

Dunne, Roberts & Samuelson (1988, RAND)

Patterns of firm entry and exit
in U.S. manufacturing industries

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Abstract

- Summarizes the pattern of firm, entry and exit in the four-digit U.S. manufacturing industries over the period 1963-1982.
- Sorting entrants by the type of entry, and examine the relative importance of each types
: entry-exit rates, and postentry performance

Background

- Theoretical studies have examined the of deterring entry.
- Empirical studies have investigated the correlation between variables measuring market performance and factors that can hinder the entry.
- This paper provide the stylized facts about the actual patterns of firm entry and exit in the U.S. economy.

Attention

- They focused on three aspects of the entry and exit process.
 - ① Types of entrants
: whether the entrant is a newly established firm or not, and whether the firm constructed a new plant to produce goods for entry to the industry.
 - ② Time-series and cross-industries patterns of entry-exit behavior
 - ③ Postentry performance of the entrants
: market shares, average size, and failure rate as they age

Data

- Dataset : Constructed from U.S. Census Bureau covers all firms producing each four-digit manufacturing industries in 1963, 1967, 1972, 1977, and 1982.
- Two general approaches in studies on firm/industry evolution : industry level and firm level.
 - This paper uses **individual plant-level** data.

Data Construction

- Standardization

Reclassified seven-digit census in '63 and '67 into the proper four-digit industry.

- Matching

Sale of the plant or legal reorganizations(administrative changes) may change plants' ID number, which leads to overstate entry and exit.

⇒ To get rid of these measurement errors, they exclude the extremely small firms.

Data Construction

- Aggregation

Construct firm-level data from the plant-level data

: Distinguish firms with single-plant with multiplant

⇒ Single-plant firms account for 93.4% of the total number, but 17.2 % of the value of production.

- Identification

- Year of Entry

- Entry Type

New firm and diversifying firm

- Entry Method

New plant construction and changing the mix of products

TABLE 1 **Summary Data for Manufacturing Firms in Each Census Year**

Census Year	Total Firms		Single-Plant Firms			Multiplant Firms			
	Number of Firms	Average Number of Four-Digit Industries per Firm	Share of Number of Firms	Share of Total Value of Production	Average Number of Four-Digit Industries per Firm	Share of Number of Firms	Share of Total Value of Production	Average Number of Four-Digit Industries per Firm	Average Number of Plants per Firm
1963	265,779	1.31	.945	.215	1.23	.055	.785	2.75	3.72
1967	265,599	1.24	.942	.194	1.15	.058	.806	2.69	3.59
1972	263,169	1.25	.926	.146	1.13	.074	.854	2.70	3.54
1977	295,687	1.23	.928	.150	1.12	.072	.850	2.55	3.59
1982	294,394	1.22	.927	.152	1.08	.073	.848	2.52	3.50

Entry & Exit Measures

- Entry and Exit Rates :

$$ER_i(t) = NE_i(t) / NT_i(t-1)$$

$$XR_i(t-1) = NX_i(t-1) / NT_i(t-1)$$

- Market Shares :

$$ESH_i(t) = QE_i(t) / NT_i(t-1)$$

$$XSH_i(t-1) = QX_i(t-1) / QT_i(t-1)$$

- Average Size : average output per firm

$$ERS_i(t) = \frac{QE_i(t) / NE_i(t)}{(QT_i - QE_i(t)) / (NT_i(t) - NE_i(t))}$$

$$XRS_i(t-1) = \frac{QX_i(t) / NX_i(t-1)}{(QT_i(t-1) - QX_i(t-1)) / (NT_i(t-1) - NX_i(t-1))}$$

Importance of Entrants/Entry Types

- In each census years, 30-40 % of the firms are entrants.
- Their market shares and sizes are relatively small (15.8% and 35.2% on average, respectively).
- Exit variables reveal a similar pattern.
- New-firm, new-plant (NF/NP) account for more than half rate of number among the entrants, followed by diversifying-firm, existing-plants(DF/PM)(36.1%) and diversifying-firm, new-plant(DF/NP)(8.5%).

