experiences in large-sized or foreign firms apparently increase the opportunity costs of

remaining in business-ownership, accelerating BO's exit decision.

BOs' unobserved heterogeneity is also found to play a significant role in our estimations. After controlling for BOs' frailty, our results suggest that ownership transfers have a U-shaped duration dependence. Neglecting BOs' unobserved heterogeneity leads to an overestimation of the negative duration dependence of dissolution hazards.

Finally, our results do not support the widespread belief that nascent entrepreneurs coming from unemployment are more likely to fail and leave their business earlier. We find that those who have been displaced immediately before entering entrepreneurship survive longer, being less likely to leave the business, whatever the exit mode. This may open new lines for future research, as individuals entering entrepreneurship almost immediately after losing their job may be a more reactive and high-ability group that becomes more attached to the BO position, when compared to long-term unemployed individuals becoming BOs, who may, instead, be a low-ability group that looks at entrepreneurship as a last resort solution, being possibly less able to run a business.

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Table A.I. Description of variables included in the empirical models

Categories of variables	Description of variables
Prior experiences in the labor market as paid employee	
Experience in a large firm	Dummy=1 if the individual has ever worked in a large firm (250+ employees) in the past.
Experience in a foreign firm	Dummy=1 if the individual has ever worked in a foreign firm (foreign capital >=50%) in the past.
Number of different employers	Number of different firms where the individual has already worked as paid employee until period t.
Recent displacement	Dummy=1 if the individual has exited a previous job in a firm that either closed or suffered a downsizing.
Years of experience in the (2-digit) industry*	Number of years of experience (as paid employee) in the 2-digit industry where the individual has entered as business-owner.
Macroeconomic environment	
Lagged unemployment rate	Annual lagged unemployment rate (one year lag).
Entry mode*	
Start-up entrepreneur single ownership	Dummy=1 if the individual becomes an Entrepreneur by establishing a new business alone; 0 otherwise.
Start-up entrepreneur shared ownership	Dummy=1 if the individual becomes an Entrepreneur by establishing a new business with others; 0 otherwise.
Acquisition entrepreneur single ownership	Dummy=1 if the individual becomes an Entrepreneur by acquiring an existing business alone; 0 otherwise.
Acquisition entrepreneur shared ownership	Dummy=1 if the individual becomes an Entrepreneur by acquiring an existing business with others; 0 otherwise.
Intrapreneur single ownership (employee buyout)	Dummy=1 if the individual becomes the only BO of the employer firm; 0 otherwise.
Intrapreneur shared ownership (partnership)	Dummy=1 if the individual becomes one of the BOs of the employer firm; 0 otherwise.
Individual-level characteristics	
Male	Dummy=1 for males, 0 for females.
Age	Age of the individual in years, in period t.
Age squared/100	Squared value of the age of the individual in period t, divided by 100.
Less than 9 years of schooling[a]	Dummy=1 if the individual has less than 9 years of schooling completed in period t, 0 otherwise.
9 years of schooling	Dummy=1 if the individual has 9 years of schooling completed in period t, 0 otherwise.
12 years of schooling	Dummy=1 if the individual has 12 years of schooling completed in period t, 0 otherwise.
College education	Dummy=1 if the individual has a college degree (including masters and/or PhD degrees) in period t, 0 otherwise.
Previous wage job characteristics	
Overeducation	Dummy=1 if the individual was overeducated in the previous wage job, 0 otherwise.
Tenure	Tenure of the worker in the previous wage job, in months.
Tenure squared/100	Squared value of the individual's tenure in the previous wage job, divided by 100.
Management position	Dummy=1 if the individual occupied a management position in the previous wage job, 0 otherwise.

Table A.I. Description of variables included in the empirical models (cont.)

Categories of variables	Description of variables
Hourly wage	Ratio of the base wage and regular benefits over the total number of normal hours worked in the reference month, in logs (wages in 2005 euros).
Foreign firm	Dummy=1 if the firm where the individual was previously employed had 50% or more of its capital held by foreign investors, 0 otherwise.
Micro firm	Dummy=1 if the firm where the individual was previously employed had less than 10 employees, 0 otherwise.
Small firm	Dummy=1 if the firm where the individual was previously employed had between 10 and 49 employees, 0 otherwise.
Medium firm	Dummy=1 if the firm where the individual was previously employed had between 50 and 249 employees, 0 otherwise.
Large firm	Dummy=1 if the firm where the individual was previously employed had 250 or more employees, 0 otherwise.
Urban location	Dummy=1 if the firm where the individual was previously employed was located in an urban center (i.e. districts of Porto and Lisbon), 0 otherwise.
Primary sector	Dummy=1 if the firm where the individual was previously employed was operating in the primary sector, 0 otherwise.
Manufacturing	Dummy=1 if the firm where the individual was previously employed was operating in the manufacturing industry, 0 otherwise.
Energy & Construction sector	Dummy=1 if the firm where the individual was previously employed was operating in the energy or construction sectors, 0 otherwise.
Services sector	Dummy=1 if the firm where the individual was previously employed was operating in the services sector, 0 otherwise.
*Firm-level characteristics**	
Firm age	Age of the firm in years.
Firm age squared/100	Squared value of the firm age, divided by 100.
Micro firm	Dummy=1 if the BO's firm is micro-sized (less than 10 employees); 0 otherwise.
Small firm	Dummy=1 if the BO's firm is small-sized (10-49 employees); 0 otherwise.
Medium firm	Dummy=1 if the BO's firm is medium-sized (50-249 employees); 0 otherwise.
Large firm	Dummy=1 if the BO's firm is large-sized (250 or more employees); 0 otherwise.
Urban location	Dummy=1 if the BO's firm is located in an urban center (districts of Porto or Lisbon); 0 otherwise.
Primary sector	Dummy=1 if the BO's firm belongs to the Primary sector; 0 otherwise.
Manufacturing	Dummy=1 if the BO's firm belongs to the Manufacturing industry; 0 otherwise.
Energy & Construction sector	Dummy=1 if the BO's firm belongs to the Energy or Construction sectors; 0 otherwise.
Services sector	Dummy=1 if the BO's firm belongs to the Services sector; 0 otherwise.

Notes: * denotes variables that are only included in the estimations of duration models to study BO's duration in the firm.

Table A.II. Multinomial logit estimation results for the sub-sample of young individuals ($\leq$ 30 years old) (Portugal, 1992-2007)

	Start-up Entrepreneur	Acquisition Entrepreneur	Intrapreneur
Prior experiences in the labor market			
Experience in a large firm	-0.7319***	-0.6179***	-0.1734***
	(0.0187)	(0.0257)	(0.0326)
Experience in a foreign firm	-0.2086***	-0.1518***	0.0871***
	(0.0233)	(0.0327)	(0.0422)
Number of different employers	1.1652***	1.1891***	0.1210***
	(0.0060)	(0.0079)	(0.0114)
Previous wage job characteristics			
Overeducation	-0.0328**	-0.0656***	0.1537***
	(0.0148)	(0.0223)	(0.0171)
Tenure	0.0191***	0.0178***	0.0020***
	(0.0009)	(0.0007)	(0.0005)
Tenure squared/100	-0.0044***	-0.0037***	0.0001
	(0.0007)	(0.0004)	(0.0001)
Management position	0.7611***	0.9100***	3.3175***
	(0.0460)	(0.0688)	(0.0291)
Hourly wage	-0.1093***	-0.2103***	-0.2488***
	(0.0222)	(0.0349)	(0.0264)
Foreign firm	-0.0138	-0.0593	-1.1820***
	(0.0276)	(0.0382)	(0.0768)
Small firm	-0.5740***	-0.3408***	-1.1534***
	(0.0159)	(0.0258)	(0.0190)
Medium firm	-1.1409***	-0.6348***	-2.3283***
	(0.0212)	(0.0309)	(0.0334)
Large firm	-1.2982***	-0.7154***	-3.7175***
	(0.0239)	(0.0325)	(0.0675)
Urban location	-0.1147***	0.0082	-0.0370**
	(0.0144)	(0.0222)	(0.0170)
Primary sector	-0.2277***	0.0348	-0.0272
	(0.0592)	(0.0842)	(0.0569)

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Table A.II. Multinomial logit estimation results for the sub-sample of young individuals ($\leq$ 30 years old) (Portugal, 1992-2007)

	Start-up Entrepreneur	Acquisition Entrepreneur	Intrapreneur
Previous wage job characteristics			
Energy & Construction sectors	0.1696***	0.0497	-0.0070
	(0.0235)	(0.0380)	(0.0285)
Services sector	0.1769***	0.1949***	-0.0912***
	(0.0178)	(0.0269)	(0.0215)
Individual-level characteristics			
Male	0.6660***	0.4038***	0.4488***
	(0.0158)	(0.0236)	(0.0183)
Age	0.4422***	0.1034***	0.3367***
	(0.0292)	(0.0410)	(0.0332)
Age squared/100	-1.0841***	-0.4459***	-0.5627***
	(0.0585)	(0.0832)	(0.0669)
9 years of schooling	0.6928***	0.4994***	0.5136***
	(0.0214)	(0.0329)	(0.0251)
12 years of schooling	0.9152***	0.7828***	0.5667***
	(0.0204)	(0.0318)	(0.0249)
College education	1.8873***	1.9649***	0.7400***
	(0.0331)	(0.0508)	(0.0421)
Macroeconomic environment			
Lagged unemployment rate	0.0990***	-0.1658***	-0.1254***
	(0.0116)	(0.0148)	(0.0097)
Constant	-13.9241***	-8.5841***	-9.8856***
	(0.3640)	(0.5003)	(0.4088)
Time Dummies	YES	YES	YES
N		9,392,808	
Log Pseudo-likelihood		-316,570.5	
Pseudo R^2		0.1429	

Notes: *, **, and *** denote significant at 10%, 5% and 1%, respectively. Worker-clustered standard errors in parentheses. Micro Firms are used as the base category for firm size. Manufacturing is used as the base category for sector. An indicator variable for "less than 9 years of schooling" is used as the base category for individual's education.

Table A.III. Estimation results from the cause-specific hazard models (sub-sample of young individuals, $\leq$ 30 years old, Portugal, 1992-2007)

	Exit by Dissolution	Exit by Own. Transfer
Entry mode		
Start-up entrepren. - shared ownership	-0.6451***	0.1517***
	(0.0453)	(0.0276)
Acquisition entrepren. - single ownership	-0.1885***	0.7491***
	(0.0562)	(0.0468)
Acquisition entrepren. - shared ownership	-1.0011***	1.0370***
	(0.0694)	(0.0368)
Intrapreneur single ownership	-0.2232***	0.8136***
	(0.0514)	(0.0425)
Intrapreneur -shared ownership	-0.8775***	0.9359***
	(0.0610)	(0.0352)
Prior experiences in the labor market		
Experience in a large firm	0.1438***	0.2052***
	(0.0316)	(0.0223)
Experience in a foreign firm	0.0412	0.1052***
	(0.0404)	(0.0287)
Number of different employers	0.1084***	0.1637***
	(0.0123)	(0.0085)
Recent displacement	-0.2720***	-0.2281***
	(0.0331)	(0.0238)
Years of experience in the industry	-0.0567***	-0.0296***
	(0.0049)	(0.0030)
Macroeconomic environment		
Lagged unemployment rate	-0.0180***	-0.2113***
	(0.0065)	(0.0048)
Individual-level characteristics		
Male	-0.2522***	-0.2960***
	(0.0241)	(0.0157)
Age	-0.0377**	-0.2073***
	(0.0156)	(0.0096)
Age squared/100	0.0496*	0.2592***
	(0.0262)	(0.0153)
9 years of schooling	-0.0852***	-0.1609***
	(0.0264)	(0.0177)

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Table A.III. Estimation results from the cause-specific hazard models (sub-sample of young individuals, $\leq$ 30 years old, Portugal, 1992-2007)

	Exit by Dissolution	Exit by Own. Transfer
Individual-level characteristics		
12 years of schooling	-0.1277***	-0.1432***
	(0.0247)	(0.0165)
College education	-0.4011***	-0.0589***
	(0.0383)	(0.0219)
Firm-level characteristics		
Firm age	-0.0366***	0.0114***
	(0.0023)	(0.0009)
Firm age squared/100	0.0079***	-0.0024***
	(0.0007)	(0.0004)
Small firm	-0.6269***	0.3200***
	(0.0391)	(0.0157)
Medium firm	-1.1038***	1.1780***
	(0.0812)	(0.0320)
Large firm	-1.7400***	1.7175***
	(0.2074)	(0.0664)
Urban location	0.2686***	-0.0015
	(0.0254)	(0.0138)
Primary sector	-0.2509***	0.4931***
	(0.0837)	(0.0484)
Energy & Construction sectors	0.3134***	-0.0309
	(0.0380)	(0.0228)
Services sector	-0.0353	0.0826***
	(0.0263)	(0.0171)
N	127,802	127,802
Log Likelihood	-59,128.9	-109,477.3
σ_u	1.2441	1.1423
Rho	0.4848	0.4423
LR test of rho=0 (χ^2)	65.47***	676.75***

Notes: *, **, and *** denotes significant at 10%, 5% and 1% respectively. Reference categories: "Start-up entrepreneurs - single ownership" for entry mode; Micro Firms for firm size; Manufacturing for sector; "Less than 9 years of schooling" for BOs' education. Both specifications also include 16 duration dummies.
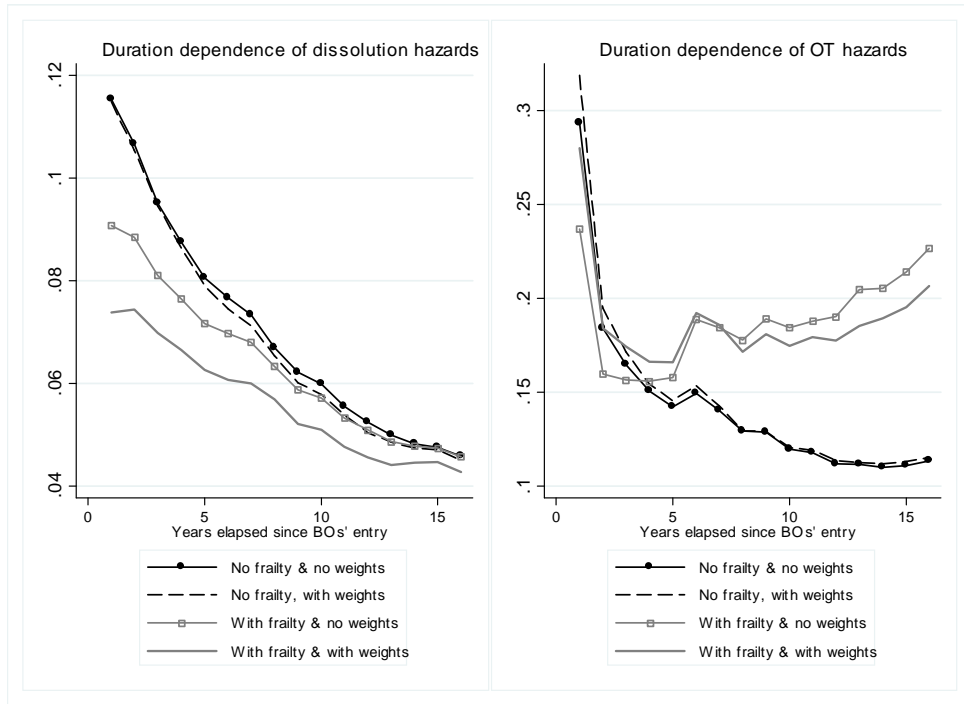
Fig. A.I. The effects of BOs' frailty and weighted estimation on duration dependence - sub-sample of young individuals (≤ 30 years old)

Serial entrepreneurship, learning by doing and self-selection*

Essay 3

May 29, 2014

Abstract

It remains a question whether serial entrepreneurs typically perform better than their novice counterparts owing to learning by doing effects or mostly because they are a selected sample of higher-than-average ability entrepreneurs. This paper tries to unravel these two effects by exploring a novel empirical strategy based on continuous time duration models with selection. We use a large longitudinal matched employer-employee dataset that allows us to identify about 220,000 individuals who have left their first entrepreneurial experience, out of which over 35,000 became serial entrepreneurs. We evaluate whether entrepreneurial experience acquired in the previous business improves serial entrepreneurs' survival, after taking into account self-selection issues. Our results show that serial entrepreneurs are not a random sample of ex-business-owners. Robustness tests based on the estimation of the person-specific effect, using information on individuals' past histories in paid employment, confirm that serial entrepreneurs exhibit, on average, a larger person-specific effect than non-serial business-owners. Moreover, ignoring serial entrepreneurs' self-selection overestimates learning by doing effects.

Keywords: Serial Entrepreneurship, Entrepreneurial Experience, Learning, Selection

JEL Codes: D83, J24, L26

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1 Introduction

Most of the seminal theories of industry evolution that incorporate entrepreneurship as a means of market entry assume that exit is a final event: once it has occurred, reentry (into the same or a different industry) is not an option (e.g., Jovanovic, 1982; Hopenhayn, 1992; Jovanovic and MacDonald, 1994). Nevertheless, not only there is a growing awareness that entrepreneurship is not solely confined to the creation of a new business as a single-action event (Ucbasaran et al., 2006; Plehn-Dujowich, 2010; Sarasvathy et al., 2013), as also empirical evidence confirms that a significant part of entrepreneurial activity around the world is conducted by serial (or renascent) entrepreneurs.[1]

As a result, serial entrepreneurs have been gaining an increasing attention of scholars and, especially, policymakers, who have enlarged entrepreneurial incentives so as to target both experienced and novice entrepreneurs (see Westhead et al., 2003, 2005a, 2005b). Moved by the widespread belief that serial entrepreneurs will perform better owing to learning effects from past entrepreneurial experiences (Cope and Watts, 2000; Minniti and Bygrave, 2001; Cope, 2005, 2011), many European countries in particular have launched new programs to promote a fresh restart of ex-entrepreneurs, especially of those who performed poorly in the past and who would, otherwise, feel prevented to try again due to the so-called "stigma of failure" (European Commission, 2002, 2011).

However, and despite the early recognized value of studying serial entrepreneurship (e.g., MacMillan, 1986), empirical research on this topic is still at the beginning stage due to the lack of suitable data (Zhang, 2011; Parker, 2012; Sarasvathy et al., 2013), as most data collection efforts cover only one of

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[1]Serial entrepreneurs have been broadly defined as individuals who have sold or closed a business in which they had a minority or majority ownership stake in the past, and who currently own (alone or with others) a different independent business that is either new, purchased or inherited (Westhead et al., 2005a). The increasing relevance of this group of entrepreneurs has been documented in several countries – see, for instance, Westhead and Wright (1998) and Westhead et al. (2005a) for UK, Wagner (2003) for Germany, Hyytinen and Ilmakunnas (2007) for Finland and Headd (2003) for USA.

a series of businesses, or track firms rather than entrepreneurs. Consequently, the research on serial entrepreneurship conducted so far is mostly descriptive or particularly concerned with establishing comparisons between serial and nascent entrepreneurs (e.g., Ucbasaran et al., 2003; Westhead et al., 2005a, 2005b; Li et al., 2009; Ucbasaran et al., 2010; Robson et al., 2012; Kirschenhofer and Lechner, 2012).

While a more recent stream of work has been increasingly interested in the dynamics of serial entrepreneurship process, substantial knowledge about how (or whether) entrepreneurs effectively learn with past experience is still lacking.[2] On the one hand, latest empirical results have offered little confidence on significant learning by doing effects (e.g., Gompers et al., 2010; Nielsen and Sarasvathy, 2011; Parker, 2012; Frankish et al., 2012). On the other hand, an emerging concern about self-selection among serial entrepreneurs is blurring the broad expectations about true entrepreneurial learning (Chen, 2013). Accordingly, it remains a question whether serial entrepreneurs typically perform better than their novice counterparts because they have learned about running a business and have improved their entrepreneurial skills with their past experience or, instead, mostly because they are a selected sample of high-ability entrepreneurs. Disentangling the effects of learning by doing from learning about own ability when assessing the performance of serial entrepreneurs has, thus, became an empirical challenge.

In this regard, this study contributes to this debate and tries to unravel these two effects by exploring a novel empirical strategy. Using the methodology developed by Boehmke et al. (2006), we estimate continuous time duration models that account for selection bias to study how previous entrepreneurial experience influences the survival of serial entrepreneurs in their second business. The analysis is based on a large longitudinal matched employer-employee dataset for Portugal (Quadros de Pessoal), where serial entrepreneurs already

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[2]See Hyytinen and Ilmakunnas (2007), Stam et al. (2008), Amaral et al. (2011) and Hessels et al. (2011) for a particular emphasis on the determinants of reentry into entrepreneurship.

account for a significant part of the entrepreneurial activity in the country –
data for the most recent years reveal that more than 20% of all new businesses
were created by renascent (i.e., serial) entrepreneurs.

About 220,000 ex-business-owners are identified, out of which 35,202 have
tried again, by becoming serial entrepreneurs. Our results and robustness
checks seem to confirm that serial entrepreneurs are not a random sample, but
a group of higher-than-average ability ex-business-owners, which significantly
moderates any learning by doing effects that might be transferred between
sequential entrepreneurial experiences. To the best of our knowledge, this is
the first comprehensive study that attempts to evaluate entrepreneurial learn-
ing effects using a unique and rich matched employer-employee datatset and
appropriate econometric tools, namely duration models with sample selection.

The remaining sections of the paper are organized as follows. Section 2
briefly presents prior literature on serial entrepreneurship and entrepreneurial
learning and establishes the objectives of the paper. Section 3 describes the
data and the methodological procedures. The empirical results are presented
and discussed in Section 4. Robustness checks are described and reported in
the fifth Section. Section 6 concludes.

2 Learning by doing and self-selection: two sources of serial entrepreneurship dynamics

2.1 Previous literature on entrepreneurial learning

The belief that entrepreneurs learn from experience is not recent (see von
Hayek, 1937), and this idea has been expressed by several highly influential
models on dynamic industrial organization over the last thirty years (e.g., Jo-
vanovic, 1982; Frank, 1988; Hopenhayn, 1992; Ericsson and Pakes, 1995). As
Minniti and Bygrave (2001: 7) explicitly state, "entrepreneurship is a process

of learning, and a theory of entrepreneurship requires a theory of learning". Consequently, several theoretical and conceptual attempts were developed during the last decade, trying to identify the mechanisms through which entrepreneurs learn, update beliefs and, consequently, improve their performance (e.g., Cope, 2005; Fraser and Greene, 2006; Parker, 2006; Petkova, 2009; Plehn-Dujowich, 2010; Ucbasaran et al., 2012).

As a result, the positive relationship between previous entrepreneurial experience and current business performance became a kind of stylized fact in entrepreneurship research. Formally, by describing entrepreneurs' performance PF (either measured by business profits, growth or survival, just to name a few performance measures) as a function of their entrepreneurial experience E, ability θ, and a wide set of characteristics of entrepreneurs, firms and industries $X - PF(E, \theta, X)$ –, this "learning by doing hypothesis" hence predicts that $PF_E > 0$.

Empirical evidence on the observed differences between novice and serial entrepreneurs has been reinforcing this expectation of significant learning by doing effects. By being more able to access financial resources, more alert to business opportunities and better endowed with a larger set of entrepreneurial skills, experienced entrepreneurs tend to offer more attractive growth prospects than first time entrepreneurs (Wright et al., 1997; Westhead and Wright, 1998; Westhead et al., 2003, 2005a, 2005b). Additionally, more recent studies have also showed that experienced entrepreneurs are usually better at developing networks (Li et al., 2009), more likely to gain access to venture capital (Zhang, 2011), more prone to take risks and pursue innovative activities (Robson et al., 2012), and also more capable of building more effective and diversified teams (Kirschenhofer and Lechner, 2012) than their nascent counterparts.

While all these studies have significantly contributed to our knowledge about how different are serial and novice entrepreneurs, they have offered no systematic empirical evaluation of learning effects resulting from entrepreneurs' past experience. Only more recent studies have tried to address this issue, either by comparing the outcomes of entrepreneurs with and without

experience (Frankish et al., 2012), or by evaluating how serial entrepreneurs' performance in one venture is related to their performance in a subsequent venture (Gompers et al., 2010; Nielsen and Sarasvathy, 2011; Parker, 2012; Chen, 2013). Nevertheless, none of their results has undoubtedly supported that serial entrepreneurs perform better owing to the experience accumulated in previous businesses.

Both Frankish et al. (2012) and Nielsen and Sarasvathy (2011) have analyzed the 3-year survival rate of new businesses for UK and Denmark, respectively. While the former found no significant survival differences between novice and experienced entrepreneurs, the latter concluded that some form of absorptive capacity (in terms of education and prior industry background) is necessary for entrepreneurs to benefit from any learning opportunities. Other authors have suggested that good performance in one venture tends to be associated with good performance in subsequent ventures, though the effects may be temporary (Parker, 2012) and partly driven by some type of skills exhibited by serial entrepreneurs – as their "market timing ability", which may help them to start a company at the right time in the right industry (Gompers et al., 2010).

These results may, in part, suggest that, on the one hand, entrepreneurial experience *per se* may be not enough to improve business performance, as entrepreneurs' experience and ability are probably complements (i.e., $PF_E > 0$; $PF_\theta > 0$; $PF_{E\theta} > 0$) – the more able (or skilled) an entrepreneur is, the more s/he will benefit from past experience and the better will be subsequent business performance. On the other hand, it is also possible that serial entrepreneurs are not a random sample of ex-entrepreneurs, but a higher-than-average ability group of individuals, so that $\overline{\theta}^{Serial} > \overline{\theta}^{Non-serial}$. If that is the case, and if moreover θ and E are significantly and positively correlated, serial entrepreneurs' higher ability may play a dominant effect on business performance, while *true* learning by doing effects (i.e., learning by doing effects expurgated from serial entrepreneurs' eventual self-selection effects) are possibly overestimated (i.e., $0 < PF_E \mid (\overline{\theta}^{Serial} - \overline{\theta}^{Non-serial}) < PF_E$) or even

negligible $(PF_E \mid (\overline{\theta}^{Serial} - \overline{\theta}^{Non-serial}) \simeq 0)$.

Despite selection on ability as a source of serial entrepreneurship dynamics had been early proposed by seminal theories of industry evolution, the literature on serial entrepreneurs has virtually neglected this aspect for decades. Theoretical grounds not only suggested that unobserved talent shapes entrepreneurial entry, but also that individuals learn and update their beliefs about their entrepreneurial ability as they accumulate experience as entrepreneurs (Jovanovic, 1982; Holmes and Schmitz, 1990). This phenomenon is expected to generate a dynamic process where high-skill entrepreneurs tend to shut down businesses of low quality to become serial entrepreneurs, aiming at finding a high quality business, while low-skill entrepreneurs are expected to shut down their businesses of low quality to enter the labor market (Plehn-Dujowich, 2010).

