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Age or Size? Determinants of Job Creation

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Age or Size? Contributions to Job Creation

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Abstract

Small firms have often been identified as drivers of job creation, although the evidence on their contribution to net employment growth has been disputed. This paper shows that job turnover and firm growth vary systematically across firm size groups and that smaller firms do indeed make an important contribution to new job creation. There is a significant caveat, however; we find that it is not firm size *per se* that is driving these results but rather firm age. The considerable overlap between the two properties, as young firms overwhelmingly tend to be small, has perhaps led to much of the effect of firm age being misattributed to size. We show that younger firms are consistently more dynamic than older firms and this holds across all size classes, not just amongst smaller firms. In addition, a relationship between lagged employment and firm growth is found to exist only for young firms.

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Non-Technical Summary

Aggregate changes in employment are the outcome of many individual firms making decisions on whether to expand or contract. The extent of this job churn is considerable and is typically many multiples of the net employment change. Small firms have been identified as tending to create and destroy jobs at higher rates than larger firms. However, the allegedly disproportionate contribution of small firms to net job creation has been disputed.

This paper shows that job turnover and firm growth vary systematically across firm size groups and that smaller firms do indeed make an important contribution to new job creation. There is a significant caveat, however; we find that it is not firm size *per se* that is driving these results but rather firm age. The considerable overlap between the two measures, as young firms overwhelmingly tend to be small, has perhaps led to much of the effect of firm age being misattributed to size.

Using a panel of Irish firms covering almost forty years, we find that younger firms, and entrants in particular, are the largest contributors to the creation of new jobs. Younger firms are consistently more dynamic than older firms and this holds across all size classes, not just amongst smaller firms. In terms of firm growth and size, we find a inverse relationship exists for young firms but that this declines in magnitude and statistical significance very markedly when the analysis is done separately for older age groups. This provides support for Gibrat's Law that size and growth are independent, but adds the qualifier that this holds once the firm has reached a mature state and does not apply to firms at the earliest stages of development.

From a policy perspective, these results imply that an environment supportive of business start-ups might be more effective in generating job creation than policies aimed more generically at specific size classes of firm. Many policies of benefit to business of course do not need to distinguish between whether they are useful to small or young or both, such as those relating to lowering red-tape burdens on firms. One area where such a distinction may be usefully made however is in policies to encourage early-firm funding access, as younger firms consistently report difficulties in access to formal sources of finance across a range of countries.

1 Introduction

Aggregate changes in employment are the outcome of many individual firms making decisions on whether to expand or contract. The extent of this job churn is considerable and is typically many multiples of the net employment change. Haltiwanger, Scarpetta and Schweiger (2008) find that combined job creation and destruction rates range from 25 to 30 percent of average total employment in their cross-country study. This breakdown of net employment change into its constituent job creation and destruction rates provides additional information on dynamic patterns underlying changes in the economy. One aspect of this which has received particular attention, both from economists and from policymakers, relates to the relative contributions of different firm types in driving these flows.

Since at least the work of Birch (1981), small firms have regularly been identified as playing a crucial role in aggregate job creation. This has been used by associations representing small business as an argument for preferential policies or supports to be targeted toward smaller firms. However, the allegedly disproportionate contribution of small firms to net job creation has been disputed, most notably by Davis, Haltiwanger and Schuh (1996) who emphasise the offsetting effect of higher job destruction amongst smaller firms.[1] Alongside this job turnover literature is the related empirical testing of the extent to which Gibrat's Law (that firm growth rates are independent of size) holds (Sutton, 1997). This paper combines elements of both the job turnover and firm growth literature to examine if small firms can be regarded as a driver of net job creation.

This builds on a recent paper by Haltiwanger, Jarmin and Miranda (2012) who have shown that, in the United States, net job creation is more strongly associated with young firms than with small firms. This refocusing away from firm size to firm age when examining contributions to job creation and firm growth is consistent with learning models of such as Jovanovic (1982), where firms are unsure of their potential productivity before they set up. Only once the firm begins production does it learn how productive and profitable it actually is. This leads to either quick exit by firms that discover they have had a low productivity draw or to rapid initial expansion of productive firms to reach their steady-state size. Haltiwanger, Jarmin and Miranda (2012) refer to this as an "up or out" dynamic for younger firms.

Given that the USA has a particularly flexible economy, with a reputation for entrepreneurial activity, it is not clear that these results would necessarily hold elsewhere. This paper examines this issue using a panel of Irish firms covering almost forty years. As in many European countries, Ireland has a social safety net designed for workers becoming unemployed but which in many circumstances cannot be accessed by self-employed people experiencing business difficulties. In addition, Ireland has personal bankruptcy laws with discharge periods as long as twelve years, which are likely to be an obstacle to serial entrepreneurship.[2] Given these differences in institutional background, the aim of this paper is to examine if the sizable contribution of young firms to job creation in the USA can be shown to hold more broadly.

We first show that differences in job turnover and firm growth vary systematically across firm size groups and that smaller firms do indeed make an important contribution to new job creation. There

[1] See also the reply by Carree and Klomp (1996).

[2] A very brief description of the rules can be found here:
http://www.citizensinformation.ie/en/money_and_tax/personal_finance/debt/what_is_bankruptcy.html#l1f4da.

is a significant caveat, however, which is that our results indicate that it is not firm size *per se* that is driving these results but rather firm age. We find that younger firms, and entrants in particular, are the largest contributors to the creation of new jobs, demonstrating that the Haltiwanger, Jarmin and Miranda (2012) findings are applicable beyond the USA. The considerable overlap between the two properties, as young firms overwhelmingly tend to be small, has perhaps led to much of the effect of firm age being misattributed to size.

We then expand on these findings to show that younger firms are consistently more dynamic than older firms and this holds across all size classes, not just amongst smaller firms. Dividing the sample into different age groups, we find a inverse relationship between employment growth and lagged size exists for young firms but that this declines in magnitude very markedly when the analysis is done for separately for older age groups. This provides some support for Gibrat's Law that size and growth are independent, but adds the qualifier that this holds once the firm has reached a mature state and does not apply to firms at the earliest stages of development.

From a policy perspective, particularly in the context of much debate on how best to develop a "growth agenda" in Europe, these results imply that an environment supportive of business start-ups might be more effective in generating job creation than policies aimed more generically at specific size classes of firm. Many policies of benefit to business of course do not need to distinguish between whether they are useful to small or young or both, such as those relating to lowering red-tape burdens on firms. One area where such a distinction may be usefully made however is in policies to encourage early-firm funding access, as younger firms consistently report difficulties in access to formal sources of finance across a range of countries (Ferrando and Griesshaber, 2011).

