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Risky Business? Earnings Prospects of Employees at Young Firms

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Abstract

Young firms are an engine of job creation, but little is known about the quality of the jobs that they offer. I use a matched employer-employee dataset to study how starting wages and lifecycle earnings of employees differ between young and mature firms. I find that young firms pay a small premium to new hires, but subsequent wage growth is better at mature firms, both within continuing job matches and when individuals change jobs. These results are confirmed by several approaches to addressing sorting and selection of employees into firms of different ages. There is substantial heterogeneity of outcomes: the few young firms that survive and become highly productive pay higher wages to employees from the outset than less successful young firms. Overall, highly-paid and stable jobs at young firms are rare. Policies that aim to stimulate job growth by encouraging the formation of new firms should therefore pay close attention to the types of firms that form as a result.

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I. Introduction

Young firms contribute significantly to aggregate job creation. Between 2002 and 2015, firms aged three years or less accounted for an average 26% of annual job creation in the United States, calculated at the level of establishments (US Census Bureau 2015). This figure is remarkable, given that firms in this age category account for less than 10% of the total employment stock in any given year. Similar patterns have been observed in other countries and time periods (Haltiwanger, Jarmin, and Miranda 2013; Criscuolo, Gal, and Menon 2014; Anyadike-Danes, Hart, and Du 2015). That may be the reason why so many policies aimed at stimulating entrepreneurship cite job growth as a key motivating factor.¹

Although the quantity of jobs created by young firms is well-documented, we know relatively little about the *quality* of those jobs. Understanding how stable and well-compensated jobs at young firms are is vital for understanding the nature of those firms' contribution to the labor market. While the literature to date has mainly focused on the founders of young firms and the returns they obtain from entrepreneurial activity (e.g., Hamilton 2000; Michelacci and Silva 2007; Manso 2016), my focus in this paper is on the employees.

I investigate how starting wages and the lifecycle earnings prospects of employees at young and mature firms differ. Using a large longitudinal dataset that combines rich individual- and firm-level data for Great Britain from 2002 to 2015, I make two main contributions to the literature. First, I enhance earlier empirical work on this subject (Brown and Medoff 2003;

¹For instance, fueling “high-growth entrepreneurship, innovation and job creation” is a strategic objective of the US Small Business Administration, a government agency with over \$100 billion in loan guarantees to small businesses (SBA 2014). “Potential for business growth and job creation” was also a central requirement of the proposed ‘startup visa’ programme for foreign entrepreneurs (International Entrepreneur Rule 2016). Similarly, the EU’s 2016 Start-up and Scale-up Initiative argues that “improving the ecosystem for start-ups and scale-ups in Europe will have a direct beneficial effect on jobs and growth in the EU.”

Brixy, Kohaut, and Schnabel 2007; Ouimet and Zarutskie 2014; Burton, Dahl, and Sorenson 2017) by considering not only the differences in the initial wages of new hires at young and mature firms, but also subsequent earnings growth over a period of up to eight years. This is important for getting a complete picture of the returns to working for a young firm. Second, I use several approaches to investigate the role of unobserved heterogeneity of firms and individuals in estimating the relationship between firm age and wages. Understanding how this heterogeneity affects the wage differentials between young and mature firms is important for identifying which types of young firms offer well-paid jobs to employees.

Britain is an especially interesting context for this study. Data from the OECD shows that compared to other developed countries, the British economy has consistently displayed very high rates of creation of “employer enterprises,” or businesses that employ individuals other than the owner—typically surpassed only by Israel and Korea (OECD 2016). Understanding the quality of jobs created by such businesses is particularly relevant in an economy with highly active firm dynamics, where young firms make a large contribution to job creation.

I document and explain several novel findings. While the average hourly wages and weekly earnings are significantly lower at young firms than at mature firms in the raw data (Figure I), I show that virtually the entire difference is driven by the effects of tenure on the job. Employees of mature firms have substantially better opportunities to accumulate long tenures than the employees of risky, young firms, and this explains the higher average compensation levels in the former group. After controlling for observable and time-invariant unobservable attributes of firms, jobs, and individuals, I find that new hires at young firms obtain a 1-2% wage premium relative to new hires at mature firms. Despite this initial premium, however, subsequent wage growth is higher for individuals who join mature firms.

This is the case both within continuing job matches and when individuals change employers. The lifecycle returns to joining a young firm as an employee are thus worse in present-value terms than returns to joining a mature firm, for a wide range of discount rates.

Young firms are highly heterogeneous, and their observed lifespans and success rates vary greatly (Haltiwanger et al. 2013; Criscuolo et al. 2014; Decker, Haltiwanger, Jarmin, and Miranda 2014, 2016; Anyadike-Danes et al. 2015). This heterogeneity impacts the quality of the jobs that these firms offer to employees. I find a strong link between current wages and subsequent performance outcomes of young firms. The young firms that survive and achieve high productivity ex post, conditional on survival, pay higher wages to similar new hires ex ante, relative to young firms that do not survive or survive but attain low productivity levels.

I investigate this heterogeneity further to determine which sectors have the highest concentration of high-paying jobs at young firms. I find that the sectors where young firms are less likely to fail, more likely to attain high productivity, and more likely to pay high wages are specialized, high-skilled services, such as software and IT, real estate, architecture and engineering, and finance. However young firms in those sectors create a small overall proportion of new jobs. In fact, most jobs at young firms are found in low-wage, high-risk, and low-productivity sectors like bars, restaurants, food retail, and cleaning. Thus, while some young firms create well-paid and stable jobs, many do not. This suggests that policymakers who aim to stimulate job growth by encouraging the formation of new firms should pay close attention to the kinds of businesses that form as a result.

From a theoretical standpoint, there are many reasons why young firms may compensate employees differently than mature, established firms. First, the short track records of young

firms mean that they generally cannot rely on their reputation to attract job applicants, unless potential workers can observe the earlier track record of the entrepreneur. Second, young firms are likely to be learning about market conditions and their productivity (like in the model of Jovanovic 1982), meaning that they may be less productive, on average, than more mature competitors. Third, young firms may face greater financial constraints than established firms (Evans and Jovanovic 1989). Fourth, young firms may provide non-pecuniary benefits that mature firms do not, such as a more flexible schedule or a less bureaucratic work environment (Sørensen 2007; Koch, Pastuh, and Späth 2013). All else being equal, those factors are likely to put downward pressure on wages.

Wages at young firms may, however, also be buoyed by several offsetting considerations. For instance, young firms have higher failure rates than mature firms (Haltiwanger et al. 2013; Anyadike-Danes et al. 2015), and accepting employment there is a risky proposition. Workers may, therefore, demand higher wages as a compensating differential to offset the risk of unemployment, particularly in markets where they cannot quickly find new jobs with similar pay. Moreover, a high risk of failure and lack of past reputation means that implicit contracts and promises of future wage growth are not credible. This implies that wages should be higher at the outset, and the wage-tenure profile should be flatter. In all, therefore, it is not clear from a theoretical perspective whether young firms should pay higher or lower wages to equivalent employees than mature firms, either upon hiring or later in the employment relationship.

My results suggest that many of these factors are at play simultaneously. I show that there is some evidence of negative selection of employees into young firms, which are, on average, less productive than mature firms. At the same time, relative starting wages at young firms

are higher in riskier sectors, consistent with the theory of compensating differentials, while the wage growth profile is flat, consistent with the lack of credibility of implicit contracts at risky employers. Yet, even controlling for these characteristics and for time-invariant unobserved heterogeneity between employees, the present value of wages at a young firm is still lower than at a mature firm. These patterns suggest that other factors, such as non-pecuniary compensation or a lack of investment in general or firm-specific human capital, may also play a role in wage-setting at young firms. This points to interesting directions for future research.

Obtaining insight into the earnings prospects of employees at young firms requires dealing with three main conceptual and methodological challenges. The first relates to identifying young firms in the data. Firm entry into business registers is often a result of corporate activity, such as mergers or spin-offs, which creates new entities that are not necessarily new business ventures. The main focus of this paper is on firms that originate as startups. I therefore use information on the corporate structure of firms to define firm age in a manner consistent with the US Business Dynamics Statistics database for the first time for the universe of British firms. This allows me to identify truly young firms separately from new registrations that arise from restructurings or mergers.

A second methodological challenge relates to the confounding effect of firm size on wages. Firm size matters for estimating the wage gap between young and old firms, because most new firms start out small, and small firms tend to pay observationally equivalent workers less than large firms do (Brown and Medoff 1989; Abowd, Kramarz, and Margolis 1999). I therefore investigate thoroughly the extent to which firm size helps explain the differences between the wages of employees at young and mature firms.

Third, the ability to estimate the effect of firm age on wages is hindered by potential sorting and selection of individuals into young and mature firms based on unobservable characteristics. However, the longitudinal nature of the dataset makes it possible to track employees over time as they move between young and mature firms. This enables me to explore four approaches to addressing selection issues, over and above controlling for observable characteristics of individuals, jobs, and firms. The first two approaches are based on comparing wages at young and mature firms within two specific sub-samples of employees: displaced workers and labor market entrants. This is motivated by the assumption that, in both cases, the decision of those individuals to search for a new job is not correlated with unobserved individual characteristics, unlike the voluntary decision of an employed worker to switch to a new job (see, e.g., Neal 1995; Couch and Placzek 2010; Huttunen, Møen, and Salvanes 2011). The other two approaches consist of comparing the starting wages of the same individuals as they join firms of different ages at different moments in their career, using fixed-effects estimation to control for unobservable, time-invariant individual and firm characteristics. I do this both for the sub-sample of labor market entrants, who can be tracked over time, and for the entire sample of employees. While each of these approaches has its advantages and disadvantages, they all lead to highly consistent conclusions. Together, therefore, they enable me to characterize the relationship between firm age and wages in ways that have not been addressed in the existing literature.

My results contribute to an emerging body of empirical work on the compensation of employees at young firms. Existing research has reached mixed conclusions about whether starting wages at young firms are higher or lower than at mature firms. Brown and Medoff (2003) found that the positive relationship between firm age and wages disappeared after

controlling for worker characteristics in a cross-section of approximately 1,000 employees in the US. Other work, however, has found persistent wage gaps between young and mature firms. Aggregating at the firm level, Brixy et al. (2007) found an average 8% wage penalty at new German firms created between 1997 and 2001 relative to incumbent firms, after taking into account a range of firm and workforce characteristics. Wage penalties at young firms in the 1-3% range were also present in several studies that combined firm-level data with information on individuals to study specific populations, such as Swedish labor market entrants and job switchers (Nyström and Elvung 2014, 2015). On the other hand, Heyman (2007) found that the conclusions about relative wages at young and mature firms differed depending on the period studied. Furthermore, Ouimet and Zarutskie’s (2014) firm-level analysis for the US from 1992 to 2004 concluded that young firms paid a premium to new hires, compared to mature firms. Similarly, Burton et al. (2017) found that young Danish firms observed between 1991 and 2006 paid a premium to new full-time hires, even after accounting flexibly for a wide range of observed attributes of firms and individuals.

One potential reason why the conclusions of these studies are contradictory is that many of them focus on specific populations or pay limited attention to unobserved characteristics that affect the selection of workers into firms of different ages. In contrast, in this paper, I use several approaches to address potential selection on unobservables. I show that neglecting to account for potential selection leads to different conclusions about the wage differences between young and mature firms. In addition, I complement existing work by considering wage growth over time. These analyses shed a new light on the nature of job creation at young firms.

The remainder of this paper is organized as follows. Section II describes the data sources

and the construction of the firm age variable. Section III documents the differences in the distribution of wages at young and mature firms. It investigates the contribution of firm, job, and individual characteristics to explaining the observed differences in wages between young and mature firms, and assesses the lifecycle earnings prospects of the employees who join those firms. Section IV assesses how starting wages at young firms vary depending on the firm's ex post success. This section also evaluates in which segments of the economy high-paying, stable jobs at young firms can be found. Section V concludes. All appendix material can be found in the Online Appendix.

