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Our results show that business dynamism has slowed down since the 2008-2009 financial crisis on two levels: firstly, a decline in job destruction and secondly, a decline in job creation due to entry. Age has an important role in UK's business dynamism – young firms are the most dynamic group of enterprises, independently of size.

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JEL classification: C81, D22, L25

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1. Introduction

Business dynamism is the study of birth, growth and decline of businesses. It has increasingly become an important topic for policy makers as the entry rate of new firms has declined in most OECD countries. This raises concerns as new entrants not only contribute towards job creation, but are also responsible for increasing innovation, competition and productivity (Criscuolo et al. 2014).

Studying business dynamism in the UK also sheds light on important policy areas. The UK employment rate reached 76.6% in February 2020, a record high, up six percentage points from 2010. In the decade to 2007 by comparison, the employment rate only rose 1.7 percentage points. The strongly increasing overall trend since 2010 masks the underlying dynamics, however. In fact, jobs were being created at a *slower rate* between 2011 to 2019 than the rate before 2008. It is job *destruction* that slowed down and led to ever higher employment rates. And in particular, job destruction from *company exit*.

Our paper makes three contributions to the existing literature. First, we create a novel firm-level dataset using archive data from the Inter-Departmental Business Register (IDBR) to examine firm dynamics at a quarterly frequency. Second, we construct a new measure of business activity status based on linking the consecutive quarterly data. We derive new status transition variables for entering and exiting businesses. The recording of business birth and death dates is problematic on the IDBR, as the data sources for a business may change and provide inconsistent values (a problem with most business registers internationally). We also derive a consistent firm age from the new activity, entry and exit measures. Third, we reconstruct measures of change in employment at the firm level, using quarterly income tax data that feeds into the IDBR, to produce employment dynamics at a quarterly frequency. The new dataset gives greater precision to total job creation and job destruction than existing studies, which are generally based on changes in employment at annual frequency. We present new breakdowns of job creation and job destruction trends over quarters for the UK from 1999 to 2019.

Our main findings on business dynamics trends are:

- In the decade to 2019, business dynamism (the rate of entry and exit of businesses) has declined in the UK, in particular through reduced job destruction.

- Micro businesses (0 to 9 employees) are primarily responsible for the decline in the job destruction rate from firm exit.
- Large businesses (250+ employees) have experienced a substantial decline in both job creation and destruction – we suspect this is to some extent linked to mergers or administrative changes (rather than genuine economic changes) as the registration of entities within a large business group are restructured.
- The job destruction rate from firm exits has fallen in all industries, but the fall in Administrative, Support, Entertainment, Recreation and Other services has been substantially larger.
- Age has an important role in UK's business dynamism both in terms of job creation by entry and destruction by exit.

The rest of the paper is structured as follows. Section 2 presents a critical summary of the key literature. Section 3 discusses the data and methodology implemented in creating the novel dataset (with more details on the data provided in the Appendix). Section 4 presents the methods we use for the analysis in this paper, the definition of transition status used in our detailed descriptive analysis and the econometric model we use. Our findings are discussed in section 5. We first present detailed summary statistics in terms of job churn for the UK by age, size, transition, industry and the different combinations. We then present regression results looking at the marginal effect of different firm characteristics on employment growth. Section 6 presents the conclusion. Finally, section 7 discusses possible further analysis and limitations.

2. Literature Review

Statistical offices, such as those in the US, Canada and New Zealand have constructed their respective Longitudinal Business Database (LBD) using national business registers, accompanied with employment and financial datasets¹ to improve their understanding of business dynamism, but also of other topics such as the impact of organisational changes (mergers and acquisitions and management practices) and labour productivity at firm and local unit level. In the UK, an LBD is yet to be fully constructed, but researchers have implemented various frameworks and datasets to

¹ See Fabling, Gretton and Powell (2008).

analyse the topic. This section summaries the relevant literature on the UK and the rest of the world, noting that the existing literature has a strong US focus.

2.1 UK wide research

Prashar et al. (2019) study the UK's business dynamism using the Business Structure Database (BSD) – an archive of IDBR data at annual frequency used regularly by UK researchers – to calculate annual job destruction and creation rates from 1998 to 2018. They also create enterprise entry and exit rates, disaggregated by size, sector and region. Existing firms were the main source of job creation.

Barnett, Chiu, Franklin and Sebastia-Barriel (2014) analyse the relationship between the movement of labour, and firm entry and exit on aggregate productivity growth using firm-level data from the Annual Business Survey (ABS) and the BSD. They find that during the initial phases of the recession in 2008, firms hoarded labour despite weak demand. But after the crisis, the rate of firm's closure decreased – an uncharacteristic feature compared to previous recessions. This situation led to a prolonged period of weakness in labour productivity especially productivity across firms – a sharp fall among small and medium sized enterprises.

Dolphin and Hatfield (2015) conduct research on Britain's productivity puzzle and utilise the Labour Force Survey (LFS) and BSD from 2000 to 2014. They find that the strength in employment growth was disproportionately in low value-added and low-paid sectors of the economy, in particular, the accommodation and food sector. They recommend that productivity growth can be restored by transferring job creation towards higher-productivity sectors such as finance and manufacturing.

Butcher and Bursnall (2013) use the BSD and the Labour Force Survey (LFS) from 2004 to 2012 to analyse the dynamics of incumbents, entrants and exiters in the private sector. They find that, before the global financial crisis, an average of 4 million jobs were created and 3.7 million jobs were lost annually, resulting in a net increase of 300,000 per year – existing firms were responsible for more than 70% of job creation. They also report that there are fewer new entrants specifically from SMEs since the financial crisis, lowering the destruction rate. This particular result could be partially explained by ongoing credit constraints that SMEs have faced since the crisis despite record low interest rates.

Anyadike-Danes et al. (2013) investigate firm dynamics (job creation and destruction) in the UK using the BSD from 1998 to 2010. The main finding is that the job creation and destruction metrics

are relatively stable over time, even after the financial crisis. High-growth firms are responsible for 22% of jobs created despite being 1% of the total sample².

2.2 International studies

Decker et al. (2018) evaluate the rapid deceleration of business dynamism and firm-level labour productivity growth in the US by combining LBD employment with revenue data from the Census Bureau's Business Register from 1996 to 2013. The paper explores two distinct measures for aggregate job reallocation: an idiosyncratic shock on the start-up rate, and the response (labour frictions). They find that the fall in business dynamism is dispersed across all industries since the start of the century and it has an adverse impact on industry-level productivity growth. Manufacturing, in particular, has been affected due to the slowdown in the reallocation of resources from low to high productivity businesses. The presence of stricter regulations on hiring and firing for businesses only partially explains the drag on aggregate productivity. In terms of young businesses, the start-up rate has fallen and they are extremely volatile in both job creation and destruction.

Criscuolo et al. (2014) investigate business dynamics using a firm-level database (national business registers) for 17 OECD countries and Brazil from 2001 to 2011. They find two important results: SMEs and young firms have an important role in creating jobs even during the financial crisis, and the 'up or out' pattern emerged for young businesses. Young firms grow more rapidly but also have a greater probability of exiting the market. The cross-country differences remained, but might partially be due to differences in how business registers identify events such as births and deaths.

Haltiwanger, Jarmin and Miranda (2013) analyse US business dynamics from 1976 to 2005 using the Census Bureau's Business Dynamics Statistics and their LBD. They find that if the smallest firms are excluded, there is no relationship between firms' size and growth, supporting Gibrat's Law without controlling for firm age. There is a great emphasis on the role of business start-ups and young businesses in US job creation – reporting the 'up or out' phenomena for young firms – similarly to Criscuolo et al. (2014) in the OECD cross-country analysis.

Overall, most UK studies agree that existing firms are the main sources of job creation. The majority of research finds that business dynamism in the UK has declined since the economic downturn in 2008, leading to an inefficient allocation of labour. In terms of international studies, there is a greater

² High-growth firms, following the OECD methodology, are defined as any firm with a minimum of ten employees at the beginning of a three-year period that achieves an average annualised employment growth greater than 20 per cent over that period.

emphasis on age rather than size on business dynamism, suggesting young firms have the lion's share of job creation rather than micro firms. One common theme appears for both the UK and other OECD countries: that the decline of new firms is the main cause for the drop in business dynamism.

3. Data: innovations and challenges

The analysis presents in this paper is based on the concept of the 'enterprise' and PAYE units³ on the Inter-Departmental Business Register (IDBR). We use archived snapshots of the IDBR from 1998Q4 to 2020Q2 (see Appendix 1 for more information on the IDBR) to construct a quarterly population of active enterprises by measuring business activity over a reference period. In this section, we provide a brief overview of the construction of our novel dataset.

3.1 Constructing a novel dataset using the IDBR

Much existing work on UK business dynamism use archived annual snapshots of the IDBR. We argue that the use of the IDBR snapshot archive imposes two challenges in constructing datasets that are fit for analysing dynamics. The first challenge comes from the nature of snapshot data: it is analogue to taking a photograph of the register. Individual snapshots represent what is true at the point in time, not over a period of time (over a quarter). The second challenge comes from the information contained in the birth and death dates on the register. It is difficult to distinguish genuine births of enterprises from pure legal and administrative changes, as highlighted in Criscuolo et al (2014).

To resolve these issues, we adapted the criteria used by the ONS Business Demography statistics to identify which enterprises are active within the duration of a reference quarter. We compare the values of employment, turnover and number of administrative units of an enterprise recorded in two consecutive snapshots. These criteria aim to capture any sign of activity during the full three months of time in the quarter. Let T denote a time period of the duration of the quarter (a "reference period"), and $t-1$ and t denote the beginning and the end point of a reference period, respectively. The

³ The IDBR covers all firms registered for VAT and/or PAYE schemes. It does not cover firms that are not registered for either VAT (e.g. those with low turnover and hence fall below the VAT threshold) or PAYE schemes (e.g. those who are self-employed and those without employees). The highest-level business unit (enterprise/enterprise group) are attached to the lower-level business units (reporting unit), and administrative units (VAT unit and PAYE unit).

snapshots are taken at t-1 and t bound the two ends of the active population of the full reference period T.

For an enterprise to be identified as active, it must meet at least one of the following criteria.

Rule A: *Turnover or employment (or both) > 0 in snapshot t and live VAT or live PAYE (or both) > 0 in snapshot t.*

Rule B: *Turnover or employment (or both) > 0 in snapshot t and no snapshot t-1 history*

Rule C: *Turnover or employment (or both) > 0 in snapshot t-1 and live VAT or live PAYE (or both) > 0 in snapshot t-1*

Rule D: *Turnover or employment (or both) > 0 in snapshot t and the value of at least one of these two variables is different in snapshot t compared to snapshot t-1*

An enterprise may “re-activate” according to these criteria. An enterprise reference may revive on the IDBR in general, according to the IDBR inclusion rules: it may be listed as having a death date in the IDBR at one point in time, but is alive at a subsequent point. For consistency, we apply our criteria consistently, and refer to “activations” and “deactivations” rather than births or deaths.

Figure 1 illustrates what is captured in the population of active enterprises for a reference quarter.

Consider there are four types of firms:

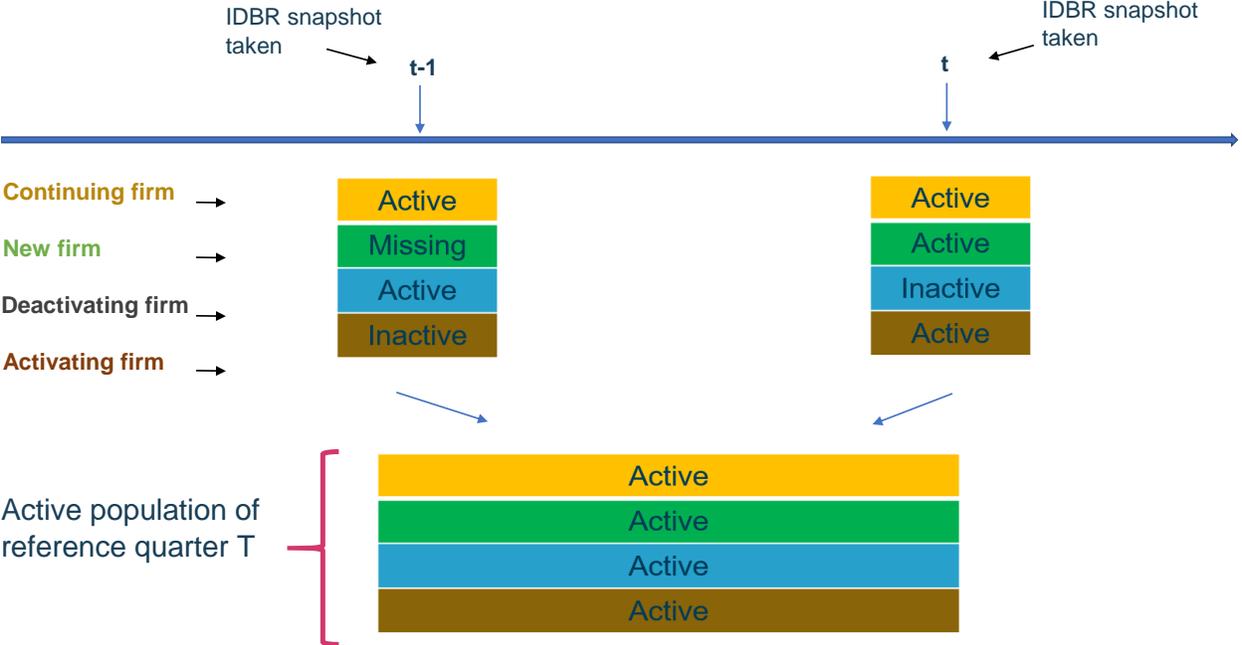
1. A continuing firm that has started trading activity before t-1 and continue trading until sometime after t
2. A new firm that has started trading activity between t-1 and t
3. A deactivating firm that has started trading activity sometime before t-1 but ceases trading between t-1 and t
4. An activating firm that has stopped trading activity sometime before t-1 but resume trading sometime between t-1 and t

Our approach identifies all the four types of firms as being active over the reference quarter T.

A snapshot shows what is seen at a point in time when the “picture” from the IDBR is taken, but it does not show us what is observed over a reference quarter. The top part of Figure 1 shows the activity statuses of the four types of firms shown in the IDBR snapshot t-1 and t. The danger of using individual snapshots to construct a database can be illustrated. Suppose snapshot t-1 and t are taken as database t-1 and t. We want to link a survey that is sampled between t-1 and t to the set of firms

on the database built using individual snapshots, but there is no IDBR snapshot taken between these two points in time. Linking the survey to either of them may result in either a non-matched response from a deactivating firm if the survey is linked to database t or non-matched responses from a new firm or an activating firm if the survey is linked to database t-1. This problem causes data to be under-utilised.

Figure 1: The construction of a reference quarter T



3.2 Constructing an age estimate

There are particular cases in which the firm birth and death variables present in the IDBR snapshots are inaccurate⁴. With a near-population coverage of UK businesses, identifying the genuine birth of each enterprise on the IDBR is a challenging task. We attempt to construct an age estimate using our quarterly active population to provide some understanding of how firm age and dynamism of UK

⁴ The measurement error is due to a mix of precise information about the first-born administrative unit, whether it is a VAT unit or a PAYE unit, arriving at a lag, and the fact that historical snapshots are not revised. The IDBR takes the birth date of the reported first-born administrative unit as the birth date of its enterprise. If information about a true first-born arrived at a later time after an IDBR snapshot is produced, the birth date of the enterprise will be updated only in subsequent snapshots. The update of the register also depends on when the ONS receive information about the true first-born.

businesses relate. To construct an age estimate, we count the number of quarters of continued activity, divided by four and rounding down to annualize the value.

Our age measure is different from a conventional measure of age. It is a strict measure of the time in which the business is substantively active to an extent to qualify for inclusion as an active enterprise on the IDBR. If a firm becomes inactive and then reactivates, it may have two different age measures at two different points in time. We allow four consecutive quarters of inactivity to restart the counter. In other words, an enterprise can either be “reborn” as the same enterprise after a long pause (more than four consecutive quarters) with no changes in its business structure, although we believe this is a rare case; or it could have gone through some significant events, such as a merger or acquisition, leading to a change in its main business activities or, in some cases, became part of a new or existing enterprise group (see Appendix 1 for the definition of enterprise group). In both cases, the enterprise would retain the same reference number on the IDBR.

Further data is required to differentiate between these two scenarios of inactivity at this stage: whether the enterprise has gone through an event like a merger, acquisition or takeover; and an investigation into whether the enterprise has been “relinked” to another enterprise group or have had its own lower-level business unit (e.g. reporting unit, local unit, or its administrative units) moved to another enterprise.⁵ We assume a disruption in the activity of a business that lasts more than one year is reasonable enough to consider it as a “new” entity and hence we recalculate its age. Nonetheless, for enterprises at the beginning of the period in (1998 Q4) we use age to that point from the recorded birth date, as there is no better alternative.