The remainder of the paper is organised as follows. Section 2 defines the job turnover definitions and discusses the data used. Section 3 presents calculations on the contributions of different firm types to job creation and destruction. Section 4 compares the rates at which firms move between different size brackets, demonstrating the greater dynamism of younger firms at all points of the size distribution. Section 5 revisits the Gibrat's law debate and shows how the size-growth relationship is affected by firm age. Section 6 concludes.

2 Definitions and Data

2.1 Job Turnover Definitions

The job flow measures we use are defined following Davis and Haltiwanger (1992, 1999):

- (Gross) job creation at time t is the employment gain summed over all business units that expand or set-up between *t-1* and *t*.
- (Gross) job destruction at time t is the employment loss summed over all business units that contract or shut down between *t-1* and *t*.
- Net employment change is job creation minus job destruction.
- (Gross) job turnover (or reallocation) is the sum of job creation and destruction.

Comparisons of job flows can be made more convenient by converting these measures into rates. In order to do this, the job flows literature uses a variant on the ordinary growth rate by defining the growth rate of the firm (or sector etc.) as the change in employment between *t-1* and *t* divided by the average of employment in *t-1* and *t* (unlike the more traditional definition of a growth rate which would divide by employment in *t-1*. The reason for this adjustment is that it gives a growth rate which is symmetric around zero and which lies within a closed interval *[2, 2]*, thereby allowing an integrated analysis of entry and exit.

The job creation rate is calculated as the sum of the size-weighted positive growth rates, while the job destruction rate is the sum of the size-weighted negative growth rates. Net employment growth is given by the difference between the two rates.

It should be emphasised that our calculations focus on job flows and not on worker flows (for a discussion of this distinction see Burda and Wyplotz (1994) or Davis and Haltiwanger (1999)). To explain what we mean by this, consider a firm that in one year has 20 employees and in the next year reports 21 employees. Our method regards this as the creation of one job. In practice, this could have involved four individuals leaving the company and five being hired. The contrary is also true and job reallocation may be treated as a lower bound to worker reallocation as it is obviously possible for workers to change jobs or move in and out of the labour market without any actual creation or destruction of jobs taking place.

The examination of data on gross job flows can be used to obtain additional information on employment dynamics, and give a better indication of the amount of structural change the economy is undergoing, which cannot be determined from aggregate employment and unemployment figures. The same net employment change may reflect very different rates of creation and destruction thereby masking an important element of the flexibility or volatility of the labour market (Konings, 1995). In addition higher simultaneous creation and destruction may imply higher adjustment costs for the economy despite resulting in the same net employment change.

2.2 Dataset

The job turnover measures are calculated using the Annual Employment Survey carried out by Forfás, the Irish government's policy advisory board for enterprise, trade and innovation. This survey tracks employment levels and has been carried out on an annual basis from 1972 to 2010, covering firms engaged in manufacturing and internationally traded services. The survey is initially carried out at the plant level and then aggregated to firm level using group identifiers; it is this firm level data that is used in this paper. Each firm is allocated a unique identifying number that allows researchers to follow them over time while preserving the anonymity of the data.

The survey aims to provide a near-census of manufacturing employment and to maximise response rates collects a very small number of variables, with the long time series being its main advantage over other sources. The data includes numbers of permanent full-time employees (and in more recent years also includes temporary or part-time employees), along with some descriptive information on the sector the firm operates in, ownership and location. The response rate generally lies in the vicinity of 80-85%. Firm age is reported when the firm first enters the sample and is available for approximately

Table 1: Distribution of Firms and Employment

I. Percentage of Firms					
Employment	<5 years	5 to 10 years	11 to 20 years	>20 years	Total
0 to 20	32.81	14.30	15.01	7.92	70.04
21 to 50	4.79	3.52	4.27	3.05	15.62
51 to 250	3.16	2.70	3.48	2.74	12.07
251+	0.47	0.51	0.70	0.58	2.26
Total	41.23	21.03	23.46	14.28	100.00
II. Percentage of Employment					
Employment	<5 years	5 to 10 years	11 to 20 years	>20 years	Total
0 to 20	6.11	2.78	2.97	1.71	13.56
21 to 50	4.90	3.26	3.94	2.85	14.96
51 to 250	10.35	8.19	10.65	8.44	37.64
251+	7.39	7.78	10.65	8.03	33.84
Total	28.74	22.01	28.22	21.03	100.00

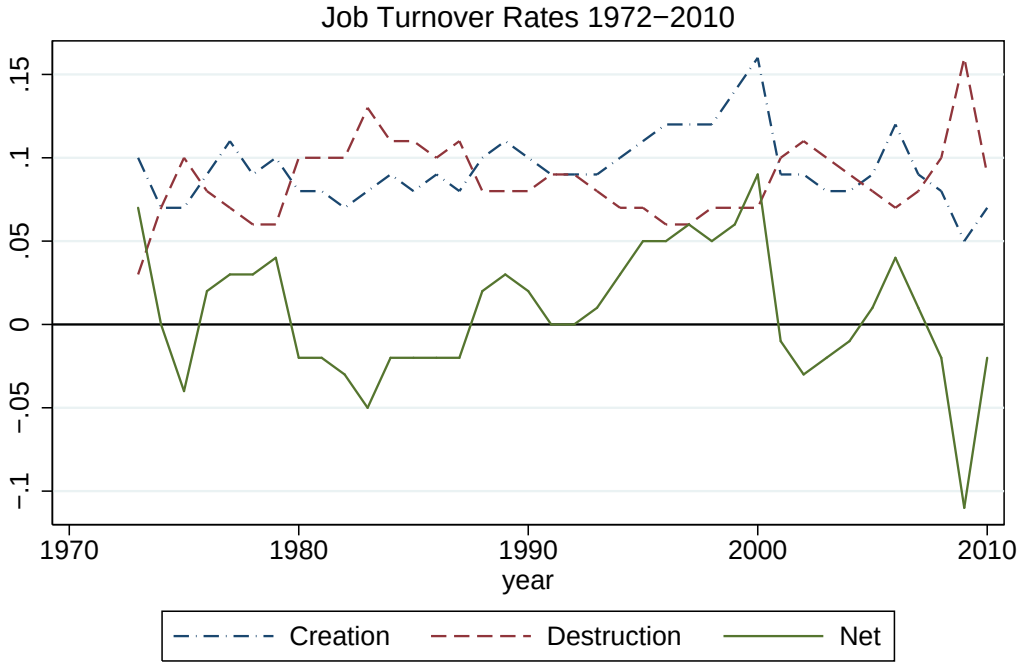
80% of the sample firms. The primary benefit of this data source is that it has been carried out on a consistent basis for a considerable period of time, allowing us to track the evolution of employment at the establishment level for 37 years. This data has been used previously by Görg and Strobl (2002) to estimate determinants of start-up size (at plant level) and by Lawless and Murphy (2008) and Lawless (2012) to look at patterns of job turnover.

