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The Declining Average Size of Establishments: Evidence and Explanations

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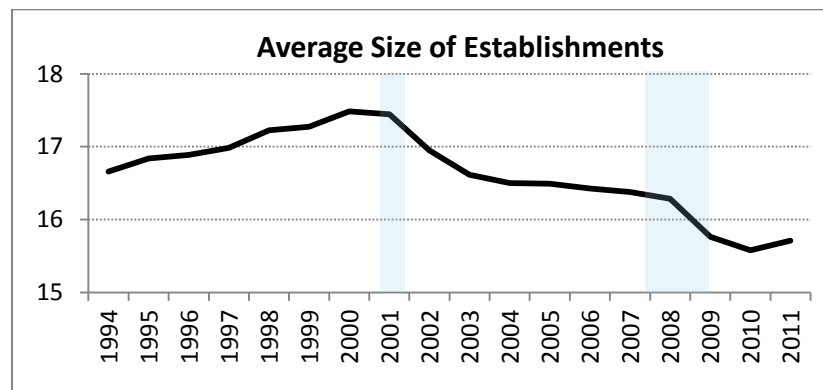
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I Introduction

Keen observers of labor market statistics have noticed that the average size of establishments has been decreasing during the last decade. The graph immediately below presents the average size of establishments in the total private U.S. economy for the 1994-2011 time period (the publicly available data from the Bureau of Labor Statistics used to create this graph are described in the following section). The average size of establishments rose through the expansion of the 1990s, and then fell slightly during the expansion of the 2000s. These trends suggest that the U.S. economy has changed in some fundamental way during the past two decades.



In this paper, we seek to understand the change in trend in the average size of establishments during the last two decades. We begin with an exploration of the robustness of the basic empirical facts – we document the data used to create the graph above, and we show that the average size of firms has similarly changed trend. We also show that the average size of establishments and firms using publicly available data from the Census Bureau mimics the trends from the BLS data, and we use the Census Bureau data to show the trends of average size in the 1990s are similar to the trends from the late 1970s and the 1980s.

Our empirical analysis results in two main conclusions. First, the change in trend of the average size of establishments occurs in almost all industries, and our decomposition shows that the sizeable shifts in industry composition that occurred in the U.S. economy during the past two decades accounts for only about half of the downward trend during the 2000s expansion. Second, we find that the decrease in the average size of establishments during the 2000s

expansion can be explained by the age of establishments. Specifically, we find that establishment births are starting smaller and staying smaller. The average size of births in the 1990s was around 7.6, whereas the average size of births fell from 6.8 in 2001 to 4.7 in 2011.¹

Our findings have several broad implications for how we think about the economy. First, we believe that it is likely that the declining average size of establishments is being driven by changing modes of production that place a greater emphasis on technology and a lesser emphasis on labor. It is reasonable to assume that these new modes of production enter the economy through business births. We discuss this point in more detail in the final section of this paper. Second, we also believe that the declining average size of establishments helps explain why average annual employment growth during the 2000s expansion (1.6 percent) is lower than during the 1990s expansion (3.0 percent) and previous expansions (such as the 3.3 percent growth rate in the 1980s expansion and the 4.5 percent growth rate in the 1976-1979 expansion).² Attempting to estimate the relationship between establishment size and total employment growth is beyond the scope of this paper.

II The Declining Average Size of Establishments

II.A Basic Facts

Our motivating graph, which shows the declining average size of establishments during the last decade, is created from Business Employment Dynamics (BED) statistics publicly available from the Bureau of Labor Statistics (BLS). The BED microdata are constructed by longitudinally linking the Quarterly Census of Employment and Wages (QCEW) microdata. The QCEW is the BLS's business list, with employment and wage information for all establishments covered by State and Federal Unemployment Insurance (UI) laws. The QCEW data are used as the sampling frame and the employment benchmark for other BLS establishment-based surveys.³ The BED program publishes first-quarter (March) non-seasonally adjusted private sector

¹ Others have remarked on the declining size of establishment births: see Sadeghi (2008), Reedy and Litan (2011), and Robertson (2011).

² The average annual employment growth rates in this paragraph are computed from March non-seasonally adjusted total private employment statistics from the Current Employment Statistics (CES). We acknowledge that supply-side factors have certainly contributed to this recent decline in the average annual employment growth rate.

³ For more information about the construction and uses of the BED, see Spletzer et al. (2004).

employment and the associated number of establishments.⁴ We compute the average size of establishments as employment divided by the number of establishments.

We present the time series of employment, the number of establishments, and the average size of establishments in Figure 1. Looking at the bottom panel of Figure 1, the average size of establishments rose during the 1990s, from 16.7 in March 1994 to 17.5 in March 2000, and then declined during and immediately following the 2001 recession, from 17.5 in March 2000 to 16.6 in March 2003. The average size of establishments declined slightly during the mid-2000s, from 16.6 in March 2003 to 16.4 in March 2007. There was another decline during and immediately after the most recent recession, from 16.4 in March 2007 to 15.6 in March 2010.

The decline in the average size of establishments during recessions is not surprising. Recessions are a period of employment loss in the economy, and are often referred to as a period of “cleansing” as many establishments decrease their employment. What we find interesting in Figure 1 is the different slopes during the expansions of the 1990s and the 2000s. The goal of this paper is to better understand this phenomenon.

II.B Establishment Versus Firm – Does it Matter?

As a check on robustness, we ask whether the average size of firms has also exhibited different slopes in the last two decades. We are somewhat worried, particularly in light of the advances in telecommunication and telework during the last decade, that a large firm might set up new establishments and transfer existing staff to these new places of work, thus generating an increase in the number of establishments with no corresponding increase in employment. In this simple example, the decline in the average size of establishments that we observe would not be mirrored by a decline in the average size of firms.

We create the average size of firms using publicly available data on employment and the number of firms from the BED program.⁵ We compute the average size of firms as employment divided by the number of firms.

⁴ The employment data are online at http://www.bls.gov/bdm/us_age_naics_00_table6.txt, and the number of establishments data are online at http://www.bls.gov/bdm/us_age_naics_00_table5.txt.

⁵ The employment data are online at http://www.bls.gov/web/cewbd/table_f.txt, and the number of firms data are online at http://www.bls.gov/web/cewbd/table_g.txt.

The time series of employment, the number of firms, and the average size of firms is presented in Figure 2. Looking at the bottom panel, we see that the time series of the average size of firms is broadly similar to the time series of the average size of establishments. Both rise during the 1990s, with the rise in the average size of firms greater than the rise in the average size of establishments, and then both decline during and immediately following the 2001 recession. During the 2000s expansion, the average size of firms rises by 0.2 (from 21.8 in March 2003 to 22.0 in March 2007), whereas the average size of establishments falls by 0.2 (from 16.6 in March 2003 to 16.4 in March 2007). Both series then decline during the 2007-2009 recession.

The data in Figures 1 and 2 leads us to conclude that both the average size of establishments and the average size of firms are rising in the 1990s expansion, and are relatively steady in the 2000s expansion. This robustness check confirms that in some manner, businesses are structuring their workforces differently in the 2000s than in the 1990s.

II.C Does Census Data Show a Declining Average Size?

The Census Bureau's Business Dynamics Statistics (BDS) is similar to the BED data from the BLS. For the purposes of this paper, both the BDS and the BED publish time series of employment, the number of establishments, and the number of firms in the private sector.⁶ The average size of establishments and firms from the BDS and the BED are graphed in Figure 3. The red lines in Figure 3 denote data from the Census Bureau, whereas the blue lines denote data from the BLS. The solid lines refer to establishments, and the dashed lines refer to firms.⁷ In the bottom panel of Figure 3, the average size of establishments is on the left axis and the average size of firms is on the right axis.

There are two immediate conclusions from Figure 3. First, we see that both the BLS and the Census Bureau data show the average size of businesses – measured as either the average size of establishments or the average size of firms – growing during the 1990s expansion, declining during recessions, and staying steady during the 2000s expansions. The precise quantifications are as follows: the average size of establishments grew by 0.8 in the BED series

⁶ The BDS data are online at http://www.ces.census.gov/index.php/bds/bds_database_list. As of December 5, 2011, data for 2010 and 2011 are not yet available from the BDS.

⁷ Note that there is no difference in employment when looking at establishments versus firms.

and by 1.5 in the BDS series during the 1990s expansion (1994-2000), whereas the average size of establishments fell by 0.2 in the BLS series and by 0.1 in the BDS series during the 2000s expansion (2003-2007). The average size of firms grew by 1.9 in the BED series and by 2.4 in the BDS series during the 1990s expansion, whereas the average size of firms grew by 0.2 in both the BLS series and the BDS series during the 2000s expansion. While the exact amount of growth and decline varies somewhat depending upon whether we are looking at establishments or firms, or whether we are looking at BLS or Census data, all four series plotted in Figure 3 agree that the time series of the average size of businesses is rising in the 1990s expansion and is relatively flat in the 2000s expansion.

The second conclusion from Figure 3 is that we see a divergence in the average size of businesses when comparing the BDS and the BED data. The BDS and the BED both agree that the average size of establishments in 1996 is 16.9. In 1998, the average size of establishments is higher in the BDS than in the BED, and this difference grows until 2000 when the average size in the BDS is 18.1 and the average size in the BED is 17.5. This difference widens as the economy emerges from the 2001 recession, and in 2004 the difference in the average size of establishments is one full employee (17.5 in the BDS versus 16.5 in the BED). This difference grows again in the mid-2000s and during the 2007-2009 recession. In 2009, the average size of establishments in the BDS is 17.1 whereas the average size of establishments in the BED is 15.8. A similar yet somewhat smaller divergence holds for the BED and BDS measures of the average size of firms.

