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by

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Abstract

During its early and formative years, the U.S. tire industry was heavily concentrated around Akron, Ohio. We test the extent to which entrants in Ohio were attracted to the Akron area by agglomeration benefits, contributing to a self-reinforcing process envisioned in many modern theories of geography. We trace the geographic and intellectual heritage of the Ohio entrants and analyze the factors underlying their creation and location at the county level. Our findings suggest it was the creation of entrants, largely spurred by the supply of entrepreneurs, and not the attraction of entrants to the Akron area that fueled the agglomeration of the industry there.

JEL classification: L65, R12, R39

[Key words: Entry, Location, Agglomerations, Spinoffs]

[Running Title: Origin and Location of Entrants]

I. Introduction

A growing body of findings suggests that entrants are heterogeneous at birth and that their distinctive pre-entry experiences have persistent effects on post-entry size and survival (Mitchell [1991], Carroll et al. [1996], Klepper and Simons [2000], Klepper [2002b], Thompson [2004]). Recent studies also explore how the heritage of entrants influences where they locate (Figueiredo et al. [2002]) and how the geographic structure of new industries evolves (Klepper [2004]). Figueiredo et al. [2002] find that while a majority of recent Portugese entrepreneurial startups located in the county where they originated, firms that did not locate in their native county tended to move to more agglomerated regions. The behavior of the moving firms is consistent with modern theories of economic geography (cf. Krugman [1991]), which posit that entrants are attracted to agglomerated regions because of the benefits such regions confer, imparting a self-reinforcing character to industry agglomerations. Taking into account the intellectual roots of entrants, Klepper [2004] similarly finds that in the early U.S. automobile industry, an important class of entrants—spinofffs founded by employees of incumbent automobile firms—tended to locate close to where they originated. He shows how this alone, without any conventional agglomeration economies, is sufficient to account for the agglomeration of the industry around Detroit. These results suggest that entry can contribute to a self-reinforcing agglomeration process even in the absence of agglomeration economies.

The main purpose of this paper is to explore these issues further in the context of the U.S. automobile tire industry, which became famously agglomerated around Akron, Ohio, a small city with no compelling advantages for tire production. We narrow our focus to the 126 firms that entered in the state of Ohio from the inception of the industry through 1930, after which entry was negligible. This made it feasible to trace both the geographic roots of the entrants, similar to Figueiredo et al. [2002], and their intellectual roots, similar to Klepper [2004], and to analyze the effects of these two dimensions of heritage jointly. We divide entrants into diversifiers, spinoffs, and other startups, and distinguish entrants that located in the county where they originated from moving firms that located elsewhere. Our two-stage analysis of entry first focuses on the effect of regional characteristics on the emergence of the different types of entrants. We then investigate how the origins of each type of entrant, coupled with regional characteristics, influenced where they located. In particular, we probe the extent to which entry reinforced the agglomeration of the tire industry around Akron and the role that agglomeration economies played in the location of the entrants.

Our findings suggest that entry played an important role in the agglomeration of the industry around Akron. One firm, BF Goodrich, was highly influential in getting the industry started around Akron. Consistent with modern theories of agglomeration, subsequent entry led to a self-reinforcing process in which entrants, particularly the better qualified ones, heavily entered around Akron. In contrast to the modern theories, though, our findings suggest that it was the *creation* and not the attraction of entrants to the Akron region that fueled the agglomeration there. Moreover, the creation of entrants in

the Akron area largely seems to have stemmed from the large supply of potential tire entrepreneurs in the Akron area rather than from benefits associated with the agglomeration of the industry there. Indeed, while Akron did attract some entrants that originated elsewhere, on net Akron lost entrants, particularly spinoffs, to other regions. The entrants that moved away from Akron were not generally attracted to other regions with large concentrations of tire producers, but because they did not tend to move far their entry reinforced the early agglomeration of the industry around Akron and Northeastern Ohio. It was only when entry became negligible and the leading firms started branching out that the agglomeration of the industry around Akron declined (Jeszeck [1982]).

The paper is organized as follows. In Section II the evolution of the market and geographic structure of the industry is reviewed. In Section III, the geographic origin of the entrants into the industry is analyzed. In Section IV, the locational choices of the entrants are analyzed. In Section V, the implications of our findings concerning the forces governing the location of entrants and the applicability of our findings to other industries are discussed.

II. Entry and the Evolution of the Tire Industry

We exploited a list of all U.S. producers of automobile tires over the period 1905-1980 compiled primarily from annual issues of *Thomas' Register of American Manufacturers* (Klepper [2002a]).[1] Firms that diversified into the tire industry by adding tires to their product line were also identified (Klepper [2002a]). The annual number of entrants, exiting firms, and producers is presented in Figure 1. Entry generally increased through 1922, after which it fell sharply and declined to negligible levels by 1930. The number of firms also peaked in 1922 at 278. Subsequently it went through a prolonged shakeout, declining to 51 by 1940, after which it continued to decline slowly. Not surprisingly given the shakeout of producers, the industry evolved to be a tight oligopoly. The top four firms, Goodyear, Goodrich, Firestone, and U.S. Rubber, increased their share of the industry's output from 53% in 1926 to 72% by 1933 (French [1991, p. 45]), which they maintained for the next 40 years

The 533 entrants through 1930 entered in 34 different states, but they were heavily concentrated in five Northeastern and Midwestern states: Ohio, Pennsylvania, Illinois, New Jersey, and New York. These states collectively accounted for 32% of the U.S. population in 1900 but 64% of the tire entrants, with Ohio accounting for 24% of the entrants, New York 15%, New Jersey 11%, Pennsylvania 8%, and Illinois 6%. The Ohio firms were distinctly successful, causing the industry to be much more concentrated there than the entry figures reflect. Table 1 lists the share of firms in the Census industry

[1] Few firms were in the industry prior to 1905. For firms listed in 1905 in the initial volume of *Thomas' Regis*ter, issues of *Hendrick's Commercial Register of the United States* for 1901-1904 were used to backdate their entry date according to year they were first listed in *Hendrick's*. The dataset used in this study slightly differs from the listing in *Thomas' Register* because additional information from other sources allowed a better sorting out of ownership changes and name changes for a few of the firms.

category encompassing tires for the Census years spanning 1899-1929.[2] The percentage of production in Ohio steadily rose through 1929, peaking at 65.3% in 1929.

The tremendous concentration of production in Ohio reflects the large number of leading tire firms that were located in Ohio, particularly in Northeastern Ohio around Akron. No comprehensive firm market share data are available for the first 30 years of the industry, but we used various sources to compile a ranking in Table 2 of the leading firms in the industry around 1920. Three of the top five firms around 1920, Goodyear, Goodrich, and Firestone, were located in Akron. A fourth early leader, Diamond Rubber, was also located in Akron before it merged with Goodrich in 1912. Table 2 indicates that Ohio also dominated the cadre of firms below the five leaders. Six of the next 20 firms entered in Akron, with one soon moving to Northwestern Ohio and another one eventually relocating to Western Maryland. Another four firms entered in Northeastern Ohio, and two others entered in Ohio in Dayton and Columbus. All told, nine of the top 24 firms were located in Akron, and in total Northeastern Ohio accounted for 15 or 63% of the largest firms in the industry.