Table 1 shows the distribution of the data across broad size and age categories. In the first panel, the data is broken down by the percentage of firms in each group, while the second panel calculates the percentage of employment accounted for by each group. Small firms, defined as having twenty or fewer employees, make up the bulk of firms in the economy (70%) but account for a relatively small share of employment (13.6%). Very few firms fall into the largest category of over 250 employees, but they account for slightly over one-third of total employment. The distribution of firms and employment across age categories is less skewed than across size groups - for example, very young firms (those founded less than 5 years) account for 41% of firms and 29% of employment, while the oldest group contains 14% of firms and employ 21% of the workers covered by the survey.

The distribution of firms and employment across size classes of the survey data can be compared to the totals from the Business Demography data collected by the Central Statistics office and shows the same pattern of firms being mainly concentrated in the smallest size category but employment somewhat more evenly distributed across firm size classes (see Table A1 in the appendix for the comparisons). This shows that relative to the total data, there are fewer very small firms in the data analysed here.

This distribution is not a special case related to Ireland. The same pattern across both size and

Figure 1



age categories can be drawn from the US Census Bureau's Business Dynamics Statistics.[3]. Table A2 shows how similar the distribution is to that in Table 1, restricting the sample to manufacturing for maximum comparability although the distribution across all sectors is not dramatically different.

The interlinkage between age and size is the focus of this paper. Looking at the distribution of firms in Table 1, we can already see that very young firms make up a considerable proportion of all small firms, and furthermore that this youngest category is almost always small. Older firms tend to be more evenly distributed across the size classes than younger firms.

3 Contributions of Firm Size and Age

3.1 Average Job Turnover Rates

Figure 1 shows the rates of job creation, job destruction and net employment growth for the firms covered by the Forfás Employment Survey from 1972 to 2010. Employment growth is positive whenever job creation is greater than job destruction, and aggregate employment declines when job destruction is higher than job creation.

In common with all other papers on job flows, we see that jobs are created and destroyed simultaneously in every year. Over the entire sample period, the job creation rate was slightly less than ten percent and the job destruction rate was approximately 9 percent, resulting in an average annual growth in net employment of one percent. This average covers many different experiences in the

[3]Downloaded from http://www.census.gov/ces/dataproducts/bds/

job turnover figures. The period up to 1994 previously examined by Barry, Strobl and Walsh (1998) showed an average job creation rate of 8.4 per cent, which increased to 11 per cent over 1994-2006.

The "Celtic Tiger" era of strong employment growth is reflected in our data, with net growth increasing from 1993 and peaking in 2000. However, even during this period of overall expansion, where job creation reached rates of 12 to 15 per cent of total employment each year, the rate at which jobs were destroyed did not fall below 6% (Lawless and Murphy, 2008). Likewise, the extreme fall in employment in the crisis period of 2008 to 2010 still saw a certain amount of jobs being created, albeit at the historically low rate of 5 percent in 2009. The job destruction rate reached a unprecedented high of 16% in the same year.

To put these figures in context, they are slightly lower but broadly similar to the US and considerably higher than most European countries. Figure A1 in the appendix graphs the Irish and US job creation, destruction and net creation rates as an illustration of this, taking the US rates from 1977 to 2010 from the US Business Dyanamics Statistics as above and again restricting the sample to manufacturing for maximum comparability. The average US job creation rate over this period was 11.3% and Ireland's was 9.5%, with job destruction rates of 12.3% and 8.8% respectively. The variability of the rates over time are also relatively similar with a standard deviation of job creation being 1.84 in the US and 2.04 in Ireland and 2.28 for job destruction in the US versus 2.18 in Ireland.

The different levels of job turnover across Europe were examined by Gomez-Salvador et al. (2004), who conducted an EU cross-country study based on large firms. They showed that net job creation averaged 1.9%, arising from average job creation and destruction rates of 5.6 and 3.7%, respectively. Given the type of data used, the EU figures are not directly comparable with the results reported in this paper because they have a more restricted focus on large firms. However, even within that study, Ireland was one of the countries that exhibited large job creation and destruction rates at 8.5 and 3.1% respectively, and had the highest net job growth rate at 5.4%.

3.2 Job Creation by Firm Size

Focusing on the contributions to total job creation and destruction by different size groups raises some measurement issues. Davis, Haltiwanger and Schuh (1996) and Neumark, Wall and Zhang (2011) point out that the decision of the reference period for the size categories can have a significant effect on the estimation of the relative contributions of the categories. This is because if a firm increases or decreases employment enough to change the size group it is included in, its contribution could be assigned to either its initial group or to the group it has moved to. Furthermore, any small measurement error of a firm's employment might result in it being assigned to the wrong group in one year, particularly for small firms. A compromise method on this issue is to use the firm's average size across the two time periods to decide the composition of the size categories and this is the approach followed here.

Table 2 presents estimates comparing the job turnover rates and contributions to total job creation and destruction for different sizes of firm. We use the average of the firm's size over each two-year period to decide which of the groups to assign it to. The top panel uses four categories for firm size (0 to 20, 21a to 50, 51 to 250 and over 250) and the bottom panel adds a category to separate out the effect of newly entered firms regardless of their size in the second period. Each panel presents

Table 2: Job Creation and Destruction by Size

	JC rate	JD rate	Net change	Share JC	Share JD	Share Net
Average size group						
0 to 20	0.21	0.16	0.06	0.25	0.24	0.43
21 to 50	0.14	0.11	0.03	0.18	0.19	0.23
51 to 250	0.11	0.08	0.02	0.35	0.36	0.18
251+	0.07	0.05	0.02	0.22	0.21	0.16
Average size group - Separating effect of entry						
Entry	2.00	0.00	2.00	0.38	0.00	1.05
1 to 20	0.10	0.17	-0.07	0.10	0.24	-0.04
21 to 50	0.09	0.11	-0.02	0.11	0.19	-0.01
51 to 250	0.07	0.08	-0.01	0.24	0.36	-0.01
251+	0.06	0.05	0.00	0.17	0.21	0.00

calculations of the job creation and destruction rates for each size group in the first two columns. It also calculates the contribution to total job creation, job destruction and net employment change by each group.