This divergence between the BED average size measure and the BDS average size measure is almost entirely due to divergences in employment rather than divergences in the number of establishments. Visual inspection of the top panel of Figure 3 shows a relatively large divergence in employment as measured by the two data sources. During the mid-1990s, BDS employment is about four million higher than BED employment. This difference then rises monotonically from 1997 to 2004; the 2004 difference is greater than eight million. The BDS has 8.4 million more employment than does the BED in 2009.⁸ The middle panel of Figure 3

⁸ The fact that the BDS employment is several million higher than BED employment in the early to mid 1990s is not surprising – this is one of the primary conclusions from the BLS-Census Business List Comparison Project that was conducted in the mid-2000s. This comparison project also found that the employment difference between BLS and Census grew in magnitude during the 1999-2002 time period (the comparison project only analyzed data from 1993 to 2002). Further details of the BLS-Census Business List Comparison Project can be found in Becker et.al. (2005), Elvery et.al. (2006), and Fairman et.al. (2008).

shows that the BED has a slightly higher growth rate of the number of establishments than does the BDS, whereas the growth rates of the number of firms appears to be identical. This small divergence in the establishment counts helps explain why the average size of establishments diverges more across data sources than does the average size of firms. A formal decomposition shows that 92 percent of the 1996-2009 divergence in the average size of establishments is due to differential growth rates in employment, with the remaining 8 percent of the divergence due to differential growth rates in the number of establishments.

II.D A Longer-Run Perspective

A natural question at this stage of the analysis is to ask about the average size of businesses before the 1990s and 2000s. We know of two data sources that would allow for pushing back the average size statistics into the 1980s and earlier. The first is the Census data used in the previous sub-section – these data start in 1977. The second is the published data on employment and the number of employers covered by State and Federal UI laws – these data go back to 1938, the start of the UI program. We have been unable to create a consistent time series from the UI data, and we use the Census data for our analysis here.⁹

We present the employment, the number of establishments and the number of firms, and the average size of establishments and firms from 1977 to 2009 in Figure 4.¹⁰ The main point to take away from Figure 4 is that the average size of establishments and the average size of firms decline during recessions and increase during the expansions of the 1970s, the 1980s, and the 1990s. The average size of establishments grew by 1.0 during the 1977-1979 time period, by 1.1 during the 1983-1989 time period, and by 1.6 during the 1992-2000 time period. The average size of firms grew by 1.3 during the 1977-1979 time period, by 1.8 during the 1983-1989 time period, and by 2.4 during the 1992-2000 time period. The trend of average size during the 2000s expansion is different from the trend during earlier expansions, in that we do not see an increase

⁹ The data on employment and the number of employers covered by UI laws are published in the annual BLS publication “Employment and Wages.” These publications are in hard cover (and not online) through 2004. The BLS now publishes UI-covered employment and the number of establishments online, with statistics available from 2001 to the present. However, for many reasons, the earlier published data, the online data series, and the data we use in Figure 1 do not form a consistent 72-year time series.

¹⁰ The 1977 and 2009 data points from the Census BDS were used by Braguinsky, Branstetter, and Regateiro (2011), who state that the U.S. firm size distribution has modestly shifted to the right between the late 1970s and 2009.

in the average size during the 2000s expansion that is of similar magnitude to the increases during the expansions of the previous three decades. In the BDS data, the average size of establishments fell by 0.2 during the 2003-2007 time period, and the average size of firms only grew by 0.2 during the 2003-2007 time period.

III Basic Analysis of Employment and Establishment Size

III.A The Size Distribution

To isolate the source of the difference in the average size growth between the 1994-2000 and 2003-2007 expansions, we start our descriptive analysis by examining where in the size distribution the difference has occurred during the two expansion periods.

We calculate the fraction of employment and establishments across the nine standard size categories: 1-4, 5-9, 10-19, 20-49, 50-99, 100-249, 250-499, 500-999, and 1000+ using unpublished BED tabulations. We also perform the similar calculations using the public use BED data on employment and the number of firms.

Table 1 presents the calculated fraction of employment and establishments (or firms) by size in March 1994, March 2000, March 2003, and March 2007, the starting and ending points that we use to define the 1990s and the 2000s expansions. The establishment data in the left panel show that employment shifted out of small establishments with 19 or less employees and grew in larger establishments with 50-999 employees during the 1994-2000 expansion. During the 2003-2007 expansion, on the contrary, there was not much of a change in the size distribution except that the fraction of employment in establishments with 1000 or more employees dropped noticeably. The fraction of establishments in each size category exhibits one prominent change across the two expansions: the share of establishments with less than 5 employees fell during the 1994-2000 expansion (from 50.2 percent to 49.8 percent) but rose during the 2003-2007 expansion (from 50.4 percent to 51.0 percent). The firm data in the right panel also tell us that employment share fell in small firms and increased in large firms during the 1994-2000 expansion but stayed relatively constant during the 2003-2007 expansion. The distribution of firms over size classes is similar across the four years, with the exception of the smallest size class, which fell in the 1990s but grew in the 2000s.

We wish to highlight the role of the smallest businesses in Table 1. During the 1990s expansion, both the employment share and the establishment share shifted from small businesses to medium and large sized businesses, but during the 2000s expansion, the employment share in the smallest businesses was constant and the relative share of businesses classified in the smallest size category increased. This suggests that the explanation for the change in trend in the average establishment size will have some of its roots in the smallest establishments and firms.

III.B Industry Analysis

We now examine whether the change in trend of the average size of establishments is driven by changes in industry composition. For example, we know that manufacturing establishments are larger, on average, than service establishments, and the shift in employment out of manufacturing and into services could generate a falling average establishment size.

Table 2 presents the fraction of employment, the fraction of establishments, and the average size of establishments by the 2-digit North American Industry Classification System (NAICS) in 1994, 2000, 2003, and 2007. The most noticeable change in the industry composition is the decline of Manufacturing since 1994. Manufacturing employed 18.3% of US workers in 1994, and this fraction decreased to 16.1% in 2000, to 13.9% in 2003, and to 12.4% in 2007. The fraction of establishments in Manufacturing also declined from 6.6% in 1994 to 6.0% in 2000, to 5.4% in 2003, and to 4.8% in 2007. This decline in manufacturing is offset by increases in Construction, Professional, Scientific and Technical Services, Administrative and Support Services, and Health Care and Social Assistance.

The far right panel of Table 2 shows that trend in the average size of establishments changed in almost all industries during the 2000s expansion compared to the 1990s expansion. The change in trend was either a slower growth or an accelerated decline after the 2001 recession. The average size was growing during the 1990s expansion and grew at a slower rate during the 2000s expansion in industries such as Construction, Retail Trade, and Accommodation and Food Services. These industries are known as cyclical industries where we would normally expect to see growth during expansions. The average size was growing during the 1990s expansion and became flat without further growth during the 2000s expansion in industries such as Wholesale Trade, Transportation and Warehousing, Administrative and

Support Services, and Other Services. Industries such as Manufacturing, Information, Real Estate and Rental and Leasing, Health Care and Social Assistance, and Arts, Entertainment, and Recreation exhibited a growing average size during the 1990s but a declining average size during the 2000s. In the Finance and Insurance, Management of Companies and Enterprises, and Educational Services industries, the average size of establishments was flat or declining during the 1990s expansion and declining more rapidly during the 2000s expansion. These trends can be seen more obviously in Figure 5, which graphically presents the average size of establishments by industry from 1994 to 2010.

To get a more formal understanding of how industry changes affect the average establishment size, we decompose the total change in the average establishment size between 1994 and 2000 as well as between 2003 and 2007 into the average size effect and the establishment share effect by industry. The average size effect measures the change in the average size of establishments attributable to the changing average size within industries, holding the industry establishment share fixed. The establishment share effect measures the change in the average size of establishments attributable to changes in the establishment share between industries, holding the average size of establishments in each industry constant.

The decomposition formula can be written as the following:

$$\Delta S_t = \sum_i \Delta S_{it} \bar{\lambda}_{it} + \sum_i \Delta \lambda_{it} \bar{S}_{it}. \quad (1)$$

Here, $\Delta S_{it} = S_{it_1} - S_{it_0}$ is the change in the average establishment size in industry i over the time interval $t = [t_0, t_1]$, $\bar{\lambda}_{it} = (\lambda_{it_1} + \lambda_{it_0}) / 2$ is the average establishment share of industry i at time t_0 and t_1 , $\Delta \lambda_{it}$ is the change in the average establishment share during time interval $t = [t_0, t_1]$, and $\bar{S}_{it} = (S_{it_1} + S_{it_0}) / 2$ is the average of industry i 's establishment size at time t_0 and t_1 . We implement this decomposition using the 20 industry categories at the 2-digit NAICS level.

Table 3-A and 3-B present the industry decomposition results for the 1994-2000 and 2003-2007 expansions, respectively. The average size of establishments increased by 0.8 during the 1994-2000 expansion – this is the growth from 16.6 to 17.5 in Table 2.¹¹ The 130.0%

¹¹ More precisely, it is an increase from 16.63 in 1994 to 17.47 in 2000.

statistic in the bottom row of Table 3-A shows that this increase is more than explained by the average size change within industries holding the establishment share constant. The increases in average size in industries such as Construction, Retail Trade, Administrative and Support Services, Health Care, and Accommodation and Food Services were the main contributors to this average size effect. The negative sign of the establishment share effect (-30.0% in the bottom row of Table 3-A) indicates that the average size should have declined due to composition changes in the establishment shares across industries during the 1994-2000 time period, holding average size within industries fixed. The establishment share effect mainly came from the relative decline of the Manufacturing and Retail Trade industries.

