

A Note on the Dynamics of Firm Turnovers in the East Liverpool (Ohio) Pottery Industry, 1825-2010

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Abstract

We examine the time series data on firm entries and exits in the East Liverpool (Ohio) pottery industry between 1825 and 2010. The purpose is to identify patterns in the movement of the firms as well as their spans of life over the course of the industry's development. Two patterns emerge: 1) the numbers of entries and exits are positively correlated; 2) the life spans of all firms that existed over the industry's life-cycle show significant "infant mortality."

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1. Introduction

Industrial migration from Britain to the United States has been a significant part of the formative history of many major industries – e.g., textiles, mining, iron and steel. Though much smaller in scale, the development of the American pottery industry followed the same migratory pattern. The massive migration started in early 1800s, mostly by the journeymen potters with skills but little capital.² According to Thistlethwaite (1958), the migration of English potters had a single origin, the Five Towns of Staffordshire, but two destinations, East Liverpool, Ohio and Trenton, New Jersey. With the high rates of tariff imposed on English imports following the Civil War, the twin centers of domestic ceramic production grew rapidly in the late 19th century to dominate the domestic market: “Trenton and East Liverpool were the centers of production in the two leading ceramic manufacturing states. These two centers produced 49.7 percent of all pottery products manufactured in the United States at the turn of the century.” [Gates (1984)]

This short note explores the entry and exit dynamics of the firms throughout the formation, growth, and the eventual decline of the pottery industry located in East Liverpool, Ohio. Its purpose is to identify patterns in the movement of the firms as well as in the distribution of their spans of life over the entire life-cycle of the industry. Two patterns emerge from this study: 1) the numbers of entries and exits are positively correlated so that the period with a high number of entries is also the period with a high number of exits and vice versa; 2) the life spans of all firms over the industry’s life-cycle show infant mortality.

2. Data

The dataset used for our study is constructed from the list of companies that operated in East Liverpool over the period of 1826 to present, as compiled by William C. Gates, Jr., Curator of History for the Ohio Historical Society.³ According to this list, the earliest recorded date of pottery production in East Liverpool is by Joseph Wells in 1826. The list contains a total of 292 firms. The dates of entry and exit are provided for 275 firms. Out of these 275 firms, 267 of them went out of existence, while eight still remain in operation. The full list with the company names, their years of operation and the life spans is provided in the Appendix.

For the population of 275 firms with entry and exit dates, some modifications had to be made. If a firm exited the industry but re-entered the market under the same name at a later date, the

² Thistlewaite (1958): “In 1815, ..., potting was still in its infancy in America: a matter of primitive kilns, scattered up and down the seaboard producing coarse wares for parochial markets. Men still had to learn to fire the native clays; to discover clay banks near coal seams; to build the canals and railways which would transport coal to clay and the bulky, fragile ware to distant markets; to find capital; to raise a tariff against the cheap and professional wares dumped on the American market from the British potting metropolis; and to overcome native prejudice against domestic wares. But above all, to establish an industry which derives from an ancient craft, it was necessary to await the immigration of ‘practical potters’, men with generations of potting in their blood, journeyman-graduates of an exacting apprenticeship, with an instinct for the chemistry of clays, sensitive to texture and form, skilled in throwing, turning, in the making of moulds and in decorating. During the nineteenth century thousands of such men emigrated to the United States to provide the essential *cadre* of artisans for a native pottery. And although some of the early potters were French and German, the very great majority came from Staffordshire.”

³ The full list is available at <http://www.themuseumofceramics.org/pottery.html> (The Museum of Ceramics, East Liverpool, Ohio). See Calhoun (1922) and Gates and Ormerod (1982) for additional information.

company was treated as having entered and exited the market twice. The Appendix will have “episode I” or “episode II” by the firm name to represent this fact. In some cases, a firm appeared to have left the market but was continuously still operating under a different name. Typically, the name change reflected the addition or deletion of one or more co-owners or it reflected the incorporation of a firm. If this was the case, these separate firms were merged into one firm. For example, the Laughlin Brothers firm was opened in 1873 and technically exited the market in 1877 when one of the Laughlin brothers left the firm. However, the other Laughlin brother continued to operate the firm under the name Homer Laughlin. In 1896, the firm was incorporated and then called the Homer Laughlin China Company. The firm continues to operate today. In this case, the lineage of the firm was able to be traced and, instead of having three separate entries, the company was treated as one firm that began in 1873 and operates to this day. The list of all firms in the Appendix includes these “merged” firms that have the comment “see note” in the comment section.