For both panels, we see that smaller firms have consistently higher rates of job creation and job destruction in line with most of the literature on job turnover. Rates of both creation and destruction decline as firm size increases, from 21% job creation amongst the smallest firms to 7% for the largest firms and job destruction rates of 16% and 5% for the smallest and largest firms respectively. All groups show positive net employment growth, which is highest for the smallest group of firms at 6% and around 2-3% for the other three groups. This higher growth rate and the large number of firms in this smaller category translates into the smaller firms accounting for a considerable fraction (43%) of the net change in jobs on averge.

However, whether newly entered firms are included as a separate category has a much greater impact on the measures of net job change and on the contributions of the different size groups to total job creation. We see that the smallest group of firms have a 25% share of job creation in the top panel, which is reduced to 10% when new entrants are removed from the defintion. In addition, job destruction rates are disproportionally higher for small firms once startups are taken into account, as found by Haltiwanger, Jarmin and Miranda (2012). Looking at larger firms, the job creation rate and share of job creation for firms with between 51 and 250 employees drops rather considerably when start-ups are excluded, indicating that some of the start-up firms must be in this bigger size category. We will see later when looking at the breakdown by ownership that this is likely to be due to the entry of multinationals.

In this bottom panel of Table 2, all of the net change in employment is accounted for by entry with existing firms having slightly negative growth rates on average. This gives us the first indication that the firm's age is playing a role in its contribution to overall job creation and destruction rates. It also

Table 3: Job Creation and Destruction by Age

	JC rate	JD rate	Net change	Share JC	Share JD	Share Net
$<$ 5 years	0.24	0.08	0.17	0.67	0.29	2.57
5 to 10 years	0.07	0.10	-0.03	0.12	0.24	-0.47
11 to 20 years	0.05	0.09	-0.03	0.13	0.28	-0.50
$>$ 20 years	0.05	0.08	-0.04	0.08	0.19	-0.60

shows that a simple assumption that all young firms are being accounted for in the small category is inaccurate - if this was the case, separating entry would not change the contributions of larger firms to such a great extent. The next table looks at how job turnover rates vary by firm age and then we combine the two characteristics to understand more fully the interaction.

3.3 Contribution of Firm Age

Table 3 divides the firms into four age categories (actually lagged age so exiting firms are captured in all four groups and new entrants are in the group of youngest firms). The job creation rate for the youngest firms, those established less than 5 years, stands at 24% and this makes up 67% of total job creation. The job creation rate for the other groups of firms are much lower, with the next age group (5 to 10 years old) creating jobs at a rate of 7%, and the two older groups both having job creation rates of 5%. There is surprisingly little variation in job destruction rates across the four age groups, although the youngest group do have the highest contribution to total job destruction by a small margin. All of the net employment growth over the period is accounted for by younger firms.

As we noted in describing the data, a firm's size and age are correlated to a considerable extent. Table 4 therefore breaks the firms into groups by both (average) size and age to start to gauge the relative importance of their contributions to job creation and destruction. For each of the four size categories, the youngest firms have the highest rates of job creation, generally by a considerable margin. They also make the largest contributions to total job creation. The highest job creation rate of 39% comes from the youngest-smallest group of firms and these firms make up 21% of total job creation. The largest contribution of total creation however comes from a larger group of firms - those employing between 50 and 250, but established less than 5 years ago have a job creation rate of 22%, which accounts for 22% of total gross job creation. As we saw in Table 3, net employment growth on average over the entire period was due to the contribution of the youngest firms. In Table 4 we see more clearly that this effect is not due to young firms always being small, in fact young firms with over 250 employees show a job creation rate of 15%.

The overall impression therefore is one of young firms driving job creation, with a more minor role for size. It is not completely independent of size, however, as each age group shows a decline in job creation rates as size increases (e.g. the creation rates for the youngest firms are 39%, 28%, 22%, and 15% as size goes from smallest to largest respectively). Turning to job destruction rates, the smallest

Table 4: Combining Contributions of Age and Size

Size	Age	JC rate	JD rate	Net change	Share JC	Share JD	Share Net
0 to 20	$<$ 5 years	0.39	0.14	0.24	0.21	0.10	2.15
0 to 20	5 to 10 years	0.08	0.17	-0.09	0.02	0.05	-0.83
0 to 20	11 to 20 years	0.06	0.16	-0.10	0.02	0.06	-0.88
0 to 20	$>$ 20 years	0.06	0.17	-0.11	0.01	0.03	-0.95
21 to 50	$<$ 5 years	0.28	0.09	0.19	0.13	0.05	1.66
21 to 50	5 to 10 years	0.08	0.12	-0.05	0.02	0.05	-0.43
21 to 50	11 to 20 years	0.06	0.12	-0.05	0.02	0.05	-0.46
21 to 50	$>$ 20 years	0.05	0.11	-0.06	0.01	0.03	-0.51
51 to 250	$<$ 5 years	0.22	0.06	0.16	0.22	0.09	1.39
51 to 250	5 to 10 years	0.07	0.10	-0.03	0.05	0.09	-0.23
51 to 250	11 to 20 years	0.05	0.09	-0.03	0.05	0.10	-0.28
51 to 250	$>$ 20 years	0.05	0.09	-0.04	0.03	0.08	-0.35
251+	$<$ 5 years	0.15	0.05	0.11	0.11	0.05	0.94
251+	5 to 10 years	0.06	0.06	0.00	0.04	0.05	-0.04
251+	11 to 20 years	0.05	0.05	-0.01	0.04	0.06	-0.05
251+	$>$ 20 years	0.04	0.05	-0.02	0.03	0.05	-0.13

group of firms have consistently higher rates of job destruction compared to the other size groups but there does not appear to be any strong pattern over the different age groups.

The effect of firms that are young but not in the smallest size category could be slightly distorted in the Irish case due to the presence of multinational firms that are more likely to open on a larger scale than a domestic start-up firm. Table 5 therefore splits the firms by ownership nationality. The basic pattern from Table 4 continues to hold, with young firms having the highest job creation rates within each size category but with the rates for each age group declining by size (so young firms in the smallest size category have a higher job creation rate than young firms in the largest size). Job creation rates are somewhat higher for foreign-owned firms, and in particular we see that the contribution of foreign firms to total job creation is significantly larger in young but larger firms. Foreign firms under 5 years with 51 to 250 employees contribute 11% of total job creation and those with over 250 employees contribute another 7%. Irish owned firms in these same categories contribute 10% and 4% respectively.