Table 3-B, on the other hand, analyzes the average size decrease of 0.3 during the 2003-2007 expansion; this is the decline from 16.6 to 16.3 in the bottom right corner of Table 2. Holding the establishment share of each industry constant, the changes in the industry-specific average sizes explain 46% of the 0.3 decrease in the average size. This average size effect was mainly contributed by the Manufacturing, Information, Finance and Insurance, Management, and Health Care industries. These are industries where technological change can easily be adopted. Holding the average size of each industry constant, the changes in the establishment shares across industries explain 54% of the 0.3 decrease in the average size. In particular, the declining relative shares of the Manufacturing and Retail Trade industries drove the 2003-2007 establishment share effect.

Our analysis in Tables 3-A and 3-B leads us to conclude that the change in trend of establishment size growth over the last two decades was not driven by a particular industry but rather by many industries, although the decline of the Manufacturing industry had a substantially larger effect than the other industries. The composition effect that occurs when the economy shifts from manufacturing, with its large average establishment sizes, to services, with its smaller establishment sizes, is estimated to decrease the average size of establishments by 0.24 in the 1994-2000 time period ($0.8 * -30\%$) and by 0.16 in the 2003-2007 time period ($-0.3 * 53.6\%$).

III.C Age Analysis

Our final descriptive analysis examines whether the change in trend of the average size is related to the age distribution of establishments. We use BED data on employment and number of establishments by age.¹²

Table 4 presents the fraction of employment and establishments as well as the average size of establishments by establishment age in 1994, 2000, 2003, and 2007. The calculations are presented by eight age categories: less than one year, one year, two years, ... , six years, and seven or more years. Since the data begins in 1994, we have incomplete information on the age distribution in 1994.¹³ Three conclusions are immediately apparent in Table 4. First, older establishments are larger, on average, in all years. For example, in 2007, the youngest establishments have an average of 5.3 employees whereas the establishments 7 years or older have an average of 22.2 employees. This positive relationship between age and average size is not surprising, and occurs because large establishments tend to survive and because surviving establishments grow during their early years. Second, over half of establishments are 7 years or older and these establishments hire over 70% of workers. Establishments and employment became more concentrated in the 7+ years category over the last decade. Third, and most importantly in our analysis, the average size of establishments decreased in all but the oldest age categories between 2000 and 2007.

Figure 6-A and Figure 6-B show the average size of establishments born between 1993 and 2010 by age and by birth cohort, respectively. Each line in Figure 6-A indicates the time series profile of each age group, and each line in Figure 6-B indicates the age profile of each birth cohort. The lowest line in Figure 6-A shows that the average size of new births was constant around 7.6 from 1994 to 1999, and has gradually declined every year since 1999. In 2011, the average size of new births is 4.7. One sees in Figure 6-A that the average size of establishments less than 7 years old was almost flat or slightly increasing during the 1994-2000 expansion and was decreasing around and after the 2001 recession. The average size of establishments 7 years or older looks almost flat or slightly increasing during the 2003-2007

¹² These data are available at http://www.bls.gov/bdm/us_age_naics_00_table6.txt and http://www.bls.gov/bdm/us_age_naics_00_table5.txt.

¹³ Not all of the eight age categories are available from the BED data in the 1994-2010 periods. For example, less than one year and one year and older are the only two available age categories in 1994.

expansion, although it is hard to generalize as we have limited data for these older establishments in these years. Interestingly, the lines do not cross and are almost parallel except for 11-14 year old establishments. In Figure 6-B, the age profiles are upward sloping and are almost parallel for the cohorts born during the 2000s expansion. Among establishments born after 2000, the age profiles for more recent birth cohorts start lower and generally stay lower than those for earlier birth cohorts.

Figure 7-A and Figure 7-B present the average size of establishments by age and by birth cohort in each industry. Figure 7-A indicates that the time series profiles of the average establishment size in almost all industries are downward sloping and almost parallel among young establishments during the 2000s expansion, which is what we observe for the total private sector in Figure 6-A. Similarly, the age profiles shown in Figure 7-B are upward sloping and parallel among young establishments in most industries. The slope of the age and time series profiles is steeper among technology intensive industries than labor intensive industries. The former include Manufacturing, Information, Management, and Administrative and Support Services, whereas Construction, Wholesale Trade, Retail trade, and Real Estate and Rental industries are the latter.

We conduct a decomposition of the change in the average establishment size into the average size effect and the establishment share effect by age groups. The decomposition formula is the same as in equation (1), but now i indicates age groups instead of industries. The decomposition is implemented with the eight age categories used in Table 4. With the limited age data, this decomposition can be performed only between 2003 and 2007.

Table 5 presents the decomposition results. The decline in the average size of establishments by 0.2 between 2003 and 2007 is more than explained by the average size effect, which is estimated to be 150.8%.¹⁴ The interpretation of this 150.8% statistic is that holding constant the establishment shares of age cohorts, the changing average size of age cohorts would suggest the decrease in the average size should be greater (in absolute value) than the observed decrease in the average size. The average size effects are generally larger for younger establishments. The estimated establishment share effect of -50.8% suggests that holding constant the average size of each age cohort, the changing share of establishments towards older

¹⁴ The discrepancy between Table 5 (-0.2) and Table 3-B (-0.3) comes from differences in the number of establishments between the published annual age data and the unpublished quarterly industry data. The difference is very small (more precisely -0.24 vs. -0.26).

cohorts should have resulted in an increased average size. The largest contributor to the establishment share effect is establishments that are 7 or more years old. Overall, looking at the total column in Table 5, the declining average size between 2003 and 2007 is quite uniformly attributable to the youngest age categories of 1-6 years old, with the 7+ year age category suggesting that the average size of establishments should have increased.

This statistical analysis in Table 5 confirms what we saw in Figure 6-A and Figure 6-B. We find that new establishment births are starting smaller and staying smaller, whereas older establishments are increasing their average size. This decline in the average size of establishment births is a pattern that is monotonic across years and industries, with a starting point around the 2001 recession.

We conclude this section by noting that our key finding – that new establishment births are starting smaller and staying smaller – is not found in the Census BDS data. Reedy and Litan (2011) note this discrepancy in their Figure 7. In the BED data, the average size of establishment births monotonically falls from 7.7 in 1999 to 4.7 in 2011, yet in the BDS data, the average size of establishment births in the BDS is relatively constant around 9.0 during the 2003-2008 time period (although this lack of trend is sensitive to endpoints – the 2002 average size is 10.8 relative to the 2003 average size of 9.0, and 2007 average size is 8.8 relative to the 2008 average size of 9.5).¹⁵ The most noticeable aspect of the Census BDS data is the spikes in employment for establishment births and the spikes in the number of establishment births that occur in years ending in “2” and “7” (which are the years of the quinquennial Economic Census). These spikes affect the entire age distribution of employment and the number of establishments.¹⁶ Because the spikes occur in both employment (the numerator of the average size calculation) and in the number of establishments (the denominator of the average size calculation), the resulting average size series appears relatively smooth. In contrast, the BED employment by age series and the BED number of establishments by age series are quite smooth over time. Given the spikes in the underlying BDS series of the numerator and the denominator, we discount the BDS average size of establishment birth series and put much more belief in the BED data.

¹⁵ We thank Javier Miranda at the Census Bureau for sending us the unpublished tabulations used in Figure 7 of Reedy and Litan (2011).

¹⁶ For example, the spike in 1992 birth employment leads to a spike in 1993 employment of establishments that are 1 year old, a spike in 1994 employment of establishments that are 2 years old, and so forth.

IV Summary and Discussion

This paper has been motivated by the observation that the average size of establishments has been falling during the decade of the 2000s. Our analysis shows that the average size of establishments rose during the 1990s expansion, fell during both the 2001 and the 2007-2009 recessions, and has been essentially flat during the 2000s expansion. This change in trend when comparing the 1990s expansion and the 2000s expansion exists for both establishments and firms, and exists in both BLS and Census public use data. The business cycle properties of the average size measure are similar in the late 1970s, the 1980s, and the 1990s, with the 2000s expansion being different than the three previous expansions.

Our key conclusion is that during the decade of the 2000s, establishment births are starting smaller and staying smaller. This is a pattern that is monotonic across the decade, with a starting point around the 2001 recession. This finding of smaller establishment births is strong enough to explain the decrease in the average size for the total private economy.