Our approach to construct an age measure allows us to accommodate a temporary pause of business activity in an old enterprise that might become inactive for a quarter and then reactivate in the following quarter – possibly indicating the enterprise is going through some unusual event, or because of the seasonality of business operations in some sectors. Following the definition of transition status we use in this paper, this enterprise will appear as an activator, but its age will not be restarted if the period of inactivity was less than a year.

Although establishing proper definitions of birth and death is beyond the scope of this paper, it is important to note that there is a potential to improve our age estimate through linking additional

⁵ To investigate whether there is “relink” of any IDBR units attached to an enterprise requires us to link up all the IDBR units that belongs to each enterprise on the register and track any movement of units from one enterprise to another enterprise over time. This is a complicated and challenging task. Although there is a potential to do it, it is beyond the scope of this paper.

information to our dataset, that would enable us to investigate the cause of the “reborn”. This could also provide us with some flexibility in establishing a definition of new birth to suit research needs. For example, whether to define birth only as a brand new enterprise reference number being introduced onto the IDBR; or to also include an existing enterprise that goes through significant changes in its structure and a complete change of its business activities – as reflected by both major relinks of its IDBR units and its Standard Industrial Classification (SIC) code – as a new-born, even if it retains the same reference number on the IDBR.⁶ Ultimately there are many margins over which a business might be reshaped and expanded.

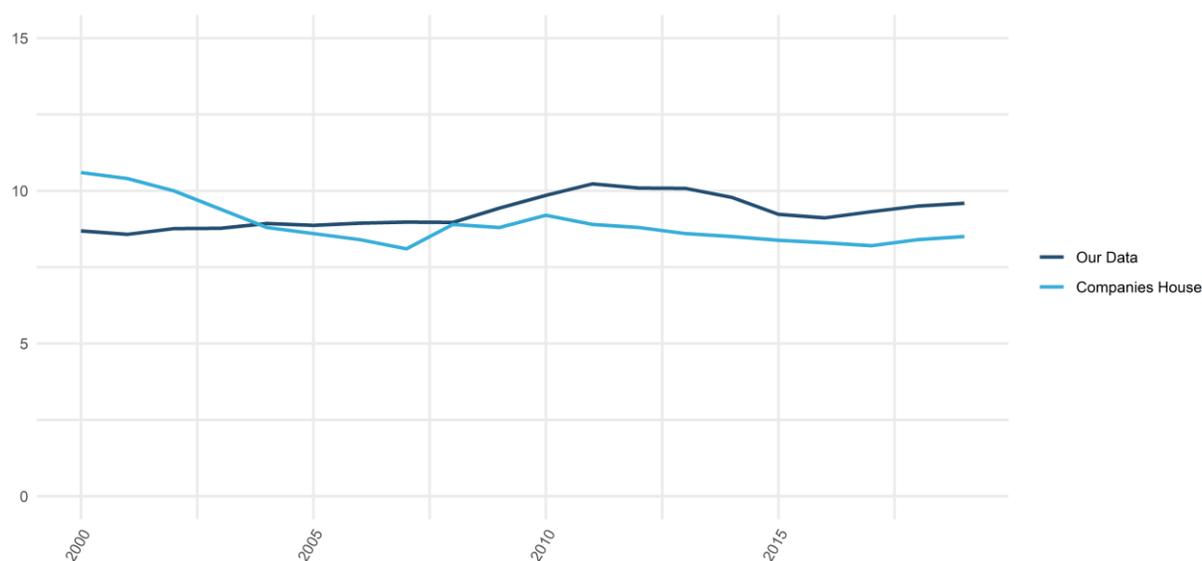
Figure 2 shows that the average age of businesses on the Companies House register is similar, in levels, to the average age of businesses with our data over time. Despite differences in data, coverage and methodology, the average age measure for the whole period, in both cases, is around 9 years old.

In terms of trends, there are two main causes of the differences. First, birth dates for companies on the Companies House register extend far earlier than any on the IDBR, including some dating to the 1800s. Our data accounts for previous operating years just for firms that were active in 1998Q4 (even then, the earliest is only around the 1970s with the introduction of VAT) . For this reason, the average age using our measure is lower than Companies House at the beginning of the period.

Second, in the early 2000s there was a large growth in the Companies House register, as the process of company creation was made significantly easier. A lot of these companies were shell legal structures rather than economically genuine businesses, and consequently were not taken onto the IDBR to the same extent. This large influx of new young companies drags down the average age in the Companies House register, relative to the LBD. These differences aside, the measures are reassuringly similar in aggregate. In future work, we hope to compare age measures on a firm-level basis.

⁶ For the latter, it prompts researchers to decide whether an enterprise can still be regarded as the “same” enterprise when it no longer belongs to the same parent (enterprise group), no longer has the same lower-level business units (i.e. reporting units, local units, VAT and PAYE units), or is no longer in the same industry, but only its reference number on the IDBR remains the same.

Figure 2: Average age of enterprises/companies in years, 2000 to 2019



Source: Office for National Statistics, Companies House

3.3 Employment measure from PAYE linking

Existing UK business databases often take information about firm-level employment from the IDBR. Employment recorded in the IDBR at the enterprise level are primarily derived from the Business Register Employment Survey (henceforth, BRES). It is often complemented with data from other surveys, such as the Short Term Employment Survey (STES), and administrative sources. BRES is a sample survey conducted annually. For the 2018 survey period, approximately 85,000 businesses were sampled on BRES in Great Britain. BRES collects detailed data on the industrial activity and employment of a business' local units (sites). Due to the survey's large sample size, it can produce good quality estimates for detailed breakdowns by industry and geography. However, BRES comes in at low frequency, at a lag, and does not have complete coverage. Although the BRES sample covers all complex and large businesses each year, the sample of small and medium sized enterprises will vary and be inconsistent for analysis. These drawbacks are disadvantageous for the study of dynamism.

One of the alternative sources of employment information to BRES is Pay as You Earn (PAYE) tax records, which are quarterly and have administrative coverage, and hence mitigate frequency and coverage problems when analysing business dynamics. The IDBR covers all firms registered for VAT and/or PAYE schemes. If an enterprise is registered to a PAYE scheme, we count the number of

employees reported on the PAYE scheme in real time as the employment of the enterprise on the IDBR instead of BRES. Some enterprises may have multiple PAYE units, so the number of employees from each PAYE unit belonging to the same enterprise are aggregated to get the enterprise-level estimate. As a result, we mainly use information from an administrative source that reflects the most up-to-date picture of the employment situation of UK businesses. We still use BRES and other smaller IDBR surveys for enterprises in the IDBR that are not covered by PAYE. For enterprises in the IDBR that are not covered by surveys or PAYE, employment is imputed based on average industry turnover per head ratios, as for this subset of enterprises there is at least turnover data from VAT.

The data from PAYE is updated with a quarter lag in the IDBR. We correct the lag in the archived snapshots so that we match the enterprise with its real time PAYE unit value in each quarter. For each reference quarter T , the active enterprise population is merged with what is recorded in the PAYE IDBR snapshot of $t+1$: the employee figure in this dataset corresponds to the reference quarter T and is used as the input for the employment measure. As an example, the PAYE snapshot taken from the IDBR in 2015Q3 is merged to the population of active enterprise to obtain an enterprise level end-of-quarter employee count for 2015Q2.

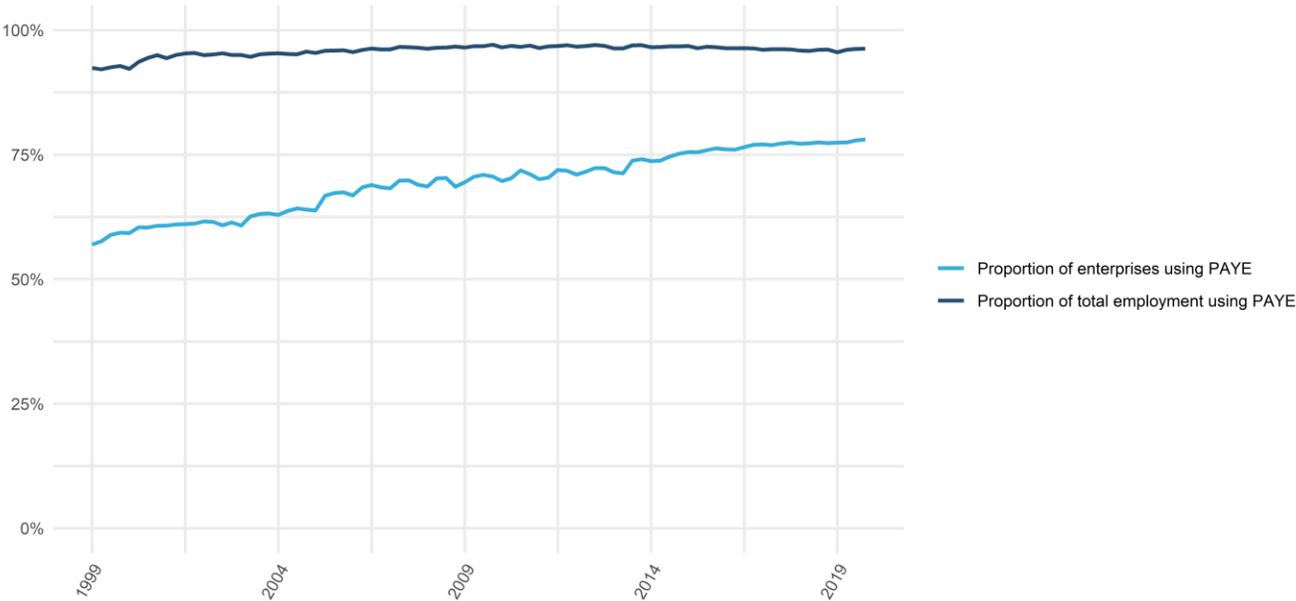
There are four things to consider when using PAYE as the main source of employment data for our enterprise level analysis:

- As noted, many small enterprises do not have a PAYE scheme, and we must use the IDBR employee measures that are derived from multiple (other) data sources.
- PAYE provides counts for employees, but not working proprietors (business owners who also work for the business). BRES collects counts of employees and working proprietors separately to form total employment. The number of working proprietors is small relative to the total workforce, and excluding their counts does not affect our results.
- For several complex enterprise groups, the PAYE unit does not match one-for-one to enterprises. Where the enterprise's PAYE unit is ambiguous, we take the default IDBR employment variable that derives either from BRES or STES.
- Administrative datasets are (generally) collected for operational purposes rather than for a specific research objective. There are several quarters where there are breaks in the updating of employment data on the IDBR – in particular in 2003, 2010 and the beginning of 2011. For that reason, we show employment dynamics over defined periods, and we exclude 2010 from our analysis.

The number of enterprises for which we have valid PAYE data is 57% in 1999, rising to 78% in 2019. However, over 92% of the total employment in the active enterprise population is derived from PAYE. This coverage is relatively stable over time, as shown in Figure 3. For this reason, there are no issues of time comparability of job creation and destruction estimates. There are two types of business for which we do not use PAYE data.

First, some firms for which we do not use PAYE data, as mentioned above, are linked to PAYE units which report for multiple enterprises. In 1999, there were 250 enterprises with PAYE units reporting to multiple enterprises, rising to almost 450 enterprises in 2019. These are mostly large firms, representing between 1.5% and 2.2% of the 6% total employment that is not derived from the PAYE source. It is extremely challenging to single out the proportion of employees taken up by each enterprise which forms part of a joint PAYE reporting arrangement, and there is not yet an appropriate method to do so. But the difference between administrative and survey is not significant – only 0.25% of total employment. Since the difference is small, we choose to allow for such potential overestimation.

Figure 3: Match rates between the quarterly active enterprise population and quarterly PAYE feed to IDBR, 1999 to 2019



Source: Office for National Statistics – Inter-Departmental Business Register (IDBR)

Second, some enterprises are not registered for PAYE, and are included on the IDBR for their VAT registration only. These firms are generally small enterprises: they are typically in the smallest employment size band (in our case 1 to 9 employees) and they accounted for 40% of the population in 1999 but only contributed 5% of employment. Their share of employment remains consistent over time but the proportion of micro enterprises with the only administrative unit being a VAT unit has been consistently decreasing over the last 15 years, to only 20% of the population by 2019. This explains the increase in the proportion of enterprises for which we use PAYE data, in Figure 3, while the share of employment based on PAYE remains much higher and stable.

3.4 Administrative data issues

The IDBR is an administrative dataset that suffers from some of the common issues associated with this type of data such as missing or poor-quality data points. In this context, the archive IDBR data for several quarters is still to be recovered. For 2003Q1, 2009Q3, 2010Q3, 2010Q4 and 2011Q1 different variables for employment data are not available and as a best approximation the data from the previous quarter were used. In a few cases the IDBR archive data is not complete, particularly 2000Q1 and 2002Q3. These gaps create outliers and spikes in our data, and we exclude generally 2010 in our results. However, the results are reasonably robust to different time windows, and to the inclusion and exclusion of the problematic quarters.

This section discusses some of the important aspects of this paper. Firstly, two quarterly consecutive snapshots are used to build one reference period to identify active enterprises throughout the entire period rather than the beginning or the end of the snapshot. Secondly, the employment measure is improved by using income tax data that feeds into the dataset to produce employment dynamics at a quarterly frequency rather than relying on surveys. Thirdly, the age measure is constructed to understand the impact of age on employment dynamics. It is important to point out that although we attempt to derive an age estimate, we focus on the use of quarterly cross-sections of active enterprise populations for our analysis. We do not attempt to track enterprises' activity longitudinally throughout the entire period considered in this paper.

4. Methods

In this section, we first discuss the definition of different transition statuses enterprises may go through over time and then present the econometric model we use.

4.1 Transitions in enterprise activity status

We define the transition status of an enterprise by comparing three consecutive quarterly active enterprise populations. The status depends on whether the enterprise has been active throughout these three reference quarters. The table below summarises the different transition statuses and the activity status of an enterprise in three consecutive reference quarters, T-1, T and T+1, with T defined as the current quarter.

Table 1: The different transition status based on active status of an enterprise

Transition Status	T-1	T	T+1
Activator in T	Inactive	Active	Active
Continuer in T	Active	Active	Active
Activator-Deactivator in T	Inactive	Active	Inactive
Closing in T, Deactivator in T+1	Active	Active	Inactive
Deactivator in T, Closing or Act-Deact in T-1	Active	Inactive	Inactive

1. Activator: an enterprise that is active in T and will remain active in T+1, though it was not active in the previous reference quarter
2. Continuer: an enterprise that is active for three consecutive reference quarters
3. Activator-Deactivator: an enterprise that is active in T, but was inactive in the previous quarter and will be inactive the next reference quarter. It captures enterprises that activate at the start of T and deactivate at the start of T-1.
4. Closing: an enterprise that was active in T and T-1, but becomes inactive in the next quarter.
5. Deactivator: an enterprise was active in T-1, but becomes inactive in T and T+1.

It takes time, both legally and statistically, for the birth and deaths of businesses to take place and to be reflected on the business register. Activators may previously have existed as registered companies, although they were not large enough to meet the tax thresholds and qualify for being

included in the IDBR. Since the markers for activity we use are based on the two snapshots that sit at either side of a reference quarter, we have two stages of exit of an enterprise: “closing” and “deactivation”. If an enterprise closes down in the middle of a reference quarter T , this is only confirmed by its inactivity in the whole of the subsequent reference quarter $T+1$. The change in employment (during the process of firm death) could take place in more than one reference quarter. For our analysis, we will combine these two exiting categories.

A “closing” business in $T-1$ will become a “deactivator” in T , but this does not mean we are double counting the employment. We are looking at the same businesses but using a different timing for the change in employment – since the closure may take longer than one quarter to take place. For instance, if a “closing” business in $T-1$ initially had 100 employees, and at the end of the period its employment went down to 50, this means 50 jobs were destroyed in $T-1$. This same business is classified as a “deactivator” in T , and it starts the reference quarter with 50 employees. If the employment goes to zero during that period, we record another 50 jobs destroyed in T .

We decompose the contribution to the change in employment by enterprise characteristics and transition status, over the two phases of exit. The transition statuses for the contribution analysis are the following:

1. Activates in T (includes Act-Deact in T)
2. Continuer, growing in T
3. Continuer, shrinking in T
4. Closing:
 - Deactivates in $T-1$ (Act-Deact in $T-1$ and Closing in $T-1$): these enterprises are active in the previous reference quarter, but they are inactive in T and $T+1$. Since they are not active in T , they are not included in the levels’ analysis, but their decrease in employment must be accounted in the contribution analysis.
 - Closing in T

Growing (shrinking) “continuers” are enterprises that are active throughout the period but an with increasing (decreasing) number of employees. Deaths can occur over multiple quarters and for this reason we combine “deactivates” and “closing” in our ‘exit’ (closing) status. However, this has implications on the job destruction rate from firm exit, when comparing it to other studies. Knowing that a business is in the process of dying (closing), we include the shrinkage of employment in the

preceding quarter in our measure of job destruction from firm exit (the extensive margin). In other studies, which do not see this, the same job destruction would have been classified as shrinking incumbents (the intensive margin). We think our approach is better, but is an issue primarily due to the quarterly frequency of our data.

