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## **Leaving employment to entrepreneurship: The value of coworker mobility in pushed and pulled-driven startups**

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We use a rich matched employer-employee dataset for Portugal, and estimate a multi-stage model addressing the issues of self-selection in entrepreneurship and endogeneity in recruitment choices. We find that spin-offs hiring coworkers from the parent firm survive longer. The survival bonus resulting from coworker mobility is higher in pushed-driven startups. This work has important implications for broader theories on the role of labor mobility in organizational outcomes of arrival firms, and also for developing theories on labor markets for entrepreneurship. It also constitutes an important step towards unpacking the mechanisms through which mobile human capital affects the performance of receiving firms.

# Leaving employment to entrepreneurship: The value of coworker mobility in pushed and pulled-driven startups\*

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## Abstract

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**Keywords:** entrepreneurship, coworker mobility, pushed and pulled spin-offs, new venture survival

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# 1 Introduction

Most new firms are spawned by existing firms (Campbell et al., 2012; Sørensen and Fassiotta, 2011). Moreover, new firm founders rarely venture out alone, and often rely on former coworkers to set up a team (Agarwal et al., 2015; Groysberg et al., 2008). That was the case of James Wood Johnson and Edward Mead Johnson, who left their job at Seabury & Johnson in 1886, together with eight women and six men recruited from their previous company, to found Johnson & Johnson (Agarwal et al., 2015). These former coworkers helped the new venture opening its doors and being successful.<sup>1</sup>

Inter-firm labor mobility has been investigated by scholars from different fields (including economics, human resource management, strategic management, and sociology), and its effects on key organizational outcomes (e.g., innovation, learning, productivity, survival) is strongly acknowledged (Mawdsley and Somaya, 2015; Parrota and Pozzoli, 2012; Song et al., 2003; Wright et al., 2014). A large subset of this stream of research has analyzed labor mobility in the context of employee startups, interchangeably referred as spin-outs or spin-offs (Agarwal et al., 2004, 2015; Audretsch and Keibach, 2007; Campbell et al., 2012; Franco and Filson, 2006). Existing theory and empirical analysis have, however, primarily looked at founders of spin-offs driven by the identification of a market opportunity. Two gaps are, therefore, identified: first, the relative inattention paid to the founder’s role as a catalyst who mobilizes an entire team, and, so, to initial human resources beyond the founder (Agarwal et al., 2015; Williamson and Robinson, 2008); second, the heterogeneous context where employee startups may be created (e.g., Bruneel et al., 2013; Buenstorf, 2009; Clarysse et al., 2011).

We address these gaps by building and testing a theory on the role of coworker mobility in the survival of pushed (or necessity-driven) and pulled (or opportunity-driven) employee startups. Our study builds on the extensive research on spin-offs and on two emerging, yet separate, streams of work: a first one investigating hiring choices in startup firms (Coad et al., 2014; Dahl and Klepper, 2015; Ouimet and Zarutskie, 2014), and a second one acknowledging the different contexts surrounding spin-off activity (e.g., Bruneel et al., 2013; Buenstorf, 2009; Rocha et al., 2015a, 2015b).

To test our hypotheses, we use a rich matched employer-employee dataset virtually covering all the private firms employing at least one wage earner in Portugal. Empirically, we adopt a novel methodology and estimate a three-stage model that addresses two important empirical issues often neglected in prior studies, which bias the estimated effects of (co)worker mobility in the context of newly founded firms: self-selection into entrepreneurship and endogeneity in

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<sup>1</sup>The story of Johnson & Johnson and its people is available at [www.kilmerhouse.com](http://www.kilmerhouse.com) (see <http://www.kilmerhouse.com/2016/01/130-years-ago-james-wood-johnson-arrives-in-new-brunswick/>).

founders' hiring choices. Our data offer a great potential to study labor mobility issues in the context of entrepreneurship, allowing the identification of both entrepreneurs and employees, as well as their prior interactions in work-related networks (Campbell, 2005). Moreover, Portugal constitutes an interesting setting to be studied, given the growing number of pushed and pulled-driven startups established over the 1990s and 2000s, and the rigidity of the labor market – which may have important implications in entrepreneurs' early recruitment decisions and future performance of new ventures.

Our study contributes to prior research on labor mobility and entrepreneurship by investigating a particular kind of labor mobility – coworkers co-moving with spin-off founders – in a new, and comparative, context – pushed and pulled spin-offs. This work has important implications for broader theories on the role of labor mobility in organizational outcomes of arrival firms, and also for developing theories on labor markets for entrepreneurship. It also constitutes an important step towards unpacking the mechanisms through which mobile human capital affects the performance of receiving firms.

In what follows, we develop the theoretical framework and the hypotheses. We then present the data and methodology, followed by a brief description of the spin-off activity and coworker mobility in our setting. Finally, we present our findings, and discuss their implications for theory, practice, and policy.

## **2 Theoretical Framework and Hypotheses**

Spin-off activity is, itself, a labor mobility process, and has been the focus of most literature connecting entrepreneurship and labor mobility issues (Audretsch and Keibach, 2007; Campbell et al., 2012). Despite the importance of employment mobility for management theory and practice, we still lack a thorough understanding of this phenomenon in different contexts triggering new venture creation.

We integrate the insights from existing research on spin-offs – which has generally addressed mobility at the level of the founder, and in contexts of voluntary (e.g., opportunity-driven) mobility – with two related, but still developing, streams of analysis: hiring choices in startups and the context triggering new venture creation. The integration of these research strands will form the basis for the development of our hypotheses.

## 2.1 Coworker mobility and post-entry survival of spin-offs

The widespread research on inter-firm labor mobility has demonstrated that mobile employees represent potential sources of knowledge, competencies, information, and routines that benefit the performance of receiving firms (e.g., Bidwell and Keller, 2014; Parrotta and Pozzoli, 2012; Song et al., 2003). Team, firm, industry, and regional-specific knowledge can, therefore, move across firm boundaries (Agarwal et al., 2004; Franco and Filson, 2006) and endow the receiving firms with valuable and non-imitable resources. Learning by hiring theories, indeed, postulate that firms can learn from workers' experiences with prior employers (Parrotta and Pozzoli, 2012; Song et al., 2003), which make human capital a strategic resource, and recruitment a strategy in itself (Phillips and Gully, 2015; Wright et al., 2014).

In the context of startup firms, early recruitment choices are among the most critical decisions for organizational success and survival (Campbell, 2005). The quality of the labor force assembled at early stages may provide the basis for firm capabilities and comparative advantages (Dahl and Klepper, 2015; Dahl and Sorenson, 2014), and hiring mobile workers can provide young and less productive firms with a valuable opportunity to learn from more experienced firms. Despite the considerable attention paid by both the strategy and human resources management fields to the concept of human capital (Wright et al., 2014), thorough research on strategic human capital and hiring practices of new firms in particular is still rare (Coad et al. (2014), Dahl and Klepper (2015), and Ouimet and Zarutskie (2014) being among the first studies). However, the early hiring decisions of startups will likely influence their performance, and will be difficult to emulate or change when a firm is older (Geroski et al., 2010; Rocha et al., 2016).

Most new ventures are founded by prior employees, and work histories may provide key resources – such as human and social capital – for prospective entrepreneurs (Burton et al., 2002; Sørensen and Fassiotto, 2011). While a wide literature has studied the formation of spin-offs as a particular form of labor mobility, through which knowledge may be transferred from a parent company to a new firm (Agarwal et al., 2004; Campbell et al., 2012; Dahl and Sorenson, 2014; Franco and Filson, 2006; Klepper and Thompson, 2010), very few studies have looked at labor mobility phenomena beyond the startup founder (see Boschma et al., 2009; Agarwal et al., 2015). Still, founders rarely venture out on their own, often turning to their colleagues to assemble a team (Agarwal et al., 2015; Groysberg et al., 2008). Given their lack of experience and resources, the majority of newly established ventures do not (yet) have formal human resources strategies and, instead, rely on informal recruitment channels to attract employees to their organizations (Aldrich and Ruef, 2006). Hiring former coworkers is, therefore, one of their natural alternatives (Nzali and Fayolle, 2014).

Brymer et al. (2014) propose pipelines as a staffing practice that firms (including newly

founded ventures) use to cope with many challenges that labor markets present, such as information asymmetries, applicant scarcity, and costly mis-hires. By using affinity groups, social ties, and/or existing organizations (that already did the necessary screening among employees) as pipelines through which they acquire most of their human resources, firms may better deal with the uncertainty in the labor market, reduce the searching and integration costs that are inherent in human capital acquisition, and circumvent situations of adverse selection (Bidwell and Keller, 2014; Dahl and Sorenson, 2014). This may be especially relevant in new and small firms, where hiring costs can still be substantial (Blatter et al., 2012).