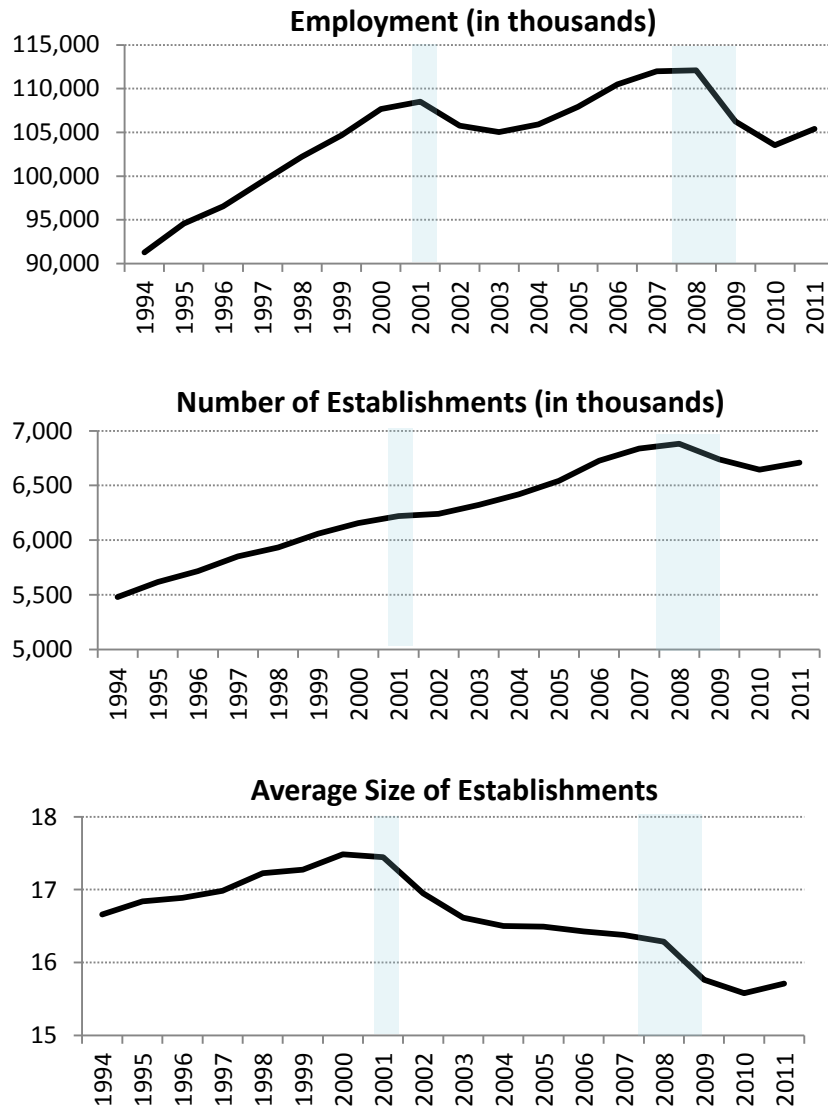
We believe that this finding of smaller establishment births is consistent with the hypothesis that births are entering the economy with new modes of production that place a greater emphasis on technology and a lesser emphasis on labor.¹⁷ Our ongoing work is focused on finding empirical evidence consistent with this hypothesis. Some of the evidence that we presented in this paper suggests that industries that intensively use technology are those with the largest change in trends in the average size of establishments. As such, with the assumption that technology can be measured by capital (or specific types of capital such as information capital), we are using industry-level data to investigate whether changes in capital-labor ratios are correlated with changes in the average size of establishments. We are also looking at the trend of the average size of young establishments in the Occupational Employment Statistics (OES) microdata, and investigating whether occupations losing employment due to decreasing establishment size are those that we would expect to be affected by technology reducing labor (occupations such as clerical, administrative, and production).

¹⁷ This hypothesis is inherent in vintage capital models, yet empirical evidence is limited. For a review of the empirical literature and some new empirical results, see Robb and Reedy (2011).

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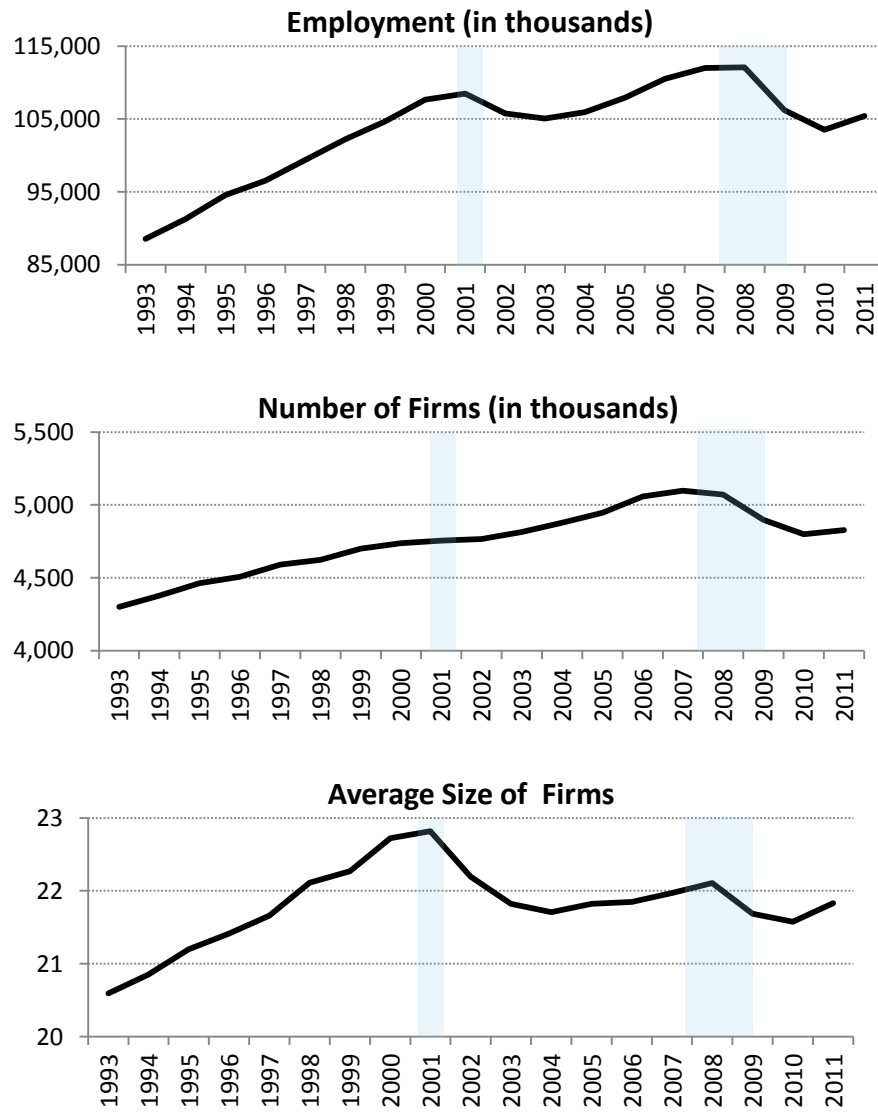
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FIGURE 1: Private Sector Employment, Number of Establishments, and Average Size of Establishments



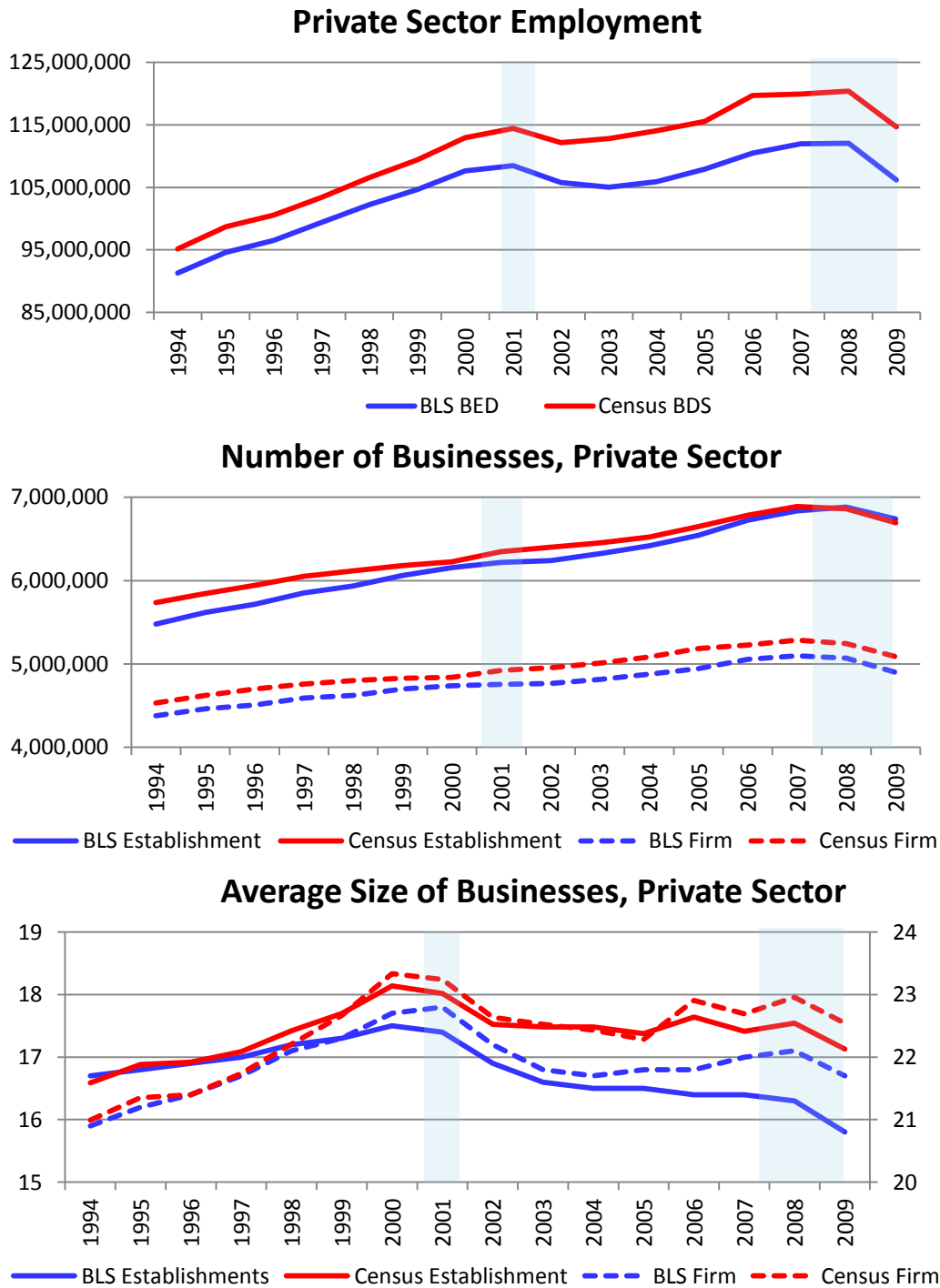
Source: Employment data from http://www.bls.gov/bdm/us_age_naics_00_table6.txt;
 Number of establishments data from http://www.bls.gov/bdm/us_age_naics_00_table5.txt.