Hence, the total change in employment is decomposed across enterprises as:

$$\begin{aligned} \Delta Emp_T = & \sum Emp_t Activates_T + \sum \Delta Emp_t Continuers, growing_T \\ & + \sum \Delta Emp_t Continuers, shrinking_T \\ & + \sum \Delta Emp_t Closing_T \end{aligned} \quad (1)$$

For decompositions of changes in incumbents (for instance, by size or age) we allocate to the group the business finishes in in the current reference period, not the one it started in. In the case of the industry code, this benefits from using the latest information, which is more likely to be accurate. While this is common in the literature, it has a potentially biasing effect of the contributions of different groups along the intensive margin, when businesses pass over the threshold from one group to another (for instance, grows such as to move into a larger size band). This is an artefact of our allocation choice, and other approaches are also possible in theory.

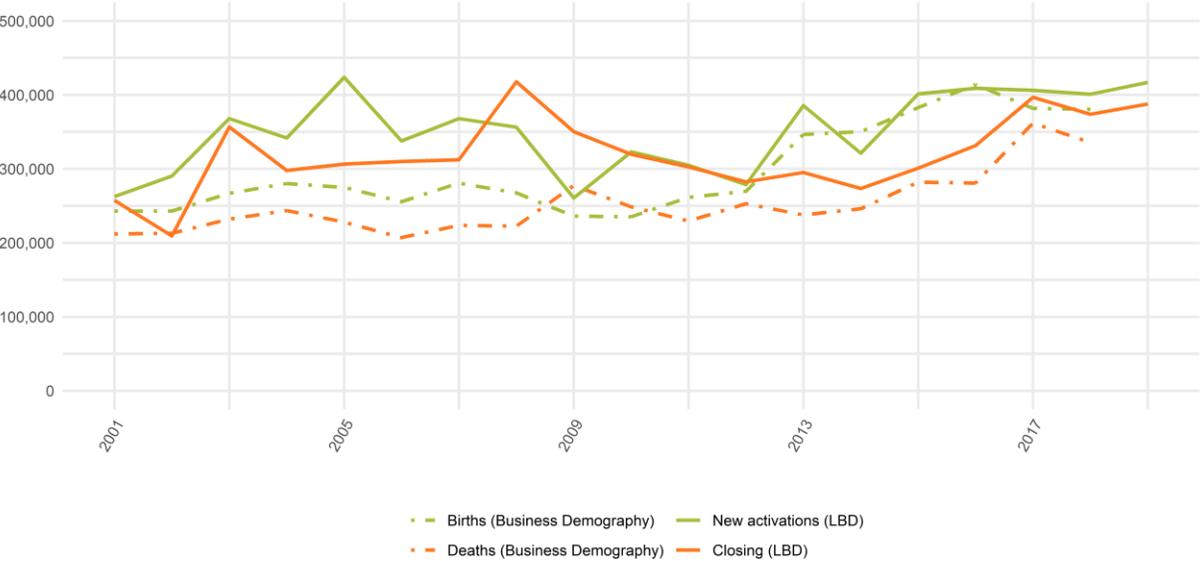
4.2 Measurement analysis

As mentioned in previous sections, the method we implement to build the dataset to measure business dynamism differs from existing literature. In general, the literature focuses on the number of businesses that are entering and exiting the market. Despite the differences in the methodology, Figure 4 shows that our entry and exit rates are broadly consistent with official (annual) business demography releases by the ONS. Our results are slightly higher in levels because we are able to capture quarterly fluctuations – a business that is born and dies in the same year might be missed in ONS annual demography publications. However, only around 10% of new businesses die inside a year, which means the addition is small. There are also timing differences given our methodology. Considering these differences, Figure 4 shows these estimates are similar.

In this context, this analysis starts on the basis that, in terms of number of businesses, our figures match with the existing data. However, we focus on the employment contributions rather than the

number of businesses because the entry and exit rates impact differently on the economy depending on the size of businesses. For this reason, entry and exit rates (the number of businesses) are not always comparable to job creation and destruction rates.

Figure 4: Annualised number of businesses entering and exiting the market in our data compared to the number of births and deaths from ONS Business Demography releases, 2001 to 2019



Source: Office for National Statistics – Inter-Departmental Business Register (IDBR), Business Demography.

In various UK literature, researchers also use employment contribution rather than the number of businesses to study this topic. However, this research uses datasets such as the Business Structure Database (BSD), the annual IDBR snapshot archive, in which they compare two consecutive annual snapshots. Therefore, the literature is unable to implement our methodology which detects signs of activity between quarters, making it impossible to observe fluctuations within the year. Measured at a higher frequency, our job creation and destruction rates for incumbents may therefore be greater in comparison to the rest of the literature, while the rates for the extensive margin (firm births and deaths) may be more similar. The difference in the intensive margin occurs because hiring and firing employees among incumbents is a relatively fast process and can be captured by the register on a

quarterly basis. However, entry and exit of enterprises is a complicated and lengthy process, and takes longer to be captured and updated on the register.

One important lesson from this exercise is that we can observe more volatility (and more accuracy) in business dynamics when examining datasets of higher frequency, e.g. quarterly as compared to annual. However, there is a limit on how much more can be captured by increasing the frequency of the data further. Since the PAYE data sources used to update the IDBR are primarily quarterly, more frequent snapshots (e.g. monthly) would not capture many more employment changes than the quarterly snapshots, and results of our analysis would not be much different. Using the quarterly snapshots therefore makes best use, at least effort, of the IDBR data for this purpose.

A further difference (and advantage) of our analytical approach as compared to much of the literature is in the more detailed delineation of transition statuses. As explained in Section 4.1, we can break down the active enterprise population into four transition statuses. This involves the use of four consecutive IDBR snapshots to examine continuity over three reference quarters. Our dataset therefore uses more information from the register to derive and capture more detailed within-quarter and longitudinal changes as compared to the common uses of existing UK business datasets.

4.3 Econometric model

Following Haltiwanger, Jarmin and Miranda (2013) we use the Davis, Haltiwanger and Schuh (1996) (hereafter DHS) growth rate as the dependent variable in regressions, and size band, age, industry and their interactions as explanatory variables. This allows us to compute the marginal effect of each of these variables separately.

The DHS employment growth measure has become standard in analysis of establishment and firm dynamics:

$$\gamma_{it} = \frac{(E_{it} - E_{it-1})}{Z_{it}} \quad (2)$$

where

$$Z_{it} = \frac{E_{it} + E_{it-1}}{2} \quad (3)$$

$$E_{it} = \text{Employment in reference quarter } T \text{ for establishment } i \quad (4)$$

This growth rate allows us to measure changes in employment and to include the contribution of entry and exit. It is also helpful for mitigating the effects of regression to the mean for quarters with positive or negative transitory shocks.⁷

The model used to estimate the correlations between employment growth and the explanatory variables, following Haltiwanger, Jarmin and Miranda (2013) is:

$$\gamma_{it} = \alpha + \beta x_{Sit} + \gamma x_{Ait} + \delta x_{Lit} + \theta x_{Sit} x_{Ait} + \varphi x_{Sit} x_{Lit} + \tau x_{Ait} x_{Lit} + \varepsilon_{it} \quad (5)$$

where

$$\gamma_{it} = \text{DHS employment growth for the enterprise } i \text{ in reference quarter } T \quad (6)$$

$$x_{Sit} = \text{sizeband of the enterprise } i \text{ in reference quarter} \quad (7)$$

$$x_{Ait} = \text{ageband of the enterprise } i \text{ in reference quarter } T \quad (8)$$

$$x_{Lit} = \text{industry of the enterprise } i \text{ in reference quarter } T \quad (9)$$

We estimate equation (5) for each population of active enterprises in each quarter between 1999 to 2019 and compute the marginal effect of each of these characteristics.

5. Results

In this section, we start by examining the change in total IDBR workforce⁸ over time. We then move on to investigate employment contribution by active enterprises. In particular, their net job creation and destruction by employee sizeband, age and industry; decomposing the effect into extensive margin and intensive margin where appropriate. We compare our results with UK and international studies. We also discuss our empirical results using the econometric model discussed in section 4.

5.1 Aggregates

The IDBR is comprehensive. IDBR enterprises include not only privately owned companies, but they also include public-sector organisations and non-profit institutions. The IDBR workforce in active

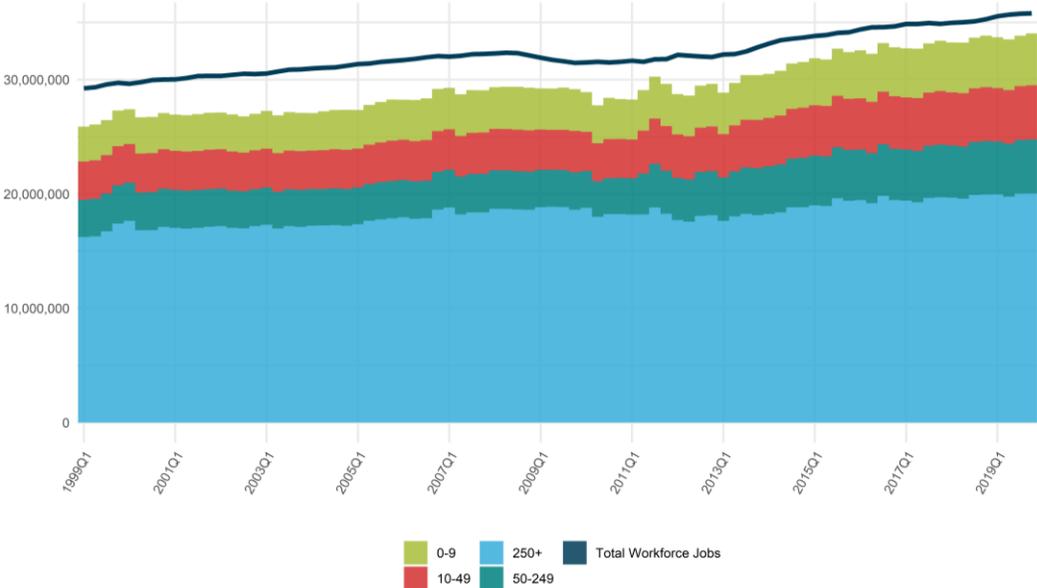
⁷ Prior to DHS growth model, businesses that recently experienced a negative transitory shock are more likely to grow while businesses that recently experienced positive shocks are more likely to shrink. This effect alone can produce an inverse relationship between size and growth. For more information see Haltiwanger et al. (2013).

⁸ IDBR workforce defined above using largely the quartlery counts PAYE employees in the active enterprise population. This measure does not differentiate between part/full time jobs, people that have multiple jobs, working proprietors, and excludes a large proportion of self-employees.

enterprises, defined as the total number of employees and computed using the method and data described in section 3 and 4, is 25.89m in 1999, up 13% to 29.34m in 2008, and a further 15% increase to 33.7m in 2019. Existing works of Anyadike-Danes et al. (2013) and Butcher and Bursnall (2013) find that private jobs are being created on average between 225,000 and 300,000 per year, respectively, over their sample period. Their results are comparable to our analysis in which we find 270,000 private jobs are added on to the UK economy per year. When the public sector is also considered, this number increases to 387,000.

The IDBR workforce reached a peak of 29.37m in Q2 of 2008, falling to a post-crisis nadir of 27.75m in Q2 of 2010, representing a decrease of 5.5% over the period. In comparison to other ONS employment measures, in Workforce Jobs⁹, total jobs reached a peak in 2007Q4 and fell by 3.9% to a post-crisis low in 2010Q3, while Labour Force Survey employment fell by 2.5% peak-to-trough in the aftermath of the crisis.

Figure 5: Active IDBR workforce by sizeband



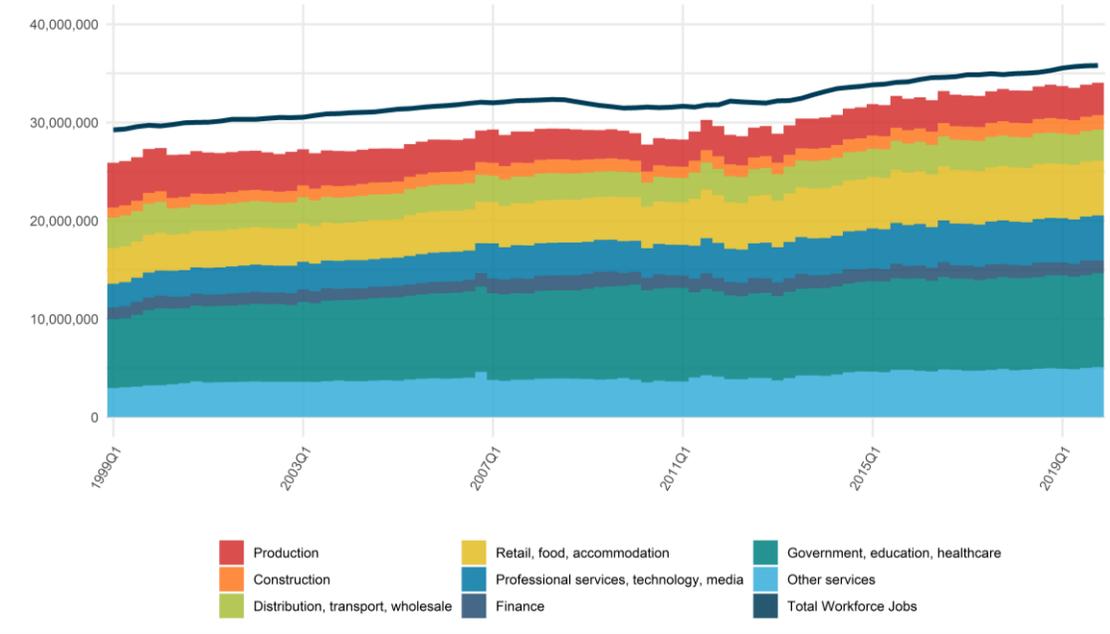
Source: Office for National Statistics – Inter-Departmental Business Register (IDBR), Workforce Jobs

⁹ Workforce Jobs figures are a measure of jobs rather than people. For this reason estimates of self-employment jobs and government supported trainee jobs differ from estimates of people in self-employment and in government supported training and employment programmes. <https://www.ons.gov.uk/employmentandlabourmarket/peopleinwork/employmentandemployeetypes/datasets/workforcejobsummaryjobs01>

Figure 5 shows the active IDBR workforce by sizeband. Most workers are in large companies with 250+ workers. Over time the preponderance of large firms has decreased, from 63% of the enterprise workforce in 1999 to 59% in 2019, and the share of the workforce has skewed to small enterprises (0 to 9 workers), from 13% to 14% from 1999 to 2019, and SMEs (10 to 249 workers), 26% to 28% over the same time period. We can that see the Workforce Job is following a similar trend, albeit slightly greater in terms of levels.

We find that the industry composition of the enterprise workforce has also changed over time as seen in Figure 6a. Out of statistical disclosure concerns a more aggregated industry grouping is used than the conventional Standard Industry Classification (SIC) sections, while still trying to preserve the economic usefulness.

Figure 6a: Active enterprise workforce and changes by broad industry groups – rolling four quarters

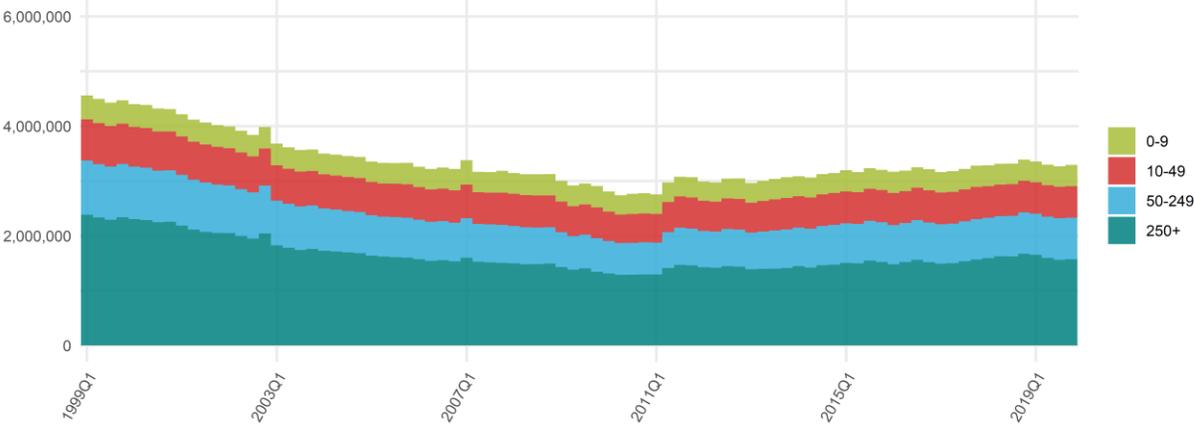


Source: Office for National Statistics – Inter-Departmental Business Register (IDBR)

Notes: Production, SIC divisions 01-39; Construction, 41-43; Distribution, transport and wholesale, 45-46 and 49-53; Retail, food and accommodation, 47 and 55-56; Professional services, technology and media, 58-63 and 68-75; Finance, 64-66; Other services, 77-82 and 90-96; Government, education and healthcare, 84-88.