Goodrich was an especially influential early firm. Founded in 1871, it had been a successful producer of bicycle tires and other rubber products before it produced the first pneumatic tire for a commercial automobile in 1896 (Blackford and Kerr [1996. p. 32]). The other major Akron firms were all linked to Goodrich in some way. Diamond was founded by Goodrich employees in 1894 and was also a successful rubber producer before it entered the tire industry. Goodyear was founded in Akron in 1898 by Frank Seiberling. His father, who was one of the original financiers of Goodrich, had started a number of businesses, including a rubber business with which Frank was familiar (O'Reilly [1983, p. 8]). Firestone was founded in Akron in 1900 by Harvey Firestone, who was born in nearby Columbiana, Ohio. After selling a successful carriage tire sales business he started in Chicago, Firestone moved to Akron to work with a local carriage tire producer, Whitman and Barnes, before leaving to start his own firm (Lief [1951, pp. 3-7]). Goodrich initially manufactured tires for Firestone and then supplied Firestone with prepared rubber and fabric when it began manufacturing its own tires (Blackford and Kerr [1996, p. 34]). Goodrich also manufactured the first carriage tire based on an important patent that launched the Kelly-Springfield Company, which was located in the Southwestern part of Ohio in Springfield. Kelly-Springfield began producing automobile tires in Akron (Jackson [1988, pp. 28-29]) and became a successful producer there.

There were 126 firms that entered in Ohio through 1930,[3] and our analysis focuses on explaining the counties in which they located.[4] Similar to the national pattern, the Ohio entrants clustered in a small number of the 88 counties in Ohio in the Northeastern part of the state (see Figure 2, right panel). The top county, Summit, which contains Akron, attracted 29% of the Ohio entrants. The next four counties, all located near Summit, accounted for another 30% of the Ohio entrants. The remainder of the Ohio tire entrants

[2] Although tire production was not distinguished as a separate industry until 1919, it dominated the Census categories in 1909 and 1914.

[3] One of the 126, Lambert Tire & Rubber, may have briefly produced tires in Portland, Oregon before locating in Ohio, but it spent nearly its entire 13-year lifetime in Ohio and so we included it as an Ohio entrant.

[4] Rosenthal and Strange [2003] found that the agglomerative pull of incumbent entrants dissipated sharply within miles of their locations, suggesting a fine-grained analysis of locational choices at the country level. Figueiredo et al. [2002] used a similar unit of analysis.

were spread over 26 other counties. Of the 31 Ohio counties with tire firms, only Cuyahoga County, which contains Cleveland, had a sizable population, accounting for 10.56% of the Ohio population in 1900. Summit and the other three leading counties collectively had only 6.72% of the Ohio population in 1900.[5]

To analyze the counties in which the Ohio entrants located, we traced the heritage of the Ohio entrants in terms of who founded them and where they originated geographically. Regarding the founding conditions, we divided the firms into three categories: diversifiers that added tires to a preexisting product line; spinoffs, which were startups with at least one founder that had worked for a prior tire producer (referred to as its parent); and other startups. Regarding the geographic origins of the firms, we identified the county where each originated (see Figure 2, left panel). The county of origin of diversifiers was where they produced just prior to adding tires to their product line. The county of origin of the spinoffs was the county where their parent firm was located. The county of origin of the other startups was the county where their founder(s) resided prior to founding the startup.

We used primarily *India Rubber Review*, a trade journal published in Akron, *Thomas' Register*, county histories, local newspapers, city directories, and state incorporation files to trace the heritages of the 126 entrants. Firms were classified as diversifiers if they were listed in other categories of *Thomas' Register* at least three years before they were listed as tire producers or if we could ascertain from the historical material that they were not started to produce tires.[6] We classified firms as spinoffs when one or more founders (sometimes referred to as promoters or organizers) were identified as previously working at another tire firm.[7] Firms whose founders were not explicitly identified in the historical record were classified as spinoffs only if the firm was named after a person who previously worked for a tire firm in our list (three cases) or if an individual who was listed as both an incorporator and first-year officer had previously worked for a tire firm in our list (ten cases). The rest of the firms were classified as startups. We adopted these criteria to exclude from the spinoff category new firms whose founders hired experienced staff from other tire firms but who themselves did not have a tire background. We were able to identify the founding conditions for 117 of the 126 entrants.[8] Seventeen were classified as diversifiers, 44 as spinoffs, and 56 as startups.

We could identify from the historical record the counties in which the diversifiers were located prior to producing tires and our list of tire producers provided the county where the parent of each spinoff was located. It was more challenging to identify the counties where the founders of the startups resided prior to founding their startups. If

[5] Similar to Cuyahoga County, the most populous counties contained the largest cities in Ohio in 1900. Hamilton, which contained Cincinnati, had 9.85% of the population, Franklin, which contained Columbus, had 3.96% of the population, Lucas, which contained Toledo, had 3.69% of the population, and Montgomery, which contained Dayton, had 3.13% of the population.

[6] For example, Alliance Rubber Company, which entered the tire industry in 1917, was announced in 1913 as a producer of all kinds of rubber goods *except* tires. It is therefore classified as a diversifying rubber producer.

[7] This category includes three firms, Firestone, Swinehart, and Falls Rubber, whose founders worked for firms that eventually produced automobile tires but only produced carriage tires during their tenure.

[8] For two firms, the available information was too sparse to classify them reliably. For another seven firms listed in *Thomas' Register*, we could not find any information about them in either trade publications or local sources. We suspect that some of these listings do not correspond to real tire producers, but may pick up second brands or dealerships. Alternatively, some of the firms may have been too short-lived to leave any local traces.

there were multiple founders and some resided in the county where the firm located, then the firm was classified as originating from the same county unless the available information indicated that the impetus for organizing the firm came from outside the county.[9] The same criteria were adopted for firms with unspecified founders if incorporators and first-year officers came from multiple locations. When the prior location of the founder(s) could not be identified but city directories indicated that the founder(s) was not present in the county where the firm located prior to the formation of the firm, the firm was classified as moving from an unknown county of origin.[10]

Table 3 summarizes the information for all the firms and the three types of firms separately for four regions: Summit County, which contains Akron; Cuyahoga County, which contains Cleveland and had the second largest number of producers outside Akron; other Ohio counties; and other U.S. states. Moving firms whose geographical origin is unknown are also distinguished. The top panel indicates that 69 of the 117 firms located where they originated, including 26 of the 36 firms originating in Summit County, 7 of the 16 firms originating in Cuyahoga County, and 36 of the 51 firms originating in the other Ohio counties. Each of the three Ohio regions attracted about as many firms as moved away from them, with the distribution of where the firms located very similar to where they originated. Disaggregating by type of entrant in the bottom panels of Table 3, the composition of the entrants and the moving patterns were distinctly different in the two leading Ohio counties. Seven of the 17 diversifiers and 21 of the 44 spinoffs originated in Summit County whereas only eight of the 56 startups originated there. On net, both diversifiers and startups moved to Summit County, while the county was a net exporter of spinoffs, with eight of its 21 moving out and only one moving in. In contrast, 14 of the 56 startups originated in Cuyahoga County but only two of the spinoffs and none of the diversifiers originated there. It was a net exporter of startups, with eight of its 14 moving out and only one moving in, whereas it was a net importer of spinoffs, with eight moving in and only one moving out.

III. Geographic Origins of Entrants

To analyze the geographic origin of the entrants, we focus on the 103 entrants whose county of origin is known and was in Ohio. Our research revealed only a small number of firms that originated in Ohio but located in another state, perhaps because there was little to attract them outside of Ohio. Thus, the 103 entrants in the analysis represent nearly all the entrants that originated in Ohio.[11]

To analyze the geographic origins of the entrants, we use the conditional logit framework utilized in many location studies dating back to Carlton [1983]:

[9] For example, Carey Tire and Rubber Company is classified as a startup originating in the county where it located. In this case, no city directories or incorporation records survive. However, several newspaper accounts stress the firm's local character. In addition, the president, vice president, and general manager show up in the local newspaper in other contexts, and there are no listings for them in the Akron city directories.

