Entry and Exit of Firms and the Turnover of Jobs in U.S. Manufacturing

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The popular press and business and labor leaders have for quite some time been pronouncing the decline of U.S. manufacturing and the loss of jobs to overseas competitors. Aggregate data reveal that employment in U.S. manufacturing has, in fact, declined at an annual rate of 2 percent over the past 20 years. Behind this trend, however, lies a more intricate and interesting drama of industry dynamics. New firms constantly enter while others exit; some firms decline in size while others remain stable or grow; new jobs are created to replace some that are lost.

In this context, interesting questions arise as to the extent of the turnover process and the role of different types of manufacturing firms in this process. For example, what is the magnitude of entry into and exit from various industries? What are the characteristics of entering firms? Are they as large as incumbent firms? Are they as likely to survive? If they survive, do they grow as fast? In this article we survey the evidence that can be brought to bear on these issues and the theories that can rationalize the evidence.

A related issue that may have public policy implications is whether small firms are more efficient at creating employment opportunities than large firms. Supporters of this view consider small firms more dynamic and more

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innovative, a claim which (to some extent) can be substantiated by the data: new firms, which tend to be smaller, are responsible for the creation of many new jobs, and many of these firms introduce new products that can potentially "take off" and generate yet more jobs. Opponents of this view, on the other hand, consider large and established firms as having proven themselves in the way they are managed or through the products and services they sell. Even though large firms are less likely to be innovative and to grow, they are also less likely to fail. Comparison of these views suggests that the relevant concept is the durability of jobs, not their mere creation. Another objective of this article, then, is to use the data reported here to construct a quantitative measure of the durability of jobs created by firms of different size.

THE EVIDENCE

The evolution of firms and industries is of interest to both business practitioners and economists. A business practitioner focuses on what accounts for the success or failure of individual firms and how firms can be profitably restructured, given the lessons learned from the experience of other firms. An economist focuses on systematic patterns that characterize the whole set of firms, for example, what the average lifetime of firms in the personal computer industry is and how it compares with that of the restaurant industry.

Although these questions arose in earlier literatures, interest in them has revived recently with the availability of more comprehensive data sets and improved methods of analyzing them, using fast digital computers.[1] The evidence in this section comes from two sources. The first is a series of papers by Timothy Dunne, Mark Roberts, and Larry Samuelson.[2] In these papers Dunne and his associates analyzed more than 300,000 manufacturing plants and the more than 200,000 firms operating them in the United States. These plants produce more than 99 percent of the output of 387 industries. Dunne, Roberts, and Samuelson followed these plants over a 20-year period and documented patterns of entry and exit, growth and decline, degree of diversification, and size distribution of firms, as well as how these variables are interrelated. The second source is a series of papers by Steve Davis and John Haltiwanger.[3] These papers address similar questions (with somewhat greater emphasis on macroeconomic issues), but they use a larger set of firms and more frequent observations.

Industry Turnover vs. Worker Turnover. Before proceeding it's important to stress both the connection and the distinction between

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[1]Two early references are P.E. Hart and S.J. Prais in the United Kingdom and H. Simon and C. Bonini in the United States. Motivated by the striking similarity of the size distribution of firms (across time, industries, and countries), these researchers sought to explain the source of this similarity, to estimate the distribution in different industries, and to show the effect of public policies on it. Later contributions tried to relate the characteristics of various industries, such as the size of efficient plant, the advertising intensity, the degree of product differentiation, or industry growth, and their net rate of entry or exit. Their main goal was to understand how the nature of the industry or the product affects the turnover process and, in turn, industry structure and pricing behavior.

[2]Timothy Dunne, Mark Roberts, and Larry Samuelson, "Patterns of Firm Entry and Exit in U.S. Manufacturing Industries," *Rand Journal of Economics* 19 (1988), pp. 495-515; "Plant Turnover and Gross Employment Flows in the U.S. Manufacturing Sector," *Journal of Labor Economics* 7 (1989a), pp. 48-71; "Firm Entry and Postentry Performance in the U.S. Chemical Industries," *Journal of Law and Economics,* 32(2), Part 2, 1989(b), pp. S233-71.

[3]Steve Davis and John Haltiwanger, "Gross Job Creation and Destruction: Microeconomic Evidence and Macroeconomic Implications," *NBER Macroeconomics Annual,* 5 (1990), pp. 123-68; "Gross Job Creation, Gross Job Destruction and Employment Reallocation," *Quarterly Journal of Economics* 107 (1992), pp. 819-63.

industry turnover and worker turnover. The connection arises because when one plant shuts down and another plant opens, some jobs are lost and others are created, so this generates reallocation of the labor force. In this way, firm turnover gives rise to worker turnover.