It can, hence, be argued that hiring former coworkers may result in greater stability and predictability of a firm's stock of skills and capabilities, better coordination and control, enhanced socialization, and lower transaction costs (Lepak and Snell, 1999). By having shared some experiences in the parent firm, the presence of coworkers in the initial workforce can also foster trust, enhance communication, efficiency, and cooperation among team members (Groysberg et al., 2008; Leana and Van Buren, 1999).

Former coworkers are, therefore, believed to be a source of human and relational capital (Nzali and Fayolle, 2014). Besides the knowledge, skills, and expertise gained through education and training, former coworkers bring also team-specific capital built through close working relationships at the parent firm. Some components of human capital are likely to be lost once individuals change employers, namely colleague- and team-specific components (Campbell et al., 2014). The co-mobility of founders and former coworkers mitigates this risk, and the relational capital embodied in the team (e.g., shared values, ties, and language) makes, furthermore, the human resources of the new venture unique and difficult to imitate (Lepak and Snell, 1999), and increases the potential for knowledge transfer (Mawdsley and Somaya, 2015).

For those reasons, employee startups are expected to benefit from coworker mobility, and to over-perform those spin-offs that do not rely on this pool of human resources. Nonetheless, this recruitment strategy is not necessarily an unqualified positive. Overreliance on former coworkers when setting up the initial team may create some lock-in problems, if the inflows of skills resemble those already present in the plant (e.g., in the founder), and may lock-out potentially more qualified candidates who are "strangers" to the founder (Boschma et al., 2009; Brymer et al., 2014). Including former coworkers in new organizational teams may, besides, be driven by founders' homophily preferences and strong ties (Ruef et al., 2003), which has potential costs, such as organizational inertia, lack of innovation and creativity, with implications for firm's ability to adapt to environmental changes and shocks (Brymer et al., 2014; Leana and Van Buren, 1999; Lepak and Snell, 1999). Dense and long-standing ties among some organizational members may also raise the risk of undesired collusions among employees (Baron and Kreps, 1999). Last

but not least, founders attracting former coworkers likely face a trade-off between the benefits of accessing to a pipeline of workers with valuable knowledge and experience, and the costs of labor poaching, which may include higher wage bills to attract workers from incumbent firms, and competitive reactions from poached firms (Combes and Duranton, 2006; Pe'er and Keil, 2013).

We expect, even so, that the benefits more than compensate the possible costs of coworker mobility, especially in the context of newly founded startups fraught by uncertainty, information asymmetries, and hiring costs that can be detrimental to their survival (Blatter et al., 2012). The benefits of using pipeline recruitment strategies are also expected to be amplified in smaller hiring firms, with narrowly focused human capital sources (Brymer et al., 2014). Therefore, we hypothesize that:

**Hypothesis 1 (H1):** *The presence of former coworkers in the initial workforce reduces spin-off exit risk.*

We acknowledge, however, that coworker mobility may have some downsides, and so we conduct post-hoc analyses to investigate this.

## **2.2 Early hiring decisions in context: pushed- and pulled-driven startups**

When hiring mobile individuals, destination firms are ultimately interested in specific attributes of the potential employee's human and relational capital that they anticipate will provide value. The impact of labor mobility on organizational outcomes is, then, likely to vary on the basis of contextual factors – such as attributes of the employee, source, and destination firms – that may moderate the transfer and utilization of human and relational capital held by mobile individuals (Mawdsley and Somaya, 2015).

The context where spin-offs emerge is a topic of increasing discussion in the literature, since not all spin-offs arise from the identification of a business opportunity. Many employees of incumbent firms also decide to set up their own firm to escape from deteriorating job conditions, or as a response to a recent job loss, being therefore referred to as pushed or necessity-driven spin-offs (e.g., Andersson and Klepper, 2013; Bruneel et al., 2013; Buenstorf, 2009; Eriksson and Kuhn, 2006; Muendler et al., 2012). While the dominating argument in this literature proposes that better parent firms spawn better spin-offs – implying that pushed spin-offs underperform their pulled counterparts (Buenstorf, 2009; Dahl and Sorenson, 2014; Eriksson and Kuhn, 2006)

– recent evidence shows that initial team composition may help reducing the survival gap often observed between those two groups of startups (Rocha et al., 2015b).

This implies that not all firms benefit from the same resources in the same way. When deciding to recruit the very first employees, founders may follow different, but not mutually exclusive strategies. They may choose employees based on social psychological motives, homophily preferences, and interpersonal fit (Aldrich and Ruef, 2006; Eisendhardt and Schoonhoven, 1990; Ruef et al., 2003), and/or they may focus on complementarities and the need for certain skills necessary to run a successful business (Wright et al., 2014). The context driving new venture creation can play a role in such strategies and, consequently, some firms – namely the less well-endowed – may particularly benefit from the privileged access to existing employee pools in clusters or pipelines (Brymer et al, 2014; Pe’er and Keil, 2013), such as prior coworkers.

Newly hired employees are not yet fully productive for several weeks, and this causes severe productivity losses (Blatter et al. 2012) that may have long lasting consequences in firm survival. This fact is especially important in countries with rigid labor market legislation, where “failed” hiring decisions are costly and difficult to adjust afterwards (Geroski et al., 2010; Rocha et al., 2016). Therefore, new business founders have large incentives to use informal recruitment processes and rely on existing networks (Williamson and Robinson, 2008), hence reducing searching costs at entry. These channels may be especially valuable for pushed-driven entrepreneurs, who most likely react to displacement by entering entrepreneurship (Berglann et al., 2011; Røed and Skogstrøm, 2014; von Greiff, 2009) under a larger (time and financial) pressure than more opportunity-based entrepreneurs, who possibly had more time to think and decide about the creation of their own business. Furthermore, the longer the period spent in unemployment, the larger the labor market penalties afterwards (e.g., wage penalties and decreased chance of finding a new job), and the higher the risk of human capital depreciation (Baptista et al., 2014; Huttunen et al., 2011), which increases the urgency in the decision making.

This pressure is likely to influence hiring decisions in pushed and pulled spin-offs. The more time is spent searching for a suitable employee, the higher the costs incurred, but the better the expected match. However, given the higher degree of urgency in pushed-driven startups, they often cannot afford to “hold out” for long in the hope of finding the most suitable employees. Pushed spin-offs may, therefore, be expected to compromise the quality of their early hires for speed of hiring. Relying on former coworkers whose competences and skills are already known by founders may help compensating this liability.

Nevertheless, startups typically have a hard time to attract top employees (Coad et al., 2014; Dahl and Klepper, 2015), and the fewer assets a firm owns in early stages, the more difficult is to attract qualified labor. Even though steeper earning profiles may be achieved later on by

those employees progressing through a small growing firm, the risk of involuntary displacement due to startup failure is higher, and initial wages tend to be lower than in established, more mature, and less cash-constrained firms (Campbell, 2005, 2013).

This may create further constraints to early-stage entrepreneurs, who might have to pay a higher wage bill in order to compensate new hires for the risk of being employed in a firm with a higher hazard. These costs are, however, expected to be relatively lower in spin-offs originating from closed or declining parent firms: not only are they less exposed to the risk of competitive reactions from poached parent firms, as it may also be easier for them to attract former (displaced) coworkers at a relatively lower cost, in case they do not have any better immediate alternative in the labor market that prevents the depreciation of their competencies.

Hiring former coworkers may, accordingly, fulfill a much greater advantage for pushed spin-offs compared to their pulled-driven counterparts. We therefore hypothesize that:

**Hypothesis 2 (H2):** *The negative effect of coworker mobility on spin-off exit risk is larger in pushed-driven spin-offs than in pulled-driven spin-offs.*

Figure 1 illustrates the theoretical model to be tested in the next sections. From the previous discussion, there are two main (non-mutually exclusive) mechanisms through which coworker mobility may improve (pushed and pulled) spin-off survival. First, former coworkers may transfer valuable knowledge from the parent firm to the new spin-off, and this may endow the receiving firms with a competitive advantage relative to spin-offs with no former coworkers in their initial workforce. Second, hiring former coworkers may also help reducing information asymmetries and searching costs in newly founded spin-offs, which, in turn, is likely to decrease their exit risk. We conduct post-hoc analyses to investigate to what extent these two mechanisms are empirically relevant in the context of pushed and pulled-driven startups.