FIGURE 2: Private Sector Employment, Number of Firms, and Average Size of Firms



Source: Employment data from http://www.bls.gov/web/cewbd/table_f.txt;
Number of firms data from http://www.bls.gov/web/cewbd/table_g.txt.

FIGURE 3: Employment, Number of Businesses, and Average Size of Businesses

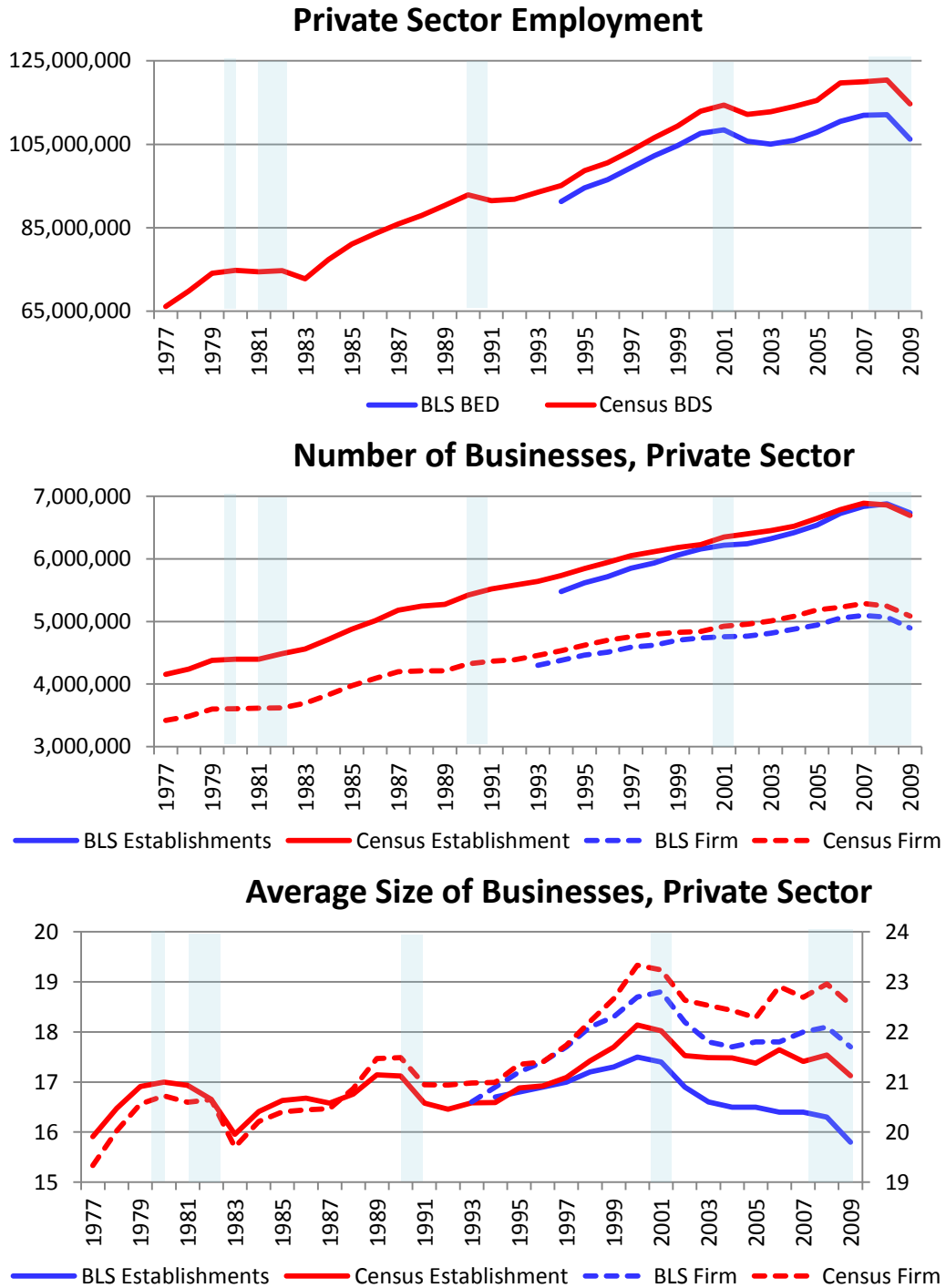


Source: See Figure 1 for BLS establishment data sources. See Figure 2 for BLS firm data sources.

Census data from http://www.ces.census.gov/index.php/bds/bds_database_list.

Note: In the bottom panel, the average size of establishments is on the left axis and the average size of firms is on the right axis.

FIGURE 4: Employment, Number of Businesses, and Average Size of Businesses

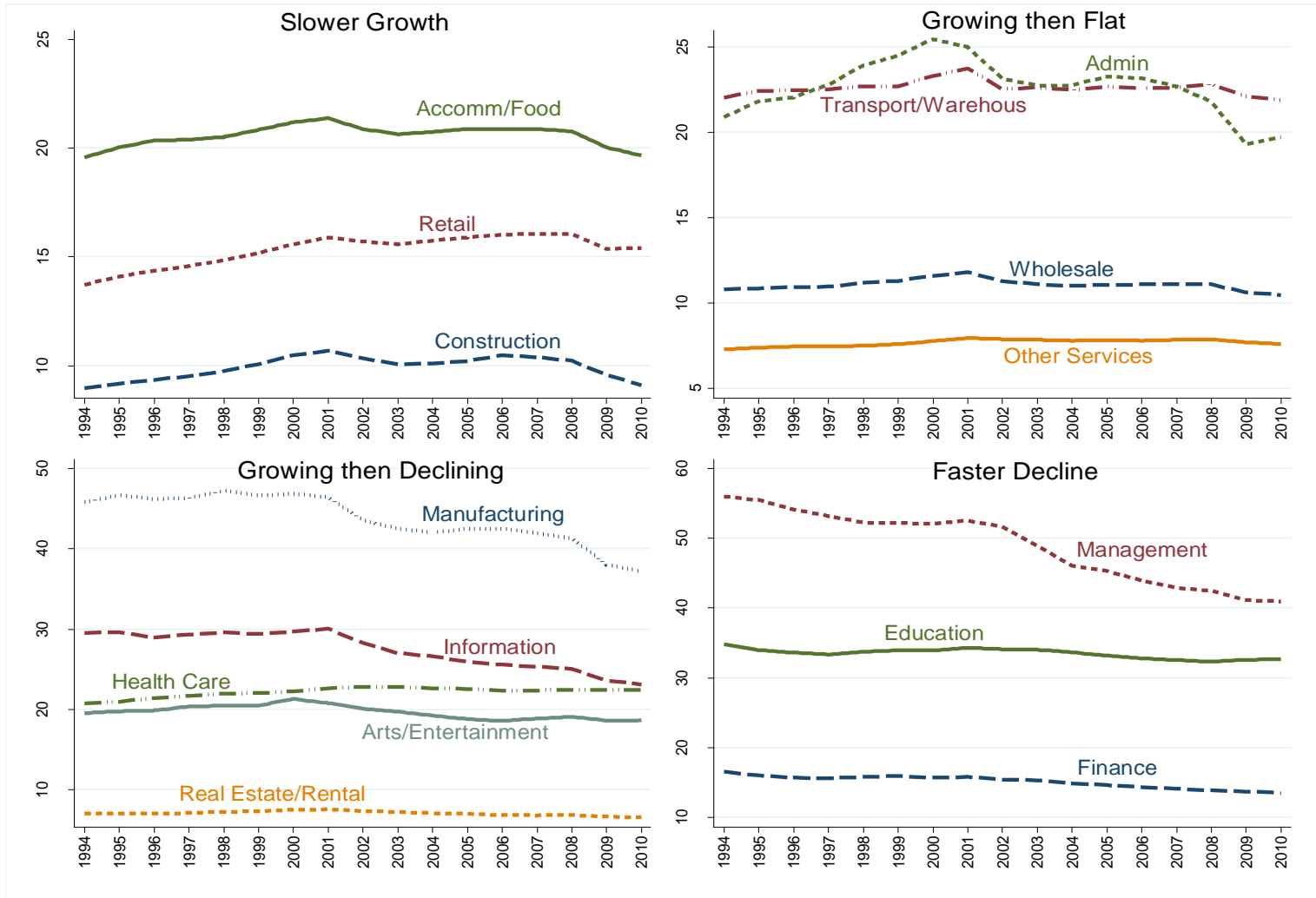


Source: See Figure 1 for BLS establishment data sources. See Figure 2 for BLS firm data sources.

Census data from http://www.ces.census.gov/index.php/bds/bds_database_list.