To the best of our knowledge, only the recent work by Chen (2013) has recognized the importance of self-selection, fostering the discussion about potential misleading interpretations of learning by doing effects among studies neglecting this second (though closely related) source of dynamics among serial entrepreneurs – learning about own ability. By combining fixed-effects panel data models and IV estimation for a sample of about 3,200 serial entrepreneurs in the U.S., she actually concluded that self-selection on ability – rather than learning by doing – is the key determinant of the early performance of new businesses. These results not only challenge the prevalent views that entrepreneurship can be learned and that next businesses will always be better than the previous one owing to past experience, as also claim for further research on serial entrepreneurship and the sources of learning.

2.2   Research questions and objectives

This paper contributes to this emerging debate by evaluating to what extent serial entrepreneurs learn with past experience, after controlling for potential

biases driven by self-selection into serial entrepreneurship. We characterize entrepreneurial experience E using three variables: i) the cumulative years the individual has survived as business-owner in the first entrepreneurial experience; ii) previous experience as a start-up founder; and iii) industry-specific experience. Regarding the performance measure analyzed in this study, we focus on serial entrepreneurs' survival.

According to prior literature, we would anticipate positive (negative) and significant effects from each of these variables on serial entrepreneurs' survival (exit). First, by running a business, entrepreneurs acquire unique specific resources, knowledge, skills and contacts that can be used to start and/or acquire subsequent businesses. For this reason, the longer an individual has been in a business in the past – successful or not – the more s/he is likely to have learned about being an entrepreneur, and the larger the stock of knowledge that may be accumulated about customers and suppliers, the wider will be the networks of contacts, as well as market-specific information (Cope and Watts, 2000; Ucbasaran et al., 2006; Frankish et al., 2012; Parker, 2012), which may constitute important resources when they decide to try again as entrepreneurs.

Second, the particular experience of founding a firm – given that not all individuals become entrepreneurs by creating a start-up venture (see, Parker and van Praag, 2011; Bastié et al., 2013; Rocha et al., 2013) – may also deliver greater opportunities to learn about the overall entrepreneurial process. Starting a firm from scratch requires a wide range of skills, and prior firm-founding experience is believed to help an entrepreneur to acquire and enhance such skills (Zhang, 2011). In addition, learning experiences are expected to be mostly relevant during business' infancy, i.e., during the first few years of the firm (van Gelderen et al., 2005).

Finally, learning by doing may also arise from industry-specific experience (Frankish et al., 2012; Chen, 2013). Individuals becoming serial entrepreneurs by establishing a business in the same industry where they operated in the past may benefit from informational advantages and suffer from lower uncertainty, which may also contribute to their resilience in their second entrepreneurial

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attempt.

However, performance (in this case, hazard rates) is only observed for ex-business-owners reentering and becoming serial entrepreneurs. This would not be a problem if serial entrepreneurs are a random selection of all ex-business-owners (i.e., if $\overline{\theta}^{Serial} = \overline{\theta}^{Non-serial}$). Nevertheless, there may be unobserved factors – related with ability differences among serial and non-serial entrepreneurs – that simultaneously affect the reentry decision (i.e., the selection in the sample) and the post-reentry performance (precisely, the hazard rates).

In such case, the previous estimated effects of entrepreneurial experience may be unreliable – as explained above, the eventual negative association between serial entrepreneurs' hazard rates and experience may not be the result of *true* learning by doing, but the result of a higher-than-average (unobserved) entrepreneurial ability of serial entrepreneurs. For instance, it is possible that some individuals have survived longer in the first business, or started a new venture from scratch instead of acquiring an existing firm, mainly because they are high-quality entrepreneurs. Similarly, those who have chosen to reenter and remain in the same industry may have made this choice because they have perceived to be more able to run a business in that particular industry than in any other one.

Accordingly, the main goal of this paper is to evaluate whether learning by doing hypothesis is verified in our data (i.e., whether $h_E < 0$, with $h(E, \theta, X)$ generally denoting serial entrepreneurs' hazard rates), taking into account self-selection issues.

3   Data and Methodological Issues

3.1   Data

This study uses data from Quadros de Pessoal (QP), a longitudinal matched employer-employee administrative dataset from the Portuguese Ministry of

Employment. QP is an annual mandatory employment survey that all firms in the private sector employing at least one wage earner are legally obliged to fill in.[3] Requested data cover firms/establishments (e.g., location, employment, industry, sales, ownership, among others) and each of its workers (for instance, professional situation, gender, age, education, occupational category and skill levels). Firms/establishments and individuals (both workers and business-owners) are identified by a unique identification number, so they can be tracked and matched over time, thus providing very rich information on individual's backgrounds, career paths and transitions across firms and industries. All these characteristics of the dataset make QP a suitable database for a dynamic analysis of serial entrepreneurship.

Raw QP files are available for the period 1986-2009, though there is a gap for the particular years of 1990 and 2001, for which there is no available information at the individual-level. We restrict our study to serial entrepreneurs reentering into entrepreneurship between 1993 and 2007, excluding reentries occurring in 2001 or 2002.[4] Data for the period 1986-1992 was only used to characterize individuals' previous experiences as entrepreneurs or paid employees.

The entrepreneur definition used in this study corresponds to business-owners (BOs) of firms with at least one wage earner (i.e., employers). We identify serial entrepreneurs in particular as those ex-BOs who become BOs again, in a different firm, after leaving their first entrepreneurial experience.

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[3]For this reason, self-employed individuals without employees are not covered by QP.

[4]To avoid measurement errors on the time spent until reentry into entrepreneurship - one of the variables to be included in our estimations - we had to exclude reentries occurring in 2002, as we are not able to ensure whether the reentry occurs in 2001 (for which no data are available at the worker-level) or in 2002. Besides, we exclude reentries occurring after 2007 because, given the criteria adopted to identify business-owner's exit, we need at least two years of available information after his/her reentry to clearly identify individual's exit.

3.2 Identifying the entry and exit of serial entrepreneurs

We started by identifying in QP files all BOs who left their first business ownership experience.[5] A total of 219,462 ex-BOs, aged between 16 and 50 years old, were identified and tracked over time, in order to find out who has reentered and became BO in a second firm, and who did not.[6] About 16% of them (precisely 35,202 ex-BOs) have tried a second chance by becoming serial entrepreneurs during the period 1993-2007. These serial entrepreneurs must be understood as small businesses' owners, given that the great majority of them own micro or small firms. Over 90% of them either run a limited liability company (*Sociedade por Quotas*) or a single-ownership business (*Empresário em Nome Individual*), and most of them (about 65%) are established in Services.

For each of those 219,462 ex-BOs, we have retained a set of information related to the previous business-ownership experience, namely the time (in years) the individual has survived as BO in the first business, the entry mode in

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[5]A BO was considered to have left the previous business if s/he has definitely exited the BO status in the previous firm. To consider that a definite exit has taken place, we have imposed an absence of the BO from the firm larger or equal to two consecutive years. Accordingly, the identification of ex-BOs' exits had to stop in 2007, as data for 2008 and 2009 were only used to check the presence/absence of each BO in the respective business. Even so, as this study covers reentries occurring between 1993 and 2007, we must restrict the analysis to ex-BOs who have left their prior business until 2006. Previous portfolio BOs were also excluded as we are mainly interested in particular characteristics of the first business ownership experience (which must be unique) when taking into account the non-randomness of serial BOs. Portfolio BOs account for less than 1% of all ex-BOs in the dataset, so their exclusion has no significant impact on our results.

[6]By imposing the upper limit of 50 years old by the time of the exit from the first business we are minimizing the reentries of serial entrepreneurs after attaining the retirement age. Additionally, in order to avoid any bias caused by eventual entrepreneurial experiences occurring before 1986 (thus, not identified in the data), we follow Amaral et al. (2011) and conduct some robustness checks for the sub-sample of ex-BOs who were 30 or younger when leaving their initial business. Even so, they also found that the probability of reentering into entrepreneurship is much higher during the years immediately following the exit from the previous business, also using QP data. So, given that we only consider reentries occurring from 1993 onwards, we believe that those potential left-censoring issues do not pose significant problems in our analysis, as those who were BOs prior to 1986 are estimated to be very unlikely to become serial entrepreneurs so many years later.

the previous business (start-up versus acquisition) and the respective industry. Additional information regarding the size of the firm at the moment of exit, the location of the firm, the ownership structure of the previous business and the exit mode[7] adopted by the BO was also gathered, as those variables may play a role when explaining the decision of reentering into entrepreneurship (i.e., the selection process of serial entrepreneurs).

We have then followed each of those 35,202 serial entrepreneurs over time, since the moment of their reentry until their last record in QP files, which may either correspond to the moment of their exit from the second business, or to the last year of available information in the dataset – right-censored cases (Lancaster, 1990; Jenkins, 2005). Following the same procedures adopted to identify the exit of the BOs from the first business, we have required an absence of each BO from the firm, or from the BO position, larger or equal to two consecutive years in order to identify serial BOs' exit year.

3.3   Econometric Model: Specification and Estimation

As the primary variable of interest is the time spent by serial BOs in their second business, hazard models were considered. A spell starts when an ex-BO becomes a serial entrepreneur. The duration of that spell corresponds to the

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[7]Regarding the exit mode followed by BOs in their first experience, QP dataset allows us to distinguish those who have left by closing down the firm from those who have exited by transferring the business to others. However, despite some studies associate an exit by dissolution to failure and an exit by ownership transfer to a more successful entrepreneurial experience (e.g., Stam et al., 2008; Amaral et al., 2011; Nielsen and Sarasvathy, 2011), we cannot ensure that this was actually the case, as QP does not provide financial data at the firm-level. Actually, as Amaral et al. (2011: 7) also recognize, an unsuccessful entrepreneurial experience may be understood as the failure to attain or exceed a performance threshold required by the entrepreneur to keep the business running (Gimeno et al., 1997; McCann and Folta, 2012), which does not necessarily indicate that the business is economically unviable. Consequently, some businesses may be transferred to other entrepreneurs with a lower performance threshold. Accordingly, we do not associate more (un)successful experiences to any of these particular exit modes and we use the information on BO's exit mode from the first business just as a control variable when studying individuals' reentry decisions.

time elapsed until the exit of the individual from this second entrepreneurial experience. Single-spell duration data were hence obtained by flow sampling. The final dataset was constructed in a continuous survival time format in order to estimate the continuous time duration models, controlling for individuals' selection bias, proposed by Boehmke et al. (2006).

We started by testing the suitability of semi-parametric and several parametric survival models (see, for instance, Lee and Wang, 2003; Jenkins, 2005; Cleves et al., 2010) accounting as well for individual-level unobserved heterogeneity, which may produce biased results when ignored (Hougaard, 1995; Jenkins, 2005). All the estimated models were evaluated and compared in terms of their Log-Likelihood, Akaike Information Criteria (AIC) and Cox-Snell residuals.[8] According to these initial tests, Weibull proportional hazard model was found to provide a very satisfactory fit to the data.

In order to have a first idea on potential learning by doing effects, we started by estimating our "Naïve Weibull model" (as in Boehmke et al., 2006), without taking into account self-selection issues. Formally, for each serial BO i, the probability of exit at time t_j, $j = 1, 2, \ldots$, given survival until then, can be defined as

$$h(t_{ij}|\theta_i, E_i, X_i) = \theta_i p \exp(E_i'\beta_1 + X_i'\beta_2)t^{p-1}\varepsilon_{ij}, \tag{1}$$

where θ_i corresponds to the time invariant individual-level unobserved heterogeneity term (e.g., individual's ability); p is a shape parameter determining the duration dependence of the hazard rates (being positive (negative) whenever p is higher (lower) than 1); E_i is the vector of entrepreneurial experience measures; X_i is a vector of individual and firm time-invariant characteristics, measured at reentry; β_1 and β_2 are vectors of unknown parameters to be estimated; and ε_{ij} is the error term. The parameters of interest related to potential learning by doing effects are those included in β_1.

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[8]Conventional wisdom (e.g., Cleves et al., 2010) suggests that the best-fitting model is the one with the largest Log-Likelihood and the smallest AIC value.

However, this naïve analysis of serial entrepreneurs' performance may be biased if there is significant self-selection in the sample of serial BOs. As previously exposed, this problem arises because the outcome of interest – $h(t_{ij}|\theta_i, E_i, X_i)$ – is only observed for those who have become BOs for a second time. So, formally, we have the following two-equation model:

$$h(t_{ij}|\theta_i, E_i, X_i) = \begin{cases} \theta_i p \exp(E_i'\beta_1 + X_i'\beta_2)t^{p-1}\varepsilon_{ij} & \text{if } y_i^* > 0 \\ - & \text{if } y_i^* \leq 0 \end{cases} \qquad (2)$$

$$c_i = \begin{cases} 1 & \text{if } y_i^* > 0 \\ 0 & \text{if } y_i^* \leq 0 \end{cases} \qquad (3)$$

where $y_i^* = \delta_0 + Z_i'\delta_1 + u_i$ represents a latent variable measuring the difference in the utility (or profit) between reentering and not reentering into entrepreneurship, and c_i is the corresponding observable realization of reentry decision. Self-selection becomes a problem whenever the error terms of both equations are significantly correlated, which means that there might be factors affecting the survival of serial BOs in their second business that also affected their decision of reentering and starting a second entrepreneurial experience.

In order to control for these effects, we use the estimator developed by Boehmke et al. (2006) to estimate a Weibull duration model with selection. Following the logic of existing models for non-random sample selection, this method allows us to model simultaneously both processes – the selection of individuals into serial entrepreneurship and their survival while serial entrepreneurs. The errors of both equations are allowed to be correlated according to a bivariate exponential distribution. Right-censored durations are also accommodated by this method.

The vector of variables included in the selection equation covers some ex-BO's characteristics (gender and education), a set of specificities related to the previous business owned by each individual (location, industry, exit mode

and ownership structure), as well as the status of each individual in the labor market before transiting.[9]

Finally, to overcome potential identification problems, we use as exclusion restriction a variable that, to some extent, proxies individual's risk aversion and entrepreneurial spirit – the age at which each individual became a business-owner for the first time. We may expect that individuals entering entrepreneurship at a younger age are less risk-averse and more entrepreneurial by nature.[10] Consequently, we may also expect that those individuals will be more likely to reenter into entrepreneurship and become serial entrepreneurs later on. In contrast, the age at which individuals became entrepreneurs for the first time, in itself, is not expected to influence the performance while serial entrepreneurs, after controlling for the accumulated experience as BOs and other specificities of previous entrepreneurial experience, as well as individuals' unobserved characteristics.

The lack of more detailed information at the individual-level – for instance regarding individuals' wealth or access to financial resources – unfortunately prevents us to use other suitable exclusion restrictions. Even so, the variable under consideration may also be a proxy for individuals' income – at younger ages, individuals' wealth is more likely to be lower.[11] Cabral and Mata (2003)

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[9]Regarding the individuals' status in the labor market before reentering as serial entrepreneurs, QP data allow us to identify whether or not the individual has been in paid employment after leaving the first entrepreneurial experience. In QP dataset, whenever an individual is temporarily absent from the annual records, we cannot be sure whether s/he is unemployed, self-employed, out of the labor force or whether s/he transited to the public sector. For this reason, instead of controlling for unemployment spells occurring in between the two entrepreneurial experiences – which cannot be accurately identified – we alternatively control for ex-BOs' transitions into paid employment in the selection equation.

[10]Occupational choice models drawing upon Knight's (1921) notion that the individual responds to the risk-adjusted relative earnings opportunities in both paid employment and self-employment corroborate this expected effect of individual's age (see, for instance, Rees and Shah, 1986). More recent studies have been confirming that a successful entrepreneur needs to be highly adaptable – i.e., one needs to be able to learn new skills, to adjust to new environments and to handle unexpected situations. In general, younger people are more adaptable, and adaptability decreases with age, so younger individuals are normally more likely to become entrepreneurs than older ones (Liang, 2011).

[11]This is supported by the well-established "lifecycle hypothesis of saving", developed

precisely found that entrepreneurs' age is a very good proxy for liquidity constraints, as entrepreneurs become wealthier as they grow older.

In this regard, and from the point of view of the lifecycle theory of entrepreneurship (see Stangler and Spulber, 2013; Spulber, 2014), the decision of becoming an entrepreneur may be understood as a form of asset accumulation that involves an opportunity cost, especially at younger ages when human capital and financial assets may be more limited. Accordingly, if those individuals becoming nascent entrepreneurs at younger ages are also more prone to engage in serial entrepreneurship – albeit their assets are, on average, lower – this will confirm that this variable may be a very satisfactory proxy for individuals' risk aversion and entrepreneurial spirit. We still perform several robustness checks in order to show that our results are consistent and are not affected by this limitation in using alternative exclusion restrictions.

4   Empirical Results

4.1   Descriptive statistics

As a starting point, we provide a simple comparison of the performance in the first entrepreneurial experience between individuals who decided to reenter and became serial entrepreneurs, and those who did not. Figure 1 depicts the distribution of BOs' survival time in the first business for each of these sub-samples. It clearly shows that non-serial BOs had lower survival rates (more than 60% of them only survived in the first business for one year), while serial BOs had a relatively better performance in the previous business, by surviving for longer periods on average. This may be a first signal to suspect that, actually, serial BOs are not a random sample of ex-BOs.

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from the seminal theories by Modigliani and Brumberg of consumer expenditure.
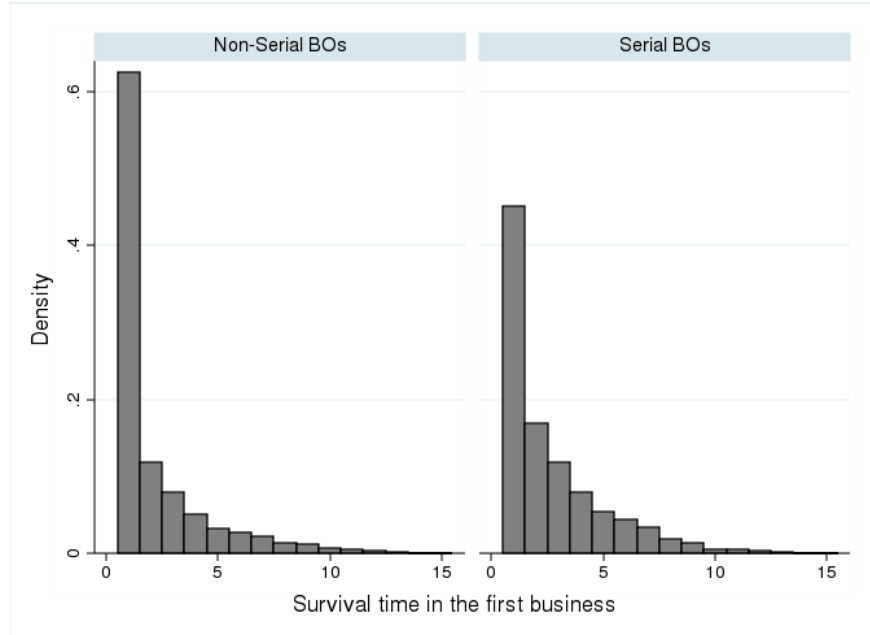
Fig.1. Comparative distribution of BOs' survival time (in years) in the first business (All ex-BOs, Portugal, 1992-2006)

Focusing in particular on serial entrepreneurs, we also compare their performance in the first and second businesses. Unconditionally, without controlling for any observed or unobserved characteristics of serial BOs and their firms, Figure 2 compares the estimated survivor function of serial entrepreneurs in the two experiences, using Kaplan-Meier (KM) estimator (Kalbfleish and Prentice, 1980). In both cases, the unconditional probability of an individual surviving as BO beyond time t was thus computed as follows:

$$\widehat{S}(t_j) = \prod_{j=t_0}^{t} (1 - \frac{d_j}{n_j}), \tag{4}$$

where d_j corresponds to the number of exits in each time interval and n_j is the total number of BOs at risk of exit. Table 1 provides a more detailed comparison of serial BOs' unconditional survival rates according to the similarity of the industries where both businesses were developed.

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The results clearly suggest that serial BOs performed better in their second attempt than in the first one, by persisting for longer periods as BOs in the firm. In the first business-ownership experience (i.e., while novice entrepreneurs), over 45% of BOs exited after one year in the business and only 13% of BOs persisted after five years since their entry. Comparing the performance of the same individuals in their second business-ownership experience (i.e., while serial entrepreneurs), the comparable statistics show that 26% of BOs only survived for one year in the business, and 41% of BOs remained in the business five years later. The median survival time was just two years in their first experience, and four years in the second try.
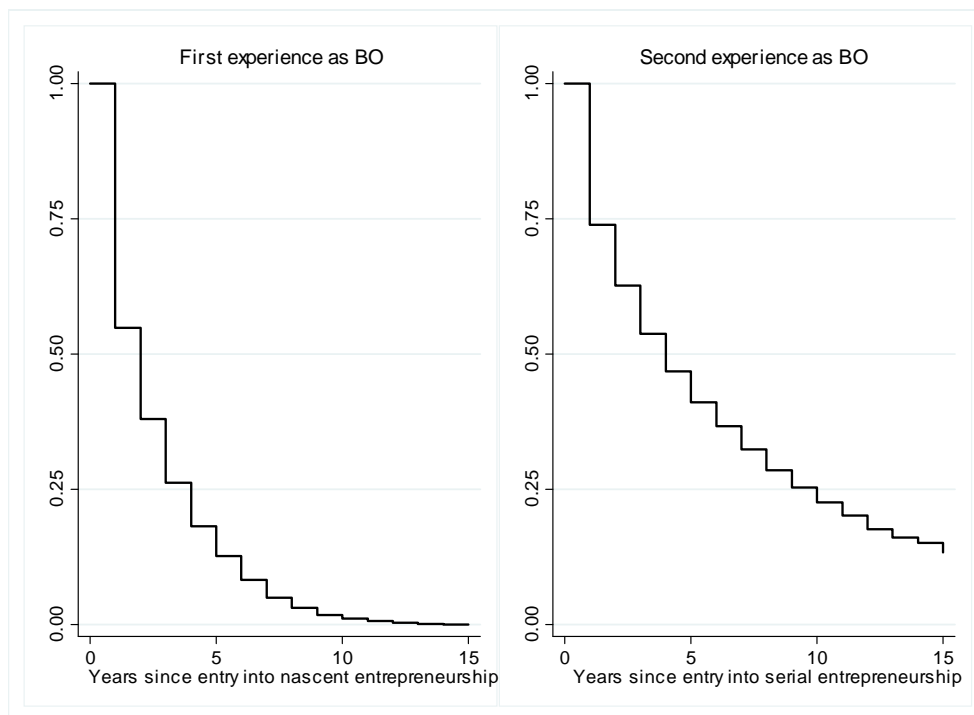
Fig.2. Comparative KM survivor functions in the first and second entrepreneurial experiences (All serial entrepreneurs, Portugal, 1993-2007)

Table 1 additionally shows that serial entrepreneurs who reentered the same industry where they operated in the past performed even better than

the average, presenting higher survival rates, which seems to suggest that industry-specific experience has also played a role on serial BOs' endurance.[12] Overall, 13% of serial BOs remained in their second business for 15 years or more. For those who stayed in the same industry, the comparable survival rate was 14.3%, being somewhat lower for those who tried their luck in a different industry (11.3%).

Table 1. Comparative survival rates in the first and second business (Portugal, 1993-2007)

Years since entry	Serial BOs reentering the same industry (N=20,997)		Serial BOs reentering a different industry (N=14,205)	
	First Business	Second Business	First Business	Second Business
1	0.5672	0.7576	0.5199	0.7097
2	0.3959	0.6503	0.3547	0.5905
3	0.2742	0.5634	0.2434	0.4986
4	0.1904	0.4930	0.1681	0.4303
5	0.1322	0.4332	0.1180	0.3758
6	0.0856	0.3882	0.0789	0.3325
7	0.0500	0.3437	0.0476	0.2939
8	0.0309	0.3019	0.0312	0.2584
9	0.0169	0.2687	0.0171	0.2282
10	0.0117	0.2394	0.0106	0.2053
11	0.0066	0.2143	0.0056	0.1829
12	0.0031	0.1873	0.0025	0.1592
13	0.0009	0.1700	0.0011	0.1466
14	0.0002	0.1592	0.0003	0.1368
15	0.0000	0.1430	0.0000	0.1127

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[12]Given some changes in the classification of economic activities (in 1995 and 2007), we have standardized this classification for every year according to the International Standard Industrial Classification of economic activities (Rev.2). A list of the 2-digit industries can be found in Table A.I, in the Appendix.

In summary, this unconditional analysis points out that serial entrepreneurs performed relatively better in their second round, especially if they tried their luck again in the same industry. Overall, these first results are in line with the general agreement that there is a positive relationship between past entrepreneurial experience and future entrepreneurial performance. Whether this result has arisen because some learning by doing has actually taken place from one experience to the other still remains unanswered.

Finally, in Table 2, we report some comparative statistics for serial entrepreneurs who have survived and those who exited their second business during the period under analysis. The variables listed in Table 2 correspond to the vector of variables X_i to be included in the estimation of duration models previously described. Individual and firm-level characteristics are measured by the time of serial entrepreneurs' entry.

The data reveal that those who survived in the second business had also persisted for relatively longer periods in the first entrepreneurial experience. Survivors were also, on average, quite more educated than those who have left the second firm. Besides, the former were less frequently located in urban centers and restarted, on average, at a relatively smaller scale.

Table 2. Descriptive statistics (means) for serial BOs, by exit decision
(Portugal, 1993-2007)

	All serial BOs (N=35,202)	Survive (N=13,540)	Exit (N=21,662)
Specificities of the first entrepreneurial experience			
Cumulative years as BO	2.698	3.079	2.460
Start-up experience (%)	0.493	0.495	0.491
Experience in the same industry (%)	0.596	0.613	0.586
Years elapsed between experiences	3.377	3.709	3.169
Individual-level characteristics			
Male (%)	0.748	0.758	0.741
Age (years)	39.30	39.74	39.03
Less than 9 years of schooling (%)	0.491	0.491	0.492
9 years of schooling (%)	0.159	0.140	0.170
12 years of schooling (%)	0.209	0.213	0.206
College education (%)	0.141	0.156	0.132
Firm-level characteristics			
Firm size at reentry	1.480	1.432	1.509
Urban location (%)	0.413	0.399	0.421
Shared ownership (%)	0.439	0.439	0.438
Primary sector (%)	0.020	0.022	0.018
Manufacturing (%)	0.162	0.154	0.168
Energy & Construction (%)	0.169	0.172	0.167
Services (%)	0.649	0.652	0.647
Reenter in a year of crisis (%)	0.098	0.093	0.101

Notes: "Start-up Experience" equals 1 if the individual has established a start-up firm in the first experience and 0 if s/he has acquired an existing firm. "Firm size at reentry" corresponds to the initial employment in the firm, in logs."Urban location" equals 1 if the firm is located in the districts of Lisbon or Porto, 0 otherwise. "Reenter in a year of crisis" equals 1 if the individual reentered in entrepreneurship in 1993 or 2003, 0 otherwise.

4.2 Naïve Weibull Estimation Results

Table 3 presents the results from the estimation of the "naïve" Weibull proportional hazard model – i.e., without taking into account, for now, potential problems of selection bias in the sample of serial entrepreneurs. Given that a significant number of serial BOs decide to share the ownership of their second business with other BO(s) (Table 2), all estimations are weighted by the number of BOs in the firm at the moment of entry.