[10] We did make sure, however, that the founders did not come from Akron by checking the Akron city directories.

[11] Moreover, in constructing the leading firms in Table 2, we identified another 30 or so firms that occupied the next rank of tire producers. Based on historical material, we were able to reconstruct the histories of these firms. There is no evidence suggesting that any of them originated in Ohio and located in a different state.

$$p_{ij} = \frac{\exp\{\underline{x}_{ij}^{'}\underline{\beta}\}}{\sum_{j}\exp\{\underline{x}_{ij}^{'}\underline{\beta}\}},$$

where p_{ij} is the probability of firm i originating in county j, $\underline{x}_{ij}$ is a vector of attributes for county j in the year prior to the entry of firm i that influence p_{ij}, and $\underline{\beta}$ is a vector of coefficients. We hypothesize that entrants primarily require entrepreneurial skills, labor, and capital, and thus the supply of entrepreneurial skills, labor, and wealth in a county will be the primary influences on the rate at which entrants originate there. We anticipate that firms in industries related to tires, including the tire industry itself, will be important influences on the supply of entrepreneurial skills and labor. Accordingly, we measured the percentage of Ohio tire firms, rubber firms, auto firms, manufacturers, value of manufacturing output, and population in each county. The two manufacturing variables were based on the 1890 Census, which was the last year such data were reported for Ohio counties. The other variables were measured annually and for each firm were assigned a value based on the year prior to the firm's entry. The tire variable was based on our annual listing of tire firms, the rubber producers variable was based on the annual producers of rubber goods listed in *Thomas' Register*, the automobile variable was based on the annual list of automobile producers used in Klepper [2002a], and the population variable was interpolated using data from the Decennial Census.[12]

The tire firms, rubber firms, manufacturers, and manufacturing value variables were all expected to influence the relevant supply of entrepreneurs and labor for starting tire firms. These variables, especially the number of tire firms, might serve as well as proxies for agglomeration benefits, such as knowledge spillovers, that might also influence the creation of tire entrants. The auto firms were demanders for one-third of the output of the industry and represented a possible influence of proximity to demanders on the creation of tire entrants. The population variable could pick up several effects. We know from the historical material that many of the founders of startups were wealthy businessmen and professionals, for example attorneys, whose experience derived from non-manufacturing activities that would not be reflected in any of the other entrepreneurial supply variables. Population also is a proxy for the wealth of a county. If it were easier to raise capital locally, then the fraction of deserving firms that were financed in a county and thus the number of firms originating there would be influenced by the wealth of the county. Finally, population could also play a role if general labor skills, the availability of business services, and/or the size of local replacement demand influenced the creation of firms.

Maximum-likelihood estimates of the coefficients of the conditional logit model are presented in the first column of Table 4 labeled Model 1. The coefficient estimates of the population, tire firms, and rubber firms variables are positive and significant at the .01, .01, and .05 levels respectively whereas the other coefficient estimates are all

[12] For rubber producers listed in 1905 in the initial volume of *Thomas' Register*, the 1902 issue of *Hendrick's Commercial Register* was used to backdate their entry to 1902 if they were listed as a rubber producer in the 1902 *Hendrick's Register*. This made it possible to measure the number of rubber producers in Ohio counties for years prior to 1905 when some of the tire firms were dated as entering. The number of tire producers in Ohio counties in years before 1905 was similarly measured using the backdated entry years of the tire firms that were listed in pre-1905 volumes of *Hendrick's Commercial Register*. The sources for the other variables provided data for years before 1905.

insignificant. It appears that the tire industry itself and the rubber industry were more relevant than other manufacturing industries for the creation of tire entrants. Furthermore, local demand from the automobile firms was apparently not a relevant determinant of the creation of tire firms. Population could represent different influences on the creation of firms, including the hypothesized effect of increasing the supply of wealthy entrepreneurs for founding startups.

To gain further insights into the role played by the population, tire firms, and rubber firms variables, each is allowed to have a separate effect for the three different types of entrants, and the other variables are dropped from the specification. If the main influence of each variable is on the respective supply of entrepreneurs, then each should principally influence the corresponding type of entrant. Diversifiers were mainly rubber producers, and so the rubber variable would have its greatest effect for the diversifiers. By definition, the spinoffs are founded by employees of incumbent tire firms and so the tire firms variable would have its greatest effect for the spinoffs. If population is primarily a proxy for the supply of wealthy businessmen available to found startups then it would have its greatest effect on the startups.

The coefficient estimates for this specification are reported in the column labeled Model 2 in Table 4. For each variable, the conjectured direct effect is greater than the two indirect effects, suggesting that the primary effect of these variables on entry was through the supply of entrepreneurs. In the case of the rubber variable, only the coefficient estimate for the diversifiers is significant (at the .10 level), whereas the effect of the tire and population variables on the diversifiers is insignificant. This result suggests that the number of diversifiers originating in a county was affected solely by the number of rubber producers in the county. In contrast, the coefficient estimates of the tire producers on the startups and population on the spinoffs are both positive and significant, suggesting these variables had broader influences on the creation of entrants than just through the supply of entrepreneurs.

As a final step in the analysis of where firms originated, we dropped the insignificant variables and added fixed effects for each county following Shaver and Flyer [2000]. If unobserved characteristics of a county influence the creation of firms, then counties with favorable unobserved characteristics will persistently have a higher rate of creation of firms. This will induce a positive correlation between p_{ij} and the tire firms variable for both the spinoffs and startups even if the number of tire firms has no causal effect on the creation of either type of firm. Similarly, if the population variable is a proxy for unobserved regional characteristics that influence the creation of firms, then it can have a positive effect on p_{ij} for both spinoffs and startups even without having a causal effect on the creation of either type of firm. The fixed effects control for unobserved regional characteristics that might be correlated with the tire firms and population variables (and the rubber firms variable) and thus eliminate this source of bias, but like any panel study they force the coefficient estimates to be based solely on the time series variation in each variable. If the variables are measured with error, this will increase the fraction of their variation attributable to measurement error, which generally will bias the coefficient estimates toward zero.

The coefficient estimates of the variables are reported in the column labeled Model 3 in Table 4 (the fixed effects are not reported). The increase in the log-likelihood is

significant at the .01 level[13] and the pseudo R^2 of the model rises from .35 to .50, suggesting the presence of unobserved regional characteristics affecting the geographic origin of the firms. All the coefficient estimates are smaller than in Model 2. The direct effects all remain significant at the .05 or .01 level. The indirect effect of tire firms on startups is also significant at the .05 level but much smaller than both the effects of population on startups and of tire firms on spinoffs. The indirect effect of the population variable on the spinoffs is now insignificant. These results suggest that all three variables influenced the creation of entrants primarily through the supply of entrepreneurs, with at most a small, broader effect of the number of tire producers on the creation of startups.