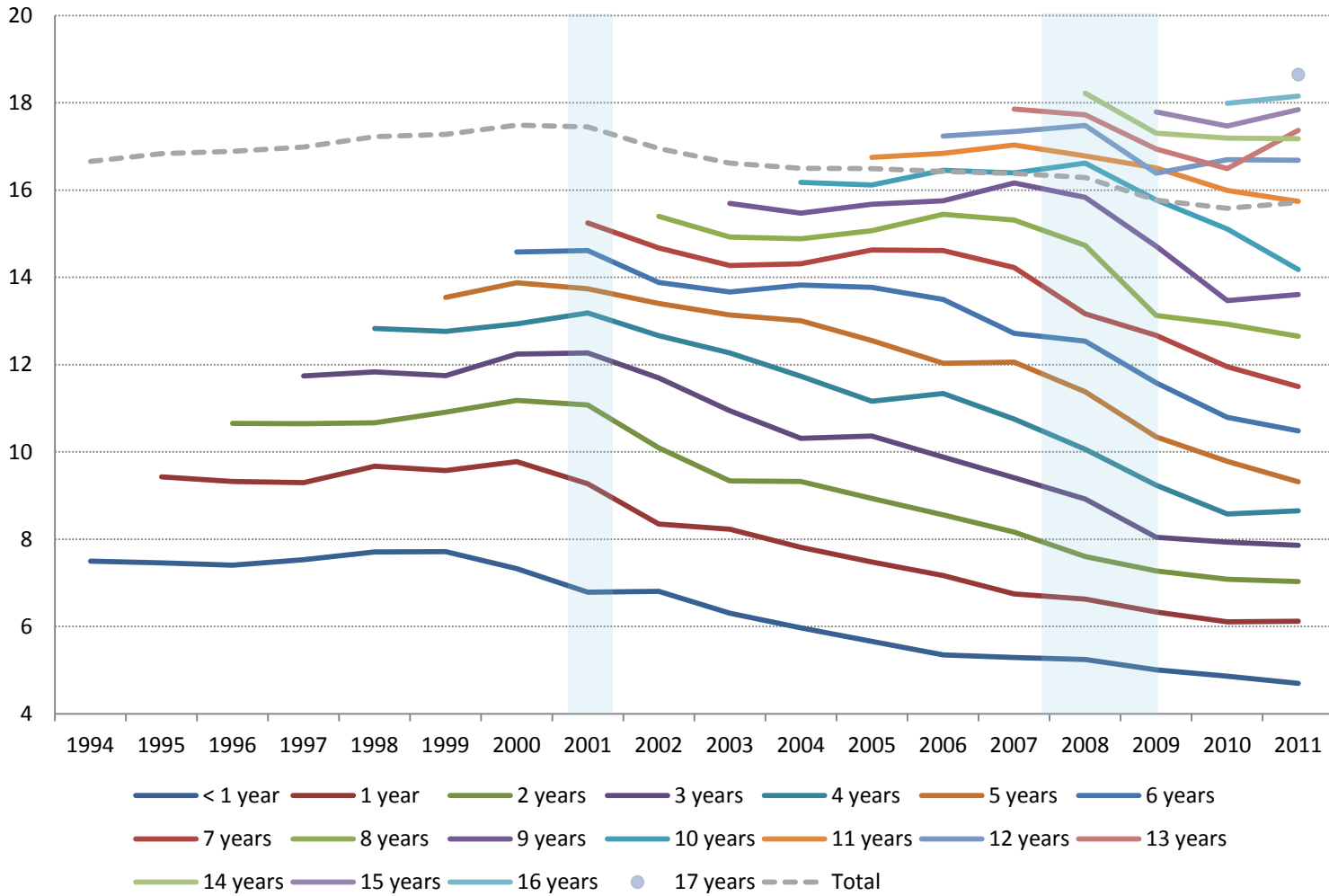
Note: In the bottom panel, the average size of establishments is on the left axis and the average size of firms is on the right axis.

FIGURE 5: Average Size of Establishments, by Industry



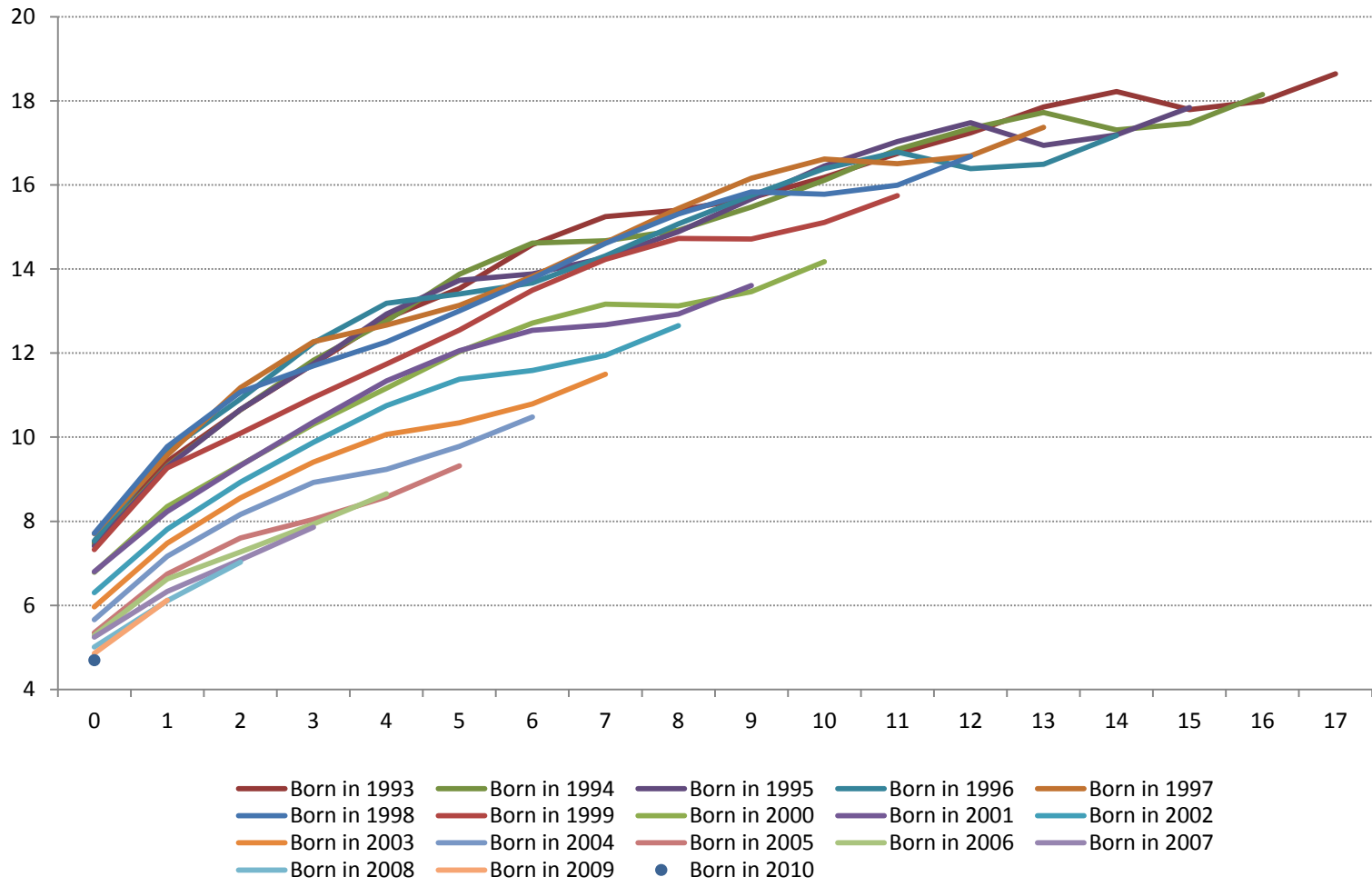
Source: Unpublished tabulations on employment and number of establishments by 2-digit NAICS.

FIGURE 6-A: Time Series Profile of Average Establishment Size by Establishment Age



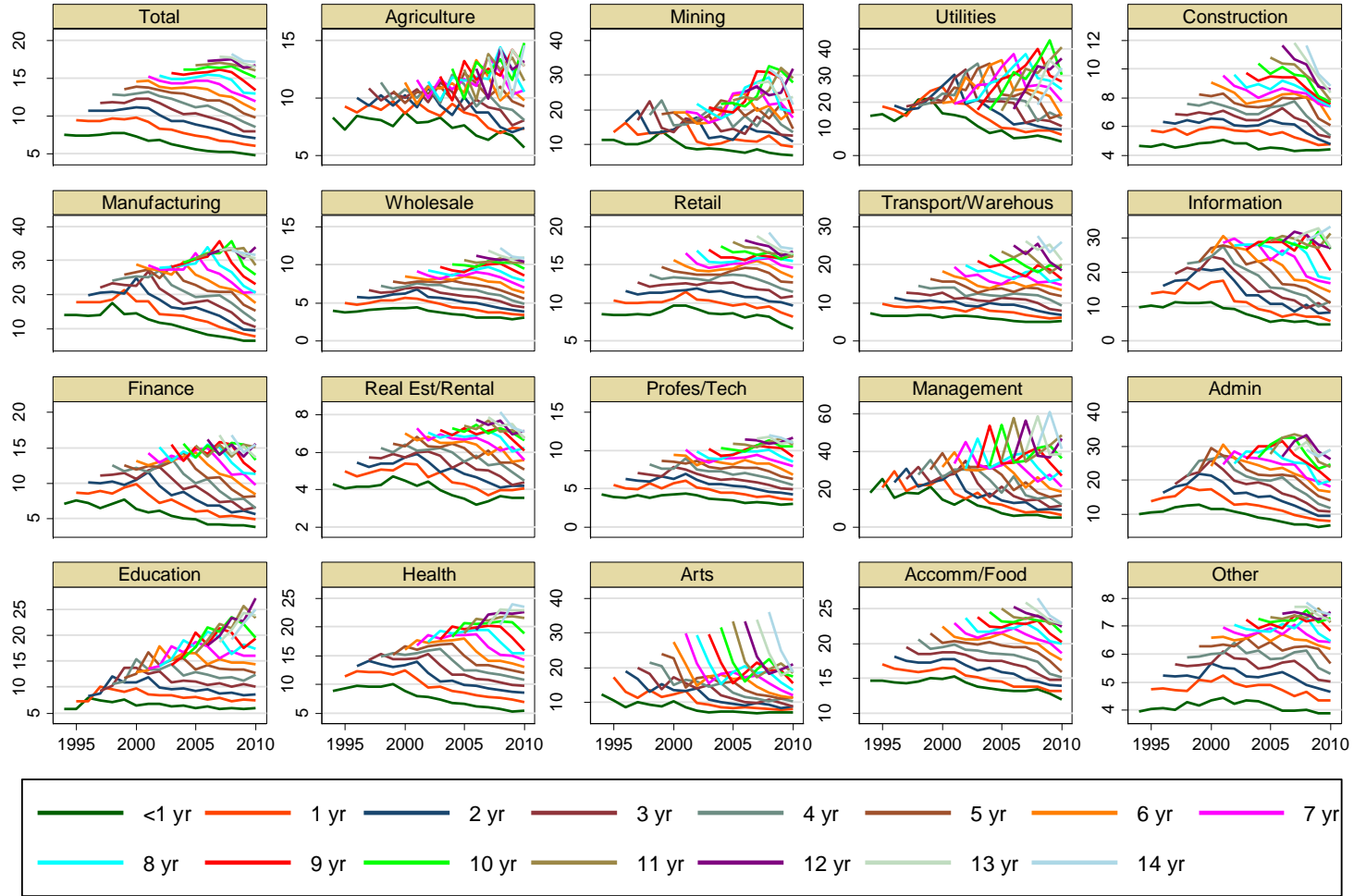
Source: Employment data from http://www.bls.gov/bdm/us_age_naics_00_table6.txt;
 Number of establishments data from http://www.bls.gov/bdm/us_age_naics_00_table5.txt.
 Note: Establishments born before 1993 are not in the graph above but are reflected in the “total” line.

