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Job Flow Dynamics in the Service Sector

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Abstract

This paper uses the new comprehensive Longitudinal Establishment and Enterprise Microdata at CES to investigate gross and net job flows for 1990 to 1995 for all establishments in the service sector. After examining the recent shifts in the distribution of employment in non-financial services, from single unit firms to multi-unit firms, and from smaller firms to larger ones, we calculate five year gross and net job flow rates for these various types of establishments. This shows that the increasing share of service employment in large firms is not due to higher growth in larger firms. Seeking the dynamics behind the shift of employment to larger firms, we investigate how job flow rates are related to firm and establishment size, using alternative size classification methods. Gross job flow rates vary inversely with the age of establishments in services, as do net growth rates of surviving establishments, even after controlling for size.

To help distinguish among the effects of age, firm size, and establishment size on gross and net job flows in services, multivariate regression analysis is used. We find that all gross job flow rates decline with increasing age of establishments when size and industry differences are controlled. Because the job destruction rate falls faster than the creation rate as age increases, net growth rates increase with age for services as a whole. Gross and net job creation also declines with increasing size of establishments, but destruction rates increase with size when controlling for age and industry differences. Firm size differences contribute little or nothing additional when we control for establishment size and age.

Key Words: Service sector, gross job creation and job destruction, net employment growth, longitudinal establishment microdata, business size classification.

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1. Introduction

Services have been one of the fastest growing sectors in the first half of the 90's, but there has been scant information for examining how the industry has been growing, businesses have been restructuring, and jobs have been created and destroyed. Although service establishments now account for over a third of the private sector jobs in the United States, study of the characteristics of their growth has primarily been left to the popular media, with most analysis generalizing from survey data or small case studies.¹

The number of jobs in the service sector increased by 20 percent between 1990 and 1995. Most other industries held steady or shrank, with an average change in employment of less than 2 percent in non-service industries. However, this increase is often discounted because of suspicions that the new service jobs are predominately low skill, low wage, unstable jobs. On the other hand, there is also a general awareness and fear of increasing concentration in the service sector, with many small firms closing or being acquired by large ones, and with spectacular growth by a few large firms.

To accurately measure changes in the businesses that are active in the service sector, we need longitudinal data that will allow us to track each business location, analyzing its survival, growth, and shrinkage. A new database recently constructed by the Bureau of the Census allows us to quantify and analyze many of these changes in service businesses. The Longitudinal Establishment and Enterprise Microdata (LEEM) file provides comprehensive, detailed, annual tracking of all business establishments with employment,

not only for the service sector, but for nearly all U.S. establishments with employment. We use these data to measure the five-year growth (and shrinkage) of employment in service establishments, and to investigate some factors which help to account for differences in their rates of job creation and destruction.²

We begin by examining the shift in distribution of service sector jobs, which are increasingly associated with large, multi-unit firms (enterprises or controlling legal entities with more than one business location). It is often assumed that the growing share of service employment in large firms implies that these large firms are creating more than their proportional share of net new jobs. But they can also increase their share of employment by acquiring smaller businesses, or by the actual growth of smaller businesses into the large size category.

An important question debated in the literature analyzing job flows (usually for manufacturing jobs only) is whether net job growth rates are correlated with business size³. And if so, whether it is the size of establishments (individual business locations), or the overall size of their firms, which is most relevant to explaining differences in average job flow rates.⁴ However, since nearly 80 percent of private sector (and 86 percent of service) establishments are themselves single-establishment firms, and all large establishments are in large firms, firm size and establishment size are highly correlated. Therefore, previous analyses have generally shown similar results, whether based on firm size or establishment

¹ For an exception see Klomp and Thurik (1999).

² For a review of the literature on job creation and destruction see Davis and Haltiwanger (forthcoming).

³ See, for example Jovanovic, 1982; Evans, 1987a and b; Hall, 1987; Dunne, Roberts and Samuelson 1989a and b; Davis, Haltiwanger and Schuh 1996a and b; Acs, Armington and Robb 1999.

⁴ For a review of the literature on Gibrat's Law, see Sutton (1997).

size. The LEEM provides accurate data on both firm size and establishment size, so that we can distinguish their respective impacts on average job growth rates.

In this paper we exploit data from the new LEEM to study recent job flow dynamics in the service sector. We make three important contributions. First, we calculate five year gross and net job flow rates for various types of establishments, and show that these differences in growth rates do not account for the shift in services employment. Most of the differences in the rate of increase in employment are due to the reclassification of single units to multi units. Second, seeking the dynamics behind the shift of employment to larger firms, we investigate how job flow rates are related to firm and establishment size, and to the age of establishments. Third, we use regression analysis to help distinguish among the effects of age, firm size, and establishment size on gross and net job flows in services. We find that all gross job flow rates decline with increasing age of establishments when size and industry differences are controlled. The relationship of gross and net job flows to establishment size is more complex. Firm size differences contribute little or nothing additional when establishment size and age are controlled. This reaffirms that the increasing share of service employment in large firms should not be attributed primarily to higher growth rates in larger firms.

Section II of this paper discusses the LEEM data and their characteristics, and summarizes what the LEEM tells us about the distribution of employment in services in 1990 and 1995. Section III discusses the use of microdata on establishments for measurement of job flows -- gross job creation, destruction, and reallocation, and net job change. Section IV explores alternative measures of size, and the relationship of business size to gross and net job growth rates. Section V examines the differences in growth rates

that are associated with age differences. Section VI uses regression analysis of gross and net job flow rates to distinguish the separate effects of age, establishment size, and firm size on these rates, for services as a whole, and for the three largest sub-sectors of services. The final section summarizes our conclusions.

II. New Services Data and Changes in the Distribution of Employment in Services

A. The Longitudinal Enterprise and Establishment Database (LEEM)

The Longitudinal Establishment and Enterprise Microdata (LEEM) file has multiple years of annual data for each U.S. private sector (non-farm) business with employees. The current LEEM file facilitates tracking employment, payroll, and firm affiliation and (employment) size for the more than eleven million establishments that existed at some time during 1989 through 1996⁵. This file was constructed by the Bureau of the Census from its Statistics of U.S. Business (SUSB) files, which were developed from the economic microdata underlying Census' County Business Patterns.⁶ These annual data were linked together using the Longitudinal Pointer File associated with the SUSB, which facilitates tracking establishments over time, even when they change ownership and identification numbers.⁷

The basic unit of the LEEM data is a business establishment (location or plant). An establishment is a single physical location where business is conducted or where services

⁵ However, most of the analysis in this paper was based on the preliminary LEEM, which included data only for 1990, 1994 and 1995.

⁶ The SUSB data and their Longitudinal Pointer File were constructed by Census under contract to the Office of Advocacy of the U.S. Small Business Administration. For their documentation of the SUSB files, see Armington (1998).