Table 5: Contributions of Age and Size by Firm Ownership

		Foreign Owned					Irish Owned				
Size	Age	JC	JD	Net	JC Share	JD Share	JC	JD	Net	JC Share	JD Share
0 to 20	$<$ 5 years	0.62	0.06	0.56	0.04	0.01	0.42	0.07	0.35	0.16	0.05
0 to 20	5 to 10 years	0.09	0.10	-0.01	0.00	0.00	0.09	0.09	0.00	0.02	0.04
0 to 20	11 to 20 years	0.07	0.11	-0.04	0.00	0.00	0.07	0.09	-0.02	0.02	0.04
0 to 20	$>$ 20 years	0.05	0.10	-0.04	0.00	0.00	0.06	0.10	-0.04	0.01	0.03
21 to 50	$<$ 5 years	0.46	0.05	0.41	0.05	0.01	0.26	0.06	0.21	0.07	0.03
21 to 50	5 to 10 years	0.09	0.09	0.00	0.01	0.01	0.08	0.07	0.01	0.02	0.03
21 to 50	11 to 20 years	0.07	0.08	-0.01	0.00	0.01	0.07	0.07	-0.01	0.02	0.04
21 to 50	$>$ 20 years	0.05	0.09	-0.04	0.00	0.01	0.06	0.08	-0.02	0.01	0.03
51 to 250	$<$ 5 years	0.29	0.04	0.25	0.11	0.03	0.22	0.05	0.16	0.10	0.05
51 to 250	5 to 10 years	0.08	0.07	0.01	0.03	0.04	0.06	0.06	0.00	0.02	0.05
51 to 250	11 to 20 years	0.06	0.06	-0.01	0.02	0.05	0.06	0.06	0.00	0.03	0.06
51 to 250	$>$ 20 years	0.04	0.06	-0.03	0.01	0.04	0.05	0.07	-0.01	0.02	0.06
251+	$<$ 5 years	0.19	0.04	0.15	0.07	0.03	0.14	0.04	0.10	0.04	0.02
251+	5 to 10 years	0.07	0.05	0.02	0.03	0.04	0.04	0.06	-0.02	0.01	0.02
251+	11 to 20 years	0.05	0.05	0.00	0.04	0.07	0.04	0.06	-0.02	0.01	0.02
251+	$>$ 20 years	0.04	0.05	-0.02	0.02	0.05	0.04	0.05	-0.01	0.01	0.02

Table 6: Contribution of Entry and Exit

	Share of total job creation	Share of total job destruction
Entry	0.38	0.00
Exit	0.00	0.30
1 to 4 years	0.26	0.16
5 to 10 years	0.14	0.17
11 to 20 years	0.14	0.21
$>$ 20 years	0.08	0.16
Total Continuers	*0.62*	*0.70*

3.4 Entry and Exit

Having established the disproportionate contribution to job creation by young firms, we turn to examine how much of this effect comes from the contribution of initial entry. Haltiwanger, Scarpetta and Schweiger (2008) found that across a range of countries, entry and exit accounted for between 30% and 40% of total job flows. Table 6 aggregates the contribution of entry over all size categories for the entire sample and shows that in Ireland the contribution of newly entering firms to total job creation is 38%, towards the upper end of the cross-country figures. The contribution of exiting firms to total job destruction is approximately 30%, a similar level to those estimated by the cross-country study. Continuing firms make up 68% of job creation and we also break this down by age to show that the impact of young firms was not completely accounted for by the effect of new entrants. Continuing firms in the age group 1 to 4 years make up over one-quarter of new jobs created and account for 16% of job destruction.

Table 7 examines if the contributions of entry and exit in Ireland might be driven by differences between domestic and foreign-owned firms. The contributions of continuing firms to job creation is the same in both ownership categories, but contracting and exiting domestic firms account for a higher share of total job destruction than foreign owned firms. Domestic entrants account for a higher share of job creation than foreign entrants, but domestic exitors also account for more job destruction. Looking at the continuers by age bracket, young firms follow entrants in terms of the proportion of job creation they account for. This is slightly larger for foreign firms, and we also see that young Irish firms have a higher probability of shedding jobs. This can be attibuted to the younger Irish firms being more likely to be genuinely new firms whereas the young foreign firms are generally subsidiaries of larger groups.

4 Size Transitions and Age

An alternative way to look at the different patterns of dynamics between young and old firms is to examine their propensity to change size classes. We divide the data into eleven groups at intervals of

Table 7: Contribution of Entry and Exit by Ownership

	Domestic		Foreign	
	Share JC	Share JD	Share JC	Share JD
Entry	0.26	0.00	0.12	0.00
Exit	0.00	0.18	0.00	0.12
1 to 4 years	0.12	0.10	0.14	0.05
5 to 10 years	0.07	0.09	0.07	0.07
11 to 20 years	0.07	0.12	0.07	0.10
$>$ 20 years	0.05	0.09	0.03	0.07
Total Continuers	*0.31*	*0.40*	*0.31*	*0.29*

50 employees (0-50, 51-100, etc.) and then calculate two transition matrices - one for firms aged five years or less and one for firms older than five years. The full matrices are included in an appendix (Tables A3 and A4) and they show the probability of a firm moving between size groups between time t (rows indicate starting size) and time $t + 1$ (columns). For both age groups, the majority of firms stay in the same size from one year to the next. Figure 2 summarises the main finding of the transition calculations, illustrating that the propensity of the older firms to remain unchanged in their size band is higher than that of younger firms.