\*\*\* Figure 1 here \*\*\*

### **2.3 From theory to empirical analysis: our empirical contribution**

Since Lucas's (1978) seminal work, scholars became aware that not all individuals are likely to leave employment to become entrepreneurs, given their different levels of entrepreneurial or managerial talent. Several studies have theorized and demonstrated that those who become entrepreneurs are a selection of the brightest workers (e.g., Cambell et al, 2012; Franco and Filson, 2006; Klepper and Thompson, 2010), though in some cases they may also correspond to the worst employees in a firm (von Greiff, 2009), or even to a mix of both stars and misfits

(Åstebro et al., 2011). In our context, these results suggest that spin-off founders are a non-random sample of employees from parent firms, but a self-selected group of individuals who may base their decision on their ability or innate talent, which is unobservable to us.

Additionally, both seminal (Lucas, 1978) and more recent studies (Agarwal et al., 2015; Baptista et al., 2013; Dahl and Klepper, 2015) document that the most able entrepreneurs are likely to attract more and better (e.g., more skilled) employees. Consequently, early hires tend to be allocated to firms according to founders' ability, and the best founders may strategically assemble teams that represent strong complementarities. Again, this implies that, in our context, the decision of hiring former coworkers may be strongly correlated with unobservable traits of spin-off founders, which makes coworker mobility potentially endogenous to spin-off survival.

Our empirical approach addresses these two issues. We acknowledge those earlier results, and adopt a recent methodology (see Roodman, 2011) that allows the joint estimation of the following three stages: i) the employee decision of becoming an entrepreneur; ii) the entrepreneurs' subsequent decision of hiring former coworkers; and finally, iii) the effect of coworker mobility on spin-off survival – which is the core relationship we want to investigate. Both self-selection in entrepreneurship (first stage) and the possible endogenous nature of coworker mobility (second stage) need to be carefully addressed in order to derive any causal effects from coworker mobility on spin-off survival in the third stage.

## 3 Data and Methods

### 3.1 Data and sample

Our data come from Quadros de Pessoal (hereafter, QP), a large longitudinal linked employer-employee register dataset maintained by the Portuguese Ministry of Employment. QP covers all firms operating in the Portuguese private sector and employing at least one wage earner. Available information at the firm-level covers employment, sales, industry, ownership, location, among other details. At the individual-level, QP reports information about each worker's age, education, gender, qualifications, wages, occupation, tenure, number of hours worked, and type of contract. All firms, establishments and workers are identified with a unique identification number, so they can be matched and followed over time. We have access to the original QP files for the period 1986-2009.<sup>2</sup>

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<sup>2</sup>We do not have information at the worker-level in 1990 and 2001. For this reason, we focus our analysis on spin-offs founded in 1992 or later, excluding those founded in 2001 – whose founder cannot be accurately identified.

Entries of new firms are identified by the first year a firm is recorded in QP files. Firm exit is identified by the moment when a firm stops answering the survey. Following previous studies that also use QP dataset (e.g., Geroski et al., 2010; Mata and Portugal, 2002), we have required an absence of the firm from the files larger or equal to two years in order to identify its definite exit.

Our analysis focuses on startups founded (in  $t$ ) by individuals (or teams of founders) who were in paid employment before (in  $t-1$  or  $t-2$ ) in incumbent firms. We follow the same definition of spin-offs (or spin-outs) adopted in prior studies also using matched employer-employee data (e.g., Andersson and Klepper, 2013; Dahl and Sorenson, 2014; Eriksson and Kuhn, 2006; Muendler et al., 2012). We consider both startups founded in the same and in a different 3-digit industry as the parent firm, as Eriksson and Kuhn (2006) and Muendler et al. (2012).

We identify a total of 28,353 new startups whose founders were in paid employment before firm creation. We refer to the previous employer as the “parent firm” throughout the analysis. Out of these, 13,822 startups were founded by individuals who left a parent firm that was declining or that definitely closed down in the same year they were employed there for the last time.<sup>3</sup> We classify this group of startups as pushed spin-offs. The remaining 14,531 startups were founded by individuals who were previously employed in incumbent firms that continued operating after their exit. A likely reason for their exit might have been the identification of an entrepreneurial opportunity, so we classify them as pulled spin-offs.

Figure 2 depicts the positive evolution in the number of pushed and pulled-driven spin-offs in the Portuguese private sector. All these firms employ at least one wage employee since their entry. The numbers show that pushed-driven startups deserve further attention, given that the number of new spin-offs triggered by necessity was higher than the startup activity driven by opportunity identification in most of the years. We also observe relatively more prominent startup activity in periods of economic downturn (e.g., 1994, early 2000s, and the years preceding the global financial crisis of the late 2000s), which may indicate that entrepreneurship is chosen by disproportionately more individuals in times of crisis, not only for necessity reasons, but also due to the identification of new market opportunities. Portugal, thus, offers an interesting context to be studied, considering the growing number of new startups being created over time (and the relatively large number of pushed-driven firms), as well as the specificities of its labor

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<sup>3</sup>Most of these pushed startups (10,252 in total) have origin in firms that definitely closed down before spin-off creation. The remaining founders come from incumbent firms that suffered massive downsizing (higher than 30%, with a minimum of five displacements) and that closed down within one or two years. The possibility that some of these spin-offs are a restructuration of closed parent firms is ruled out by excluding startups whose initial workers have a tenure larger than 24 months in the year of entry. Our sample is also unlikely to include new firms resulting from mergers or acquisitions, as less than 1% of firm closures in Portugal are caused by M&A (Geroski et al., 2010). Both aspects reinforce that the displacements identified in our data are exogenous.

market, known as one of the most rigid and regulated labor markets in OECD (OECD, 2012). Given the difficulty in changing initial conditions over firms' lifecycle, and the non-negligible role of new spin-offs (including those driven by necessity) in job creation (Rocha et al., 2015a), we provide a novel and relevant setting to investigate the benefits of coworker mobility for pushed and pulled spin-offs survival.

\*\*\* Figure 2 here \*\*\*

In order to address self-selection into entrepreneurship and the potential endogeneity in the recruitment of former coworkers, we need to take into consideration all the employees hired at the parent firm right before spin-off creation. Our final pool of employees includes 1,186,097 individuals, out of which 24% were employed in declining incumbent firms that closed down in the same year or within two years at most (see Figure 3). About 6% of them became entrepreneurs (business owners) after leaving the firm, some of them in teams, thus sharing the ownership of the new business.<sup>4</sup> As expected, the proportion of workers in other (surviving and non-declining) incumbent firms who started their own venture is much lower (1.8%), as their opportunity costs of leaving wage employment are naturally higher.

We also identify a considerable number of employees moving out of the parent firm and being hired by spin-offs in the year of their creation, whom we refer to as "coworkers". Most spin-offs hire one or two coworkers. The small size of most parent firms gives support to the claim that spin-off founders and mobile coworkers actually know each other and have interacted quite often in the previous work environment (the median number of employees is six (fourteen) in pushed (pulled) spin-offs' parent firm by the time of founders' exit). This is further reinforced by the fact that most founders and coworkers had the same or close (contiguous) qualification levels at the parent firm, which broadly correspond to hierarchies at the workplace.

This labor mobility phenomenon is, yet, more remarkable among pushed spin-offs: 44% of pushed-driven startups hired at least one coworker from the parent firm, while this kind of labor mobility was only observed in 13% of pulled spin-offs. The fact that pushed spin-offs have a higher degree of urgency in setting up a team with lower information asymmetries may explain this difference. Furthermore, pulled spin-offs' founders may have a harder time attracting former coworkers, who have probably better work conditions and career prospects in the parent firm.

\*\*\* Figure 3 here \*\*\*

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<sup>4</sup>This explains why the number of founders is higher than the number of startups.

## 3.2 Empirical methodology

The main goal of our empirical analysis is to study how coworker mobility affects spin-off survival (Hypothesis 1), and how different is the effect for pushed and pulled spin-offs (Hypothesis 2). As previously discussed, two empirical issues must be addressed in order to study the causal effects of coworker mobility on spin-off outcomes: first, self-selection effects in entrepreneurship entry, and, second, endogeneity in the founders' decision of hiring coworkers. We, therefore, frame our empirical analysis in a three-stage model, and simultaneously estimate the three (binary) recursive outcomes: 1) entrepreneurial entry; 2) founders' decision of hiring previous coworkers; and 3) spin-off survival. Not all employees in the parent firm decide to become entrepreneurs and found their own business. As a result, the second and third outcomes are only observed among those who actually made the decision of leaving the parent firm to spin-out. While this group of individuals may be a non-random sample of employees, their unobserved attributes – e.g., ability – may also drive their hiring decisions once they engage in startup activity, and jointly affect their performance later on. Neglecting these aspects is likely to bias the core effect of interest: the impact of coworker mobility on spin-off survival.

The three stages of our model are illustrated in Figure 4. To allow for the joint estimation of these three stages, we tested our hypothesized effects with robust maximum likelihood estimation in a simultaneous equation model with correlated error terms, as proposed by Roodman (2011). The system corresponds to a multi-equation probit model, also containing a Heckman-type selection model, where selection into entrepreneurship (first stage) is modeled along the two dependent variables observed for the subset of spin-off founders (second and third stages).