But there are other reasons workers look for new jobs. By looking for a new job a worker can create a better match between his or her qualifications and the job's requirements. Furthermore, because it takes time to determine the quality of a match and because new workers constantly arrive over time, workers are continually in the process of sorting and resorting themselves into more suitable jobs.

Another reason behind worker turnover is that workers accumulate knowledge and experience at their present jobs, qualifying them for more advanced positions. Yet, such positions are not always available with their present employer, either because of the nature of their present employment or because others are already occupying the more advanced positions. Thus, a certain fraction of job switches occurs for career or advancement reasons.

Finally, some switches are induced by temporary changes in the conditions that firms face: workers are laid off from jobs during bad times, with the possibility of recall at a later date when business conditions improve. By that time, however, some of these workers have found different jobs, and consequently, their positions are filled by others. Given these causes, workers reshuffle across jobs, although the jobs themselves remain intact. Thus, worker turnover is not perfectly matched by firm turnover.[4] One estimate states that the fraction of job switches induced by firm turnover is between 35 and 56 percent.[5]

Volume of Turnover. Let's turn to the features of the data. The most striking finding is the magnitude of firm turnover: every year an average of 8 percent of all incumbent firms in manufacturing exit and an average of 9 percent enter, resulting in 17 percent turnover with net entry of 1 percent.[6] Likewise, the rate of job destruction is 11 percent a year, and the rate of job creation is 9 percent, resulting in 20 percent turnover with a net loss of 2 percent.[7] The entrants represent either de novo firms (a new firm with a new production facility) or diversification by a firm already operating in another industry but now changing the mix of outputs in its plant or adding a new plant. The breakdown between these two categories (averaged over all manufacturing industries) is 55 de novo firms to 45 non-de novo.[8]

Variation Across Industries. While these numbers represent averages across all firms in the manufacturing sector of the U.S. economy, there's a great deal of variation between industries. Some broad industry categories—for example, lumber and apparel—exhibit high firm and job turnover; others—for example, tobacco and primary metals—exhibit low turnover.[9] Usually, industries that show high entry rates (rates refer to the *gross* rate unless other-

[4]To distinguish between the two I will refer to changes that emanate from firms as job creation and destruction (or job turnover) and to changes that emanate from workers as employment search; the fact that a worker changed her job (for whatever reason) is referred to as a job switch.

[5]Davis and Haltiwanger, 1992, pp. 833-84.

[6]See Dunne, Roberts, and Samuelson, 1988, p. 503.

[7]Davis and Haltiwanger, 1992, p. 820.

[8]See Dunne, Roberts, and Samuelson, 1988, p.504.

[9]Industries are often classified as two-digit and four-digit, referring to the Standard Industrial Classification (SIC) of sectors in the U.S. economy. The two-digit classification is a coarse breakdown of sectors into 20 categories numbered from 20 through 39, the tobacco sector corresponding to 21, for example. The four-digit classification is a refinement into subsectors, the cigarette subsector corresponding to 2117, for example. Further details on this classification system can be found in F.M. Scherer, *Industrial Market Structure and Economic Performance* (Houghton Mifflin Company, 1980).

wise specified) simultaneously show high exit rates, implying high turnover. Industries that exhibit a higher than average entry rate in a given year tend to exhibit a higher than average entry rate in the following year. The extent of turnover is a characteristic of the industry that tends to persist over time.

The degree to which industrial turnover varies across industries can be measured in gross rates of entry and job creation. Firm entry rates range between 5 and 13 percent across industry categories, the average being 9 percent. Gross job creation rates range between 5.9 percent in the tobacco industry and 12.9 percent in the lumber industry (Table 1).[10] Furthermore, even within a given industrial category, there's a great deal of variation across subcategories. For instance, while the average entry rate for the food-processing industry is 8.9 percent, 10 percent of its subindustries exhibit an entry rate not exceeding 1.4 percent, while 10 percent exhibit an entry rate above 15 percent.

Net vs. Gross Entry and Job Creation. Since industries with high entry rates also usually have high exit rates, net entry of firms bears little relationship to gross entry and turnover. Take, for example, the transportation industry, in which the number of firms declined only 0.2 percent per year over the sample period. Yet, it experienced gross rates of entry and exit of 9.1 and 9.3 percent, respectively, each of which is almost 50 times larger than the net change![11] Similarly, the gross job creation rate in the transportation industry averaged 9.4 percent per year, and job destruction averaged 9.9 percent, both much larger than net job creation (Table 1). Thus, we cannot view turnover in manufacturing as if it were stemming from sectoral shifts alone, that is, firms and jobs moving from declining industries into growing industries. On the contrary, the data show that even within the same industry, large flows of entry and exit occur, which shows that turnover is based as much on the characteristics of the firm as on the environment in which it operates.