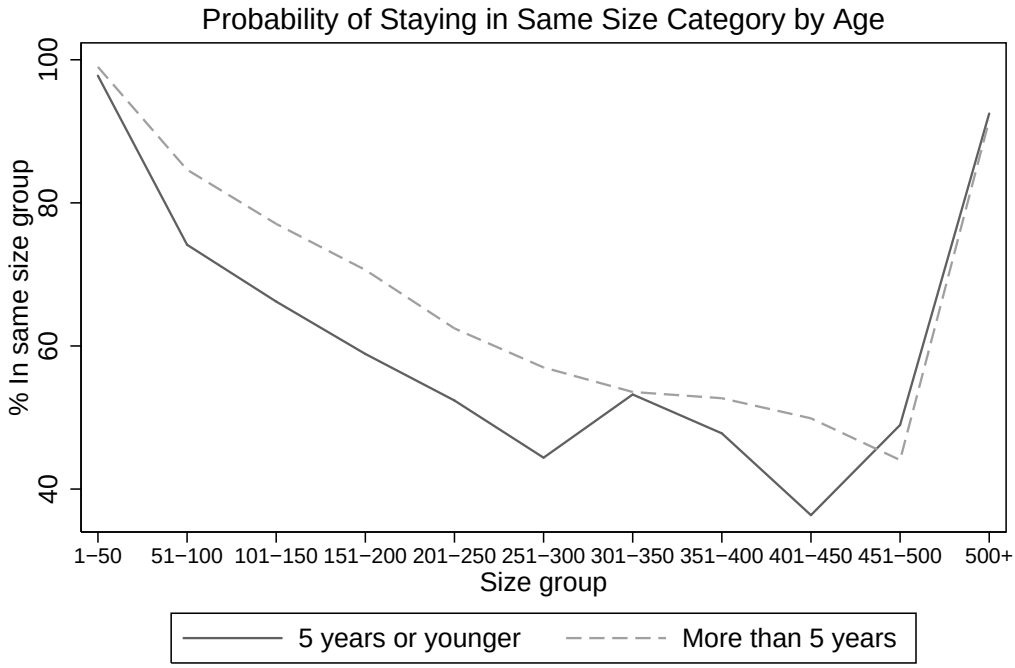
Figure 2 shows the difference in the probability of staying in the same size class by plotting the diagonals of the two transition matrices. This shows that the younger firms are considerably less likely to stay in the same size class from year to year compared to the larger firms (with the only exception being for firms with over 500 employees, which have a similar probability for both age groups). This demonstrates a greater dynamism amongst younger firms regardless of their size category.

For firms that do change their size category, the most frequently observed path is to move up or down a single category. Although we do have instances of firms moving two or more size bands in a single year, these account for quite a small percentage of total firms, and the transition probabilities furthest from the diagonal tend to be zero or very close to it.

The greater dynamism exhibited by younger firms can also be seen by comparing growth rates of firms of different ages across all size groups. To look in finer detail at the smaller firms, we change our size group definitions to have more groups for firms with fewer than 100 employees. Figure 3 shows the average employment growth rates of four age groups across categories. The youngest group of firms have the highest growth rate regardless of size category, indicated by the top line in the graph. For all other age groups the average growth rate is similar and close to zero. The regular pattern of higher growth amongst smaller firms can be clearly seen only for the youngest group.

This could be a statistical artifact resulting from the inclusion of newly entered firms in the youngest age category, who by definition cannot have a negative growth rate. Figure 4 therefore replicates the graph of growth by age and size but excludes new entrants. The main effect this has is to reduce the average growth rate of the young firms across all size categories (note the change in scale) and

Figure 2



particularly for the two smallest size groups where entry was clearly a dominant factor. The overall picture of higher growth by young firms regardless of size is unchanged by the exclusion of entrants.

5 Age, Size and Growth

This section looks at the relationship between firm size and its growth rate (both measured in terms of employment) - a topic of much empirical testing to validate or refute Gibrat's Law that growth is independent of size. Empirical evidence on this has been mixed, with Santarelli, Klomp and Thurik (2006) providing a useful overview of a wide range of studies. While a number of these studies control for age or entry, we focus on how age changes the relationship between size and growth. We will show that this is a crucial consideration, which adding age as an explanatory variable does not pick up.

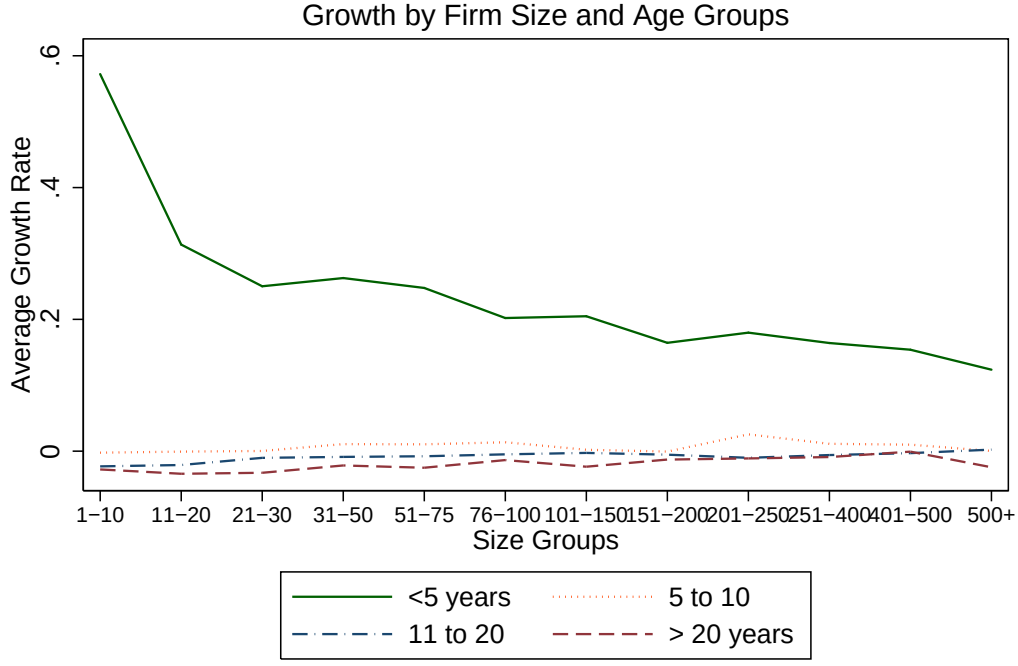
We begin by looking at all firms controlling only for sector and then adding some additional firm and aggregate factors. As we are mainly interested in the interplay between the effects of firm size and age, our approach will be to run the regressions for all firms initially and then divide the sample into age groups as in the job creation analysis earlier to examine if the relationship between size and growth varies across age groups.

The very basic initial specification for firm growth in each period g_{it} is as follows:

$$g_{it} = \alpha + \beta_1 Size_{i,t-1} + \beta_2 Size^2_{i,t-1} + \beta 3 SectorDummies_i + \epsilon_{it} \quad (1)$$

where $Size_{i,t-1}$ is the firm's employment in the previous period and controlling for sector (at NACE 2-digit level). The error term is ϵ_{it}.