The largest change since 1999 is the shrinking of the manufacturing industries. Manufacturing is the vast majority of the production industry group shown in Figure 6a, larger than agriculture, mining and quarrying (i.e. the extraction industries, in the almost all UK oil and gas) and utilities. In the decade to the start of the recession, the production industries in total shrank from 17% of the active enterprise workforce in 1999 to 11% in 2008 and by 2019, it is only 10%. Figure 6b shows the active IDBR workforce in the production industries by employee sizeband. Large enterprises are slightly less preponderant, 48% of the workforce in production industries in 2019, down from 52% in 1999. The majority of the employee jobs are taken up by large production enterprises with 250+ employees, in line with the aggregate picture. However we also observe a dip in the workforce between 2010Q2 and 2011Q4, which is more prevailing in large (250+ employees) and medium (50 to 249 employees) enterprises – the dip coincides with our problematic quarters where we do not have up-to-date employment information as discussed in section 3.

Figure 6b: Active IDBR workforce by sizeband, production, through time



Source: Office for National Statistics – Inter-Departmental Business Register (IDBR)

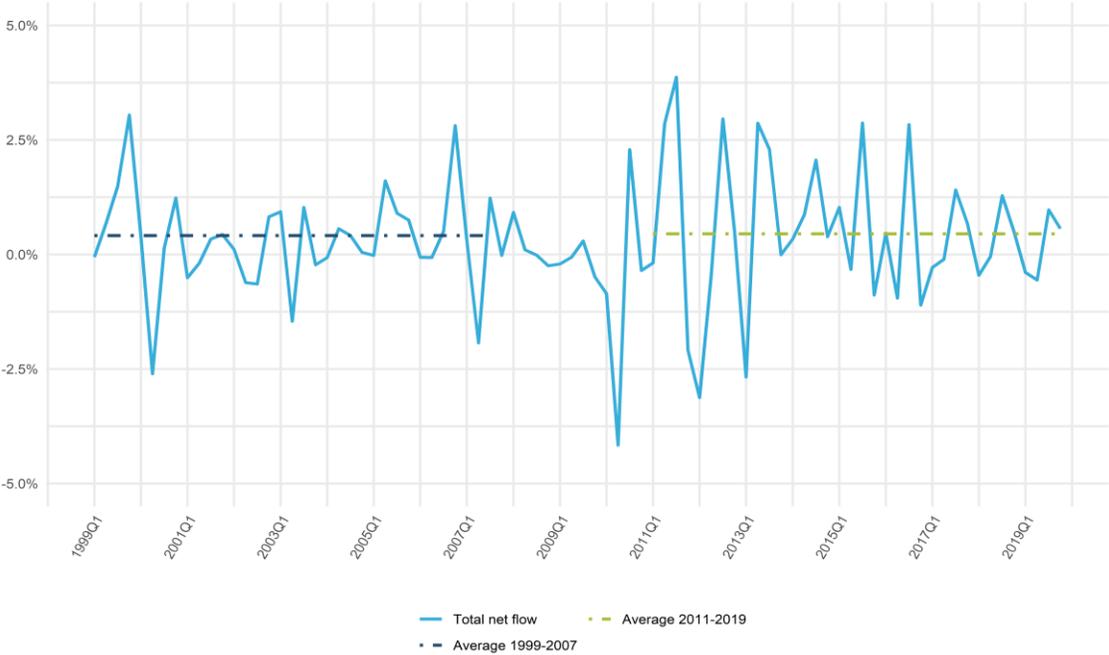
5.2 Employment Dynamics

In this subsection, we look beyond the level of total employment to examine the employment contribution of different businesses towards total employment. In particular, we examine net job creation and net job destruction. It is important to point out that we only observe net job creation at the enterprise level from our active enterprise population, but we do not observe gross changes at

the enterprise level. For example, if an enterprise hires 100 workers, and sacks 50 workers, then we only observe a net creation of 50 jobs. While this will underestimate the true change in the workforce of an enterprise, we observe changes at quarterly frequency, at least limiting the bias versus comparing changes in employment at annual intervals. However, we can distinguish between existing companies that are creating jobs (growing) and existing companies that are destroying jobs (shrinking). For this reason, our figures slightly differ when using the Criscuolo et al. (2014) methodology. They calculate job creation and destruction with entering and exiting firms, respectively, and include the net contribution of continuers to the measure depending on the sign. Neither do we observe the cause of job destruction, if it is initiated by the employer or employee.

Figure 7 shows the quarterly percentage change in the active enterprise workforce. By our measure of net job creation/destruction, we find that 87,875 jobs were net created on average per quarter from 1999 to 2007, an average net change of +0.41% in the total active workforce in each quarter. However, the remarkable fact of the UK labour market is the increase in the workforce in the period following the recovery from the recession. The average for the period 2011 to 2019 is 159,377 additions, or an average net change of +0.45% in the active workforce, per quarter. The financial crisis was excluded from this analysis since it is not comparable to the rest of the periods due to the various external factors occurring.

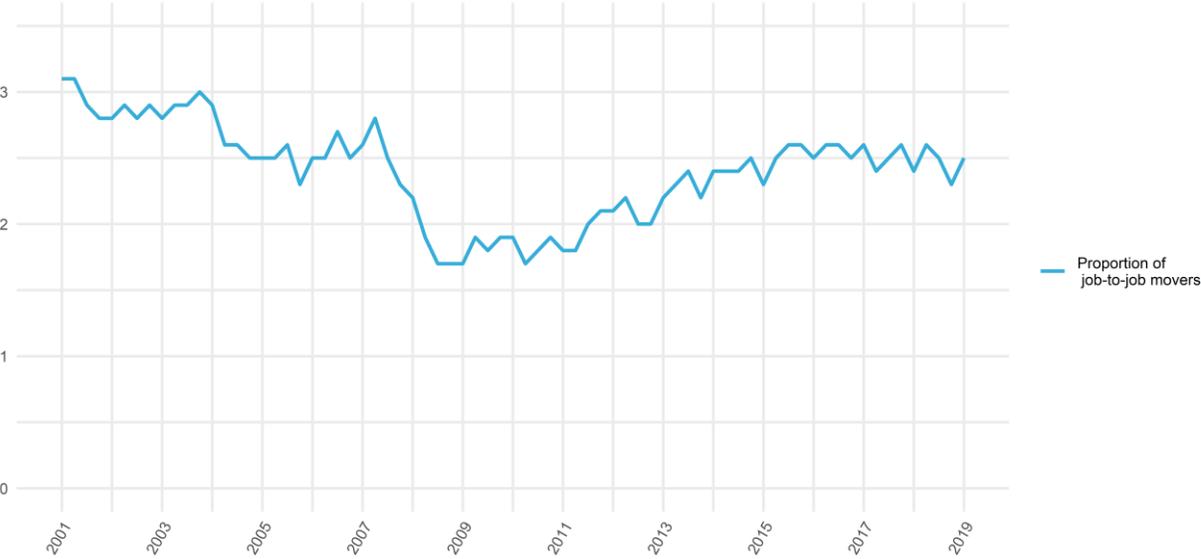
Figure 7: Quarterly percentage change in workforce of active enterprises



Source: Office for National Statistics – Inter-Departmental Business Register (IDBR)

However, this aggregate growth rate masks an active labour market. As revealed by Figure 8, using data from the Labour Force Survey, workers move from job to job to a large degree. In 2019, 2.5% of employees per quarter experienced a job move. While these changes do not show up in the aggregate, the changes at the level of individual businesses are quite substantial.

Figure 8: Job-to-job movers as percentage of total workers in Labour Force Survey



Source: Office for National Statistics – Labour Force Survey (LFS)

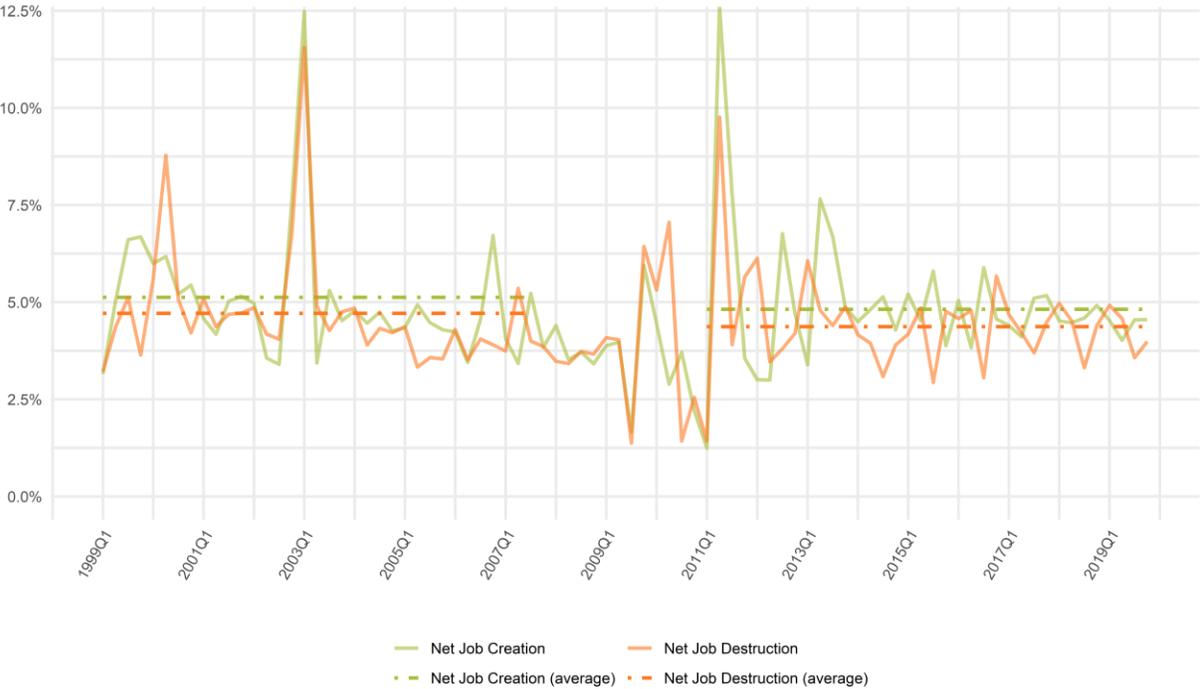
Figure 9 plots the quarterly net job creation and job destruction from 1999 to 2019, alongside the average job creation and average job destruction in the pre- and post-financial crisis periods. The graph shows clear quarterly variations in net job creation and destruction. There are substantial increases in job creation and destruction in some quarters e.g. 2003Q1 and 2011Q2, due to lack of up-to-date and missing information for those quarters as discussed in Section 3. For the whole period 1999 to 2019, our results show that enterprises that are net creating jobs make net additions of 4.78% of the active IDBR workforce, or 1,407,000 net jobs created per quarter. The counterparts, enterprises that are on net destroying jobs make net destruction of 4.47% of the active IDBR workforce or 1,310,000 net jobs destroyed per quarter on average.

Particularly, we find that net job *destruction* is responsible for the increase in the workforce since 2011, not net job creation. Post-recession, jobs are being added at a *slower* rate, 4.82% after 2010

versus 5.12% before 2008. After 2010, a gap has been opened up between the two rates: jobs are being destroyed at a slower rate, 4.37% versus 4.71% before 2008, and the small change is consistent enough to make a substantial difference. During the last two decades, the period between 2012 and 2016 showed the most intensive employment growth; the active IDBR workforce expanded by 3.2 million jobs, more than than in the preceding 15 years. If job creation and destruction rates had remained as they were before 2008, only 1.8 millions jobs would have been added between 2012 and 2016.

While the quarterly series is volatile, there are outliers due to several points in the data series where there were changes in how the PAYE data is fed into the IDBR, in particular in 2003 and in 2010 as discussed in section 3. However, the change in the gap between net creation and destruction rates is robust to different time windows.

Figure 9: Quarterly net job creation and net job destruction rates



Source: Office for National Statistics – Inter-Departmental Business Register (IDBR)

We further decompose by the extensive margin – jobs created by activating firms and destroyed by exiting firms – and intensive margin – the change in firms that are continuing from quarter to quarter.

The intensive margin is the most important channel for job creation and destruction. Nearly all (96-99%) of the workforce remains in enterprises that are continuing from quarter to quarter. However, the extensive margin still has an important impact on the overall dynamics of job creation and destruction despite only being a small fraction of the workforce.

On the extensive margin, we compare the change in the two periods: 1999 to 2007 (pre-recession period) and 2011 to 2019 (post-recession period). Table 2 shows that job creation from entry overall has fallen from 1.31% of total active employment to 1.12% of total active employment in the two comparison periods, on average per quarter. Meanwhile, job destruction from exit overall has fallen from 1.36% of total active employment to 0.74% of total active employment.

On the intensive margin, there is less of a fall in dynamism. Continuer or existing enterprises that are net job creators are creating fewer jobs, falling from 3.81% to 3.70% of all employment over the time periods (a sharper decrease for large enterprises). However, net job destruction of shrinking existing enterprises rose from 3.35% of jobs to 3.63% of jobs on average per quarter – increased dynamism, also mostly due to large enterprises. The fall in job destruction is only due to the extensive margin. As stated, we cannot observe total gross flows at the firm level, so results for the intensive margin will be underestimated of the true extent of labour market transitions.

Table 2: Quarterly job creation and destruction rates by intensive and extensive margins.

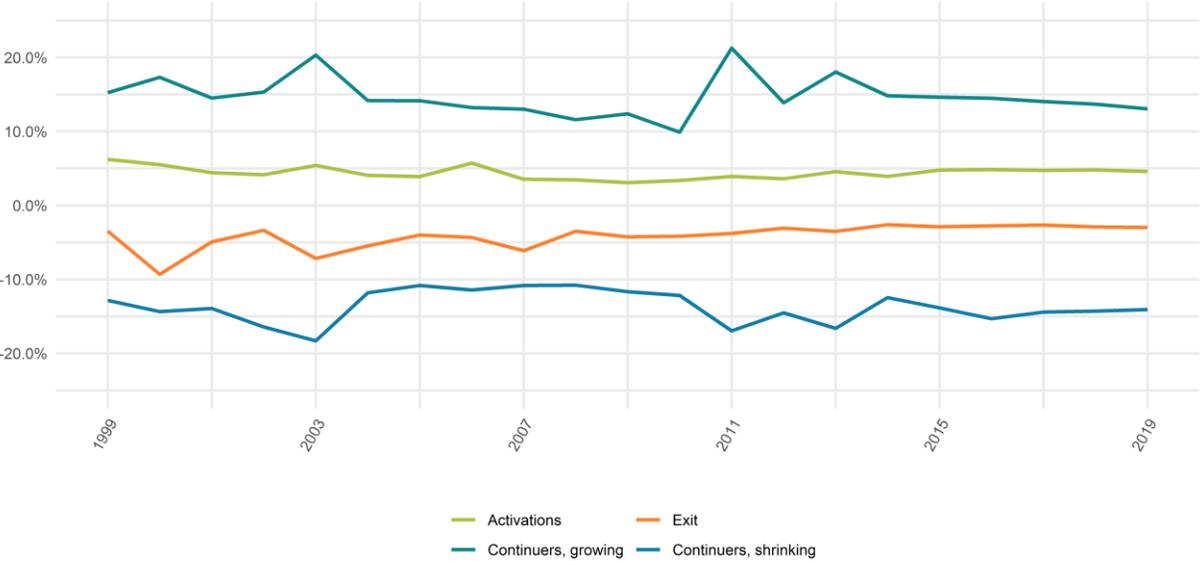
	1999-2007	2011-2019	Change
Job Creation	5.12%	4.82%	-0.31%
Entry	1.31%	1.12%	-0.20%
Continuers, growing	3.81%	3.70%	-0.11%
Job Destruction	4.71%	4.37%	-0.34%
Exit	1.36%	0.74%	-0.62%
Continuers, shrinking	3.35%	3.63%	0.27%
Net Effect	0.41%	0.45%	0.04%

Source: Office for National Statistics – Inter-Departmental Business Register (IDBR)

Figure 10 shows the times series for the annualised rates of job creation and destruction for incumbents and extensive margin. Incumbents create and destroy on average around 15% and 14% jobs, respectively, per year. On the other hand, annual job creation due to entry was around 4.4% whilst job destruction was 4.15% on average over the last two decades.