The magnitude of the effects implied by the coefficient estimates of Model 3 can be quantified as follows. There are 88 Ohio counties, and if all counties had the same population, number of tire firms, and number of rubber firms then the predicted value of p_{ij} for each county would be .0114. The rubber producers were concentrated in Summit County, which contained between 13.64% and 81.82% of the rubber producers in Ohio over the period 1905-1930. If the percentage of rubber producers is set equal to 50% and the percentage of rubber producers for each of the other counties is set equal to .57% (50% divided by 87), then p_{ij} for diversifiers increases from .0114 to .28. The tire producers were also concentrated in Summit County, with their share ranging between 29.49% and 85.71% over the period 1905-1930. Setting the percentage of tire producers to 50% increases p_{ij} from .0114 to .34 for spinoffs and .04 for startups. Finally, the population was largest in Cuyahoga County, ranging from 12.01% to 18.08% over the period 1905-1930. Setting the percentage of the population to 15% increases p_{ij} from .0114 to .24 for startups and .03 for spinoffs.

We interpreted the influence of the number of tire firms on the creation of spinoff entrants as operating primarily through the supply of entrepreneurs. We can investigate the spinoff-generating process further by analyzing the rate at which incumbent firms spawned spinoffs. If our interpretation that incumbent firms provide opportunities for employees to found their own firms is correct, then we would expect that more successful firms had a greater supply of potential entrepreneurs to found entrants and thus a higher spinoff rate. They would not only have had more employees to found spinoffs, but they might also have provided a superior environment for employees to learn about best organizational practices that they could apply to their own firms. We have two proxies for firm performance--firm output and longevity. We construct two 1-0 dummy variables for output. The first equals one for Goodrich, Goodyear, Diamond, and Firestone, which were the top four Ohio firms over the entire period 1905-1930. The second dummy equals one for the other Ohio firms listed among the second tier of industry leaders in Table 2. Firm longevity is measured by the total number of years the firm produced tires. We anticipated that in addition to the quality of a firm, its rate of spinoffs would vary over time according to its experience and industry conditions bearing on entry of all kinds.

To test this, an ordered logit model was estimated of the annual rate of spinoffs for all the Ohio entrants. Each firm's history is broken into annual intervals from the year of its entry through 1930, which allows for spinoffs to emerge even after the parent firm exited.

[13] The additional degrees of freedom are 24 as the fixed effects are not identified for the 64 counties where no tire firms originated.

The dependent variable for each firm year equals 0 if the firm had no spinoffs in that year, 1 if it had one spinoff, 2 if it had two spinoffs, and 3 if it had three spinoffs (which was the maximum number of spinoffs spawned by a firm in a single year). The independent variables are the two quality dummies, the total years of production of the firm, a 1-0 dummy equal to 1 if the firm was an active producer, and a variable equal to the number of contemporaneous Ohio entrants other than spinoffs divided by the number of Ohio firms in the prior year to control for entry conditions.[14]

The coefficient estimates of the ordered logit based on the pooled sample of annual firm observations are reported in Table 5. The coefficient estimates for the two size dummies are positive and significant at the .01 and .05 levels, respectively, with the coefficient estimate of the dummy for the top four firms approximately twice that of the dummy for the next cadre of firms. As expected, the coefficient estimates for the dummy for active firms and for the entry variable are also positive and significant at the .05 level. The coefficient estimate of the total years of production is not significant. This variable is highly correlated with the two dummies for the production leaders, however, and its coefficient estimate is significant when these two variables are dropped. Thus, the estimates of the ordered logit are consistent with the hypothesis that more successful firms provided a greater supply of entrepreneurs to found tire entrants.

We conjectured two reasons the more successful tire firms might have had a higher spinoff rate—their size and organizational prowess. One bit of evidence suggests the latter factor might have been important. The spinoffs from the first and second tier Ohio firms survived 17.2 and 18.8 years respectively versus 10.2 years for the rest of the Ohio spinoffs. This suggests that more successful firms did in fact provide a superior environment to learn organizational best practices, consistent with our conjecture about how this might have affected firm spinoff rates.

IV. The Locations of Entrants

Table 3 indicates that among the 103 entrants originating in Ohio (with known county of origin), 69 entrants or 67% entered in the county where they originated. If there were as many firms of Ohio origin that entered in other states as out-of-state firms that entered in Ohio (nine), then the incidence of Ohio entrants locating in their county of origin would drop to 62%. This is still a majority of entrants, similar to the findings on entrepreneurial startups in Portugal (Figueiredo et al. [2002]). At the same time, a sizable percentage of the firms moved away from their county of origin. Following Figueiredo et al. [2002], we analyze the locational choices of all 126 Ohio entrants given their county of origin.[15]

[14] Following Klepper and Sleeper [2000] and Klepper [2004], we also controlled for the number of years the firm had produced for years when the firm was still active, but this did not have a significant effect when entered linearly or quadratically. In another specification we added a dummy variable for Akron firms to test if spinoffs were more likely in Akron, all else equal. The effect of this variable was also was insignificant.

[15] Alternatively, we analyzed the subset of 117 firms whose background we could determine and also the subset of 103 firms whose county of origin is known and in Ohio. This had little effect on the results.

Our reconstruction of the heritage of the Ohio entrants was suggestive about why a number of firms moved away from their county of origin. One motive appears to be associated with finance. The majority of firms seem to have attracted local capital, but many did not. Some of the non-locally financed firms moved to the location of their investors, possibly to facilitate monitoring. Several of the firms that located in Cleveland, for example, appear to fit this pattern. A second motive may be related to the existence of vacant plants that had previously been used for tire production or could be readily adapted to tire production. These plants were seemingly an important impetus for the formation of some of the firms, and when the founders of the firms came from other counties, the firms ended up entering in a different county than where they originated. A third motive was suggested by firms that moved to Ohio from out of state. These firms often originated in locations that had few tire firms, and they seem to have moved to Ohio, particularly Northeastern Ohio, to take advantage of the benefits conferred by the clustering of tire producers.

We again use a conditional logit specification to analyze the factors influencing the counties where the Ohio entrants located. We estimate an initial model containing the same six variables that were used in Model 1 to analyze the county of origin of the entrants. This is the model conventionally estimated in studies of the location of entrants. We use it merely as a benchmark to demonstrate that the location of entrants is heavily influenced by where they originate. The coefficient estimates for this model are reported in the first column of Table 6 labeled Model 4. The coefficient estimates for the population and tire firms variables are both positive and significant at the .01 level, like Model 1, whereas the coefficient estimate of the rubber firms is positive but not significant, unlike Model 1. The coefficient estimates of the other variables are all negative and insignificant.

Following Figueiredo et al. [2002], we now include a dummy variable representing the county of origin of each firm. For the 103 firms of Ohio origin whose county of origin is known, this dummy equals 1 for the county of origin and 0 for all other counties. For the 23 firms whose county of origin is not known or is outside Ohio, the dummy equals 0 for all counties. Given that the majority of firms entered in the county where they originated, the county of origin would be expected to be an important determinant of the county of location. Its inclusion changes the interpretation and thus expectations concerning the other independent variables. With the county of origin controlled for, the independent variables reflect the effect of county characteristics on the probability of firms staying in their home county and on the probability of attracting firms that move from their home county. One could readily conjure up agglomeration benefits of locating in counties with more tire producers or with a greater population, but the benefits of locating in counties with more rubber, automobile, and manufacturing firms are less clear. Consequently, only the tire producers and population variables are expected to influence positively p_{ij}.

The estimates of this specification are reported in Table 6 under the column labeled Model 5. The fit of the model improves greatly, as expected, with the change in the log-likelihood significant at the .01 level and the pseudo R^2 rising from .25 to .48. The coefficient estimate of the home county dummy is positive, sizable, and significant at the .01 level. The coefficient estimates of the population and tire firms variables are both positive and significant at the .05 and .01 levels respectively, suggesting that more

populous counties and counties with more tire firms were more attractive venues in which to locate. None of the other coefficient estimates is positive and significant, as expected, although the coefficient estimates of both the rubber and auto firms variables are unexpectedly negative and significant at the .10 level.