3. Entry, Exit, and Industry Structure

Starting with 1825, Figure 1 plots the time series over 186 years of the number of entries, $\{n_t\}_{t=1825}^{2010}$, and the number of exits, $\{x_t\}_{t=1825}^{2010}$. The persistence of these movements in and out of the industry throughout the horizon is noteworthy. More importantly, however, these time series appear to move in concert, though imperfectly. The table below shows the correlations between the two series with up to five periods of lag for the number of exits:

$Corr(n_t, x_t)$	0.360394
$Corr(n_t, x_{t+1})$	0.684669
$Corr(n_t, x_{t+2})$	0.439309
$Corr(n_t, x_{t+3})$	0.490466
$Corr(n_t, x_{t+4})$	0.346086
$Corr(n_t, x_{t+5})$	0.468828

First, note that n_t and x_t are positively correlated so that the year having a relatively large number of entries is also the one with a relatively large number of exits.⁴ More interestingly, the positive correlation is at its highest when the number of exits is lagged by one year. This suggests a shakeout process operating throughout the horizon, perhaps as the result of random external shocks (either in demand or supply) that were unanticipated by the producers.

While both entry and exit persist over time, we do observe that, on average, there are net entries in early years (up to about 1900), while there are net exits in the later years. This leads to Figure 2, which shows the total number of operating firms over the same horizon. Both the rise and the

⁴ We also find that the gross entries are positively correlated with the net entries: $Corr(n_t, n_t - x_t) = 0.618553$.

decline of the industry along its life cycle are apparent in this figure. Some noticeable peaks and troughs are precisely indicated with the corresponding years.

4. Life Spans of Firms

Inspecting the list of firms, one can see that there are substantial variations in their life spans; the short-lived ones with only one year of operation and the long-lived ones with over 125 years. To see the distribution of the firms' life spans, let us create bins, each with up to five years of life span: that is, the first bin with firms having a life span of 1 to 5 years; the second bin with those having a life span of 6 to 10 years; the third bin with firms having a life span of 11 to 15 years, and so forth. Excluding the eight firms that are still in business, we count the number of firms in each bin. In Figure 3, we plot these numbers in a bar graph. It clearly shows a phenomenon of *infant mortality*, in which a disproportionately large number of firms lived for less than 5 years. The number of firms belonging to each bin of longer life spans drops down rapidly, as shown in the figure.

While Figure 3 shows the phenomenon of infant mortality, one may further inquire about what happens with even shorter life spans. In Figure 4, we have divided the 5-year bins into single-year bins for up to 20 years of life span. The resulting histogram shows that a significant proportion of firms exit the market within the first year.

5. Discussion

Several comments are in order. First, both the infant mortality and the positive correlation between entries and exits have been observed in the empirical literature in industrial organization. For instance, our findings are in line with three of the stylized facts presented by Geroski (1995): 1) "Entry is common. Large numbers of firms enter most markets in most years, but entry rates are far higher than market penetration rates"; 2) "Entry and exit rates are highly positively correlated, and net entry rates and penetration are modest fractions of gross entry rates and penetration"; 3) "The survival rate of most entrants is low, and even successful entrants may take more than a decade to achieve a size comparable to the average incumbent."

Similarly, Caves (2007) states:

Turnover in particular affects entrants, who face high hazard rates in their infancy that drop over time. It is largely because of high infant mortality that rates of entry to and exit from industries are positively correlated (compare the obvious theoretical model that implies either entry or exit should occur but not both). The positive entry-exit correlation appears in cross-sections of industries, and even in time series for individual industries, if their life-cycle stages are controlled. [Caves (2007: 9-10)]

Further evidence is provided by Geroski and Mazucato (2001) who examined the 93 years of data on the population of domestic U.S. auto producers. They found that the number of entrants and the number of exiting car producers between 1895 and 1967 are positively correlated (0.6086).