In section 4.2, we outlined the potential difference that may occur between our results and the existing work using the BSD, such as Prashar et al. (2019). When comparing Figure 10 with its counterpart in Prashar et al. (2019), our results exhibit similar trends. The extensive margin is consistent with the literature. As expected, our measures capture a greater volatility within the year. Hence, the aggregate value of incumbents expansion and contraction is 6% and 8% larger, respectively. The greater job destruction from incumbents captured in this analysis reduces the overall contribution from incumbents towards net job creation compared with the results in Prashar et al. (2019).

Figure 10: Annual job creation and destruction rates by intensive and extensive margins



Source: Office for National Statistics – Inter-Departmental Business Register (IDBR)

Table 3 shows the extensive margin contributions to the total employment by different size bands. The extensive margin may be overstated here, however – about a quarter of job creation and destruction on the extensive margin is due to large enterprises with more than 250 workers. We suspect mergers, acquisitions or group restructurings are possible reasons for the entry and exit of large enterprises shown in our results. We find few brand new businesses will reach 250 workers within a quarter of registering for PAYE, which seems unlikely from organic growth over such a short period. Even excluding large businesses, there is a slowdown in exit. Most job destruction from exit is due to small firms with fewer than 10 workers. From 1999 to 2007, small businesses that left the

market destroyed 0.87% of jobs on average per quarter; while in 2011 to 2019, that was only 0.58% of jobs on average per quarter. As Table 3 shows, most of remaining change in job creation and destruction is due to large firms, where the net change is close to zero.

Table 3: Extensive margin by size band

Job Destruction from exit by size				
	1999-2007	2008-2009	2011-2019	Pre and post recession change
0-9	0.87%	0.75%	0.58%	-0.30%
10-49	0.08%	0.08%	0.05%	-0.02%
50-249	0.07%	0.05%	0.04%	-0.04%
250+	0.35%	0.10%	0.08%	-0.27%

Source: Office for National Statistics – Inter-Departmental Business Register (IDBR)

Job Creation from entry by size				
	1999-2007	2008-2009	2011-2019	Pre and post recession change
0-9	0.43%	0.39%	0.49%	0.07%
10-49	0.17%	0.14%	0.17%	0.00%
50-249	0.16%	0.10%	0.14%	-0.02%
250+	0.57%	0.19%	0.31%	-0.25%

Source: Office for National Statistics – Inter-Departmental Business Register (IDBR)

Table 4 shows the average quarterly contribution to total employment by size band and transition. It is noteworthy that average quarterly job destruction in the financial crisis period 2008-2009 is lower than in the preceding period in all employee sizeband (see Appendix 2 and 3 to see the whole time series). From the data used here, we cannot disentangle the effect from businesses hoarding labour and workers being reluctant to move. However, if there is a higher cleansing effect on aggregate productivity from being in a recession, then given the lower overall job destruction rates, exiting and shrinking would have to be more closely targeted at low productivity firms. The job destruction rate remains low in the extended recovery period along the extensive margin for all sizebands, but in terms of intensive margins, the destruction rate remains low only for micro firms.

Anyadike, Danes et al (2013) found that small firms are responsible for a significant amount of net job creation. However, our results show that micro firms are net job destroyers, despite the reduction in the gap between job creation and destruction rates after the 2008-2009 economic downturn.

Table 4: Average quarterly contribution to total employment by size band and transition

Size band by transition	1999-2007	2008-2009	2011-2019
0-9	-1.02%	-0.76%	-0.67%
Activates	0.43%	0.39%	0.49%
Continuer, growing	0.66%	0.52%	0.61%
Continuer, shrinking	-1.24%	-0.93%	-1.20%
Exit	-0.87%	-0.75%	-0.58%
10-49	0.22%	0.16%	0.28%
Activates	0.17%	0.14%	0.17%
Continuer, growing	0.68%	0.55%	0.73%
Continuer, shrinking	-0.55%	-0.45%	-0.56%
Exit	-0.08%	-0.08%	-0.05%
50-249	0.22%	0.15%	0.27%
Activates	0.16%	0.10%	0.14%
Continuer, growing	0.56%	0.44%	0.59%
Continuer, shrinking	-0.42%	-0.34%	-0.43%
Exit	-0.07%	-0.05%	-0.04%
250+	1.00%	0.49%	0.57%
Activates	0.57%	0.19%	0.31%
Continuer, growing	1.92%	1.47%	1.77%
Continuer, shrinking	-1.13%	-1.08%	-1.43%
Exit	-0.35%	-0.10%	-0.08%

Source: Office for National Statistics – Inter-Departmental Business Register (IDBR)

Notes: Micro businesses appear to have a negative net effect, which would indicate the shrinkage of this group over time. In fact, Figure 5 suggests the micro business group has not shrunk. Given a large number of ‘no change’ incumbents, not shown in Table 4, the negative net effect would be small on the size of the group as a whole. However, it is also an artefact of our choice to allocate based on the size band the businesses finish in, rather than the one it starts in (as explained in Section 4.1). When businesses pass over the threshold from one group to another (for instance, grows such as to move into a larger size band) the contribution is allocated to the new sizeband. Other approaches are also possible in theory.

Following the method discussed in Section 3, we establish an age estimate. This allows us to further investigate job creation and destruction by the enterprise age and size. Our results show that young firms are the most at risk of exit, with job destruction due to exit generally falling as the enterprise grows older and becomes more established. In total, micro enterprises, at a point in time, stop creating jobs and in fact, they become net job destroyers. However, the rate of exiting old micro

enterprises has decreased over time which suggests that these net job destroying firms remain in the market. Table 5a decomposes the change in job destruction rates by age. The fall in job destruction holds across age bands for small enterprises.

Table 5a: Average quarterly job destruction from exit as proportion of total active employment

Job Destruction from exit by size and age

Size	Age	1999 -2007	2011-2019	Pre and post recession change
0-9		0.87%	0.58%	-0.30%
	0-1	0.30%	0.25%	-0.05%
	2-4	0.15%	0.09%	-0.06%
	5-9	0.14%	0.06%	-0.08%
	10-14	0.10%	0.04%	-0.06%
	15+	0.18%	0.13%	-0.04%
10-249		0.15%	0.09%	-0.06%
	0-1	0.06%	0.05%	-0.02%
	2-4	0.03%	0.02%	-0.01%
	5-9	0.02%	0.01%	-0.01%
	10-14	0.01%	0.01%	-0.01%
	15+	0.03%	0.01%	-0.02%
250+		0.35%	0.08%	-0.27%
	0-1	0.19%	0.06%	-0.13%
	2-4	0.02%	0.01%	-0.01%
	5-9	0.08%	0.01%	-0.08%
	10-14	0.02%	0.00%	-0.02%
	15+	0.04%	0.01%	-0.03%
Total job destruction from exit		1.37%	0.75%	-0.63%

Source: Office for National Statistics – Inter-Departmental Business Register (IDBR)

The “up-or-out dynamic” would show high rates of both gross job creation and destruction for young firms, and this is the case, as shown in Table 5b. Micro enterprises (0 to 9 workers) have a high job destruction rate but it is lower in the post-crisis period relative to the pre-crisis period. This is mainly explained by the decrease in the exit of older micro firms. By comparison, Table 5c shows the average quarterly job creation and destruction of young micro firms. These enterprises are very dynamic –

high job creation and destruction – however, the net effect of young continuer small enterprises is negative on employment. Our results differ from the results of Decker, Haltiwanger, Jarmin and Miranda (2013), where for the US the study finds that the role of young dynamic businesses in the economy is decreasing over time.

Table 5b: Average contributions to change in total enterprise active workforce by age band and size band

Size band by ageband			
	1999-2007	2008-2009	2011-2019
0-9	-1.03%	-0.76%	-0.67%
0-1	0.00%	0.08%	0.09%
2-4	-0.24%	-0.22%	-0.22%
5-9	-0.26%	-0.19%	-0.16%
10-14	-0.19%	-0.10%	-0.10%
15+	-0.35%	-0.32%	-0.28%
10-49	0.22%	0.16%	0.29%
0-1	0.20%	0.14%	0.20%
2-4	0.04%	0.03%	0.04%
5-9	0.02%	0.02%	0.03%
10-14	0.00%	0.00%	0.01%
15+	-0.03%	-0.02%	0.00%
50-249	0.22%	0.15%	0.27%
0-1	0.18%	0.12%	0.16%
2-4	0.03%	0.03%	0.04%
5-9	0.02%	0.02%	0.03%
10-14	0.00%	0.01%	0.01%
15+	-0.01%	-0.02%	0.03%
250+	1.00%	0.48%	0.57%
0-1	0.47%	0.20%	0.33%
2-4	0.10%	0.06%	0.06%
5-9	0.07%	-0.02%	0.05%
10-14	0.18%	0.06%	0.04%
15+	0.17%	0.18%	0.08%
Total	0.41%	0.03%	0.45%

Source: Office for National Statistics – Inter-Departmental Business Register (IDBR)

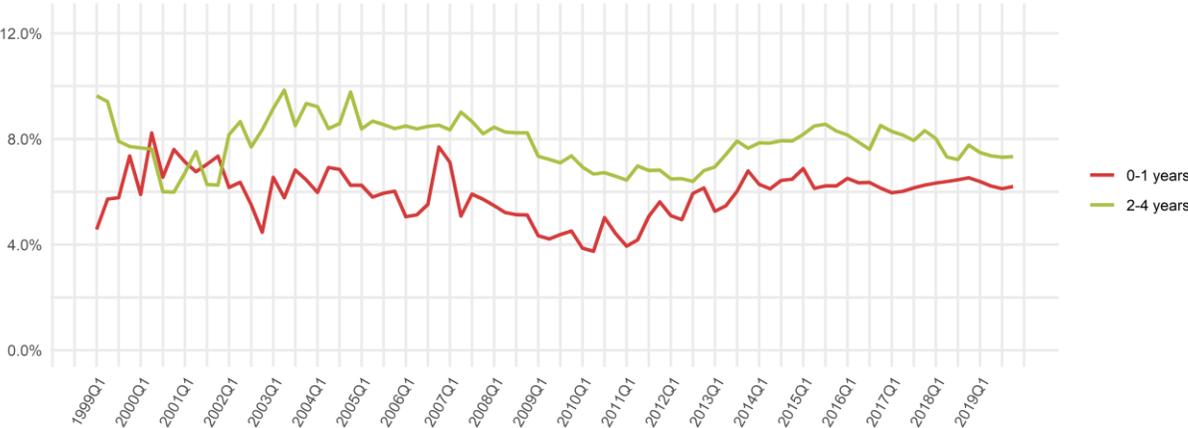
As a consequence of the high exit rates for young firms prior to the crisis, the economy is dominated by older enterprises. The proportion of young enterprises (0 to 1 and 2 to 4 years old) reaches a peak between 2003-2004. It begins to decline until 2011, where the lower exit rate of young enterprises leaves a larger proportion in the overall workforce. By 2013 the entry and exit rates of young enterprises has stabilized as shown in Figure 11.

Table 5c: Job creation and destruction rates of young firms as a proportion of total active employment

Small and young enterprises					Pre and post recession change
Size	Age	1999-2007	2008-2009	2011-2019	
0-9	0-1				
	Job Creation	0.62%	0.53%	0.67%	0.05%
	activates	0.43%	0.39%	0.49%	0.07%
	continuer, growing	0.19%	0.14%	0.18%	-0.02%
	Job Destruction	-0.61%	-0.45%	-0.58%	-0.03%
	closing	-0.22%	-0.11%	-0.12%	-0.09%
	continuer, shrinking	-0.32%	-0.21%	-0.33%	0.01%
	deactivates	-0.08%	-0.14%	-0.13%	0.05%
	Total	0.00%	0.08%	0.09%	0.09%

Source: Office for National Statistics – Inter-Departmental Business Register (IDBR)

Figure 11: Proportion of workforce in young active enterprises (0-1 years old and 2-4 years old)

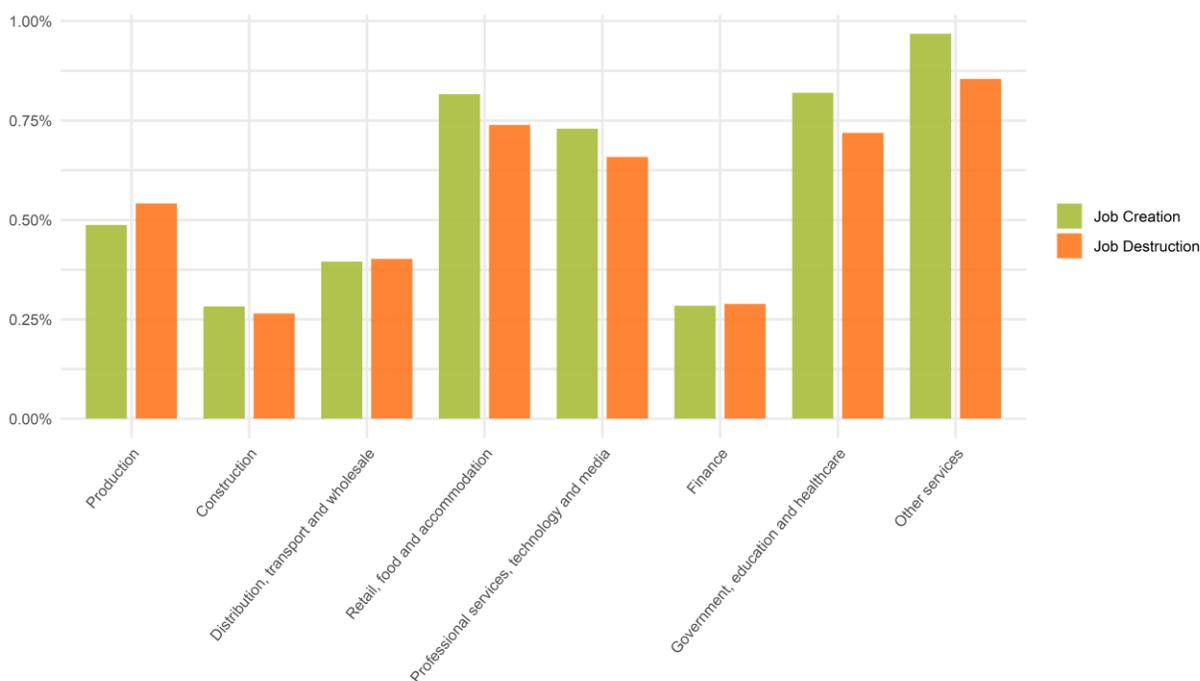


Source: Office for National Statistics – Inter-Departmental Business Register (IDBR)

5.3 Analysis by industry

Figure 12a shows average quarterly job creation by net job creators and job destruction by net job destroyers for broad industry groups. Over the last 20 years, the largest share of job destruction (excluding the public sector) comes from Other Services, Retail, Food and Accommodation and Professional Services, Technology and Media industries, with the job destruction rates of 0.85%, 0.74% and 0.66%, on average per quarter, over the active IDBR total employment, respectively. This is equivalent to 252,000, 217,000 and 194,000 jobs destroyed on average per quarter, respectively. In terms of job creation, the same sectors are responsible for creating the most jobs where they create 286,000, 240,000 and 216,000 jobs on average per quarter, respectively, over the same sample period.