Figure 3



The expanded specification for firm growth in each period g_{it} is as follows:

$$g_{it} = \alpha + \beta_1 Size_{i,t-1} + \beta_2 Size^2_{i,t-1} + \beta_3 GDP_t + \beta_4 Irish_i + \beta 5 InitialSize_i + \beta 6 Sector_i + \epsilon_{it} \quad (2)$$

where $Size_{i,t-1}$ is the firm's employment in the previous period as before and GDP_t is the GDP growth rate to control for business cycle effects. A dummy variable to indicate if the firm is Irish owned, $Irish_i$, and sector dummies (at NACE 2-digit level) are also included. In the regression analysis, we use lagged employment as the measure of firm size in line with much of the Gibrat's Law literature surveyed Santarelli, Klomp and Thurik (2006). For robustness, bearing in mind the "regression to the mean" concerns of Davis and Haltiwanger (1996) and Haltiwanger, Jarmin and Miranda (2012) we also test if using current firm size gives similar results and find that the pattern remains extremely similar, albeit with smaller coefficients.[4]

Following the findings of Audretsch and Mahmood (1995) and Segarra and Callejon (2002) that firm survival rates are inversely related to initial size, we include start-up size as an additional control.[5] As an indication of the relationship between start-up size and survival, Figure 5 graphs a Kaplan-Meier survival function grouped by broad categories of start-up size, which shows the greater exit probability of firms that began in the smallest size category and a gradually increasing probability of survival for each of the larger categories. Finally, ϵ_{it} is the error term.

[4] These and other robustness results are available on request.

[5] This leads to the further question of what determines start-up size but this is beyond the scope of the current paper. See Görg and Strobl (2002) more on this topic.

Table 8: Growth and Size

	(1) All Firms	(2) All Firms	(3) Age<5	(4) Age 5-10	(5) Age 11-20	(6) Age 20+
			Panel A: Basic Specification			
Size	-0.03*	-0.04*	-0.16*	-0.008*	-0.005*	-0.01*
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
$Size^2$	0.0001*	0.0001*	0.0001*	0.0001*	0.0001*	0.0001*
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Age	-1.43*					
	(0.01)					
Observations	278,028	278,020	114,655	58,476	65,175	39,722
R^2	0.13	0.05	0.14	0.02	0.02	0.02
			Panel B: Expanded Specification			
Size	-0.03*	-0.03*	-0.14*	-0.005*	-0.003*	-0.011*
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
$Size^2$	0.0001*	0.0001*	0.0001*	0.0001*	0.0001*	0.0001*
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Age	-0.91*					
	(0.01)					
GDP Growth	0.89*	0.88*	1.73*	0.93*	0.70*	0.50*
	(0.02)	(0.02)	(0.06)	(0.03)	(0.02)	(0.02)
Irish Owned	-2.48*	-1.99*	-9.09*	-0.26	-0.41 [a]	1.05*
	(0.17)	(0.18)	(0.42)	(0.24)	(0.20)	(0.26)
Initial Size	0.004*	0.007*	0.04*	-0.002*	-0.003*	-0.0001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.0001)
Observations	273,910	273,910	110,547	58,471	65,171	39,721
R^2	0.11	0.06	0.14	0.04	0.03	0.03

Notes: OLS regressions, weighted by employment.

Size is measured as employment at time $t-1$, sector controls included in all specifications.

Standard errors in parentheses. [a] indicates signficant at 5% and * at 1%.

Figure 4

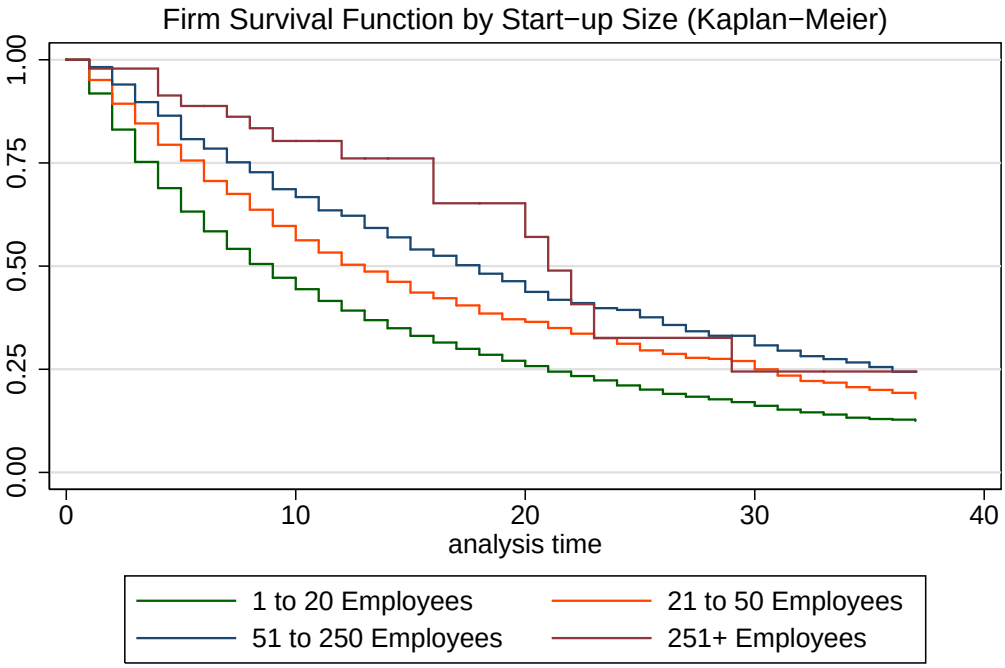
Table 8 presents the results, with the first and second columns pooling all firms, before looking separately at different size groups in the remaining columns. The regressions are weighted by employment with the top panel of the table showing results containing size and age only as independent variables and the bottom panel adding some additional controls.[6] In the basic specifications in columns (1) and (2), we find that there is an inverse relationship between firm size and growth, supporting our earlier job turnover results that showed faster growth amongst small firms and appearing to reject the Gibrat's Law prediction. Looking at the effect of adding age to the regression, we see a significant negative effect, indicating that older firms grow more slowly.

The remaining columns repeat the regression for four different firm age groups to examine if the size of the relationship between size and growth varies. We see that the effect of size on growth is considerably larger for the youngest group of firms, by several multiples if we compare the youngest and oldest firm groups, although all specifications show a statistically significant relationship. This backs up our earlier results that the growth and job creation effects attributed to small firms is actually concentrated in young firms.

The lower part of Table 8 adds some further additional control variables. Again the pooled results for all firms shown in the first and second columns show a negative and significant relationship between firm size and growth and a negative effect of firm age. However, when we look at how this relationship differs across size groups, we find a large and significant effect for young firms and that the coefficients for the other age groups are almost negligible in size in comparison, although remaining

[6] Unweighted results give a similar pattern and are available on request.

Figure 5



statistically significant. This would point to the conclusion that Gibrat's Law is a relationship that holds for established firms but that the learning occuring in the initial years after start-up constitute an exception.