Second, the simultaneous occurrences of entry and exit suggest a pervasive heterogeneity among firms, either in terms of the product characteristics or in terms of production technologies held by them. Unanticipated shocks to consumer preferences over product attributes or to production technologies (possibly through changes in relative input prices) can then affect the firms unequally, thereby simultaneously inducing entries of those who are favorably affected and exits of those who are adversely affected. Of course, such inter-firm heterogeneity can be a persistent source of the phenomenon in question, only if there are inherent frictions in the market which prevent the firms from instantaneously copying the most preferred product or the most efficient technology.

Third, the striking degree to which our findings show the presence of infant mortality suggests a limitation in the textbook models of market competition, in which firms are characterized as rational optimizers having perfect foresight. The entry and exit behaviors of the firms in our study simply do not conform to this standard. This leads to our final point that the study of industry dynamics may benefit from theoretical work involving firms with bounded rationality.⁵ Efforts in this direction, using computational methods, are made in Chang (2009, 2011b, 2012).⁶

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⁵ While there have been attempts to incorporate bounded rationality into industrial organization, much of this work has focused on modeling the consumers as being boundedly rational, while keeping the firms as profit-maximizers with perfect foresight. [See Spiegler (2011).]

⁶ See Chang (2011a) for a general discussion on the need for this approach in industrial organization.