TABLE 2 Entry and Exit Variables for the U.S. Manufacturing Sector
(Averages over 387 Four-Digit SIC Industries)

	1963-1967	1967-1972	1972-1977	1977-1982
Entry Rate (<i>ER</i>):				
All firms	.414	.516	.518	.517
Smallest firms deleted	.307	.427	.401	.408
Entrant Market Share (<i>ESH</i>):				
All firms	.139	.188	.146	.173
Smallest firms deleted	.136	.185	.142	.169
Entrant Relative Size (<i>ERS</i>):				
All firms	.271	.286	.205	.228
Smallest firms deleted	.369	.359	.280	.324
Exit Rate (<i>XR</i>):				
All firms	.417	.490	.450	.500
Smallest firms deleted	.308	.390	.338	.372
Exit Market Share (<i>XSH</i>):				
All firms	.148	.195	.150	.178
Smallest firms deleted	.144	.191	.146	.173
Exit Relative Size (<i>XRS</i>):				
All firms	.247	.271	.221	.226
Smallest firms deleted	.367	.367	.310	.344

²⁰ When we include the smallest firms in each industry, the entry rate increases by approximately 10 percentage points in each year.

²¹ The market share of all entering firms varies from .139 to .188 over time. It falls by approximately .4 percentage points when the smallest firms are deleted. This indicates that entrants account for approximately 55% of the industry output, which is deleted when small firms are excluded.

²² When all firms are included, the exit rate increases by approximately 11 percentage points in each year, but the market share increases by only .4 percentage points.

TABLE 3 **Entry Variables by Type of Firm and Method of Entry**
(Averages over 387 Four-Digit SIC Industries)

Type of Firm/ Method of Entry*	1963-1967	1967-1972	1972-1977	1977-1982
<u>Entry Rate</u>				
Total	.307	.427	.401	.408
<i>NF/NP</i>	.154	.250	.228	.228
<i>DF/NP</i>	.028	.053	.026	.025
<i>DF/PM</i>	.125	.123	.146	.154
<u>Entrant Market Share</u>				
Total	.136	.185	.142	.169
<i>NF/NP</i>	.060	.097	.069	.093
<i>DF/NP</i>	.019	.039	.015	.020
<i>DF/PM</i>	.057	.050	.058	.057
<u>Entrant Relative Size</u>				
Total	.369	.359	.280	.324
<i>NF/NP</i>	.288	.308	.227	.311
<i>DF/NP</i>	.980	.919	.689	.896
<i>DF/PM</i>	.406	.346	.344	.298

* *NF/NP* = new-firm, new-plant; *DP/NP* = diversifying-firm, new-plant; *DF/PM* = diversifying-firm, product-mix.

TABLE 4 Exit Variables by Type of Firm and Method of Entry
(Averages over 387 Four-Digit SIC Industries)

Type of Firm/ Method of Entry	1963-1967	1967-1972	1972-1977	1977-1982
<u>Exit Rate</u>				
Total	.308	.390	.338	.372
1963 firms	.308	.224	.103	.082
<i>NF/NP</i>		.087	.134	.173
<i>DF/NP</i>		.011	.024	.022
<i>DF/PM</i>		.068	.076	.096
<u>Exit Market Share</u>				
Total	.144	.191	.146	.173
1963 firms	.144	.126	.056	.061
<i>NP/NP</i>		.032	.050	.061
<i>DF/NP</i>		.005	.013	.014
<i>DF/PM</i>		.027	.028	.038
<u>Exit Relative Size</u>				
Total	.367	.367	.310	.344
1963 firms	.367	.499	.506	.802
<i>NF/NP</i>		.312	.290	.255
<i>DF/NP</i>		.587	.628	.639
<i>DF/PM</i>		.360	.301	.322

Across Industries

- Across-industry difference is substantial.
 - In each sector, there exists an industry whose entry rate is extremely high/low.
- Generally, the entrants' effect on their industry's output is small.
- Sector-characteristics of the exit firms are similar to that of the entrants.
 - The simple correlation of average market share is .92.
 - That of average relative size is .98.