FIGURE 6-B: Age Profile of Average Establishment Size by Birth Cohort



Source: Employment data from http://www.bls.gov/bdm/us_age_naics_00_table6.txt;
 Number of establishments data from http://www.bls.gov/bdm/us_age_naics_00_table5.txt.

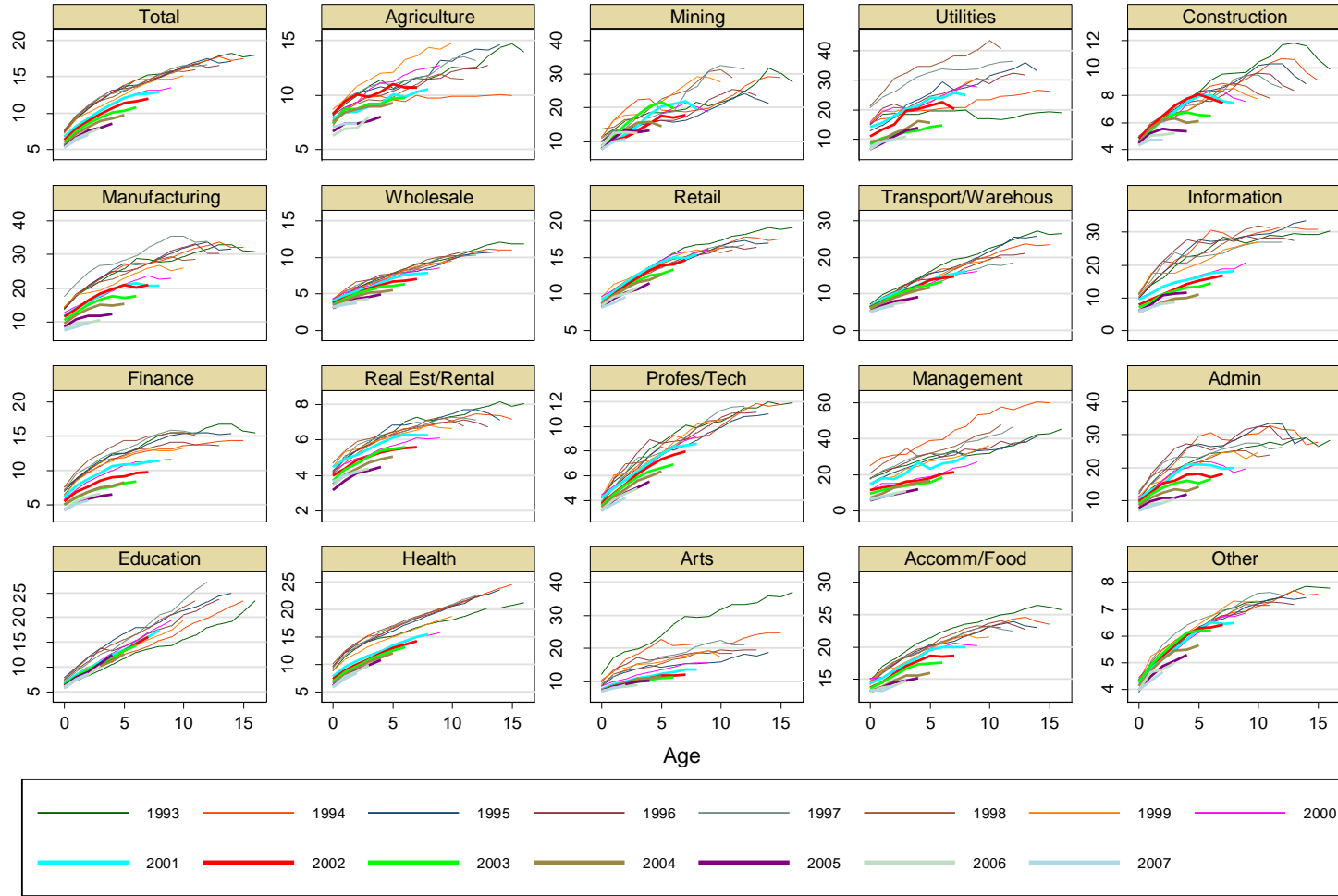
FIGURE 7-A: Time Series Profile of Average Establishment Size by Establishment Age in Each Industry



Graphs by indus

Source: Employment data from http://www.bls.gov/bdm/us_age_naics_00_table6.txt;
 Number of establishments data from http://www.bls.gov/bdm/us_age_naics_00_table5.txt.

FIGURE 7-B: Age Profile of Average Establishment Size by Birth Cohort in Each Industry



Graphs by indus

Source: Employment data from http://www.bls.gov/bdm/us_age_naics_00_table6.txt;
 Number of establishments data from http://www.bls.gov/bdm/us_age_naics_00_table5.txt.

TABLE 1: Employment and Establishment (Firm) Shares by Establishment (Firm) Size (in percentage), Total Private U.S. Economy

Size Category	Establishment Data								Firm Data							
	Employment Share				Establishment Share				Employment Share				Firm Share			
	1994	2000	2003	2007	1994	2000	2003	2007	1994	2000	2003	2007	1994	2000	2003	2007
1-4	6.5	6.0	6.3	6.4	50.2	49.8	50.4	51.0	5.5	4.9	5.2	5.2	53.6	53.1	54.0	54.8
5-9	8.6	7.9	8.3	8.2	21.6	20.9	20.8	20.3	6.7	6.0	6.2	6.0	21.2	20.7	20.6	20.0
10-19	10.9	10.6	11.1	11.2	13.5	13.7	13.6	13.5	8.0	7.5	7.7	7.5	12.5	12.7	12.5	12.2
20-49	16.5	16.5	17.0	17.4	9.1	9.5	9.4	9.4	11.4	10.9	11.0	10.9	7.9	8.2	8.0	7.9
50-99	12.8	13.1	13.2	13.5	3.1	3.3	3.2	3.2	8.5	8.3	8.2	8.2	2.6	2.7	2.6	2.6
100-249	16.1	16.6	16.5	16.7	1.8	1.9	1.8	1.8	10.6	10.5	10.4	10.5	1.5	1.6	1.5	1.5
250-499	9.3	9.9	9.5	9.4	0.5	0.5	0.5	0.4	7.1	7.4	7.1	7.2	0.4	0.5	0.5	0.5
500-999	7.0	7.4	6.8	6.7	0.2	0.2	0.2	0.2	6.6	7.0	6.8	6.8	0.2	0.2	0.2	0.2
1000+	12.3	11.9	11.3	10.5	0.1	0.1	0.1	0.1	35.6	37.5	37.4	37.8	0.2	0.2	0.2	0.2
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Source: Data on employment by firm size from http://www.bls.gov/bdm/table_f.txt;
 Data on number of firms by size from http://www.bls.gov/bdm/table_g.txt;
 Unpublished tabulations on employment and number of establishments by establishment size.

TABLE 2: Employment and Establishment Shares and Average Size of Establishments, by Industry