Empirical results obtained from the estimation of specification (1) suggest that the experience acquired in the first business significantly reduces the hazard rate in the second business. Those who survived longer in the first business and those who try again in the same industry are found to be less likely to exit in their second entrepreneurial experience.

However, the longer the time elapsed since the first entrepreneurial experience, the higher the exit risk in the second experience, suggesting that potential learning by doing effects tend to vanish over time (see also Parker, 2012). Accordingly, in specification (2), we allow the effect of cumulative experience as BO and industry-specific experience to vary over the time elapsed since the exit from the first business. The results confirm that both variables reduce serial entrepreneurs' exit risk, though temporarily. The negative effect exerted by the cumulative experience as BO on exit rates is found to disappear four years after leaving the first business, while the survival advantages gained through industry-specific knowledge extinguish after eight years.

Regarding the experience as a start-up founder, results show that those who have established a venture from scratch in the past are actually less likely to survive than those who have, alternatively, acquired an existing firm. Despite starting a firm requires – and allegedly helps an entrepreneur to acquire and enhance – a wide range of skills (e.g., van Gelderen et al., 2005; Zhang, 2011), it is also during business infancy that the greatest challenges are posed to the business-owner – the so-called liability of smallness and newness, just to name a few (e.g., Brüderl et al., 1992).

Table 3. Estimation results from the Weibull proportional hazard model
(Portugal, 1993-2007)

	(1)	(2)
Specificities of the first entrepreneurial experience		
Cumulative years as BO	-0.0151***	-0.0337***
	(0.0052)	(0.0068)
Start-up experience	0.0982***	0.0970***
	(0.0208)	(0.0208)
Experience in the same industry	-0.2290***	-0.3721***
	(0.0217)	(0.0303)
Years elapsed between 1st and 2nd experiences	0.0407***	
	(0.0044)	
Cumulative years as BO*Years elapsed		0.0073***
		(0.0022)
Experience in the same industry*Years elapsed		0.0434***
		(0.0071)
Individual-level characteristics		
Male	-0.1212***	-0.1231***
	(0.0240)	(0.0239)
Age	-0.0883***	-0.0876***
	(0.0117)	(0.0117)
Age squared/100	0.1171***	0.1165***
	(0.0149)	(0.0149)
9 years of schooling	-0.0415	-0.0411
	(0.0294)	(0.0294)
12 years of schooling	0.1731***	0.1723***
	(0.0280)	(0.0280)
College education	0.1258***	0.1275***
	(0.0333)	(0.0332)
Firm-level characteristics		
Firm size at reentry	0.0043	0.0039
	(0.0124)	(0.0124)
Urban location	0.0852***	0.0846***
	(0.0211)	(0.0211)
Shared ownership	-0.1254***	-0.1274***
	(0.0217)	(0.0216)

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Table 3. Estimation results from the Weibull proportional hazard model

(Portugal, 1993-2007)	(1)	(2)
Firm-level characteristics		
Primary Sector	-0.1778**	-0.1772**
	(0.0800)	(0.0868)
Energy & Construction	0.0826**	0.0868**
	(0.0359)	(0.0359)
Services	0.0415	0.0452
	(0.0295)	(0.0294)
Macroeconomic environment		
Reenter in a year of crisis	0.0073	0.0119
	(0.0349)	(0.0348)
Constant	-0.2348	-0.1159
	(0.2298)	(0.2295)
Number of observations	35,202	35,202
p (duration dependence)	1.8233***	1.8212***
Log Likelihood	-47,926.1	-47,919.4
Theta	5.4457***	5.4164***

Notes: *, **, and *** denote significant at 10%, 5% and 1% levels, respectively. Huber-White robust standard errors in parentheses. Both specifications include an individual-level inverse gaussian distributed unobserved heterogeneity term. Theta corresponds to the variance of this term. "Less than 9 years of schooling" is the base category for individuals' education. Manufacturing is the base category for sector.

As a result, not only may it be more difficult to learn under more unstable experiences, as also few business are identical – possibly favoring the accumulation of business-specific rather than general entrepreneurial learning (Chen, 2013) –, so that learning possibilities are modest and difficult to be transferred across different experiences (Frankish et al., 2012), which may explain the results found for start-up experience. In alternative, the choice of the entry mode may rather reflect individuals' attitude towards risk, more than an opportunity to learn. Establishing a start-up firm, instead of acquiring an existing business, may be a sign of low risk aversion. However, while recent

research has been supporting a positive correlation between risk attitudes and entrepreneurial entry decision, the effects on survival are not straightforward, as high risk attitudes may increase exit rates (e.g., Caliendo et al., 2010).

Regarding the several individual-level characteristics taken into account in our estimations, results confirm that men survive longer as serial BOs than women, and that serial BOs' age exerts an U-shaped effect on hazard rates. Higher levels of education seem to be associated with greater exit rates, which may be related to the higher opportunity costs that highly educated individuals probably have by remaining in the business, as they may be more likely to find more satisfactory alternatives (in the form of less risk-taking and better remunerated options) in the labor market (Gimeno et al., 1997; Georgellis et al., 2007), particularly after their previous experience as BOs (see Baptista et al., 2012).

Being located in an urban center is found to increase exit rates, probably due to the greater competition characterizing large urban regions (Stearns et al., 1995). As expected, sharing the ownership of the second business with other BO(s), by reducing the risk and potentially increasing the sources of capital and knowledge, is found to reduce entrepreneurs' exit rates. Overall, reentries occurring in times of crises seem not to significantly affect the persistence of serial entrepreneurs.

Finally, our results show that serial entrepreneurs' exits present positive duration dependence (the estimated value for p is higher than 1), which means that BO's exit becomes more likely as time goes by. However, this result is mainly capturing the relatively higher and increasing hazard rates suffered during the initial years in business, when the liabilities of newness and smallness play a particularly significant, and thus dominant, role. If, instead, the baseline hazard rate was parameterized according to a non-linear distribution, serial BOs' exit rates would rather show an inverted U-shaped dependence, as expected.[13]

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[13]Alternative estimations of a loglogistic AFT model showed that the estimated hazard

4.3 Self-selection and serial entrepreneurs' persistence

We now take into account the possibility that some unobserved factors influence the decision of reentering into entrepreneurship, making serial entrepreneurs a non-random group of ex-BOs. Before analyzing this issue, we briefly characterize ex-BOs according to their reentry decision (see Table A.II in the Appendix).

The data show that those who became serial entrepreneurs correspond to i) those who survived for longer periods in the first business; ii) those with more experience as start-up founders; iii) those with higher levels of education on average; and iv) those who owned larger firms at the time of exit from the first business. All these characteristics shown by serial BOs may also be (positively) correlated with their unobserved characteristics, namely their innate ability or entrepreneurial talent. Accordingly, it becomes crucial to understand whether the unobserved factors that may have influenced the decision of reentering into entrepreneurship were also correlated with the performance shown by serial entrepreneurs after their reentry.

Table 4 presents the results obtained from the estimation of specifications (1) and (2), now using the two-staged Full Information Maximum Likelihood Weibull duration model with selection developed by Boehmke et al. (2006).[14] Over again, the estimations are weighted by the number of BOs in the firm at entry. The results for the estimated selection equation (reported in Table A.III in the Appendix, first column) confirm that those who established a start-up venture before and those who have survived for a longer period in the first business are more likely to try again and become serial entrepreneurs.

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rates would be increasing during the first three to four years of the BO in the firm, starting to decrease thereafter. The remaining results were not significantly different from those obtained with the Weibull model.

[14]The estimations were performed with the program DURSEL (version 2.0) for Stata, for right-censored survival time data, written by F. Boehmke, D. Morey and M. Shannon (available at: http://myweb.uiowa.edu/fboehmke/methods.html) (see also Boehmke et al., 2006).

Table 4. Estimation results from the Weibull proportional hazard model with selection (Portugal, 1993-2007)

	(1)	(2)
Specificities of the first entrepreneurial experience		
Cumulative years as BO	-0.0003	-0.0156***
	(0.0041)	(0.0053)
Start-up experience	0.0918***	0.0912***
	(0.0172)	(0.0172)
Experience in the same industry	-0.1475***	-0.2489***
	(0.0175)	(0.0250)
Years elapsed between 1st and 2nd experiences	0.0315***	
	(0.0034)	
Cumulative years as BO*Years elapsed		0.0058***
		(0.0016)
Experience in the same industry*Years elapsed		0.0304***
		(0.0054)
Individual-level characteristics		
Male	-0.0659***	-0.0674***
	(0.0194)	(0.0194)
Age	-0.0640***	-0.0636***
	(0.0097)	(0.0097)
Age squared/100	0.0836***	0.0836***
	(0.0121)	(0.0121)
9 years of schooling	-0.0249	-0.0235
	(0.0235)	(0.0234)
12 years of schooling	0.1253***	0.1259***
	(0.0228)	(0.0228)
College education	0.0915***	0.0935***
	(0.0268)	(0.0268)
Firm-level characteristics		
Firm size at reentry	0.0036	0.0029
	(0.0116)	(0.0116)
Urban location	0.0585***	0.0583***
	(0.0173)	(0.0173)
Shared ownership	-0.0892***	-0.0910***
	(0.0174)	(0.0174)

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Table 4. Estimation results from the Weibull proportional hazard model with selection (Portugal, 1993-2007)

	(1)	(2)
Firm-level characteristics		
Primary sector	-0.1333**	-0.1321**
	(0.0627)	(0.0627)
Energy & Construction	0.0606**	0.0641**
	(0.0288)	(0.0288)
Services	0.0243	0.0270
	(0.0246)	(0.0246)
Macroeconomic environment		
Reenter in a year of crisis	0.0083	0.0126
	(0.0267)	(0.0267)
Constant	-1.2500***	-1.1553***
	(0.1927)	(0.1925)
No. of observations	219,462	219,462
Uncensored Obervations	35,202	35,202
p (duration dependence)	1.1745***	1.1733***
Log Likelihood	-179,835.4	-179,833.4
Rho (error correlation)	-0.1421***	-0.1422***

Notes: *, **, and *** denote significant at 10%, 5% and 1% levels, respectively. Huber-White robust standard errors in parentheses. "Less than 9 years of schooling" and Manufacturing are the base categories for individuals' education and sector, respectively.

The estimations also confirm that those who became BOs for the first time at younger ages are also more likely to become serial business-owners. In addition, higher levels of education and a larger size of the previous business, among other factors, are also associated with a greater likelihood of reentering into entrepreneurship. Those who (re)entered into paid employment after leaving their first entrepreneurial experience, in turn, are found to be significantly less likely to reenter into entrepreneurship, as they may have better opportunities in the labor market and, for this reason, higher opportunity costs of reentering entrepreneurship (Baptista et al., 2012).

These second results attest that selection should not be overlooked, as a negative and significant correlation is found between the error terms of the two equations (see the estimated values for *rho* at the bottom of Table 4). In other words, there are unobserved factors that positively affect reentry into entrepreneurship and simultaneously decrease subsequent hazard rates. This finding is in line with the theories predicting that those involved in serial entrepreneurship correspond to individuals with higher-than-average innate ability and skills (Holmes and Schmitz, 1990; Plehn-Dujowich, 2010).

Additionally, accounting for serial entrepreneurs' self-selection has important implications on the conclusions derived from potential learning by doing effects. First, results now show that the cumulative experience acquired in the first business does not exert any significant effect on serial BOs' hazards. The significant negative effects previously found are now shown to be irrelevant (first specification) or vanishing in a very short period of time (two years after leaving the previous business, according to the second specification).

The effects of industry-specific experience are also found to be overestimated when self-selection is ignored – those who tried their luck in the same sector have actually around 14% $(1 - exp(-0.1475) = 0.1371)$ lower hazard rates than those who moved to a different sector, instead of 20% $(1 - exp(-0.2290) = 0.2047)$ lower hazard rates as suggested by the "naïve" Weibull model (specification (1) from Table 3). Even so, this comparative advantage seems to vanish about eight years after leaving the first business. Figure 3 compares the marginal effects of both measures of entrepreneurial experience, by years elapsed between the first and the second business ownership experiences, obtained from both models – i.e., with and without taking into account serial BOs' self-selection. The overestimation of learning by doing effects when self-selection is ignored is clear-cut in both cases.

The presence of significant self-selection also changes the magnitude of almost all coefficients, which were considerably overestimated in the "naïve" Weibull model. The same is applicable to the duration dependence – serial BOs' hazards are found to increase over time, but at a much lower rate when

accounting for self-selection (the parameter p is now lower, though still higher than 1). The constant term also decreases considerably when correcting selection bias, confirming that exit rates of serial entrepreneurs were artificially increased in previous naïve Weibull models. In sum, once we account for the decision of reentering into entrepreneurship, the estimated exit rates of serial entrepreneurs decrease, since the negative error correlation biases the baseline hazard rates upwards, when ignored.

Overall, our results show that neglecting self-selection of serial entrepreneurs may produce biased conclusions about learning by doing effects that can be transmitted from past entrepreneurial experiences to the current ones. The positive association between prior experience and the performance of serial BOs in subsequent entrepreneurial attempts seems to be mainly due to selection on ability, rather than the result of learning by doing. Some learning by doing is found only through industry-specific experience (see also Frankish et al., 2012; Chen, 2013). Otherwise, learning effects seem to be really modest.
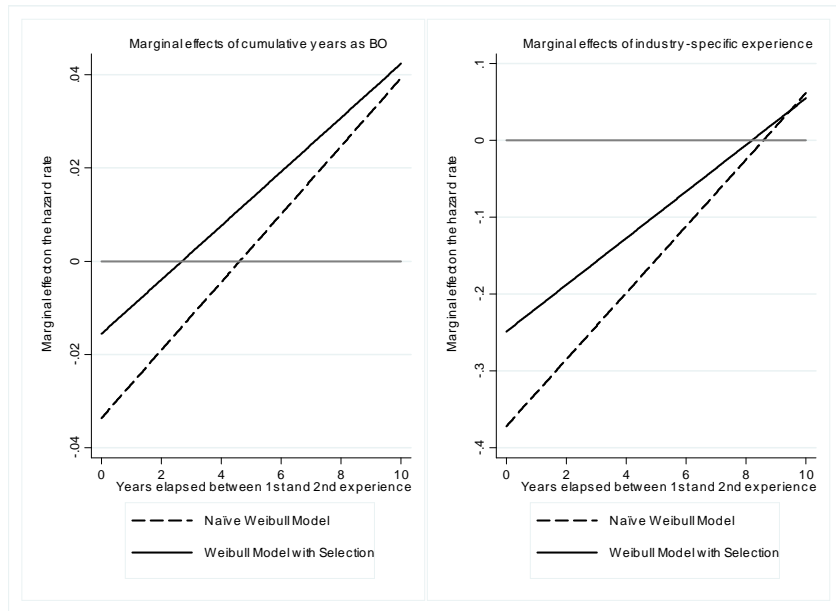
Fig. 3. Marginal effects of entrepreneurial and industry-specific experience, by years elapsed between experiences (All serial BOs, Portugal, 1993-2007)

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5 Robustness Checks

5.1 Estimation results for the sub-samples of start-up serial entrepreneurs and young ex-BOs

As a first robustness test, we estimate both models (the naïve model and the model with selection) for the sub-sample of entrepreneurs entering via start-up. On the one hand, entrepreneurial activity is more often associated to new venture creation, so individuals who have established a start-up firm from scratch in both business-ownership experiences may be considered to be the most entrepreneurial ones – at least regarding the risk-taking and the comprehensiveness of entrepreneurial steps they were exposed to. On the other hand, start-up entrepreneurs may be driven by different motivations and may have a different post-entry behavior than those entering by acquisition (e.g., Rocha et al., 2013). Finally, our previous results showed that those with a past experience as a start-up founder have actually higher hazard rates in the second venture than those without such experience, suggesting that learning from a past founding experience may be harder than expected. For these reasons, we test the consistency of our results by repeating the analysis after excluding ex-BOs who entered the first entrepreneurial experience through acquisition, as well as serial entrepreneurs acquiring an existing business in their second attempt. The final sample is composed by 81,587 ex-BOs, out of which 9,479 became serial entrepreneurs by establishing, again, a new start-up venture.

Additionally, in order to ensure that our results are not biased by potential left-censoring issues related to eventual entrepreneurial experiences prior to 1986, we also re-estimate both models for the sub-sample of ex-BOs who left their prior business at the age of 30 or younger, as in Amaral et al. (2011).[15]

Table 5 summarizes the results obtained from the estimation of our pre-

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[15]We report the results obtained from the sub-sample of young start-up serial BOs. The results obtained for all younger ex-BOs, regardless their entry mode in the first and second experience, were not qualitatively different from those here presented.

ferred specification for both sub-samples. The correlation between the error terms remains negative and highly significant in both cases. For start-up serial BOs, both sources of learning by doing (i.e., the cumulative experience as BOs and industry-specific experience) are confirmed to be temporary and overestimated when self-selection is ignored. Figure 4 illustrates these results. For younger BOs, industry-specific experience seems to be the only significant source of learning by doing. However, over again, such learning effects are overestimated under the naïve model, as Figure 5 makes clear.

Table 5. Estimation results for particular sub-samples − Naïve Model and Weibull model with selection (Portugal, 1993-2007)

| | Start-up | | Young Start-up | |
| | Serial BOs | | Serial BOs | |
	Naïve	Selection	Naïve	Selection
Cumulative years as BO	-0.0676***	-0.0433***	-0.0164	0.0155
	(0.0140)	(0.0109)	(0.0646)	(0.0538)
Exper. same industry	-0.3677***	-0.2437***	-0.4693***	-0.2936**
	(0.0592)	(0.0500)	(0.1294)	(0.1068)
Cumul. years as BO*Years elap.	0.0108**	0.0093***	0.0114	0.0096
	(0.0047)	(0.0034)	(0.0149)	(0.0113)
Exper. same indus.*Years elap.	0.0412***	0.0277**	0.0858***	0.0553***
	(0.0144)	(0.0111)	(0.0281)	(0.0211)
No. Observations	9,479	81,587	2,011	16,404
Uncensored observations	-	9,479	-	2,011
p (duration dependence)	1.8539***	1.1914***	1.8241***	1.1806***
Log Likelihood	-13,049.8	-51,941.3	-2,860.4	-10,968.3
Rho (error correlation)	-	-0.1319***	-	-0.1397***

Notes: *, **, and *** denote significant at 10%, 5% and 1% levels, respectively. Huber-White robust standard errors in parentheses.
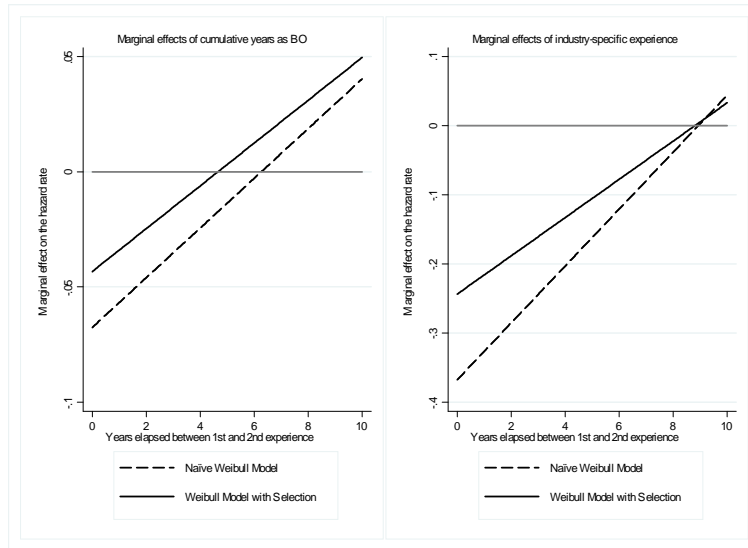
Fig. 4. Marginal effects of cumulative years as BO and industry-specific experience, by years elapsed between first and second experience (Start-up Serial Entrepreneurs, Portugal, 1993-2007)
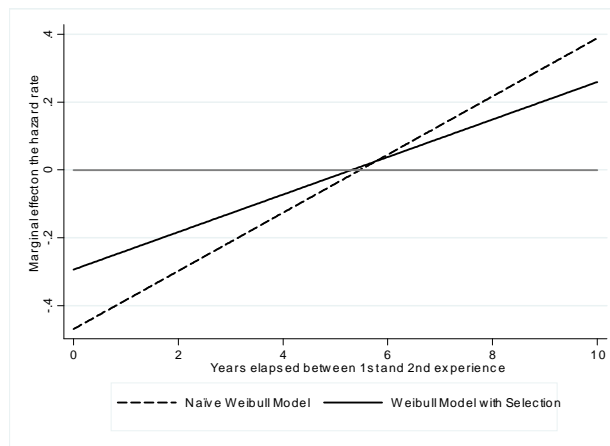
Fig. 5. Marginal effects of industry-specific experience, by years elapsed between first and second experience (Young Start-up Serial Entrepreneurs, Portugal, 1993-2007)

5.2 Estimating the person-specific effect of ex-BOs

As a second robustness check, and in order to confirm that serial entrepreneurs are an above-average ability group of ex-BOs, we have tried to obtain a proxy for workers' unobserved ability based on ex-BOs' past histories in the labor market while paid employees. For that purpose a fixed effects approach was used with the aim of estimating the person-specific effect that measures the returns to time-invariant observed and/or unobserved characteristics.

Thus, using the QP worker files for the 1986-2007 period (which cover more than 6 million workers), we have followed the approach of Carneiro et al. (2012) in order to estimate a two high-dimensional fixed effects wage equation that simultaneously accounts for worker and firm observed and unobserved (permanent) heterogeneity (see also Guimarães and Portugal, 2010). Even if this is not a perfect measure of individuals' unobserved entrepreneurial talent, we believe that it captures in a very satisfactory way those unobserved differences in individuals' innate characteristics that influenced their wages while paid employees in the past. However, it is only possible to estimate those person-specific effects for those with a previous history in paid employment, as no data on wages are available for BOs in QP files.

The wage levels equation controls for individual's age (and its square), tenure (and its square), education, skill level, time dummies, as well as for worker observed/unobserved (permanent) heterogeneity and firm observed/ unobserved (permanent) heterogeneity. This equation was estimated by OLS using a sample of 34,080,042 observations (years*individuals) for the 1986-2007 period.[16]

We were able to estimate the person-specific effect for 97,800 ex-BOs and 18,538 serial BOs.[17] In Table 6, we provide some summary statistics for this

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[16]The dependent variable was defined as the natural log of real hourly earnings. Hourly earnings correspond to the ratio between total regular payroll (base wages and regular benefits) and the total number of normal hours worked in the reference period. The wages were deflated using the Consumer Price Index (CPI). Outliers were removed from the estimations – i.e., the 1% with highest and lowest real hourly wages (in logs), in each year.

[17]For the remaining entrepreneurs, it was not possible to obtain a measure of their returns

variable, comparing serial BOs with non-serial BOs, overall and across some sub-samples. On average, serial BOs exhibit a larger person-specific effect than non-serial BOs, regardless the sub-sample considered. The differences are always statistically significant at the 1% level.

Table 6. Estimated person-specific effect for serial and non-serial BOs (mean values, N=97,800 ex-BOs)

	All ex-BOs	Males	Females	Start-up BOs
Serial BOs	-0.2185	-0.1832	-0.3286	-0.2190
Non-serial BOs	-0.2906	-0.2440	-0.3728	-0.2785

Figure 6 depicts the kernel density estimates of serial and non-serial BOs' person-specific component of the logarithm of hourly earnings, confirming that serial entrepreneurs are associated to higher returns to time-invariant characteristics (the kernel density function is slightly more shifted to the right for the group of serial BOs), in line with our previous result that they are not a random sample of ex-BOs, but a selection of higher-than-average ability entrepreneurs. A positive and significant correlation of 0.0775 is also found between the person fixed effect and the indicator variable distinguishing those who reentered into entrepreneurship and those who did not.

All these patterns are consistent with the previous finding of a negative error correlation between the error terms of the selection and hazard equations. Moreover, the evidence of a larger return to time-invariant characteristics in paid employment for the group of serial BOs also confirms that they have a relatively higher opportunity cost of leaving the labor market to become entrepreneurs.

In order to confirm this result, we have estimated a wage equation for those ex-BOs with past records in paid employment, prior to their first entry

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to time-invariant characteristics because they were never in paid employment before or due to missing information on their wages.

in entrepreneurship, and included a dummy variable identifying those individuals who, in the future, become serial BOs. The results showed that, even after controlling for a number of individual and job observed characteristics (namely, age and its square,education, tenure and its square, and skill level), time effects and firm fixed effects, those individuals who became serial BOs later on earned about 4.8% higher wages in the past than those who did not reenter in entrepreneurship for a second time. In view of that, if some ex-BOs still become entrepreneurs for a second time instead of returning to paid employment, it is likely that that they actually have some unobserved characteristics as a stronger entrepreneurial behavior/talent, a lower risk aversion and/or a greater taste for independence.
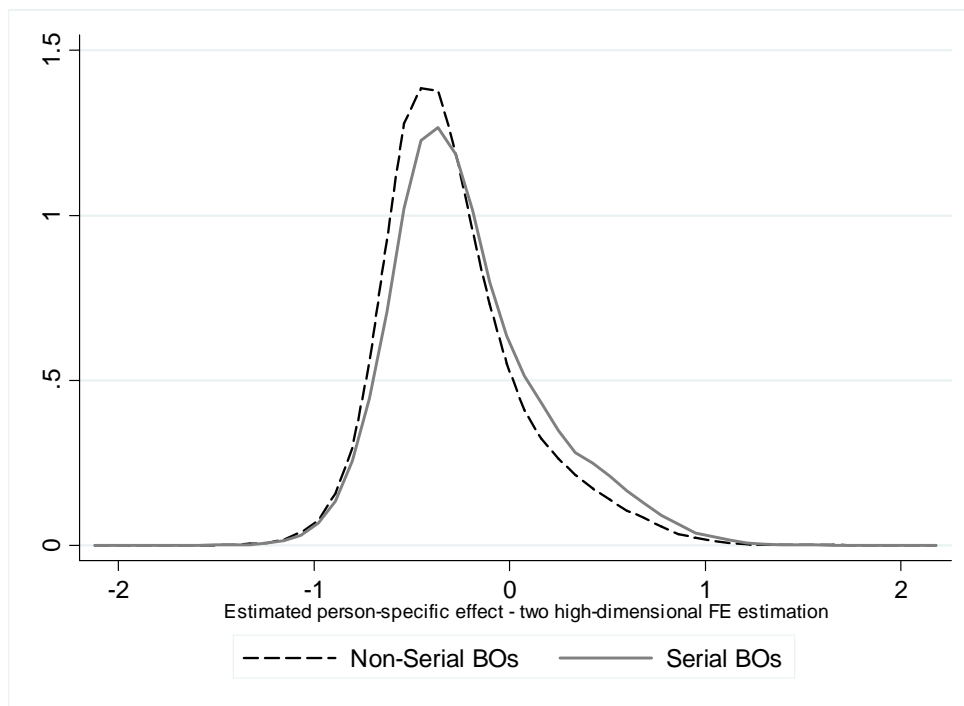
Fig. 6. Kernel density of estimated person-specific effect

Finally, we report in Table 7 some statistics for the performance shown by ex-BOs in the first business across the different percentiles of individuals' fixed

effect distribution. The data suggest that individuals with a larger person-specific effect have survived longer in the first business, though the relationship becomes less evident at the top percentiles.