TABLE 5 **The Distribution of Entry and Exit Variables across Industries**
(Means and 10% and 90% Deciles (in parentheses) across Years
and Four-Digit Industries Within Each Two-Digit Sector)

Two-Digit Sector	Rate	Market Share	Relative Size
<u>Entry Variables</u>			
20 Food Processing	.239 (.08, .39)	.098 (.02, .19)	.313 (.10, .57)
21 Tobacco	.205 (.00, .63)	.021 (.00, .06)	.107 (.00, .27)
22 Textiles	.372 (.17, .60)	.177 (.05, .31)	.374 (.16, .56)
23 Apparel	.403 (.20, .65)	.262 (.11, .38)	.512 (.22, .82)
24 Lumber	.497 (.23, .90)	.264 (.09, .42)	.424 (.21, .64)
25 Furniture	.471 (.28, .69)	.239 (.13, .38)	.383 (.21, .65)
26 Paper	.314 (.07, .52)	.107 (.01, .24)	.304 (.10, .74)
27 Printing	.490 (.22, .91)	.228 (.09, .39)	.407 (.15, .71)
28 Chemicals	.325 (.12, .53)	.086 (.01, .18)	.217 (.08, .44)
29 Petroleum and Coal	.337 (.16, .58)	.140 (.02, .28)	.354 (.10, .83)
30 Rubber and Plastics	.431 (.10, .88)	.129 (.01, .26)	.224 (.06, .43)
31 Leather	.294 (.19, .48)	.186 (.06, .33)	.476 (.23, .83)
32 Stone, Clay, Glass	.344 (.13, .58)	.131 (.02, .29)	.330 (.07, .65)
33 Primary Metals	.319 (.08, .55)	.122 (.01, .26)	.328 (.10, .63)
34 Fabricated Metals	.429 (.23, .65)	.193 (.07, .35)	.376 (.15, .70)
35 Nonelectrical Machinery	.465 (.26, .66)	.167 (.06, .32)	.299 (.11, .52)
36 Electrical Machinery	.461 (.21, .78)	.095 (.03, .26)	.216 (.08, .45)
37 Transportation Equipment	.465 (.09, .73)	.141 (.01, .39)	.257 (.06, .73)
38 Instruments	.603 (.29, .88)	.189 (.06, .32)	.224 (.09, .39)
39 Miscellaneous	.402 (.21, .63)	.187 (.07, .30)	.351 (.15, .61)

	<u>Exit Variables</u>		
20 Food Processing	.313 (.16, .44)	.123 (.03, .23)	.303 (.11, .55)
21 Tobacco	.223 (.03, .48)	.032 (.00, .09)	.110 (.00, .25)
22 Textiles	.372 (.22, .52)	.179 (.06, .32)	.355 (.18, .55)
23 Apparel	.453 (.34, .58)	.291 (.15, .45)	.517 (.27, .77)
24 Lumber	.441 (.29, .57)	.264 (.12, .41)	.452 (.25, .71)
25 Furniture	.431 (.32, .62)	.241 (.12, .36)	.418 (.22, .63)
26 Paper	.299 (.14, .43)	.122 (.05, .24)	.324 (.13, .57)
27 Printing	.429 (.33, .58)	.243 (.11, .40)	.439 (.19, .73)
28 Chemicals	.285 (.13, .42)	.081 (.01, .17)	.213 (.08, .42)
29 Petroleum and Coal	.297 (.13, .40)	.144 (.02, .27)	.373 (.09, .74)
30 Rubber and Plastics	.302 (.09, .52)	.133 (.01, .25)	.316 (.09, .48)
31 Leather	.390 (.28, .49)	.240 (.13, .40)	.487 (.33, .77)
32 Stone, Clay, Glass	.307 (.13, .46)	.138 (.03, .29)	.357 (.08, .69)
33 Primary Metals	.277 (.10, .43)	.120 (.01, .29)	.341 (.08, .69)
34 Fabricated Metals	.355 (.21, .48)	.182 (.05, .31)	.406 (.13, .73)
35 Nonelectrical Machinery	.373 (.29, .48)	.161 (.06, .28)	.328 (.12, .55)
36 Electrical Machinery	.351 (.23, .48)	.119 (.03, .25)	.240 (.08, .45)
37 Transportation Equipment	.327 (.05, .56)	.117 (.00, .28)	.233 (.06, .50)
38 Instruments	.468 (.35, .61)	.182 (.08, .28)	.254 (.10, .39)
39 Miscellaneous	.410 (.30, .49)	.222 (.10, .34)	.430 (.19, .71)

Coverage: 387 four-digit SIC industries in 1963–1967 and 1967–1972, 431 four-digit SIC industries in 1972–1977 and 1977–1982.