Another piece of evidence supports this fact: the magnitude of turnover persists across all phases of the business cycle. Even 1975, the worst downturn year between 1973 and 1986, saw an entry rate of 6.7 percent, while 1973, the best upturn year, saw an exit rate of 6.1 percent.[12,13] Similarly, even in average years there is substantial entry and exit. Hence, it's unlikely that macroeconomic changes alone drive the turnover process, that is, firms exit when conditions are bad and enter when they improve. Instead, the characteristics of individual firms (or changes in these characteristics) are important in explaining how macroeconomic changes will affect firms.

Persistence and Concentration. The turnover process demonstrates both persistence and concentration. When a firm enters, it's more likely to stay subsequently than to exit, and the likelihood of continued survival rises over time.[14] Similarly, when a diversified firm exits an industry, it's more likely to remain inactive thereafter than to resume activity. Also, when an incumbent firm grows, it's more likely to retain its size than to decline again. Therefore, these events reflect a *persistent* change in a characteristic of a firm.

Second, changes in employment affect certain firms much more than others. For instance, firms that fire more than 50 percent of their workers account for 34 percent of job

[10]Dunne, Roberts, and Samuelson, 1988, p.505.

[11]Dunne, Roberts, and Samuelson, 1988, p. 506.

[12]Davis and Haltiwanger, 1992, p. 830.

[13]One curious feature of the data is that entry is countercyclical, i.e., it tends to be relatively high in downturn years.

[14]Dunne, Roberts, and Samuelson, 1988, p. 510.

TABLE 1

Gross and Net Job Creation Rates by Industry

(size-weighted annual average[a] percent change)

Industry (SIC code)	Job Creation	Job Destruction	Net Job Creation	Job Turnover	MAX
Food (20)	8.9	10.4	-15.0	19.3	10.8
Tobacco (21)	5.8	8.2	- 2.4	14.0	9.0
Textile (22)	7.4	11.0	- 3.6	18.5	12.4
Apparel (23)	11.6	15.6	- 4.0	27.2	16.8
Lumber (24)	12.9	16.0	- 3.1	28.8	18.8
Furniture (25)	10.1	12.1	- 1.9	22.2	14.3
Paper (26)	6.3	7.8	- 1.5	14.1	8.9
Printing (27)	9.1	8.7	+ 0.4	17.8	9.9
Chemicals (28)	6.8	8.0	- 1.3	14.8	8.9
Petroleum (29)	6.6	9.1	- 2.5	15.7	10.0
Rubber (30)	10.7	11.8	- 1.1	22.5	14.3
Leather (31)	9.1	14.4	- 5.3	23.5	15.2
Stone, clay and glass (32)	9.3	12.3	- 3.1	21.6	13.6
Primary metals (33)	5.9	11.4	- 5.4	17.3	12.6
Fabricated metals (34)	9.5	12.0	- 2.5	21.5	13.7
Nonelectric machinery (35)	9.6	12.1	- 2.5	21.7	14.1
Electric machinery (36)	9.7	10.9	- 1.1	20.6	13.0
Transportation (37)	9.4	9.9	- 0.6	19.3	12.3
Instruments (38)	9.3	9.3	- 0.2	18.6	11.2
Miscellaneous (39)	10.8	14.5	- 3.7	25.3	15.6
Total manufacturing	9.2	11.3	- 2.1	20.5	12.9
Size-weighted cross-industry standard deviation	1.6	21.0	1.5	3.4	2.3

[a] Size-weighted average based on annual values for 1973-86 (but not 1974, 1979, 1984)

Table based on data from Table II in Steven Davis and John Haltiwanger, "Gross Job Creation, Gross Job Destruction, and Employment Reallocation," *Quarterly Journal of Economics*, 107 (1992), p. 831, excerpted with permission from The MIT Press, Cambridge, MA.

destruction.[15] Therefore, job destruction is concentrated in some firms instead of being spread evenly across firms, showing again the effect of firm-specific attributes.