\*\*\* Figure 4 here \*\*\*

The first stage equation includes three main sets of variables that, according to existing literature, are likely to explain why individuals leave paid employment and become entrepreneurs (e.g., Åstebro et al., 2010; Berglann et al., 2011; Burton et al., 2002; Campbell et al., 2012; Hyytinen and Maliranta, 2008): individual-level characteristics, parent firm characteristics, and contextual factors. At the individual-level, we consider gender, age, and both general and specific human capital. Employees' general human capital is measured by their education level, their qualifications (from a set of eight possible qualification levels or hierarchies), and by their hourly wage in the parent firm. We also include the number of different firms where the individual was employed to capture the diversity of their labor market experience, which was earlier shown to influence entrepreneurial choices (e.g., Rocha et al., 2015c). As measures of specific human capital, we consider their tenure (in months) in the parent firm, the experience (in years) in the industry, and the accumulated experience in management and business ownership positions (also

in years). Regarding parent firm characteristics, we consider firm size (number of employees) and whether the individual was employed in a declining or closing parent firm (to distinguish between necessity and opportunity-driven entrepreneurial decisions). We then control for several contextual factors, namely the industry and region of the parent firm, and the macroeconomic environment (by including year dummies).

The second stage equation – hiring previous coworkers – includes the same set of variables mentioned above, now observed only for those who became founders of new firms. Furthermore, it includes a set of indicator variables to distinguish between spin-offs founded i) in the same or in a different 3-digit industry as the parent firm, ii) in the same or in a different location (municipality) as the parent firm, iii) by a single founder or a team of two or more founders coming from the same parent firm (shared ownership). These startup conditions are also expected to influence the decision of hiring former coworkers. This second equation also includes entry year and industry dummies to control for differences in coworker recruitment choices over time and across industries.

The final stage – spin-off survival – will allow us testing the validity of our hypotheses. Coworker mobility, already modeled in the second stage, is one key explanatory variable of spin-off survival. The coefficient obtained for this variable will provide the basis for testing our Hypothesis 1. Spin-off type – pushed versus pulled – will also be included in the set of explanatory variables, given the growing debate about performance gaps between pushed and pulled spin-offs (Buenstorf, 2009; Dahl and Sorenson, 2014; Eriksson and Kuhn, 2006). The second hypothesis will then be tested by including an interaction term between these two variables (*Hire coworkers x Pushed spin-off*). This final equation will, additionally, control for founder’s general and specific human capital, as described before, as well as startup conditions (shared ownership, similarity to parent firm’s industry and location, and initial size), parent firm size (in order to test whether smaller firms produce better entrepreneurs, as suggested by Hyytinen and Maliranta (2008) and Rocha et al., (2015c), among others), and average human capital in the initial workforce (age and education level), as proxies for spin-off average wage costs. In case of spin-offs founded by teams of two or more founders, human capital measures will correspond to the average human capital in the founding team.

The estimations will be cluster-adjusted to further account for non-independence of the observations of employees working in the same parent firm. Finally, though Wilde (2000) shows that a general (recursive) multi-equation probit model is identified as long as each equation contains one varying predetermined variable, as in our case, we include some exclusion restrictions to improve identification. We augment the first stage (selection) equation and introduce the entry rate of new firms in the municipality in the previous year, as a proxy of the entrepreneur-

ial environment in each narrow region. While this variable is believed (and shown) to affect employees' entrepreneurial propensity, it is exogenous to the founders' future decision of hiring coworkers from the parent firm. We additionally included two other variables in the second-stage equation that are found to be significant predictors of the decision of hiring coworkers, but not significant predictors of spin-off survival – the proportion of skilled and unskilled (low skilled, unskilled, trainees, and apprentices) workers employed at the parent firm, before spin-off creation. The skill composition of the overall workforce at the parent firm proxies the availability of human resources that might be of interest of spin-off founders, which is likely to affect founders' probability of hiring former coworkers, being exogenous to the survival prospects of new ventures.

## 4 Pushed and pulled spin-off activity and coworker mobility: A description

Before presenting the results and testing our hypotheses, this section provides a brief description of our sample and documents some individual-level differences that will be taken into account in the estimations. Besides examining whether there is any survival bonus in hiring former coworkers, we also briefly describe who spins-off and who hires former coworkers.

### 4.1 Pushed and pulled spin-off survival when coworkers (do not) co-move

Figure 5 illustrates the survivor functions of pushed and pulled spin-offs, with and without coworkers in their initial workforce. These first statistics suggest that spin-offs with coworkers survive relatively longer. Unconditionally (i.e., without controlling for any (un)observed characteristics of entrepreneurs and firms), pushed spin-offs seem actually to survive longer than their pulled counterparts, which may be mostly driven by the fact that they rely on former coworkers more often (e.g., Rocha et al., 2015b). Raw survival rates show that the share of pushed startups surviving during the studied period is 65% among those hiring coworkers and 54% for those without any coworker in the initial workforce. The respective shares among pulled spin-offs are 58% and 55%, which indicates that coworker mobility may, indeed, bring larger survival benefits to pushed-driven spin-offs, given the relatively more uncertain conditions and larger pressure under which they are established.

\*\*\* Figure 5 here \*\*\*

## 4.2 Who spins-off?

We must, still, be aware that spin-off founders – even those driven by necessity – may be a selection of employees with different characteristics. Table 1 describes the main characteristics of different groups of employees at the parent firm. Those becoming entrepreneurs are more often male, and have more experience as business owners and/or managers. Coworkers moving to newly founded spin-offs correspond, on average, to younger workers with lower education levels and wages. This pattern is in line with recent evidence showing that new firms disproportionately hire young and less educated workers (Coad et al., 2014; Ouimet and Zarutskie, 2014), who are relatively more risk tolerant, and more willing to bear a lower labor income and the human capital risk of working for a startup. The remaining employees at the parent firm are older on average, have a longer tenure, earn higher wages, and may be, consequently, more difficult to attract to new startups. There are also significant differences between employees at declining firms and employees at other incumbent firms, namely in terms of hourly wages and education levels. They are, on average, considerably lower among workers in declining firms.

\*\*\* Table 1 here \*\*\*

As a more fine-grained measure of individuals' ability and productivity potential, we additionally estimated the person fixed effect obtained from an AKM wage equation (see Abowd et al., 1999), including both worker and firm fixed effects (Figure 6).<sup>5</sup> We clearly observe that individuals becoming entrepreneurs correspond to a higher-ability group of employees. This is consistent with the idea that individuals self-select into entrepreneurship according to their own ability. A multinomial logit model distinguishing the three alternative groups of employees further confirms this claim, by showing that the employee's education level and wages at the parent firm (conventional proxies of individual ability) are positively associated with entrepreneurship choices afterwards (see Table A.I in the Appendix).

\*\*\* Figure 6 here \*\*\*

The opposite association is found in coworker mobility, which is indicative that coworkers absorbed by new spin-offs belong to a group of less skilled employees at the parent firm. While this may be, indeed, the case in pushed-driven startups, pulled-driven founders may be in a better position to attract some of the best employees in the parent firm (see Figure 6 and the

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<sup>5</sup>This fixed-effects wage equation was estimated using the procedure described in Guimarães and Portugal (2010), and all the history we have for each individual in the labor market. The dependent variable was defined as the real hourly earnings (in logs). This wage equation controlled for individual's age (and its square), tenure (and its square), education, qualifications, year dummies, and, following Abowd et al. (1999), both worker and firm unobserved (permanent) heterogeneity, which are typically interpreted as a measure of their (fixed) quality.

person fixed effect of coworkers, compared to other workers in each group of parent firms). These entrepreneurs are more skilled on average, they may have identified a profitable market opportunity, and they are probably less restricted (e.g., financially) than their necessity-driven counterparts. This points out that the intentions of pushed and pulled founders when hiring coworkers may be different, and that coworker mobility may not necessarily affect the survival of pushed and pulled spin-offs through the same mechanisms.

### **4.3 Who hires former coworkers?**

We, therefore, further analyze how different are spin-off founders according to their decision of hiring former coworkers. A brief comparison between founders hiring and not hiring coworkers is available in Table A.II (Appendix). To better understand the different profile of these two groups of founders, we estimated the second stage of the model – the decision of hiring coworkers – jointly with the first-stage decision of entering entrepreneurship (self-selection equation), using the aforementioned method of Roodman (2011). The results (in Table A.III in the Appendix) show that the decision of hiring coworkers is not random, but negatively correlated with the unobservable traits that may drive individuals into entrepreneurship, such as ability or risk taking preferences ( $\rho = -0.8229$ ). This indicates that founders employing former colleagues are a negative selection of all the entrepreneurs in our sample – who, themselves, are a positive selection of all the employees in the parent firm (as illustrated in Figure 6). The more experienced and educated they are, the lower their propensity to absorb labor from the parent firm. This result hints that founders recruiting from their network may decide to do so to compensate any relative disadvantage in skills, knowledge, or experience. This also reinforces that hiring coworkers is endogenous and driven by founders’ unobservable characteristics that are likely to affect spin-off performance.