II. What Is a Young Firm?

To study the characteristics of jobs at young firms and the relationship between firm age and wages, I match annual data on a sample of employees to the administrative register of firms in Great Britain from 2002 to 2015. This section describes the data sources, the construction of the firm age variable, and the characteristics of the final sample used in the empirical analysis.

II.A. Employee Data

Employee data is taken from the Annual Survey of Hours and Earnings (ASHE) administered by the Office for National Statistics (ONS). ASHE is a 1% random sample of all employees in Great Britain registered on the national Pay As You Earn (PAYE) income tax and social security system. Data are provided by employers, who are legally required to supply it in April each year. As a result of its source in payroll data, ASHE provides high-quality

information and serves as one of the main sources for analysing the structure and evolution of British wages.²

ASHE supplies rich data on individual compensation (including bonuses, overtime pay, and pension contributions), as well as personal and job characteristics such as age, gender, occupation, workplace location, contract type, and hours worked. Compensation is not top-coded, so the full distribution is observed. A unique personal identifier can be used to trace each individual over time since 1997. Firm identifiers are provided from 2002 onwards, allowing for employees to be matched to employers, and thus determining who works at young and mature firms.

II.B. Employer Data

Employer data comes from the Business Structure Database (BSD), an annual April snapshot of all firms registered for value-added tax or PAYE in Great Britain. The BSD contains information on firm employment, sales, sector, registered address, legal form, and ownership since 1997.³ The dataset covers an estimated 99% of formal economic activity (ONS 2006) and serves as the sampling frame for business surveys used to produce GDP estimates for national accounts.

²Researchers routinely use ASHE for empirical work. This dataset has been used, for instance, to study the impact of the Great Recession on real wages (Gregg, Machin and Fernández-Salgado 2014) or the effects of increases in the minimum wage (Bell and Machin 2018).

³The BSD defines a firm as an ‘enterprise,’ i.e., the smallest organizational unit producing goods and services that has autonomy over its resource allocation decisions (ONS 2006). A large corporate group may thus include several ‘firms’ linked by common ownership. I take these linkages into account when defining firm age, as described further below.

II.C. Matching Employees with Employers

Employee data from ASHE is matched to employer data from the BSD based on a unique firm reference number provided by the ONS. I restrict the sample to employees whose reported hourly wage does not reflect a junior/trainee rate and was not affected by absence. These exclusions serve to avoid potential distortions in reported wages and are standard in published aggregates derived from ASHE. In addition, I exclude sectors dominated by public employers and focus on the ‘business economy,’ composed of: mining, energy, manufacturing, construction, trade, finance, transportation, accommodation and food, real estate, renting, and business activities (SIC 2003 sectors C through K).

The resulting sample consists of 1,329,513 job-year observations on 269,258 individuals working at 131,099 firms. Of those individuals, 17,131 are observed working at both young and mature firms at different points during the sample period. They will be relevant for the estimation of results with individual fixed effects. Appendix A describes the construction of the sample in greater detail and shows that the final dataset matches several stylized facts of the overall UK business economy.

II.D. Defining Firm Age

Comparing the wages of employees at young and mature firms requires determining the age of each firm in the dataset. One challenge is that corporate events such as mergers or restructurings often lead to the creation of new firm identifiers, and it is difficult to distinguish such cases from genuine firm births. Since the main interest of this paper is in identifying the employees of firms that start as independent, new ventures, additional steps

are needed to define firm age in a way that distinguishes between different forms of entry.

To define firm age in the data, I exploit available information on each firm’s corporate structure. When a firm first appears in the BSD, I set its birth year to be the birth year of its oldest establishment. Each firm is then aged by one year every year. The establishment birth year is defined as the year when the establishment was first identified as a workplace of at least one employee in the tax records. I classify firms observed in their year of birth as ‘new’ if they are not owned by a pre-existing corporate group, and if they enter with employment of less than 2,500.⁴ On the other hand, if a firm is observed as belonging to a pre-existing group in the year of entry into the dataset, or if it enters with employment of 2,500 or more, then I classify it as a ‘not truly young’ firm. Those firms are most likely entering the register as a result of mergers, spin-offs, or restructuring activity, rather than being new, business ventures. Separating out ‘not truly young’ firms is important for ensuring that the conclusions about wages at young firms are not contaminated by the inclusion of established businesses.

This process provides an internally-consistent measure of each firm’s age over time that is not affected by the opening and closing of establishments post-entry. It avoids incorrectly classifying new entries into the register as new firms if they result from M&A activity or restructuring involving pre-existing firms. It is also consistent with the algorithm used to derive firm age in the US Business Dynamics Statistics database, as described in Becker, Haltiwanger, Jarmin, Klimek, and Wilson (2006). This makes the resulting dataset useful for cross-country comparisons of firm entry and exit activity.

The analyses in this paper compare the wages of employees at ‘young’ and ‘mature’ firms.

⁴This threshold is chosen to be consistent with US Business Dynamics Statistics.

Throughout the paper, I define young firms as those that are aged 3 years or less, and mature firms as those aged 10 years or more. These thresholds are motivated by three observations. First, Appendix B shows that the contributions to job creation are greatest for young firms aged 3 years or less, so this firm age category is the most interesting to analyse from a policy standpoint. Second, raw data on average hourly wages and weekly earnings by firm age in Figure I shows that the gradient flattens just before the age of 10, suggesting that this is a good threshold for defining a mature firm. Third, setting the threshold for a mature firm at age 10 is consistent with how mature firms are often defined in the literature (e.g., Haltiwanger et al. 2013).

II.E. Characteristics of Young and Mature Firms and Their Employees

Young and mature firms, and their employees, differ on several observable dimensions. Table I presents summary statistics on annual observations at firms aged 3 years or less and firms aged 4-9 years. Table II presents the same data for mature and ‘not truly young’ firms.

These summary statistics show that average hourly wages and weekly earnings at young firms are lower than at mature firms. The median real hourly wage is £9.7 at firms aged 3 years or less, £10.7 at firms aged 4 to 9, and £11.2 at firms aged 10 or more. Weekly earnings rise more steeply with firm age than wages, because hours worked are higher at older firms.

Young firms tend to have characteristics that are typically associated with low wages. For instance, the average young firm is smaller than the average mature firm. Median employment is 9 for observations at firms aged 3 years or less, 20 at firms aged 4 to 9, and

1,528 at firms aged 10 or more. Median real annual sales in those three firm age categories are £0.5 million, £1.6 million, and £162.9 million, respectively. Another noteworthy pattern is that average sales increase more steeply with firm age than average employment. This suggests that older firms generate higher sales per worker than younger firms. Jobs at young firms are also more likely to belong to low and medium skill categories than jobs at mature firms. Finally, young firms are more likely to offer jobs in the service sector, where wages are generally low.

Tables I and II also show that firms classified as ‘not truly young’ differ from young firms in two main ways. First, the average ‘not truly young’ firm is larger, with median employment of 149 and real annual sales of £9.9 million. It is therefore significantly more sizeable than the median firm aged 3 years or less (which has employment of 9 and sales of £0.5 million) or the median firm aged 4-9 years (which has employment of 20 and sales of £1.6 million). Second, the average tenure in the job of individuals working at ‘not truly young’ firms is greater than the average tenure of individuals working at young firms aged either 3 years or less or 4 to 9 years. In fact, 27% of the employees observed at this group of firms have reported tenure that is longer than the firm’s existence in the dataset. This suggests that many of those firms were existing businesses that had undergone a transformation that generated a new entry in the register. Appendix B shows that the patterns of job creation and job destruction of ‘not truly young’ firms are similar to those of mature firms. All these attributes confirm the suspicion that those are not new ventures, justifying the decision to classify them as a distinct category.

III. Comparing Wages at Young and Mature Firms

This section begins by using the matched sample to document differences in the observed wage distribution at firms of various ages. It then takes advantage of the longitudinal nature of the dataset to assess how the wages of new hires, and subsequent wage growth, differ between young and mature firms for similar individuals performing similar jobs, using several methods to address potential sorting and selection based on unobservables.

III.A. Distribution of Wages at Young and Mature Firms

Figure II compares the distribution of real hourly wages across all jobs at firms aged 3 or less (shaded bars) and firms aged 10 or more (transparent bars). Panel A considers all employees in the dataset, pooling across all years in the sample. The chart on the left-hand side shows the main part of the distribution, up to and exceeding the 90th percentile, while the chart on the right-hand side shows most of the upper tail of the distribution, up to and exceeding the 99th percentile. Wages at young firms are substantially more concentrated at the low end of the distribution, compared to wages at mature firms. Low wages at young firms are concentrated mainly at the minimum wage.⁵ The distribution of wages at mature firms has greater mass in the middle, but, interestingly, the two distributions look relatively similar at the upper end. Thus, while many employees at young firms earn very low wages, (and hence the average wage at a young firm is lower than at a mature firm), some are compensated very highly, even above the 90th or 99th percentile of the overall distribution. Later in this paper, I shed some light on this dispersion by investigating what kinds of young firms pay

⁵Figure D2 in the Appendix illustrates this using the last year of the sample period.

high wages.

The differences between the distributions of hourly wages at young firms and mature firms are far less pronounced when considering only wages paid to new hires in Panel B. In other words, the large differences in the distribution (and in the average) of wages at young and mature firms can largely be ascribed to differences in employees' tenure on the job.⁶ Tenure is mechanically low at a young firm, since an employee cannot have been employed at the firm any longer than the firm has been in existence. In contrast, employees at mature firms have a wide range of tenures, from one day to several decades. At the same time, tenure is associated with higher wages. Tenure is thus probably the reason why studies based on payroll data aggregated at the firm level find that young firms pay substantially less than mature firms (e.g., Brixy et al. 2007, Ouimet and Zarutskie 2014).

III.B. Explaining the Wage Differences between Young and Mature Firms

The fact that the wage distribution is similar at young and mature firms does not necessarily mean that a given employee would be compensated equally at firms of different ages. Young firms and mature firms may differ on a number of dimensions that could be correlated with wages. For instance, young firms might be more likely to offer jobs in well-paid occupations (such as computer programming or engineering), but due to their limited track record, they might attract relatively less productive employees than mature firms. The result could, therefore, be that the initial wage, and perhaps also the future earnings prospects, of an individual endowed with specific skills, abilities, and training depended on the age of the firm, even if the overall wage distributions were the same in the data. This section explores

⁶Figure D3 in the Appendix shows that the same conclusions hold for weekly earnings.

the extent to which employees are compensated at firms of different ages.

I focus on a simple metric: the gap in mean log hourly wages between young and mature firms.⁷ To assess first how observed characteristics of firms, jobs, and employees explain this gap, I estimate the empirical model of individual wages given by

$$w_{ijt} = \beta_0 + \beta_1 \mathbf{1}(\text{Firm age} \leq 3)_{jt} + \beta_2 \mathbf{1}(4 \leq \text{Firm age} \leq 9)_{jt} + \beta_3 \mathbf{1}(\text{Not truly young})_{jt} + \delta_t + X_{ijt}\Gamma + \varepsilon_{ijt} \quad (1)$$

which models the log real hourly wage, w_{ijt} , of individual i , observed working at firm j in year t . There are three dummy variables for firm age, with mature firms aged 10 years or more being the omitted category. The coefficients on each firm age dummy therefore represent the approximate percentage difference in wages relative to mature firms. Year dummies δ_t absorb annual trends in average wages. Finally, the vector X_{ijt} contains additional controls and fixed effects, described further below.

Figure III gives a visual summary of the results of estimating equation (1), pooling all observations in the sample. The height of each bar represents the estimated coefficient $\hat{\beta}_1$ on the dummy for a young firm. Each of the bars corresponds to a different specification of the vector of controls, X_{ijt} . The underlying regression results are reported in greater detail in Table III.