These findings confirm that heterogeneity across firms is a crucial feature of the turnover process. Individual firms may still be affected by outside factors—for example, sectoral shifts and business fluctuations—but whether a particular firm can weather these fluctuations or even prosper from them depends on its innate characteristics: how well it is managed, what labor relations within it are like, whether it is

[15]Davis and Haltiwanger, 1992, p. 836.

innovative, and so forth.

The Size of Entering and Exiting Firms. The next issue is, what observable attributes characterize firms that enter or exit? The most apparent attribute is size: although 8 to 9 percent of firms turn over in any given year, entering firms account for only 3 percent of the output in the industry they belong to. Therefore, the size of entering firms is significantly smaller than the size of an average incumbent firm. Dunne and associates estimate the average output of an entrant to be 35.2 percent of the average output of an incumbent firm.[16] A similar pattern is detected for exiting firms: they are smaller than the average surviving firm.[17]

Patterns That Arise Over Time. Next, let's consider how newly established firms change over time, particularly their chances of surviving and growing. On average, across industry categories, the market share of entrants during their first five years is 16.2 percent; in their next five years it's 10.4 percent; then 8.3 percent.[18] Therefore, if we follow a set of firms that enter in the same year (also known as a cohort), we see that their market share steadily declines over the years. This represents two opposing forces. First, during the three consecutive five-year periods, the size of the average surviving firm rises from 35.2 percent to 54.3 percent to 127 percent of the average firm size in its industry. On the other hand, the share of firms surviving decreases with age from 38.5 percent to 19.9 percent to 14.0 percent. Therefore, while young firms increase in size if they survive, their chances of survival are smaller. On balance, the latter effect dominates the former, resulting in a decreasing market share as a cohort ages. A second prominent feature is that the standard deviation of survival rates and market shares declines as a cohort ages. That is, over time the members of a cohort become more homogeneous, and uncertainty about their future prospects is diminished.

Hence, small firms partake more actively in the entry and growth process, but they are less likely to succeed and stay around for a long time.

JOB CREATION: SMALL VS. LARGE PLANTS

The turnover processes we have been examining—entry and exit of firms and survival, growth, or demise of entrants—are important components of job turnover overall, but they are not the only components. Further contributing to the creation and destruction of manufacturing jobs are growth and decline among well-established firms. This section combines information on entry and exit with information on growth or decline of existing firms to determine the net impact of all of these dynamic influences. In particular, we compare firms in different size categories and look at their contributions to job stability, taking into account the durability of jobs as well as their creation.

To that end, consider Table 2, which is based on annual observations of manufacturing plants during the period 1973-88.[19] The

[16]Dunne, Roberts, and Samuelson, 1988, p. 503.

[17]These numbers pertain to the entire population of entrants. De novo entrants account for 55.4 percent of the number of new firms, but for only 50 percent of the output of new firms. On the other hand, diversifying firms with new plants account for 8.5 percent of the number and 14.4 percent of the output of all new entrants. The size of a de novo entrant is only 28.4 percent of the average firm size in its industry, while the corresponding size of a diversifying firm is 87.1 percent. Thus, diversifying entrants tend to be larger than de novo entrants.

[18]Dunne, Roberts, and Samuelson, 1988, p. 510.

[19]Data in Table 2 are taken from *Quarterly Journal of Economics,* 107, 1992, Davis and Haltiwanger, "Gross Job Creation, Gross Job Destruction, and Employment Reallocation, p. 841, and excerpted with permission of The MIT Press, Cambridge, Massachusetts.

TABLE 2

Gross Rates of Job Growth and Decline by Plant Size

(annual percent change)

No. of employees	1-99	100-249	250-499	500-999	1000+
POSITIVE	14.0	9.9	8.6	7.0	6.0
NEGATIVE	16.4	12.0	10.5	9.3	7.8
SHARE (%)	24.6	18.5	16.2	13.4	27.3

columns of this table correspond to the size of a plant at the date of observation; for example, 100-249 corresponds to a plant employing between 100 and 249 workers. The row labeled POSITIVE shows, for each size category, the average rate of job growth across all observations of plants that happen to be growing (which includes new entrants or growing establishments). NEGATIVE shows, for each size category, the average rate of job loss across all observations of plants that are declining in size. For example, plants that employ between 100 and 249 people and were declining in size experienced an annual rate of job loss of 12 percent, on average. The last row in this table (SHARE) represents the share of the industry employment accounted for by different-sized plants. For example, plants with more than 1000 employees accounted for 27.3 percent of employment in the manufacturing sector. This table shows that the rates of growth and decline are both smaller for larger plants, which shows the greater stability of these plants, that is, large plants create jobs less rapidly, but they also lose jobs less rapidly.