⁷ These LEEM data are housed at the Center for Economic Studies at the U.S. Bureau of the Census. For a more complete description of the LEEM, see Acs and Armington (1998).

or industrial operations are performed. The microdata describe each establishment for each year of its existence in terms of its employment, annual payroll, location (state, county, and metropolitan area), primary industry, and start year. Additional data for each establishment and year identify the firm (or enterprise) to which the establishment belongs, and the total employment of that firm.

A firm (or enterprise or company) is the largest aggregation (across all industries) of business legal entities under common ownership or control. Establishments are owned by legal entities, which are typically corporations, partnerships, or sole proprietorships. Most firms are composed of only a single legal entity that operates a single establishment -- their establishment data and firm data are identical. Only 4 percent of firms have more than one establishment, and they and their establishments are both described as multi-location or multi-unit. Multi-unit firms may be composed of one or more legal entities.

Establishments that continue their operations can usually be tracked through time using the LEEM, even if their identification numbers are changed due to changes in their location, legal form, or ownership. Therefore, it is generally possible to clearly identify the startup (birth) of a new establishment or the termination (death or closure) of an establishment, as distinguished from the appearance of a new identification number or the discontinuance of an old one.

For this study of changes in service establishments, we included all U.S. establishments in the LEEM⁸ with positive employment in 1990 or 1995 if their most recent industry classification was in the non-financial services sector (Standard Industrial

Classifications 7000 through 8900). Those with positive employment in 1990, but not in 1995, were service establishment deaths, while those with positive 1995 employment, but no employment in 1990, were service establishment births in this period. Surviving establishments are those with positive employment in both periods.

B. Distribution of Services Employment by Type of Firm in 1990 and 1995

The 28.9 million employees in services in 1990 accounted for just over 30 percent of total U.S. private sector, non-farm employment. Table 1 summarizes the number of LEEM establishments in the service sector, and their employment, in the two years. By 1995, services employment had increased 20 percent from its 1990 level, while non-service employment grew less than 2 percent. This increased the service sector's job share to 34.6 percent – over a third of all private sector jobs in 1995.

The detail rows in Table 1 distinguish whether service establishments belong to multi-unit firms⁹ or are single location firms in each period. Service establishments in multi-unit firms accounted for only 14.0 percent of all service establishments in 1990, while 27 percent of non-service establishments (not shown) were in multi-unit firms. So the service sector was composed much more predominately of single location firms than the rest of the economy.¹⁰ However, the average employment of service establishments in multi-location

⁸ These were extracted from the preliminary LEEM (which covered only 1990, 1994, and 1995), whose scope and employment for those years is identical, but whose most current industry classification might differ in rare cases from that of the 1989-1996 LEEM.

⁹ The multi-location firms owning a service sector establishment might be composed entirely of service establishments, or predominately service establishments, or predominately non-service establishments. We do not distinguish here by primary industry of the firm.

¹⁰ Our economy includes all the non-farm private sector establishments with employment that are covered by the Economic Census, and therefore by the LEEM. This included 5.5 million establishments in 1990, and 5.9 million establishments in 1995, with employment of 93.4 million and 100.3 million, respectively.

firms was 46, considerably higher than the average of 39 for non-service multi-unit establishments in 1990.

Service establishments in multi-unit firms accounted for 42.5 percent of all service employment in 1990, again considerably below the 59.4 percent share of multi-unit employment in non-service establishments. This service share rose to 46.7 percent by 1995. Its increase of 4.2 percentage points dwarfs the 1.5 percentage point increase in the share of non-service employment in multi-unit firms.

Looking at the rates of increase in employment from 1990 to 1995 in service establishments by firm type (in the right-hand column of Table 1) we see that employment in multi-unit service establishments increased 31.6 percent, in contrast to the growth of 11.4 percent for employment in single unit firms. This would suggest to the naïve reader that net job generation in the establishments belonging to multi-unit firms was nearly three times that of single unit firms. We will examine the problems with this naïve assumption later, after discussing measures of job growth rates.

III. Measuring gross job flow rates and net job growth rates

A. Definition of job flows and mean-based growth rates

We will deal in this section with measures of gross job flows and net job growth, and with the choice of an appropriate growth rate calculation method for comparing rates of change of different types and sizes of establishments. Following DHS (1996a), we define changes in establishment employment using three subscripts. The letter *e* denotes a specific establishment, the letter *s* denotes the sector (or other special classification) to

which the establishment belongs, and the letter t denotes the time period. The symbol Δ denotes the first-difference operator, such as $\Delta X_t = X_{t+1} - X_t$.

Gross job creation is the sum of all new jobs at an expanding or newly born establishment. Formally, gross job creation and destruction in sector s at time t are:

$$C_{st} = \sum_{e \in s^+} \Delta X_{est}, \quad D_{st} = \sum_{e \in s^-} |\Delta X_{est}|$$

where X denotes employment, and the subscripts $+$ and $-$ indicates the subset of establishments in the sector that expand and contract respectively.

The sum of job creation and destruction in sector x is the gross reallocation of jobs between t and $t+1$:

$$R_{st} = C_{st} + D_{st}.$$

Gross job reallocation is the sum of the absolute value of the net changes in numbers of jobs at each of the establishments in the sector during the period from t to $t+1$. High rates of reallocation are indicators of instability in a sector, where there is simultaneous rapid growth in some establishments and rapid loss in others. Such behavior might be associated with shifts in the relative market shares, technology, or productivity of the establishments in the sector.

Gross job creation and destruction are related to the net change in employment, or net job growth, by the following formula:

$$\text{Net}_{st} = C_{st} - D_{st} = \Delta X_{st}.$$

We define job flow rates by dividing the changes by a measure of size, mean employment.

Mean establishment employment, Z_{est} , is the average of employment in period t and $t+1$:

$$Z_{est} = 0.5(X_{est} + X_{es,t+1}),$$

and the corresponding establishment growth rate is:

$$g_{est} = \Delta X_{est} / Z_{est}.$$

This is a convenient approximation to the continuous, or compounded, growth rate.¹¹ This use of the mean of the beginning and ending period employment as the divisor for calculating rates avoids the problems of asymmetry and unbounded range in growth or flow rates calculated traditionally (by dividing change by the total number of jobs in the initial period). These mean-based job flow rates vary only from a maximum of 200 percent for establishment births, to a minimum of –200 percent for establishment deaths.

Sectoral rates of gross job creation and destruction are employment-weighted sums of establishment level growth rates:

$$c_{st} = C_{st}/Z_{st} \quad \text{and} \quad d_{st} = D_{st}/Z_{st}.$$

Similarly, the reallocation rate between t and t+1 is the sum of job creation and destruction rates:

$$r_{st} = c_{st} + d_{st}.$$

The net job growth rate is then:

$$net_{st} = c_{st} - d_{st} = \Delta X_{st}/Z_{st}.$$

B. Gross and Net Job Creation Versus Differences in Numbers of Service Jobs

¹¹ The continuous growth rate is calculated as $\ln X_{est\ t+1} - \ln X_{est}$. Its values are virtually identical to those of the mean-based rate for changes below 10 percent, and are similar for changes up to 100 percent. However, the mean-based rate is capped at 200 percent for all changes from zero to a positive number (births), while the continuous rate is not defined for such changes, although it approaches $+\infty$. Similarly, the change from positive employment to zero (death of an establishment) results in a mean-based change rate of –200 percent, while the continuous rate is undefined, but approaches $-\infty$. Both calculations have the merit of symmetry, so that a change from a to b will have the same value with the opposite sign as a change from b to a.