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Figure 1: Entries and Exits

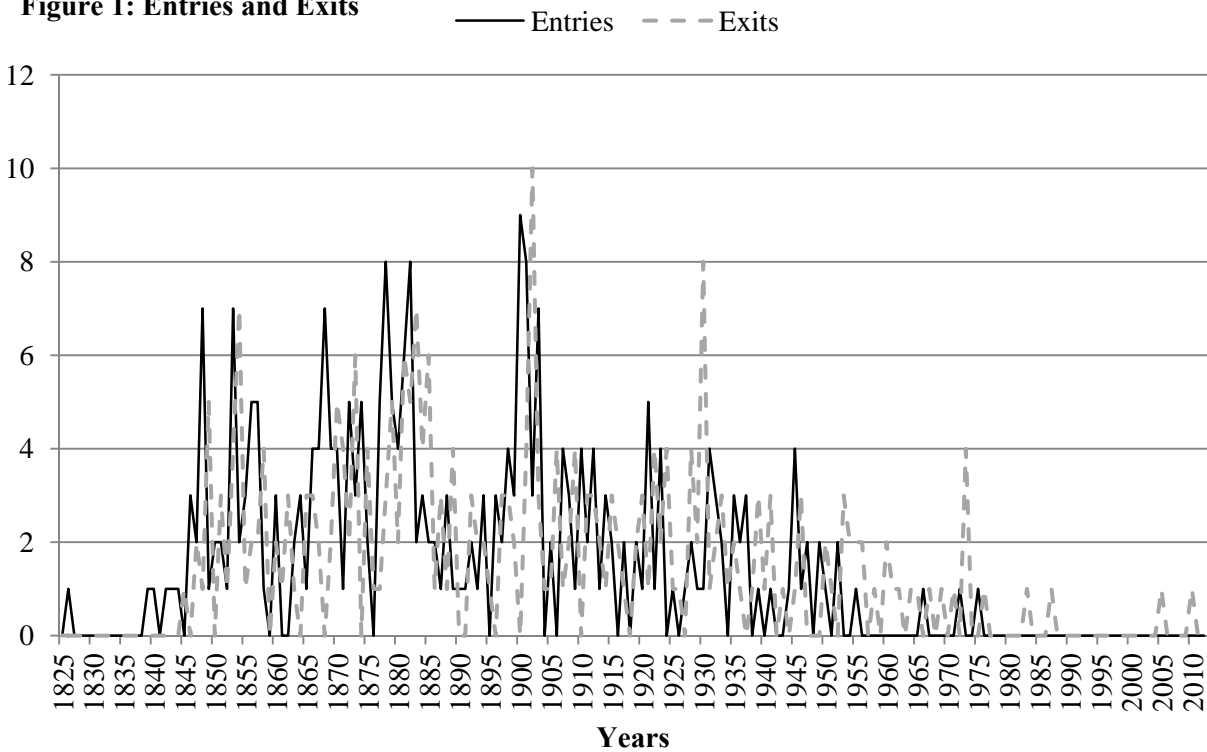


Figure 2: Total Number of Firms

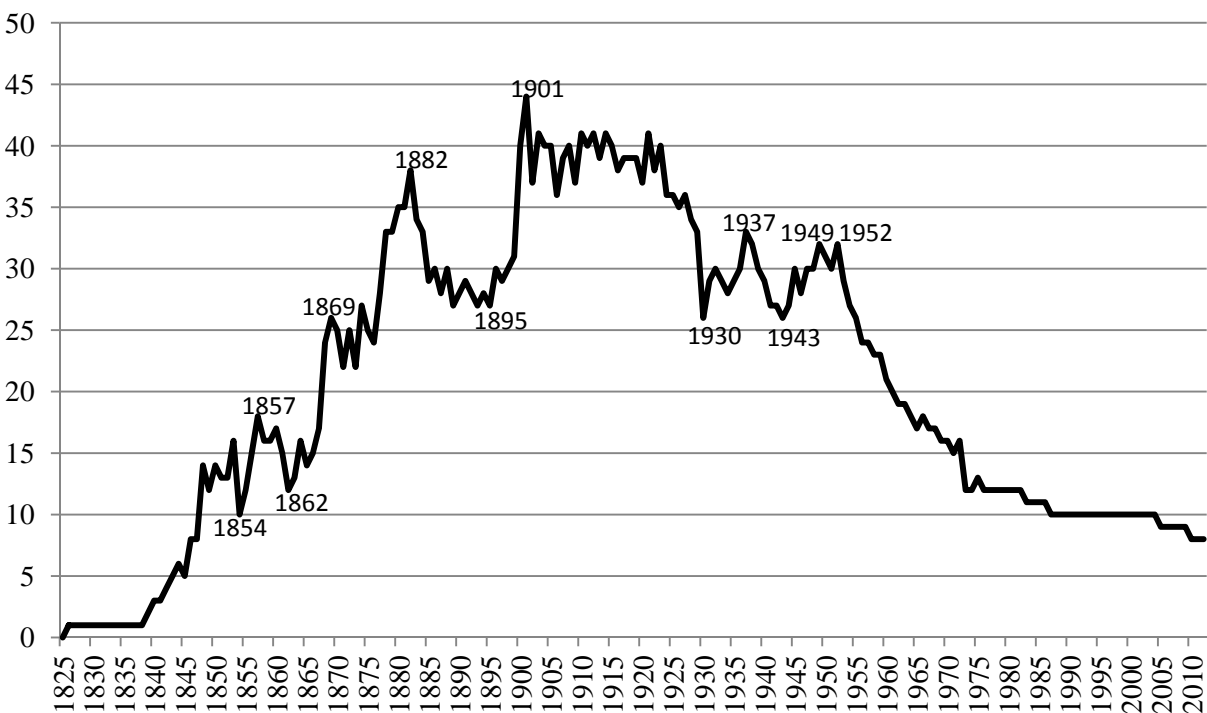
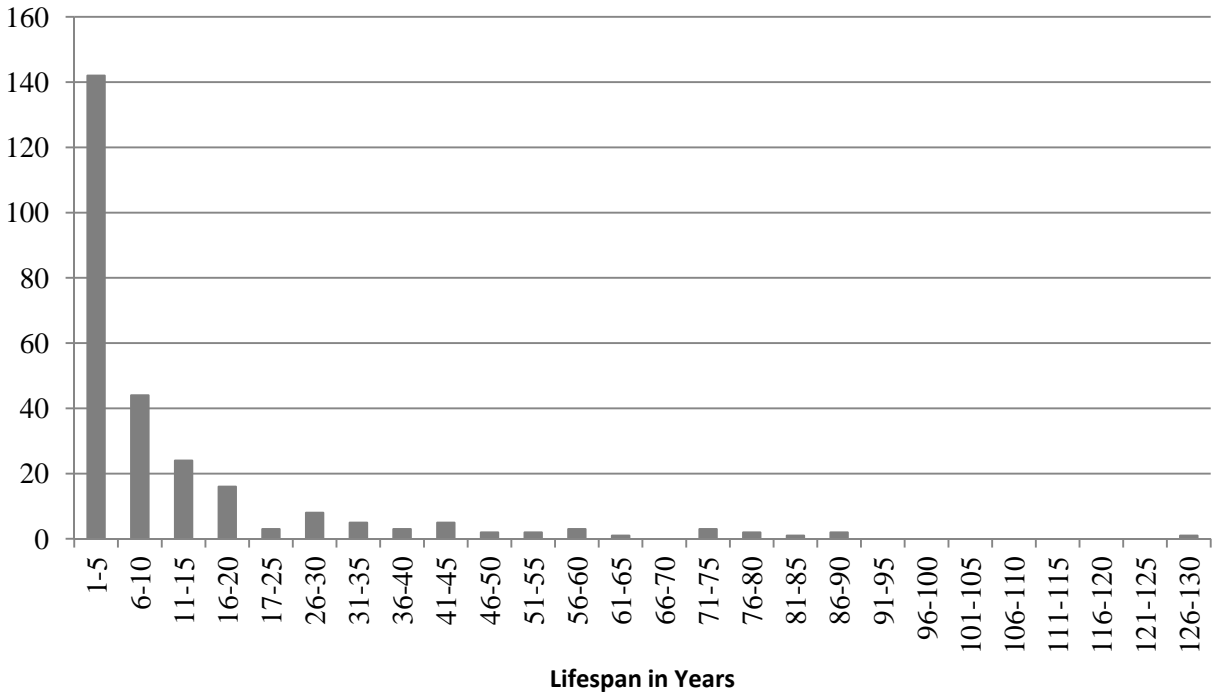