These numbers represent *averages* over all plants. *Individual* plants, however, may experience different rates of growth or decline—even if they belong to the same size category. For example, while the average growth rate in the positive category for the 100-249 size group was 9.9 percent, some plants may have increased by only 5 percent, while others increased by 15 percent. Likewise, if we take a long-term perspective, different plants may undergo dramatically different employment histories—even when they start out with the same number of employees. To give a simple numerical example, a certain plant may have employed 45 workers in its first year in business, then 49 in the second year, then 32, 47, and 15 in the third, fourth, and fifth years, and then may have gone out of business by the end of its fifth year. Altogether, over the time it was operating, such a plant provided 188 annual jobs. Another plant may have undergone a different employment history: 45, 22, and 0 (going out of business by the end of the second year), resulting in a total employment of 67 annual jobs. Therefore, although these plants started out with the same number of employees, they stayed in business a different number of years and provided a different number of jobs every year they operated. For ease of reference we shall call the total number of annual jobs generated over the time a plant was operating "job years."

In the example above, we simply added up jobs in different years without considering the timing of job creation. But a firm that starts with 100 employees and contracts to 80 employees in its second year can be viewed as generating jobs of greater total value during those two years than a firm that starts with 80 people and a year later expands to 100, because the first firm is generating jobs sooner. In this view, which we adopt, the sooner jobs are created the better, holding total annual jobs constant. Thus, employing a discount factor of 4 percent, we shall discount jobs in later years in counting the jobs generated over a particular firm's employment history.[20] If we apply this rate to the two examples in the previous paragraph, we obtain 176 and 66 discounted job years (instead of 188 and 67).[21]

Contributions of Firms in Various Categories to Job Stability. The next task is to determine the number of jobs that the typical firm in a given size category can be expected to generate over future years. This will yield comparisons between firms in terms of how effectively they create durable job opportunities. This task is accomplished by using information about the growth and decline of firms' employment by size category (as shown in Table 2) to generate a numerical assessment of the various possible employment histories and the resulting average number of discounted job years. The appendix spells out the technical details of this estimation procedure.

The first row in Table 3 (national average) shows the results of this estimation (ignore, for now, the remaining rows). As the table shows, the average number of future jobs generated by a representative firm steadily increases with its current size, that is, a firm that is large today is expected to provide more jobs over its lifetime than a firm that is small today. This finding should come as no surprise. First, a large firm is providing more jobs at present. Second, large firms' persistence rate is higher, that is, a large firm is more likely to retain its size than to decline (and a small firm is more likely to exit than to stay in business). Both factors favor large firms as generators of durable employment opportunities. The problem with the argument in favor of small firms is that it puts too much weight on the increase in their size when they happen to succeed, overlooking the large number of small firms that fail. As the data show, a small firm is more likely to fail (on average) than a large one, a fact mirrored by the smaller number of discounted

[20] I chose this rate because it represents the rate by which investors might discount riskless future earnings. The results reported below have the same qualitative feature for interest rates between 0 and 20 percent.

[21] The discounted total jobs in the first example equal $45 + 49/(1.04) + 32/(1.04)^2 + 47/(1.04)^3 + 15/(1.04)^4 = 176.31$. Those in the second example equal $45 + 22/(1.04) = 66.15$.

TABLE 3

Discounted Job Years Generated by Different Sized Firms Nationwide and in Different Regions

No. of employees	1-99	100-249	250-499	500-999	1000+
REGION					
National Average	2402	3661	5881	9541	15,626
New England	2310	3552	5783	9501	15,817
Middle Atlantic	1969	2947	4772	7962	13,784
South Atlantic	1982	3023	4974	8397	14,657
E. South Central	2390	3681	5979	9768	16,113
W. South Central	2536	3954	6443	10,483	17,098
E. North Central	2360	3636	5915	9688	16,041
W. North Central	2591	3921	6220	9899	15,829
Mountain	3060	4608	7161	11,042	16,920
Pacific	2662	3929	6089	9497	14,904

job years a small firm can be expected to generate. A recent paper by Steve Davis, John Haltiwanger, and Scott Schuh confirms the result that small firms generate less durable jobs.[22]

Put another way, the results in Table 3 show that while small firms tend to grow, on average, relative to their initial size, enough of them fail so that the representative small firm will not create as many durable jobs as the representative large firm that exists today.