The measurement of job flow rates for various categories of establishments, as it is defined above, requires tracking the changes in employment (or numbers of jobs) at individual establishments, and accumulating these changes for all of the establishments in each category at some time period. The overall net change in employment calculated this way will be identical to the difference in aggregate employment over the same period. However, the distribution of that change over various categories of businesses is likely to be very different. This is because the simple comparison of aggregate employment levels in a group of businesses at two points in time is affected by changes in the population of businesses classified in that group, as well as by changes in the employment of the businesses which remained in the group.

Table 2 facilitates comparison of percentage differences in service employment in various types of firms with the comparable job flow rates. As we saw earlier, total employment in services increased by 20.0 percent between 1990 and 1995. When this is expressed as a mean-based net growth rate it is equivalent to the 18.1 percent rate shown for Net Job Growth line in the total column in Table 2. The 1990 to 1995 difference (shown in the third line of Table 2) in aggregate employment of establishments in multi-unit firms was 31.6 percent, while the number of jobs in single unit firms/establishments increased only 11.4 percent. When we separate service establishments into those that were in multi-unit firms, and those that were always single-unit firms, we find a net job growth rate of only 18.4 percent for the multi-units. This group differed by only 0.5 percentage points from the 17.9 percent net growth rate of the singles. *Apparently most of the huge difference in their rates of increase in employment which we observed above is due to the reclassification of single-unit firms/establishments to multi-unit status.* This would occur

whenever single-unit firms were acquired by multi-unit ones, and whenever single-unit firms converted to multi-unit ones by opening additional locations.

Looking more closely at the differences in growth in multi-unit and single-unit service establishments in the lower part of Table 2, it is apparent that single-unit firms/establishments had higher rates of change in all of the types of job changes that we measure, both positive and negative. Gross job creation in singles was 51.0 percent, 7.1 percentage points higher than that of multis. The gross job destruction in single-unit establishments was 7.6 percentage points higher than that in multis. When we separate the types of job loss into that due to contraction and that due to closure or death of establishments, we see that most of the difference in destruction rates is attributable to the higher losses from deaths of single-unit establishments.

When service establishments are classified by the initial total employment of their firms, we again see what a difference there is between static comparisons of aggregate numbers of jobs, and job flows calculated by tracking and aggregating employment changes in individual establishments. Service establishments were divided into 4 firm-size categories (or quartiles) with roughly equal aggregate employment. The third line on Table 2 shows us the differences in numbers of jobs in the establishments in each of the firm-size classes in 1990 and in 1995. These differences are proportionally greater in the larger size classes, varying from 8.4 percent in firms with less than 20 employees, up to 37.8 percent in firms with at least 2,500 employees. This is starkly different from the pattern of net job growth rates within establishments that are classified by the size of their firm in the initial year. Establishments in firms with less than 20 employees in 1990 had net growth of 23.6 percent, while the three larger size classes grew at rates that ranged from 18.9

percent to 14.1 percent for the largest firm-size. Again, it appears that in the largest firm-size class more than half of the large change in employment was due to changes in classification – net acquisitions, and net shift of establishments into that firm-size class.

When we break up the net growth of employment within these establishments classified by the size of their firms in the initial year of the growth period, we see a general pattern of gross job flows decreasing with increasing firm size. This pattern was quite strong for losses due to establishment deaths, and for gains due to expansion of existing establishments. It was relatively weak for losses due to contractions, and for gains due to births.

Table 3 reports 1990 employment levels by two-digit SIC industry sector, along with their rates of net job growth, and their gross job creation, destruction, and reallocation for the period from 1990 to 1995. Note that the industries have been ordered by decreasing net growth rates, and that their gross change rates are not correlated with their net change rates.

The highest net growth rate was in business services, although they had a high destruction rate as well as a high creation rate. The high net growth rate in social services resulted from a somewhat high creation rate and a somewhat low destruction rate, and their job reallocation rate was a little below the average for all services. Amusement and recreation services had high growth due to its combination of a high creation rate with an average destruction rate, while health services had above average net growth in spite of both creation and destruction rates that were very low.

Net job growth was low in hotel services, which grew only 1.1 percent, and in legal services, at 2.7 percent. Growth was negative for the five-year period in miscellaneous

repair services and in miscellaneous services, primarily due to high destruction rates combined with average creation rates.

The job reallocation rate, which represents the sum of job creation and destruction, was 77.6 percent for the five-year period for services as a whole. The variation by sector was tremendous, and the sectoral reallocation rates were not correlated with their net employment growth rates. The highest rates of job reallocation were in motion picture services (127 percent), due to high rates of both job creation and job destruction, with average net job growth. A similarly high reallocation rate was observed in business services, but their destruction rate was lower, so their net job growth rate was higher. This was followed by personal services, amusement and recreation services, and hotels and lodging services (89 to 79 percent reallocation rates). Education services had, by far, the lowest job reallocation rate, at 42.9 percent, with very low creation and destruction rates, but average net job creation.

IV. Differences in Job Flow Rates by Size of Business

A. Alternative methods for classification of business size

There has been considerable controversy and confusion over the most appropriate way to measure differences in job creation and job destruction by different sizes of businesses.¹² The issues involved include both the appropriate choice of business unit for analysis of job generation differences, and the appropriate timing for the size classification.

¹² See Birch, 1979; Leonard, 1986 and 1987, Davis Haltiwanger and Schuh, 1996 a and b; Carree and Klomp, 1996; Davidsson, Lindmark and Olofsson, 1998; Acs, Armington and Robb, 1999. For a review of the literature discussing these issues, see Caves (1998).

The principal alternative units of business are the establishment (plant, or location) and the firm (enterprise, or company). It is generally agreed that there is some association between job generation rates and business size, at least at the extreme sizes, but there is little agreement over whether this association is primarily with the size of an establishment, or with the overall size of the firm controlling the establishment.

In the extensive literature dealing with issues about the size of businesses, there has historically been an unfortunate sloppiness about the unit of business, both for theory and for the choice of data used to illustrate issues or test theories. Often, the available data offers no choice, so whichever unit is available is used, regardless of the theory. In many cases such substitution between establishments and firms has not caused substantial problems. More than three-quarters of establishments are identical to firms, because they are single location firms. For these, aggregate data on establishments and on firms are identical. When the relatively small number of multi-unit establishments or firms are added in, these data are still highly correlated, and may sometimes serve as useful proxies for each other (Sutton, 1997).