Table 7. Performance in the first business at different levels of individuals' fixed effect distribution (N=97,800 ex-BOs)

	Individuals' fixed effects distribution (percentiles)				
	10th	25th	50th	75th	90th
Survival time in the 1st business	2.4650	2.4691	2.4810	2.4869	2.4465

Overall, these robustness checks corroborate the idea that the use of variables measuring accumulated entrepreneurial experience to study learning by doing effects among serial entrepreneurs may be misleading if selection issues are ignored. Actually, individuals who survived longer in the first business not only had more time to learn about being entrepreneurs, but also to learn about their own ability. Consequently, those who perceived to have higher ability were also more likely to reenter and become serial entrepreneurs. Disentangling the two effects is empirically challenging, but neglecting these unobserved relationships actually lead to biased conclusions about learning by doing effects arising from accumulated experience, as our results seem to consistently show.

6 Concluding Remarks

The topic of entrepreneurial learning has been nurturing a growing debate in the midst of both scholars and policymakers over the most recent years. Entrepreneurs are believed to accumulate unique knowledge and skills by creating

and running new ventures, and by establishing networks with suppliers, customers and other business-owners. All this know-how accumulated through experience is believed to make serial entrepreneurs more able to run successful ventures than novice (i.e., inexperienced) entrepreneurs.

Nevertheless, if on the one hand, the lack of suitable data has prevented in-depth empirical analyses about entrepreneurial learning for long time, on the other hand, more recent empirical studies addressing these issues have been finding limited support for entrepreneurial learning hypotheses (e.g., Frankish et al., 2012; Parker, 2012). While the significance of learning by doing remains a question, a new debate has been emerging regarding the potential selection bias associated with the reentry of individuals into entrepreneurship. In fact, do entrepreneurs really learn with their past experience or are those who try again a selected sample of higher-than-average ability entrepreneurs? Whether their usual outperformance comes from learning by doing or self-selection according to their own innate ability, thus, remains a pertinent query.

This paper contributes to this debate by using a large longitudinal matched employer-employee dataset that allows us to track individuals and their entrepreneurial experiences over time. We evaluate how previous entrepreneurial experience impacts on serial entrepreneurs' persistence in the second business, exploring a novel empirical strategy based on continuous time duration models that take into account selection bias issues.

Our results seem to confirm that serial entrepreneurs are not a random sample of individuals. Instead, they possess some unobserved characteristics that not only make them more likely to try again as entrepreneurs, as also reduce their exit rates in their second entrepreneurial experience. After correcting this bias in their selection process, the cumulative experience as business-owners exerts no significant persistent effect on their survival in the second business. Besides, the comparative advantages associated with industry-specific experience are found to be overestimated when ignoring self-selection problems.

In short, our study does not offer a strong support for the widespread expectations related to significant entrepreneurial learning. While part of the

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performance shown by serial entrepreneurs may result from the entrepreneurial knowledge acquired in the previous business, especially when the second entrepreneurial try occurs in the same industry, learning by doing effects seem to be less important than self-selection effects. Instead, individuals' unobserved heterogeneity seems to play an essential, and possibly dominant, role.

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Table A.I. Classification of Economic Activities (ISIC-Rev.2, 2-digit)

Primary Sector:
(11) Agriculture and Hunting
(12) Forestry and Logging
(13) Fishing
(21) Coal Mining
(22) Crude Petroleum and Natural Gas Production
(23) Metal Ore Mining
(29) Other Mining

Manufacturing:
(31) Manufacture of Food, Beverages and Tobacco
(32) Textile, Wearing Apparel and Leather Industries
(33) Manufacture of Wood and Wood Products, including Furniture
(34) Manuf. of Paper and Paper Products, Printing and Publishing
(35) Manuf. of Chemicals and Chemical, Petroleum, Coal, Rubber and Plastic Products
(36) Manuf. of Non-Metallic Mineral Products, except Products of Petroleum and Coal
(37) Basic Metal Industries
(38) Manuf. of Fabricated Metal Products, Machinery and Equipment
(39) Other Manufacturing Industries

Energy & Construction Sectors:
(41) Electricity, Gas and Steam
(42) Water Works and Supply
(50) Construction

Services:
(61) Wholesale Trade
(62) Retail Trade
(63) Restaurants and Hotels
(71) Transport and Storage
(72) Communication
(81) Financial Institutions
(82) Insurance
(83) Real State and Business Services
(91) Public Administration and Defense
(92) Sanitary and Similar Services
(93) Social and Related Community Services
(94) Recreational and Cultural Services
(95) Personal and Household Services
(96) International and Other Extra-Territorial Bodies

Table A.II. Descriptive statistics for ex-BOs, by reentry decision (Portugal, 1993-2007)

	All ex-BOs (N=219,462)	Serial BOs (N=35,202)	Non-serial BOs (N=184,260)
Specificities of the first entrepreneurial experience			
Cumulative years as BO	2.288	2.698	2.210
Start-up experience (%)	0.408	0.493	0.391
Individual-level characteristics			
Paid employment after BO (%)	0.302	0.184	0.324
Male (%)	0.667	0.748	0.652
Age (years)	36.86	35.96	37.03
Less than 9 years of schooling (%)	0.527	0.512	0.530
9 years of schooling (%)	0.170	0.168	0.171
12 years of schooling (%)	0.185	0.192	0.183
College education (%)	0.118	0.128	0.116
Characteristics of the first business			
Previous dissolved business (%)	0.285	0.384	0.266
Firm size at exit (in logs)	1.553	1.614	1.542
Urban location (%)	0.416	0.418	0.416
Shared ownership (%)	0.537	0.504	0.543
Primary sector (%)	0.024	0.020	0.025
Manufacturing (%)	0.190	0.189	0.190
Energy & Construction (%)	0.140	0.158	0.137
Services (%)	0.646	0.633	0.648

Notes: The statistics reported are the mean values of each variable, observed at the time of exit from the first business. "Start-up Experience" equals 1 if the individual has established a start-up firm in the first experience and 0 if s/he has acquired an existing firm. "Paid employment after BO" is an indicator variable assuming the value 1 if the individual was registered as paid employee in t-1 or t-2, 0 otherwise (with t corresponding to the year of reentry into entrepreneurship - for those who reentered - or to the last year each individual is observed in the data - for those never reentering into entrepreneurship (right-censored cases)). "Previous dissolved business" equals 1 if the individual has left the first business by dissolving it, 0 if s/he has left by ownership transfer. "Urban location" equals 1 if the first business was located in the districts of Lisboa or Porto, 0 otherwise.

Table A.III. Reentry into entrepreneurship - Estimation results for the selection equation (Portugal, 1993-2007)

	Probit Model		
	All Serial BOs	Start-up Serial BOs	Young Start-up Serial BOs
Specificities of the first entrepreneurial experience			
Cumulative years as BO	0.0352***	0.0043**	0.0662***
	(0.0012)	(0.0020)	(0.0149)
Start-up experience	0.1635***	-	-
	(0.0060)	-	-
Individual-level characteristics			
Age at the entry of the 1st business	-0.0125***	-0.0116***	-0.0098**
	(0.0004)	(0.0007)	(0.0043)
Paid employment after BO	-0.3550***	-0.6125***	-0.6167***
	(0.0063)	(0.0118)	(0.0235)
Male	0.1749***	0.2116***	0.2355***
	(0.0059)	(0.0109)	(0.0235)
9 years of schooling	-0.0115	0.0046	0.0308
	(0.0076)	(0.0136)	(0.0292)
12 years of schooling	0.0049	0.0132	0.0108
	(0.0074)	(0.0133)	(0.0270)
College education	0.0577***	-0.0072	-0.1142***
	(0.0088)	(0.0168)	(0.0371)
Characteristics of the first business			
Previous dissolved business	0.2524***	0.1661***	0.1798***
	(0.0065)	(0.0104)	(0.0220)
Firm size at exit	0.0948***	0.1994***	0.1786***
	(0.0032)	(0.0084)	(0.0159)
Urban location	0.0082	-0.0213**	0.0249
	(0.0055)	(0.0101)	(0.0220)
Shared ownership	-0.3009***	-0.2517***	-0.2481***
	(0.0058)	(0.0103)	(0.0227)
Primary Sector	-0.0196	-0.0580	0.0281
	(0.0193)	(0.0371)	(0.0886)
Energy & Construction	0.0316***	0.0276	-0.0040
	(0.0094)	(0.0171)	(0.0389)

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Table A.III. Reentry into entrepreneurship - Estimation results for the selection equation (Portugal, 1993-2007)

	Probit Model		
	All Serial BOs	Start-up Serial BOs	Young Start-up Serial BOs
Characteristics of the first business (cont.)			
Services	0.0624***	0.0513***	-0.0103
	(0.0076)	(0.0149)	(0.0320)
Constant	-0.5799***	-0.6669***	-1.2906***
	(0.0178)	(0.0326)	(0.1203)
Number of observations	219,462	81,587	16,404
Reentries in serial entrepreneurship	35,202	9,479	2,011
Log Likelihood	-179,833.4	-51,941.3	-10,968.3
Wald χ^2	10,945.1***	3,731.3***	987.0***

Notes: These results correspond to the selection equation of global specifical of Weibull model with selection reported in Tables 4 and 5. *, **, and *** denote significant at 10%, 5% and 1% levels, respectively. Huber-White robust standard errors in parentheses. "Less than 9 years of schooling" and Manufacturing are the base categories for individuals' education and sector, respectively.

Where do spin-offs come from? Start-up conditions and the survival of pushed and pulled spin-offs*

Essay 4

May 29, 2014

Abstract

Although previous research shows that spin-offs are among the most successful firms in an industry, outperforming *de novo* entrants, few studies have considered the heterogeneous nature of corporate spin-offs, as not all spin-offs arise from the identification of a business opportunity. Against this backdrop, this paper aims at understanding how differently pushed (or necessity-based) and pulled (or opportunity-based) spin-offs survive in the market, taking into account a number of start-up conditions where they may differ – namely, the industrial and geographical relatedness to the parent firm, their initial recruitment strategies, and founders' general and specific human capital. The analysis is based on a linked employer-employee dataset for Portugal and covers 50,656 spin-offs entering during the period 1992-2007. Unconditionally, pushed spin-offs are found to survive longer than their pulled counterparts. However, as we control for an increasing number of observed characteristics where these firms differ, their survival gap almost vanishes. We use multivariate decomposition techniques for hazard rate models in order to understand the sources of pushed-pulled differences in exit rates. Our results confirm that a great part of pushed spin-offs' relative survival advantages come from their larger endowments of particular human resources at the time of entry, namely the characteristics and the relative importance of their co-workers at entry, and the human capital endowments of their business-owners.

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1   Introduction

For a long time, corporate spin-offs – commonly defined as start-ups founded by a former employee of an existing firm – were documented to have great comparative advantages and to perform better than *de novo* entrants (Franco and Filson, 2006; Agarwal et al., 2011; Muendler et al., 2012; Andersson and Klepper, 2013). By being understood as a particular form of labor mobility through which knowledge is more easily transferred from an incumbent firm (Klepper and Sleeper, 2005; Boshma et al., 2009), and by benefiting from parent firm's contacts and network ties (Agarwal et al., 2004), spin-offs are comparatively better endowed with specific resources and informational advantages that make them better able to overcome the so-called liability of newness (Phillips, 2002).

More recently, researchers claimed for further attention to the heterogeneity of corporate spin-offs, and a line of research has been exploring the distinction between opportunity (pulled) and necessity (pushed) entrepreneurship applied to spin-off activities (e.g. Buenstorf, 2009; Bruneel at el., 2013; Dick et al., 2013).[1] Opportunity (or pulled) spin-offs are broadly defined as spin-offs triggered by the discovery of a promising entrepreneurial opportunity. In contrast, necessity (or pushed) spin-offs are, by definition, triggered by events that adversely affect the parent firm and that render future employment at this firm less attractive or even impossible. As a result, necessity spin-offs are very often launched by employees of incumbent firms to escape deteriorating job conditions, or as a response to a recent job loss.

However, while the importance of pulled-induced spin-offs has increasingly been recognized in recent years, the role of pushed-nature spin-offs has been far overlooked (Buenstorf, 2009). Moreover, research addressing how different are the performance prospects of spin-offs according to their type is still scarce. The few studies conducted so far suggest that pulled spin-offs tend to outper-

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[1] The distinction between opportunity and necessity spin-offs is solely based on the triggering event driving the actual decision to start the new firm.

form their pushed counterparts (e.g., Eriksson and Kuhn, 2006; Muendler et al., 2012; Andersson and Klepper, 2013), though, sometimes, the analyses are restricted to very particular industries and/or regions (e.g., Buenstorf, 2009; Cabral and Wang, 2009; Bruneel et al., 2013).

Against this backdrop, the contribution of this paper is twofold. Firstly, differences and commonalities between opportunity spin-offs and necessity spin-offs are further explored, using a large longitudinal matched employer-employee dataset for Portugal. We identify and follow 50,656 spin-offs founded between 1992 and 2007, being our study innovative and rare on this regard. Using discrete time hazard models that take into account firms' unobserved heterogeneity, we analyze whether start-up triggering conditions influence spin-offs' hazard rates – i.e., whether there are significant survival differences between pushed and pulled spin-offs, after controlling for a number of observed characteristics where they differ.

Secondly, we aim at understanding how particular start-up conditions – namely, industry and geographic relatedness to the incumbent firm, the presence of co-workers absorbed from the parent firm, and the general and specific human capital of spin-offs' founders – may moderate pushed-pulled survival differences.[2] We follow the recent decomposition methodologies for hazard models proposed by Powers and Yun (2009) and Powers et al. (2011) in order to decompose the survival gap observed between pushed and pulled spin-offs into components attributable to their differences in endowments and differences in effects.

To the best of our knowledge, this is one of the first studies comparing the post-entry performance of pushed and pulled spin-offs, using a rich matched employer-employee dataset, taking also into consideration a number of start-up conditions that can both affect spin-off survival and moderate the survival differences between necessity and opportunity spin-offs. Finally, while most of

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[2] "Incumbent firm" and "parent firm" will be used interchangeably throughout the paper and should be understood as synonymous.

the literature concerned with spin-offs has restricted their attention to high-tech spin-offs spawned by successful surviving parent firms (e.g., Klepper and Sleeper, 2005; Franco and Filson, 2006; Agarwal et al., 2011), our study covers all spin-offs established in all industries during the timespan under analysis. Finally, we provide empirical evidence for a European economy where entrepreneurship – particularly necessity-driven entrepreneurship – may play an important role, given the large number of bankruptcies and the significant increase in unemployment rates observed over the most recent years in Portugal, as a result of the severe economic crisis.

The paper is organized as follows. Section 2 briefly reviews the main literature on the comparative performance of pushed and pulled spin-offs, and discusses how some startup conditions where these two types of firms eventually differ might balance their post-entry performance differences. Section 3 presents the data and the criteria adopted to identify pushed and pulled spin-offs. Section 4 provides a brief description of the sample, in order to highlight the main sources of observed differences between the two types of spin-offs. Section 5 presents the empirical methodology and discusses the results. Section 6 concludes.

2   Prior Literature and Background

2.1   The heterogeneous nature of spin-offs: pushed versus pulled spin-offs

Not all spin-offs arise from the identification of an opportunity by some employee(s), or from some strategic action of incumbent firms – which frequently seed spin-offs to develop new technologies, to serve new markets, to create complementarities or to focus on their core business (Parhankangas and Arenius, 2003; Iturriaga and Cruz, 2008). Most spin-offs also emerge from necessity. Adverse shocks in the incumbent firm, such as firm closure, massive downsiz-

ing, changes in management or a takeover, may push an employee (or a few of them) to leave and create their own company (e.g., Von Greiff, 2009; Bruneel et al., 2013).

During the last few decades, most of the western economies have suffered extensive worker displacements (Von Greiff, 2009), a scenario that has been even more exacerbated by the recent economic crisis and the consequent large number of firm closures (ILO, 2013). With entrepreneurship being proposed as one of the possible routes to exit the crisis and reduce unemployment (OECD, 2013), pushed spin-offs – which were virtually neglected by researchers until the most recent years – are now recognized to deserve the attention of both scholars and policy-makers more than ever, given their potential role in absorbing some of the unemployees coming from declining parent firms.

So far, despite few studies have analyzed the heterogeneity of corporate spin-offs in relation to their post-entry performance, a number of arguments apparently suggest that pulled (opportunity) spin-offs are likely to outperform their pushed (necessity) counterparts. First, opportunity spin-offs may have the comparative advantage of being based on a unique, newly discovered business opportunity and a more controlled timing of entry.

Second, this group of spin-offs may keep strong relationships with their parent firm after entry, which can provide them the access to important information, resources, markets and technologies, as well as sources of credibility, legitimacy, reputation and identification of opportunities (Hitt et al., 2001, Phillips, 2002; Eriksson and Kuhn, 2006). Moreover, by preserving some links with their parent firms, pulled spin-offs may maintain the advantages of operating at a small scale, while using the existing assets of a larger corporation (Parhankangas and Arenius, 2003; Wallin and Dahlstrand, 2006). The same is not possible for necessity spin-offs, particularly for those prompted by the closure of the parent firm.

From a different perspective, other authors propose that there is a significant positive correlation between parent and spin-off performances (Bruneel et al., 2013; Dick et al., 2013), and that spin-offs generating from surviving

incumbents are typically founded by individuals with higher entrepreneurial talent on average (Cabral and Wang, 2009). Overall, these lines of thought propose that spin-offs driven by pushed-nature factors, as parent firm closure or massive downsizing, are likely to perform worse than the remaining spin-offs in the market.

However, while the linkages established between pulled spin-offs and their parent firms may give them some comparative advantages, parental influence can also generate inertia, dependence and resistance to change (Wallin and Dahlstrad, 2006; Ferriani et al., 2012). In this regard, necessity spin-offs, by being forced to strive in the market without similar support, may become more autonomous and more able to adjust to the overall environment. Furthermore, those creating their own company as a way to escape unemployment – despite their possibly lower entrepreneurial ability (Cabral and Wang, 2009) – may become comparatively more attached to their business (see, for instance, Block and Sandner, 2009; Rocha et al., 2013). Alternatively, they may also have lower performance thresholds than those creating a spin-off to explore an identified opportunity, who may have more ambitious goals and consequently give up earlier and close down the firm if such performance thresholds are not attained (Gimeno et al., 1997; McCann and Folta, 2012).

Hence, a deep analysis of post-entry performance of necessity and opportunity based spin-offs is still lacking in the literature. Valuable contributions on this subject have been provided by Buenstorf (2009), Cabral and Wang (2009) and Bruneel et al. (2013), whose studies have compared the performance of pushed and pulled spin-offs for particular industries or regions. More comprehensive studies were conducted by Eriksson and Kuhn (2006), Muendler et al. (2012) and Andersson and Klepper (2013), though mainly focusing on the comparative performance of (pushed and pulled) spin-offs and *de novo* entrants. This study, thus, contributes to the existing literature by evaluating the survival prospects of over 50,600 new spin-offs who were established in Portugal during the period 1992-2007, paying particular attention to the potential differences between pushed and pulled spin-offs' exit rates.

2.2 Start-up conditions as moderating factors of spin-offs' survival gap

Besides the heterogeneous nature of spin-offs in what concerns the triggering event driving their entry, pushed and pulled spin-offs are also probably different in a variety of aspects, namely in a set of start-up conditions. The relatedness to the parent firm in terms of industry and geographical location, the presence of co-workers (i.e., employees who move from the parent firm to the new spin-off) in the initial workforce, and entrepreneurs' human capital are three dimensions that, according to the literature, are believed to affect spin-off performance and that could either amplify or mitigate the performance differences between pushed and pulled spin-offs.

Firstly, the proximity between the parent firm and the spin-off has been mostly analyzed at the industry-level, as most of the studies have been defining spin-off companies as new firms founded by former employees in the same (usually high-tech) industry (e.g., Agarwal et al., 2004; Klepper and Sleeper, 2005; Franco and Filson, 2006). However, many spin-offs neither operate in high-tech industries, nor in exactly the same industry of the parent firm (Eriksson and Kuhn, 2006; Muendler et al., 2012).

The same applies to the region where spin-offs locate. While the inheritance of routines and the transfer of resources from the parent firm is more likely when firms operate in the same industry, this is also a "local affair" (Boschma and Frenken, 2011), as knowledge transfers and labor mobility are believed to be more successful the greater the proximity (at the industry and geographical levels) between firms (e.g., Sapienza et al., 2004; Malmberg and Power, 2005; Boschma et al., 2009). For these reasons, we analyze whether remaining in the same industry and the same location of the parent firm improves spin-offs' survival prospects.

Secondly, the mobility of workers from the parent firm to the spin-off also constitutes one of the most important mechanisms through which routines, procedures, knowledge and various forms of human capital may be transferred

(Helfat and Lieberman, 2002; Audretsch and Keilbach, 2005; Franco and Filson, 2006). Accordingly, firms hiring these co-workers at the moment of entry are believed to be better able to reduce the initial uncertainty in the market and to have a comparative advantage over other firms (Song et al., 2003; Leung et al., 2006; Tzabbar et al., 2013). Furthermore, not only knowledge transfers (embodied in co-workers) as well as knowledge spillovers (conditional on, for instance, co-workers' accumulated experience in the parent firm) may improve spin-offs' performance (Agarwal et al., 2011), but also attenuate the differences between pushed and pulled spin-offs.

In fact, despite pushed spin-offs originating from dying companies cannot maintain any relationship with their parent firms afterwards, workers flowing from the parent firm may constitute a particularly important resource − in the form of industry-specific, firm-specific or even team-specific human capital − for those new spin-offs, helping them to overcome the initial uncertainty in the market and the so-called liability of newness. Additionally, hiring some co-workers from the parent firm may constitute a less costly screening process for pushed spin-offs, whose founders may be more able to identify and attract some of the best workers, who otherwise would not have great employment perspectives in the parent firm. For all these reasons, pushed spin-offs may play an important role in reducing unemployment and preventing the depreciation of the human capital of those who have lost their job due to unfavorable economic conditions in the previous employer (Buenstorf, 2009). Therefore, we analyze how the presence and the average quality of co-workers influence the post-entry survival of spin-offs, and how these factors might moderate the potential survival differences between spin-offs of different types.

Finally, entrepreneurs' characteristics are also increasingly recognized to significantly influence new venture performance. Entrepreneurial talent of start-up founders – being multidimensional (Unger et al., 2011; Mayer-Haug et al., 2013) and mainly embodied in entrepreneurs' general and specific human capital – has been shown to be particularly important during firm infancy and to improve the survival of new firms (e.g., Delmar and Shane, 2006). Given

that pushed and pulled spin-offs' founders may have different human capital endowments (Cabral and Wang, 2009), and opportunity and necessity-driven businesses may be affected by different dimensions of founders' human capital (Baptista et al., 2014), this issue should not be neglected. Most of the studies have been unable to control for these potential differences among firms due to data restrictions (e.g., Muendler et al., 2012; Andersson and Klepper, 2013), so we also contribute to this literature by taking into account the potential moderating role of founders' human capital. Business-owners' average age and schooling years are used as measures of general human capital. Founders' specific human capital is measured by the average years of industry-specific experience and entrepreneurial experience accumulated in the past.

3 Data and Methodological Issues

3.1 Data

Our study uses data from Quadros de Pessoal (QP), a large longitudinal matched employer-employee dataset from the Portuguese Ministry of Employment. All firms in the private sector employing at least one wage earner are legally obliged to fill in this annual survey and provide information about each of its establishments and workers. Detailed yearly information at the firm/establishment-level (e.g., employment, industry, location) and worker-level (e.g., age, education, gender, qualifications, wages, occupational category, tenure) is available in QP files. All firms, establishments and workers are identified with a unique identification number, so they can be followed and matched over time. QP dataset, thus, allows the identification of entries and exits of firms and individuals, besides making possible to track individuals' paths and transitions across firms, industries and locations.

Raw QP files are available for the period 1986-2009.[3] Entries of new firms

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[3]There is a gap for the particular years of 1990 and 2001 in the worker-level files, for

are identified by the first time (year) a firm is recorded in QP files. Firm exit is identified by the moment when a firm ceases to answer the survey. We have required an absence of the firm from the files larger or equal to two years in order to identify its definite closure.[4] For this reason, in our empirical analysis we use data only until 2007, as the last year for which we can identify firm exits is 2007. Data for 2008 and 2009 are only used to check the presence or absence of firms in QP files.

3.2   Identification of Pulled and Pushed Spin-offs

We started by identifying all new start-up firms entering during the period 1992-2007 (excluding 2001), whose business-owner(s) (BOs) was/were in paid employment in $t-1$ or $t-2$ and who left the previous employer.[5] For spin-offs founded by two or more BOs in each year t, we have required that all of them were employed in the same incumbent firm, and that all of them have left their previous employer immediately before (in $t-1$ or $t-2$) engaging in the creation of the new start-up firm.

We have then classified these spin-offs as "pushed" or "pulled" according to the status of the incumbent firm by the time of the employees' exit (see Table 1). Those spin-offs founded by individuals who come from a firm that either closed or suffered a significant downsizing are classified as "pushed spin-offs". In such a case, the creation of the spin-off may actually be a response

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which no information was gathered at the individual-level.

[4]A temporary exit may occur for a number of reasons other than cessation of activity, a very likely reason being that the data were not received in the Ministry of Employment before the date when the recording operations were closed. Accordingly, firms that were temporarily absent from the files for one year were not considered to have definitely closed. Following the procedures of other studies also using QP data (e.g., Mata and Portugal, 2002; Geroski et al., 2010), firm-level time-varying variables were amended for that year using data on adjacent years.

[5]Due to the missing data at the worker-level for 2001, we are not able to identify the BO(s) of firms entering in this year. As our classification of spin-offs into "pushed" or "pulled" requires detailed information about the origin of BO(s) founding the firm, entries occurring in 2001 had to be excluded.

of some employees to an adverse shock in the parent firm, being possibly closer to necessity spin-offs. The remaining spin-offs were classified as "pulled spin-offs", which may include either corporate spin-offs that are the result of opportunities exploited by an incumbent firm, or spin-offs initiated by one or more employees that identify an opportunity and who decide to explore it independently of their employer. Though we are not able to distinguish these two cases in our data, both types of firms are probably closer to opportunity-based spin-offs (Buenstorf, 2009; Bruneel et al., 2013).

We have identified a total of 50,656 spin-offs entering during the period 1992-2007 (excluding 2001) – more precisely, 16,001 pushed spin-offs and 34,655 pulled spin-offs. Out of these, 49% operated in the same 2-digit industry of the parent firm. By distinguishing pushed from pulled spin-offs, this share changes to 63% and 43%, respectively. Regarding spin-offs' location and their geographic proximity to the parent firm, 53% of spin-offs (66% of all pushed and 47% of all pulled spin-offs) were located in the same municipality of the parent firm.

