Friends or Foes: The Spatial Dynamic between Established Firms and Entrants

by

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Purpose

State and municipal economic development agencies are increasingly designing policies to nurture and support home-grown businesses to achieve their growth objectives.

This research explores the impact on established firms of new local entrants. It evaluates the competing views that new firms increase competition and thus hurt existing firms and, on the other hand, that new entrants provide positive spillover effects that benefit everyone, including existing firms.

Overall Findings

In the first year of a new firm's existence, before the entrant has time to contribute to positive local effects, its entry is more likely to hurt the financial performance of existing firms. By the third year after entry, however, the effect on the financial performance of existing firms is positive. In the short term, entrants are foes and in the long term, entrants are friends.

Highlights

- The average return on assets for the sampled 377 focal firms was negative during the 1990 to 2004 period. This is consistent with the belief that newly public firms often take a few years to show a positive financial return.
- In the year of local business entry, the effect on existing firms' financial performance (return on assets) was negative. One and two years following entry, the impact subsided (was not statistically significant).
- The three-year lag effect of entrants on existing firms was positive (and statistically significant). This is consistent with the belief that in the first two years or so of a firm, they produce limited positive spillover effects as they are struggling for survival, but eventually positive spillover effects occur.
- Technology-oriented existing firms are less affected by entry than are nontechnology-oriented existing firms.
- Smaller first-year local entrants cause less damage to existing firms. Existing firms' financial performance in the entrant's first year decreased as the average size of the entrant increased.
- The research points out that existing firms may want to conduct activities that nurture new entrants to improve their own future financial performance. Results suggest they would do well to befriend other firms in the immediate area.
- The control variables showed little statistical significance throughout the econometric models (this was understandable because the lag of the independent variable was used as a dependent variable to ward off spurious results).

Scope and Methodology

The research uses 377 firms that filed initial public offerings from 1990 to 1993 as the basis for existing firms and follows their financial performance from 1990 to 2004. Employer establishments entering a 75-mile radius of the 377 existing firms were considered entrants.

Econometric models were used to test the impact of various lag intervals of entrants on the return of assets for 377 firms. Control variables included a technology component (R&D expenditure), firm advertising expenditures, and the area's business environment (business size and density).

Two side projects were also evaluated The technology component was tested to see if the technology intensity of the existing firm had an effect on its financial performance impact from entrants, and the impact of the average entrant's size on existing firms was studied.

The researcher procured special tabulations from the U.S. Census Bureau on establishment births and utilized Compustat data for financial information as the basis for data in the models.

This report was peer-reviewed consistent with Advocacy's data quality guidelines. More information on this process can be obtained by contacting the Director of Economic Research via email at **advocacy@sba.gov** or (202) 205-6533.

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INTRODUCTION

There is mounting evidence and acceptance among economists and management scholars that *where* a firm locates, as well as subsequent changes to its local environment, are key determinants of firm performance and productivity (Rosenthal & Strange, 2004; Sorenson & Baum, 2003). Most empirical work has centered on the effects of agglomeration economies on a plant's or firm's *productivity,* i.e., its output typically measured in currency units (Rosenthal & Strange, 2003). This research has yielded important insights regarding the productivity effects of agglomeration economies.

Very few studies, however, have focused on the effects of such externalities on firm *profits* mainly because adequate data to do so are difficult to obtain (Rigby, 1991). Profit-based agglomeration studies have the advantage of examining the possibility that agglomeration forces may affect input marginal productivity differently and independently from their impact on input costs. In addition, where some studies have examined agglomeration economies as a determinant of new venture or plant creation, it appears that no studies have examined the effect of local entry on either the productivity or profits of incumbents.

Rosenthal and Strange (2004), in their review of nearly 30 years of empirical research by spatial economists, provide a useful guide for an empirical study of agglomeration economies. While the body of work has steadily improved in the past three decades as more geographically refined data have become available, only recently have studies started to approach productivity-based studies of agglomeration economies at a firm or plant level of analysis (e.g., Henderson, 2003). The newest studies suggest that the effects of agglomeration economies on productivity are not only driven by the geographic concentration of firms, but are also a function of time, distance, and other organizational factors. As a result, Rosenthal and Strange (2004), suggest future studies should account for the *industrial, geographic, temporal, and organizational scope of agglomeration externalities.*

With this in mind, the purpose of this paper is to examine with a longitudinal research design what effect local entry has on the profits of newly established firms. Since it is reasonable to expect that agglomeration economies take time to develop, it is expected that local entry will have a negative contemporaneous effect on established firm profits. After some time, this effect is expected to be positive as the entrant matures, grows in scale, and, thus starts to contribute to positive local externalities. This general thesis, encompassing the temporal scope of agglomeration economies, will also be examined in the context of the organizational scope (i.e., the average size of the local entrants and the technological capabilities of the established firm).