Time-Series Correlation

- Each variables are positively correlates with itself across census years, especially in market share.
: Correlation diminishes as the years become farther apart.
- Industries with high entry rate also tend to have high rate of exits.
- Considering panel nature : considering industry-specific characters, the correlation between entry-exit rate(deviation from the industry mean) in the same period is negative.
- t period and $t + 1$ period are positively correlated.
- About market share, such characteristics are not observed.

TABLE 6 Correlations between Industry Entry and Exit Measures across Census Years
(387 Four-Digit Industries)

	Entry Measures				Exit Measures			
	1963-1967	1967-1972	1972-1977	1977-1982	1963-1967	1967-1972	1972-1977	1977-1982
<u>Entry Rate</u>					<u>Exit Rate:</u>			
1963-1967	1.000	.310	.233	.251	1.000	.671	.594	.577
1967-1972		1.000	.274	.265		1.000	.681	.624
1972-1977			1.000	.306			1.000	.739
1977-1982				1.000				1.000
<u>Entrant Market Share</u>					<u>Exiter Market Share:</u>			
1967	1.000	.721	.697	.598	1.000	.777	.707	.649
1972		1.000	.804	.692		1.000	.778	.721
1977			1.000	.759			1.000	.787
1982				1.000				1.000
<u>Entrant Relative Size</u>					<u>Exiter Relative Size:</u>			
1967	1.000	.400	.455	.377	1.000	.569	.502	.501
1972		1.000	.610	.503		1.000	.617	.564
1977			1.000	.609			1.000	.555
1982				1.000				1.000

TABLE 7 **Correlations between Industry Entry and Exit Variables (387 Four-Digit Industries)**

		No Correction for Fixed Industry Effects				Correction for Fixed Industry Effects			
		1963-1967	1967-1972	1972-1977	1977-1982	1963-1967	1967-1972	1972-1977	1977-1982
		<u>Entry Rate</u>				<u>Entry Rate</u>			
<u>Exit Rate</u>									
	1963-1967	.180	.363	.387	.323	-.249	.071	.123	-.005
	1967-1972	.447	.274	.273	.363	.371	-.191	-.177	.118
	1972-1977	.358	.408	.321	.328	.051	.137	-.129	-.081
	1977-1982	.237	.324	.389	.304	-.114	-.029	.147	-.028
		<u>Entrant Market Share</u>				<u>Entrant Market Share</u>			
<u>Exiter Market Share</u>									
	1963-1967	.741	.725	.743	.691	.308	-.116	-.037	-.167
	1967-1972	.722	.770	.759	.703	.124	.154	-.058	-.228
	1972-1977	.681	.800	.788	.784	-.153	.160	-.044	.032
	1977-1982	.571	.691	.758	.804	-.287	-.172	.132	.354

Growth and Exit of the Entrants

- After the entry, the entrants' market share tend to decline as time goes.
: Exit of firms
- Average size continues to increase
: Surviving firms grow as the cohort ages.
- On average, 79.6 % of all firms exit within 10 years.

TABLE 8 **Market Shares, Average Firm Sizes, and Exit Rates of Entry Cohorts by Year (Means and Standard Deviations across 387 Industries)**

	1963	1967	1972	1977	1982
<u>Market Shares</u>					
1963 Firms	1.00	.861 (.104)	.729 (.169)	.657 (.202)	.578 (.222)
1967 Entry Cohort		.139 (.104)	.083 (.062)	.067 (.054)	.053 (.044)
1972 Entry Cohort			.189 (.130)	.131 (.088)	.099 (.069)
1977 Entry Cohort				.147 (.109)	.098 (.074)
1982 Entry Cohort					.173 (.113)
<u>Average Size of Surviving Firms Relative to All Firms in the Industry</u>					
1963 Firms	1.00	1.49 (.406)	2.13 (1.13)	2.92 (1.90)	3.76 (3.37)
1967 Entry Cohort		.352 (.240)	.597 (.485)	.915 (.935)	1.32 (1.47)
1972 Entry Cohort			.396 (.250)	.686 (.455)	1.07 (.867)
1977 Entry Cohort				.308 (.202)	.560 (.357)
1982 Entry Cohort					.346 (.204)
<u>Cumulative Cohort Exit Rates</u>					
1963 Firms		.419 (.116)	.640 (.120)	.741 (.118)	.815 (.109)
1967 Entry Cohort			.639 (.100)	.790 (.075)	.876 (.063)
1972 Entry Cohort				.575 (.103)	.782 (.090)
1977 Entry Cohort					.632 (.111)