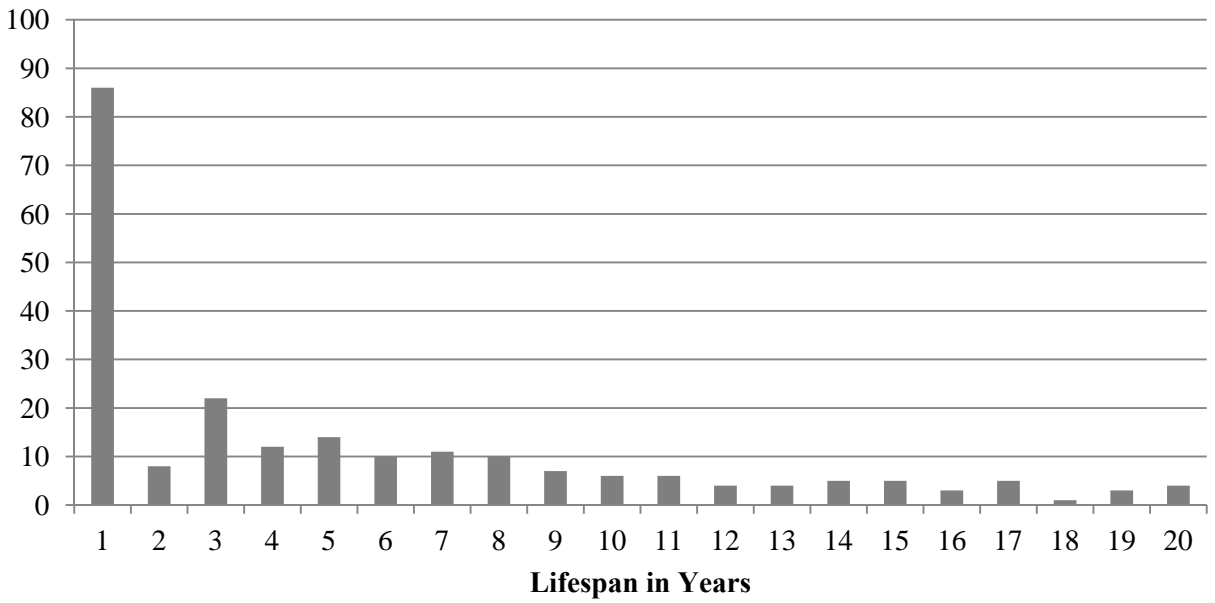


Figure 3: Lifespan of Firms*



*Excludes firms that are currently in business

Figure 4: Lifespan in Years (≤ 20)*



*Excludes firms that are currently in business