# Dunne, Roberts & Samuelson (1988, RAND)

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

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# Abstract

- Summerizes 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-industres 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
  Reclassfied 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.
  $\Rightarrow$ 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
  $\Rightarrow$ 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 diversifyng firm
  - Entry Method
    New plant construction and changing the mix of products

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

| | Total Firms | | Single-Plant Firms | | | Multiplant Firms | | | |
|---|---|---|---|---|---|---|---|---|---|
| Census Year | 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 :

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

- 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 (*ER*): | | | | |
| All firms | .414 | .516 | .518 | .517 |
| Smallest firms deleted | .307 | .427 | .401 | .408 |
| Entrant Market Share (*ESH*): | | | | |
| All firms | .139 | .188 | .146 | .173 |
| Smallest firms deleted | .136 | .185 | .142 | .169 |
| Entrant Relative Size (*ERS*): | | | | |
| All firms | .271 | .286 | .205 | .228 |
| Smallest firms deleted | .369 | .359 | .280 | .324 |
| Exit Rate (*XR*): | | | | |
| All firms | .417 | .490 | .450 | .500 |
| Smallest firms deleted | .308 | .390 | .338 | .372 |
| Exiter Market Share (*XSH*): | | | | |
| All firms | .148 | .195 | .150 | .178 |
| Smallest firms deleted | .144 | .191 | .146 | .173 |
| Exiter Relative Size (*XRS*): | | | | |
| 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 |
|---|---|---|---|---|
| Entry Rate | | | | |
| Total | .307 | .427 | .401 | .408 |
| *NF/NP* | .154 | .250 | .228 | .228 |
| *DF/NP* | .028 | .053 | .026 | .025 |
| *DF/PM* | .125 | .123 | .146 | .154 |
| Entrant Market Share | | | | |
| Total | .136 | .185 | .142 | .169 |
| *NF/NP* | .060 | .097 | .069 | .093 |
| *DF/NP* | .019 | .039 | .015 | .020 |
| *DF/PM* | .057 | .050 | .058 | .057 |
| Entrant Relative Size | | | | |
| Total | .369 | .359 | .280 | .324 |
| *NF/NP* | .288 | .308 | .227 | .311 |
| *DF/NP* | .980 | .919 | .689 | .896 |
| *DF/PM* | .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 |
|---|---|---|---|---|
| Exit Rate | | | | |
| Total | .308 | .390 | .338 | .372 |
| 1963 firms | .308 | .224 | .103 | .082 |
| *NF/NP* | | .087 | .134 | .173 |
| *DF/NP* | | .011 | .024 | .022 |
| *DF/PM* | | .068 | .076 | .096 |
| Exit Market Share | | | | |
| Total | .144 | .191 | .146 | .173 |
| 1963 firms | .144 | .126 | .056 | .061 |
| *NP/NP* | | .032 | .050 | .061 |
| *DF/NP* | | .005 | .013 | .014 |
| *DF/PM* | | .027 | .028 | .038 |
| Exit Relative Size | | | | |
| Total | .367 | .367 | .310 | .344 |
| 1963 firms | .367 | .499 | .506 | .802 |
| *NF/NP* | | .312 | .290 | .255 |
| *DF/NP* | | .587 | .628 | .639 |
| *DF/PM* | | .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-charactaristics 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 |
|---|---|---|---|
| | Entry Variables | | |
| 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) |