The LEEM provides annual data for both of these alternative units: the size of each establishment, and overall size of its owning firm. These size data are in the form of March employment reported for the establishment, and the sum of the March employment of all establishments in the firm (under the same ownership or control)¹³. We use these data to classify establishments by both their own establishment employment, and by the employment of their firm if they are multi-unit establishments. . We will investigate whether

¹³ Since firm employment is the sum of employment in its component establishments, an establishment's firm-size may change not only as a result of changes in the employment of its component establishments,

the size differences in job generation patterns are primarily associated with the size of the establishment or the size of the firm.

The other important issue in the measurement of business size is that of timing. The traditional procedure has been to classify businesses by their size at the beginning of a period, and then analyze the relationship between that initial size and their subsequent activity. Certain problems have been recognized with this practice. First, beginning period size is not useful for analysis of the patterns of job generation from business births, because they do not exist at the beginning of the period. Second, there has been concern¹⁴ that using the initial size of a business may bias the analysis of the relationship of size and growth.

Nevertheless, in this paper we classify businesses primarily by their initial size in the period. With the initial year classification method for job flows over the period from t to $t+1$, all establishments and/or firms that exist in the initial year, t , are classified according to their size in that year. New establishments are also classified by their initial size, which is that for year $t+1$, the ending year of the growth interval. New establishments in firms that did not already exist at the beginning of the period also use their firm size in the ending year as their initial firm size.

To facilitate comparison of job flows in services with some of the prior job growth analysis (usually for manufacturing), we show some additional job flow tables with service establishments classified by mean firm size or establishment size. The mean size

but also due to a change in the number or identity of other establishments owned by the firm, or as a result of the establishment's being divested or sold to a different firm.

¹⁴ See Friedman (1992) and DHS (1996a) section 4.6, pp. 66-70, for instance. The relevant issues are clarified in Acs, Armington, and Robb (1999), pp. 9-13.

classification method was proposed by DHS¹⁵ as an alternative that would avoid any regression-to-the-mean bias. It is a special case of a long-term weighted average size approach. It uses a weight of one-half for initial year and one-half for ending year. Thus each establishment is classified strictly according to the average of its employment in the initial and ending year, using zero for years when the establishment does not exist. Mean firm size is calculated similarly, using the mean of the employment reported for the firm owning the establishment in the initial year, and that of the firm owning the establishment in the ending year, even when the ownership changes.

If there were no relationship between size and growth, then it would make little difference whether initial size, mean size or ending size were used to classify businesses to show this. But if there is a relationship between initial size and growth rates, then when growth is classified by the initial size of businesses, the results will differ substantially from those based on size at the end of the measured growth period, after their growth has already affected their size. The use of mean size may be thought of as a compromise between these two extremes, so it can be expected to obscure any relationship between size and growth. In addition, since the mean size calculation allocates job flows from establishment births and deaths to the size class for establishments that are half their initial or final reported size¹⁶, its use will distort any association of size with gross job flows from births and deaths. This distortion from use of mean size is much greater for five-year

¹⁵ In DHS (1996a) this size measure is called “current” size.

¹⁶ The first year of positive March employment for births may indicate their intended size, or may indicate only the number of jobs filled near the beginning of the hiring process. There are similar problems with the employment reported for establishments that close during the measurement period, since their size at the beginning of the period may substantially understate their size when the decision was made to close the business.

growth analysis, where 60 percent of services' gross flows are derived from births and deaths, than for annual growth, where only 33 percent were from births and deaths.

B. Employment Flows by Firm Size Classification

Table 4 presents employment flows for establishments classified by the size of their firms, using initial size for the upper panel, and mean firm size for the lower panel¹⁷. This size is determined from the aggregate national employment of all establishments belonging to the firm, regardless of their industry. The patterns of gross job flows show all rates decreasing with increasing firm size. This is true for creation, destruction, and reallocation, whether initial size or mean size is used to classify the size of firms.

However, it is apparent that the negative relationship between firm size and gross job flows is very weak for the larger size classes, which contain primarily multi-location firms. Establishments in firms with at least 10,000 employees deviated from the general pattern of monotonically decreasing rates with their exceptionally high destruction rates, and these are also reflected in their higher reallocation rates.

The relationships between net job generation rates and firm size are less clear. Excluding the smallest and largest size classes, the net growth rates appears to increase weakly with both initial firm size and mean firm size. However, when looking at all initial firm size classes, net average employment growth ranged from 34.7 percent down to 11.5 percent as firm size increased. Using mean firm size classification, the net growth rates

¹⁷ Mean employment is always used in this paper as the denominator for calculating job flow rates from the gross job changes, regardless of which employment measure is used for classification of size. Therefore the creation rates and destruction rates are symmetrical, and the range of possible growth rates is bounded by the rates for births and deaths, which are 200 percent and -200 percent, respectively.

had a much narrower range, only from 13.5 to 22.1 percent, although the extreme size classes grew only 14.6 percent for the smallest, and 15.2 percent for the largest.¹⁸

The comparison, in Table 5, of 1990 to 1995 job growth patterns by initial firm-size for each of the three larger major groups within the services sector shows somewhat diverse tendencies. At this level of aggregation we no longer see a consistent negative relationship between the gross flows and the size of firms. While creation rates generally fall with increasing size, destruction rates were alternatively decreasing, stable, or increasing with size.

In business services, the relationship of net growth rates to initial firm size was “u”-shaped, except for the low rate for the largest size class. The destruction rate in business service establishments was nearly constant across all size classes, so the other three flows each take the shape of the creation rate pattern.

Health services, on the other hand, showed strongly decreasing gross flow rates, including job destruction. The gross flow rates for the largest size class were all slightly higher than for the next smaller class, but its net growth followed the general pattern of decrease with increasing size. Net employment change in health services was generally declining with size, with the notable exception of the peculiarly low growth (and job creation) rate for establishments in firms with 5 to 19 employees.

The engineering and management services group showed net growth very strongly inversely related to firm size for firms with less than 2,500 employees. Unlike the other industry groups examined here, this one showed nearly constant gross job creation rates,

¹⁸ Acs, Armington, and Robb (1999) studied similar data for the entire private sector's job flows for a single year, 1994-1995, and found that net growth rates fell with firm size, whether measured by initial employment

with the exception of the two extreme size classes. Their destruction rates were positively correlated with size (the larger the firm, the greater the job loss rate), except for the class with 2,500 to 9,999 employees.

DHS (1996) found a strong negative relationship between the long-run average firm size and manufacturing job reallocation rates (*gross turnover*). The recent data from the LEEM affirm this relationship with mean firm size for most of the large major groups within the service sector, as shown in Figure 1. Hotels, health services, legal services, education, and social services, all exhibit a decline in job reallocation rates with increasing firm size. However, for business services, and for engineering and management services, reallocation rates are generally flat, except for the much higher rates for establishments in the smallest firm-size class.