Across-Entry-Type

- About the rate of the number, basic tendency is similar : DF/NP firms show the smallest decline, while more than a half of DF/PM firm exit within ten years.
- In average size, there is large difference among the types of entry :
DF/NP firms grows to where their average market size is larger than the industry average(largest s.d.).
- Also in cumulative exit rate, DF/NP firm shows the lowest number.

TABLE 9 **Market Shares of Entry Cohorts and Entry Categories by Year**
(Means and Standard Deviations across 387 Industries)

	1963	1967	1972	1977	1982
<u>1963 Firms</u>	1.00	.861 (.104)	.729 (.169)	.657 (.202)	.578 (.222)
<u>1967 Entry Cohort</u>					
<i>NF/NP</i>		.062 (.059)	.033 (.036)	.025 (.027)	.019 (.022)
<i>DF/NP</i>		.020 (.025)	.019 (.025)	.018 (.026)	.015 (.026)
<i>DF/PM</i>		.058 (.066)	.032 (.040)	.026 (.038)	.020 (.031)
<u>1972 Entry Cohort</u>					
<i>NF/NP</i>			.099 (.088)	.065 (.055)	.046 (.042)
<i>DF/NP</i>			.040 (.040)	.034 (.040)	.030 (.040)
<i>DF/PM</i>			.052 (.051)	.032 (.040)	.024 (.032)
<u>1977 Entry Cohort</u>					
<i>NF/NP</i>				.073 (.066)	.047 (.044)
<i>DF/NP</i>				.017 (.020)	.015 (.021)
<i>DF/PM</i>				.059 (.056)	.038 (.046)
<u>1982 Entry Cohort</u>					
<i>NF/NP</i>					.095 (.069)
<i>DF/NP</i>					.021 (.033)
<i>DF/PM</i>					.059 (.052)

TABLE 10 **Average Size of Surviving Firms Relative to All Firms in the Industry
for Entry Cohorts and Entry Categories by Year
(Means and Standard Deviations across 387 Industries)**

	1963	1967	1972	1977	1982
<u>1963 Firms</u>	1.0	1.49 (.406)	2.13 (1.13)	2.92 (1.90)	3.76 (3.37)
<u>1967 Entry Cohort</u>					
<i>NF/NP</i>		.270 (.213)	.392 (.355)	.551 (.556)	.750 (.842)
<i>DF/NP</i>		1.41 (2.06)	2.82 (4.60)	4.26 (6.69)	5.55 (9.98)
<i>DF/PM</i>		.404 (.390)	.725 (1.03)	1.14 (1.70)	1.53 (2.03)
<u>1972 Entry Cohort</u>					
<i>NF/NP</i>			.319 (.243)	.518 (.400)	.752 (.639)
<i>DF/NP</i>			1.39 (1.77)	2.49 (2.93)	3.49 (4.28)
<i>DF/PM</i>			.406 (.392)	.681 (.692)	1.036 (1.07)
<u>1977 Entry Cohort</u>					
<i>NF/NP</i>				.229 (.166)	.406 (.299)
<i>DF/NP</i>				1.07 (1.40)	2.22 (3.17)
<i>DF/PM</i>				.456 (.416)	.780 (.827)
<u>1982 Entry Cohort</u>					
<i>NF/NP</i>					.320 (.211)
<i>DF/NP</i>					1.42 (2.86)
<i>DF/PM</i>					.339 (.277)

Conclusion

- Firm-level data from plant-level data provides a summary of the basic patterns of firm entry, growth, and exit.
- The variation in entry patterns influences on their postentry performance and exit patterns.
- Further research
 - To identify the characteristics of industry technology and demand
 - Analyzing within-industry competition and long-run evolution of industry structure.