A similar procedure can be used to assess the number of discounted job years generated by firms of different sizes in different regions of the country. The results of this estimation are shown in the last nine rows of Table 3. The pattern revealed in these rows is similar to the national pattern: a large firm can be expected to generate more lifetime jobs than a small one. However, the differences between large and small firms are starker for some regions. For example, in the South Atlantic and the West South Central regions, the "handicap" of small firms compared with large ones was bigger than that in the Pacific and Mountain regions. Therefore, the long-term prospects of small firms were better in the western regions.

Next we consider the effect of firms' age: is a young firm more likely to generate more discounted job years than an older firm, or the other way around? Using a procedure similar to the one used to generate Table 3, we estimated the number of discounted job years likely to be created` by firms of different ages (Table 4). This table reveals an interesting pattern: the age effect for small plants is negative, that is, the older a small firm is, the fewer discounted job years it is likely to generate. For successively larger firms, the age effect is still negative, but it's weaker. Finally, for the largest firms the age effect is positive. Therefore, we have a positive interaction between size and age: the number of discounted job years increases with firm size, but it increases even faster if we allow a simultaneous increase in firm age. One possible interpretation is that if a firm is small and old, chances are it is "on its

[22]See Steve Davis, John Haltiwanger, and Scott Schuh, "Small Business and Job Creation: Dissecting the Myth and Reassessing Facts," National Bureau of Economic Research Working Paper 4492, October 1993.

TABLE 4

Discounted Job Years Generated by Firms in Different Age Groups

No. of employees	1-99	100-249	250-499	500-999	1000+
AGE IN YEARS					
1	3473	4764	6776	9674	13,813
2	2363	3439	5331	8418	13,544
3	2741	4305	7000	11,277	18,079
4-5	2261	3457	5617	9236	15,437
6-10	2235	3496	5798	9696	16,452
11-14	2058	3278	5574	9598	16,908
15+	1642	2642	4673	8599	16,958

way out." On the other hand, if a firm is large and old, its method of operation or its product enables it to generate large sales and to survive for a long time. Thus, age provides supplemental evidence concerning the success of firms, although the implications are asymmetric across small and large firms.

Finally, we can analyze the effect of firm structure, particularly the employment prospects of single- vs. multiple-plant firms. The results of the same estimation procedure for this case are shown in Table 5, which demonstrates that a multiple-plant firm can be expected to generate a larger number of jobs than a single-plant one. However, the advantage of being part of a multiple-plant firm declines as a plant increases in size. The ratio of discounted job years generated by multiple-plant vs. single-plant firms declines as plant size rises. Thus, the feedback between size and multi-plant status is negative. A possible interpretation is that a plant that's part of a multiplant firm can freely "borrow" the expertise of its parent company, giving it an advantage over a firm that has no access to such expertise. However, once a plant reaches a large enough size, it is successful enough on its own, and the ownership effect is less relevant.

While these results provide support in favor of large firms as generators of employment, one should be careful in using them for policy analysis. The numbers in the tables reflect only the discounted number of job years generated by representative firms of different sizes, not the differential costs of operating these firms or the subsidies that might be needed to sustain them at their present size or to cause them to grow (which is much harder data to come by). It's quite conceivable that the subsidy needed to create a new job at a large firm is higher than the corresponding subsidy for a small one. Whether a given subsidy or tax break can stimulate more new jobs at a large firm will depend on the firm's effectiveness in creating an extra job, which is a separate issue from the durability of a job once it is created. Hence, further empirical analysis is needed to determine the effectiveness of subsidies in the hands of large vs. small firms (and to balance that against the differential durability of jobs).

TABLE 5

Discounted Job Years Generated by Single- vs. Multiple-Plant Firms

No. of employees	1-99	100-249	250-499	500-999	1000+
OWNERSHIP TYPE					
Single-plant firm	1927	2966	4935	8435	14,950
Multiple-plant firm	2978	4449	6888	10,619	16,314
Difference (multi - single)	1051	1483	1953	2,184	1,364
Ratio (multi/single)	1.545	1.50	1.395	1.258	1.091

THEORIES THAT EXPLAIN FIRM TURNOVER

The sections above surveyed the facts about industry dynamics and provided a method for estimating the number of jobs generated by representative firms of different sizes, but they did not elaborate on the basic forces that drive the turnover process. The purpose of this section is to survey such theories and indicate how they relate to the systematic patterns shown by the data.

Broadly speaking, theories of firm turnover fall into three categories: passive learning, active learning, and adjustments to outside disturbances.