C. Employment Flows by Establishment Size Classification

Having established the general magnitude of gross job flows in the economy, and how they vary by size of firm, we now turn to the question of how these flows vary for different sizes of establishments. Although 86 percent of service establishments are single-location firms, these establishments account for only 46 percent of the employment in services. Many of the establishments in multi-location firms may dominate their firms and make job creation decisions on substantially the same bases as single-location firms. Others are secondary locations that may be opened, closed, expanded, or contracted by their headquarters in response to other needs of the firm which are not reflected in their

or mean employment. It is not yet clear whether these service sector results differ primarily because of differences in the timing or duration of the period, or due to sectoral differences.

own size. We do not have a theoretical basis for predicting how the establishment-size patterns will compare to the firm-size patterns of job flows.

For comparison purposes, employment flows classified by establishment size are shown using both initial and mean establishment size classifications. The top panel of Table 6 provides annual gross and net job generation rates for establishments classified by their employment in the initial year, which is 1990 generally, but 1995 for births. The bottom panel shows the same net and gross job flows, but here they are classified by the mean employment of each establishment.

Looking first at how service job flows differ with the initial size of establishments, we see some clear patterns. First, net job creation is strongly negatively related to the initial size of establishments, as are each of the gross flows—job creation, job destruction, and reallocation. In other words, as establishment size increases, both the net job creation rate and all gross flow rates decline sharply. Only the largest size class breaks this pattern, with its higher creation rate being reflected in higher net growth and reallocation. The smallest establishments create jobs at much higher gross rates than larger establishments, leading to a very high net growth (and reallocation) rate for these tiny establishments.

Second, the gross job flow rate patterns in the lower panel are similar to those in the top panel, decreasing as mean establishment size increases.¹⁹ However, the rate of decrease in job destruction rates is much steeper by mean size than by initial size. The net change rates therefore show little variation by size, and no clear pattern. The very large

¹⁹ In the lower panel of Table 6 the same job flows for establishments are classified according to their mean employment in 1990 and 1995, regardless of whether they existed (had any employees) in both periods.

establishments, with an average of at least 5000 employees, had an extremely low destruction rate, leading to their relatively high net growth rate²⁰.

Third, we see that the use of mean establishment size classification greatly reduced the job creation included in the smallest firm size class (1-4 employees). Its net job growth rate fell from 36.9 percent to 16.7 percent when we shifted from initial to mean size classification. This is due primarily to an increase in job destruction by the smallest mean size class, which lost 52.9 percent of its mean employment, while those which were initially in that size class lost only 34.1 percent of their mean employment. Many contracting and closing establishments that were initially in the next larger size class shifted to this smallest mean size class. Indeed, the 1990 employment in the smallest firm size class rose from 2.27 million to 3.04 million when we changed from initial size classification to mean size. This 0.77 million difference represents the net of employment in growing establishments that are shifted to a larger mean size class, over the 1990 employment in initially larger establishments that died or contracted into the smallest mean size class.

Fourth, throughout the size distribution, the use of the mean establishment size classification tends to shift contracting establishments' job destruction to smaller establishment size classes. Similarly, much of the expansion in jobs by establishments that were small in 1990 is shifted to larger establishments. When initially small establishments grow rapidly, all of their growth is attributed to larger establishment mean size classes. Notice that both net and gross job creation rates distributed by mean size classes are

²⁰ Any establishment with 5,000 to 10,000 employees in 1990 that closed during the five-year period would be classified in the next smaller size class, because their ending size of zero would be averaged with their initial size. Therefore, with the exception of a very few births and deaths due to restructuring of service establishments which reported having more than 10,000 employees, no establishments deaths would be

larger than the corresponding ones using initial size for all classes of establishments with more than 19 employees, except for the open-ended class with at least 5,000 employees. The extent of the shifting of gross job flows from initial size classes to mean classes is very sensitive to the width of the class boundaries.

The use of mean size classification was originally advocated for use in studies of the relationship between employer size and job creation to avoid any regression-to-the-mean bias due to errors and temporary disturbances in the employment data (Leonard, 1986). Over a five-year period there is little reason to suspect that much of the measured employment change should be attributed to data errors and temporary disturbances. If there actually is a negative correlation of employment change with prior period change over five year intervals, it should be interpreted primarily as indicative of economic behavior, rather than as statistical error. Therefore, the remainder of this paper will use only the initial size of firms and establishments as the basis for classification of size of business units for analysis of their subsequent job creation performance.

IV. Job Flow Differences by Establishment Age

We have seen that gross job flows in services are generally negatively related to size of business units, with the relationship much stronger for establishment size. Since age is correlated positively with size, we would expect gross job flows in services also to be negatively related to business age. Younger establishments are generally thought of as less stable, both creating and destroying jobs at much higher rates than older businesses.

included in the mean size class with over 5000 employees. Similarly, those initially in the over 5000 class that had substantial losses of employment would fall into the next lower mean size class.

Net and gross job flows by age²¹ of establishment are reported in the top panel of Table 7 for all establishments that existed in 1990 or 1995. Note that the net growth rate for establishments that started in 1991-1995 was 200 percent, because that category includes only job creation from births of establishments that survived to 1995. . The bottom panel shows similar data for all establishments with employment in 1990 that survived to 1995, excluding both births and deaths during this period.

Gross job creation rates for service establishments declined strongly with establishment age, across the entire range of ages measured. In establishments that existed in 1990, gross creation rates declined from 89.6 percent to 16.8 percent as age increased. Gross job destruction rates also declined with age after the initial year (1990), but much less strongly. Businesses that started in each period prior to 1990 lost more jobs, on average, than they created during the five-year interval.

Employment volatility also declined fairly strongly with establishment age, as indicated by the figures for job reallocation. For establishments that started in 1990, the annual job reallocation rate was a remarkable 128.6 percent. It dropped to 87.0 percent for establishments that were just three years older, and then gradually declined to 40.0 percent for establishments that started in or before 1977.²²

²¹ The age of an establishment on the LEEM is determined from the year in which it first appears in the Census data system (Acs and Armington, 1998). When establishment records with different Census identification numbers are linked together to represent a continuing establishment, the start year of the oldest is used. However, establishment births are identified as all establishments reporting employees in 1995 that had no employment in March of 1990. Most of these births have start year of 1991 to 1994. But any establishment that started in 1990 or earlier and reported employment of zero in 1990 was also classified as a birth for this analysis. Because we use mean-base growth rates, all births have a growth rate of +200 percent. This analysis is based on data only for 1990 and 1995, so the observed births are limited to those that survived to 1995. Their calculated job creation is net of any destruction that took place between their birth and 1995, so their destruction rate is zero and their net growth rate is also 200 percent.

²² What mechanism might account for such a systematic negative relationship? Nucci (1999) documents how business survival rates rise rapidly as age increases. Many of the new businesses learn rapidly about

In order to examine the growth rate patterns when controlling for both the age and size of establishments, we looked at growth classified by establishment size for service establishments in each of six age groups. In Figure 2, the upper panel shows the patterns for all establishments that existed in 1990, using the initial size of each establishment for classification. The lower panel shows the comparable growth rates for continuing service establishments – excluding both births and deaths. In summary, this figure shows that net growth decreases with age when controlled for size, and decreases with size when controlled for age.