## **5 Results**

### **5.1 Coworker mobility and spin-off survival**

Table 2 reports the results obtained for spin-off exit risk and provide the basis for testing our theoretical hypotheses. The first two columns provide the baseline results obtained with the simple estimation of a probit model for the probability of firm exit, neglecting the issues of self-selection and endogeneity in coworker mobility previously discussed. We address these concerns in the last two columns, by simultaneously estimating the three-stage model described earlier.

The results reported correspond to the last stage of the recursive model: spin-off exit risk. The results for the first and second stages are qualitatively similar to those presented in Table A.III.

From the first column, we conclude that spin-offs hiring former coworkers survive longer, which confirms our Hypothesis 1. However, the survival bonus resulting from coworker mobility is notably underestimated when we ignore self-selection in the sample of spin-off founders and the endogenous nature of their hiring choices, once we compare the estimates obtained in column 3. By computing the average marginal effect of hiring coworkers (from column 3), we conclude that this labor inflow reduces the exit risk of newly founded spin-offs by 10.9 percentage points, on average. This corresponds to a reduction of almost one fourth (23.7%) in the risk of exit for the average firm, which amounts to 45.9% according to the estimated model. Neglecting those two empirical issues produces a biased average marginal effect of -7.7 percentage points (column 1).

\*\*\* Table 2 here \*\*\*

Regarding the remaining variables, the results show that no significant survival differences exist between pushed and pulled spin-offs once we address the two aforementioned sources of bias (column 3). Being located in the same 3-digit industry as the parent firm slightly improves spin-off survival chances, and staying in the same region is found to significantly decrease the exit risk. Older founders, with longer experience and higher education levels, run spin-offs with better survival chances, which is line with an extensive literature showing that founder human capital is a vital determinant of new venture performance (e.g., Eisenhardt et al., 1990; Rocha et al., 2015c, 2016). However, there might be a trade-off in starting a firm with a skilled and experienced set of workers: though human capital may endow startups with a competitive advantage, it also implies higher labor costs in early stages, in order to attract, retain, and compensate better works for the risk of working in startups. Our results indicate that the latter effect prevails in our sample of spin-offs.<sup>6</sup>

Those who share the business ownership with other founder(s) are more likely to survive, as they possibly also share risks and financial assets. New ventures established in larger urban areas may face higher competition, which increases their exit risk. Startup size is inversely (though weakly) related to exit risk, while parent firm size seems to play an important role, as spin-offs originating from smaller parent firms survive longer. Though this is apparently conflicting with the idea that better parent firms (which are typically assumed to correspond to larger incumbent firms) produce more successful spin-offs, this result is in line with the literature documenting

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<sup>6</sup>Similar conclusions are obtained if we use the average wage of the initial workforce instead of average age and education of workers. However, given some missing values in wages in startup firms in the first year of activity, we would lose a considerable number of observations.

that smaller firms provide a better context for employees to learn from other entrepreneurs and to succeed in their own entrepreneurial firms later on (e.g., Hyytinen and Maliranta, 2008; Parker, 2009).

In order to test the validity of the second hypothesis, we extended the exit equation by including an interaction term between the type of spin-off and the presence of coworkers in the initial workforce (columns 2 and 4). The results support that the negative effect of coworker mobility on spin-off exit risk is larger in pushed-driven spin-offs, in line with Hypothesis 2. This confirms that relying on former coworkers fills a larger gap in initial labor necessities among those who set up their business for necessity reasons, and possibly under larger time and financial pressures.<sup>7</sup> We next conduct some post-hoc analyses in order to better understand the (different) value that former coworkers can add to pushed and pulled-driven startups.

## 5.2 Post-hoc analyses

Two main mechanisms were theoretically advanced along the development of our hypotheses: former coworkers may transfer knowledge that increases the survival prospects of the new firm, and they may also reduce labor searching costs and consequently reduce spin-off exit risk. We now investigate how empirically relevant they are in our data. First, we extend the last stage of the multi-equation system in order to test how pushed and pulled spin-offs' exit risk is affected by coworkers' general and specific knowledge, and by labor adjustment costs at the firm-level. Second, we analyze how coworker mobility impacts on other spin-off outcomes in later stages.

Table 3 summarizes the results obtained for spin-off exit, when including measures of coworkers' general and specific knowledge, and labor adjustment costs. To account for industry- and region-specific knowledge embodied in these mobile employees, we consider the relative importance of coworkers with former experience in the same region or industry where the spin-off is founded (i.e., their share in the initial workforce). As a proxy of coworkers' general knowledge and ability, we include the hourly wage they earned in the parent firm before moving to the startup.<sup>8</sup> Finally, in order to measure the costs incurred with recruitment and adjustments in the workforce in early stages, we add the turnover in the workforce at the end of the first year of activity (the sum of hiring and separation rates at the firm-level).

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<sup>7</sup>Our results are robust to several alternative specifications and sub-samples. Using the share of coworkers in the initial workforce, or the number of coworkers, instead of the binary decision of hiring (versus not hiring) any coworkers produces the same qualitative results. The main results are also consistent when we look at particular sub-samples of spin-offs (e.g., spin-offs founded by a single founder versus teams of two or more founder, spin-offs established in manufacturing versus services), where knowledge transfer mechanisms could have a different relative importance. These results will be available upon request.

<sup>8</sup>As an alternative measure of coworkers' ability we used their average person fixed effect. Most results were qualitatively similar to those in Table 3.

\*\*\* Table 3 here \*\*\*

The results support that the presence of former coworkers benefits the longevity prospects of both types of spin-offs (H1), though the effects are stronger for pushed-driven startups, as previously hypothesized (H2). In the case of pushed spin-offs, the survival gain resulting from coworker mobility is higher when they rely relatively more on former colleagues coming from the same region where the firm is created. The literature on labor mobility and local labor markets establishes that distance acts as a mobility barrier and increases firm searching costs (e.g., Boschma et al., 2009; Combes and Duranton, 2006; Pe'er and Keil, 2013; Timmermans and Boschma, 2014), so hiring coworkers from the same region where founders set up their firm may decrease the costs of hiring labor. This may be especially relevant in startups founded in more adverse conditions, which may need to setup an initial workforce relatively faster and at a lower price than more opportunity-driven startups, in order to survive. Besides making the recruitment easier and less costly, these coworkers may also bring specific knowledge about the region (e.g., contacts of customers and suppliers), which may be particularly important for new entrepreneurs triggered by necessity.

In contrast, pulled spinoffs are found to benefit less from coworkers when they come from the same industry and region. First, the costs of labor poaching and of competitive reactions (e.g., rivalry and retaliation) by parent firms are expected to be higher in that case. Second, these results further suggest that pulled spin-offs benefit more from workers conveying new knowledge to the firm (see Timmermans and Boschma, 2014). Hiring coworkers whose specific knowledge is probably very similar to the one embodied in the founder may add less or no value (knowledge-wise) to the new firm, besides hampering the ability to adapt to, and learn from, new environments (Pe'er and Keil, 2013).

The results furthermore show that coworkers' average quality is only a significant determinant of survival in pulled-driven startups. This may indicate that hiring former coworkers may improve productivity and knowledge transfer to a higher extent in pulled spin-offs, which may be more able to attract better quality workers (cf. Figure 6). Finally, both types of spin-offs are found to suffer a higher exit risk when the adjustments in the initial workforce (hiring and separation rates) are larger, though the effects are more detrimental in pushed spin-offs. Pushed-driven startups seem to be particularly vulnerable to searching and adjustment costs, so relying on former coworkers may help them reducing this liability.

These previous results suggest that both mechanisms (knowledge transfer and reduced searching costs) are relevant explanations for the survival bonus found in spin-offs hiring former coworkers. We now look at the effect of coworker mobility on other firm-level outcomes in order to better infer about the relevance of those mechanisms in the two types of spin-offs.

Table 4 summarizes the estimated effects of hiring coworkers on spin-offs' average employment growth, hiring and separation rates, labor productivity, and sales growth during their first three years of activity. In order to estimate each of these equations, we used our previous three-stage model but replacing the firm-level outcome in the third-stage equation by each of the outcomes reported in Table 4. We furthermore extended the system of equations to take into consideration the fact that these outcomes are only observed for spin-offs surviving the first three years of activity, which may be a selection of the best and more efficient firms (Jovanovic, 1982). For this reason, we added a fourth equation to the system to model the probability of surviving at least for three years.