Figueiredo et al. [2002] maintain that if there are agglomeration benefits, they should be more salient in attracting firms that move from their home region than in inducing firms to remain in their home region. They conjecture that firms originating from a region know the region better than firms that originate elsewhere. Knowledge of their home region allows indigenous firms to better secure finance and business services, hire suitable employees, arrange transportation, and the like than firms that originate elsewhere. Thus, even if a region is short on finance, potential employees, etc., firms that originate in the region should be less deterred than other firms from locating there. Alternatively, if a firm moves, then it will have limited knowledge about its options and will value more regions with the kinds of benefits that arise from concentrations of tire firms and population. Consequently, in our analysis variables that proxy for agglomeration benefits should have less effect on inducing firms to remain in their home county than on firms that move from their home county.[16]

We can test this conjecture by interacting each of the six independent variables with two dummies: the home county dummy and one minus the home county dummy, denoted as the other county dummy. This yields two estimates for each variable, which we denote as the home county and the other county effects, respectively. The former quantifies the influence of a variable on the decision to remain in the home county while the latter quantifies the influence of a variable on the locational choice of firms that move to another county. The coefficient estimates of this model are reported in Table 6 under the column labeled Model 6. The change in the log-likelihood is again significant at the .01 level, suggesting that the variables have different effects on the two locational decisions. The coefficient estimate of the home county dummy remains positive, large, and signficant at the .01 level. The coefficient estimate of population is positive for both the home and other county, but the estimate for the other county is five times as large as for the home county and significant at the .05 level, whereas the coefficient estimate for the home county is insignificant. The coefficient estimate of the tire firms variables is also positive for both the home and other county. It is larger for the home county but so is its standard error, with the coefficient estimate for the home county significant at the .10 level and the coefficient estimate for the other county significant at the .01 level. The only other estimate that is significant, at the .10 level, is the home county effect of rubber producers, and this is implausibly negative. Thus, there is some support for the idea that county characteristics that influence location, particularly the population and number of tire firms variables, exert a greater effect on the locational choices of firms moving from their home county than those remaining in their home county.

[16] These predictions implicitly assume that economic factors motivate the decision about whether to stay in the home county. Alternatively, firms may stay in their home county because of social benefits reaped by their founders and leaders, such as preserving family ties, friendships, schooling arrangements for children, and relationships with service providers such as health care professionals, restaurants, etc. If the social benefits to firms from staying in their home county vary across firms and are the primary determinant of whether a firm stays in its home county, then the observables we measure would also be unlikely to influence the decision to stay in the home county but could well be relevant to those firms that move to another county.

The effects of county attributes can be probed further by allowing them to differ for the different types of entrants. Table 3 indicates that among the firms originating in Ohio, spinoffs were more prone to move than either the diversifiers or startups. Moreover, in contrast to the diversifiers and startups, spinoffs tended to move away from Summit County. This suggests that the locational choices of spinoffs differed from those of other entrants. To economize on variables, this possibility was tested as follows. First, only the home county, population, and tire firms variables were retained in the specification. As in Model 6, the population and tire firms variables were interacted with the home and other county dummies. This yields five variables. Each of these five variables was in turn allowed to have a different effect for spinoffs and the other entrants.

The estimates of this model are reported in Table 6 under the column labeled Model 7. The rise in the log-likelihood is again significant at the .01 level (relative to the model with the same five variables but with no distinction between types of entrants), suggesting that the locational choices of the two types of entrants were different. The estimates now conform more closely to the findings of Figueiredo et al. [2002]. The coefficient estimate of the home county dummy is still sizable and significant at the .01 level for both types of firms. For the nonspinoffs, the coefficient estimates of the population and tire firms variables are both positive and significant at the .01 level for the other county but not for the home county (though the coefficient estimate for population for the home county is unexpectedly negative and significant at the .01 level). For the spinoffs, the coefficient estimate of the population variable for the other county is positive and significant at the .01 level but the coefficient estimate of the tire firms variable for the other county is not significant, whereas both coefficient estimates are not significant for the home county. Thus, for both types of firms, the decision to remain in their home county was not systematically related to characteristics about their home county whereas county characteristics did influence the locational choice of firms that moved from their home county. Both types of firms were apparently attracted to more populous counties when they moved, but unlike the other entrants the spinoffs were not attracted to counties with a large number of tire firms. This is consistent with eight of the 21 spinoffs that originated in Summit County moving to other counties, whereas only one spinoff moved there from another location.[17]

The robustness of these results is tested by adding county fixed effects to Model 7 to control for unobserved county characteristics. Coefficient estimates for this model are reported in Table 6 under the column labeled Model 8. The home county dummies continue to have sizable and significant coefficient estimates. The inclusion of the fixed effects renders insignificant the effects of population both for the home and other county for both types of firms. The only other significant coefficient estimate is for the tire variables for the other county for the nonspinoffs. This coefficient estimate continues to be positive and significant (at the .05 level), indicating that when nonspinoffs moved they were attracted to counties with more tire firms. For the spinoffs, the effect of the tires variables for the other county continues to be insignificant but is now negative. This

[17] Moreover, the one firm that moved to Summit County, the Trump Brothers Rubber Company, is a peculiar case. The firm was founded by two former employees of Goodyear and Goodrich, who had previously started Excel Tire and Rubber in Medina County (just outside Akron) and came back to Akron to found Trump after they were ousted from Excel. Thus, although the firm moved from its county of origin, its move to Akron may well have been induced more by familiarity than by any expected agglomeration benefits.

suggests that in contrast to the nonspinoffs, when the spinoffs moved they were not attracted to counties with more tire firms, and if anything moved away from such counties. Whatever benefits were conferred by being in counties with more tire producers, they were apparently attractive to the startups and diversifiers but not the spinoffs.

V. Discussion

A majority of the firms located where they originated, and our findings confirm the sizable effect that the geographic origin of firms had on their location. The estimates for the various specifications suggest that county characteristics, such as the population of the county and number of tire firms, had little influence on whether a firm located in its home county. It appears that for a majority of firms, the benefits of remaining in their home county outweighed any advantages from moving to a different county. Among firms that did not locate in their home county, the main county characteristic that influenced where they located appears to have been the number of tire firms in the county. In particular, startups and diversifiers that did not locate in their home county seemed to favor locating in counties with more tire producers. In contrast, spinoffs that did not locate in their home county were not drawn to counties with more tire producers, and if anything moved to less agglomerated tire counties.

The dominant influence of the geographic origin of firms on their location means that factors influencing the geographic origin of firms are key to understanding the role that entry played in contributing to the agglomeration of the tire industry. Our findings suggest that the entrants originated principally in counties with a greater supply of potential tire entrepreneurs. Diversifiers were more likely to originate in counties with more rubber firms, spinoffs were more likely to originate in counties with more incumbent tire producers, and startups were more likely to originate in more populous counties. The estimated effects were sizable, implying that more populous counties and counties with more rubber and tire producers had sharply higher probabilities of generating the respective types of entrants. Given the propensity of firms to locate where they originated, the same county attributes governing the creation of firms heavily conditioned where they located.