These plots indicate that not only do net growth rates decrease with increasing size, but the rate of decrease is reduced as age increases. For all establishments that existed in 1990, the slope of the decline approaches the horizontal for establishments started in 1977 or earlier. They have an average net growth rate around –8 percent regardless of size. All of the younger age cohorts have higher net growth in their smaller size classes, with growth rates declining as their age increases. The growth rate for each age cohort declines as size increases, generally reaching a minimum for the largest size class. This minimum is always lower than the rate for establishments that started in 1977 or earlier, and it descends with decreasing age. While not shown, these results also hold in each of the three sectors—business services, health services, and engineering related services—as well as for single unit firms and for establishments in multi-unit firms.

their poor prospects for success, and close in their first year, so they never appear in the LEEM (if they never had positive payroll in the first calendar quarter). Many that survive to their second year have already accumulated substantial favorable information, but a fraction of the remainder in that year, and in each succeeding year, decide against continuing, and close. This pattern of substantial, but decreasing, job destruction from closures in the first few years after startup, combined with the substantial job creation associated with business births, accounts for much of the strongly higher reallocation rates in the younger businesses.

When we examine the net growth in the surviving 1990 establishments (lower panel, excluding births and deaths) we see similarly descending lines, with each age cohort showing growth decreasing as size increases. Similarly, the rate of decrease with size is reduced with increasing age, to nearly horizontal for those starting in 1977 or earlier. The exclusion of deaths from these data results in higher net growth rates overall, but a wider spread between ages for the smallest size class. This narrows down to nearly identical rates for different age groups for the largest size class.

V. Separating the Effects of Age, Firm Size, and Establishment Size

In this section, regression analysis is used to help distinguish among the effects of age, firm size, and establishment size on the patterns of gross job creation, destruction,²³ and reallocation, and on net job growth in service establishments that existed in 1990. Job creation from business births is not included in the regression analysis.

Business births are establishments with no employment in the initial year of the growth analysis interval, but with positive employment in the ending year. Their job creation is dependent neither on their age (which is zero, by definition), nor on their initial size, which is also zero. In fact, our use of mean employment as the basis for the rate calculations leads to a constant net growth rate of 200% for all establishments with age of zero. Therefore, we cannot include births in this analysis of the joint effects of age and employment size on job flow rates without seriously biasing the estimates.

²³ Recall that we calculate job destruction as a positive number. For example if a firm had 20 employees in 1994 and 15 in 1995, job destruction would be 5. Likewise, if an establishment had 20 employees in 1994 and 25 employees in 1995, job creation would be 5. Thus, Net = creation - destruction and Reallocation = creation + destruction.

Establishment deaths, on the other hand, are distributed over all age classes, and can therefore be treated as contractions to zero employment. The job flows analyzed in this section thus include only those of pre-existing businesses, excluding the substantial job creation from births of new establishments (both new single establishment firms and new branches of existing firms). Because deaths are included and births are excluded, the net growth rates used in this analysis are generally negative, even when overall employment was growing.

A. Measurement of variables

The observations on individual establishments were grouped into cells with other establishments that had similar characteristics. Then average gross and net job flows were calculated for each cell, based on the aggregate changes of all the establishments in each cell. These constructed cells then became the observations on which the regression analysis was based. Since the cells varied greatly in the amount of employment they represented, the regressions were weighted²⁴ by the sum of the initial employment of all establishments in each cell.

Gross job creation, destruction, and reallocation, and net job change in each cell are expressed as mean-based rates, as specified above. Thus, for each cell, the sum of each flow is divided by the sum of mean employment (of initial year and ending year, including zeros for 1995 employment of deaths) of all establishments in the cell.

Each establishment with positive employment in 1990 is assigned to a cell which is defined by a relatively narrow range of values for starting year, establishment size, type of

²⁴ Recall that these are not sample weights, because the entire universe of U.S. service establishments with employees in 1990 has been sorted by their characteristics and aggregated into these cells.

firm (single or multi-unit), industry sector, and firm size²⁵. These cells are bounded as follows:

-- age class values for analysis of 1990 to 1995 growth:

Median age	Start year
0.5	1990
1.5	1989
2.5	1988
3.5	1987
4.5	1986
5.5	1985
7.0	1983-1984
8.0	1981-1982
11.5	1978-1980
16.5	1977 or earlier

-- establishment-employment size-classes:

1-4, 5-19, 20-49, 50-99, 100-499, 500 or more

-- type of firm:

multi-establishment (in 1990 and/or 1995)	1
single establishment	0

-- firm-employment size-classes:

²⁵ We explored several other specifications for measuring the additional impact of firm size (beyond that of establishments size) on job flows, but they were generally not significant. These included the ratio of firm

1-4, 5-19, 20-99, 100-499, 500-2,499, 2,500 or more

-- industry major groups:	2-digit SIC
Hotel and Other Lodging Places	70
Personal Services	72
Business Services	73
Automotive Repair, Services, and Parking	75
Miscellaneous Repair Services	76
Motion Pictures	78
Amusement and Recreation Services	79
Health Services	80
Legal Services	81
Educational Services	82
Social Services	83
Museums, Art Galleries, and Gardens	84
Membership Organizations	86
Engineering and Management Services	87
Miscellaneous Services	89

Although they are derived from cell averages that are bounded by the cell definitions, age, establishment-size, and firm size were each treated as continuous variables. Since the age classes were quite limited, the mid-point of each closed age interval was used as the value for each cell, as an approximation to the median. For the

size to establishment-size, and the residual firm employment in other establishments belonging to the firm.

open age range, a value was chosen to represent the mature establishments. Since the effects of age differences on job generation appear to be much stronger for the first several years, and fall off rapidly after several years, the natural logarithm of age was used to transform it to approximate linearity.²⁶

The representative establishment employment for each cell was calculated as the average initial employment of all establishments in that cell, and for cells with multi-unit establishments, the average firm employment was similarly calculated from the initial employment of their owning firms. These business size variables were also expressed as natural logarithms, since their expected impact was not proportional to their levels, but to proportional differences in their levels.

The complete LEEM universe of service sector employer establishments that existed at the beginning of 1990 was used to construct the cell-level data for regressions. Each establishment was classified by its age, industry, firm type, and initial employment, plus its firm employment if it was part of a multi-unit firm in either 1990 or 1995. Then the data for each cell were constructed by aggregating or averaging the values for all of the individual establishments within each cell. Regressions then used the cell level data as observations. We analyzed each of the three major sub-sectors --Business services, Health services, and Engineering and management services -- in addition to all services together (with dummies to allow for differences among sub-sectors). The numbers of cells per regression varied from 300 for engineering and management services to 4,084 for all services.

²⁶ This assumption of linearity with the logarithm of age in years was tested, by adding the square and the cube of the logarithm of age to the model specification. This produced little or no improvement in the fit for

B. Regression model

Multivariate regressions assist us in distinguishing the contribution to gross and net job flow averages from each of the factors previously discussed – firm size, establishment size, and establishment age. Here it is assumed that each of the four job flows – gross job creation, destruction, and reallocation, and net job change – varies as a function of these factors, and that this function differs for establishments that are single unit firms, and for those that belong to multi-unit firms. We also allow for differences among industries within the service sector (at the 2-digit or major group level), by using industry dummies that are not shown in the results.