Table 1. Criteria to identify pushed and pulled spin-offs

		Firm A closes down in the	
The employee i	+	same year of employee's exit	= Firm B is
leaves the firm A		Firm A suffers a significant	classified as a
("parent/incumbent	+	downsizing ($\geq$30% of workers,	= Pushed Spin-off
firm") in $t-1$ or		with 5 or more separations) in	
$t-2$ and becomes		the same year of employee's exit	
BO in the new		Firm A continues operating after	Firm B is
spin-off firm B in t	+	the employee's exit, without	= classified as a
		significant downsizing	Pulled Spin-off

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4 Pushed and Pulled Spin-offs in Portugal

Figures 1 and 2 illustrate the relative importance of spin-offs in the Portuguese economy. The former depicts the share of both types of spin-offs in the total number of new firm entries identified in QP data. Over 30% of the new firms founded in the Portuguese private sector in recent years are spin-offs. Since the early 2000s, spin-offs have also been responsible for an increasing share of the total employment created by new firms (Figure 2). Our data show that, in 2007, spin-offs accounted for 34% of all new jobs created by new entrants in Portugal.
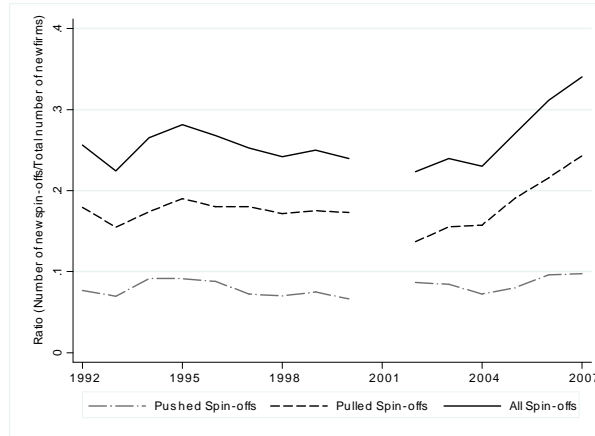
Fig. 1. Number of spin-offs in the total number of new entries

Additionally, these figures confirm that pushed spin-offs should not be over-looked. Despite their lower relative importance comparatively to pulled-nature spin-offs, they already corresponded to 10% of all new start-ups at the end of the period under observation (Figure 1), absorbing around 14% of new jobs created by all new entrants (Figure 2). Moreover, while pulled spin-offs seem to occupy a much stronger relative position in number, both types of firms are apparently becoming closer in terms of the share of employment created at entry, which may indicate that pushed spin-offs are somewhat larger than pulled spin-offs, on average.

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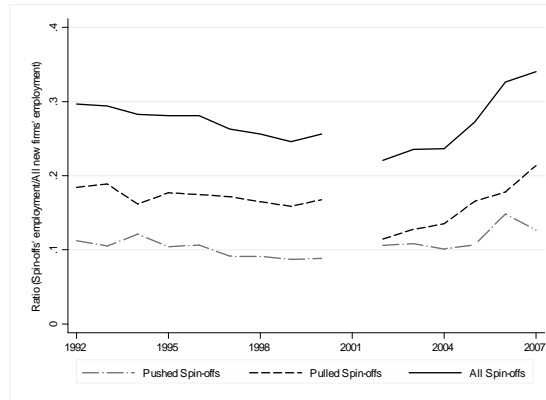
Fig. 2. Relative importance of spin-offs in the employment created by new firms

Table 2 shows the relative importance of pushed and pulled spin-offs in different industries.[6] Retail trade absorbs over 20% of all spin-offs. There is also significant spin-off activity in Construction, Restaurants and Hotels, Wholesale Trade, as well as Real State and Business Services. In some industries, spin-offs emerge more often in the same industry of the parent firm (see, for instance, the cases of spin-offs operating in Textile Manufacturing Industry and Construction). In contrast, spin-offs in Services (e.g., Wholesale Trade or Real State and Business Services) are less frequently related with the parent's former industry.

These patterns suggest that industry-specific knowledge may be relatively more important to enter into some particular industries than in others. Starting a business – either driven by opportunity or necessity – in certain industries (especially in Manufacturing) may require some prior specific knowledge about the industry in order to reduce uncertainty and risk. The lack of specific knowledge about the industry may be understood as less problematic when entering in other industries (possibly in Trade and some particular Services).

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[6]Industries are classified according to ISIC-Rev.2 (2-digit). Industries 21-Coal Mining, 22-Crude Petroleum & Natural Gas Production, 23- Metal Ore Mining, 96-International and Other Extra-Territorial Bodies are not included in Table 2, given that no spin-offs were identified in these industries.

Table 2. Distribution of spin-offs by 2-digit industries (values in %)

	Pulled Spin-offs			Pushed Spin-offs		
	All Pulled	Same 2d as PF	Diff. 2d as PF	All Pushed	Same 2d as PF	Diff. 2d as PF
Agriculture and Hunting	1.12	0.84	1.33	1.08	1.07	1.10
Forestry and Logging	0.23	0.13	0.30	0.27	0.25	0.31
Fishing	0.04	0.03	0.06	0.03	0.00	0.09
Other Mining	0.15	0.10	0.19	0.30	0.30	0.30
Food, Beverages, Tobacco	1.39	1.49	1.32	1.74	1.82	1.61
Textile, Wearing, Leather	3.63	6.24	1.70	6.39	9.00	1.85
Wood Products	0.94	0.90	0.97	2.23	2.54	1.70
Paper, Printing, Publishing	1.10	1.30	0.95	1.03	1.13	0.86
Chemic., Coal, Rubber, Plastic	0.33	0.31	0.35	0.38	0.35	0.44
Non-Metallic Mineral Prod.	0.74	0.86	0.65	1.17	1.38	0.80
Basic Metal Industries	0.08	0.02	0.12	0.08	0.04	0.14
Metal , Machinery, Equipm.	3.35	4.16	2.75	4.56	5.11	3.59
Other Manufacturing Industries	0.87	0.82	0.90	1.81	1.84	1.75
Electricity, Gas and Steam	0.02	0.00	0.03	0.01	0.00	0.03
Water Works and Supply	0.01	0.00	0.02	0.03	0.01	0.07
Construction	12.90	16.61	10.16	17.04	20.85	10.43
Wholesale Trade	10.10	8.35	11.39	10.43	8.20	14.31
Retail Trade	22.67	22.46	22.83	21.27	20.12	23.26
Restaurants and Hotels	12.92	12.51	13.22	10.64	10.44	10.98
Transport and Storage	5.18	6.21	4.41	4.11	4.39	3.64
Communication	0.23	0.07	0.35	0.20	0.09	0.40
Financial Institutions	0.47	0.25	0.64	0.29	0.17	0.51
Insurance	0.17	0.16	0.18	0.09	0.02	0.21
Real State and Business Serv.	15.72	11.78	18.64	10.64	7.78	15.60
Public Administr. & Defense	2.73	2.78	2.68	1.83	1.73	2.01
Sanitary and Similar Serv.	0.15	0.06	0.22	0.08	0.07	0.09
Social & Relat. Commun. Serv.	0.43	0.25	0.56	0.24	0.18	0.35
Recreation. and Cultural Serv.	0.84	0.31	1.22	0.65	0.30	1.24
Personal and Household Serv.	1.49	0.98	1.87	1.37	0.82	2.33
TOTAL (%)	100.00	100.00	100.00	100.00	100.00	100.00

Notes: PF: Parent Firm.

Figure 3 plots pushed and pulled spin-offs' survival patterns using Kaplan-Meier estimator (Kalbfleish and Prentice, 1980). Table 3 complements this analysis, by presenting the survival rates of both groups of firms for selected periods of time, according to the industry and geographic relatedness to the incumbent firm.[7] These results show that, unconditionally (i.e., without controlling for any observed or unobserved differences between firms), pushed spin-offs survive longer than their pulled counterparts. These differences remain statistically significant across the several subsamples described in Table 3, except for spin-offs located in a different municipality of the parent firm – in that case, pulled spin-offs seem to outpace those entrepreneurial firms driven by more pushed-nature factors.
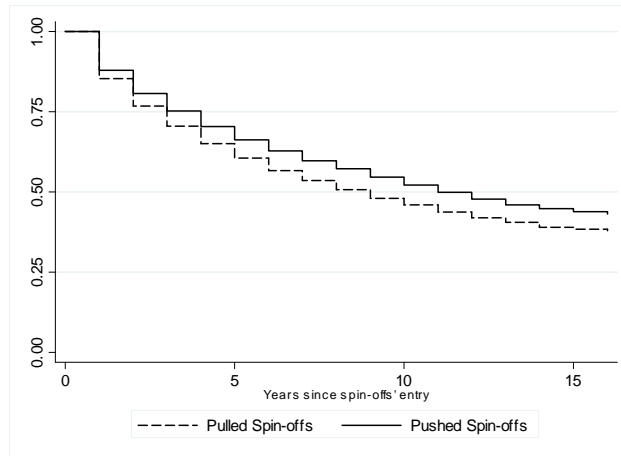
Fig 3. Kaplan-Meier survivor function of pushed and pulled spin-offs

As expected, hazard rates are lower for those spin-offs more closely related to the parent firm – i.e., both for those remaining in the same region (county) and those operating in the same industry of the parent firm. Nonetheless, these initial results seem to suggest that geographical distance has a larger negative

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[7]The geographical proximity between the spin-off and the parent firm is analyzed at the county-level. In 2007, Portugal had 308 different counties.

impact on spin-offs' survival prospects than industry-level distance. About 70% of the spin-offs established in a different region from that of the incumbent firm had already closed down five years after entry; the corresponding exit rate for those establishing close to the incumbent firm (i.e., in the same county) was around 30%. Entering in an industry different from that of the parent firm also seems to penalize spin-offs in terms of survival. However, the data show that even 15 years after entry about 36-40% of spin-offs operating in a different 2-digit industry remained active.

Table 3. Comparative survival rates of pushed and pulled spin-offs, according to the proximity to the parent firm

Years	Industry-level (2d) Proximity				Geographic Proximity			
since	Same industry		Different industry		Same region		Different region	
entry	Pushed	Pulled	Pushed	Pulled	Pushed	Pulled	Pushed	Pulled
1	0.8957	0.8701	0.8524	0.8408	0.9258	0.9209	0.5296	0.5786
5	0.6939	0.6316	0.6099	0.5869	0.7065	0.6677	0.2954	0.3278
10	0.5488	0.4893	0.4750	0.4379	0.5574	0.5093	0.1952	0.2147
15	0.4652	0.4108	0.3935	0.3637	0.4691	0.4252	0.1518	0.1756

Finally, Table 4 provides additional descriptive statistics for pushed and pulled spin-offs. The variables summarized in the Table correspond to the vector of variables to include in our empirical estimations. In addition to start-up conditions related to the presence of co-workers in spin-offs' initial workforce and BOs' human capital, we also control for a number of characteristics of firms and industries.

Our data reveal that hiring co-workers is a much common practice among pushed than among pulled spin-offs: almost 43% of all pushed spin-offs hire at least one worker who was employed in the parent firm; such hiring scheme is observed in less than 14% of pulled spin-offs. This recruitment strategy is even more significant among spin-offs located geographically close to, and remaining in the same industry of, the parent firm.

Table 4. Descriptive statistics for pushed (PS) and pulled (PL) spin-offs (Portugal, 1992-2007)

	Same industry		Different industry		Same region		Different region	
	PS	PL	PS	PL	PS	PL	PS	PL
Co-workers								
Hire co-workers	0.533	0.226	0.241	0.073	0.515	0.193	0.254	0.090
Human capital of BO(s)								
BOs' age	37.15	35.47	36.83	36.13	37.22	35.53	36.66	36.12
Schooling years	7.559	8.315	8.647	9.254	7.503	8.445	8.839	9.211
Industry exper.	4.104	4.062	0.557	0.386	3.104	2.279	2.218	1.661
Experience as BO	1.544	1.316	1.403	1.228	1.573	1.354	1.336	1.188
Firm & Industry controls								
Number of BOs	1.531	1.318	1.350	1.249	1.545	1.316	1.310	1.244
Start-up size	1.372	1.037	1.033	0.884	1.325	0.976	1.098	0.925
College workers	0.055	0.099	0.096	0.137	0.050	0.101	0.109	0.138
Urban location	0.386	0.400	0.422	0.414	0.371	0.369	0.453	0.443
Min. Effic. Scale	3.993	3.662	3.419	3.310	3.897	3.550	3.561	3.381
Industry growth	0.027	0.038	0.054	0.051	0.034	0.043	0.042	0.048
Ind. churn rate	0.241	0.243	0.244	0.247	0.241	0.245	0.244	0.245

Notes: BOs' human capital variables are measured in years. Start-up size: number of employees at entry, in logs. College workers: share of workers with higher education. Urban location=1 if the spin-off is located in the districts of Porto or Lisbon, 0 otherwise. Minimum Efficient Scale (MES): median number of employees in the 2-digit industry in each year. Industry growth: annual percentage change in 2-digit employment. Industry churn rate: Ratio (entries+exits)/total number of firms in the 2d sector, by year.

Regarding general and specific human capital of spin-offs' founders, these statistics show that BOs of pulled spin-offs are, on average, younger and more educated, while pushed spin-offs' founders are relatively more endowed with specific human capital, by presenting longer industry-specific and entrepreneurial experiences.

At the firm-level, we observe that pushed spin-offs enter at a relatively larger scale than their pulled counterparts – which may be achieved, in part, by hiring some workers from the parent firm –, while pulled spin-offs present a larger share of highly-educated individuals. Following prior studies on firm survival (e.g., Mata and Portugal, 1994; Audretsch and Mahmood, 1995; Honjo, 2000; Manjón-Antolín and Arauzo-Carod, 2008), we also control for the overall environment in the industry where firms operate, by taking into account the minimum efficient scale, the employment growth rate, and the churn/turnover rate of the industry where each spin-off is established.

Overall, these statistics show that pushed and pulled spin-offs are differently endowed with particular resources at the start-up, which may contribute to explain why they may perform differently after entry.

5 Empirical Analysis

5.1 Empirical strategy

To study which factors may affect the survival of spin-offs and to test whether the survival differences of pushed and pulled spin-offs are significant, we employ discrete time duration models, also controlling for spin-offs' "frailty" (i.e., unobserved heterogeneity). With this empirical strategy, we are accounting for the potential presence of a latent multiplicative effect on the hazard function, potentially caused by heterogeneous and unobserved times-to-failure among the firms under study. It is possible that some spin-offs are more "frail" for reasons left unexplained by the covariates in the model (e.g., founders' motivations and unobserved ability, or business quality), and hence will have an increased risk of exit, while other spin-offs may be more likely to survive longer all else being equal. If that is the case, neglecting spin-offs' unobserved heterogeneity may produce biased results (Hougaard, 1995; Jenkins, 1995).

We follow each spin-off since the moment of entry until its last record in

QP files – which may either correspond to their closure or to the last year of available information about the firm (right-censored cases). We then estimate a piecewise constant hazard model, where exit rates are assumed to be constant within each interval but allowed to be different between particular intervals of some years. Such non-parametric modeling has been recognized to be preferred in order to avoid serious misspecifications of the functional form of baseline hazard rates. Moreover, such flexible baseline hazard function makes an attractive model with which to combine a specific heterogeneity assumption (e.g., Cameron and Trivedi, 2005). Accordingly, following usual conventions (e.g., Meyer, 1990), the model to be estimated corresponds to the Prentice-Gloeckler (1978) model, incorporating a gamma mixture distribution to control for firm-level unobserved heterogeneity. Formally, for each spin-off i, the probability of exit at discrete time t_j, $j = 1, 2, \ldots$, given survival until time t_j, is defined as

$$h_{ij} = 1 - \exp\{-\exp[\gamma(t) + X_i(t)'\beta + \log(\varepsilon_i)]\}, \tag{1}$$

where h_{ij} is the hazard rate of spin-off i after surviving for exactly j years; $\gamma(t)$ is a set of indicator variables for different duration intervals, thus, describing the pattern of duration dependence in spin-offs' exit rates; $X_i(t)$ is a vector of time dependent and independent variables which are expected to impact on spin-offs' survival; β is a vector of unknown parameters to be estimated and ε_i is a Gamma distributed random variable with unit mean and variance $\sigma^2 = \nu$. Conveniently, the survivor function for this model has a closed form expression (see Meyer (1990) for details), and hence so too does the log-likelihood function, which may be written as follows:

$$
\begin{aligned}
L(\gamma, \beta, \sigma^2) = \ & \sum_{i=1}^{N} \log\{[1 + \sigma^2 \sum_{j=0}^{t_j-1} \exp\{\gamma(t) + X_i(t)'\beta\}]^{-\sigma^{-2}} \\
& - c_i[1 + \sigma^2 \sum_{j=0}^{t_j} \exp\{\gamma(t) + X_i(t)'\beta\}]^{-\sigma^{-2}}\},
\end{aligned}
\tag{2}
$$

where c_i is an indicator variable, assuming the value 1(0) whenever the spin-off's spell is complete (right-censored).

Vector $X_i(t)$ includes the main variables of interest in our analysis, namely an indicator variable for the type of spin-off (pushed versus pulled), the start-up conditions previously discussed (i.e., indicator variables for parent–spin-off relatedness in terms of industry and location, the presence of co-workers among spin-offs' new hires at entry, and founders' general and specific human capital).[8] Additionally, it also includes the firm-level and industry-level characteristics described in the previous section (Table 4), and an indicator variable controlling for crisis periods.[9]

5.2 Empirical results on spin-offs survival

In Table 5, we present the results obtained from the estimation of several specifications of the discrete time hazard model with gamma frailty described above. The first specification only includes an indicator variable distinguishing pushed from pulled spin-offs. The second, third and fourth specifications add, sequentially, the variables related to the start-up conditions under analysis. The final specification also controls for other firm and industry characteristics, as well as for macroeconomic conditions.

Our results show that, as we control for an increasing number of observed characteristics of spin-offs, the survival gap found between pushed and pulled spin-offs tends to vanish. In other words, the several start-up conditions that we take into account, in addition to other time-varying characteristics of firms, industries and macroeconomic environment, seem to moderate the differences initially found between the two groups of firms. Even so, the results from

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[8]For spin-offs founded by two or more BOs, we consider their average human capital (in particular, the average number of schooling years, the average number of years of experience in the 2-digit industry and the average number of years of entrepreneurial experience acquired in the past).

[9]The indicator variable "Crisis Periods" is equal to 1 in the years 1993 and 2003, and 0 otherwise.

the estimation of our final specification show that a statistically significant difference still exists between the hazard rates of pushed and pulled spin-offs – pushed spin-offs are estimated to face 96% of the exit risk faced by pulled spin-offs ($exp(-0.0419) = 0.9590$).

In line with the expectations raised from the exiting literature, both industrial and geographical relatedness to the parent firm improves spin-offs' survival. However, the survival bonus from remaining in the same region of the incumbent firm seems to be much more significant than that resulting from industry-level similarities.

Spin-offs hiring some co-workers are found to suffer lower risks of exiting − they are estimated to face 87% of the hazard faced by those spin-offs with no co-wokers. This confirms that the presence of these workers may be a source of competitive advantage, as they may be a channel for knowledge transfers, or even a channel to minimize bad matches at entry, which both reduce uncertainty and mitigate the so-called liability of newness (Song et al., 2003; Audretsch and Keilbach, 2005; Agarwal et al., 2004, 2011).

All measures of BOs' human capital are also found to significantly improve spin-offs' survival prospects, by significantly reducing the exit risk. Spin-offs owned by more than one BO also present longer lifetimes and, thus, lower exit rates than spin-offs run by a single BO, which suggests that a larger entrepreneurial team, by sharing risks and resources, may reduce the liability of newness of these firms. The results from the global specification additionally suggest that a larger start-up size and a more educated workforce are both associated with lower hazard rates, while location in a large urban area seems to increase firms' hazard rates. Finally, industries where the minimum efficient scale is larger shift firm exit rates upward, as well as industries where entry and exit rates are higher, and where turbulence and competition tend to be stronger (Santarelli and Vivarelli, 2007). In contrast, industry growth rate, by potentially signaling better industry conditions and profit opportunities, reduces exit rates (see also Honjo, 2000). In line with prior studies (e.g., Varum and Rocha, 2012), hazard rates are higher during more recessive periods.

Table 5. Empirical results for the discrete time proportional hazard model with gamma unobserved heterogeneity (Portugal, 1992-2007)

	(1)	(2)	(3)	(4)	(5)
Type of Spin-off					
Pushed Spin-off	-0.2420***	-0.1609***	-0.1286***	-0.1300***	-0.0419**
	(0.0186)	(0.0177)	(0.0170)	(0.0180)	(0.0169)
Same industry as		-0.2012***	-0.1683***	-0.1377***	-0.0495**
the PF		(0.0168)	(0.0162)	(0.0208)	(0.0199)
Same region as		-0.2580***	-0.2461***	-0.2520***	-0.2340***
the PF		(0.0147)	(0.0145)	(0.0150)	(0.0148)
Co-workers					
Hire co-workers			-0.3288***	-0.2828***	-0.1438***
			(0.0351)	(0.0358)	(0.0359)
Human capital of the BO(s)					
BOs' age				-0.0102***	-0.0076***
				(0.0010)	(0.0009)
Schooling years				-0.0194***	-0.0101***
				(0.0019)	(0.0021)
Industry experience				-0.0195***	-0.0305***
				(0.0038)	(0.0038)
Experience as BO				-0.0627***	-0.0261***
				(0.0088)	(0.0082)
Firm and industry controls					
Number of BOs					-0.3201***
					(0.0156)
Start-up size					-0.2473***
					(0.0123)
College workers					-0.3073***
					(0.0377)
Urban location					0.1210***
					(0.0154)
Min. Effic. Scale					0.0412***
					(0.0072)
Industry Growth					-0.3827***
					(0.0700)

(it continues in the next page)

Table 5. Empirical results for the discrete time proportional hazard model with gamma unobserved heterogeneity (Portugal, 1992-2007)

	(1)	(2)	(3)	(4)	(5)
Industry churn rate					4.7314***
					(0.1282)
Macroeconomic Environment					
Crisis Periods					0.1069***
					(0.0220)
Constant	-1.7757***	-1.5995***	-1.5857***	-0.9567***	-1.8381***
	(0.0157)	(0.0182)	(0.0177)	(0.0482)	(0.0713)
Observations	250,242	250,242	250,242	250,242	250,242
Log Likelihood	-76,388.5	-76,139.8	-76,094.3	-74,673.7	-73,121.9
Unob. Heterogen.	0.7582***	0.5083***	0.2886***	0.5011***	0.3213***

Notes: *, ** and *** denote significant at 10%, 5% and 1%, respectively. "Unobserved Heterogeneity" refers to gamma variance, which is always significantly different from zero. All specifications include dummies for firm age, confirming that spin-offs' exit rates have negative duration dependence. The final specification also includes 1-digit industry dummies.

5.3 The relative quantity and quality of co-workers

The literature on spin-offs' performance has been highlighting the need to consider both the relative quantity and the quality of labor moving from the parent firm to the spin-off. The better the quality of those workers moving from one firm to another – in terms of education, ability or experience –, the more valuable may be their presence in the spin-off. In this Section, we extend the previous analysis in order to study in more detail the characteristics of co-workers hired at entry and how they may influence spin-off survival.

Figure 4 confirms, over again, that hiring workers who were previously employed in the parent firm is a more common practice among pushed spin-offs. Besides, among those firms hiring at least one co-worker at the moment of their entry, the relative importance of these employees is higher in the subsample

of pushed spin-offs – on average, 44% of the pushed spin-offs' workforce at entry was composed by co-workers; in pulled spin-offs, they corresponded, on average, to 37% of the initial labor force.
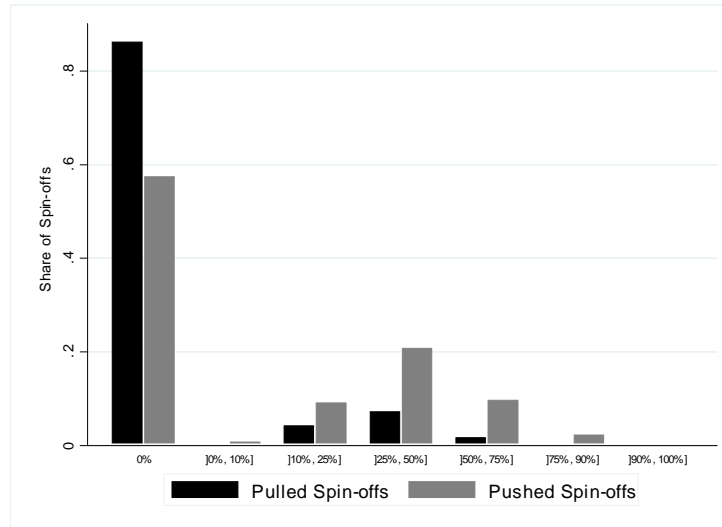
Fig. 4. Relative importance of co-workers in total spin-off workforce, at entry

Figure 5 shows the relative importance of those co-workers subsequently hired by spin-offs in the total workforce of the parent firm. On average, pushed (pulled) spin-offs absorb 38% (21%) of the parent firm's workforce. This also reveals the significant role played by pushed spin-offs in generating new jobs for those who may have become unemployed due to parent firm closure or downsizing.

Table 6 provides some descriptive statistics for those co-workers employed by pushed and pulled spin-offs at the moment of their entry, according to the parent–spin-off relatedness at the industry and geographic levels. Some remarkable patterns arise from the analysis of the data. First, the mobility of co-workers is more significant between more related firms (either at the industry-level or in geographic terms) (cf. Table 4). Second, co-workers employed by pushed spin-offs are, on average, older and have accumulated a

longer experience in the parent firm. In contrast, co-workers hired by pulled spin-offs are more educated on average, and earned higher hourly wages at the parent firm.
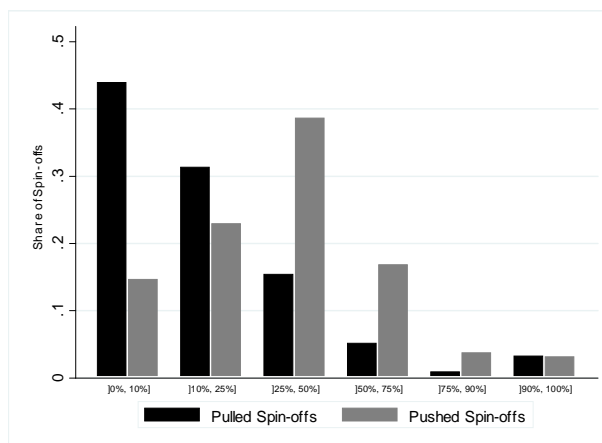
Fig. 5. Relative importance of co-workers in total parent firm workforce, at the moment of spin-offs' founders' exit (Note: Spin-offs with no-coworkers are excluded)

Table 6. Description of co-workers moving from the PF to the new spin-off (Portugal, 1992-2007)

	Same industry		Different industry		Same region		Different Region	
	PS	PL	PS	PL	PS	PL	PS	PL
Share of CW $_{(\%)}{}^{a}$	0.238	0.085	0.103	0.027	0.231	0.075	0.105	0.032
Tenure in PF $_{(months)}{}^{b}$	54.92	48.28	56.60	53.90	57.03	51.56	48.35	47.08
Schooling years^{b}	6.115	6.651	6.777	7.600	6.121	6.699	6.767	7.391
Hourly wage in PF $_{(€)}{}^{b}$	2.801	3.042	3.072	3.649	2.729	2.895	3.360	3.846
Age $_{(years)}{}^{b}$	35.51	33.69	35.28	33.64	35.45	33.76	35.50	33.52

Notes: ^{a}Mean values for all spin-offs. ^{b}Mean values for the sub-sample of spin-offs hiring, at least, one co-worker. PS: Pushed Spin-off; PL: Pulled Spin-off; CW: Co-workers; PF: Parent Firm.