Passive Learning. This theory is based on the premise that firms find out about their suitability to an industry (that is, their relative efficiency) only by operating in it.[23] According to this theory, whether a firm belongs in an industry is an inherent characteristic (a type) that remains unchanged over time but that can be discovered only through experience. Therefore, the process of entry and exit can be thought of as natural selection or survival of the fittest. This idea may explain the fact that young firms have a comparatively low survival rate but also a comparatively high growth rate when they survive. This follows from the fact that young firms are largely uncertain about their type. Once they have operated, they learn about their type and the uncertainty is reduced. As a consequence, either such firms become dismayed and leave or they receive favorable information and are able to grow rapidly. This also explains why the variability of growth rates is highest among young firms and why it declines with age, as shown by the evidence cited earlier.

This model explains other historical patterns not previously discussed, including the positive correlation between size and profits. That is, efficient firms produce large quantities and generate large profits at the same time. Likewise, as the industry matures, it becomes more concentrated as more efficient firms gain market share at the expense of less efficient firms. Accordingly, this process produces a positive correlation between concentration and average profitability. Also, this process induces a positive correlation between concentration and variability of profits. Again, this occurs because a firm's size and profits are directly related to the firm's efficiency, and efficiencies diverge over time as firms are sorted out.

The main shortcoming of this theory is that firms in the real world continually enter and exit even in mature industries, but this theory predicts such a process should eventually subside (unless industry demand keeps growing). Nonetheless, this theory has retained its popularity because it can explain a broad range of systematic patterns. It seems especially relevant to industries in which the success of firms depends on a difficult-to-alter specialized asset (a manager or a particular location or raw material).

Active Learning. The basic premise that distinguishes this theory from passive learning is that a firm's type, that is, its suitability to a given industry, changes during its tenure in the industry. This change may be the result of any number of things: successfully completing a research and development project, developing a new product and successfully marketing it, hiring a particularly successful manager, or raising morale among its employees. Alternatively, all or some of these endeavors may fail, leading to an unfavorable change in the firm's type. In some formulations of the theory the process by which a firm's type changes is explicitly incorporated, while in others only the net outcome of such a process is specified.[24,25] Either way, an important consequence of the active learning premise is that firms

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[23]See Jovanovic, 1982, for a comprehensive treatment of the theory.

continually enter and exit even though the industry remains stable over time.

The main findings of this theory are as follows. First, if the process of learning to be successful exhibits persistence—that is, if currently efficient firms are expected (on average) to remain efficient in the future—then, for a given cohort of firms, the range of firms' sizes, profits and stock-market valuations, and the likelihood of firm survival all increase over time.

Second, increased cost of entry lowers the rate of both entry and exit, the rate of turnover, and the number of operating firms. Therefore, the industry becomes more sluggish, and firms collect returns on their cost of entry over a longer period. This lowers the average profitability in the industry but raises the profitability and market share of larger and more efficient firms. It also produces a positive correlation between the two, which we historically observe.[26]

Third, increasing the demand for an industry's output raises the entry rate as well as the number of firms in the industry but leaves all life-cycle properties—such as longevity and probability of survival—intact. Furthermore, the effect that increasing demand has on output, prices, and wages depends on how inputs are priced: if inputs command the same price no matter how many are purchased, the output increases but without an increase in the product price; otherwise, both the product price and real wages increase, the degree to which they increase depending on conditions in the labor market.

Fourth, a higher fixed cost makes it more costly for a firm to stick around during "bad times" (for example, when the variable cost of production is high), which leads to more firm attrition and an increase in the efficiency of operating firms and in their profits. This feature is the theoretical counterpart of how the presence of economies of scale leads to larger firms.[27] The main shortcoming of this theory is that it does not adequately explain what causes changes in firms' efficiencies and how different sources of change affect firms differently.

Adjustments to Outside Disturbances. The premise behind this theory is that firms enter or exit, or grow or decline, in response to outside changes (called shocks) that affect their industry.[28] For instance, firms respond to changes in the demand for their final product (because of changes in consumer tastes, for instance), the costs of entry and exit, or the prices they have to pay for inputs. Consequently, the entry and exit process can be understood as mirroring these changes and how firms react to them. One feature of this theory is the influence of history: a firm that enters in response to a favorable demand disturbance will not later exit if the disturbance merely reverses itself; to induce exit, a larger negative disturbance is needed. Therefore, how many firms operate in an industry at a given point depends on the history of demand disturbances, not merely on the present state of the industry.

This theory also establishes that a higher cost of entry will reduce the rate of turnover and increase the variability of the value of firms. This is consistent with what is observed in sectors such as agriculture or housing (where there is a large sunk investment): the value of firms fluctuates over a much wider range than in retail trade or restaurants (where there is a small sunk investment). This occurs because

[24]For example, Ericson and Pakes, 1990.