The first bar shows the coefficient on the young firm dummy when the model is estimated

⁷There are two reasons for focusing on log hourly wages, rather wages in levels or weekly earnings. First, the mean log wage is more representative of a typical (median) employee than the mean wage. The distribution of log wages is also closer to normal, with lower skewness that does not vary substantially with firm age. Figure D1 in the Appendix illustrates this visually, while Table D1 reports selected moments of the distribution of real hourly wages and log real hourly wages by firm age. Second, hourly wages represent remuneration per unit of labor input. Thus, they provide a measure of compensation that is consistent with theoretical models of wage determination. For these reasons, log wages are a standard measure of compensation in the labor economics literature. Appendix C shows that the results of this paper are robust to using weekly earnings as the dependent variable.

on the full sample of employees, and the vector of controls X_{ijt} is empty. On average, wages at young firms are 12.6% lower (log difference -0.135) than at mature firms. However, the second bar shows that when comparing only the wages of new hires, the estimated wage penalty at young firms relative to mature firms turns into a premium of 2.5%. Tenure effects thus play an important role in explaining why wages are substantially lower at young firms than at mature firms when averaging across all jobs.

The next three bars examine the extent to which the estimated wage difference is affected by controlling for observable characteristics of firms, jobs, and employees. The third bar continues to consider only new hires but controls additionally for firm size and sector. Firm size is a crucial control variable. Young firms typically start out small (Haltiwanger et al. 2013), and a well-established literature shows that smaller firms typically pay lower wages than large firms (Brown and Medoff 1989; Abowd et al. 1999). The limited empirical literature on wages at young firms has therefore recognized the importance of distinguishing firm age effects from size effects (see Brown and Medoff 2003 for an early discussion). I control flexibly for size by adding dummies for 19 ventiles of employment.⁸ Once controls for size and 5-digit sector are in place, the wage premium at young firms rises slightly to 3.1%.

The fourth bar controls additionally for observed attributes of the job. These controls consist of: region, 2-digit occupational code, whether the job is part-time or full-time, and whether the job contract is temporary or permanent. This leads the estimated wage premium to fall to 0.8%.

⁸Figure D4 in the Appendix explores the firm size-wage relationship in detail. Table D2 shows that the results on the estimated wage gap between young and mature firms are similar, whether ventiles, centiles, or a polynomial specification are used for firm size, but they differ significantly when size is only controlled for linearly (as the literature has typically done).

Finally, the fifth bar adds controls for observed personal attributes. The personal variables available in the dataset are age, age squared, and gender. ASHE lacks data on education or training, so I control for each individual’s occupation-specific experience, estimated as the number of prior periods in which the individual was observed working in the same occupation. Occupation-specific experience is an important determinant of wages (Kambourov and Manovskii 2009, Sullivan 2010, and Zangelidis 2009 using British data) and is the best available proxy for education in this dataset.⁹ I also control for the average of the individual’s past log hourly wages to capture unobservable attributes of employees that may be correlated with wages, such as individual productivity. Finally, I add a dummy for whether the individual has previously worked at a young firm to address the possibility that firms differentiate among workers based on prior experience at a firm of similar age.¹⁰

Controlling for these individual characteristics reduces the estimated wage gap between young and mature firms to a precisely-estimated zero. The results in the remainder of the paper control for all of the above attributes, which I will refer to as ‘full controls.’¹¹

III.C. Sorting and Selection on Unobservables

Controlling for observables does not address the potential bias from the sorting and selection of individuals into young and mature firms based on omitted, unobserved variables that may be correlated with wages. The direction of this bias is difficult to determine. Consider

⁹In Sullivan’s (2010) estimates, the coefficient on occupation-specific experience is more statistically significant and larger in magnitude than that on education.

¹⁰Left-censoring of individual labor market histories is mitigated by using data going back to 1997 to estimate occupation-specific experience and past wages. Controlling for these variables leads labor market entrants to be dropped from the sample. However, I consider this group separately below.

¹¹Related work on the starting wages of new hires has used propensity score matching as another approach to control for observable differences between the employees of young and mature firms (Nyström and Elvung 2014; Burton et al. 2017).

two scenarios. First, suppose that individuals who are naturally risk-averse are attracted to stable jobs at mature firms, and that risk aversion is negatively correlated with wages. This could happen, for instance, if risk-averse individuals have a lower reservation wage (Cox and Oaxaca 1989). In this scenario, the estimate of the wage gap will be biased upwards. Second, suppose instead that young firms attract individuals with lower ability and skills than mature firms, due to their short track record and greater instability. Since low ability and skills are likely to be associated with low wages, the estimate of the wage gap will be biased downwards. Both scenarios seem plausible. The estimates from the prior section are therefore not well-suited for drawing conclusions about the impact of firm age on wages.

In this section, therefore, I use four approaches to address the potential confounding effects of the unobservable attributes of employees. Each approach focuses on a different sub-sample of individuals, involving different sets of treatment and control groups, and has its own strengths and weaknesses. I report all four to build a comprehensive picture of the wage differences between new hires at young and mature firms.

The first approach is to consider displaced workers. These are individuals who were forced out of their previous job by the employer shutting down. I compare the wages of displaced workers who joined young firms with those who joined mature firms by estimating equation (1) with full controls on the sub-sample of displaced workers only. To the extent that firm exit is a random event uncorrelated with unobserved individual characteristics, focusing on this sub-sample can address concerns about selection into job search. This approach is often used in the labor economics literature (e.g., Neal 1995; Couch and Placzek 2010; Huttunen et al. 2011). However, there are two main reasons for caution. The first is that while focusing on displaced workers may address the “push” factor that leads employees to look for another

job, it does not address the “pull” factor that leads them to choose a job at a young firm. Second, it is possible that displaced workers may be non-random if they were previously selected into riskier firms based on some unobservable characteristics.

A second, complementary approach focuses on labor market entrants, as individuals with no prior experience who could not have previously sorted into failing firms. labor market entrants are an interesting group to study in their own right, given that many countries implement policies focused on youth employment. I define labor market entrants as individuals that are at most 25 years old when they are observed for the first time in the dataset. I then estimate equation (1) with full controls on the sub-sample of labor market entrants. Like in the case of displaced workers, however, the choice of whether to join a young or a mature firm could be driven by omitted, unobserved variables. The results may thus suffer from similar biases.¹²

The third approach is to address the biases that arise from a labor market entrant’s choice of employer by comparing the wages of the same individual during employment spells at firms of different ages. The empirical implementation consists of estimating equation (1) with individual fixed effects using the sub-sample of individuals who have been observed as entering the labor market for the first time at some point during the sample period. Two additional modifications are needed. First, the firm age dummies are interacted with an indicator of whether the employee is a new hire in a given period. Second, job tenure is added to the vector of controls to account for the effect of tenure on wages in other periods.

¹²There are also other ways in which labor market entrants, defined in this manner, are a self-selected group. To be captured in the dataset, they must have chosen to enter wage work, as opposed to, for instance, self-employment or non-employment. However, this applies equally to all individuals in the dataset, given this paper’s focus on employees.

In this approach, identification of the wage differential between young and mature firms is based on the assumption that unobservable individual attributes that affect both wages and the likelihood of being hired by a young firm are time-invariant, conditional on the full set of time-varying individual characteristics and labor market variables described above.

The fourth, and final, approach is to extend the estimation with individual fixed effects to all employees in the dataset. Here, the control group for any employee joining a young firm is the same individual joining a mature firm at another point in their career. The empirical implementation is the same as for labor market entrants with individual fixed effects, except that the sample consists of all employees observed more than once in the dataset.

Figure IV summarizes the results for the starting wages of new hires using the four approaches. Each bar reports the coefficient on the young firm dummy. Among displaced workers, the estimated wage premium for new hires at young firms compared to new hires at mature firms is 2.1%. This estimate is not statistically significant due to a small sample size.¹³ The estimated premium for labor market entrants is 1.0%, significant at a 10% level. These results suggest that negative selection into job search may have played a role in the earlier finding of no wage difference between young and mature firms. Adding individual fixed effects to the regression for labor market entrants increases the estimated premium to 2.0%, significant at a 1% level. This suggests that negative selection of individuals into jobs at young firms may also be present, although the difference between the estimate with and without individual fixed effects is not statistically significant. Finally, extending the model with individual fixed effects to all employees gives an estimated wage premium of 1.4%.

¹³There are 588 individuals observed as joining a young firm immediately after their previous employer shut down. The estimated premium is insignificant also when using the full sample of new hires and interacting the firm age dummies with an indicator for whether the worker was displaced.

The results of all four approaches are directionally consistent with one another and suggest that young firms pay a 1-2% starting wage premium to similar new hires, relative to mature firms.¹⁴

The conclusion that young firms pay slightly higher wages to new hires than mature firms is robust to a range of alternative specifications. Appendix C shows that the conclusions are not sensitive to different definitions of a young firm, the potential presence of firm owners in the data, or alternative measures of compensation, such as weekly earnings or total compensation including fringe benefits.

The results are also robust to including firm fixed effects to control for time-invariant, unobserved attributes of employers, such as firm-specific wage policies not explained by observed firm characteristics. Adding firm fixed effects to the model with individual fixed effects and using the full employee sample increases the estimated hourly wage premium to 2.3%, significant at a 1% level (see Table C3). Moreover, R^2 rises to 0.93 (compared to 0.20 without firm fixed effects), suggesting that unobserved firm attributes explain a substantial part of the variation in individual compensation, consistent with the literature (Abowd et al. 1999). Therefore, later in this paper, I investigate to what extent the heterogeneity of young firms matters for wages.

III.D. Earnings Prospects of Employees at Young Firms

This section provides evidence on the wage growth profile of individuals who join young firms, compared to those who join mature firms. A good starting point is to consider each employment spell in the dataset and compare how wages subsequently evolve for those

¹⁴The underlying regression results are reported in Columns (1) to (4) of Table IV.

individuals who join a young firm relative to individuals who join a mature firm, regardless of whether those individuals remain with the same firm or switch jobs in future periods. I call these ‘unconditional returns.’ I use them further below as a benchmark for comparing the returns in continuing worker-firm matches. The unconditional returns are particularly relevant if working at a young firm leaves a lasting (positive or negative) imprint on an individual’s future earnings potential.

To assess the unconditional returns to joining a young or mature firm, I normalize the starting year of each observed employment spell to zero.¹⁵ I then estimate equation (2) below. This is an enhanced version of equation (1) with full controls and individual fixed effects, expanded to include dummies for each year k elapsed since the beginning of the employment spell, $\mathbf{1}(\text{Years} = k)_{ijt}$, interacted with firm age dummies.

$$\begin{aligned}
w_{ijt} = & \beta_0 + \beta_1 \mathbf{1}(\text{Firm age} \leq 3)_{jt} + \sum_{k=0}^{13} \beta_{1,k} \left(\mathbf{1}(\text{Firm age} \leq 3)_{jt} \times \mathbf{1}(\text{Years} = k)_{ijt} \right) \\
& + \beta_2 \mathbf{1}(4 \leq \text{Firm age} \leq 9)_{jt} + \sum_{k=0}^{13} \beta_{2,k} \left(\mathbf{1}(4 \leq \text{Firm age} \leq 9)_{jt} \times \mathbf{1}(\text{Years} = k)_{ijt} \right) \\
& + \beta_3 \mathbf{1}(\text{Not truly young})_{jt} + \sum_{k=0}^{13} \beta_{3,k} \left(\mathbf{1}(\text{Not truly young})_{jt} \times \mathbf{1}(\text{Years} = k)_{ijt} \right) \\
& + \sum_{k=1}^{13} \theta_k \left(\mathbf{1}(\text{Years} = k)_{ijt} \right) + \delta_t + a_i + X_{ijt}\Gamma + \varepsilon_{ijt}
\end{aligned} \tag{2}$$

Panel A in Figure V plots the results. Returns are expressed relative to the starting wage of new hires at a mature firm, normalized at zero. Relative returns at a young firm are represented by a solid line, while returns at a mature firm are represented by a dashed line.

¹⁵I define a spell loosely as an observed employment relationship between a firm and a worker. Since the dataset is based on an annual snapshots, it does not capture information about spells that do not span the April reporting date. When individuals are observed as switching jobs between consecutive reporting dates, the starting date of the new job is known, but the exact end date of the previous job spell is not.