We have then extended our previous estimations in order to evaluate how the relative quantity and quality of co-workers influence spin-offs' hazards. Departing from the global specification presented in Table 5, we have replaced the indicator variable "Hire co-workers" by the set of variables summarized in Table 6, in order to, first, measure the relative importance of co-workers in the total spin-off's workforce and, second, proxy the general and specific human capital of these workers. We summarize the main results in Table 7.

Table 7. The effect of relative quantity and quality of co-workers on spinoffs' survival (Portugal, 1992-2007)

	(1)	(2)	(3)
Pushed Spinoff	-0.0136	-0.0179	-0.0143
	(0.0176)	(0.0176)	(0.0177)
Share of co-workers at entry	-0.3961***		-0.1699**
	(0.0482)		(0.0864)
Average schooling of co-workers		-0.0130***	-0.0106**
		(0.0046)	(0.0048)
Averare tenure of co-workers in the PF		-0.0019***	-0.0018***
		(0.0003)	(0.0003)
Average age of co-workers		-0.0001	0.0012
		(0.0011)	(0.0013)
Average hourly wage of co-workers in the PF		0.0026	0.0028
		(0.0057)	(0.0057)
Number of Observations	250,242	250,242	250,242
Log Likelihood	-73,094.6	-73,077.8	-73,075.8
Unobserved Heterogeneity (Gamma Variance)	0.3838***	0.4020***	0.4013***

Notes: *, ** and *** denote significant at 10%, 5% and 1%, respectively. Standard errors in parentheses. PF: Parent Firm. All these specifications also control for the firm, industry and macro variables previously described.

From the first specification, our results indicate that firms entering with a larger proportion of co-workers among their initial employees will have lower

hazard rates. In the second specification, we replace this variable by the four proxies of co-workers' human capital summarized above. Despite each of them is found to reduce spin-offs' hazard rates (not reported), when included all together in the same specification, only co-workers' education and tenure in the parent firm remain statistically significant.

The final specification controls for both the relative quantity of co-workers and their average "quality". The effect of the relative quantity of co-workers is now lower in magnitude, but still significant. Regarding the variables measuring the human capital of these workers, the experience accumulated in the parent firm seems to be the most relevant source of human capital to reduce spin-offs' exit rates (the effect is statistically significant at the 1% level). This suggests that co-workers' specific human capital is a particularly valuable asset to new spin-offs hiring these workers. The longer these workers were employed at the parent firm, the greater might be their knowledge of routines and procedures, and the resultant knowledge spillovers (Wezel et al., 2006; Agarwal et al., 2011).

Additionally, a longer tenure in the previous employer may also be a sign of a good match between the worker and the firm, being also a possible proxy for workers' ability. Pushed spin-offs seem to have some comparative advantages in this regard, given that their co-workers are, on average, slightly more experienced than those hired by their pulled counterparts. They may, thus, benefit from more significant knowledge transfers and team-specific human capital owing to the presence of these workers at entry. Alternatively, pushed spin-offs may use these recruitment schemes as a less costly screening strategy, in order to be able to attract the best workers from the parent firm, where employment conditions may not be so favourable due to adverse economic shocks.

Finally, these additional estimations show that, when we control for the relative importance of co-workers and their human capital, the survival differences between pushed and pulled spin-offs almost vanish, being no longer statistically significant. This may suggest that most of the observed differences in pushed and pulled spin-offs' exit rates might be explained by differences in

their initial endowments – in particular, those related to co-workers. Next we conduct a brief multivariate decomposition analysis in order to evaluate this hypothesis in more detail.

5.4 Multivariate decomposition of pushed-pulled survival gap

Multivariate decomposition has been widely used by researchers from several fields to quantify the components of a group (e.g., men and women, black and white individuals) difference in a statistic (e.g., a mean or a proportion), which can be attributed to group differences in characteristics and group differences in effects. Similar decomposition techniques have been extended and improved for non-linear models – and hazard models in particular – during the most recent years (Powers and Yun, 2009; Powers et al. 2011), making possible to understand the sources of group differences in (exit) rates.

In this Section, we apply the multivariate decomposition techniques developed by Powers and Yun (2009) and Powers et al. (2011) to better understand the link between pushed and pulled spin-offs' survival gap and their different start-up conditions. Formally, the method allows the decomposition of the overall observed difference between pushed and pulled spin-offs' hazard rates into a first component E that reflects compositional differences between groups (i.e., differences in their characteristics or endowments), and a second component C that reflects differences in the effects of those characteristics (or endowments) between groups (i.e., differences in the returns, coefficients or behavioral responses), as follows:

$$h_{PS} - h_{PL} =$$

$$= \left\{ \overline{F(X'_{PS}\beta_{PS})} - \overline{F(X'_{PL}\beta_{PS})} \right\} + \left\{ \overline{F(X'_{PL}\beta_{PS})} - \overline{F(X'_{PL}\beta_{PL})} \right\} = \quad (3)$$

$$= E + C \quad (4)$$

We have chosen pushed spin-offs as the comparison group and pulled spin-offs as the reference group.[10] In this case, E reflects a counterfactual comparison of the difference in hazard rates from pushed spin-offs' perspective (i.e., the expected difference if pushed and pulled spin-offs had the same distribution of covariates), and C reflects a counterfactual comparison of hazard rates from pulled spin-offs' perspective (i.e., the expected difference if pulled spin-offs had the behavioral responses of pushed spin-offs to X). The decomposition further allows to partition both E and C into portions E_k and C_k $(k = 1, \ldots, K)$ that represent the unique contribution of the kth covariate to E and C, respectively, which, in turn, make possible the aggregation into groups of components that might be of interest (e.g., BOs' human capital or co-workers' characteristics).[11]

In order to understand how particular start-up conditions may contribute to explain spin-offs' survival gap, we have, thus, decomposed the observed pushed-pulled difference in hazard rates using the global specification of our complementary log-logistic model presented in Table 5. Additionally, we have performed a similar decomposition using the alternative specification that controls for both the relative quantity and quality of co-workers (specification 3 from Table 7). Table 8 provides the detailed decompositions for the key variables under analysis. Figure 6 complements the analysis by illustrating the relative importance of different groups of variables in these decompositions.[12]

The total observed gap in pushed and pulled spin-offs' exit rates amounts to 4.2 percentage points. According to the first decomposition, differences in pushed and pulled spin-offs' observed characteristics account for 69% of this gap. However, when we also control for the relative quantity and quality of co-

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[10] However, the same differential (with a change in sign) can be obtained from an alternative decomposition that switches the roles of the reference and comparison groups (see Powers et al., 2011).

[11] The decomposition proposed by Powers and Yun (2009) and Powers et al. (2011) also solves the problem of "path dependence", according to which nonlinear decompositions are sensitive to the order in which independent variables enter the decomposition.

[12] The decompositions were performed with the user-written programs mvdcmp and mvdcmpgroup for Stata (see Powers et al., 2011), using the options that provide normalized solutions for dummy variables.

workers hired at the start-up, the *Endowments* component represents 90% of the overall gap. In other words, the results suggest that 90% of the difference observed between pushed and pulled spin-offs in exit rates can be attributed to differences in their characteristics, and especially to differences in their co-workers and BOs – from Figure 6, differences in these two groups of start-up conditions account for 64% of the pushed-pulled survival gap (Model 2). The contribution of regional and industry similarities between the spin-off and the parent firm are, in contrast, negligible.

In line with our previous results, these decompositions confirm that the relative quantity and quality of co-workers play a particularly significant role in the explanation of firms' survival differences. From the first specification – where differences in co-workers are only measured by an indicator variable distinguishing firms hiring at least one co-worker from firms with no co-workers (*Hire co-workers*) – the results suggest that if pulled spin-offs hired co-workers with the same frequency as pushed spin-offs, their exit rates would be reduced by 3.3% ($-0.0014/-0.0420$). From the second specification, the decomposition results indicate that if pulled spin-offs had the same proportion of co-workers in their initial workforce as their pushed counterparts, and if their co-workers had similar characteristics (namely in terms of average education and accumulated experience in the parent firm) as those hired by pushed spin-offs at entry, their survival differences would be reduced by 41%.

Regarding BOs' characteristics, the detailed decomposition reported in Table 8 actually shows that not all BOs' human capital measures are working in the same direction. While specific human capital measures (namely industry-specific and entrepreneurial experience) are favoring pushed spin-offs – thus, contributing to reinforce the pushed-pulled gap –, differences in BOs' age and education apparently attenuate the gap. Even so, overall and in net terms, the different endowments of pushed and pulled spin-offs in terms of BOs' human capital are found to contribute for a superior performance of pushed over pulled spin-offs. A great part of the observed gap in exit rates seems to come from their differences at BOs' industry-specific experience.

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Table 8. Multivariate decomposition of pushed-pulled differences in hazard rates

	(1)		(2)	
	Endowments	Coefficients	Endowments	Coefficients
Similarity to the PF				
Same 2d industry	0.0013***	0.0002	0.0019***	0.0018
of the PF	(0.0004)	(0.0012)	(0.0004)	(0.0021)
Same region	-0.0019***	-0.0043**	-0.0019***	-0.0053
of the PF	(0.0002)	(0.0020)	(0.0002)	(0.0047)
Co-workers (CW)				
Hire CW	-0.0014***	-0.0006***		
	(0.0002)	(0.0002)		
Share of CW			-0.0110***	-0.0066
			(0.0018)	(0.0053)
Average schooling			-0.0044***	-0.0006
of CW			(0.0013)	(0.0014)
Average tenure			-0.0019**	-0.0014
of CW in the PF			(0.0008)	(0.0013)
Human capital of the BO(s)				
BOs' age	0.0009***	0.0437***	0.0010***	0.0579
	(0.0002)	(0.0159)	(0.0002)	(0.0479)
Schooling years	0.0029***	-0.0065	0.0026***	-0.0059
	(0.0004)	(0.0054)	(0.0004)	(0.0079)
Industry experience	-0.0116***	-0.0040*	-0.0107***	-0.0027
	(0.0009)	(0.0023)	(0.0009)	(0.0033)
Experience as BO	-0.0031***	-0.0020	-0.0027***	0.0002
	(0.0004)	(0.0028)	(0.0004)	(0.0033)
Total decomposition	-0.0291***	-0.0129***	-0.0378***	-0.0042**
	(0.0028)	(0.0060)	(0.0034)	(0.0060)
	69%	31%	90%	10%

Notes: *, ** and *** denote significant at 10%, 5% and 1%, respectively. Standard errors in parentheses. The results on other firm, industry and macroeconomic variables are available upon request from the authors.
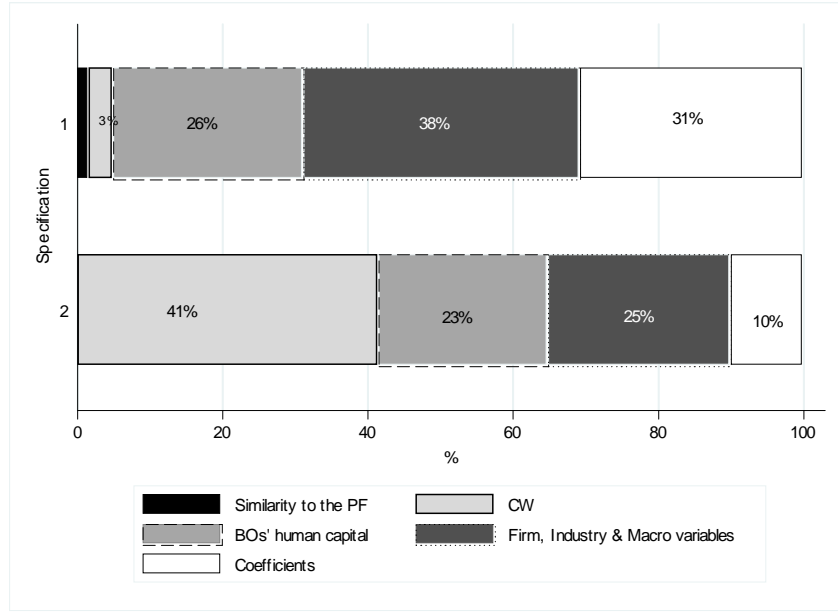
Fig. 6. Multivariate decomposition of pushed-pulled differences in hazard rates, by groups of variables

In summary, our results do not confirm the expectation raised by the literature that pulled (or opportunity) spin-offs outperform those firms driven by more pushed-nature factors. Unconditionally, we actually find that pushed spin-offs survive longer. As we control for a larger number of start-up conditions and other firm and industry dimensions where pushed and pulled spin-offs differ, the survival gap becomes less significant. Our multivariate decomposition confirms that a great part of the relative survival advantages shown by pushed spin-offs comes from their larger endowments of particular human resources at entry, namely the characteristics and the relative importance of their co-workers, and the human capital of their BOs.

6 Concluding Remarks

In this study we have used a large longitudinal matched employer-employee dataset covering all firms in the Portuguese private sector, which allowed us to identify a total of 50,656 spin-offs entering during 1992-2007 (16,001 pushed spin-offs and 34,655 pulled spin-offs). Discrete time hazard models, incorporating a gamma mixture distribution to control for firm-level unobserved heterogeneity, were employed to study how different are the survival prospects of those two groups of spin-offs. Additionally, we have tried to uncover some of the factors that may help to explain these differences, by taking into account the parent–spin-off relatedness at the industry and geographic levels, the presence and the characteristics of co-workers, and BOs' human capital.

Our empirical analysis reveals that, unconditionally, pushed spin-offs have lower exit rates than pulled counterparts. However, as we control for a larger number of observed differences between pushed and pulled spin-offs, the survival gap almost vanishes. A multivariate decomposition of the observed differences in their hazard rates showed that about 64% of the gap observed between pushed and pulled spin-offs' exit rates can be attributed to differences in their start-up conditions, namely those regarding the relative quantity and quality of their co-workers and their BOs' human capital.

Our study also suggests that pushed spin-offs may be important employers and that, for this reason, their significance should not be neglected. Their relative importance in the total employment created by new entrants in the private sector has been growing over the most recent years. Moreover, they also assume an important role in the absorption of many of those workers who were recently displaced by the parent firm, consequently allowing the reutilization of their skills and preventing the depreciation of their human capital. Under the widespread context of economic crisis in many European countries, marked by an unusually large number of bankruptcies and massive layoffs, spin-offs of a more pushed-nature may, thus, become more prominent in the near future, by working as a possible solution to unemployment.

Finally, the fact that our results do not confirm that pushed-nature entrepreneurial firms perform worse than other spin-offs in the market also calls for further research and reflection about pushed and pulled spin-offs' performance differences. Despite pushed spin-offs may be triggered by more unfavorable environments at the parent firm, and their creation may constitute an immediate response to founders' job loss, they still may be able to perform as well as other firms driven by the identification of a great business opportunity. Actually, by being forced to be more self-sufficient comparatively to those launching opportunity-based businesses, necessity-based entrepreneurs may become more attached to their firms and, thus, be more resilient in the market, which may contribute to improve the survival prospects of their firms.

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Workers' skills and the post-entry dynamics of new spin-offs*

Essay 5

May 29, 2014

Abstract

Despite the increasing interest in firm growth and survival over the last decades, research on how the dynamics of new firms – and particularly spin-offs – is related to the characteristics of their initial workforce is still scarce. This paper uses a large longitudinal matched employer-employee dataset to study how spin-offs' post-entry employment growth, worker flows and survival are associated to their initial human capital endowments. We focus on three measures of human capital at entry: the average skill level of workers, their skill dispersion and the share of co-workers in the workforce. In order to measure workers' skills, we use a multidimensional skill index that takes into account both observed and unobserved characteristics of the worker. Our results show that firms employing a more skilled workforce at the start-up face lower exit rates. In contrast, skill dispersion at entry increases the risk of exit and significantly reduces post-entry employment growth, by increasing spin-offs' separation rates. Finally, spin-offs entering with a more significant share of co-workers in the initial workforce survive longer and seem to suffer less significant labor adjustments over their lifecycle.

Keywords: Entrepreneurship, Spin-offs, Firm Growth, Firm Survival, Human Capital, Worker Turnover
JEL Codes: J24, J63, L25, L26, M13

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1 Introduction

Research on firm growth and survival has been accumulating at a remarkable pace over the last decades, being one of the central topics in the entrepreneurship field (Coad, 2009; Leitch et al., 2010; McKelvie and Wiklund, 2010). Understanding how entrepreneurs survive in the market, and how their firms can grow and create sustainable jobs constitutes a well-documented and still timely debate among scholars, policy makers and business-owners, especially following one of the worst financial and economic crisis in decades, marked by the closure of many firms and massive layoffs (OECD, 2010; 2013a).

What has been left aside by most of this already vast literature is how the dynamics of new firms (in terms of survival, growth and labor adjustments over firms' lifecycle) are related to the characteristics – specifically the skills – of the workers these firms employ at entry. Although a large empirical literature suggests that workers' outcomes are associated with firms' characteristics (see, for instance, the literature on firm size-wage effects), very little is known about the converse relationship. This neglect of the literature is indeed surprising, given that any level of employment growth can be achieved by different combinations of hires and separations (Burgess et al., 2000), so we may expect that a strong association between firm growth, labor reallocation and initial workers' skills actually exists. Moreover, labor is probably the most heterogeneous of all inputs in production functions (Lazear and Oyer, 2007), so matching the right firms to the right workers is expected to create economic value of a magnitude that few other economic processes can, and hence to have important effects on firm survival.

The lack of proper longitudinal data matching firms and workers partially explains why the potentially significant link between firms' initial choice of worker mix and subsequent firms' outcomes was overlooked for long time (Haltiwanger et al., 1999, 2007; Hamermesh, 2008; Iranzo et al., 2008). In this line, this study aims at understanding how the growth and survival patterns of new firms are related to the characteristics of the workers they employ at

the time of entry, using a rich matched employer-employee dataset for Portugal. We focus on a significant group of new start-up firms that are established every year – spin-offs launched by individuals who have recently left their job either due to the identification of a business opportunity (pulled spin-offs), or by necessity (pushed spin-offs) – and where hiring strategies and, thus, initial workforce characteristics, may be particularly relevant to explain their post-entry performance (see Song et al., 2003; Franco and Filson, 2006; Agarwal et al., 2011; Muendler et al., 2012; Andersson and Klepper, 2013).

The paper focuses on three particular aspects of spin-offs' initial workforce: the average skill level of the first employees, their skill dispersion, and the share of co-workers at entry.[1] Regarding skill measurement, we follow the strategy proposed by Portela (2001) and use a multi-dimensional index of workers' skills, which allows considering both observable and unobservable characteristics of the workers employed by spin-offs at the time of entry. This approach constitutes a novel contribution to the existing literature, as previous studies have mostly focused on very particular and observable characteristics of workers to measure their skills (e.g., Ilmakunnas et al., 2004; Haltiwanger et al., 1999, 2007; Ilmakunnas and Ilmakunnas, 2011; Lopez-Garcia and Puente, 2012; Koch et al., 2013).

The main contributions of this study are twofold. First, we follow 50,656 new spin-offs established during the period 1992-2007 and analyze how the aforementioned initial human capital endowments are related to spin-offs' growth rates, worker flows (hires and separations) and survival. Second, we test whether, accounting for a set of firm, industry and entrepreneurs characteristics, any significant differences remain between pushed and pulled spin-offs in terms of employment growth and survival. To the best of our knowledge, this is the first study analyzing how those firm-level outcomes are related to the characteristics of the workforce hired at the time of entry, focusing particularly

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[1] Co-workers are defined as those workers hired by the new spin-off at the start-up and who were previously employed in the parent firm where the spin-off's founder comes from.

on pushed and pulled spin-offs.

The remaining sections of the paper are organized as follows. Section 2 briefly reviews the main literature relating firms' outcomes with workers' skills, and discusses the human capital measures used in this study. Section 3 describes the data and the methodological details about the computation of the skill index. Section 4 presents some descriptive and comparative statistics on the employment dynamics and workers' skills for pushed and pulled spin-offs. Section 5 presents the empirical models and discusses the results. Section 6 concludes.

2 Firm-level outcomes and workforce characteristics

2.1 Previous literature and theoretical background

There is an increasing integration and interdependence of the fields of industrial and labor economics (Haltiwanger et al., 1999, 2007; Ilmakunnas et al., 2004; Mamede, 2008). New firm performance – in terms of growth and survival – is a topic where this connection is particularly clear. On the one hand, the interesting issue from the point of view of industrial economics is how we can explain firms' post-entry performance with the fact that the "quality" and the "mix" of workers they start with is different. On the other hand, from the labor economics perspective, an imperative issue is how new firms might contribute to job creation, destruction and labor turnover over their lifecycle.

Labor reallocation has been documented to be particularly significant among new and young firms (e.g., Abowd et al., 1999a; Burgess et al., 2000; Davis et al., 2009; Haltiwanger et al., 2013). Imperfect information – either in the form of information asymmetry (Gibbons and Katz, 1991) or matching quality (Jovanovic, 1979, 1984) – is argued to play a key role in this process of workers' reallocation at the firm-level (Abowd et al., 1999a). Actually, as firms get

themselves sorted out and survive in the market, they probably identify their best workers, or the particular "skill mix" they require, and gradually move towards their desired team (Geroski and Mazzucato, 2002; Haltiwanger et al., 2007). As a result, firm-level employment growth rates and exit decisions may reflect adjustments in firms' (and entrepreneurs') perceptions about their own ability and efficiency.

While much attention has been paid to the role of the human capital of the founder(s) (Rauch et al., 2005; Koch et al., 2013), the relationship between workers' human capital and firm performance has been relatively neglected. However, under the resource-based theory of competitive advantage (e.g., Barney, 2001), human capital – understood as the most universally valuable and imperfectly imitable resource – is believed to explain why some firms outperform others (Crook et al., 2011). In times of increasing internationalization and a continuous acceleration of technological development, human capital endowments are recognized to be important preconditions to obtain information about markets and technologies, to remain connected and reactive in the market, to maintain and strengthen the competitiveness, and to give satisfactory signals to both clients and competitors (Rauch et al., 2005; Koch et al., 2013). Furthermore, initial human capital endowments may play an even more important and strategic role in newborn firms, which typically have less well-developed resources (e.g., immature internal structures, lack of reputation, and insufficient access to networks) and face higher exit rates, and which, therefore, need to find specific strategies to compete successfully with incumbents and to be able to grow.

The existing studies evaluating the role of human capital have mostly focused on firm productivity and workers' observed characteristics. So far, empirical evidence for U.S. (Haltiwanger et al., 1999, 2007), Finland (Ilmakunnas et al., 2004) and Spain (Lopez-Garcia and Puente, 2012) confirmed that firms employing more educated workforces are more productive on average (see also Crook et al. (2011) for a survey of results on other firm-level outcomes and for other countries). Similar results were obtained for Italy by Iranzo et al.

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(2008), who alternatively used the person fixed effect from an estimated wage equation (with both worker and firm fixed effects) as a measure of workers' skills. Studies analyzing how workers' skills may influence firm employment and survival dynamics are however much scarcer. The recent study by Koch et al. (2013), for Germany, has attempted to fill this gap, showing that employing a larger share of highly educated workers in the year of start-up has a significant positive impact on new firms' post-entry growth.

This paper, thus, tries to understand how the growth and survival of new spin-offs is related to their human capital endowments at the time of entry. Besides, we pay further attention to the heterogeneous nature of spin-offs, as not all spin-offs arise from the identification of an opportunity by some employee(s), or from some strategic action of incumbent firms. Several spin-offs also emerge from necessity (e.g., to escape from unemployment or unstable job conditions), though only more recent studies started recognizing their importance (e.g. Buenstorf, 2009; Bruneel et al., 2013; Dick et al., 2013).

Although most of those studies have been suggesting that pulled spin-offs outperform their pushed counterparts by surviving longer, recent evidence has also found that, after controlling for a number of start-up conditions where these firms differ, pushed and pulled spin-offs' exit rates are not significantly different (Rocha et al., 2013). Evidence on the role of initial workforce skills on pushed and pulled spin-offs' employment dynamics and survival is still limited, so this paper tries to contribute to this emerging debate by exploring whether a different worker mix at entry leads to different adjustments in pushed and pulled spin-offs' labor force, and whether the *type* of spin-off becomes imprinted in these firms' DNA, possibly leading to enduring post-entry performance differences, even after controlling for the characteristics of workers, business-owners, firms and industries.

2.2 Human capital measures

In this paper, we use three variables to measure the human capital endowments of pushed and pulled spin-offs at the moment of start-up: the average skill level of the initial workforce, the workers' skill dispersion at entry, and the share of co-workers hired at the start-up.

While the literature generally agrees on a positive association between workers' average skills and firm performance (usually measured by firm productivity), the effects potentially arising from skill dispersion are not so clear-cut. On the one hand, diversity (in tangible and intangible resources) within firms is often considered to be positively related to performance (Lazear, 1999; Ilmakunnas and Ilmakunnas, 2011; Østergaard et al., 2011; Koch et al., 2013), as a diversified workforce may raise the firm's ability to react and adapt to external shocks, improve the firm's problem-solving routines, besides providing access to a broader set of resources and increased information about global markets, potentially making the firm more creative, innovative and open to new ideas.

On the other hand, workers' heterogeneity also increases the need for interaction and communication, as it may lead to conflicts, distrust, rivalry, dissatisfaction, poor cooperation among workers and increased transaction costs (Parrotta et al., 2012). Moreover, according to the O-ring theory of production function (Kremer, 1993), workers are normally sorted out according to their skills, so people of similar skills are expected to work together and firms tend to specialize either in low-skill or in high-skill workers.

Empirical results on this relationship are still scanty and ambiguous. For Finland, Ilmakunnas and Ilmakunnas (2011) found that age (education) diversity is positively (negatively) related to firm productivity, while Østergaard et al. (2011) and Parrotta et al. (2012) obtained the reverse relationship, both for Denmark.[2] Martins (2008) and Iranzo et al. (2008), instead, measured work-

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[2]The study by Østergaard et al. (2011) however focuses on the relationship between employee diversity and firm innovation.

ers' skills through the person-specific effect obtained from a wage equation. The former concluded, for Portugal, that an increase in workers' heterogeneity is associated with a decrease in firm productivity, whereas the latter, using Italian data and distinguishing between production and nonproduction workers, found positive (negative) effects from within-occupation (between-occupation) skill diversity. Hence, we contribute to this literature by analyzing not only the role of workers' average skills, but also the effect of workers' skill dispersion at the moment of entry – measured by the standard deviation of the average skill index of the initial workforce.