Figure 12a: Quarterly average net job creation by entering and expanding enterprises and net job destruction by exiting and shrinking enterprises as fraction of broad industry group employment, 1999 to 2019

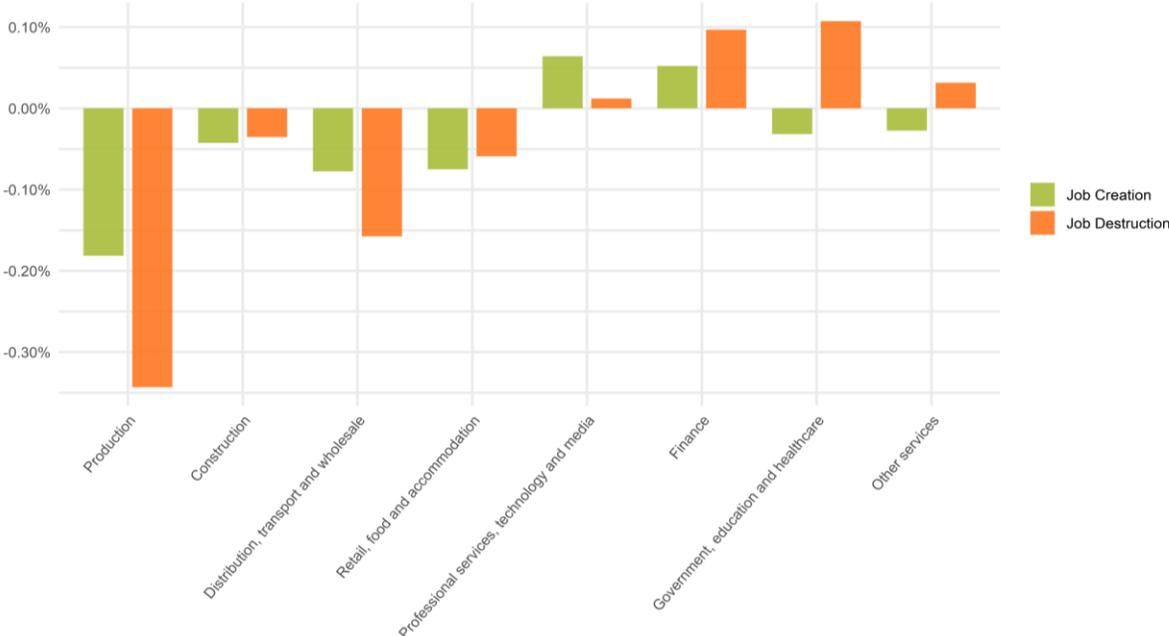


Source: Office for National Statistics – Inter-Departmental Business Register (IDBR)

Figure 12b shows that Production has the largest fall in job destruction rates between the two periods, due largely to changes in job destruction rates at large continuing enterprises and small

exiting enterprises. The production industries employed 4.6 million workers at the beginning of 1999, and currently employs 3.3 million workers. Before the financial crisis, the sector was destroying 200,000 jobs and in recent times, it is destroying 121,000 jobs, on average per quarter. Increased automation and increased international competition (and the interaction of the two factors) are important drivers of this trend. Both were strong in the 2000s, particularly with the entry of China into the WTO and the further integration of Eastern European economies into international supply chains. Total factor productivity growth in manufacturing in the pre-2008 period was considerable, but mainly due to falling inputs, indicative of some degree of cleansing through competition hitting lower productivity parts of the industry. While job creation relative to the rest of the economy is still lower for Production in 2011 to 2019 than 1999 to 2007, the fall in job destruction might be seen as a positive sign that the remaining manufacturing sector in 2011 is less vulnerable to international competition.

Figure 12b: Quarterly average changes in net job creation by entering and expanding enterprises and net job destruction by exiting and shrinking enterprises as fraction of broad industry group employment. Difference between pre and post crisis average contributions.



Source: Office for National Statistics – Inter-Departmental Business Register (IDBR)

The growth areas are services. Low value-added and relatively lower-paid sectors of the economy, particularly the accommodation and food sector, are key contributors, and the Retail, Food and

Accommodation industry grouping grew by 2.4% as a share of total employment over the period – ranked third in terms of the largest growing industry over the last 20 years. Only Professional Services, Technology and Media and Other Services grew more, 4.1% and 3.1%, respectively.

Table 6a shows job destruction by exiting firms by industry and Table 6b shows job creation by entering firms by industry. Other Services is the most dynamic industry grouping with the high job creation and destruction rates, including after the industry biggest decrease in both rates. The decrease in job destruction due to exit seems to be evenly distributed throughout sectors, excluding Construction and Finance where the decrease is lower. Job creation by entry is mainly lower due to Other Services.

Table 6a: Job Destruction from exiting firms by industry

	1999-2007	2008-2009	2011-2019	Pre and post recession change
Construction	0.07%	0.08%	0.05%	-0.02%
Distribution, transport, wholesale	0.16%	0.09%	0.07%	-0.10%
Finance	0.10%	0.05%	0.06%	-0.04%
Government, education, healthcare	0.17%	0.10%	0.09%	-0.08%
Other services	0.26%	0.22%	0.15%	-0.10%
Production	0.18%	0.11%	0.08%	-0.10%
Professional services, technology, media	0.23%	0.16%	0.14%	-0.09%
Retail, food, accommodation	0.19%	0.16%	0.10%	-0.09%
Total	1.36%	0.97%	0.74%	-0.62%

Source: Office for National Statistics – Inter-Departmental Business Register (IDBR)

Table 6b: Job Creation from entering firms by industry

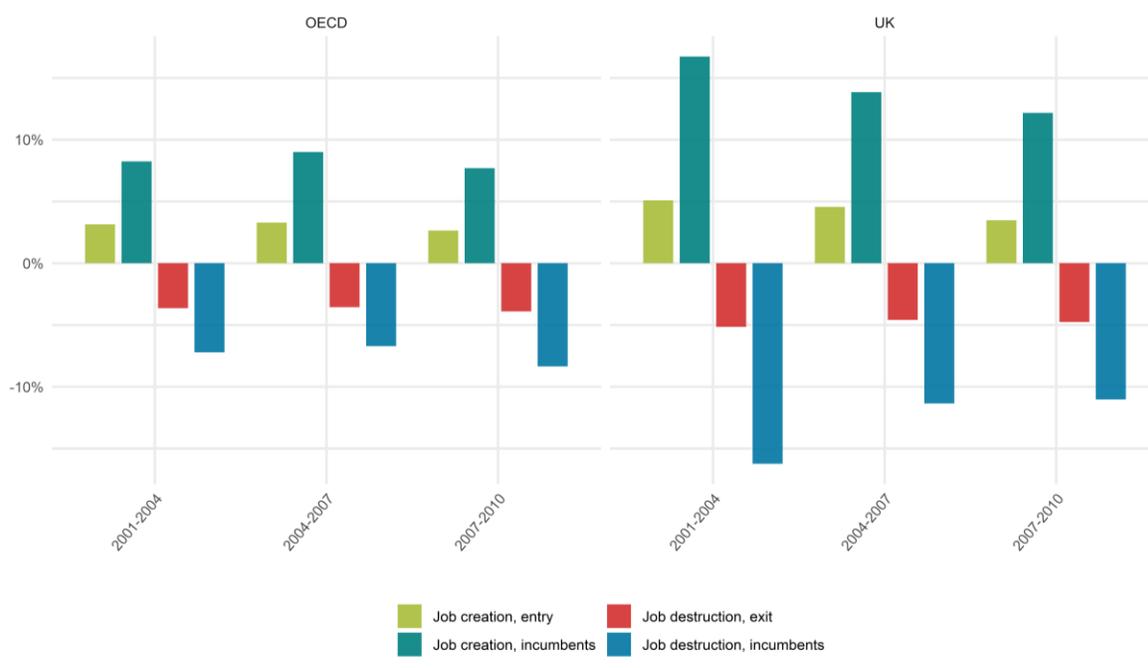
	1999-2007	2008-2009	2011-2019	Pre and post recession change
Construction	0.09%	0.07%	0.08%	-0.01%
Distribution, transport, wholesale	0.10%	0.06%	0.09%	-0.01%
Finance	0.08%	0.03%	0.07%	-0.01%
Government, education, healthcare	0.16%	0.08%	0.12%	-0.04%
Other services	0.30%	0.21%	0.22%	-0.08%
Production	0.15%	0.08%	0.11%	-0.04%
Professional services, technology, media	0.25%	0.16%	0.24%	0.00%
Retail, food, accommodation	0.20%	0.13%	0.18%	-0.02%
Total	1.33%	0.82%	1.12%	-0.21%

Source: Office for National Statistics – Inter-Departmental Business Register (IDBR)

5.4 International comparisons

In this section, we compare our findings to the cross-country measures that the OECD has conducted as part of the wider Dynemp project. We also compare our reallocation rates with the US data provided by the US Census Bureau¹⁰. Although there are differences in the methodologies, we find similar and interesting results from this exercise.

Figure 13: Gross job flows by intensive (incumbents) and extensive (entry-exit) margins, periods between 2001 and 2010



Source: Office for National Statistics – Inter-Departmental Business Register (IDBR), OECD – DynEmp

Notes: We use the average gross job flows from our dataset for the UK. The OECD compute their average flows for 18 countries including GBR¹¹.

Figure 13 decomposes the job creation and destruction rates by intensive and extensive margins in different periods between 2001 and 2010. The chart on the left shows the figures corresponding to the UK using our data whilst the one on the right shows the cross-country average for 18 OECD countries.¹² Due to the fact that we use a different classification for types of enterprises, for the ease

¹⁰ 2018 BSD Tables: <https://www.census.gov/data/tables/time-series/econ/bds/bds-tables.html>

¹¹ DynEmp and MultiProd Metadata

https://www.oecd-ilibrary.org/science-and-technology/dynemp-and-multiprod-metadata_3dcde184-en

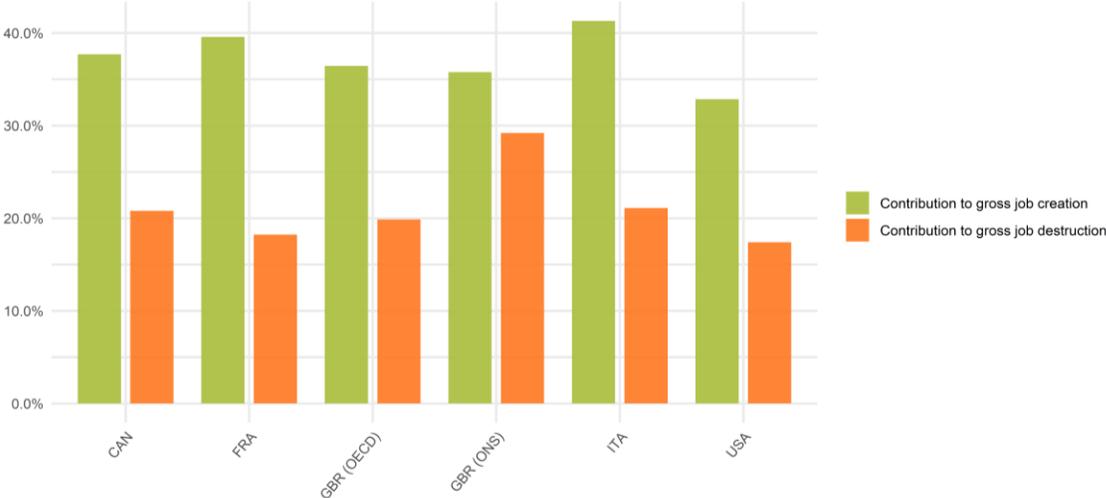
¹² GBR is included in this average calculation.

of comparison, we refer continuers (both growing and shrinking) and activators in our dataset as incumbents. We can see that the trends are similar, even though the UK figures are larger in magnitude – especially for incumbents. As mentioned in section 4.2, this can be at some extent explained by the higher fluctuations between quarters within existing firms – captured by our methodology. Also, the UK presents a more persistent decline than the average cross-country trend.

The business dynamism literature highlights the role of young SMEs on employment dynamics. Figure 14 shows that that the UK’s contribution from young SMEs to total employment is similar to its counterparts in countries like the US, Canada, Italy and France.

The OECD results for the UK are consistent for gross job creation contribution but they slightly differ on job destruction. This is explained by our larger measure for job destruction by firm exits explained in section 4.1. Since young SMEs are likely to enter and leave the market in a higher frequency than older firms, most of their job creation and job destruction comes from entry and exit. Hence, a larger job destruction measure from firm exits increases the contribution from young firms on total job destruction.

Figure 14: Average contribution to job creation and job destruction by young SMEs, 2001 to 2009



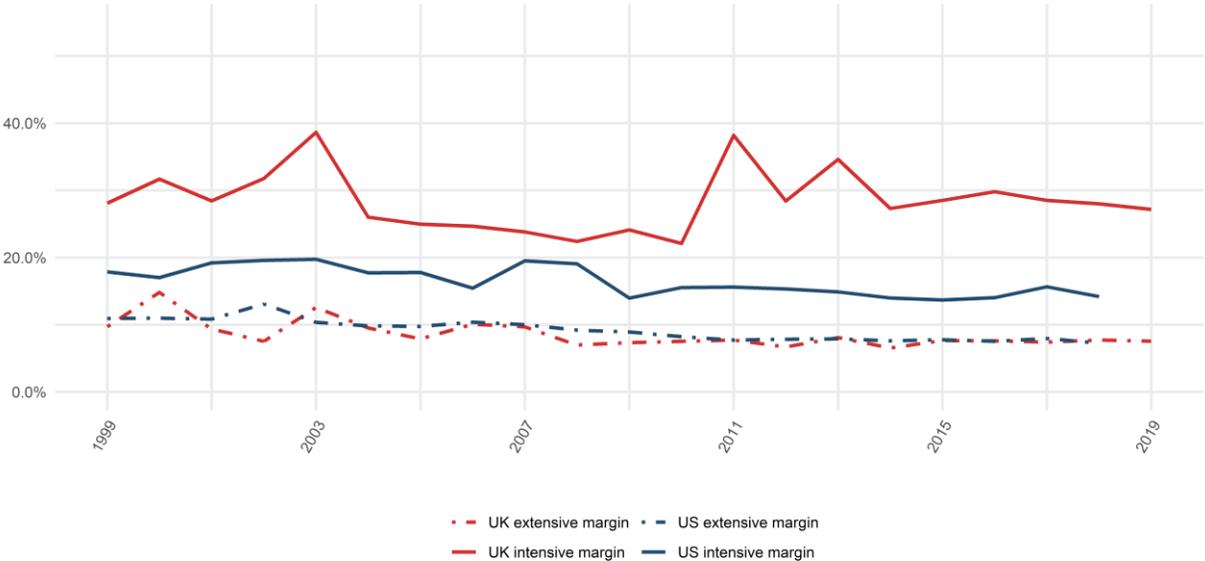
Source: Office for National Statistics – Inter-Departmental Business Register (IDBR), OECD – DynEmp

Notes: Young SMEs are defined by the OECD as enterprises with fewer than 250 employees that are between 0 and 5 years old.

A significant amount of research into business dynamics is based on data produced by the US Census Bureau. Figure 15 compares the annual extensive and intensive reallocation rates for the US and the UK. As before, the extensive margin trends and levels of the UK are consistent with those of the US, whilst the intensive margin shows more differences between these two countries. This is partially explained by the higher quarterly frequency.

There is an important difference in the long-term trend between the job reallocation rate within existing firms. In the US, the job reallocation is persistently decreasing in both margins whilst in the UK this is just true for the extensive margin. As shown in previous sub-sections, job destruction from incumbents has increased during the last decade in the UK. Since job creation has not significantly gone down, this directly translates into higher rates of job reallocation. Existing businesses in the UK are shrinking in a larger proportion while job creation rates have not changed significantly. Incumbents in the US are not shrinking as much as before but they are not creating new jobs either.

Figure 15: Reallocation rates for the US and the UK (using our data), annualised rates, from 1999 to 2019



Source: Office for National Statistics – Inter-Departmental Business Register (IDBR), US Census Bureau

Overall, our results are consistent with other cross-country measures. Part of the discrepancies come from the difference in methodologies and the higher frequency we use in this analysis. However, the UK is clearly experiencing a different trend for incumbents compared to the US. The reasons of this

may be linked to market structure or regulatory differences – which could be explored in future research.

5.5 Econometric analysis

In this subsection, we present results obtained using the econometric model discussed in section 4.3 in order to support our descriptive statistics. Figure 16a reports the effect of size on the growth rate of employment of the enterprise, weighted by the size of the enterprise, following Haltiwanger, Jarmin and Miranda (2013). The total marginal effect for each sizeband on employment growth is calculated for each quarter, with the 95% confidence interval shown. By computing the total marginal effect using the interactions of age and industry controls, we control for any composition effects of different size and age firms spread in different industries. It shows that the only size band that has a significant effect on employment growth is businesses that employ between 0 to 9 employees. The marginal effect of being in another size band is non-significant as the confidence intervals are over zero.

Figure 16b reports the same specification for age, accounting for composition effects from size and industry. Similar to the size effect, the only age band that has a significant effect on employment growth are young enterprises (0 to 1 years old). Nevertheless, the direction of the effect is different between age and size. The average marginal effect from small businesses is negative while the average marginal effect of young businesses is positive.