As shown before, hourly wages are initially higher at the start of a spell at a young firm, relative to the start of a spell at a mature firm. However, subsequent real wage growth is negative at a young firm and positive at a mature firm. Unconditional wage returns at a young firm are therefore significantly lower than at a mature firm.¹⁶

One reason why unconditional wage growth after joining a young firm is lower relative to joining a mature firm is that spells at young firms are more likely to end in separation. Switching jobs is often associated with a decline in wages, even if the transition is voluntary (Jolivet, Postel-Vinay, and Robin 2006; Nosal and Rupert 2007). Moreover, many of the transitions out of young firms are, in fact, involuntary because many of those firms shut down within a few years of entry (see Figure B3). Such transitions are typically associated with large and persistent earnings losses (Couch and Placzek 2010). Joining a young firm is thus, on average, risky business.

Do the expected returns improve when considering only firms that survive and continuing worker-firm matches? Panel B of Figure V illustrates the answer by plotting the marginal effects of firm age at each year of tenure from equation (3) below. This is, once again, an enhanced version of equation (1) with full controls and individual fixed effects. This time, however, firm age dummies are replaced by dummies indicating the age of the firm when the individual was originally hired (abbreviated as ‘Age’ in the equation). These dummies are then interacted with indicators for each year k of tenure in the job, $\mathbb{1}(\text{Tenure} = k)_{ijt}$. This equation can therefore be used to estimate the wage returns at young and mature firms at

¹⁶Figure C2 in the Appendix shows similar patterns for weekly earnings.

different tenure points, relative to the baseline group of new hires at mature firms.

$$\begin{aligned}
w_{ijt} = & \beta_0 + \beta_1 \mathbb{1}(\text{Age} \leq 3)_{jt} + \sum_{k=0}^{13} \beta_{1,k} \left(\mathbb{1}(\text{Age} \leq 3)_{jt} \times \mathbb{1}(\text{Tenure} = k)_{ijt} \right) \\
& + \beta_2 \mathbb{1}(4 \leq \text{Age} \leq 9)_{jt} + \sum_{k=0}^{13} \beta_{2,k} \left(\mathbb{1}(4 \leq \text{Age} \leq 9)_{jt} \times \mathbb{1}(\text{Tenure} = k)_{ijt} \right) \\
& + \beta_3 \mathbb{1}(\text{Not truly young})_{jt} + \sum_{k=0}^{13} \beta_{3,k} \left(\mathbb{1}(\text{Not truly young})_{jt} \times \mathbb{1}(\text{Tenure} = k)_{ijt} \right) \\
& + \sum_{k=1}^{13} \theta_k \left(\mathbb{1}(\text{Tenure} = k)_{ijt} \right) + \delta_t + a_i + X_{ijt} \Gamma + \varepsilon_{ijt}
\end{aligned} \tag{3}$$

Panel B of Figure V plots these relative returns. Even when conditioning on continuing matches, employees hired by young firms subsequently experience lower average wage growth than those hired by mature firms. Focusing on the first five years and assuming the same number of hours worked per year, the present value of wages at a young firm only exceeds the present value of wages at a mature firm for a discount rate greater than 50%. Thus, even in this highly selected sample of surviving firms and continuing employees, joining a mature firm pays more in expectation than joining a young firm, for an individual who is able to choose between the two.¹⁷

These results are somewhat surprising if one believes that wages at young firms should offer a compensating differential for the high risk of job loss resulting from firm failure. One potential explanation that reconciles this view with the results would be that employees are simply unaware of the high exit rates of young firms. However, two pieces of evidence

¹⁷Figure C3 in the Appendix shows that the patterns of lifecycle wages within continuing matches are robust to excluding foreign-owned firms and individuals who may be firm owners. Those were the most important of the potential concerns tested in the context of the initial wage premium at young firms above. When such firms and individuals are excluded from the sample, the returns to being hired at a young firm are still lower than the returns to being hired at a mature firm, both unconditionally and conditioning on continuing matches.

argue against this view. First, Table V shows the results of enhancing the individual wage regression given by equation (1) with the additional variable that measures the differential between the average 3-year exit rates of young and mature firms within each 5-digit sector over the sample period. This exit rate differential is also interacted with the young firm dummy to measure whether the new hire wage premium at young firms relative to mature firms is higher in sectors where there is a larger gap between the exit rates of young and mature firms. The results show that a 1 percentage-point increase in the sectoral exit risk differential leads to a 0.8% rise in wages at young firms relative to mature firms. Given that these results also control for individual fixed effects, they suggest that employees differentiate between risky and safe jobs in their wage demands.

Second, Table VI reports the wage premium at young firms relative to mature firms at different points in time since joining the firm. The sample is split into two, based on whether the exit rate differential is below or above that of the median sector. In sectors where young firms are much more likely to fail than mature firms (column 1), the initial wage premium at young firms relative to mature firms is higher than in sectors where young and mature firms fail at similar rates (column 2). Yet, the subsequent wage profile is similar across the two columns. The net present value of the wage differential over the first 5 years of the match is therefore higher in sectors where the relative risk of joining a young firm is higher, for any discount rate. This argues against the lack of knowledge on the part of the employees.

In the results above, returns to tenure in a continuing match at a young firm are better than the unconditional returns. Moreover, there is some evidence that at a sectoral level, wages at young firms are relatively higher when exit risk is higher. These patterns suggests that firm heterogeneity may play an important role in the earnings prospects of the employ-

ees who join young firms. The next section of the paper explores this further.

IV. Which Young Firms Create High-Paying Jobs?

The result that joining a young firm entails an initial wage premium compared to joining a mature firm, but subsequent wage growth is better at a mature firm, reflects *average* outcomes. An appropriate analogy would be to an individual—with their observed and unobserved attributes—who chooses to enter a job with specific observable characteristics, such as sector and occupation, but ultimately decides which firm to join by rolling a dice. It is therefore relevant to ask: does it matter what *type* of young firm that individual joins? In this section I assess how the earnings prospects of employees at young firms differ depending on the ex-post success of their employer, where firm success is measured in terms of survival and productivity outcomes. I then look at the sectoral composition of young firms to determine whether jobs created by those firms tend to be concentrated in sectors with particular characteristics, based on average wages, survival rates, and productivity.

IV.A. Firm Success and Employee Wages

Similar employees are compensated differently at different firms. One indication of this is the role of firm fixed effects in explaining the variation in individual wages and earnings of new hires, measured by R^2 . This is consistent with the literature, which finds that individuals with the same time-invariant characteristics are compensated differently at different firms (Abowd et al. 1999).

The approach I take to understanding the impact of unobserved heterogeneity of young

firms on the compensation of employees is to focus on measures of firm success that are observable ex post. I define success in two ways. The first is the firm's survival over a 1-, 2-, or 3-year horizon, defined as continued appearance in the dataset. One shortcoming of this definition is that non-survival can result from one of several different forms of exit, such as a bankruptcy, a voluntary closing down of a business, or a sale to another firm. A sale could be a sign of success or the result of a last-minute effort to avoid liquidation. Non-survival may therefore mix successful and unsuccessful outcomes. The dataset does not allow me to distinguish between different forms of exit. However, one advantage of measuring success in terms of survival is that the second measure of ex post success, described below, can only be calculated conditionally on the firm appearing in the dataset in future periods.

The second way in which I define ex post success is whether the young firm is in the top quartile of the overall annual productivity distribution in 1, 2, or 3 years' time, conditional on survival. The best available measure of productivity for the entire universe of British firms captured by the BSD is real sales per employee, which serves as a proxy for the average product of labor.¹⁸ While selection effects may lead the least productive firms to exit over time, the surviving firms are nevertheless heterogeneous in terms of observed productivity based on this measure. Table D3 in the Appendix shows that 56% of firms aged 3 years or less are in the bottom quartile of the overall annual productivity distribution, while only 8% are in the top quartile. It is therefore relatively uncommon for an employee to work at a young firm that is in the top quartile of the productivity distribution, though some young firms do attain this level of performance.

¹⁸While other survey data can be used to construct other measures of labor productivity, such as gross output per employee or value added per employee, that data is only available for a sample of British firms. Small firms are not sampled every year, which makes tracking their performance difficult.

I use these two measures of success to answer three questions. First, do young firms that turn out to be successful pay higher or lower wages to their early new hires than young firms that turn out to be unsuccessful? Second, how do the wages of new hires at successful young firms compare to the wages of new hires at successful mature firms? And third, how do the wages of new hires at unsuccessful young firms compare to the wages of new hires at unsuccessful mature firms?

For starting wages, these questions can be answered by enhancing the empirical model of individual wages specified by equation (1), with full controls and individual fixed effects, to additionally include indicators of ex post firm success in $k = 1, 2$, or 3 years' time and interacting them with the firm age dummies. When success is measured as survival, the indicator variable $\mathbb{1}(\text{Success})_{j,t+k}$ is binary. On the other hand, when success is measured in terms of productivity conditional on survival, I use three dummy variables for quartiles $q = 1, 2$, or 3 of the distribution of sales per employee, $\mathbb{1}(\text{Qtile} = q)_{j,t+k}$.

Table VII reports the results.¹⁹ In Columns (1)-(3), success is defined as survival over various time horizons. In Columns (4)-(6), a successful firm is defined as one that is in the top quartile of the overall annual distribution of productivity, while an unsuccessful firm is defined as being in the bottom quartile. The results in Panel A suggest that young firms that are successful ex post in year $t + 1$, $t + 2$, or $t + 3$ pay higher starting wages to their new hires in year t than young firms that turn out to be unsuccessful in the same future periods. In the

¹⁹An alternative, complementary way to link the wages of early hires to the subsequent success of the firm is to ask whether wages are a predictor of firm success. This entails swapping the dependent and independent variables in Table VII and regressing success indicators on wages and controls, such that the independent variables are measured earlier than the dependent variable. The results, reported in Table D4 in the Appendix, confirm that over a 3-year horizon, there is a positive and statistically significant relationship between the wages of new hires and subsequent firm survival and productivity outcomes. Wages can, therefore, be thought of as a predictor of firm success.

case of surviving young firms, this premium is in the range of 1.3 to 1.9% over the 1 to 3-year horizon. The results for firms that survive the next 2 or 3 years are statistically significant at a 5% and 10% level, respectively. Moreover, firms in the top quartile of productivity in 1, 2, or 3 years' time, conditional on survival, pay between 5.6% and 6.4% more to their new hires today than firms that end up in the bottom quartile. The results for productivity are larger in magnitude than the results for survival and are statistically significant at a 1% level. There are two possible interpretations of the difference in the magnitude and significance of the results for the two measures of firm success. The first is that mere survival is not a sufficiently precise measure of success, as discussed earlier. The second is that while firms that survive ex post may differ ex ante in some aspects from firms that do not survive, those aspects are less relevant for wages than the attributes that differentiate high-productivity firms from low-productivity firms.

Comparing the wages of new hires at young firms with the wages of new hires at mature firms with the same ex post level of success in Panels B and C confirms the earlier, more general result that young firms pay a 1-2% wage premium relative to mature firms. This is somewhat surprising, since the same objective measure of success is likely to be more difficult for a young firm to achieve than for a mature firm. For instance, the average young firm that breaks into the top quartile of productivity may have a particularly efficient technology, innovative intangible capital, or high-quality human capital, compared to the average mature firm in the same productivity quartile. Alternatively, if young firms are more susceptible to negative shocks or if they are less prepared to weather those shocks than mature firms, then a greater proportion of young firms that are unsuccessful ex post would have potentially had positive prospects ex ante, relative to mature firms. In these scenarios, the average ex ante

wage premium at young firms relative to mature firms in the same ex post success category should be higher than the one estimated earlier over the entire sample. One possible reason why the results are similar is that young firms differ systematically from mature firms on other unobserved measures. The fact that the estimated premium is higher when firm fixed effects are used, as mentioned earlier, supports this interpretation. For instance, financial constraints driven by a short track record may be putting downward pressure on starting wages at young firms, even at those that turn out to be highly productive later.