\*\*\* Table 4 here \*\*\*

We find that pulled spin-offs hiring coworkers grow, on average, 2.1% more in employment size and 2.8% more in sales, and have about 7% higher productivity levels, during their first years of activity, compared to spin-offs without coworkers. These results are consistent with the idea that coworkers may convey some valuable knowledge and experience that boosts the performance of the receiving firms. Hiring coworkers at entry also reduces their future adjustments in the labor force (both hiring and separation rates). This indicates that former coworkers may, indeed, be good matches for the spin-off – owing to the screening that founders could have already made at the parent firm at a lower cost – reducing the need for large labor adjustments that often characterize young firms (Haltiwanger et al., 2013).

However, pushed-driven spin-offs are found to score lower than their pulled counterparts both in early growth and labor productivity, and to perform even poorer when they hire former coworkers. Moreover, they hire disproportionately less when they include coworkers in their initial team, and this probably hampers their employment growth. This result highlights the relevance of startup conditions and the long-term consequences arising from initial choices (Geroski et al., 2010; Rocha et al., 2016). Even though we find that coworker mobility is particularly relevant for the survival of pushed-driven startups, there might be a trade-off between the survival benefits of quickly hiring former coworkers with lower information asymmetries and the detrimental impacts on future performance, especially when founders are not able to attract the best coworkers (due to time, financial, and/or founders' ability constraints), and when they rely mostly on coworkers whose specific knowledge is similar to that already embodied in founders. This may not only block pushed spin-offs' chances of learning and acquiring new knowledge from other sources, but also hinder future growth and their ability to attract better human resources over their lifecycle. Our analysis, therefore, shows that a longer survival does not necessarily imply a good performance.

Considering all our results, we find support for both mechanisms in the case of pulled spin-offs. Hiring coworkers may help them surviving longer, not only by reducing the burden of initial recruitment and searching costs, but also by transferring valuable knowledge and experience that can enhance their productivity and growth prospects already in early stages. In the case of pushed-driven startups, coworker mobility seems to diminish their exit risk largely through the reduction in searching costs at the moment of entry. The detrimental effect of coworker mobility in pushed spin-offs' performance later on does not give support to the knowledge transfer mechanism in this particular group of startups.

## 6 Discussion and conclusion

Our aim with this paper was to provide an expanded understanding of how labor mobility from incumbent firms impacts the survival of new spin-offs founded in different contexts. The contributions made by this study shed light on a central topic in the entrepreneurship literature – the value of initial human resources to new venture performance – and fill major gaps within the existing theories and empirical evidence linking labor mobility and entrepreneurship. Prior work on this link has widely acknowledged that most entrepreneurs are spawned by existing firms (Audretsch and Keilbach, 2007; Burton et al., 2002; Campbell et al., 2012; Sørensen and Fassiotta, 2011), but generally neglected two points: i) the fact that not all entrepreneurs are driven by the identification of an opportunity, but sometimes by necessity and deteriorating conditions in paid employment; ii) the fact that founders may often rely on their prior coworkers when venturing out and setting up their teams.

This paper, thus, contributes to prior research on labor mobility and entrepreneurship by looking beyond the founders and the so-called pulled spin-offs. We are the first studying the value of coworker mobility in two different, but equally relevant, contexts: pushed (or necessity-driven) and pulled (or opportunity-driven) spin-offs. This work also contributes to the developing theories on labor markets for entrepreneurship and to prior research on entrepreneurs' hiring choices (Coad et al., 2014; Dahl and Klepper, 2015), by highlighting the central role played by the founder in these decisions and the long-lasting consequences of human capital initial choices. We also provide an empirical contribution by proposing an empirical methodology that takes into account two issues largely overlooked by prior studies: self-selection bias in the sample of entrepreneurs and the endogenous nature of their hiring choices.

Finally, and more broadly, this study also contributes to the literature on the role of labor mobility in organizational performance, and addresses some of the gaps raised in recent works (e.g., Mawdsley and Somaya, 2015). It provides evidence of different mechanisms through which

(co)worker mobility may affect the performance of the receiving firms, it compares this phenomenon in different contexts (i.e., different types of receiving firms) that may moderate the main effects under study, and it also challenges the almost taken for granted assumption that labor mobility benefits the performance of receiving firms.

### **Theoretical, practical, and policy implications**

Our study has crucial implications for existing theories on labor mobility and entrepreneurship. We provide important complements to prior work by developing and testing a model of how hiring former coworkers may differently contribute to startup performance, according to the context triggering new venture creation. Our analysis implies that, in order to understand the micro-foundations of entrepreneurship, researchers should take into further consideration not only the heterogeneous contexts where entrepreneurship emerges, but also the fundamental role of the founder in the formation, and later adjustments, of the team.

Though we focus on spin-offs, our analysis has broader implications for inter-firm labor mobility research. Our results suggest that existing labor mobility theories should accommodate multilevel contextual factors – such as different attributes of the source and destination firms, as well as attributes of mobile individuals – when studying the impacts of employee mobility on organizational outcomes, besides considering different mechanisms through which mobile employees may affect destination firms. Moreover, the consideration of these different layers should be complemented by further efforts on theorizing the pros and cons of labor mobility for receiving firms.

Likewise, this work has important implications for managers, and more specifically for entrepreneurs. Our study highlights the value of developing social networks inside organizations to potential founders. By developing links with coworkers at the workplace, prospective founders may screen potential team members in advance and at a lower cost, determine which coworkers have important complementary and/or unique, non-imitable, skills, and, hence, increase the survival chance of their entrepreneurial ventures. Nevertheless, when deciding the composition of their initial workforce and considering hiring coworkers, entrepreneurs should be aware of the trade-offs involved, and balance the benefits of reducing the initial uncertainty and recruitment costs with the risks of blocking learning from external sources of labor.

For policy makers, our work confirms that startup conditions are of chief importance and have long-term consequences, which emphasizes the relevance of policies targeting newborn firms and supporting entrepreneurs at very early stages. Our comparison between pushed and pulled-driven startups shows that important employment opportunities are provided by startup firms, even by those created out of necessity. By relying more often on prior coworkers, pushed spin-offs play an essential role in avoiding the depreciation of human capital of many recently displaced

individuals – including the founders themselves. Our results suggest that there is still scope for policy intervention in startups with origin in declining parent firms. Though these firms help lessening the penalties of carrier interruptions in the aftermath of a job loss, their founders may need further support in the initial and follow-up stages, not only to reduce the financial pressure under which these firms may be established – which has serious impacts on the quality of the workers hired – but also to incentivize job creation over their lifecycle, and improve their growth prospects.

### **Limitations and future research**

Several promising opportunities exist to further extend research in this area. First, although our definition of pulled spin-offs follows prior studies also using linked employer-employee data (e.g., Andersson and Klepper, 2013; Dahl and Sorenson, 2014; Eriksson and Kuhn, 2006; Muendler et al., 2012), we cannot distinguish between voluntary and involuntary mobility of founders (e.g., disagreements between the employee and the previous employer (Klepper and Thompson, 2010)), neither can we directly infer any information on the size of the opportunity possibly pursued by the founder. Future research might usefully extend our analysis and explore more different contexts within the broad group of pushed and pulled spin-offs, by using more in-depth (e.g., survey-based) information about the motivations behind new venture creation.

Second, though it was not the aim of this paper to decompose the two mechanisms through which coworker mobility may affect spin-off survival, not even to quantify their relative importance in pushed and pulled spin-offs, future analyses could study this in more detail, and also explore alternative or additional mechanisms that may be relevant in this context. We recognize that we cannot precisely disentangle the two mechanisms, not only because they are not mutually exclusive, but also because some variables may capture both specific knowledge transfer and reduced searching costs (e.g., the share of coworkers from the same region).

Finally, we have focused on the decision of hiring former coworkers at entry for three reasons. First, our data reveal that the mobility of former coworkers largely takes place at the moment of new venture creation, being less frequent in later stages of the spin-off lifecycle. Second, founding conditions – including human capital choices – are known to be difficult to change afterwards, and to have long term impacts on firm outcomes (Geroski et al., 2010; Rocha et al., 2016), especially in rigid labor markets like the Portuguese, where job protection and firing costs are high (which makes labor adjustments very costly, especially in small and young firms). Third, looking at coworker mobility in later stages of the spin-off lifecycle would impose further empirical challenges in the estimation of our multi-stage model. We believe our empirical approach provides an important contribution to the existing literature, by carefully addressing the issues of self-selection into entrepreneurship and endogeneity in entrepreneurs’ hiring choices,

which are shown to bias the key results of interest. While we accept the trade-off between our ability of empirically dealing with those issues, and the limitation in not extending the analysis to coworker mobility in later stages of the firm, we encourage future research to investigate this question, also in other labor markets with different degrees of rigidity, where looking at labor adjustments over firm lifecycle may be relatively more pertinent.