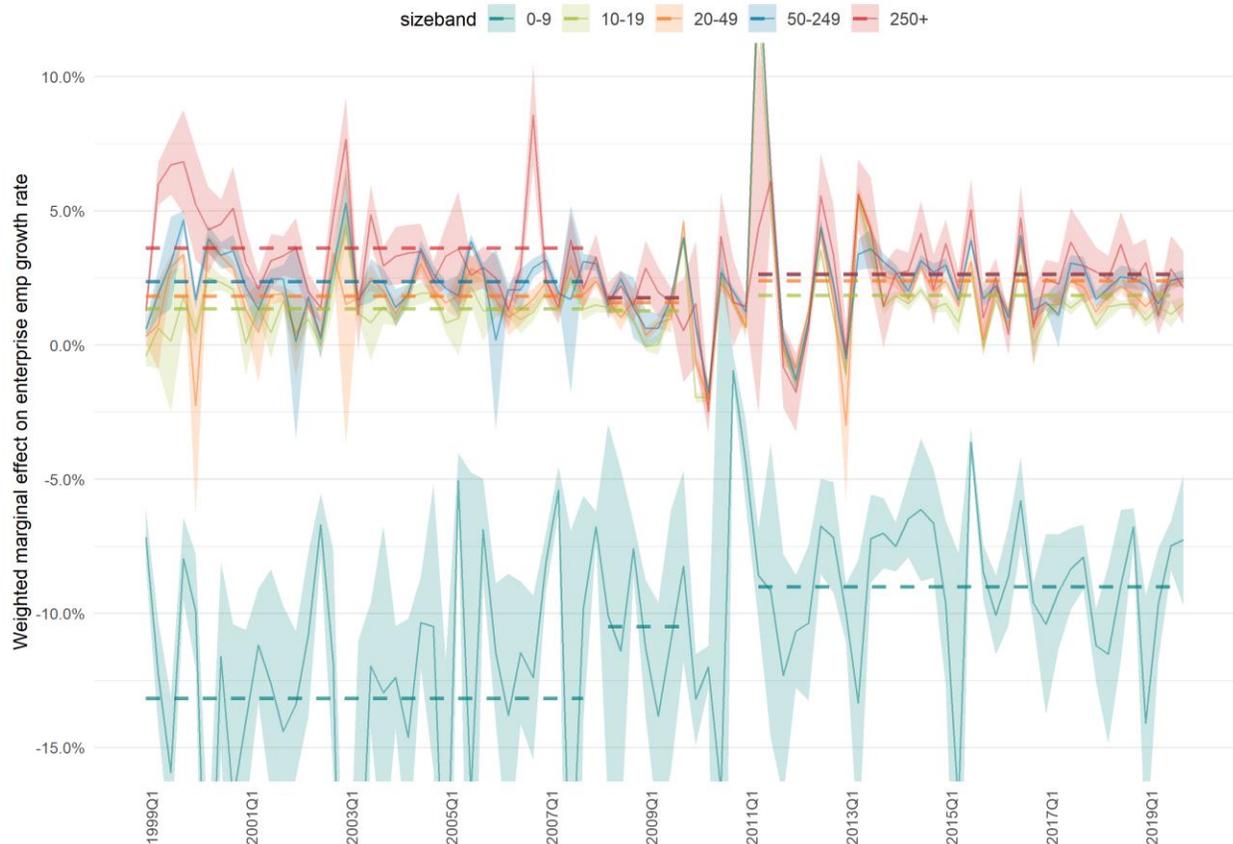
In general, age is the more important factor than size. The effect of being a young enterprise (0 to 1 years) on net growth is higher than the effect of being a small enterprise (0 to 9 workers) on net reduction consistently, despite many quarters of volatile coefficients.

However, our results suggest the main change over the past two decades is the effect of size. Table 7a and 7b show the marginal effect from size and age on employment growth for three different periods. From 1999 to 2007, the average marginal effect of the dummy variable for sizeband 0 to 9 is -13%, which shrinks in magnitude to 9% for 2011 to 2019. The average marginal effect of the dummy variable for age 0 to 1 is 29% in the earlier period and 27% in the later period, a shallower decline. Small enterprises are on net not contributing to job destruction as strongly as before 2008, even accounting for the new age structure of enterprises in the 2010s.

Figure 16c shows the effect size of age only on job destruction, $\gamma_{it} * I(\gamma_{it} < 0)$, rather than net growth in either direction. Taken with Figure 16b, this shows the “up-or-out” pattern: while being a young

enterprise has the strongest effect on net growth, it also has the strongest effect on net shrinking. The change over time in this relationship is negligible: given the changing mix of firm sizes and industry composition, there is no substantial change in the rate at which age determines growth and reduction in enterprise employment.

Figure 16a: Marginal effects of size on growth, individual regressions per quarter



Source: Office for National Statistics – Inter-Departmental Business Register (IDBR)

Table 7a: Average marginal effect by size on employment growth, for three periods, UK.

	1999-2007	2008-2009	2011-2019
0-9	-13.17%	-10.49%	-9.00%
10-49	1.35%	1.27%	1.85%
50-249	1.82%	1.58%	2.40%
250+	2.37%	1.76%	2.63%

Source: Office for National Statistics – Inter-Departmental Business Register (IDBR)

Figure 16b: Marginal effects of age on growth, individual regressions per quarter



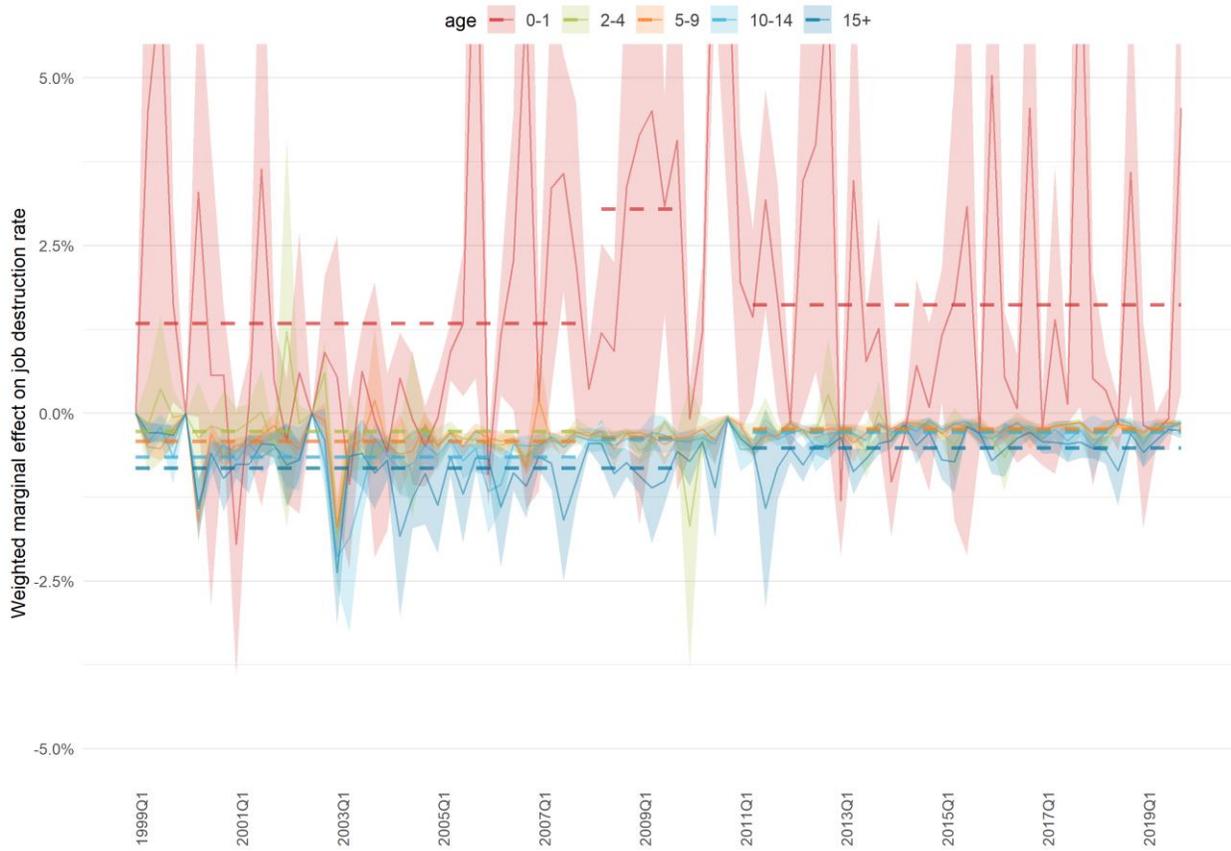
Source: Office for National Statistics – Inter-Departmental Business Register (IDBR)

Table 7b: Average marginal effect by age on employment growth, for three periods, UK.

	1999-2007	2008-2009	2011-2019
0-1	28.61%	27.32%	26.72%
2-4	2.64%	1.73%	2.59%
5-9	0.64%	-0.29%	0.70%
10-14	-0.13%	0.24%	0.34%
15+	-1.29%	-1.19%	-0.89%

Source: Office for National Statistics – Inter-Departmental Business Register (IDBR)

Figure 16c: Marginal effects of age on rate of job destruction, individual regressions per quarter



Source: Office for National Statistics – Inter-Departmental Business Register (IDBR)

Table 7c: Average marginal effect by age on job destruction rate, for three periods, UK.

	1999-2007	2008-2009	2011-2019
0-1	1.34%	3.05%	1.62%
2-4	-0.27%	-0.36%	-0.25%
5-9	-0.42%	-0.37%	-0.24%
10-14	-0.65%	-0.39%	-0.28%
15+	-0.81%	-0.81%	-0.51%

Source: Office for National Statistics – Inter-Departmental Business Register (IDBR)

5.6 Robustness

These trends are robust to using the standard employment information from the IDBR. For the above analysis we used PAYE data where possible to get a timelier and higher frequency time series for more enterprises, only using other sources where no unambiguous PAYE data could be used. However, using the default IDBR enterprise employment, based on a mixture of PAYE and slower-frequency ONS survey data, the same trends in business dynamism broadly hold.

6. Conclusion

Our paper makes numerous contributions to the current literature – importantly, the creation of a novel firm-level dataset designed to understand firm dynamics at quarterly frequency. This is achieved by using two consecutive quarterly snapshots to build an active enterprise population for a reference quarter, using different metrics (employment, turnover, number of administrative units) to identify activity throughout the quarter. Secondly, we construct a measure of business activity based on the changes of the businesses linked over three consecutive quarters, and age estimates. Thirdly, we construct measures of change in employment at the firm level from the income tax data that feeds into the IDBR to reveal a picture of employment dynamics at a quarterly frequency, using more timely information than those used in previous related analysis where their ultimate data source for employment are ONS business surveys.

Using the data and methodology implemented in this paper, our results show that business dynamism has fallen in the UK which is consistent with multiple studies. We can identify that the drop in business dynamism in all measures: job creation and destruction rates, in particular, by extensive margins. The fall in job creation was shallower than the fall in job destruction which help to explain the growing labour market in recent years. The intensive margin is also significant because it contains over 96% of the economy's total workforce, but the job creation rate has declined and the job destruction rate has risen – overall, it has a smaller share in UK's total employment. This result challenges the results of existing studies that incumbents create the most jobs in the UK. Previous studies were done in annual frequency capturing less dynamism and lower rates of job destruction.

We find that micro enterprises are primarily responsible for the decline in the job destruction rate from enterprise exits. A lower exit rate may allow low-productive businesses to stay in the economy, which would have a negative impact on labour productivity. Although new micro enterprises are creating more jobs, the net job creation is overall negative. Large enterprises experience a decline in both job creation and destruction by extensive margins. The decline in both rates almost offset each other which suggests that the potential change is from legal and administrative restructuring of the enterprises.

Age has an important role in UK's business dynamism where young firms exhibit high rates of job creation and destruction, but they are also the main contributors to job creation. This is consistent with the international literature. In addition, we can find that old micro firms are mostly destroying jobs but at a slower rate than pre-2008. This suggests the micro firms are failing to grow after a period of time, which could indicate two effects: age is more important than size and they are high barriers to exit. These are critical findings because many policies are designed for SMEs which inadvertently protect old inefficient firms. If policies are contingent upon age, it can protect young firms that are mainly creating jobs and are usually dynamic.

Our entry and exit figures are consistent with the ONS Business Demography releases, allowing us to do further comparisons. In general, our findings are in line with the existing UK and cross-country measures, although we find some discrepancies within incumbents. This is in part explained by the higher frequency we introduce in this work. However, there are structural differences in the job reallocation trend for incumbents when compared to the US.

7. Discussion

This article has provided a detailed description and analysis of business dynamism with the aim to understand employment dynamics in the UK. In addition, it has also contributed with the introduction of a novel dataset that is designed to capture changes firms have gone through over a reference period and includes more timely information from an administrative source. However, there are some key caveats and data issues that are worth discussing in detail. The largest of these issues are summarised in this section, yet none of them present unsurmountable obstacles.

7.1 Caveats and limitations

7.1.1 Firm continuity

Firm age, birth and death remain complex issues and there are potential solutions to address this issue. Our dataset can only track the continuation of legal units rather than firms. This implies that reactivations or changes in legal structure could be misleading in terms of continuity. In terms of births, it is difficult to distinguish real births from reactivations or an organisation undergoing restructuring which causes issues for calculating age. If we were able to recognise the real birth date, we still could not explicitly discuss the age of the firm because the firm could be operating for a period of time before it appears on the register. This issue exists with many international business registers.

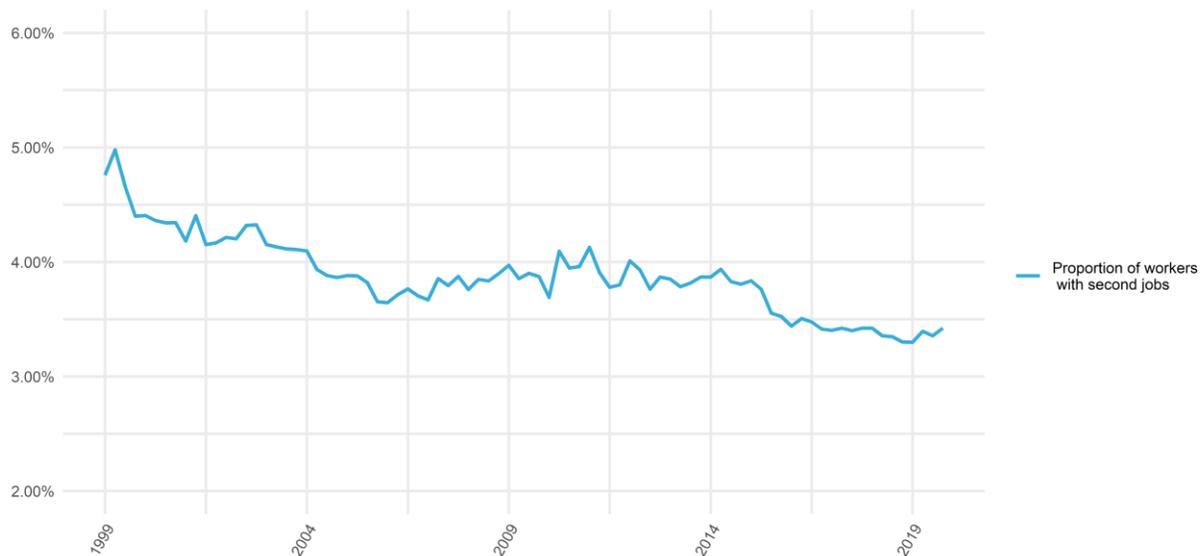
In terms of future improvements, being able to identify mergers, acquisitions and takeovers could help researchers to establish firm entry and exit more accurately. This can be potentially achieved in two different procedures. Firstly, we can link existing mergers and acquisitions survey data from the ONS to clearly identify firms undergoing structural changes. There is a drawback from using this method as our active populations are built using the IDBR that gives a near-population coverage of firms, but surveys are restricted by sample size. The second method is to link individual employment data (from HMRC) – a method used by Canada Statistics. It will allow the users to track employment through the different legal units. In other words, one will be able to observe continuity, mergers, acquisitions and takeovers clearly.

7.1.2 Employment measure

There are some limitations in our employment measure despite using information from PAYE. The employment measure is headcount per enterprise rather than full-time equivalent which is a common practice amongst OECD countries. It places a greater emphasis on part time employment – showing greater employment dynamics (Criscuolo et al., 2014). More detailed research will require more data sources giving characteristics for the business level workforce comprehensively.

A second limitation is that if we aggregate enterprise level employment, it does not represent the total number of individuals employed in the UK because some people have multiple jobs. Figure 17 illustrates the proportion of workers with seconds job. Initially, it was 4.9% and it has steadily declined over the years, currently at 3.4%.

Figure 17: Proportion of workers with second jobs



Source: Office for National Statistics – Employment and Labour Market

7.1.3 Missing quarters

As mentioned in Section 3, the IDBR is an administrative dataset and there are certain challenges with this type of data. In this context, we are aware of the existence of missing quarters, poor quality employment data or even the lack of up-to-date information. This generates spikes and outliers in our data, but the results are robust to this. We deemed it appropriate to exclude 2010 from the analysis and overall, it does not affect the trends presented.

7.2 Scope for improvement

The method we use to construct our dataset that aims to capture activity and changes in enterprises over a period of time reveals the potential to develop it into a longitudinal dataset for enterprises. The dataset could also be enriched by further linking it to all other IDBR business units including the enterprise group, enterprise, reporting and local units, as well as the administrative units, namely the VAT and PAYE units. Careful consideration needs to be taken into account when designing methods to deduce signs of activity of other IDBR units because different rules are followed when their information is updated on the register. Having a “longitudinal identity spine” established will allow us to link survey and administrative data collected from different units of the same firm together consistently over time. Not only this will provide us with a framework to further explore the

use of administrative data, it will also allow users to conduct sub-national level analysis. Although the construction and maintenance of such a longitudinal identity spine is a challenging task, it could offer numerous benefits for future economic analysis. In particular, enabling users to track the dynamics of both firms and their establishments and the potential to establish consistent measures of firm entry, exit and growth could significantly improve our understanding of the changes in the UK economy.