| | Exit Variables | | |
|---|---|---|---|
| 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 charactaristics 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 |
| **Entry Rate** | | | | | **Exit Rate:** | | | |
| 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 |
| **Entrant Market Share** | | | | | **Exiter Market Share:** | | | |
| 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 |
| **Entrant Relative Size** | | | | | **Exiter Relative Size:** | | | |
| 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 |
| | | Entry Rate | | | | Entry Rate | | |
| Exit Rate | | | | | | | | |
| 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 |
| | | Entrant Market Share | | | | Entrant Market Share | | |
| Exiter Market Share | | | | | | | | |
| 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 |
|---|---|---|---|---|---|
| Market Shares | | | | | |
| 1963 Firms | 1.00 | .861 | .729 | .657 | .578 |
| | | (.104) | (.169) | (.202) | (.222) |
| 1967 Entry Cohort | | .139 | .083 | .067 | .053 |
| | | (.104) | (.062) | (.054) | (.044) |
| 1972 Entry Cohort | | | .189 | .131 | .099 |
| | | | (.130) | (.088) | (.069) |
| 1977 Entry Cohort | | | | .147 | .098 |
| | | | | (.109) | (.074) |
| 1982 Entry Cohort | | | | | .173 |
| | | | | | (.113) |
| Average Size of Surviving Firms Relative to All Firms in the Industry | | | | | |
| 1963 Firms | 1.00 | 1.49 | 2.13 | 2.92 | 3.76 |
| | | (.406) | (1.13) | (1.90) | (3.37) |
| 1967 Entry Cohort | | .352 | .597 | .915 | 1.32 |
| | | (.240) | (.485) | (.935) | (1.47) |
| 1972 Entry Cohort | | | .396 | .686 | 1.07 |
| | | | (.250) | (.455) | (.867) |
| 1977 Entry Cohort | | | | .308 | .560 |
| | | | | (.202) | (.357) |
| 1982 Entry Cohort | | | | | .346 |
| | | | | | (.204) |
| Cumulative Cohort Exit Rates | | | | | |
| 1963 Firms | | .419 | .640 | .741 | .815 |
| | | (.116) | (.120) | (.118) | (.109) |
| 1967 Entry Cohort | | | .639 | .790 | .876 |
| | | | (.100) | (.075) | (.063) |
| 1972 Entry Cohort | | | | .575 | .782 |
| | | | | (.103) | (.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 differernce 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 |
|---|---|---|---|---|---|
| 1963 Firms | 1.00 | .861 | .729 | .657 | .578 |
| | | (.104) | (.169) | (.202) | (.222) |
| 1967 Entry Cohort | | | | | |
| *NF/NP* | | .062 | .033 | .025 | .019 |
| | | (.059) | (.036) | (.027) | (.022) |
| *DF/NP* | | .020 | .019 | .018 | .015 |
| | | (.025) | (.025) | (.026) | (.026) |
| *DF/PM* | | .058 | .032 | .026 | .020 |
| | | (.066) | (.040) | (.038) | (.031) |
| 1972 Entry Cohort | | | | | |
| *NF/NP* | | | .099 | .065 | .046 |
| | | | (.088) | (.055) | (.042) |
| *DF/NP* | | | .040 | .034 | .030 |
| | | | (.040) | (.040) | (.040) |
| *DF/PM* | | | .052 | .032 | .024 |
| | | | (.051) | (.040) | (.032) |
| 1977 Entry Cohort | | | | | |
| *NF/NP* | | | | .073 | .047 |
| | | | | (.066) | (.044) |
| *DF/NP* | | | | .017 | .015 |
| | | | | (.020) | (.021) |
| *DF/PM* | | | | .059 | .038 |
| | | | | (.056) | (.046) |
| 1982 Entry Cohort | | | | | |
| *NF/NP* | | | | | .095 |
| | | | | | (.069) |
| *DF/NP* | | | | | .021 |
| | | | | | (.033) |
| *DF/PM* | | | | | .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 |
|---|---|---|---|---|---|
| 1963 Firms | 1.0 | 1.49 | 2.13 | 2.92 | 3.76 |
| | | (.406) | (1.13) | (1.90) | (3.37) |
| 1967 Entry Cohort | | | | | |
| *NF/NP* | | .270 | .392 | .551 | .750 |
| | | (.213) | (.355) | (.556) | (.842) |
| *DF/NP* | | 1.41 | 2.82 | 4.26 | 5.55 |
| | | (2.06) | (4.60) | (6.69) | (9.98) |
| *DF/PM* | | .404 | .725 | 1.14 | 1.53 |
| | | (.390) | (1.03) | (1.70) | (2.03) |
| 1972 Entry Cohort | | | | | |
| *NF/NP* | | | .319 | .518 | .752 |
| | | | (.243) | (.400) | (.639) |
| *DF/NP* | | | 1.39 | 2.49 | 3.49 |
| | | | (1.77) | (2.93) | (4.28) |
| *DF/PM* | | | .406 | .681 | 1.036 |
| | | | (.392) | (.692) | (1.07) |
| 1977 Entry Cohort | | | | | |
| *NF/NP* | | | | .229 | .406 |
| | | | | (.166) | (.299) |
| *DF/NP* | | | | 1.07 | 2.22 |
| | | | | (1.40) | (3.17) |
| *DF/PM* | | | | .456 | .780 |
| | | | | (.416) | (.827) |
| 1982 Entry Cohort | | | | | |
| *NF/NP* | | | | | .320 |
| | | | | | (.211) |
| *DF/NP* | | | | | 1.42 |
| | | | | | (2.86) |
| *DF/PM* | | | | | .339 |
| | | | | | (.277) |

# Conclusion

- Firm-level data from plant-level data provides a summery 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 charactaristics of industry technology and demand
  - Analyzing within-indusitry competition and long-run evolution of industry structure.