Does firm success also lead to higher wage growth over time? Figure VI plots the returns within continuing matches at young firms that are in the top half of the overall productivity distribution and compares them to the average mature firm that was plotted earlier in Panel B of Figure V. It turns out that the wage-tenure profile continues to be flat. However, thanks to the high initial wage premium paid to new hires at successful young firms, joining such a firm pays more in present value over the first 5 years than joining an average mature firm, for any discount rate. From a wage standpoint it matters, therefore, what kind of young firm a given individual joins.

IV.B. Where in the Economy Are the High-Paying Jobs at Young Firms?

Which sectors of the economy account for the largest proportion of jobs created by young firms? And do young firms in those sectors tend to offer high-paying and stable jobs?

Table VIII lists the ten 2-digit SIC sectors that account for the largest number of jobs at young firms in the first year of operations (“startups” for short), on average across the sample period—as well as the 10 sectors that contribute the least to the stock of jobs at

newly-created firms. For each sector, the table shows the average real hourly wage in the sample (expressed in 2014 pounds), the average 3-year exit rate of startups, and the average real productivity of startups after 3 years, conditional on survival and measured as real sales per employee. Out of the 46 two-digit sectors in the sample, the top ten account for 87.8% of jobs at newly-created firms. The largest, “Other business activities,” which represents 25.5% of such jobs, captures a mix of skilled service activities that include tax, accounting, management, and technical advisory and consulting services. The average wage in this sector is £11.57 per hour, 11.4% above the overall average of £10.39, while the exit rates and productivity outcomes are close to average.

The next two top sectors offer a different picture. “Hotels and restaurants” and “Retail trade except motor vehicles” jointly account for 28.6% of jobs created at startups but offer average wages that are well below the overall average (at £7.21 and £8.26 per hour, respectively) and exit rates that are above average. Young firms in the hotel and restaurant sector also attain low productivity levels, even conditional on survival. While retail traders appear to achieve high productivity, this is likely to be an artefact of how the productivity variable is constructed in the table. As the only way to measure productivity for the universe of firms in this dataset is using sales, the productivity of businesses that trade finished goods, like retailers, will be overstated relative to measures based on value added that are, arguably, more relevant for wage setting.

The remaining large contributors to job creation at startups represent a mix of service sectors. Only in sixth place do we see “Computer and related activities,” or software and technology firms that are colloquially referred to as “startups.” While new firms in this sector offer high wages, as one might expect, they represent only 5.5% of aggregate employment

at firms of that age. Finally, the ten sectors that contribute the least to job creation at startups tend to offer above-average wages but jointly represent only 1.4% of the stock of jobs at startups. Overall, therefore, the table paints a mixed picture of the quality of jobs at startups, with a large proportion of them being concentrated in low-wage and relatively unstable sectors.

Differences in average wages across sectors may be affected by considerations such as the sorting of individuals with different characteristics among different occupations and segments of the economy. Figure VII assesses the relationship between relative sectoral wages at startups, exit rates, and productivity outcomes—after controlling for the observable characteristics of firms and workers, as well as for individual fixed effects. It is, therefore, a way to assess the quality of jobs created at startups after taking into account the sorting and selection of employees across sectors.

The figure plots the average exit rates and productivity levels of firms aged 1 year against the relative wages of new hires at such firms, by sector. In Panel A, the vertical axis shows the 3-year exit rate of firms aged 1 year, calculated annually for each 3-digit SIC sector and averaged over the period from 2002 to 2012. In Panel B, the vertical axis shows the sectoral average of the log of real sales per employee 3 years after firm birth, conditional on appearance in the dataset. On the horizontal axis in both panels, average sectoral wages are calculated as sector fixed effects from estimating equation (1) with full controls on the subsample of employees at firms aged 1 year. Each bubble represents a 3-digit SIC sector, and its size is proportional to the annual number of jobs at 1-year-old firms in that sector, averaged over the period from 2002 to 2012. Selected sectors with extreme values are highlighted.

Figure VII confirms that jobs in sectors where young firms pay high wages, fail less fre-

quently, and achieve high productivity, are rare compared to sectors where young firms have less attractive prospects, even after accounting for compositional differences. A substantial proportion of jobs at young firms are concentrated in a few low-wage, high-risk, and low-productivity sectors like bars, restaurants, food retail, and industrial cleaning. In contrast, the sectors with high wages, low risk, and high productivity are more heterogeneous. They can be described as mainly high-skilled, specialized service sectors, such as software and computer services, real estate activities, architectural and engineering services, and finance. In aggregate, however, young firms in these high-wage sectors create a small proportion of jobs compared to young firms in the low-wage sectors, as indicated by the small relative size of the bubbles.

These conclusions are not surprising. Most new firms have low productivity, and their founders do not aim to innovate or grow (Shane 2009; Hurst and Pugsley 2011), so one might expect that they do not create high-paying jobs. This paper is the first, however, to confirm explicitly that variation in the quality (defined in terms of survival and profitability) of young firms is closely linked to the quality (defined in terms of wages) of the jobs that they create. It does so thanks to the availability of longitudinal data on individuals and firms. These data enable a careful definition of firm age, entry, and exit, as well as considering differences in observable and (time-invariant) unobservable characteristics of the employees of those firms, shedding some light on the characteristics of the young firms that create “good,” high-paying jobs. While the job-creating properties of young firms have captivated economists and policymakers alike, the results of this paper show that “good” jobs created by those firms are rare.

Should policy aim to stimulate firm creation in the high-wage sectors highlighted in this

section to enable more high-wage jobs to be created? There are at least two reasons for approaching such a recommendation with caution. First, the relationships identified in this paper may not hold in future periods. For instance, sectors with low exit rates in the past may not be the sectors with low exit rates in the future. Second, industrial policy focused on subsidizing or otherwise encouraging firm creation in specific sectors may have implications for aggregate productivity and welfare that are not explored here. Increasing the number of new firms in a given sector may lead to a fall in the average productivity of firms in that sector and reduce wages. The results of the previous section suggest that focusing on firms with better survival prospects and expectations of higher productivity may be more useful than a blanket sector-based policy. An important step in this direction is Guzman and Stern’s (2017) methodology for forecasting the probability of future growth of early-stage startups based on information available in business registration records or early milestones. Future research should also focus on how to identify *ex ante* which young firms are likely to attain high productivity levels.

V. Conclusion

In this paper, I use matched employer-employee data for Great Britain to study the wages of employees at young firms. I document and explain several novel findings. I show that most of the differences in the distributions of hourly wages, weekly earnings, and hours between young and mature firms observed in the raw data on all jobs are driven by tenure effects. New hires at young firms actually earn a small premium relative to similar new hires at mature firms. This result is robust to using several approaches to addressing the selection of individuals

into young firms based on observable and time-invariant unobservable characteristics. I also find that despite the initial premium at young firms, new hires experience better subsequent earnings prospects at mature firms.

Young firms are a heterogeneous group, however. Those young firms that survive and attain high productivity levels, conditional on survival, pay higher wages to new hires at the outset than less successful young firms. These results suggest that policies aiming to stimulate job creation by means of new firm creation may have different labor market effects, depending on the types of businesses that form as a result.

The results of this paper give rise to a number of questions for future research. For instance, why do people join a typical young firm, despite it offering only a small initial wage premium and worse earnings growth than a typical mature firm? There are at least three possible explanations. First, the individuals who join young firms may be less risk-averse than those who join mature firms (Roach and Sauermann 2017). Second, employees may be attracted to young firms for non-pecuniary motives, such as working in a more flexible environment (Koch et al. 2013) or a flatter hierarchy (Sørensen 2007). This is analogous to the argument that non-pecuniary reasons may explain why many individuals decide to become entrepreneurs despite the average returns being lower than in the counterfactual scenario of wage employment (Hamilton 2000; Hurst and Pugsley 2011, 2017). Third, people may join young firms simply because other, preferred forms of employment are difficult to obtain in some labor markets, particularly in weak economic conditions. All these explanations merit further exploration, using the results of this paper as a starting point.

Continued research on the employees of young firms and their earnings prospects is vital, given the quantitative importance of entrepreneurship for aggregate job creation and the

fact that the nature of young firms appears to be changing. Over the last decade and a half, jobs at young firms have become more likely to be concentrated in low-wage sectors and occupations. Young firms have also become less productive—both in absolute terms and relative to mature firms operating within the same narrowly-defined sector. Moreover, these trends have coincided with a deterioration in the wage gap between young and mature firms. Highly-paid and stable jobs at young firms have thus become increasingly rare, casting a shadow on the contribution of young firms to job creation. From a labor market perspective, the inevitable conclusion is that indiscriminate support for new firm creation may be detrimental to the quality of new jobs. Any local or national policies that aim to stimulate job growth through the creation of new businesses may do well to pay close attention to the nature of the firms that are being created.

Supplementary Material

The following appendices are available [online](#).

- Online Appendix A: Sample Construction
- Online Appendix B: Job Creation and Job Destruction at Young Firms
- Online Appendix C: Robustness Checks
- Online Appendix D: Additional Figures and Tables

References

- Abowd, John, Francis Kramarz, and David Margolis, “High Wage Workers and High Wage Firms,” *Econometrica*, 67 (1999), 251-333.
- Adrjan, Pawel and Brian Bell, “Pension Shocks and Wages,” CEP Discussion Paper No. 1536, 2018.
- Anyadike-Danes, Michael, Mark Hart, and Jun Du, “Firm Dynamics and Job Creation in the United Kingdom: 1998-2013,” *International Small Business Journal*, 33(2015), 12-27.
- Becker, Randy, John Haltiwanger, Ron Jarmin, Shawn Klimek, and Daniel Wilson, “Micro and Macro Data Integration: The Case of Capital,” in *A New Architecture for the U.S. National Accounts*, Dale Jorgenson, Steven Landefeld, and William Nordhaus, eds. (Chicago: NBER/University of Chicago Press, 2006).
- Bell, Brian and Stephen Machin, “Minimum Wages and Firm Value,” *Journal of Labor Economics*, 36 (2018), 159-195.
- Brixy, Udo, Susanne Kohaut, and Claus Schnabel, “Do Newly Founded Firms Pay Lower Wages? First Evidence from Germany,” *Small Business Economics*, 29 (2007), 161-171.
- Brixy, Udo, Susanne Kohaut, and Claus Schnabel, “Employment Stability in Newly Founded Firms: A Matching Approach Using Linked Employer-Employee Data from Germany,” *Small Business Economics*, 36 (2011), 85-100.
- Brown, Charles and James Medoff, “Firm Age and Wages,” *Journal of Labor Economics*, 21 (2003), 677-697.
- Burton, Diane, Michael Dahl, and Olav Sorenson, “Do Start-ups Pay Less?” *Industrial and Labor Relations Review*, forthcoming, 2018.
- Couch, Kenneth and Dana Placzek, “Earnings Losses of Displaced Workers Revisited,” *American Economic Review*, 100 (2010), 572-589.
- Cox, James and Ronald Oaxaca, “Laboratory Experiments with a Finite-Horizon Job Search Model,” *Journal of Risk and Uncertainty*, 2 (1989), 301-329.