Finally, regarding the presence of co-workers in the initial workforce, the literature suggests that this may constitute a possible source of competitive advantage for the firm. By working as a possible channel through which routines, procedures, knowledge and various forms of human capital (e.g., industry-specific, firm-specific, team-specific human capital) may be transferred from the parent firm (Audretsch and Keilbach, 2005; Franco and Filson, 2006), co-workers may actually be a firm-specific resource – therefore, difficult to imitate.

Nonetheless, a stronger presence of co-workers at entry may also moderate the post-entry growth of new spin-offs. On the one hand, the choice of the initial workforce is documented to have long-term, persistent, effects, not only due to the informal ties developed between the first employees and firms' founders (Koch et al., 2013), but also because firing is costly and time consuming (Messina and Vallanti, 2007), potentially restricting subsequent labor adjustments at the firm-level. On the other hand, absorbing some co-workers from the parent firm may be a less costly process of screening the best workers or matches at entry. Accordingly, information asymmetries between firms/entrepreneurs and workers may be mitigated (and the match quality may be improved) in spin-offs where co-workers have a more relative importance at the start-up, thus reducing the need for great labor reallocation after entry – which may be translated into lower hiring and separation rates –, though potentially reducing firm exit risks. Given these mixed arguments and the lack

of empirical evidence on this relationship, we also consider the effect of this measure of human capital in our analysis.

3   Data and Methodological Issues

3.1   Data and identification of spin-offs

Our data come from Quadros de Pessoal (hereafter, QP), a large longitudinal linked employer-employee dataset obtained from the Portuguese Ministry of Employment. QP covers all firms operating in the Portuguese private sector and employing at least one wage earner. Every year, each of those firms is legally obliged to fill in a survey and to report information on each of its establishments and workers. Available information at the firm-level includes employment, sales, industry, ownership, location, among others. At the individual-level, QP reports information about each worker's age, education, gender, qualifications, wages, occupational category, tenure, number of hours worked and type of contract. All firms, establishments and workers are identified with a unique identification number, so that they can be followed and matched over time. For these reasons, QP provides very rich and reliable micro data, allowing the identification of entries and exits of firms, BOs and workers, besides making possible to track individuals' trajectories and transitions across firms, industries, locations, occupational categories, among others.

Raw QP files are available for the period 1986-2009.[3] Entries of new firms are identified by the first time (year) a firm is recorded in QP files. New spin-offs are identified as a particular group of start-up firms entering in t, whose founder(s) was/were in paid employment in $t-1$ or $t-2$ and who left the previous employer. For spin-offs founded by two or more BOs in each year t, we have required that all of them were employed in the same incumbent firm,

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[3]There is a gap for the particular years of 1990 and 2001 in the worker-level files, for which no information was gathered at the individual-level.

and that all of them have left their previous employer immediately before (in $t-1$ or $t-2$) engaging in the creation of the spin-off.

Pushed spin-offs were then distinguished from pulled spin-offs according to the potential triggering event driving the individuals' decision to start a business. Spin-offs founded in t by an individual (or a set of individuals) coming from an incumbent firm that either closed or suffered a significant downsizing in $t-1$ or $t-2$ were classified as "pushed spin-offs".[4] In this case, the creation of their own business may actually be a response of some employees to an adverse shock in the parent firm, being possibly closer to necessity-based spin-offs. The remaining cases were classified as "pulled spin-offs", which may either include "incumbent-backed spin-offs" – i.e., corporate spin-offs that are the result of opportunities exploited by an incumbent firm – or cases closer to "opportunity spin-offs" – that is, businesses initiated by one or more employees that identify an opportunity and who decide to explore it independently of their employer (see Buenstorf, 2009; Bruneel et al., 2013). We are not able to distinguish these two last cases in our data.

We have followed the employment growth and survival patterns of 50,656 spin-offs identified in QP data – 16,001 pushed and 34,655 pulled –, which entered during the period 1992-2007 (excluding 2001).[5,6] The analysis stops at 2007, the last year for which we can identify the exit of firms. Firm exit is identified by the moment when a firm ceases to answer the survey. Following previous studies that also use QP dataset (e.g., Mata and Portugal, 2002; Geroski et al., 2010), we have required an absence of the firm from the files

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[4]Following OECD (2013b), a significant downsizing corresponds to a reduction in firm size larger or equal to 30% of the workforce, with a minimum number of separations equal to five.

[5]Due to the missing data at the worker-level for 2001, we are not able to identify the BO(s) of firms entering in this year. As our classification of spin-offs into "pushed" or "pulled" requires detailed information about the origin of BO(s) founding the firm, entries occurring in 2001 had to be excluded.

[6]About 97% of the 50,656 spin-offs under analysis are either limited liability companies (*Sociedades por Quotas*) or one-person business (*Empresário em Nome Individual*). From the 16,001 pushed spin-offs identified, 10,161 were established after the parent firm closure and the remaining 5,840 emerged after a significant downsizing of the parent firm.

larger or equal to two years in order to identify its definite exit.[7] Data for 2008 and 2009 were only used to check the presence or absence of firms in QP files.

3.2   Measuring workers' skills

Previous studies have already recognized that finding the right measure of skills is quite controversial (Iranzo et al., 2008). As already discussed, most of the existing studies constructed human capital proxies based on *observed* dimensions as workers' educational attainment, age, earnings or gender (e.g., Haltiwanger et al., 1999, 2007; Ilmakunnas et al., 2004; Ilmakunnas and Ilmakunnas, 2011; Koch et al., 2013). However, since the seminal contribution of Abowd et al. (1999b), it is well known that worker heterogeneity can exceed considerably the differences across individuals in terms of the observable variables mentioned above, which only imperfectly reflect *unobserved* differences as innate ability, informal skills or education quality (see also Iranzo et al, 2008; Martins, 2008).

As a result, we provide a methodological contribution to the existing literature using the multi-dimensional skill index developed by Portela (2001) to measure workers' skills. This index synthesizes different observable and unobservable dimensions of the productivity of workers – in this case, schooling, experience and unobservable permanent heterogeneity. Accordingly, we started by computing the skill index of each worker i in each year t as follows:

$$S_{it} = mschool * a_{\text{school}} * a_{\text{experience}} * a_{\text{unobserved ability}}$$

where:

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[7]We define exit as firm closure. Despite the comprehensiveness of QP dataset, it does not allow the distinction between different modes of exit. Regarding the exits due to mergers or acquisitions (M&A), prior studies (e.g., Geroski et al., 2010) have documented that less than 1% of the total number of liquidations in Portugal has been due to M&A, thus suggesting that our inability to identify mergers in QP is not likely to affect our results.

- *mschool* is the average schooling years in the economy in each year;

- a_{school} is a correction factor taking into account the actual position of the individual, in each year, in the schooling distribution, being computed as follows:

$$a_{\text{school}} = 0.5 + \frac{\exp((school_i - mschool)/sschool)}{1 + \exp((school_i - mschool)/sschool)},$$

where $school_i$ stands for the schooling level (in years) of worker i and $sschool$ represents the standard deviation of schooling in the population;

- $a_{\text{experience}}$ is a correction factor for worker's experience, conditional on their schooling level, calculated as follows:

$$a_{\text{experience}} = 0.5 + \frac{\exp((age_i - mage|school_i)/(sage|school_i))}{1 + \exp((age_i - mage|school_i)/(sage|school_i))},$$

where age_i represents the age (in years) of worker i, $mage|school_i$ is the average age of the population within schooling level $school_i$ and $sage|school_i$ is its standard deviation;

- $a_{\text{unobserved ability}}$ is a correction factor for worker's unobserved ability, conditional of their schooling level and experience, calculated as follows:

$$a_{\text{unobserved ability}} = 0.5 + \frac{\exp((FE_i - mFE|school_i, age_i)/(sFE|school_i, age_i))}{1 + \exp((FE_i - mFE|school_i, age_i)/(sFE|school_i, age_i))},$$

where FE_i denotes the worker-specific effect, $mFE|school_i, age_i$ is the average of those worker fixed effects for individuals with the same schooling and age, and $sFE|school_i, age_i$ is the standard deviation of those effects.

In order to estimate the worker fixed effect, a two high-dimensional fixed-effects wage equation was estimated using the procedure described in Guimarães and Portugal (2010). The dependent variable was defined as the natural log of

real hourly earnings.[8] This wage equation controls for individual's age (and its square), tenure (and its square), education dummies, qualification dummies, time dummies and, following Abowd et al. (1999b), both worker and firm unobserved (permanent) heterogeneity.

The computation of the skill index for each worker i in each year t has then allowed the construction of firm-level measures of workers' skills. In particular, for each firm, at the moment of entry, we have computed the average value and the standard deviation of their workers' skills, two of the key variables to be included in our empirical analysis – *Average Workers' Skills* and *Skill Dispersion*. With this last variable we aim at measuring the workforce inequality within the firm, in terms of skills, in the year of start-up. The higher (lower) the *Skill Dispersion*, the more heterogeneous (homogeneous) will be the initial workforce in terms of skills.[9]

4   Employment dynamics and workers' skills in pushed and pulled spin-offs

4.1   Employment growth, job and worker flows over firms' lifecycle

Figure 1 depicts the evolution of pushed and pulled spin-offs' growth rates over the years. On average, pulled spin-offs tend to present higher growth rates (3.9% against 1.3% for pushed spin-offs), though the growth rates of

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[8]Hourly earnings correspond to the ratio between total regular payroll (base wages and regular benefits) and the total number of normal hours worked in the reference period. Earnings were deflated using the Consumer Price Index. Outliers (i.e., the 1% with highest and lowest real hourly log earnings in each year) were removed from the estimations.

[9]It is possible to have some missing values in particular years at the firm-level, especially for firms employing only one worker, if some of the components of the skill index have missing data. Nevertheless, this does not seem to affect our results, given that the overall conclusions remain unchanged even when we exclude those firms from the dataset.

both groups of firms seem to converge as they age.[10] Growth rates tend to be higher during firms' infancy, becoming lower and even negative as firms become older, suggesting that most of the jobs are created at younger ages, while at more mature stages firms tend to stagnate or reduce their average size. The data actually reveal that average growth rates become negative relatively early, in part because many spin-offs close down and exit few years after start-up. About 28% of all spin-offs exit during the first three years of activity and only 64% survive at least five years. Conditional on survival, the average growth is found to be positive – though also decreasing – throughout the first eight to nine years of firm activity. The variability of growth rates also decreases over firms' lifecycle (see the right-hand side plot of Figure 1).
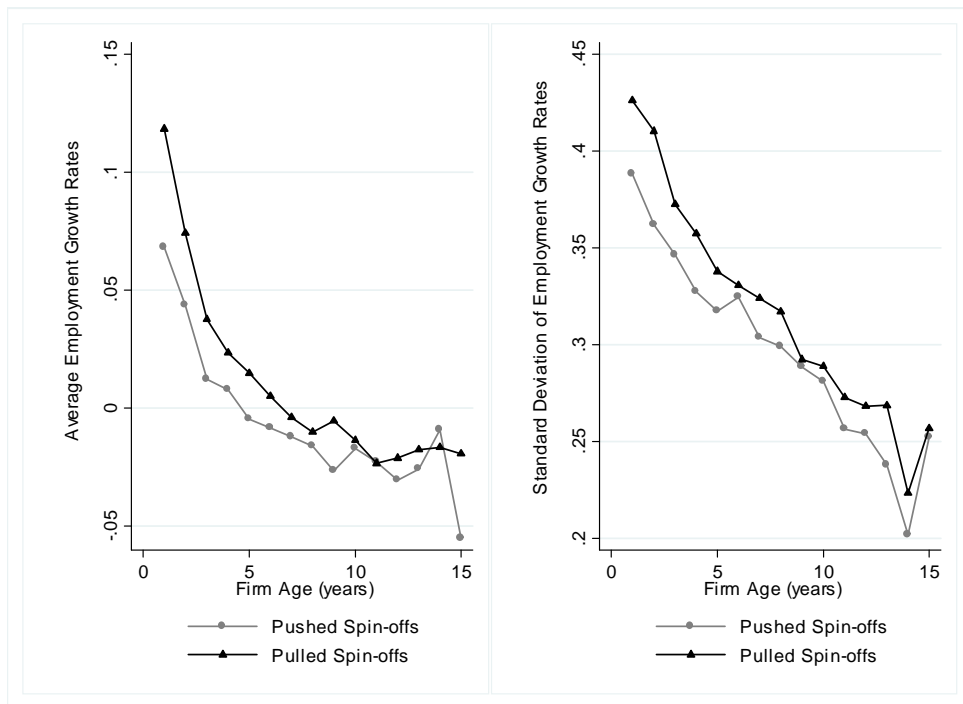
Fig. 1. Employment growth rates over firms' lifecycle, by spin-off type (average and std. dev. of growth rates)

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[10]However, we should notice that pushed spin-offs enter at a slightly larger scale – the mean and median start-up size of pushed spin-offs in our data is 5 and 3 employees, respectively; the respective values for pulled spin-offs are 4 and 2 employees.

Figure 2 plots the job reallocation rate, the worker flow rate and the churning rate over time, comparing, over again, pushed with pulled spin-offs. We follow Davis and Haltiwanger (1990, 1992) and Davis et al. (1996, 2006) in order to compute these rates.
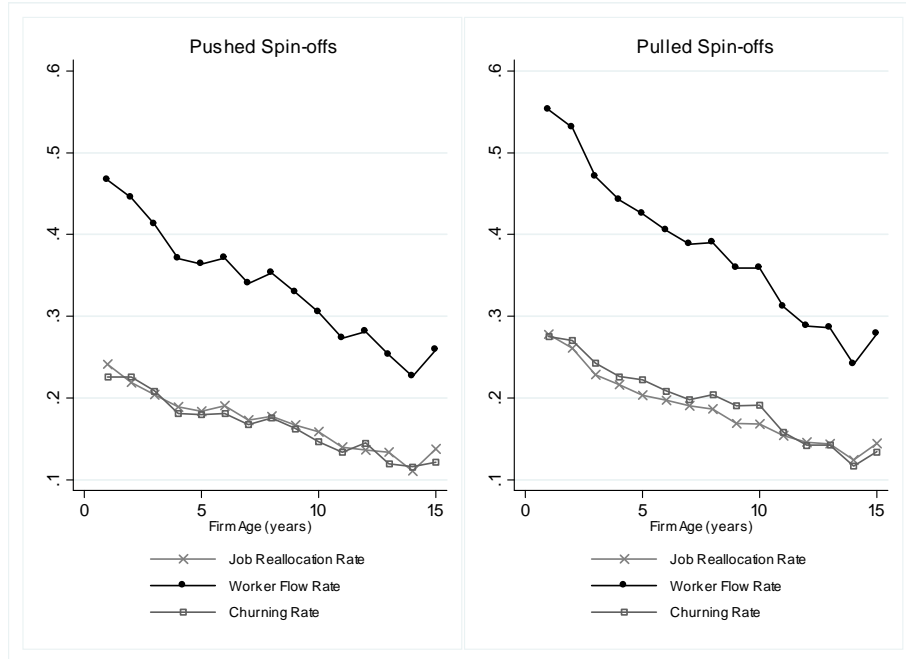
Fig. 2. Job and worker flows over firms' lifecycle

Job flows refer to the annual change in employment at the firm-level: $JF_{it} = E_{it} - E_{it-1}$. Accordingly, job creation (destruction) is a positive (negative) job flow. We define job reallocation at the firm-level as the absolute value of job flows ($JR = |JF|$). Total worker flows are defined as the sum of hires and separations, $WF_{it} = H_{it} + S_{it}$, so that job flows are also defined as $JF_{it} = H_{it} - S_{it} = E_{it} - E_{it-1}$. Worker flows can thus be rewritten as $WF_{it} = JR_{it} + CF_{it}$, where the second term denotes "Churning Flows" – the number of worker flows over and above those necessary to achieve the firm's desired employment change. Hence, worker flows comprise two main components: firms simultaneously hiring and firing (i.e., firms churning workers) and

workers quitting and being replaced (i.e., workers churning firms). The corresponding rates are the levels divided by the current average size of the firm $((E_{it} + E_{it-1})/2)$.

We observe, first of all, a clear pattern for the worker flow rate to decline with firm age, deriving from a decline in both job reallocation and churning rates. The data further show that worker turnover was higher in pulled than in pushed spin-offs. Overall, these patterns confirm that new spin-offs suffer a significant reallocation of workers over their lifecycle, especially during the first years of activity. As firms evolve over time, they probably have to decide and adjust the optimal mix of workers to employ. The fact that worker flows decline over firms' lifecycle may actually sign the already discussed behavioral and learning process at the firm-level – as firms age and learn about themselves and the market, they possibly identify their best workers/matches and/or the particular skill mix they require, and gradually adjust their workforce towards their desired team.

Table 1 additionally shows that while job destruction rates and separation rates were more similar among pulled and pushed spin-offs, the former exhibited higher job creation rates, as well as higher hiring rates. In summary, the data suggest that pulled spin-offs make more significant adjustments in their workforce after entry, while pushed spin-offs probably enter with a more stable worker mix, in part due to a stronger presence of co-workers and the potential knowledge advantages that may arise from them. In the year of start-up, about 19% of the initial workforce of pushed spin-offs is composed by co-workers, while in pulled spin-offs only 5% of the employees come from the parent firm.

In alternative, pushed spin-offs may have greater difficulties in adjusting their workforce over the lifecycle, either because their initial worker mix may be more rigid by nature (as informal ties with the first hires may create barriers to labor adjustments), or because they may be founded under more unfavorable conditions (i.e., possibly more driven by necessity) than their pulled counterparts, which may constrain their post-entry growth.

Table 1. Labor market flow rates, by spin-off type (mean rates)

	Pushed Spin-offs	Pulled Spin-offs
Job Creation Rate	0.1045	0.1297
Job Destruction Rate	0.0910	0.0907
Job Reallocation Rate	0.1955	0.2204
Hiring Rate	0.1962	0.2406
Separation Rate	0.1860	0.2044
Worker Flow Rate	0.3822	0.4450
Churning Rate	0.1928	0.2316

With Figure 3, we try to understand the relationship between worker turnover and job turnover at the firm-level, by plotting hiring and separation rates on firms' net employment growth rates. To construct this figure, and following Davis et al. (2006), we have used pooled annual data at the firm-level level from 1992 to 2007 to estimate the mean hiring rate and the mean separation rate for narrow intervals of spin-offs' growth rate distribution.[11]

As expected, both hiring and separation rates increase with the magnitude of the variation of net employment at the firm-level, being almost flat for positive (negative) employment growth rates in the case of separation (hiring) rates. In particular, hires (separations) increase roughly one-for-one with job growth (loss) at expanding (contracting) spin-offs. In addition, both hiring and separation rates are lowest for zero-growth spin-offs, which imply that these firms are relatively stable regarding job growth and worker turnover. Very similar patterns were identified for the subsamples of pushed and pulled spin-offs.

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[11]This method is equivalent to a least squares regression of the hiring (separation) rate on a large number of dummy variables for growth rate intervals that partition the -200 to +200 percent range. These OLS estimates are weighted by firms' average size.

Fig. 3. The relationship of spin-offs' hiring and separation rates to employment growth

Finally, Table 2 provides some information on the persistence of workers hired at entry. Column 1 summarizes the average share of "stayers" and shows that, on average, the proportion of workers hired at the start-up and remaining in the firm n years later is larger in pushed than in pulled spin-offs, but decreasing over the lifecycle in both groups of firms. This confirms that a significant part of the initial workforce leaves the firm over time.

Column 2 provides similar statistics for the subgroup of co-workers. The data confirm that the persistence rates of this type of workers are comparable to those of other workers – by the fifth year of spin-offs' activity, about 37% (31%) of those co-workers hired by pushed (pulled) spin-offs at entry still belong to the workforce. In other words, more than 60% of co-workers initially hired leave the firm during the first five years of activity.

The last column shows the relative importance of co-workers in the group of stayers. In pushed spin-offs, for each five stayers one is a co-worker hired from the parent firm. The relative presence of co-workers is much lower in pulled spin-offs, which also reflects the different importance that this group of workers assumes in both types of firms since their entry.

Table 2. Workers' persistence in the firm over firms' lifecycle

| | Stayers | | CW Stayers | | CW/Stayers | |
| | (1) | | (2) | | (3) | |
	Pushed Spin-offs	Pulled Spin-offs	Pushed Spin-offs	Pulled Spin-offs	Pushed Spin-offs	Pulled Spin-offs
Year 2	80.2%	78.5%	80.7%	77.5%	22.8%	6.1%
Year 3	61.4%	57.4%	60.7%	56.7%	23.8%	5.8%
Year 4	48.9%	44.8%	47.3%	42.2%	24.6%	6.4%
Year 5	39.0%	34.7%	37.4%	31.2%	24.2%	7.0%

(1) Stayers: #Workers entering in year 1 and persisting in the firm in year n/Total # workers hired in year 1.

(2) CW Stayers: # CW hired in year 1 and persisting in year n/Total # CW hired in year 1.

(3) CW/Stayers: #CW hired in year 1 and persisting in year n/#Workers entering in year 1 and persisting in the firm in year n.

4.2   Evolution of workers' skills over firms' lifecycle

Figure 4 illustrates how the average and the dispersion of the workers' skill index have evolved over time in pushed and pulled spin-offs. We observe an upward trend in both variables during the first years of activity, which suggest that both types of spin-offs evolve, on average, towards a more skilled and diversified workforce after entry. However, this evolution seems to slow down

or even reverse at more mature ages, as firms probably identify the best skill mix they need to perform their activity in the market.

Pulled spin-offs not only present a more skilled, but also a more heterogeneous, workforce than their pushed counterparts. On the other hand, while we observe some patterns of convergence over time between the two groups of spin-offs in what concerns the average skills of their employees, the same does not apply when we consider the standard deviation of workers' skills, as the differences between firms seem to remain large as they age.

Next we try to understand whether those who persist in the firm for relatively long periods (in this case, five years or more since the start-up), those who were recently hired, those who were separated, and those who come from the parent firm (co-workers) differ in terms of average skills. Table 3 summarizes the average skill index and the skill dispersion of these groups of workers, by spin-off type. Figure 5 complements the analysis by illustrating the distribution of the average skill index for different groups of workers.
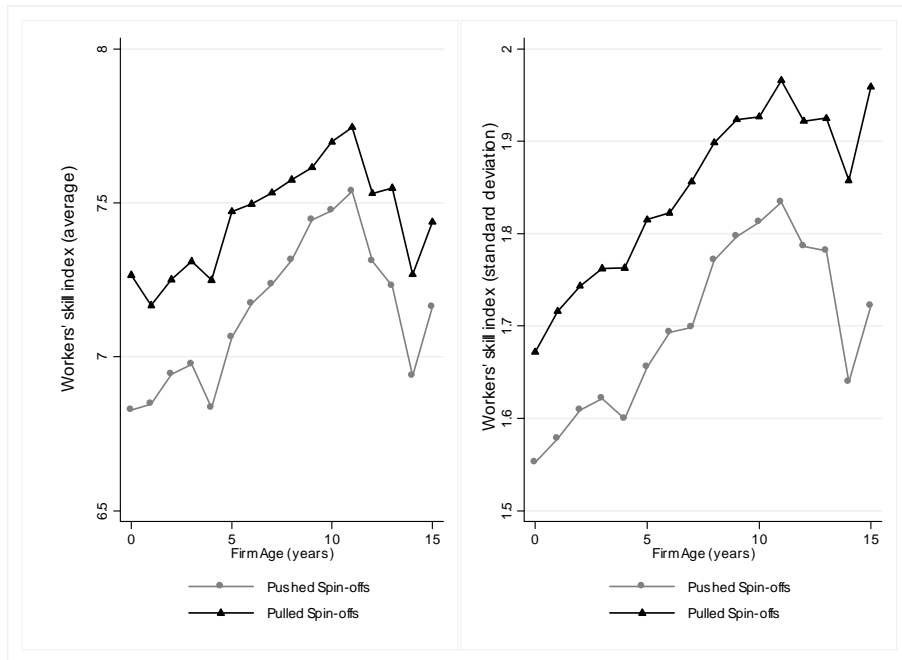
Fig. 4. Evolution of workers' skill mix over firms' lifecycle

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Table 3. Average skill index and average skill dispersion, by workers and spin-off type

	Pushed Spin-offs		Pulled Spin-offs	
	Average	Std. Dev.	Average	Std. Dev.
New Hires	6.401	2.289	6.495	2.330
Separations	6.628	2.377	6.718	2.243
Co-workers	6.716	2.326	7.404	2.518
Stayers (persisting $\geq$ 5 years)	7.268	2.641	7.744	2.648
Co-workers persisting $\geq$ 5 years	7.016	2.451	7.883	2.437
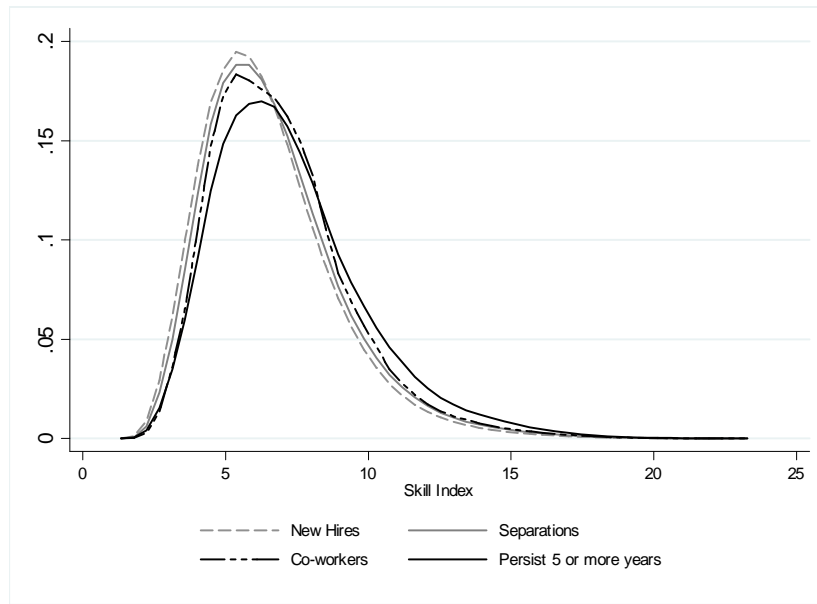
Fig. 5. Kernel density of average skill index, by worker types

The data confirm that stayers have a higher skill index than those who are hired over the firm lifecycle and those who leave the firm (voluntarily or involuntarily). Co-workers (particularly those persisting in the firm for longer periods) also present a higher skill index than those entering and leaving the firm over its lifecycle. This, over again, may sign some learning by firms, which

seem to improve their average skill levels by holding the most skilled workers in the firm and adjusting their workforce by churning workers with lower skills on average.