2-digit NAICS	Employment Share				Establishment Share				Average Size of Establishments			
	1994	2000	2003	2007	1994	2000	2003	2007	1994	2000	2003	2007
11 Agriculture, Forestry, Fishing, and Hunting	1.1%	1.0%	1.0%	0.9%	1.5%	1.3%	1.3%	1.2%	12.6	12.9	12.8	13.0
21 Mining	0.6%	0.5%	0.5%	0.6%	0.4%	0.4%	0.3%	0.4%	23.1	22.3	22.3	25.1
22 Utilities	0.8%	0.6%	0.6%	0.5%	0.3%	0.2%	0.2%	0.2%	50.7	40.7	37.9	35.8
23 Construction	5.0%	5.9%	6.0%	6.5%	9.2%	9.8%	9.9%	10.3%	9.0	10.5	10.1	10.4
31-33 Manufacturing	18.3%	16.1%	13.9%	12.4%	6.6%	6.0%	5.4%	4.8%	45.8	46.8	42.5	41.9
42 Wholesale Trade	5.4%	5.3%	5.3%	5.3%	8.4%	8.0%	7.9%	7.8%	10.8	11.6	11.1	11.1
44-45 Retail Trade	14.3%	13.9%	13.9%	13.6%	17.3%	15.6%	14.8%	13.8%	13.7	15.6	15.6	16.1
48-49 Transportation and Warehousing	3.7%	3.8%	3.7%	3.8%	2.8%	2.9%	2.7%	2.7%	22.0	23.3	22.6	22.6
51 Information	3.0%	3.3%	3.1%	2.7%	1.7%	1.9%	1.9%	1.7%	29.5	29.7	27.0	25.3
52 Finance and Insurance	5.5%	5.1%	5.5%	5.4%	5.5%	5.7%	5.9%	6.2%	16.5	15.7	15.3	14.1
53 Real Estate and Rental and Leasing	1.9%	1.9%	1.9%	1.9%	4.5%	4.3%	4.4%	4.6%	7.1	7.5	7.3	6.8
54 Professional, Scientific and Technical Services	5.6%	6.2%	6.3%	6.8%	9.3%	10.7%	11.0%	11.5%	10.0	10.2	9.5	9.7
55 Management of Companies and Enterprises	1.6%	1.6%	1.6%	1.6%	0.5%	0.6%	0.5%	0.6%	56.0	52.1	48.9	42.8
56 Administrative and Support Services	5.7%	7.3%	7.0%	7.3%	4.6%	5.0%	5.1%	5.3%	20.9	25.5	22.7	22.7
61 Educational Services	1.6%	1.7%	2.0%	2.1%	0.8%	0.9%	1.0%	1.0%	34.8	33.9	34.0	32.5
62 Health Care and Social Assistance	11.8%	11.6%	13.0%	13.4%	9.4%	9.1%	9.4%	9.8%	20.7	22.2	22.8	22.4
71 Arts, Entertainment and Recreation	1.5%	1.6%	1.6%	1.6%	1.3%	1.3%	1.3%	1.4%	19.6	21.3	19.7	18.9
72 Accommodation and Food Services	9.1%	9.1%	9.6%	9.9%	7.8%	7.5%	7.7%	7.8%	19.6	21.2	20.6	20.9
81 Other Services (except Public Administration)	3.6%	3.4%	3.6%	3.4%	8.1%	7.7%	7.6%	7.2%	7.3	7.8	7.8	7.8
99 Unclassified	0.1%	0.2%	0.2%	0.2%	0.2%	1.1%	1.5%	1.7%	5.7	2.9	2.6	2.1
Total	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	16.6	17.5	16.6	16.3

Source: Unpublished tabulations on employment and number of establishments by 2-digit NAICS.

TABLE 3-A: Decomposition of the Change in the Size of Establishments from 1994 to 2000, by Industry

2-digit NAICS		2000-1994 Difference		Decomposition of Total Change (=0.8)		
		Average Size	Establishment Share	Avg Size Effect	Estab Share Effect	Total Effect
11	Agriculture, Forestry, Fishing, and Hunting	0.3	-0.1%	0.5%	-1.6%	-1.1%
21	Mining	-0.7	-0.1%	-0.4%	-2.2%	-2.6%
22	Utilities	-10.0	-0.01%	-3.0%	-0.7%	-3.7%
23	Construction	1.5	0.6%	17.3%	7.4%	24.6%
31-33	Manufacturing	1.1	-0.7%	8.0%	-36.2%	-28.1%
42	Wholesale Trade	0.8	-0.4%	7.8%	-5.2%	2.6%
44-45	Retail Trade	1.9	-1.7%	36.7%	-30.6%	6.1%
48-49	Transportation and Warehousing	1.3	0.1%	4.3%	2.1%	6.4%
51	Information	0.1	0.3%	0.3%	9.4%	9.6%
52	Finance and Insurance	-0.8	0.2%	-5.6%	4.0%	-1.6%
53	Real Estate and Rental and Leasing	0.5	-0.2%	2.4%	-1.6%	0.8%
54	Professional, Scientific and Technical Services	0.2	1.4%	2.0%	17.2%	19.2%
55	Management of Companies and Enterprises	-3.9	0.1%	-2.4%	4.8%	2.4%
56	Administrative and Support Services	4.6	0.4%	26.1%	11.6%	37.8%
61	Educational Services	-0.9	0.1%	-0.9%	4.7%	3.8%
62	Health Care and Social Assistance	1.5	-0.3%	16.7%	-8.6%	8.1%
71	Arts, Entertainment and Recreation	1.7	0.02%	2.7%	0.4%	3.0%
72	Accommodation and Food Services	1.6	-0.2%	14.8%	-6.0%	8.8%
81	Other Services (except Public Administration)	0.5	-0.4%	4.7%	-3.6%	1.1%
99	Unclassified	-2.8	0.9%	-2.1%	4.8%	2.7%
Total		0.8	-	130.0%	-30.0%	100.0%

Source: Unpublished tabulations on employment and number of establishments by 2-digit NAICS.

Note: The 1994-2000 differences in establishment share are in percentage points. See text for the decomposition formula.

TABLE 3-B: Decomposition of the Change in the Size of Establishments from 2003 to 2007, by Industry

2-digit NAICS	2007-2003 Difference		Decomposition of Total Change (= -0.3)		
	Average Size	Establishment Share	Avg Size Effect	Estab Share Effect	Total Effect
11 Agriculture, Forestry, Fishing, and Hunting	0.2	-0.1%	-1.0%	5.3%	4.2%
21 Mining	2.8	0.03%	-3.9%	-2.5%	-6.4%
22 Utilities	-2.0	-0.02%	1.8%	2.8%	4.7%
23 Construction	0.3	0.4%	-12.5%	-15.7%	-28.2%
31-33 Manufacturing	-0.5	-0.6%	10.6%	99.4%	110.0%
42 Wholesale Trade	0.002	-0.1%	-0.05%	4.7%	4.6%
44-45 Retail Trade	0.5	-0.9%	-27.0%	57.8%	30.8%
48-49 Transportation and Warehousing	0.004	-0.01%	-0.04%	1.2%	1.2%
51 Information	-1.7	-0.1%	11.9%	13.7%	25.6%
52 Finance and Insurance	-1.2	0.3%	28.3%	-17.0%	11.2%
53 Real Estate and Rental and Leasing	-0.4	0.2%	7.3%	-5.0%	2.3%
54 Professional, Scientific and Technical Services	0.1	0.4%	-5.7%	-16.4%	-22.1%
55 Management of Companies and Enterprises	-6.1	0.1%	13.6%	-15.5%	-1.9%
56 Administrative and Support Services	-0.05	0.2%	1.0%	-16.6%	-15.6%
61 Educational Services	-1.5	0.1%	5.8%	-12.3%	-6.5%
62 Health Care and Social Assistance	-0.4	0.3%	15.7%	-29.8%	-14.0%
71 Arts, Entertainment and Recreation	-0.9	0.1%	4.6%	-4.6%	0.003%
72 Accommodation and Food Services	0.2	0.1%	-7.0%	-7.1%	-14.2%
81 Other Services (except Public Administration)	-0.0002	-0.4%	0.01%	12.2%	12.3%
99 Unclassified	-0.5	0.1%	3.2%	-1.2%	2.1%
Total	-0.3	-	46.4%	53.6%	100.0%

Source: Unpublished tabulations on employment and number of establishments by 2-digit NAICS.

Note: The 2003-2007 differences in establishment share are in percentage points. See text for the decomposition formula.

TABLE 4: Employment and Establishment Shares and Average Size of Establishments, by Establishment Age

Age Class	Employment Share				Establishment Share				Average Size of Establishments			
	1994	2000	2003	2007	1994	2000	2003	2007	1994	2000	2003	2007
< 1 year	4.5%	4.3%	3.7%	3.1%	10.0%	10.3%	9.6%	9.6%	7.5	7.3	6.3	5.3
1 year	-	4.4%	3.8%	3.1%	-	7.9%	7.6%	7.6%	-	9.8	8.2	6.7
2 years	-	4.4%	3.6%	3.2%	-	6.8%	6.4%	6.4%	-	11.2	9.3	8.2
3 years	-	4.2%	3.9%	3.1%	-	6.1%	5.9%	5.4%	-	12.2	10.9	9.4
4 years	-	3.8%	3.8%	3.2%	-	5.2%	5.1%	4.9%	-	12.9	12.3	10.8
5 years	-	3.7%	3.7%	3.3%	-	4.7%	4.7%	4.5%	-	13.9	13.1	12.1
6 years	-	3.4%	3.5%	3.2%	-	4.1%	4.3%	4.1%	-	14.6	13.7	12.7
7+ years	-	71.7%	74.1%	77.7%	-	55.0%	56.3%	57.5%	-	22.8	21.8	22.2
Total	-	100.0%	100.0%	100.0%	-	100.0%	100.0%	100.0%	16.7	17.5	16.6	16.4

Source: Employment data from http://www.bls.gov/bdm/us_age_naics_00_table6.txt;

Number of establishments data from http://www.bls.gov/bdm/us_age_naics_00_table5.txt.

TABLE 5: Decomposition of the Change in the Size of Establishments from 2003 to 2007, by Establishment Age

Age Class	2007-2003 Difference		Decomposition of Total Change (= -0.2)		
	Average Size	Establishment Share	Avg Size Effect	Estab Share Effect	Total Effect
< 1 year	-1.0	-0.04%	41.1%	1.1%	42.2%
1 year	-1.5	0.04%	47.5%	-1.4%	46.1%
2 years	-1.2	-0.08%	31.5%	3.1%	34.6%
3 years	-1.5	-0.46%	36.4%	19.7%	56.1%
4 years	-1.5	-0.20%	32.0%	9.5%	41.5%
5 years	-1.1	-0.18%	20.9%	9.5%	30.4%
6 years	-1.0	-0.19%	16.8%	10.8%	27.6%
7+ years	0.3	1.11%	-75.4%	-103.0%	-178.5%
Total	-0.2	-	150.8%	-50.8%	100.0%

Source: Employment data from http://www.bls.gov/bdm/us_age_naics_00_table6.txt;

Number of establishments data from http://www.bls.gov/bdm/us_age_naics_00_table5.txt.

Note: The 2003-2007 differences in establishment share are in percentage points. See text for the decomposition formula.