- Criscuolo, Chiara, Peter Gal, and Carlo Menon, “The Dynamics of Employment Growth: New Evidence from 18 Countries,” OECD Science, Technology and Industry Policy Papers No. 14, 2014.
- Decker, Ryan, John Haltiwanger, Ron Jarmin, and Javier Miranda, “The Role of Entrepreneurship in US Job Creation and Economic Dynamism,” *Journal of Economic Perspectives*, 28 (2014), 3-24.
- Decker, Ryan, John Haltiwanger, Ron Jarmin, and Javier Miranda, “Where Has All the Skewness Gone? The Decline in High-Growth (Young) Firms in the U.S.,” *European Economic Review*, 86 (2016), 4-23.
- Evans, David and Boyan Jovanovic, “An Estimated Model of Entrepreneurial Choice Under Liquidity Constraints,” *Journal of Political Economy*, 97 (1989), 808-827.
- Goetz, Christopher, Henry Hyatt, Erika McEntarfer, and Kristin Sandusky, “The Promise and Potential of Linked Employer-Employee Data for Entrepreneurship Research,” in *Measuring Entrepreneurial Businesses: Current Knowledge and Challenges*, John Haltiwanger, Erik Hurst, Javier Miranda, and Antoinette Schoar, eds. (Chicago: University of Chicago Press, 2017).
- Gregg, Paul, Stephen Machin, and Mariña Fernández-Salgado, “Real Wages and Unemployment in the Big Squeeze,” *Economic Journal*, 124 (2014), 408-432.
- Guzman, Jorge and Scott Stern, “Nowcasting and Placecasting Entrepreneurial Quality and Performance,” in *Measuring Entrepreneurial Businesses: Current Knowledge and Challenges*, John Haltiwanger, Erik Hurst, Javier Miranda, and Antoinette Schoar, eds. (Chicago: University of Chicago Press, 2017).
- Haltiwanger, John, Ron Jarmin, and Javier Miranda, “Who Creates Jobs? Small versus Large versus Young,” *Review of Economics and Statistics*, 95 (2013), 347-361.
- Hamilton, Barton, “Does Entrepreneurship Pay? An Empirical Analysis of the Returns of Self-Employment,” *Journal of Political Economy*, 108 (2000), 604-631.
- Heyman, Fredrik, “Firm Size or Firm Age? The Effect on Wages Using Matched Employer-

- Employee Data,” *Labour* 21 (2007), 237-263.
- Hurst, Erik and Benjamin Pugsley, “What Do Small Businesses Do?” *Brookings Papers on Economic Activity* (2011), 73-142.
- Hurst, Erik and Benjamin Pugsley, “Wealth, Tastes, and Entrepreneurial Choice,” in *Measuring Entrepreneurial Businesses: Current Knowledge and Challenges*, John Haltiwanger, Erik Hurst, Javier Miranda, and Antoinette Schoar, eds. (Chicago: University of Chicago Press, 2017).
- Huttunen, Kristiina, Jarle Møen, and Kjell Salvanes, “How Destructive Is Creative Destruction? Effects of Job Loss on Job Mobility, Withdrawal and Income,” *Journal of the European Economic Association*, 9 (2011), 840-870.
- International Entrepreneur Rule, *Federal Register* 81 FR 60129, 2016.
- Jolivet, Grégory, Fabien Postel-Vinay, and Jean-Marc Robin, “The Empirical Content of the Job Search Model: Labor Mobility and Wage Distributions in Europe and the US,” *European Economic Review* 50 (2006), 877-907.
- Jovanovic, Bojan, “Selection and Evolution of Industry.” *Econometrica*, 50 (1982), 649-670.
- Kambourov, Gueorgui and Iourii Manovskii, “Occupational Specificity of Human Capital,” *International Economic Review*, 50 (2009), 63-115.
- Koch, Andreas, Daniel Pastuh, and Jochen Späth, “New Firms and New Forms of Work.” *mimeo*, 2013.
- Manso, Gustavo, “Experimentation and Returns to Entrepreneurship,” *Review of Financial Studies*, 29 (2016), 2319-2340.
- Michelacci, Claudio and Olmo Silva, “Why So Many Local Entrepreneurs?” *Review of Economics and Statistics*, 89 (2007), 615-633.
- Neal, Derek, “Industry-Specific Human Capital: Evidence from Displaced Workers,” *Journal of Labor Economics*, 13 (1995), 653-677.
- Nosal, Ed and Peter Rupert, “How Amenities Affect Job and Wage Choices over the Life Cycle,” *Review of Economic Dynamics*, 10 (2007), 424-443.

- Nyström, Kristina and Gulzat Zhetibaeva Elvung, “New Firms as Employers: The Wage Penalty for Voluntary and Involuntary Job Switchers,” *Labour*, 29 (2015), 348-366.
- Nyström, Kristina and Gulzat Zhetibaeva Elvung, “New Firms and Labor Market Entrants: Is There a Wage Penalty for Employment in New Firms?” *Small Business Economics*, 43 (2014), 399-410.
- OECD, *Entrepreneurship at a Glance 2016*, Paris: OECD Publishing, 2016.
- Office for National Statistics, *Business Structure Database User Guide*. <https://discover.ukdataservice.ac.uk/catalogue?sn=6697>, 2006 (last accessed 16 March 2017).
- Office for National Statistics, Annual Survey of Hours and Earnings, 1997-2016: Secure Access. [data collection]. 9th Edition. UK Data Service. SN: 6689, <http://doi.org/10.5255/UKDA-SN-6689-8>, 2017 (last accessed 16 March 2017).
- Office for National Statistics, Business Structure Database, 1997-2016: Secure Access. [data collection]. 7th Edition. UK Data Service. SN: 6697, <http://doi.org/10.5255/UKDA-SN-6697-7>, 2017 (last accessed 16 March 2017).
- Ouimet, Paige and Rebecca Zarutskie, “Who Works for Startups? The Relation between Firm Age, Employee Age, and Growth,” *Journal of Financial Economics*, 112 (2014), 386-407.
- Roach, Michael and Henry Sauermann, “Ex Ante Career Preferences and Sorting into Startup Employment,” *mimeo*, 2017.
- Shane, Scott, “Why Encouraging More People to Become Entrepreneurs Is Bad Public Policy.” *Small Business Economics*, 33 (2009), 141-149.
- Small Business Administration, *Strategic Plan. Fiscal Years 2014-2018*. https://www.sba.gov/sites/default/files/aboutsbaarticle/SBA_FY_2014_-2018_Strategic_Plan-1.pdf, 2014 (last accessed 30 September 2017).
- Sørensen, Jesper, “Bureaucracy and Entrepreneurship: Workplace Effects on Entrepreneurial Entry,” *Administrative Science Quarterly*, 52 (2007), 387-412.
- Sullivan, Paul, “Empirical Evidence on Occupation and Industry-Specific Human Capital,”

Labour Economics, 17 (2010), 567-580.

US Census Bureau, Business Dynamics Statistics. [data collection]. https://www.census.gov/ces/dataproducts/bds/data_firm.html, 2015 (last accessed 30 September 2017).

Zangelidis, Alexandros, “Occupational and Industry Specificity of Human Capital in the British Labour Market,” *Scottish Journal of Political Economy*, 55 (2008), 420-443.

Table I
Summary Statistics: Young Firms

	Observations at firms aged ≤ 3 years				Observations at firms aged 4-9 years			
	Mean	Median	Standard Deviation	Number of Observations	Mean	Median	Standard Deviation	Number of Observations
<i>Individual characteristics</i>								
Real hourly wage (£)	12.9	9.7	11.2	41,132	14.2	10.7	12.6	88,780
Log(Real hourly wage)	2.4	2.3	0.5	41,132	2.5	2.4	0.5	88,780
Real weekly earnings (£)	436.9	343.1	431.3	41,132	497.4	396.1	470.7	88,780
Weekly hours	32.5	37.0	13.3	41,132	34.1	37.5	12.6	88,780
Age	38.2	37.0	12.7	41,132	38.8	38.0	12.6	88,780
Female (0/1)	0.4	0.0	0.5	41,132	0.4	0.0	0.5	88,780
Job tenure	1.5	1.0	0.9	38,494	3.3	3.0	2.3	84,939
<i>Firm characteristics</i>								
Employment	154.8	9.0	743.3	41,132	298.8	20.0	966.2	88,780
Real sales (£m)	10.7	0.5	63.2	41,132	36.9	1.6	196.2	88,780
Firm age (years)	2.1	2.0	0.9	41,132	6.4	6.0	1.7	88,780
<i>% of observations by:</i>								
	1 (Low)	2-3	4 (High)		1 (Low)	2-3	4 (High)	
Occupational skill level (%)	19.2	57.6	23.1		17.1	58.5	24.4	
	Industry	Services	Construction		Industry	Services	Construction	
Sector (%)	11.1	80.9	8.0		12.3	79.5	8.2	

Notes. This table presents summary statistics for observations at firms aged 3 years or less and at firms aged 4-9 years. Real variables are deflated using CPI and expressed in 2014 GBP. Occupational skill levels follow ONS (2003) and are derived from 2-digit SOC 2000 and 2010 occupational classifications, based on the duration of training and/or work experience typically required to perform the activities in a given job. Sectoral classifications are based on the SIC 2003 system, with Industry defined as sectors C-E, Construction as sector F, and Services as sectors G-K.

Table II
Summary Statistics: Mature Firms

	Observations at firms aged 10+ years				Observations at 'not truly young' firms			
	Mean	Median	Standard Deviation	Number of Observations	Mean	Median	Standard Deviation	Number of Observations
<i>Individual characteristics</i>								
Real hourly wage (£)	14.9	11.2	14.7	1,165,860	15.8	12.1	13.3	33,741
Log(Real hourly wage)	2.5	2.4	0.6	1,165,860	2.6	2.5	0.6	33,741
Real weekly earnings (£)	538.6	435.8	493.6	1,165,860	580.1	471.2	505.1	33,741
Weekly hours	35.2	37.5	11.3	1,165,860	35.9	37.5	11.0	33,741
Age	39.9	40.0	12.8	1,165,860	39.2	38.0	12.2	33,741
Female (0/1)	0.4	0.0	0.5	1,165,860	0.4	0.0	0.5	33,741
Job tenure	8.0	5.0	8.3	1,117,167	6.4	4.0	7.7	29,967
<i>Firm characteristics</i>								
Employment	23,417.2	1,528.0	52,328.8	1,165,860	4,399.0	149.0	11,715.2	33,741
Real sales (£m)	4,282.2	162.9	11,369.1	1,165,860	855.8	9.9	2,533.9	33,741
Firm age (years)	28.1	29.0	9.2	1,165,860	6.7	7.0	2.3	33,741
<i>% of observations by:</i>								
	1 (Low)	2-3	4 (High)		1 (Low)	2-3	4 (High)	
Occupational skill level (%)	16.3	62.7	21.0		12.7	61.6	25.8	
	Industry	Services	Construction		Industry	Services	Construction	
Sector (%)	21.2	73.8	5.0		17.1	71.8	11.2	

Notes. This table presents summary statistics for observations at firms aged 10 years or more and at firms classified as 'not truly young,' as defined in Section II.D. See the notes to Table I for more details.

Table III
Comparing Hourly Wages at Young and Mature Firms

Dependent variable: log real hourly wage	Raw data	New hires	Size and sector	Job attributes	Personal attributes (“full controls”)
	(1)	(2)	(3)	(4)	(5)
Firm aged ≤ 3 years	−0.135*** (0.015)	0.025** (0.012)	0.031*** (0.005)	0.008** (0.004)	0.000 (0.004)
Firm aged 4-9 years	−0.053*** (0.016)	0.026** (0.012)	0.003 (0.005)	0.002 (0.003)	0.009** (0.003)
Not truly young	0.051* (0.027)	0.085*** (0.027)	0.025** (0.011)	0.018*** (0.007)	0.021*** (0.007)
R ²	0.01	0.01	0.31	0.59	0.70
Number of Observations	1,329,513	272,969	272,705	272,570	179,812

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Notes. This table reports the coefficients on firm age dummies from regressions of the log real hourly wage given by equation (1). Column (1) includes year fixed effects. Column (2) uses the sub-sample of new hires. Column (3) additionally controls for firm size and 5-digit sector. Column (4) adds controls for 2-digit occupation, indicators for full-time/part-time and permanent/temporary jobs, and NUTS 1 region dummies. Column (5) adds age, age squared, gender, an indicator for past young firm experience, and years of occupation-specific experience (“full controls”). Standard errors clustered at the firm level are in parentheses.