Moreover, co-workers hired and retained by pulled spin-offs are much more skilled, on average, than those absorbed by their pushed counterparts. This may also suggest that, despite pulled spin-offs start with a much lower share of co-workers in their initial workforce, they seem to choose among the most skilled ones. In opposition, necessity reasons, more than skill requirements, may explain the relatively stronger presence of these workers in pushed spin-offs.

Finally, given the average skill differences found between pushed and pulled spin-offs, we explore which human capital components – workers' education, experience (proxied by age) and unobserved ability – matter the most for the skill gap observed among pushed and pulled spin-offs at entry. For that purpose, we use Gelbach's (2009) unambiguous decomposition of the conditional skill gap observed in the year of their entry. We regressed each firm's *Average Workers' Skills* on their workers' average education, age and unobserved ability (measured by the person-specific fixed effect previously obtained from the wage equation with firm and worker fixed effects), controlling as well for spin-offs' size, industry and time effects. Table 4 summarizes the results.

The results confirm that pushed spin-offs have a lower average skill index than pulled spin-offs (the gap is negative and statistically significant), even after controlling for their size, sector and time effects. The most important source of these differences seems to be workers' unobserved heterogeneity, followed by workers' education. In other words, pushed spin-offs enter with a less skilled workforce on average because their first workers have a lower person-specific effect and are less educated than those hired by pulled spin-offs at entry. In contrast, pushed spin-offs' workers are relatively more experienced, which somewhat attenuates the skill gap observed among the two types of firms.

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Table 4. Conditional decomposition of the spin-offs' average skill index gap, according to spin-offs' type[a]

	Start-up year
Workers' School Years	-0.1462***
	(0.0087)
Workers' Age	0.1353***
	(0.0072)
Workers' Unobserved Heterogeneity (FE)	-0.2144***
	(0.0132)
Total Gap (Pushed vs. Pulled)	-0.2252***
	(0.0190)

Notes: [a] Decompositions based on Gelbach (2009). *** mean significant at the 1% level. The baseline model corresponds to an OLS regression with the firm's average skill index as the dependent variable, controlling for time fixed effects, spin-offs' start-up size, sector and a dummy for spin-off type. The full model additionally includes the average workers' education, age and unobserved ability as independent variables.

5 Empirical Strategy

5.1 Empirical Model

The aim of the following empirical analysis is to study the impact of spin-offs' initial human capital endowments on their post-entry growth and survival. For this purpose, we start by estimating the following employment growth equation:

$$\text{Growth}_{i,t+1} = \beta_1 X_{1i,0} + \beta_2 X_{2i,t} + \beta_3 X_{3i,t} + \gamma_t + \varepsilon_{it} \tag{1}$$

where $\text{Growth}_{i,t+1} = \frac{E_{it+1} - E_{it}}{0.5 * (E_{it+1} + E_{it})}$ is the employment growth rate of each spin-off i between years t and $t+1$ (with E_{it} representing total employment in

firm i in year t), $X_{1i,0}$ is the vector of variables measuring the human capital endowments of spin-offs at entry (including a constant term) and β_1 is the corresponding vector of parameters of interest to be estimated.[12] Additionally, we control for a number of characteristics of firms and their BOs, which are denoted by vectors $X_{2i,t}$ and $X_{3i,t}$, respectively. Finally, γ_t represents annual time fixed effects, while ε_{it} is the error term. To account for the fact that the observations of the same spin-off over time are not independent, standard errors are corrected for clustering at the firm-level.

Firm-level variables include the type of spin-off (pushed versus pulled), two dummy variables indicating whether or not the spin-off is established in the same location (county) and in the same industry of the parent firm, in addition to spin-offs' start-up size, age (and its square), productivity (measured by the log of sales per worker) and an indicator variable controlling for firm location in an urban region.

Regarding BOs' characteristics, we control for their general and specific human capital (BOs' age, education, entrepreneurial experience and industry-specific experience). Furthermore, we include two dummy variables indicating whether there are two or more BOs in the firm (shared ownerships) and whether the spin-off suffers any type of ownership change in the subsequent year. This last aspect has been recurrently neglected by previous studies on new firm performance, though seminal theories on entrepreneurship and BOs' turnover recognize that ownership transfers may be common, as the entrepreneur and the firm are two different parts that should be perfectly matched (Holmes and Schmitz, 1995, 1996). In our data, about 30% of all spin-offs under analysis suffer at least one change in their "entrepreneurial team" dur-

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[12]When defining our growth measure, we follow previous influential studies (e.g., Davis and Haltiwanger, 1990; 1992; Davis et al., 1996; Burgess et al., 2000; Haltiwanger et al., 2013) who highlight the importance of taking into account the current average size in the denominator in order to mitigate the effects of regression to the mean and avoid any bias. While using base year size could yield a negative bias, using the end year size could produce a positive bias. The current average size – $0.5 * (E_{i,t+1} + E_{i,t})$ – is, thus, a satisfactory alternative.

ing the lifecycle, so we also control for these ownership changes.[13] A detailed description of all these variables can be found in Table A.I, in the Appendix.

However, a relevant problem in new firm growth studies is the possibility of selection bias, given that selection is a function of the firm's efficiency in competition with other similar firms (Delmar et al., 2013). In particular, and according to the classic results of Nelson and Winter (1982), the most efficient (or the "fittest") firms normally survive and grow, while less viable firms (which typically correspond to smaller and more slowly growing firms) are systematically selected out of the market. Consequently, spin-offs' growth rates are only observed for the subset of surviving firms and, for this reason, pooled OLS estimation results may be inconsistent if firm exit and employment growth are not independent phenomena.

We, thus, specify a two-equation Heckman-type model in order to correct for selection bias on spin-offs' exit.[14] Formally, we have an outcome (growth) equation and a selection (exit) equation, as follows:

$$
\text{Growth}_{i,t+1} = \begin{cases} \beta_1 X_{1i,0} + \beta_2 X_{2i,t} + \beta_3 X_{3i,t} + \gamma_t + \varepsilon_{it} & \text{if } y^*_{i,t+1} > 0 \\ - & \text{if } y^*_{i,t+1} \leq 0 \end{cases} \quad (2)
$$

$$
Exit_{i,t+1} = \begin{cases} 0 \text{ if } y^*_{i,t+1} > 0 \\ 1 \text{ if } y^*_{i,t+1} \leq 0 \end{cases} \quad (3)
$$

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[13]The changes in the entrepreneurial team may take several forms. Either the founder(s) may have transferred the firm to other BO(s) during the firm lifecycle (this is the most frequent case, with the founder/current BO being replaced by a new one), or a new BO may join the current entrepreneurial team after the firm has been established (for instance, when the firm is established as a single-owned firm and then changes to a status of shared ownership), or even one of the BOs may leave the current entrepreneurial team, which may be composed by two or more BOs. Moreover, multiple ownership changes may occur over firms' lifecycle, though this is less frequent. Among the 15,037 spin-offs suffering ownership changes in our dataset, 64% of them suffer only one ownership change during the time period under observation.

[14]The Heckman's (1979) procedure has been used by several recent studies on the relationship between firm growth and survival (e.g., Czarnitzk and Delanote, 2012; Delmar et al., 2013; Koch et al., 2013; Huber et al., 2014).

where $y^*_{i,t+1} = \beta_1 X_{1i,0} + \beta_2 X_{2i,t} + \beta_3 X_{3i,t} + \beta_4 X_{4i,t} + \gamma_t + \theta_{it}$ represents a latent variable measuring the differential in spin-offs' utility (or profit) between remaining active or exiting the market. By allowing the error terms ε_{it} and θ_{it} to be correlated, we are able to correct for the possible non-randomness of the selected sample of spin-offs.

To improve the robustness of our estimation, we follow the two-step estimator and use a vector of industry-level characteristics $(X_{4i,t})$ as exclusion restrictions for a more robust identification. This vector includes the industry's minimum efficient scale, concentration, growth, agglomeration and entry rates (see Table A.I for a detailed description of these variables). While industry-specific characteristics seem to consistently explain differences in survival rates across firms, these variables typically add limited explanatory power in firm growth studies (see the surveys by Manjón-Antolín and Arauzo-Carod (2008) on firm survival, and Coad (2007, 2009) on firm growth). Furthermore, in our data, industry-level variables can be shown to have a significant effect on firm exit and a negligible effect on spin-offs' employment rates.

We have then repeated this procedure to estimate similar equations for particular dimensions of spin-offs' worker flows, namely Hiring Rates and Separation Rates, aiming at understanding how the characteristics of spin-offs' initial workforce may influence these post-entry labor adjustments.

5.2   Empirical Results

Table 4 reports and compares the results obtained from the estimation of pooled OLS employment growth equation and Heckman two-step model. Some descriptive statistics on the variables included in these estimations can be found in Table A.II, in the Appendix. Besides the differences in their initial workforce, these statistics also reveal that pushed spin-offs are more frequently established in the same location and in the same industry where the parent firm operated before. This group of firms also starts at a slightly larger scale than pulled spin-offs, which may be achieved through the absorption of a more

significant number of co-workers at entry. Though their BOs are, on average less educated, they seem to be more experienced than pulled spin-offs' BOs. Finally, both shared ownerships and ownership changes are relatively more frequent in pushed than in pulled spin-offs.

The empirical results confirm that there is a significant selection bias in the sample due to firm exit. We found a negative and significant correlation between the error terms of the two equations, which attests that firm exit and growth are not independent. Instead, exiting firms tend to suffer a significant downsizing before closing down operations, in line with the so-called "growth of the fitter hypothesis" of evolutionary models (e.g, Jovanovic, 1982; Nelson and Winter, 1982).

Moreover, the results show that not controlling for spin-offs' selection on exit has important implications regarding the impact of the initial human capital endowments on post-entry growth. When accounting for selection bias in the sample, only the *Skill Dispersion* of the initial workforce exerts a significant effect on spin-offs' employment growth. The results suggest that starting with a more heterogeneous workforce in terms of skills reduces employment growth, besides increasing firm exit rates.

The other measures of initial human capital do not seem to significantly affect post-entry growth after controlling for spin-offs' exit. Pooled OLS estimation results would suggest that pushed spin-offs grow less than their pulled counterparts, and that entering with a larger share of co-workers would penalize firms' post-entry growth. However, the estimation results for the selection (exit) equation point out that, first, pushed spin-offs have slightly lower exit rates than pulled spin-offs, and second, that the presence of co-workers reduces the risk of exit. Overall, the effects of these variables on firm survival seem to cancel out their potential negative effects on post-entry growth.

Regarding the effects of workers' average skills, starting with a more skilled workforce seems to decrease firm exit rates, while no important effects seem to arise in terms of growth. The results, overall, suggest that initial human capital endowments are more important for firm survival than for firm post-

entry growth. Though initial workforce characteristics seem to influence both firm growth and exit individually, when we control for the fact that both processes are negatively correlated, most of the effects on spin-offs' growth actually vanish.[15]

The results for the remaining variables included in estimations are, overall, in line with the literature. Spin-offs established in the same location (county) of the parent firm survive longer and present higher post-entry growth rates, as they may benefit from prior experience in the region and have specific knowledge, networks and contacts that help them to perform better than those who are established in a different region. Firms entering at a larger scale grow less, but overcome the so-called liability of smallness – suffering, thus, lower exit rates. More productive firms (in terms of sales per worker) grow more and survive longer on average.

Both general and specific human capital of BOs seem to improve spin-offs' survival, while the effects on post-entry growth are almost negligible. Sharing the ownership of the business with other BO(s) is found to improve both growth and survival prospects at the firm-level. Ownership changes, in turn, seem to have negative effects on both performance measures. While the literature has been suggesting that founder or BOs turnover are likely to be motivated by perceived mismatches between business quality and entrepreneurs' ability (e.g., Holmes and Schmitz, 1995, 1996), evidence on the effects of these ownership transfers is still limited and inconclusive. Chen and Thompson (2013), for instance, found that business transfers are associated with higher growth rates among surviving firms, but also with higher firm exit rates.

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[15] As a robustness check, we have estimated the Heckman two-step model for the separate samples of spin-offs operating in Manufacturing and Services, where workers' initial skills might play different roles or assume a different importance. The results are summarized in Table A.III in the Appendix and remain consistent with the results previously obtained for all spin-offs, though the effects of the variables of interest are found to be more significant for spin-offs operating in Services. We have also re-estimated the Heckman two-step model with sample weights, using spin-offs' survival time as the weighting variable. The estimated effects of spin-offs' initial human capital measures remain qualitatively unchanged, being summarized in Table A.IV.

Table 4. Estimation results for employment growth and survival (Portugal, 1992-2007)

	Pooled OLS	Heckman Two-step model	
	Employment growth	Employment growth	Firm exit
Pushed Spin-off	-0.0063***	0.0112	-0.0265**
	(0.0018)	(0.0133)	(0.0123)
Average skill index at entry	0.0003	0.0005	-0.0145***
	(0.0006)	(0.0050)	(0.0039)
Skill dispersion at entry	-0.0020**	-0.0181***	0.0170***
	(0.0008)	(0.0064)	(0.0055)
Share of co-workers at entry	-0.0138***	0.0254	-0.1082***
	(0.0041)	(0.0364)	(0.0280)
Same location of PF	0.0588***	0.1569**	-0.2793***
	(0.0062)	(0.0629)	(0.0230)
Same sector of PF	0.0013	-0.0025	-0.0198
	(0.0019)	(0.0131)	(0.0129)
Start-up size	-0.0190***	-0.0718***	-0.0504***
	(0.0018)	(0.0138)	(0.0091)
Urban	0.0007	-0.0215	0.0510***
	(0.0017)	(0.0156)	(0.0111)
Age	-0.0185***	-0.0094	-0.0379***
	(0.0010)	(0.0107)	(0.0069)
Age squared	0.0010***	0.0011**	0.0012***
	(0.0001)	(0.0005)	(0.0005)
Firm sales per worker	0.0388***	0.0442***	-0.0227***
	(0.0011)	(0.0072)	(0.0053)
BOs' age	-0.0013***	0.0008	-0.0019***
	(0.0001)	(0.0007)	(0.0007)
BOs' schooling years	-0.0006**	-0.0004	-0.0037**
	(0.0003)	(0.0017)	(0.0015)
BOs' entrepreneurial experience	-0.0014***	-0.0006	-0.0060**
	(0.0004)	(0.0034)	(0.0031)
BOs' industry experience	0.0016***	0.0090***	-0.0058***
	(0.0003)	(0.0024)	(0.0021)
Shared Ownership	-0.0125***	0.1207*	-0.2801***
	(0.0018)	(0.0630)	(0.0126)
Ownership Change	0.0066**	-0.0911***	0.1176***
	(0.0027)	(0.0296)	(0.0151)

(It continues in the next page)

Table 4. Estimation results for employment growth and survival

(Portugal, 1992-2007)	Pooled OLS	Heckman Two-step model	
	Employment growth	Employment growth	Firm exit
MES	-	-	0.0382***
	-	-	(0.0038)
HH Index	-	-	-1.5499***
	-	-	(0.5880)
Industry Growth	-	-	-0.0933*
	-	-	(0.0519)
Industry Agglomeration	-	-	0.6501***
	-	-	(0.1412)
Industry Entry Rate	-	-	0.4849***
	-	-	(0.1875)
Constant	-0.2717***	0.9530*	-1.6814***
	(0.0203)	(0.5172)	(0.0799)
Inverse Mills Ratio	-	-0.5569**	-
	-	(0.2594)	-
Observations	131,734	143,911	

Notes: Time-varying independent variables are measured in t-1. All the models include time dummies. Both employment growth equations also include 2-digit industry dummies. Firm-cluster robust standard errors in parentheses. *, ** and *** denote significant at 10%, 5% and 1%, respectively. The estimated correlation between the errors of employment growth and firm exit equations is negative and significantly different from zero ($\widehat{\rho}$ =-0.8332).

As expected, industry environment significantly influences spin-offs' survival. Exit rates tend to be higher in industries where the minimum efficient scale, employment agglomeration and entry rates are also higher – and where competition is stronger. In contrast, firms operating in more concentrated industries, by probably having higher market power, are found to face lower risks of exit.

Finally, given that firm-level employment growth is the result of firms' adjustments in their workforce through different combinations of hires and separations, we explore how the characteristics of spin-offs' initial workforce

might be associated with these particular worker flows. We present a summary of the results obtained from Heckman two-step procedure in Table 5.

Table 5. Estimation results for spin-offs' hiring and separation rates, Heckman two-step model (Portugal, 1992-2007)

	Hiring Rates	Separation Rates
Pushed Spin-off	-0.0105	-0.0111
	(0.0073)	(0.0117)
Average skill index at entry	-0.0016	-0.0020
	(0.0028)	(0.0044)
Skill dispersion at entry	0.0010	0.0178***
	(0.0035)	(0.0056)
Share of co-workers at entry	-0.0571***	-0.0728**
	(0.0203)	(0.0320)
Inverse Mills Ratio	-0.0558	0.4589**
	(0.1510)	(0.2293)
Observations	143,911	143,911

Notes: All the models include the firm-level and BO-level variables included in the specification of the employment growth equation presented in Table 4, in addition to time dummies and industry dummies. *, ** and *** denote significant at 10%, 5% and 1%, respectively. The estimated error correlation between the error terms is equal to -0.2073 in the case of hiring rates (not significantly different from zero) and 0.8055 in the case of separation rates (statistically different from zero at the 1% level).

As expected, firm exit is negatively (positively) correlated with hiring (separation) rates at the firm-level. Moreover, these additional results confirm that the skill dispersion of the initial workforce plays a significant negative effect on post-entry growth by increasing firm-level separation rates. In addition, the estimations also indicate that spin-offs hiring a larger share of co-workers at the time of entry not only tend to hire less new workers, as also present lower separation rates. Overall, labor adjustments in these firms seem to be less frequent, either because they start with a more stable (or rigid) workforce

– which may make subsequent adjustments more costly –, or because they identify their best matches earlier than other firms, possibly owing to the past relationship between co-workers and spin-offs' founders at the parent firm.

Finally, despite pulled spin-offs unconditionally present more remarkable adjustments in their workforce over the lifecycle, the differences between pushed and pulled spin-offs' hiring and separation rates become, over again, insignificant when we correct for firm selection on exit. Actually, after taking into account several characteristics of workers, BOs, firms and industries, we find no evidence that pulled spin-offs outperform their pushed counterparts – neither in growth, nor in survival –, as some recent studies have proposed (e.g., Buenstorf, 2009; Bruneel et al., 2013). Though pushed spin-offs may be mostly established under more unfavorable conditions (i.e., as a reaction to deteriorating job conditions and without any type of support from the parent company), these firms seem to be able to perform as well as spin-offs driven by pull-nature factors.

6 Concluding Remarks

In this paper we have analyzed how the post-entry employment dynamics and survival of pushed and pulled spin-offs were associated to the characteristics of the workers employed at entry. Our empirical results suggest that spin-offs' survival is closely related to the human capital endowments presented at entry. Firms employing a more skilled workforce at the start-up and a higher share of co-workers absorbed from the parent firm face lower exit rates. In contrast, skill dispersion at entry increases firm exit rates and significantly reduces post-entry employment growth, by increasing firms' separation rates.

Overall, the data suggest that spin-offs adjust their workforce over the lifecycle by preserving the most skilled workers, and by hiring and separating the less skilled employees, as those staying in the firm for longer periods are,

on average, more skilled than those who enter and exit the firm (voluntarily or not) over time. Additionally, worker flows are lower in spin-offs entering with a more significant share of co-workers. Pushed and pulled spin-offs seem to have different post-entry adjustments in their labor force due to, in part, the different worker mix they enter with.

In summary, the choice of the very first employees seems to have long-term effects on spin-offs' labor adjustments, either due to informal ties developed between the initial workers and spin-offs' founders, or due to firing restrictions. Labor adjustments may be difficult, either due to strict employment legislation or by firm natural inertia. In view of that, start-up conditions – namely the skills of the initial workforce and the firms' early ability of screening heterogeneous workers – may play a crucial role in the post-performance of new firms, especially in countries where strict employment legislation restricts labor adjustments and, consequently, firms' ability to respond to market changes in a short-time horizon.

Finally, the paper offers possible avenues for future extensions that may be of interest for both labor economics and industrial organizations researchers. From the point of view of labor economics, this study highlights the role that workers' human capital may play in worker turnover and labor reallocation processes. From the point of view of industrial economics, the results shed new light on the significant link between firm performance and workers' characteristics, and on the relevance of start-up conditions – in particular, the role of spin-offs' initial human capital endowments – for post-entry employment growth and survival. Last but not least, the results here presented may also motivate further research on the post-entry performance differences between pushed (necessity) and pulled (opportunity) spin-offs, as our analysis does not confirm the belief that pulled spin-offs outperform their pushed counterparts.

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Table A.I. Description of variables

Initial human capital endowments

Workers' average skills at entry	Average level of workers' skill index, by firm, at the start-up.
Skill dispersion at entry	Standard deviation of workers' skill index, by firm, at the start-up.
Share of co-workers at entry	Total number of co-workers in the workforce in firm i at the start-up/Total number of employees in firm i at the start-up.

Firm-level characteristics

Pushed Spin-off	Dummy variable equal to 1 if the firm is a pushed spin-off, 0 otherwise.
Firm start-up size	Number of employees of firm i at entry, in logs.
Firm age	Years elapsed since the start-up.
Firm Productivity	Sales per worker, in logs. Sales are in constant prices of 2005.
Urban region	Dummy variable equal to 1 if the spin-off is located in the districts of Porto or Lisbon, 0 otherwise.
Same location of the parent firm	Dummy variable equal to 1 if the spin-off is located in the same county of the parent firm, 0 otherwise.
Same industry (2d) of the parent firm	Dummy variable equal to 1 if the spin-off operates in the same 2-digit industry of the parent firm, 0 otherwise.

Business-Owners' characteristics

BOs' age[a]	Business-owners' age, in years, in the reference period.
BOs' education[a]	Business-owners' schooling years in the reference period.
BOs' entrepreneurial experience[a]	Total number of years of experience as BOs in the reference period.
BOs' industry experience[a]	Total number of years of experience in the 2-digit industry (as BO or paid employee) in the reference period.
Shared Ownership	Dummy variable equal to 1 if the spin-off has 2 or more BOs in the reference period, 0 otherwise.
Ownership change	Dummy variable equal to 1 if the spin-offs' entrepreneurial team changes in the next year, 0 otherwise.

Industry-level characteristics[b]

MES (Minimum Efficient Scale)	Median number of employees in the 2-digit industry in each year.
HH index	Sum of the squared share of each firm's employment in the total 2-digit industry's employment in each year.
Industry growth	Annual percentage change in 2-digit employment.
Industry agglomeration	Share of 2-digit industry's employment in the total employment in the country, in each year.
Entry rate	Ratio of total firm entries over the total number of incumbent firms in the 2-digit industry, by year.

[a] Whenever the spin-offs has two or more BOs, these variables measure their average age, education and years of experience, respectively as BOs or in the industry.

[b] These variables are only included in the selection (exit) equation.

Table A.II. Descriptive statistics (Portugal, All spin-offs, 1992-2007)

	All Spin-offs		Pushed Spin-offs		Pulled Spin-offs	
	Average	Std. Dev.	Average	Std. Dev.	Average	Std. Dev.
Workers' Skills at entry						
Workers' average skills	7.1255	2.3348	6.8266	2.1824	7.2649	2.3898
Skill dispersion	1.6297	1.1594	1.5526	1.0734	1.6717	1.2016
Share of co-workers	0.0982	0.2016	0.1947	0.2584	0.0536	0.1493
Firm-level Variables						
Same location of PF (%)	0.8679	0.3386	0.9123	0.2828	0.8474	0.3596
Same industry of PF (%)	0.4908	0.4999	0.6330	0.4820	0.4251	0.4944
Start-up size (logs)	0.9798	0.7763	1.1913	0.8305	0.8821	0.7296
Firm age (y)	4.5794	3.5117	4.6667	3.5303	4.5354	3.5015
Urban region (%)	0.4055	0.4910	0.3992	0.4897	0.4085	0.4916
Sales per worker (logs)	10.513	1.1028	10.495	1.0944	10.521	1.107
BO-level variables						
BOs' age (y)	39.832	9.1752	40.631	9.2024	39.428	9.1349
Bos' education (y)	8.4169	4.2954	7.8060	4.0427	8.7247	4.3851
BO's entrepren. exp. (y)	3.5327	2.7148	3.7756	2.7959	3.4103	2.6646
BOs' industry exp. (y)	4.5175	3.8538	5.1302	3.9344	4.2088	3.7749
Shared ownership (%)	0.3199	0.4665	0.3851	0.4866	0.2871	0.4524
Ownership changes (%)	0.1385	0.3455	0.1454	0.3525	0.1351	0.3418
Industry-level variables						
MES	3.4949	1.6253	3.6682	1.7216	3.4076	1.5674
HH index	0.0031	0.0110	0.0028	0.0097	0.0032	0.0116
Industry growth	0.0385	0.1521	0.0333	0.1547	0.0412	0.1507
Industry agglomeration	0.0868	0.0404	0.0863	0.0410	0.0871	0.0401
Entry rate	0.1291	0.0410	0.1253	0.0411	0.1310	0.0408

Notes: PF means Parent Firm. y means years. Regarding BOs' age, education and experience variables, whenever the firm has two or more BOs, these variables correspond to the average years of age, education and experience of all BOs in the firm.

Table A.III. Heckman two-step estimation results for different subsamples

	Manufacturing		Services	
	Employment growth	Firm exit	Employment growth	Firm exit
Pushed Spin-off	0.0101	-0.0470*	0.0057	-0.0158
	(0.0301)	(0.0275)	(0.0132)	(0.0157)
Average skill index at entry	-0.0016	-0.0302***	-0.0014	-0.0179***
	(0.0137)	(0.0104)	(0.0035)	(0.0042)
Skill dispersion at entry	-0.0093	0.0051	-0.0100*	0.0158**
	(0.0151)	(0.0156)	(0.0053)	(0.0063)
Share of co-workers at entry	-0.0541	-0.0711*	0.0211	-0.1131***
	(0.0574)	(0.0348)	(0.0334)	(0.0378)
Inverse Mills Ratio	-0.6845**	-	-0.1577**	-
	(0.3413)	-	(0.0805)	-
Observations	28,488		90,519	

Notes: *, ** and *** denote significant at 10%, 5% and 1%, respectively. The coefficients on the firm, BOs and industry variables are available upon request.

Table A.IV. Heckman maximum-likelihood estimation results, weighted by spin-offs' survival time

	Employment growth	Firm exit
Pushed Spin-off	0.0176	-0.0129
	(0.0147)	(0.0128)
Average skill index at entry	0.0075	-0.0127***
	(0.0046)	(0.0039)
Skill dispersion at entry	-0.0223***	0.0201***
	(0.0061)	(0.0056)
Share of co-workers at entry	0.0255	-0.1059***
	(0.0323)	(0.0290)
Observations	143,911	

Notes: This model corresponds to the same model presented in Table 4, but using maximum likelihood and sampling weights, as weighted estimation is only possible under maximum likelihood estimation. *** denotes significant at 1%. The estimated correlation between the errors is statistically significant at the 1%, and equal to -0.8936. The coefficients of firm, BOs and industry variables are not reported to save space, being available upon request.