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Appendix

1. The Inter-departmental Business Register

The IDBR is a comprehensive dataset of UK businesses, developed in the 1990s to replace the Value Added Tax (VAT)-based register of the Central Statistical Office and Pay As You Earn (PAYE)-based register of the Employment Department¹³. It is maintained by the Office for National Statistics (ONS) based on data feeds from Companies House, HMRC and the approximately 250,000 per year responses to ONS business surveys. It provides a sampling frame for surveys of business activities, conducted by the Office for National Statistics (ONS) and other government departments.

The IDBR covers all firms registered for VAT and/or PAYE schemes. It does not cover firms without VAT (e.g. those with low turnover and hence fall below the VAT threshold) or without PAYE schemes (e.g. those who are self-employed and those without employees). The number of live enterprises registered on the IDBR is around 3 million as of December 2019.

The register draws information on businesses from different sources:

1. Her Majesty's Revenue and Customs (HMRC) information about businesses registered for Value-Added Tax (VAT) and employers operating a Pay As You Earn (PAYE) tax scheme.
2. Companies House information about incorporated business; usually provided on a daily feed.
3. Dunn and Bradstreet information about business ownership links; usually updated annually, to populate information at the enterprise group level.
4. Survey information from the Department for the Economy in Northern Ireland¹⁴
5. Department for Environment, Food and Rural Affairs farms register.
6. ONS surveys data, direct contact with businesses

The administrative sources provide most of the information contained on the IDBR. Information from surveys supplement the administrative sources by identifying new, and maintaining existing, business structures, and if necessary ONS contacts businesses directly for the purpose of maintaining

¹³ See Review of the Inter-Departmental Business Register, National Statistics Quality Review Series, Report No. 2, 2001.

¹⁴ Formerly the Department for Enterprise, Trade and Investment (DETINI).

the structure on the IDBR¹⁵. With some exceptions, public bodies are treated as businesses on the IDBR in the same manner as private sector businesses. Entities are classified on the IDBR by sector – private corporation, public corporation, local government, central government, etc. – if necessary, on a case-by-case basis.¹⁶

The IDBR is a live register and is updated daily or as new information arrives. The IDBR is archived every quarter to 2016. A “snapshot” is taken of the IDBR on a day near the end of the quarter.¹⁷ From 2016 the core of the IDBR is also archived monthly, in addition to the quarterly archive snapshots.

The IDBR holds business names, addresses, standard industrial classification (SIC), employment, turnover and ownership and legal status. “Business” is an elastic concept. A business may be represented on the IDBR as different linked business units:

- Enterprise group: group of enterprises under common ownership.
- Enterprise: the smallest combination of legal units with certain degree of autonomy in decision-making. An enterprise can carry out one or more business activities at one or more locations. It could also be a sole legal unit.
- VAT unit: the VAT registration. An enterprise can have one or more VAT units.
- PAYE unit: the PAYE scheme. An enterprise can have one or more PAYE units.
- Local unit: part of an enterprise located in a geographically identified location where all or part of the economic activity of the enterprise is carried out (at least one worker for at least 20 hours per week)
- Reporting unit: the unit to which the ONS sends survey questionnaires. Almost always this is coterminous with the enterprise. However, for many large enterprises, subdivisions of the enterprise are created by arrangement with the ONS, to make separate reporting units within the enterprise. This is either to reduce reporting burden for large enterprises or because the enterprise is involved in various business activities that belong to multiple Standard Industrial Classification (SIC) codes. E.g. ONS has specific surveys for retailers, so surveys a retail division of an enterprise separately from a manufacturing division.

¹⁵ Evans, P., and Welpton, R. (2009), “Business Structure Database: The Inter-Departmental Business Register (IDBR) for Research”, Economic and Labour Market Review, Vol. 3, No. 6.

¹⁶ See “UK economic statistics sector and transaction classifications: the classification process” <https://www.ons.gov.uk/methodology/classificationsandstandards/economicstatisticsclassifications/ukenomicstatisticssectorandtransactionclassificationstheclassificationprocess> for more detail on classifications.

¹⁷ The Business Structure Database is the enterprise and local unit datasets from the March IDBR snapshot.

The highest-level business unit (enterprise/enterprise group) are attached to the lower-level business units (reporting unit), and administrative units (VAT unit and PAYE unit). Where there are multiple reporting units, the local units are attached to individual reporting units. Figure A1a and A1b display examples of a ‘simple’ firm and a ‘complex’ firm in terms of IDBR business units, respectively.

Figure A1a: ‘Simple’ business in the IDBR

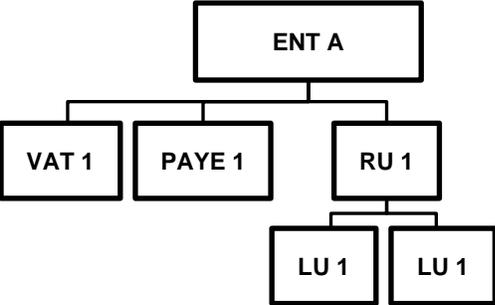
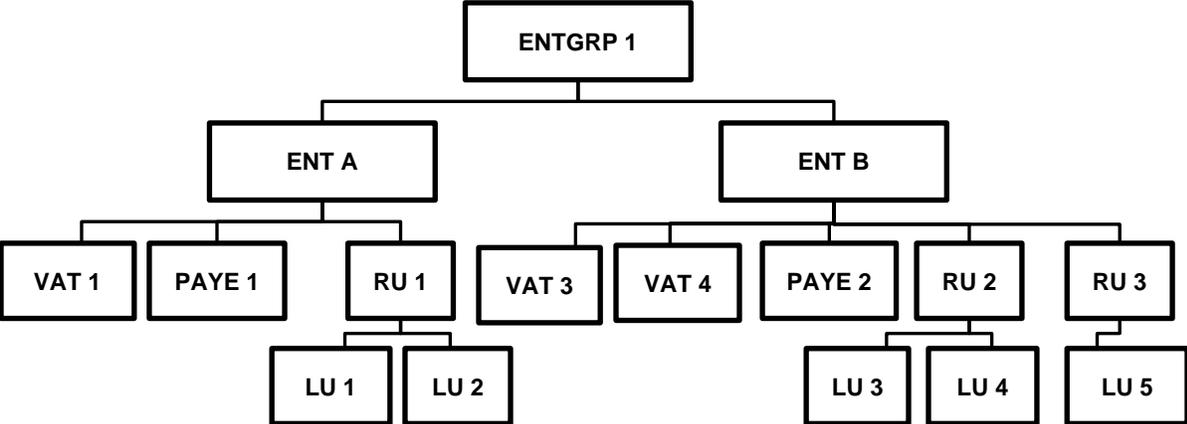


Figure A1b: ‘Complex’ business in the IDBR

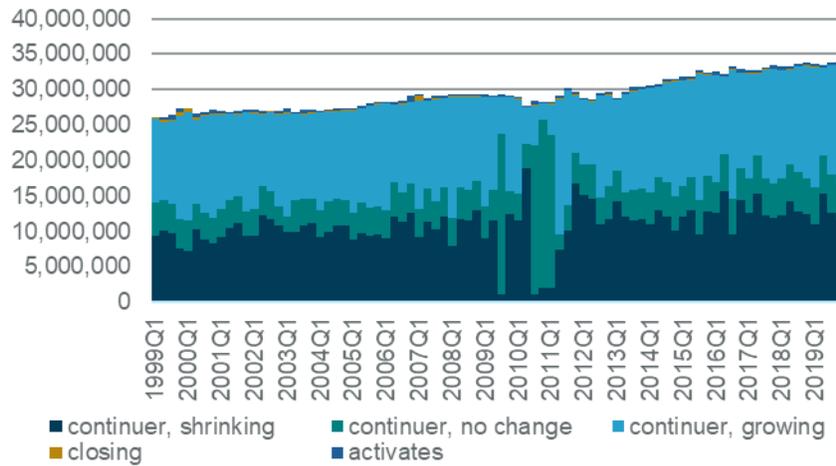


The IDBR contains records of both live and dead enterprises. An enterprise is born on the IDBR and its entry created when there is a birth of either a VAT unit or a PAYE unit, or both. An enterprise “dies” on the register when the ONS receives confirmation that it has ceased to trade, and the entry for a dead enterprise remains on the IDBR holding the information at its date of death. An enterprise will only be removed from the register if its structure has become “empty” – in the case when all of

its lower-level business units are removed. It is important to note that in our analysis, we refer to an enterprise as being active or inactive rather than alive or death. It is a real challenge to establish genuine birth and death of enterprises using information from the IDBR. Resolving this issue is beyond the scope of this paper and we do not attempt to look at enterprise activity status across more than three consecutive quarters. Besides, we observe that enterprises could be actively trading for some time and become inactive for some other time without being actually dead. We therefore consider enterprises as being active or inactive instead of alive or dead.

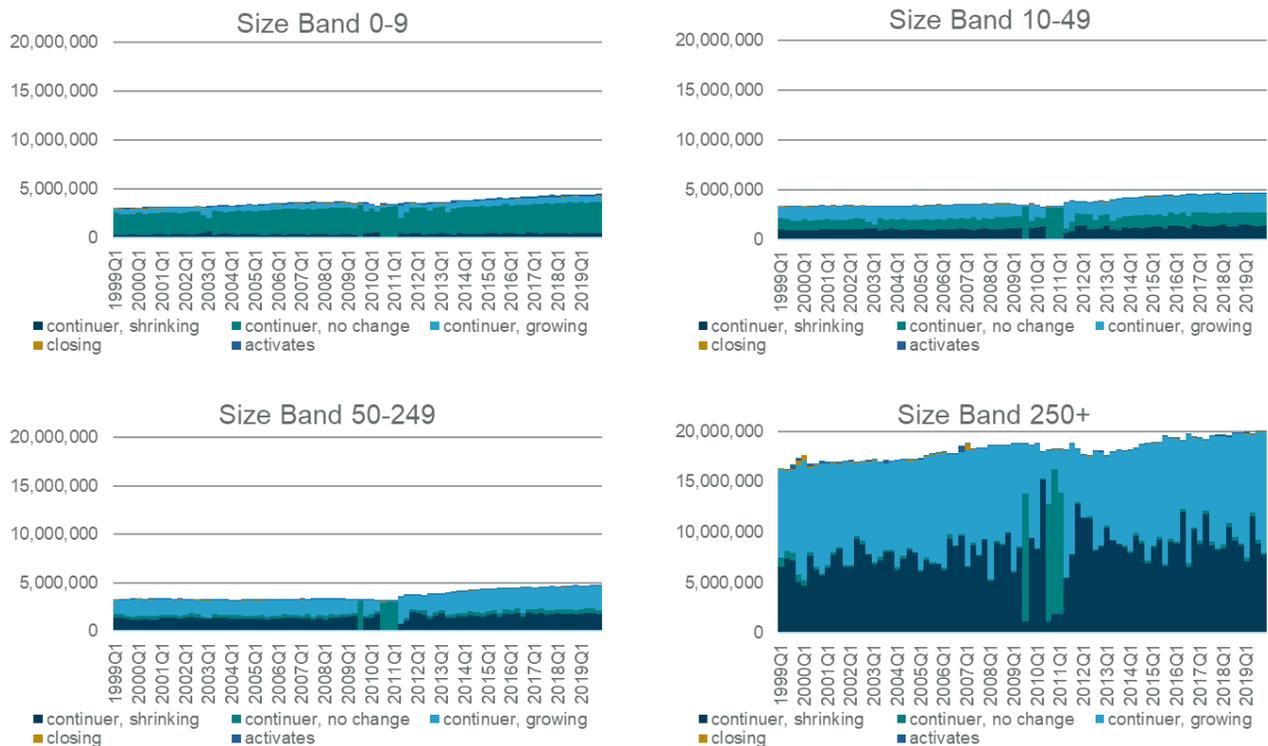
2. Levels of employment over time by transition status and size bands

Figure A2a: Total active IDBR workforce by quarterly transition status



Source: Office for National Statistics – Inter-Departmental Business Register (IDBR)

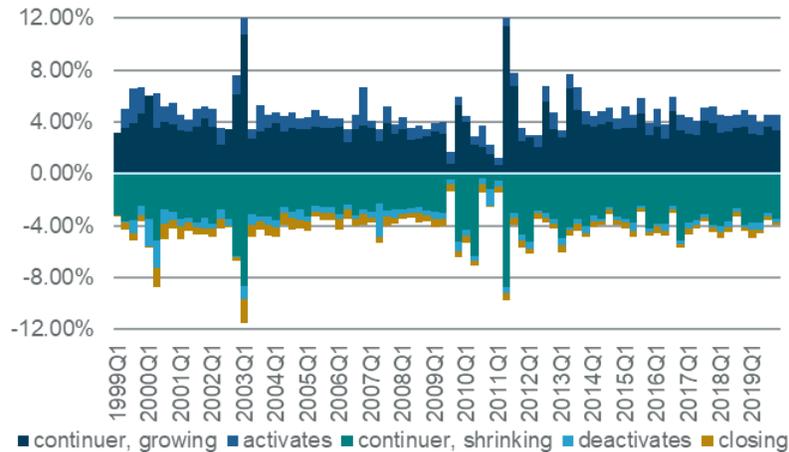
Figure A2b: Total active IDBR workforce by quarterly transition status and breakdown by sizeband



Source: Office for National Statistics – Inter-Departmental Business Register (IDBR)

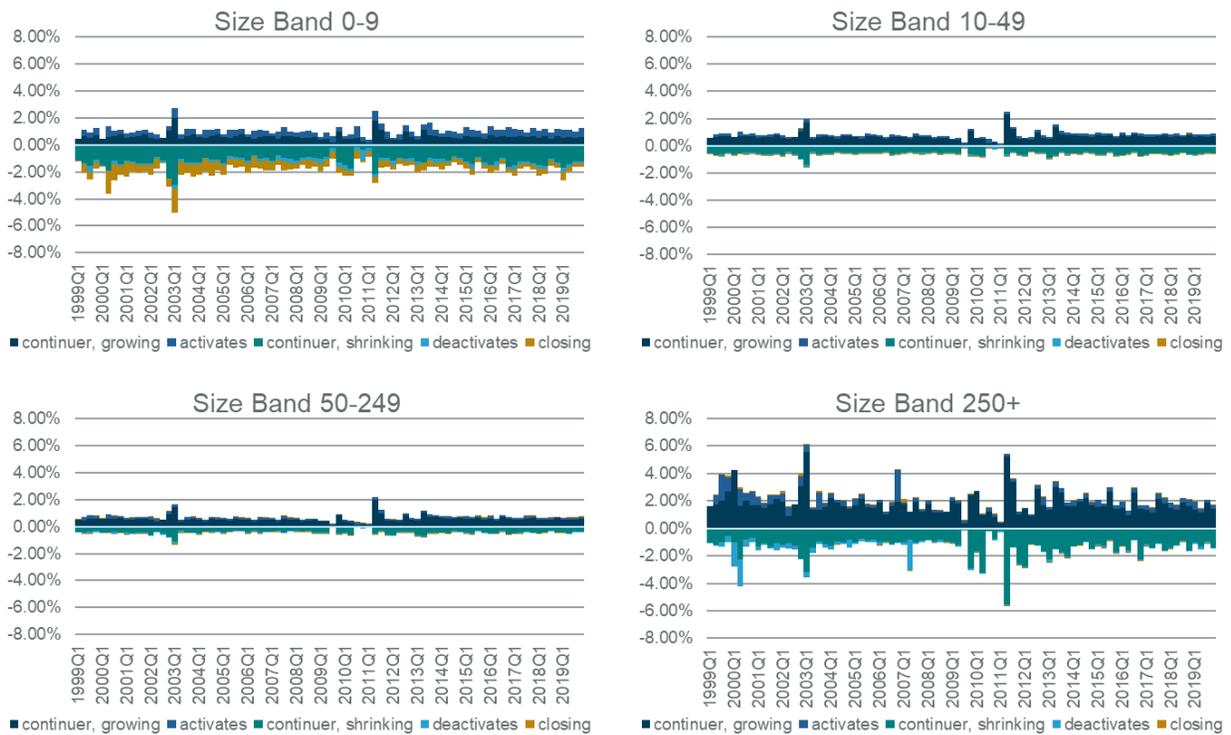
3. Employment proportional contribution over time by transition status and size band

Figure A3a: Proportional contributions to change in workforce by transition status



Source: Office for National Statistics – Inter-Departmental Business Register (IDBR)

Figure A3b: Proportional contributions to change in workforce by transition status and breakdown by sizeband



Source: Office for National Statistics – Inter-Departmental Business Register (IDBR)