The relative sizes of these job flows are expected to vary as a function of the relative values of the explanatory variables, not as a function of differences in their levels. A difference of 2 years in age should have a greater impact when it is between 1 and 3 years than when it is between 8 and 10 years. Similarly, a difference of 50 employees should have more impact when it is 50 percent of employment than when it is only 5 percent. Therefore the regression model is specified in terms of the natural logarithms for all independent variables except dummies. Each flow is estimated in the following form:

$$c_s \text{ (or d or r or net)} = \beta_1 + \beta_2 * \ln \text{ age} + \beta_3 * \text{multi} * \ln \text{ age} + \beta_4 * \ln \text{ empl} + \\ \beta_5 * \text{multi} * \ln \text{ empl} + \beta_6 * \text{multi} * \ln \text{ fempl} + \beta_n * \text{inddum}_n + \varepsilon_i$$

where:

c_{st} (or d or r or net) = the mean-based rate of job flows from 1990 to 1995 for establishments in cell s;

$\ln \text{ age}$ = log of establishment age in years in cell s;

any of the dependent variables.

multi = a dummy variable = 1 for cells containing establishments that are parts of multi-unit firms and = 0 for cells with single unit firms/establishments;

ln empl = log of average establishment employment in cell s ;

ln fempl = log of average firm employment in cell s ;

inddum _{n} = a dummy variable for industry n ; and

ε_i is a random disturbance, which incorporates the unexplained variation.

Regressions are run with data for cells representing single-unit establishment/firms and those for establishments in multi-unit firms pooled together. The cross-products of the multi dummy with other variables are used to allow for differences in the behavior of multi-units. The firm employment size variable is included only as a cross-product so that it will only be used for multi-unit establishment cells, because firm size is identical to establishment size for the single establishments. This specification helps us distinguish how the job flow patterns of single unit establishments (which are themselves independent firms) differ from those of multi-unit establishments (which may be controlled by other establishments in their firm).

C. Empirical Results

Cell-based weighted least squares regressions were run on the job flow rates for each of job creation, destruction, reallocation and net change, to assist in separating the effects of multi-unit status, age, establishment size, and firm size. Detailed regression results for 1990-1995 employment flows for services, and for three large service sub-sectors are shown in Table 8.

The coefficients estimated for all establishments specify the relationship of each explanatory variable to the job flow while controlling for the effect of multi-units. The separate multi-unit effect coefficient indicates how multi-unit establishments differ from single-unit establishments in this relationship. Thus, in Table 8, for job creation in all services, we estimate a coefficient of $-.063$ on log of age for all establishments, but the estimated multi effect is $.032$, indicating that the condition of being a multi-unit establishment is associated with a reduction in the negative association of job creation to age. Effectively, the estimated coefficient of age regressed on job creation for multi-units is $-.063 + .032$, or $-.031$, only half of that for establishments that are not multi-units. The corresponding pair of coefficients on establishment employment have the same signs, indicating that the multi-effect strengthens the measured (negative) association of establishment size with job creation in services. The coefficient estimated at $-.035$ for all establishments must be added to the multi effect of $-.012$ to get the effective coefficient of $-.047$ for establishment size on gross job creation in multi-unit establishments in services.

These results, in Table 8, show all *gross job flows* declining with age after controlling for establishment size. The coefficients on age are negative and statistically significant for job creation, destruction, and reallocation, regardless of the time period, type of establishment, or the industry coverage. The linearity of the relationship of gross flows to age was explored with higher powers of age, up to the third power. For gross job flows, a model including the square and cube of the logarithm of age had significant coefficients, but only marginal increases in explanatory power.

The negative relationship of age to gross job flows in services is stronger for destruction than for creation, so when destruction is subtracted from creation to calculate net change, the impact of age on *net job change* is positive and generally significant.²⁷ This unexpected positive sign on age was suspected of being due to the dominance of gross job destruction over creation, as a result of the one-sided exclusion of jobs created by establishment births. When deaths were omitted from the aggregation of establishments into cells, the resulting regressions, while similar in other respects, had lower coefficients on age for destruction, and had significant negative coefficients for age in the equation for net change.

For establishment age, the sign on the multi effect is always opposite that on the overall relationship, indicating that the age effect on multis is consistently weaker than for singles for all of our measured job flows and for each of the industry sectors covered here. This was expected, because the multi-unit establishments may have additional resources, both human and financial, to draw on which are not typical of their own age, but depend on the overall capacity of the firm of which they are a part.

Gross job creation declined with establishment size after controlling for age, as expected. However, the coefficients on establishment size for destruction were positive for all types of service establishments, while the additional multi-unit effect coefficient was high enough to give multi-unit establishments a small negative combined coefficient in most sectors. Only health services had a negative coefficient on establishment size for destruction for all establishments, and it had a larger negative for the multi-unit effect. Prior

²⁷ The coefficients on age for net growth in most of the detailed industries were not significant. This was the case for all establishments and for the additional factor for multi-unit firms.

analysis of 1990 to 1995 gross job flows for all industries, using the same LEEM data, had not shown a negative relationship of establishment size to destruction, nor had the single-year (1994-1995) regression analysis of services.²⁸

The coefficients on establishment size for *net job change*, after controlling for age, are negatively related to net growth rates, and the parameters are generally²⁹ statistically significant. Thus, for business services and engineering and management services, and for all services together, net job growth rates tend to fall with increasing initial establishment size.

Multi-unit status exerted a negative effect on the relationship of establishment size to gross job flow rates of all types. However, for net growth the multi-unit effects are small and positive, so the effect of establishment size on net change rates is less negative for multi-units than it is for single-unit establishments.

When we examine the coefficients on firm size for establishments in multi-unit firms, we see that after establishment size and age are accounted for, firm size differences contribute little or nothing to explaining the differences in either gross or net job flows. The coefficients for firm size are consistently very small, and often not significant at the 5 percent level. For all services together, they suggest that for gross and net job creation in larger firms, the negative effects of larger establishment size tend to be partially offset by the marginally positive effect of larger firm size.

For destruction for all services firm size has a small negative coefficient, which would slightly reinforce the negative total impact of establishment size on multi-unit

²⁸ See Acs, Armington and Robb (1999), Tables 5 and 6.

establishments. A larger and positive impact was estimated for firm size on destruction in engineering and management services. However, this coefficient is not significant for business services or for health services.

On the whole, these results suggest that the size of firms has little relationship to the net growth or gross job flow rates of existing service establishments, after the size and age of the establishments have been taken into consideration. For very large firms, the effect of firm size somewhat mitigates the effects of establishment size, as the tiny firm-size coefficients normally have the opposite sign from the larger establishment-size coefficients. Dropping the firm size variable leaves the other results virtually unchanged. It appears that most of the relationships that have been found between firm size and gross and net job flows, as in Table 4 and Figure 1 above, are dependent on the close correlation of firm size with establishment size and age.