[25]Hopenhayn, 1992.

[26]Similar features arise if the cost of entry is the same, but the productive efficiency is worse upon initial entry into the industry.

[27]See Orr, 1970.

[28]See Lambson, 1992.

the turnover process in industries with high sunk cost is sluggish, and it's more economical for firms to weather changes than to exit and re-enter.

Furthermore, the theory attributes the coexistence of entry and exit to infrequent changes in market conditions. For instance, the oil shock of the 1970s induced exit of energy-inefficient firms, development of more energy-efficient techniques, and entry of new firms that use these techniques. The limitation of this theory is that it relies on such infrequent shocks to explain simultaneous entry and exit, while the data show that entry and exit occur on a regular basis without the occurrence of any unusual disturbances.

CONCLUSION

This article argues that the entry and exit of firms is not solely driven by factors external to them—macroeconomic changes or sectoral shifts that drive firms out of declining industries and into growth industries. Instead, the data show that entry of new firms occurs even in the worst downturn years and exit occurs in the best upturn years. Similarly, even when the number of firms in an industry declines, new firms still enter and grow. Therefore, to account for entry and exit one should look at characteristics of *individual* firms—size, age, whether they operate in a single industry or several, where they are located, and so on.

Considering these characteristics allows us to evaluate the number of jobs different types of firms create. New firms tend to be smaller, and they create the bulk of new jobs. On the other hand, small firms tend to be short-lived, and hence, so are the jobs they create. Therefore, to compare small and large firms, this article introduced a unit of measurement that combines the flow of new jobs and their persistence. We compared small and large firms in terms of the number of durable job opportunities they generate.

Using a numerical exercise, we showed that a representative large firm can be expected to generate a larger number of durable job opportunities because of the greater stability of these firms. In other words, a large firm has a smaller probability of decline, so once it has created a job, it tends to persist. This finding holds for firms in different regions of the country, although the effect is somewhat weaker in the higher turnover regions—Mountain and Pacific. The effect of age is negative for small firms (the older the firm, the fewer durable jobs it generates), but it's positive for large firms. Finally, being part of a multi-plant firm enhances the number of durable jobs a firm creates, although the effect tends to be weaker for larger firms.

In summary, this article presents evidence on the turnover of firms in U.S. manufacturing and estimates of the durability of jobs generated by different firms. A primary conclusion arising from the estimates is that a job generated at a large firm tends to last longer than a job generated at a small one.

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APPENDIX

Estimating the Number of Discounted Job Years Generated by Different-Sized Firms

Given the data in Table 2, the first step is to estimate the probabilities of increase and decrease in the size of firms as a function of their present size. It is assumed that firms can only switch to adjacent size groups and that the probability of switches are given by:

$$P_{i,i-1}=NEG_i[1+(i-1)k_1]/2,$$

$$P_{i,i-1}=POS_i[1+(i-1)k_2]/2,$$

$$P_{i,i}=1-P_{i,i-1}-P_{i,i+1}$$

where POS_i is the actual rate of growth of firms in size class i (i=1,...,5), NEG_i is the actual rate of decline, and k_1 and k_2 are parameters to be estimated. This generates a Markov chain, and we can compute its steady state. The numerical values that k_1 and k_2 take are chosen so that the steady state is as close as possible (in a chi-square sense) to the actual size distribution of firms (as given by the last row of Table 2).

Given this transition matrix, we can determine the expected number of jobs that each firm can generate during the course of its existence. For firms in class i this number is denoted n_i. Let $\delta=1/1.04$ represent the discount factor used to add up jobs generated in different periods, and let z_i represent the number of (current) jobs for firms in class i. For firms in class 1, which corresponds to firms with 1 to 99 employees, $z_1=50$; in general, z_i is the midpoint of the class i interval (and for firms in the 1000+ size class, $z_i = 1500$). Then the following system of equations determines n_i:

$$n_i=z_i+\delta(P_{i,i-1}n_{i-1}+P_{i,i}n_i+P_{i,i+1}n_{i+1}),\ i=0,1,\ldots,5,\ \text{where } n_{-1}=0.$$

The solution to this system (the numerical values obtained for n_i's) is in the first row of Table 3.

To generate the rest of Table 3 we repeat the same simulations, except that POS_i and NEG_i are first adjusted to reflect the region-specific rate of growth/decline. A similar procedure is followed for age effects (Table 4) and for single- vs. multiple-plant firms (Table 5).