Table IV
Addressing Potential Selection of Employees

Dependent variable: log real hourly wage	Individual selection on unobservables			
	Displaced workers	Labor market entrants	Individual fixed effects (labor market entrants)	Individual fixed effects (all workers)
	(1)	(2)	(3)	(4)
Firm aged ≤ 3 years	0.021 (0.020)	0.010* (0.006)	0.020*** (0.007)	0.014*** (0.003)
Firm aged 4-9 years	-0.008 (0.024)	0.002 (0.005)	-0.006 (0.006)	0.011*** (0.002)
Not truly young	0.013 (0.039)	0.003 (0.010)	0.006 (0.008)	0.006 (0.005)
R ²	0.74	0.51	0.42	0.20
Number of Observations	2,208	56,089	165,428	1,226,228

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Notes. This table reports the coefficients on firm age dummies from regressions of the log real hourly wage, using four approaches to account for sorting and selection of individuals into firms of different ages based on unobservable attributes, as described in Section III.C of the main text. All regressions include “full controls,” as listed in the notes to Table III. Standard errors clustered at the firm level are in parentheses.

Table V
Do Young Firms Compensate Employees for High Exit Risk? New Hire Wage Premium

	(1)
Exit rate differential	0.086** (0.041)
Firm aged ≤ 3 years	-0.038*** (0.007)
Exit rate differential * Firm aged ≤ 3 years	0.807** (0.088)
Number of Observations	1,226,228

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Notes. This table reports the results of individual-level regressions of the log real hourly wage on firm age dummies as in equation (1), with the addition of the exit rate differential and its interaction with the firm age dummies. The exit rate differential is calculated as the difference in the average 3-year exit rates between young and mature firms within each 5-digit SIC sector over the period from 2002 to 2012. The regression includes individual fixed effects and “full controls,” as described in the main text. Standard errors are clustered at the firm level.

Table VI
Do Young Firms Compensate Employees for High Exit Risk? Wage Returns

Year since hiring	Young firm wage premium	
	Exit rate differential > median sector	Exit rate differential ≤ median sector
	(1)	(2)
0	0.031*** (0.005)	0.006 (0.004)
1	−0.007 (0.005)	−0.003 (0.004)
2	−0.006 (0.006)	−0.014*** (0.005)
3	−0.019*** (0.006)	−0.014*** (0.005)
4	−0.016** (0.007)	−0.022*** (0.006)
Discount rate required for NPV=0	17%	119%
Number of Observations	492,132	709,363

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Notes. This table reports the results of individual-level regressions of the log real hourly wage using equation (3) in the main text, focusing on continuing firm-worker matches. The values in the table represent the wage premium at young firms relative to mature firms based on the number of years elapsed since joining the firm (up to 4 years shown). Column 1 shows the results for the sub-sample of sectors where the exit rate differential is greater than the exit rate differential of the median sector. Column 2 uses the sub-sample of remaining sectors. The exit rate differential is calculated as the difference in the average 3-year exit rates between young and mature firms within a 5-digit SIC sector over the period from 2002 to 2012. Both regressions include individual fixed effects and “full controls,” as described in the main text. Standard errors are clustered at the firm level.

Table VII
Wages and Ex-Post Success of Young Firms

	Measure of firm success					
	Survival			Top quartile of productivity conditional on survival		
	1-year horizon (1)	2-year horizon (2)	3-year horizon (3)	1-year horizon (4)	2-year horizon (5)	3-year horizon (6)
Panel A: Successful young firms vs. unsuccessful young firms						
Wage premium/(penalty)	0.013 (0.012)	0.019** (0.008)	0.013* (0.007)	0.064*** (0.010)	0.063*** (0.010)	0.056*** (0.010)
Panel B: Successful young firms vs. successful mature firms						
Wage premium/(penalty)	0.015*** (0.003)	0.014*** (0.003)	0.013*** (0.003)	0.025*** (0.010)	0.020** (0.009)	0.013 (0.009)
Panel C: Unsuccessful young firms vs. unsuccessful mature firms						
Wage premium/(penalty)	0.015 (0.015)	0.001 (0.010)	0.001 (0.008)	0.017*** (0.004)	0.014*** (0.004)	0.011** (0.005)
Number of Observations	1,167,661	1,063,910	965,404	1,167,661	1,063,910	965,404

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

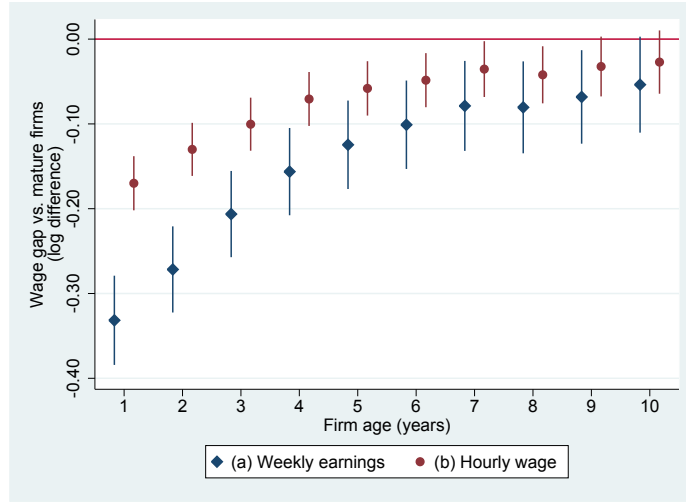
Notes. This table measures the relationship between a young firm’s ex-post success over a 1-, 2-, and 3-year horizon and the wages it pays to new hires. In Columns (1)-(3), success is defined as survival. In Columns (4)-(6), a “successful” (“unsuccessful”) firm is defined as one that is in the top (bottom) quartile, conditional on survival. Panel A compares wages at successful young firms to wages at unsuccessful young firms. Panel B compares wages at successful young firms to wages at successful mature firms, while Panel C compares wages at unsuccessful young firms to wages at unsuccessful mature firms. All regressions include “full controls,” as listed in the notes to Table III. Standard errors clustered by firm are in parentheses.

Table VIII
Startup Job Creation, Wages, and Firm Outcomes by Sector

Sector (2-digit SIC 2003 code)	Average contribution to job creation at startups (%)	Average real hourly wage (£)	Average 3-year exit rate of startups (%)	Average real productivity of startups after 3 years (£000s)
<i>Top 10 sectors by contribution to job creation at startups:</i>				
Other business activities (74)	25.5	11.57	39.0	41.6
Hotels and restaurants (55)	17.8	7.21	50.2	34.5
Retail trade except motor vehicles (52)	10.8	8.26	42.5	55.2
Construction (45)	10.5	11.18	39.3	49.5
Real estate activities (70)	6.6	12.28	29.2	39.2
Computer and related activities (72)	5.5	15.34	39.0	41.0
Wholesale trade except motor vehicles (51)	4.5	11.52	43.3	67.0
Sale, maintenance and repair of motor vehicles (50)	3.1	9.58	40.8	55.7
Land transport (60)	2.1	10.51	43.8	40.8
Publishing, printing, and reproduction of recorded media (22)	1.4	12.83	39.3	40.0
Total contribution of the top 10 sectors	87.8			
<i>Bottom 10 sectors by contribution to job creation at startups:</i>				
Research and development (73)	0.2	15.51	31.9	34.7
Manufacture of medical/optical instruments and clocks (33)	0.2	13.46	41.1	47.2
Manufacturing of pulp, paper, and paper products (21)	0.2	12.30	41.4	50.4
Manufacturing of basic metals (27)	0.2	12.10	39.0	53.5
Manufacturing of radio, TV & communication equipment (32)	0.2	12.25	42.0	46.1
Recycling (37)	0.2	12.57	43.6	68.0
Electricity, gas, steam and hot water supply (40)	0.1	14.64	29.3	61.0
Manufacturing of leather goods, luggage, and footwear (19)	0.1	10.84	43.1	39.2
Insurance and pension funding (66)	0.1	16.76	22.5	10.0
Manufacturing of coke and refined petroleum products (23)	0.0	17.81	48.7	65.1
Total contribution of the bottom 10 sectors	1.4			
Average across all sectors of the business economy		10.39	39.8	42.3

Notes. This table shows the top and bottom 10 sectors by contribution to the average annual number of jobs created at all firms aged 1 year (“startups”) between 2002 and 2015, based on firm-level data from BSD. The average real hourly wage for each sector is based on individual-level data from ASHE between 2002 and 2015 and calculated as $\exp(\text{mean of the log real hourly wage})$. The average 3-year exit rate and average productivity 3 years from entry conditional on survival are calculated based on the BSD. Productivity is measured as real sales per employee. Sectors with fewer than 10 individuals observed in ASHE as new hires at startups over the sample period are excluded. Real values are deflated by CPI and expressed in 2014 £.

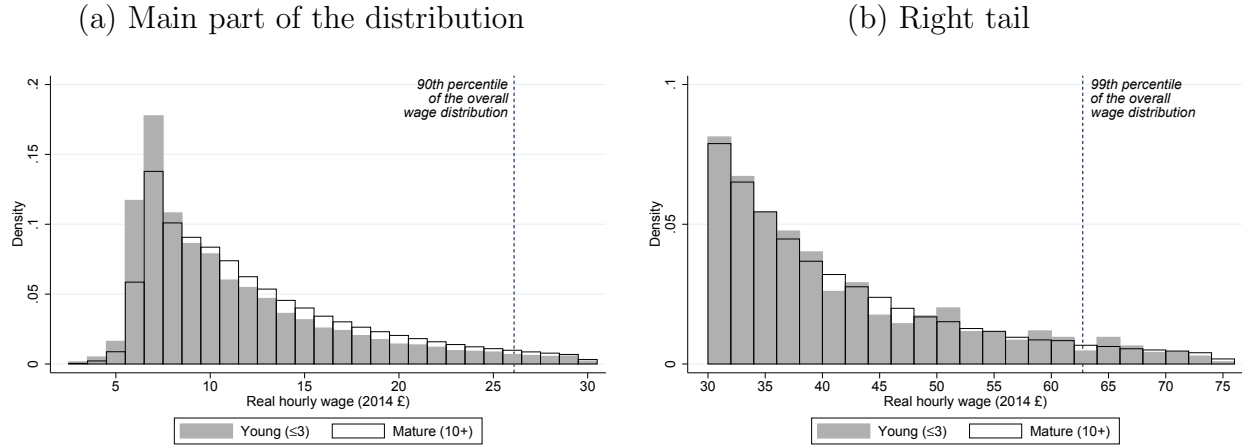
Figure I
Average Wage Gap between Young and Mature Firms



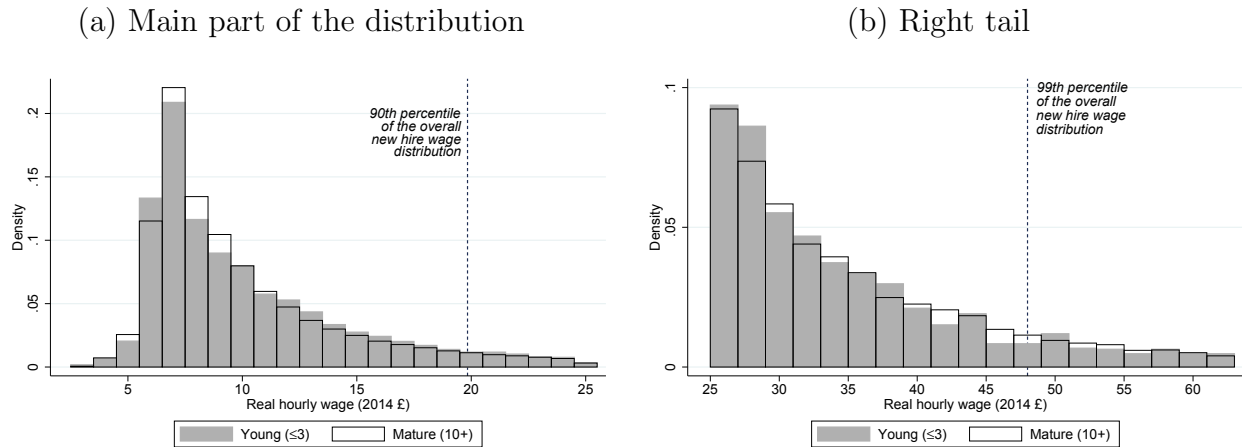
This figure plots firm age coefficients from a regression of (a) log real weekly earnings and (b) log real hourly wages on firm age dummies and year fixed effects. The omitted category are firms aged more than 10 years. Real earning and wages are deflated by the Consumer Price Index and expressed in 2014 GBP. Vertical bars indicate 95% confidence intervals based on clustering by firm. The sample consists of 1,329,517 observations pooled.