These findings provide insight into the evolution of Akron, and Northeastern Ohio more generally, as the center of tire production in the United States. The rubber industry was initially concentrated in New England and the Mid-Atlantic states, but even before the advent of the tire industry Akron was emerging as an important center of rubber goods production. Akron's rise was fueled by BF Goodrich, which was one of the most successful rubber producers in the country in the latter part of the 19th century. Goodrich in turn spawned Diamond, which soon joined Goodrich as a successful rubber producer. Both firms were early producers of carriage and bicycle tires. Whitman and Barnes was another early rubber producer located in Akron that produced carriage tires. Given this concentration of carriage and bicycle tire producers in Akron, it is not surprising that seven of the 17 diversifiers that entered the tire industry originated in Summit County. All of them located in their home county, and Summit County attracted two other

diversifiers, including Kelly-Springfield, a successful early tire producer that originated in Southwestern Ohio. BF Goodrich may also have influenced the local creation of Goodyear and Firestone. All told, this provided a distinctive base of early tire producers in Akron.

This base was important in conditioning the number of spinoffs that originated in Summit County. It included five of the most successful early entrants into the tire industry, Goodrich, Diamond, Goodyear, Firestone, and Kelly-Springfield. Our findings indicated that more successful tire firms had substantially higher spinoff rates. Consequently, it is not surprising that nearly half—21 of 44—of all the spinoffs that entered the industry in Ohio originated in Summit County. Spinoffs were the most peripatetic of the three types of entrants, and our findings suggest that when they moved they moved away from more agglomerated (tire) counties such as Summit County. Nevertheless, Summit County retained many important spinoffs, including Firestone, Mohawk, General, and Seiberling, all of which made it in into the ranks of the leading firms in Table 2 and played an important role in the success of Akron. Moreover, the eight of the 21 spinoffs that originated but did not locate in Summit County all located close by in Northeastern Ohio, so they remained a force in keeping the industry concentrated near Akron.

Startups were more likely to originate in more populous counties, which did not favor Summit County, which had only 1.7% of the Ohio population in 1900 and 5.2% in 1930 even after the great growth of the tire industry. Consistent with this, only eight of the 56 startups originated in Summit County. Our findings suggested that when the startups moved, they tended to move to counties with more tire producers such as Summit, which attracted five startups and lost only two to other counties. But even this inflow was not very significant, increasing Summit's share of startups only to 11 out of 56. Moreover, the startups that were attracted to Summit County were not as successful as the diversifiers and spinoffs located there and thus were not an important influence on the agglomeration of the industry there.

So overall there was a strong self-reinforcing quality to Akron as a center of tire production. Akron was an early center of tire production in Ohio and the U.S. and as a result many entrants located there, a number of which became leading firms in the industry. The processes underlying the entry of tire firms in the Akron area, though, appear to have been markedly different from those envisioned in modern theories of economic geography. Akron did not attract a large number of firms that originated elsewhere. Rather, firms entered in the Akron area largely because of the concentration of potential entrepreneurs in the Akron area and the tendency of firms to locate where they originated. Indeed, spinoffs, which made up more than half of all firms originating in the Akron area, were more likely than other kinds of tire firms to move away from where they originated. Nonetheless, because a majority of the spinoffs that originated in Akron remained there and the others generally did not move far, the high rate of creation of spinoffs in Summit County fueled the agglomeration of the industry there.

Our findings suggest that through the spinoff process early industry conditions can have a profound effect on the geographic distribution of producers. This resonates with a recent account of the agglomeration of the automobile industry around Detroit, Michigan. This agglomeration was perhaps even more extreme than the agglomeration of the tire

industry around Akron and it was just as unexpected. Klepper [2004] demonstrated that it was also largely fueled by spinoffs. Four early successful entrants located in Detroit, partly due to the pioneering efforts of Olds Motor Works, the first great firm in the industry. These firms in turn led to a spinoff juggernaut around Detroit that solidified the agglomeration of the industry there. Goodrich played a similar role to Olds Motor Works in the tire industry. All the early major Akron firms were related in one way or another to Goodrich, and coupled with Goodrich they spawned many of the other successful firms that located in Summit County. While the formative years of the automobile and tire agglomerations are now nearly 100 years old, Moore and Davis [2004] tell a similar story about the agglomeration of the semiconductor industry around Silicon Valley, where Fairchild Semiconductor played a similar role to Goodrich and Olds Motor Works.

Tires, automobiles, and semiconductors all illustrate the importance of understanding the breeding process underlying entry. Entrants do not originate *deus ex machina*, but have a heritage, and that heritage is a key determinant of where they locate. Agglomeration economies may play a role in influencing entrants to move away from where they originated, but if the tire firms of yore and the modern Portuguese entrepreneurial startups are representative, the geographic origins of entrants are likely to be key to where they locate. Understanding the geographic origins of firms will thus require digging into the heritage of entrants. This is a process that is just beginning (see Helfat and Lieberman [2002] for a recent review of the literature), and we have much to learn.

Table 1: U.S. State Shares of U.S. Rubber and Tire Production Volume (percentages)

	1899 rubber and elastic goods	1904 rubber and elastic goods	1909 rubber goods	1914 rubber goods	1919 tires, inner tubes and rubber goods	1921 tires, inner tubes and rubber goods	1921 tires and inner tubes	1923 tires and inner tubes	1925 tires and inner tubes	1927 tires and inner tubes	1929 tires and inner tubes
CA	.11	.35	.25	.40	.50	1.57	1.77	2.40	N.A.	N.A.	7.31
CT	15.67	14.08	8.57	4.56	3.44	3.26	2.42	2.65	N.A.	1.74	N.A.
IL	7.00	4.52	.30	.89	.42	1.05	.74	.75	N.A.	N.A.	N.A.
IN	N.A.	3.74	3.36	2.83	2.12	2.14	2.22	1.85	N.A.	1.27	N.A.
MA	26.38	22.38	12.30	10.29	9.46	N.A.	N.A.	6.99	N.A.	N.A.	N.A.
MI	.09	N.A.	N.A.	N.A.	5.10	N.A.	N.A.	4.29	N.A.	N.A.	N.A.
NJ	16.07	7.68	15.22	11.39	8.52	8.53	6.09	4.77	4.49	3.36	1.48
NY	10.08	13.12	6.84	4.57	3.35	3.65	1.16	1.15	N.A.	N.A.	N.A.
OH	13.93	25.34	41.97	49.04	55.83	50.60	58.81	60.75	60.14	64.97	65.34
PA	2.22	3.52	3.65	5.45	3.63	5.46	5.72	2.98	2.79	2.13	1.75
RI	4.79	4.10	2.45	2.72	1.61	N.A.	N.A.	N.A.	.00	.00	.00
WI	1.40	1.14	N.A.	3.30	3.68	2.74	3.29	4.47	5.00	5.04	5.36

Source: U.S. Census of Manufactures, various volumes. Note: Entries marked “N.A.” denote data that are not reported by the Bureau of the Census due to confidentiality considerations. Due to various changes in the demarcations of categories used by the Bureau of the Census, figures are not strictly comparable over time. Figures for rubber goods do not include rubber footware, belting and hose.