## **Conclusion**

By combining the insights from the widespread research on entrepreneurial spin-offs and from the emerging literature on hiring choices in startups, we investigated the role of coworker mobility in pushed and pulled spin-off survival. Using a rich matched employer-employee dataset for Portugal, and a multi-stage model addressing the issues of self-selection in entrepreneurship and endogeneity in recruitment choices, we covered over a million of employees from about 26,700 parent firms, and a total of 28,353 spin-offs founded between 1992 and 2007.

We find that spin-offs hiring coworkers from the parent firm survive longer. The survival bonus resulting from coworker mobility is higher in pushed-driven startups. Our analysis suggests that coworker mobility improve pulled spin-offs' survival chances, not only by transferring valuable knowledge, but also by reducing founders' searching costs. In the case of pushed spin-offs, coworker mobility seems to largely help them thriving in the market through the reduction in recruitment costs at entry. This labor inflow is not found to boost pushed spin-offs' productivity, neither growth prospects, which does not give support to the knowledge transfer mechanism. Hiring former coworkers seems to be a choice often driven by necessity, which may limit the quality of the initial human resources, and hurt future performance, especially in rigid labor markets.

## **APPENDIX**

Please download our online Appendix here:

<https://dl.dropboxusercontent.com/u/2248124/DRUID2016Appendix.pdf>

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## Tables

**Table 1.** Descriptive statistics of workers at the parent firm, according to their mobility decisions

	Pushed spin-offs' parent firms			Pulled spin-offs' parent firms		
	Startup founders	Coworkers moving to the new startup	Other workers at the PF	Startup founders	Coworkers moving to the new startup	Other workers at the PF
Male	0.6933	0.5780	0.5751	0.6947	0.6133	0.5803
Age	34.259	33.942	36.275	34.438	34.356	37.003
Previous experience as business-owner (%)	0.1131	0.0255	0.0195	0.1431	0.0233	0.0214
Number of different firms as wage employee	1.9071	1.9832	1.9804	2.1418	1.9812	2.0906
Years of experience in management positions	0.4257	0.0630	0.1543	0.6131	0.1116	0.2705
Tenure in the parent firm (months)	64.905	64.064	96.599	66.420	70.189	106.81
Less than 9 years of education (%)	0.5456	0.7639	0.5795	0.4599	0.7156	0.5462
9 years of education (%)	0.1845	0.1231	0.1552	0.1606	0.1166	0.0992
12 years of education (%)	0.1870	0.0899	0.1775	0.2214	0.1255	0.2248
Higher education (%)	0.0829	0.0232	0.0878	0.1582	0.0423	0.1299
Years of experience in the industry (2digit)	3.3341	3.6357	3.8678	3.7377	3.4239	5.4040
Hourly wage in the parent firm (log)	4.2175	3.1690	5.3709	6.2934	4.0008	6.9548
<b>Number of observations (individuals)</b>	<b>17,642</b>	<b>21,131</b>	<b>244,527</b>	<b>16,125</b>	<b>5,482</b>	<b>881,190</b>

**Table 2.** The effect of hiring coworkers on spin-off exit risk

	Single-equation estimation		Multi-equations estimation	
	(1)	(2)	(3)	(4)
Hire coworkers	-0.2279*** (0.0211)	-0.0789** (0.0329)	-0.3212*** (0.0465)	-0.1217** (0.0587)
Pushed spin-off	-0.0521** (0.0203)	0.0338 (0.0250)	-0.0280 (0.0230)	0.0400 (0.0261)
Hire coworkers*Pushed spin-off		-0.2338*** (0.0398)		-0.2254*** (0.0411)
Same 3d-industry of the PF	-0.0514*** (0.0200)	-0.0552*** (0.0200)	-0.0343* (0.0200)	-0.0483** (0.0215)
Same municipality of the PF	-0.1081*** (0.0204)	-0.1084*** (0.0204)	-0.1069*** (0.0204)	-0.1081*** (0.0204)
Founders' experience as BOs	-0.0173** (0.0070)	-0.0173** (0.0070)	-0.0158** (0.0073)	-0.0171** (0.0073)
Founders' age	-0.0067*** (0.0011)	-0.0066*** (0.0011)	-0.0065*** (0.0011)	-0.0065*** (0.0011)
Founders' schooling years	-0.0143*** (0.0027)	-0.0143*** (0.0027)	-0.0143*** (0.0027)	-0.0143*** (0.0027)
Shared ownership at entry	-0.3401*** (0.0211)	-0.3413*** (0.0211)	-0.3278*** (0.0218)	-0.3368*** (0.0218)
Location in urban centers	0.0819*** (0.0182)	0.0814*** (0.0182)	0.0806*** (0.0182)	0.0810*** (0.0182)
Startup size	-0.0015* (0.0008)	-0.0015* (0.0008)	-0.0015* (0.0008)	-0.0015* (0.0008)
Parent firm size	0.0476*** (0.0070)	0.0489*** (0.0070)	0.0523*** (0.0092)	0.0518*** (0.0092)
Workers' average schooling years	0.0106*** (0.0035)	0.0103*** (0.0035)	0.0104*** (0.0035)	0.0102*** (0.0035)
Workers' average age	0.0042*** (0.0011)	0.0043*** (0.0011)	0.0042*** (0.0011)	0.0043*** (0.0011)
Constant	0.7772*** (0.0933)	0.7313*** (0.0937)	0.7717*** (0.0941)	0.7335*** (0.0944)
Spin-off 2d-industry dummies	Yes	Yes	Yes	Yes
Spin-off entry year dummies	Yes	Yes	Yes	Yes
Number of Observations	28,353	28,353	1,186,097	1,186,097
Log Likelihood	-13,849.0	-13,849.0	-113,077.5	-113,077.5

The model in the two last columns was estimated using the user-written program `cmp` (version 6.8.7) for Stata (see Roodman, 2011). \*, \*\*, and \*\*\* mean significant at 10%, 5%, and 1% levels, respectively. The values reported are coefficients and the values in parentheses are robust standard errors, clustered at the parent-firm level.

**Table 3.** Coworkers knowledge, recruitment costs, and spin-off exit risk

Dependent variable: spin-off exit	All spin-offs	Pushed spin-offs	Pulled spin-offs
Hire coworkers	-0.1527** (0.0691)	-0.2556*** (0.0660)	-0.2081* (0.1105)
Pushed spin-off	0.0634** (0.0295)		
Hire coworkers*Pushed spin-off	-0.1348*** (0.0467)		
Share of coworkers same 3d-industry	0.1318* (0.0797)	0.0981 (0.1010)	0.3124** (0.1577)
Share of coworkers same municipality	-0.1644** (0.0792)	-0.3223*** (0.1006)	0.3657** (0.1532)
Coworkers' average wage in the parent firm	-0.0266** (0.0109)	-0.0155 (0.0119)	-0.1039*** (0.0265)
Turnover in initial workforce	0.2143*** (0.0212)	0.2968*** (0.0307)	0.1297*** (0.0297)
Number of Observations	1,186,097	283,300	902,797
Log Likelihood	-110,290.4	-49,255.4	-60,043.8

All the models were estimated using the user-written program cmp (version 6.8.7) for Stata (see Roodman, 2011). All the specifications include the same control variables listed in Table 3. \*, \*\*, and \*\*\* mean significant at 10%, 5%, and 1% levels, respectively. Values in parentheses are robust standard errors, clustered at the parent firm-level.