Figure II
Distribution of Hourly Wages by Firm Age

Panel A: All Employees

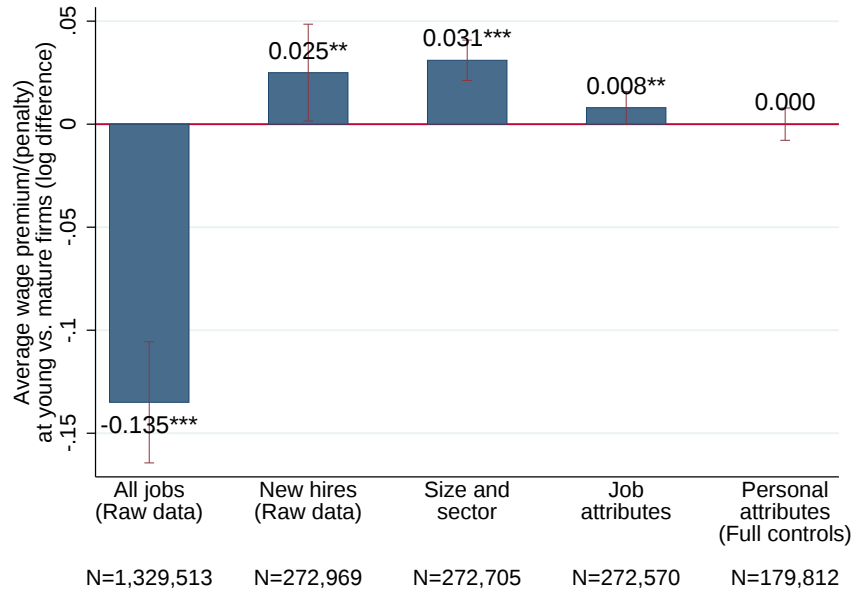


Panel B: New Hires Only



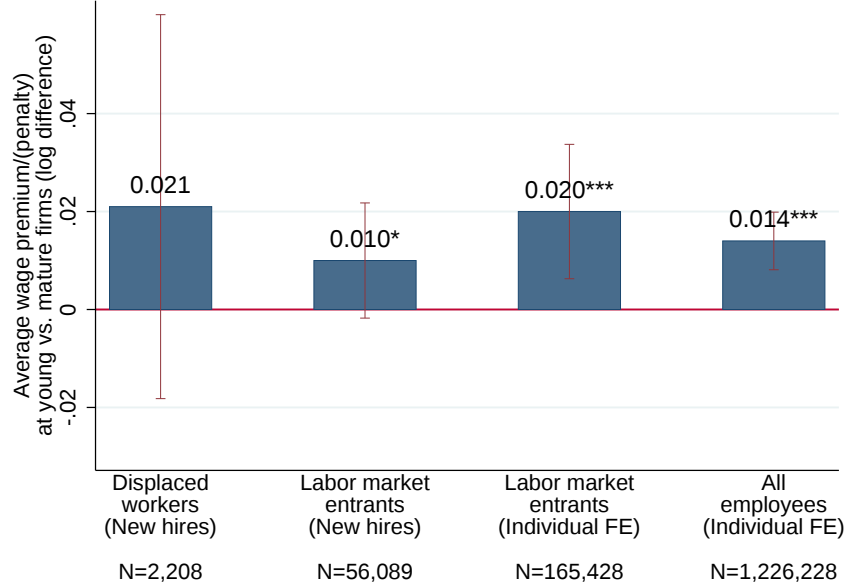
This figure compares the relative distribution of real hourly wages at firms aged 3 years or less (shaded bars) with wages at firms aged 10 years or more (transparent bars). Data is pooled over all years in the sample (2002-2015). Wages are deflated by CPI and expressed in 2014 GBP. Panel A shows all jobs, while panel B shows new hires.

Figure III
New Hire Wage Premium at Young vs. Mature Firms



This figure plots the estimated coefficient on the indicator for a firm aged 3 years or less from individual wage regressions with varying controls, specified by equation (1). Detailed results are shown in Columns (1)-(5) of Table III.

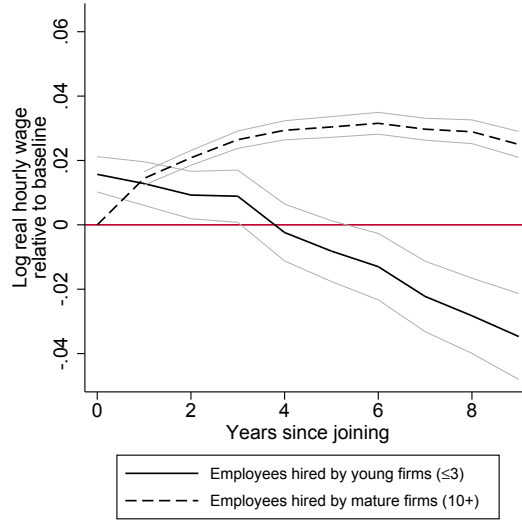
Figure IV
New Hire Wage Premium at Young vs. Mature Firms
(Selection of Employees on Unobservables)



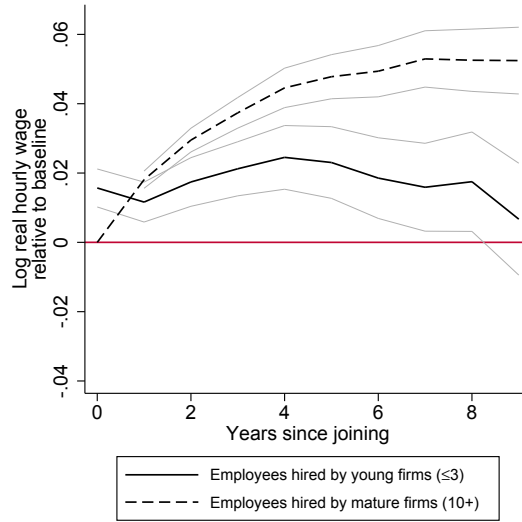
This figure plots the estimated coefficient on the indicator for a firm aged 3 years or less from individual wage regressions on various sub-samples that represent four approaches to address potential selection of individuals to young and mature firms based on unobservables. The models are specified by equation (1). Detailed results are shown in Columns (1)-(4) of Table IV.

Figure V
Returns to Joining a Young Firm

Panel A: Unconditional Returns

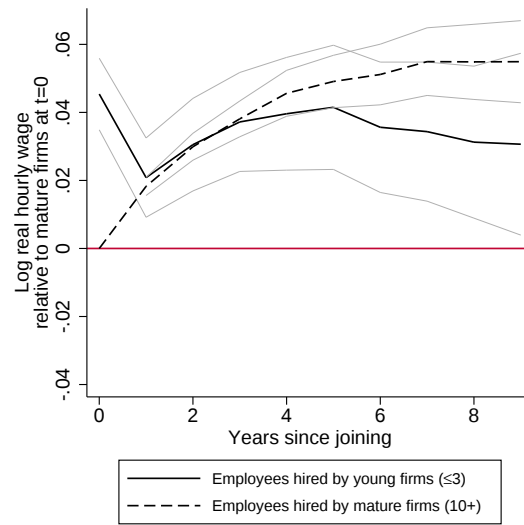


Panel B: Returns in Continuing Matches



This figure presents the evolution of wages of individuals hired by young firm, compared to individuals hired by a mature firm. Panel A shows the subsequent evolution of wages regardless of whether the individuals stay at the same firm or are observed at other firms (unconditional returns). Panel B shows returns to tenure within continuing matches. It plots the coefficients on tenure dummies from a regression of individual wages on tenure dummies interacted with firm age dummies, full controls, and individual fixed effects. In each plot, wages are expressed relative to new hire wages at mature firms. Thin grey lines represent 95% confidence intervals.

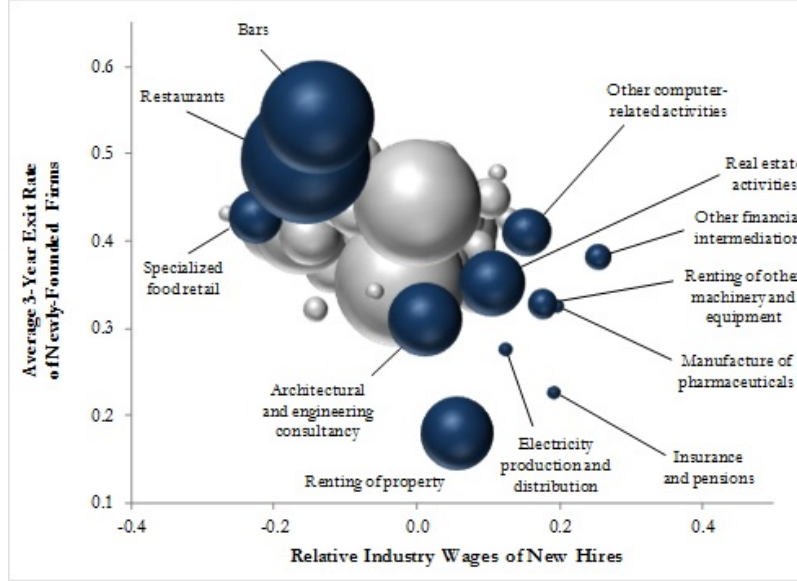
Figure VI Returns to Joining a Successful Young Firm



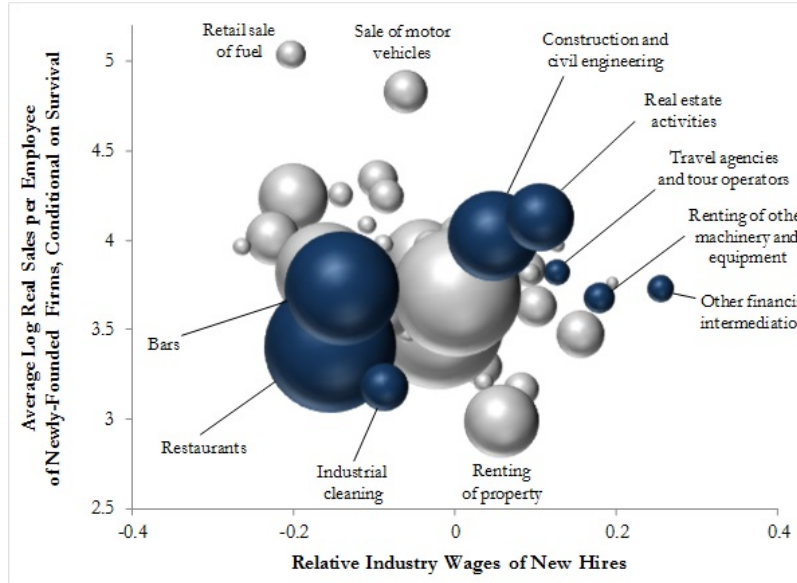
This figure presents the returns to tenure within continuing matches of individuals at young firms with above-median productivity, compared to individuals at any mature firm. In each plot, wages are expressed relative to new hire wages at mature firms. Thin grey lines represent 95% confidence intervals. See the notes to Figure V for more details.

Figure VII
Where Are the “Good” Jobs at Young Firms?

Panel A: Sector wages vs. exit rates of young firms



Panel B: Sector wages vs. productivity of young firms



This figure plots sectoral measures of the riskiness and productivity of young firms against the average wages of new hires at those firms. In both panels, average wages of new hires are expressed on the horizontal axis as the estimated sector fixed effects from a regression of individual log real hourly wages of new hires at firms aged 1 year on 3-digit sector dummies and full controls from Column (5) of Table III (7,565 observations). In panel A, the vertical axis shows the sectoral average of the 3-year exit rate of firms aged 1. In panel B, the vertical axis is the sectoral average of log real sales per employee 3 years after firm birth, conditional on survival. These averages are calculated over the period from 2002 to 2012, using BSD data. The size of each bubble represents the average employment of firms aged 1 year in the sector. To comply with disclosure restrictions, only sectors with at least 10 new hires observed over the sample period are shown.