Table 2: Top 24 U.S. tire firms around 1920

Top 5	Goodyear	Akron (OH)
	Goodrich	Akron (OH)
	U.S. Rubber	Hartford (CT) / Detroit (MI)
	Firestone	Akron (OH)
	Fisk	Chicopee (MA)
Second Tier	Ajax	Trenton (NJ) / New York (NY)
	Miller	Akron (OH)
	Kelly-Springfield	Akron (OH) / Cumberland (MD)
	Republic	Youngstown (OH)
	McGraw	East Palestine (OH)
	Mason	Kent (OH)
	Pennsylvania	Erie / Jeannette (PA)
	Mansfield	Mansfield (OH)
	General	Akron (OH)
	Dayton	Dayton (OH)
	Seiberling	Akron (OH)
Other major firms	Hood	Boston (MA)
	Gillette	Eau Claire (WI)
	Cooper	Akron (OH) / Findlay (OH)
	Mohawk	Akron (OH)
	Gates	Denver (CO)
	Pharis	Columbus (OH) / Newark (OH)
	Michelin	Milltown (NJ)
	Dunlop	Buffalo (NY)

Source: Own compilation based on French [1991, p. 45] and on figures on firms' production capacities between 1920 and 1923 reported by *India Rubber Review* [1921, p. 795], Leigh [1936, p. 17], and Moody's [1924]. "Top 5 firms" are those listed with a 1920 production capacity exceeding 10.000 tires/day in Leigh [1936]. The second tier includes the four "medium-sized" firms specified by French [1991], Seiberling, and six additional firms with a 1921 production capacity between 1,000 and 10,000 tires/day. "Other major firms" includes four firms characterized by French as "small, but still significant," plus four additional firms whose 1921/1923 production capacities are as least as large as those of the firms mentioned by French (Hood, Gillette, Cooper and Mohawk).

Table 3: Locations Of Origin And Locations Of Entry of Ohio Tire Producers

All firms

from \ to	Summit County	Cuyahoga County	Other Ohio counties	Sum
Summit County	26	4	6	36
Cuyahoga County	1	7	8	16
Other Ohio counties	2	3	36 w/in cty 10 movers	51
Other U.S. states	2	2	5	9
Unknown	3	0	2	5
Sum	34	16	67	117

Diversifiers

from \ to	Summit County	Cuyahoga County	Other Ohio counties	Sum
Summit County	7	0	0	7
Cuyahoga County	0	0	0	0
Other Ohio counties	1	0	7 w/in cty 1 mover	9
Other U.S. states	1	0	0	1
Unknown	0	0	0	0
Sum	9	0	8	17

Table 3 continued: Locations Of Origin And Locations Of Entry of Ohio Tire Producers

Startups

from \ to	Summit County	Cuyahoga County	Other Ohio counties	Sum
Summit County	6	1	1	8
Cuyahoga County	1	6	7	14
Other Ohio counties	0	0	22 w/in cty 3 movers	25
Other U.S. states	1	0	3	4
Unknown	3	0	2	5
Sum	11	7	38	56

Spinoffs

from \ to	Summit County	Cuyahoga County	Other Ohio counties	Sum
Summit County	13	3	5	21
Cuyahoga County	0	1	1	2
Other Ohio counties	1	3	7 w/in cty 6 movers	17
Other U.S. states	0	2	2	4
Unknown	0	0	0	0
Sum	14	9	21	44

Table 4: Origins of Tire Firms

Variable	Model 1	Model 2	Model 3 (with county fixed effects)
Population	.4623*** (.1318)		
Tire Firms	.0385*** (.0083)		
Rubber Firms	.0325** (.0131)		
Auto Firms	-.0209 (.0259)		
Mfg Establishments	.1033 (.1547)		
Mfg Volume	-.2219 (.1721)		
Pop_Diversifiers		.0075 (.1133)	
Pop_Startups		.2571*** (.0262)	.2347** (.0997)
Pop_Spinoffs		.0896* (.0503)	.0654 (.1054)
Rubber_Diversifiers		.1056* (.0556)	.0713*** (.0225)
Rubber_Startups		.0039 (.0195)	
Rubber_Spinoffs		.0254 (.0342)	
Tire_Diversifiers		.0004 (.0383)	
Tire_Startups		.0506*** (.0128)	.0273** (.0139)
Tire_Spinoffs		.0894*** (.0344)	.0771*** (.0208)
No. of observations	9064	9064	9064
Log-likelihood	-310.806	-297.6348	-229.4306
Pseudo R^2	.3260	.3546	.5025

Standard errors in parentheses.

*** p≤.01; **p≤.05; *p≤.10

Table 5: Spinoff creation

Variable	
Top 4 Firm	2.2138*** (.6390)
Major Firm	1.1589** (.4812)
Survival Years	-.0032 (.0096)
Active Firm	1.2682** (.5599)
Nonspin Entry	.0214** (.0091)
No. of observations	1558
Log-likelihood	-159.3162
Pseudo R^2	.1316

Standard errors in parentheses.

*** p≤.01; **p≤.05; *p≤.10

Table 6: Location of tire firms

Variable	Model 4	Model 5	Model 6		Model 7		Model 8 (with county fixed effects)	
			Home Cty	Other Cty	Home Cty	Other Cty	Home Cty	Other Cty
Home County		4.3474*** (.2504)	6.1022*** (.5884)					
Population	.4493*** (.1167)	.3875** (.1515)	.0886 (.2339)	.4556** (.1995)				
Tire Firms	.0489*** (.0082)	.0463*** (.0104)	.0640* (.0341)	.0471*** (.0111)				
Rubber Firms	.0085 (.0126)	-.0283* (.0164)	-.0758* (.0418)	-.0031 (.0190)				
Auto Firms	-.0411 (.0294)	-.0708* (.0395)	.0307 (.0648)	-.0783 (.0500)				
Mfg Establ.	-.0162 (.1570)	-.1700 (.2098)	.0686 (.5697)	-.3268 (.3274)				
Mfg Volume	-.1203 (.1637)	.0320 (.2073)	-.2278 (.3517)	.1171 (.2395)				
Home County (Spinoffs)					4.8409*** (.5993)		3.0430*** (.6999)	
Home County (Non-Spinoffs)					7.1048*** (.6027)		7.9346*** (1.0700)	
Population (Spinoffs)					-.0177 (.0922)	.2419*** (.0328)	.1005 (.2454)	.3179 (.2438)
Population (Nonspinoffs)					-.1528*** (.0516)	.1245*** (0.482)	-.1473 (.2480)	.1707 (.2508)
Tire Firms (Spinoffs)					.0172 (.0129)	.0250 (.0290)	.0126 (.0184)	-.0660 (.0554)
Tire Firms (Nonspinoffs)					.0063 (.0178)	.0646*** (.0078)	-.0291 (.0216)	.0335** (.0165)
No. of observations	11088	11088	11088		11088		11088	
Log-likelihood	-423.9373	-292.2298	-267.8261		-263.787		-205.1081	
Pseudo R^2	.2485	.4820	.5253		.5324		.6364	

Standard errors in parentheses; ***p≤.01; **p≤.05; *p≤.10

Figure 1: Entry, exit and the number of producers in the U.S. tire industry, 1900-1950.