Looking at the effects of the other control variables, GDP growth has the expected positive relationship with growth performance at the individual firm level. Irish-owned firms grew more slowly than foreign-owned in this sample but the effect of Irish ownership is mainly significant only for the youngest firms - once firms have survived more than five years, the growth differential by ownership seems to evaporate. Initial size is mainly important for the youngest firms; as a proxy for survival probability this makes sense as these are the firms with the greatest hazard of exit.

6 Conclusion

This paper investigates the relationship between firm size, job creation and employment growth. The main finding is that the disproportionate contribution of small firms in job creation is driven mainly by young firms (with entrants being particularly important). In line with learning models of firm growth, once the firm is established the link between size and growth weakens dramatically.

The interlinkage between age and size is therefore crucial in understanding where contributions to net employment growth originate. Because young firms make up a considerable proportion of all small firms but older firms tend to be more evenly distributed across different size classes, much of the effect of firm age may have been underplayed and attributed instead to the effect of size. We find that across all size categories, the youngest firms have the highest rates of job creation, generally by a

considerable margin, and that they also make the largest contributions to total job creation. We also show that the younger firms are considerably less likely to stay in the same size class from year to year compared to the larger firms, demonstrating a greater dynamism amongst younger firms regardless of their size category.

Connecting this to the literature on Gibrat's Law, we find a strong inverse relationship between firm growth and previous employment levels exists but that this is driven almost entirely by firms in the youngest age category. When the sample is restricted to older groups of firms, Gibrat's prediction of independence between size and growth is found to hold.

These results suggest a range of policy implications that could be broadly divided into ways to encourage (or not impede) firm formation and policies aimed at existing but early stage firms. As mentioned earlier, the findings imply that an environment supportive of business start-ups might be more effective in generating job creation than policies aimed more generically at specific size classes of firm. If taxation or technical assistance policies towards existing firms are to be targeted at a particular group of firms to maximise return on limited public resources, this suggests that a age criterion rather than one based on size should be considered.

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Table A1: Comparison to other Irish data

	CSO - All firms		CSO - Manufacturing		Forfas data	
	% Firms	% Emp	% Firms	% Emp	% Firms	% Emp
0-20	95.85	31.83	89.73	16.24	70.04	13.56
21-50	2.67	13.63	5.41	11.99	15.62	14.96
51-250	1.25	20.60	3.92	29.13	12.07	37.64
251+	0.23	33.95	0.95	42.64	2.26	33.84

Source: Central Statistics Office (CSO) Business Demography data and own calculations.

Table A2: Distribution of US Establishments and Employment

I. Percentage of Firms					
Employment	< 5 years	5 to 10 years	11 to 20 years	> 20 years	Total
1-19	19.83	17.74	21.12	16.11	74.79
20-49	1.46	2.32	3.69	4.57	12.04
50-250	0.83	1.32	2.14	4.18	8.49
250+	0.12	0.28	1.28	3.00	4.68
Total	22.24	21.67	28.23	27.87	100.00
II. Percentage of Employment					
Employment	< 5 years	5 to 10 years	11 to 20 years	> 20 years	Total
1-19	4.71	4.63	6.10	5.18	20.62
20-49	2.21	3.18	5.05	6.18	16.63
50-250	3.56	4.76	7.62	13.61	29.55
250+	0.95	2.55	6.43	23.29	33.21
Total	11.43	15.11	25.19	48.27	100.00

Source: US Business Dynamics Statistics (US Census Bureau)

Table A3: Size Transitions for Firms 5 Years or Less

	Time t+1											
Time t	0-50	51-100	101-150	151-200	201-250	251-300	301-350	351-400	401-450	451-500	500+	Total
0-50	97.77	2.08	0.12	0.01	0.01	0	0	0	0	0	0	100
51-100	6.22	74.15	14.92	3.93	0.57	0.1	0.02	0.02	0	0	0.07	100
101-150	0.27	8.41	66.21	14.04	6.58	3.39	0.47	0.41	0.14	0.07	0	100
151-200	0.27	1.22	10.72	58.89	17.37	3.66	5.02	2.04	0.41	0.27	0.14	100
201-250	0	0	1.36	17.46	52.38	14.97	3.4	0.91	3.63	4.31	1.59	100
251-300	0.45	0.45	0.9	3.14	13.9	44.39	17.94	4.93	1.35	0.9	11.66	100
301-350	0	0	0	1.17	3.51	11.7	53.22	18.13	2.92	1.75	7.6	100
351-400	0	0	0.88	0	0	4.42	15.04	47.79	10.62	7.08	14.16	100
401-450	0	0	0	0	1.3	0	7.79	20.78	36.36	12.99	20.78	100
451-500	0	0	0	0	0	0	3.13	6.25	14.58	48.96	27.08	100
500+	0	0	0	0	0.3	0.6	0.3	0.6	1.2	4.5	92.49	100
Total	89.59	5.48	1.98	1	0.58	0.3	0.24	0.16	0.1	0.12	0.46	100

Table A4: Size Transitions for Firms Over 5 Years

	Time t+1											
Time t	0-50	51-100	101-150	151-200	201-250	251-300	301-350	351-400	401-450	451-500	500+	Total
0-50	99	0.99	0	0	0	0	0	0	0	0	0	100
51-100	9.83	84.64	5.36	0.12	0.03	0	0	0.01	0	0	0	100
101-150	0.29	13.61	77.07	8.45	0.49	0.09	0	0	0	0	0	100
151-200	0.07	1.26	16.52	70.63	10.5	0.81	0.14	0	0.07	0	0	100
201-250	0	0.25	1.95	18.39	62.46	15.19	1.32	0.38	0	0	0.06	100
251-300	0.09	0.18	0.46	2.93	20.95	57	15	2.56	0.55	0.18	0.09	100
301-350	0	0.13	0	0.53	3.7	20.24	53.57	17.59	3.04	0.93	0.26	100
351-400	0.15	0	0.15	0.31	1.85	4.17	20.71	52.7	15.92	2.32	1.7	100
401-450	0	0	0	0.45	0.45	0.9	4.29	22.57	49.89	15.58	5.87	100
451-500	0	0	0	0	0	0.31	1.25	8.13	23.44	44.06	22.81	100
500+	0	0	0	0.07	0.14	0.27	0.27	0.34	1.29	6.05	91.57	100
Total	81.35	8.87	3.68	1.89	1.07	0.72	0.5	0.43	0.3	0.22	0.97	100

Figure A1

Comparison of US and Irish Job Turnover Rates