V. Summary and Conclusions

This paper has exploited the new LEEM data to study patterns of job creation and destruction in the service sector. The LEEM is an economy-wide longitudinal database covering all U.S. business locations with employees, with data for tracking multiple years of employment changes and other characteristics of each individual establishment and the firm that owns it. These data provide an unprecedented resource for exploring alternative methods for measurement of job flows. Thus we can also evaluate the relative impact of

²⁹ The parameter on establishment size for net growth in the health sector is not significant, but those for business services and engineering and management services have high levels of significance.

differences in establishment size versus firm size on expected differences in average job flow rates.

After examining differences in job flow rates in service establishments classified by firm size, industry, establishment size, and age, we turn to multivariate methods to help distinguish the separate effects of these various inter-related factors. Regression analysis is used to investigate the direction and relative size of the relationships between employer size and age and the various job flow rates, in establishments that already existed in the initial year of each time period. We find that all *gross job flows* decline with age after controlling for establishment size. The coefficients on age are negative and statistically significant for job creation, destruction, and reallocation, for all services together, and for each of the three major sub-sectors we analyze. This relationship with age is much stronger for establishments that are single unit firms than for those that belong to multi-unit firms

Establishment size is also negatively related to gross job creation and to net job changes. However, we found that for single-unit service establishments, the five-year job destruction rates were positively related to the initial size of the establishments. In other words, their gross job loss rates increased with their employment size, after controlling for age differences. This was not true for health services, which were further distinguished by having little or no relationship between establishment size and net job creation rates.

The coefficients for firm size, when it differs from establishment size (i.e. for establishments that are part of multi-unit firms), are extremely small, and frequently not significant. Firm size differences contribute little or nothing additional to explaining differences in gross or net job flow rates when establishment size and age are controlled

for. Large firm growth rates are typically lower, than that of small firms because large firms are usually composed primarily of older and larger establishments, both of which tend to have lower gross and net job creation rates. However, the share of services employment in large firms is increasing as a result of growth and acquisition by firms of all sizes.

References

- Acs, Zoltan J., and Catherine Armington, 1998, "Longitudinal Establishment and Enterprise Microdata LEEM Documentation," Center for Economic Studies, U. S. Bureau of the Census, CES 98-9.
- Acs, Zoltan J., Catherine Armington, and Alicia Robb, 1999, "Measures of job Flow dynamics in the U. S. Economy," Center for Economic Studies, U. S. Bureau of the Census, CES 99-1.
- Armington, Catherine, 1998, "Statistics of U. S. Business - Microdata and Tables of SBA/Census data on Establishment Size," Office of Advocacy, U. S. Small Business Administration, Washington, D. C.
- Birch, David, 1979, "The Job Generation Process." Final Report to the Economic Development Administration, Cambridge, MA: MIT Program on Neighborhood and Regional Change.
- Boeri, Tito, 1994, "Why Are Establishments So Heterogeneous?" *Small Business Economics*, 6(6), 409-420.
- Boeri, Tito and U. Cramer, 1992, "Employment Growth, Incumbents and Entrants: Evidence from Germany," *International Journal of Industrial Organization*, 10, 545-565.
- Carree, Martin and Luuk Klomp, 1996, "Small Business and Job Creation: A Comment," *Small Business Economics*, 8(4), 317-322.
- Caves, Richard E., "Industrial Organization and new Findings on the Turnover and Mobility of Firms," *J. of Economic Literature*, 36(December), 1947-1982.
- Davidsson, Per, Leif Lindmark, and Christer Olofsson, 1998, "The Overestimation of Small Firm Job Creation – An Empirical Examination of the Regression Bias", *Small Business Economics*, 11(1), 87-100.
- Davis, Steven J., and John Haltiwanger, forthcoming, "Gross Job Flows," in Orley Ashenfelter and David Card, eds., *Handbook of Labor Economics*, Volume 3 and 4, New York, North Holland.
- Davis, Steven J., and John Haltiwanger, 1992, "Gross Job Creation, Gross Job Destruction, and Employment Reallocation," *Quarterly Journal of Economics*, 107(3), 819-63.
- Davis, Steven J., John Haltiwanger, and Scott Schuh, 1996a, *Job Creation and Destruction*, Cambridge, MA., The MIT Press.

Davis, Steven J., John Haltiwanger, and Scott Schuh, 1996b, "Small Business and Job Creation: Dissecting the Myth and Reassessing the Facts," *Small Business Economics*, 8(4), 297-315.

Dunne, Timothy, Mark Roberts, and Larry Samuelson, 1989a, "The Growth and Failure of U. S. Manufacturing Plants," *Quarterly Journal of Economics*, 104(4), 671-98.

Dunne, Timothy, Mark Roberts, and Larry Samuelson, 1989b, "Plant Turnover and Gross Employment Flows in U. S. Manufacturing Sector," *Journal of Labor Economics*, 7(1), 48-71.

Evans, David, 1987a, "Tests of Alternative Theories of Firm Growth," *Journal of Political Economy*, 94(4), 657-54.

Evans, David, 1987b, "The Relationship between Firm Growth, Size and Age: Estimates for 100 Manufacturing Industries," *Journal of Industrial Economics*, 35(4), 567-81.

Friedman, Milton, 1992, "Do Old Fallacies Ever Die?" *Journal of Economic Literature*, 30(4), 2129-32.

Hall, Bronwyn, 1987, "The Relationship between Firm Size and Firm Growth in the U. S. Manufacturing Sector," *Journal of Industrial Economics*, 35(4), 583-606.

Jovanovic, Boyan, 1982, "Selection and the Evolution of Industry," *Econometrica*, 50(3), 649-70.

Klomp, Luuk and Roy Thurik, 1999, "Job Flows of Firms in Traditional Services," in Z. J. Acs, et. al., eds, *Entrepreneurship, Small and Medium Sized Enterprises and the Macroeconomy*, Cambridge: Cambridge University Press, 310-326.

Konings, Jozef, 1995a, "Job Creation and Job Destruction in the U.K. Manufacturing Sector," *Oxford Bulletin of Economics and Statistics*, 57, 5-24.

Konings, Jozef, 1995b, "Gross Job Flows and the Evolution of Size in U.K. Establishments," *Small Business Economics*, 7, 213-220.

Leonard, Jonathan, S., 1986, "On the Size Distribution of Employment and Establishments," NBER Working paper no. 1951, Cambridge, MA: NBER.

Leonard, Jonathan, S., 1987, "In the Wrong Place at the Wrong Time: The Extent of Frictional and Structural Unemployment," in Kevin Lang and J. Leonard, eds., *Unemployment and the Structure of Labor Markets*, New York: Basil Blackwell.

Nucci, Alfred, 1999, "The Demography of Business Closings," *Small Business Economics*, 12 (1), 25-39.

Sutton, J., 1997, "Gibrat's Legacy," *J. of Economic Literature*, 35(1), 40-59.