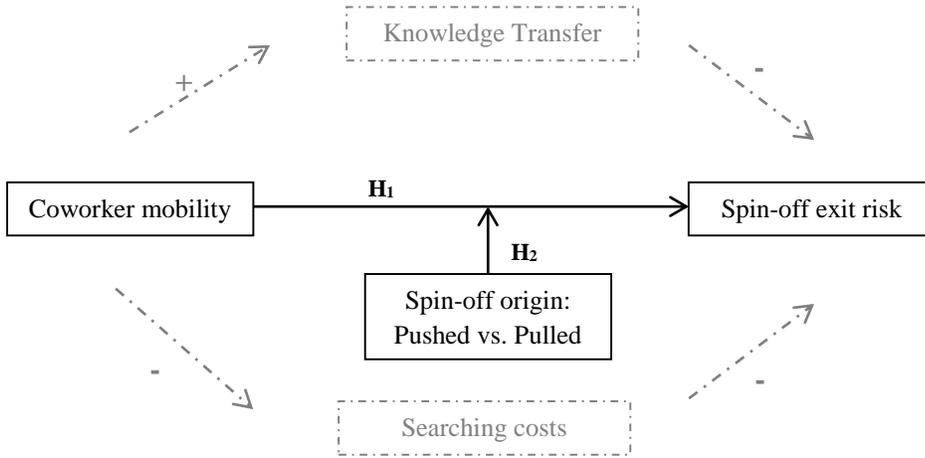
**Table 4.** The effect of hiring coworkers on other spin-off outcomes (Multi-equations estimation)

	Average outcomes during the first three years of startup activity				
	Employment growth	Hiring rates	Separation rates	Labor productivity	Sales growth
Hire coworkers	0.0213** (0.0106)	-0.0280*** (0.0103)	-0.0387*** (0.0056)	0.0764*** (0.0277)	0.0278* (0.0165)
Pushed spin-off	-0.0183*** (0.0052)	-0.0235*** (0.0048)	-0.0073 (0.0045)	-0.0440** (0.0224)	-0.0283** (0.0142)
Hire coworkers*Pushed spin-off	-0.0344*** (0.0078)	-0.0280*** (0.0072)	0.0073 (0.0068)	-0.0845** (0.0331)	-0.0711*** (0.0211)
Number of observations	1,186,097	1,186,097	1,186,097	1,186,097	1,186,097
Log-likelihood	-119,220.1	-117,618.9	-117,531.1	-141,172.1	-136,139.1

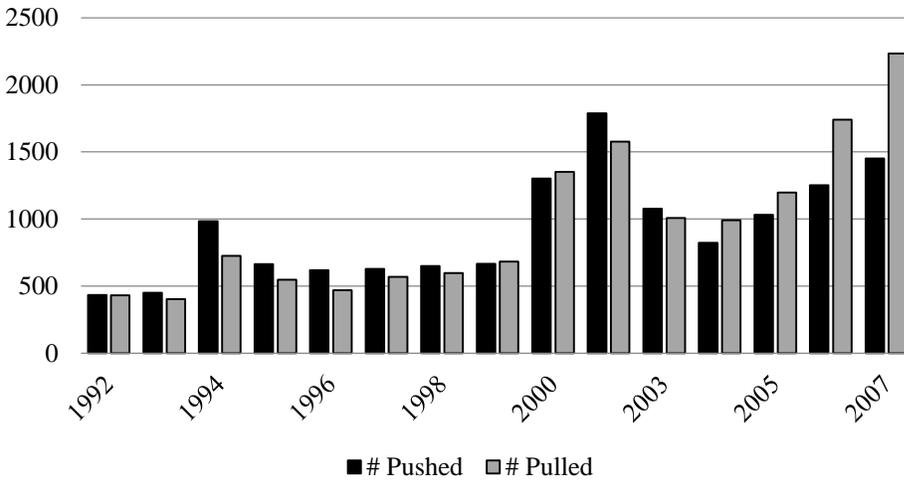
All the specifications include the same control variables listed in Table 3. For all outcomes the system of equations was extended in order to include an additional equation for the probability of surviving for at least three years, in order to take into account that surviving firms may correspond to the most efficient or represent the most talented entrepreneurs. \*, \*\*, and \*\*\* mean significant at 10%, 5%, and 1% levels, respectively. Values in parentheses are robust standard errors, clustered at the parent firm-level.

# Figures

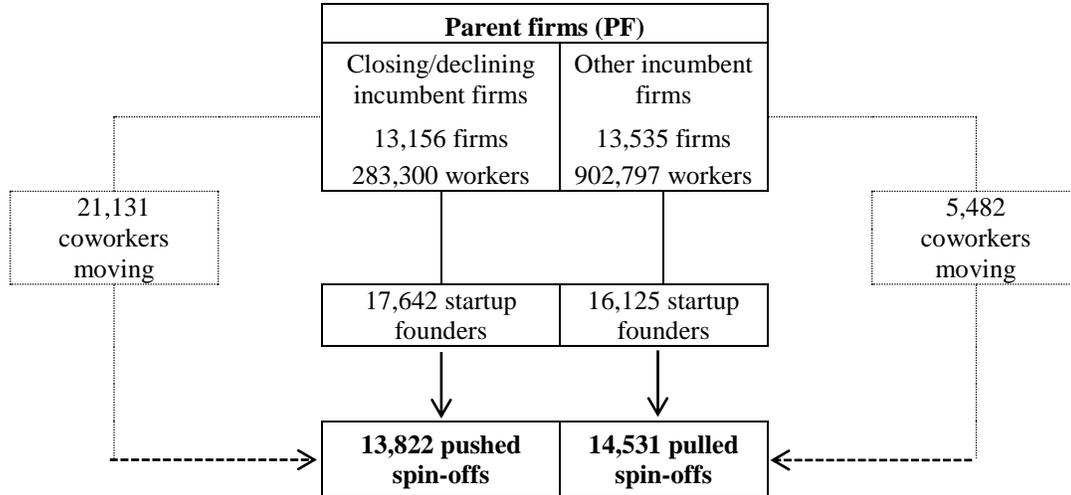
**Figure 1.** Theoretical model



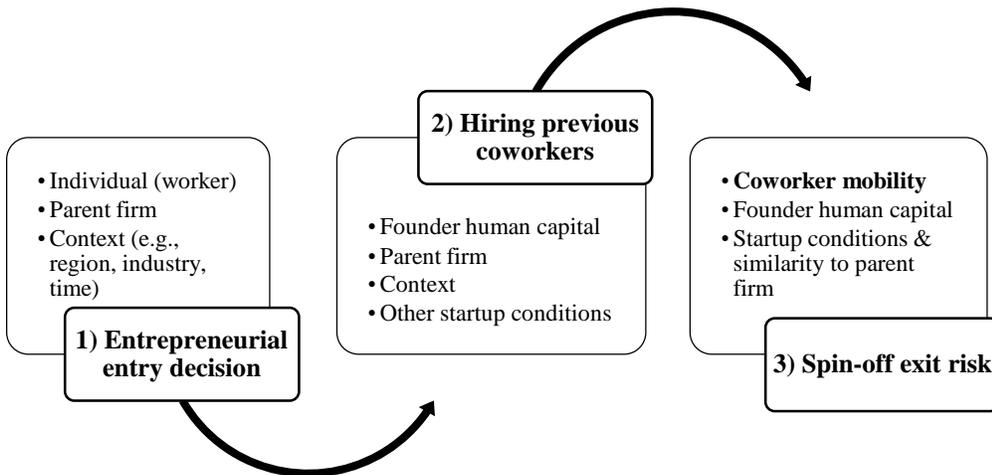
**Figure 2.** Number of pushed and pulled spin-offs founded by year



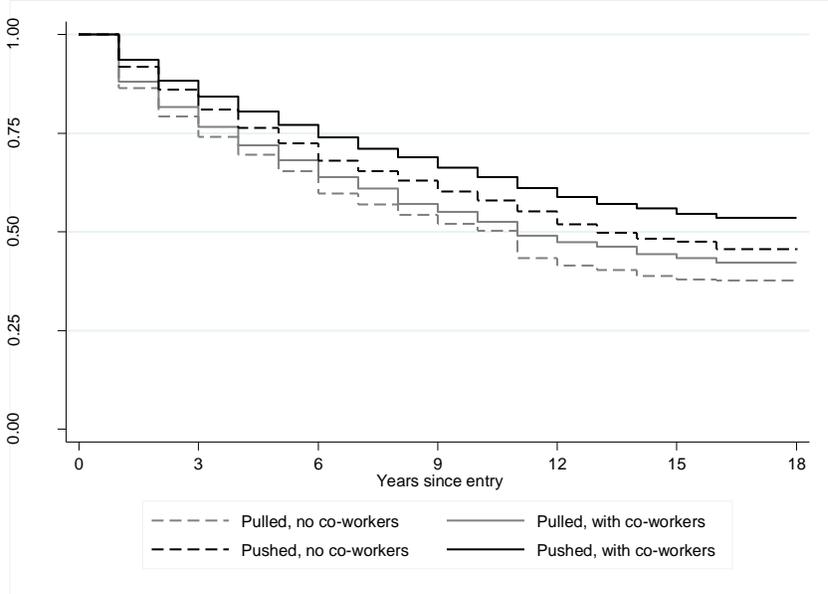
**Figure 3.** Structure of the data



**Figure 4.** Empirical design: recursive system of equations



**Figure 5.** Kaplan-Meier survivor function of pushed and pulled spin-offs, with and without coworkers at entry



**Figure 6.** Person fixed effect of spin-off founders, coworkers, and other workers at the parent firm