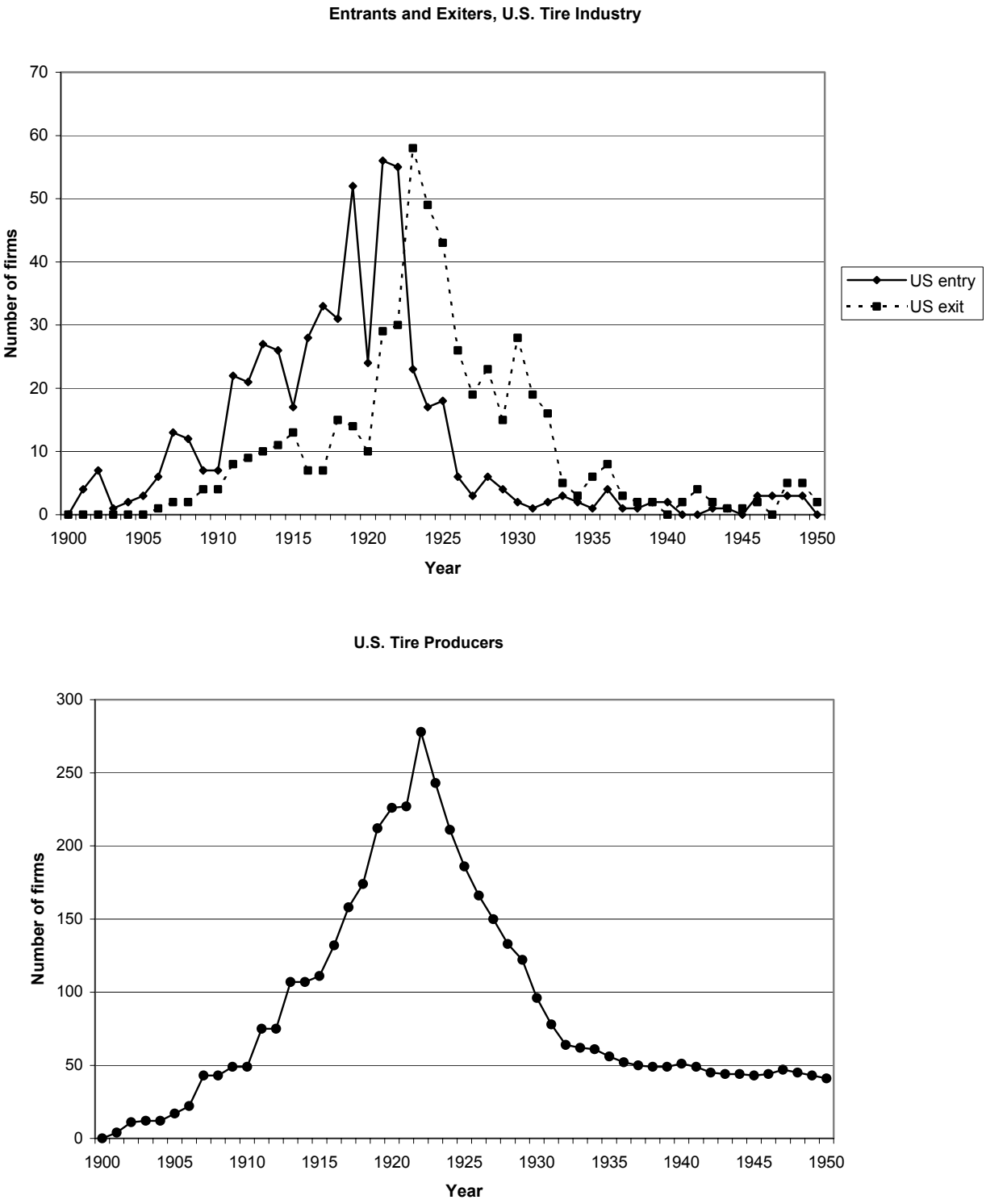
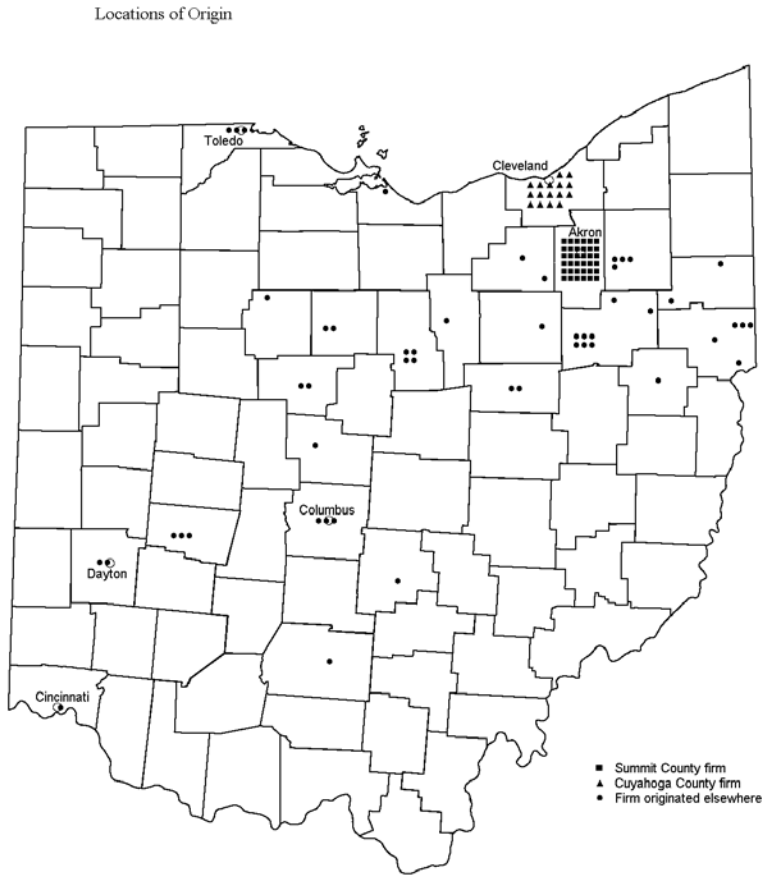
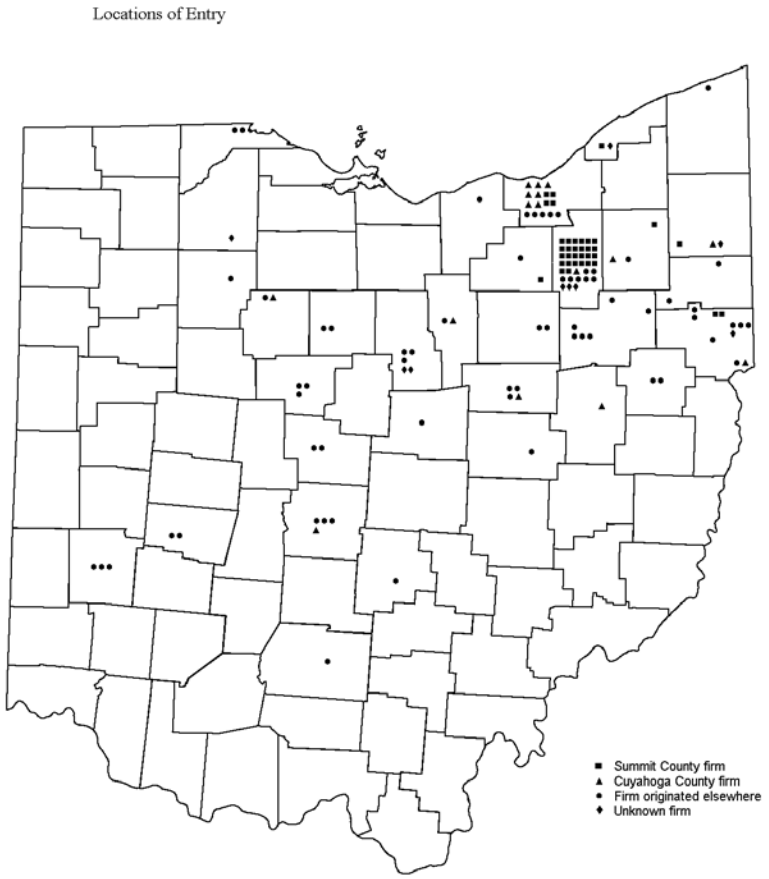


Figure 2: Locations of Origin and Locations of Entry of Ohio Tire Producers





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