I test the hypotheses developed in this study using a sample of 377 firms making an initial public offering between 1990 and 1993. Using financial performance data for these firms collected from Compustat, the Securities and Exchange Commission's (SEC) EDGAR database, and Thomson Financial's SDC Platinum database, the resulting dataset includes 15 years of observations from 1990 to 2004 totaling 3,833 firm-year observations. Of particular note is the use of the US Bureau of the Census' County Business Patterns database from which was ordered custom, unpublished tabulations of county establishment births and deaths from 1990 to 2004. The information represented in these tabulations is the basis for calculating and estimating the economic impact of "local entry" on the performance of newly established firms.

The remainder of this paper is organized as follows. In the next section, I review the relevant literature regarding this study's central research question and offer specific comments regarding the public policy implications thereof. Following that I develop four groups of hypotheses corresponding to the four scopes of agglomeration economies described in the literature review. From there, I discuss the research design for the study and the expected timeline and milestones. I then offer a few concluding remarks regarding the findings.

THE SOURCES AND SCOPE OF AGGLOMERATION ECONOMIES

The prevailing view of industrial economics and most strategic management paradigms is that entry adversely affects the performance of established firms (Scherer & Ross, 1990). In a general sense, entrants are thought to discipline the profits of incumbents most likely by adding production capacity, introducing new and superior products or services to the market, limiting the monopoly pricing power of incumbents, and/or engendering a shift in consumer preferences.

The industrial economics view of entry eroding the performance of incumbent firms seems at odds with an alternative perspective offered by spatial economists. This alternative reasoning is based on the notion that *more* firms in the local economy might well *improve* a given firm's profitability, provided the firms are geographically concentrated (Duranton & Puga, 2004). Such concentration, it is argued, enables *agglomeration economies* resulting in "a decrease in the unit cost of a firm, consequent on the concentration of economic activity at a given location, with the decrease involving either a movement along the falling portion of the firm's long-run average costs curve or a downward shift in the curve" (Parr, 2002: 151).

The Sources of Agglomeration Economies

While the conceptualization of the *sources* of agglomeration economies varies within the multiple branches of spatial economics,[1] the prevailing view is that agglomeration economies derive principally from three sources: labor pooling, specialized suppliers, and knowledge spillovers (Krugman, 1994; Marshall, 1920). First, the geographic concentration of firms in an industrial center enables the emergence of a market for workers with specialized skills and abilities. Second, as with a pooled labor market, clustering supports a local market for the supply of specialized nonlabor inputs and business services in greater variety and at lower cost than would otherwise be possible. Finally, and perhaps most important, the close proximity of firms in an industrial concentration enables the flow and spillover of knowledge between firms.

Labor Market Pooling

Labor market pooling is argued by some to be the primary source of agglomeration economies (Dumais, Ellison, & Glaeser, 2002). There are, however, two overlapping interpretations of why such pooling is a positive development for firm performance (Rosenthal & Strange, 2004): The first interpretation involves a kind of "efficiency effect"—that is, industry agglomeration and the resulting labor pool improve the allocation of workers to tasks that best suit their individual skills (Wheeler, 2001). This in turn encourages workers to develop specialized skills that increase their productivity (Baumgartner, 1988) and to invest in the development of these skills through training and education at their own expense (Rotemberg & Saloner, 2000). The second interpretation of labor pooling centers on risk (Rosenthal & Strange, 2004). This perspective suggests that labor pooling mitigates the risk associated with worker termination or, more generally, the possibility that at some point in the future a worker will want another job better suited to their abilities. From this point of view, labor pooling acts as a type of insurance for both workers and firms by granting workers local job mobility[2] while also releasing

[1] There is some debate as to whether agglomeration economies are "technological" in the sense of influencing the productive capacity of firms or operate through some other means such as regional culture, local institutions, and the like. This pits, for example, the view espoused by Krugman (1991) and his emphasis on labor and supplier agglomeration effects against that offered by Saxenenian (1994) in which regional advantage is enabled by a shared culture and norms. This study adopts the technological view of agglomeration economies.

[2] Workers may even take lower real wages in regions where mobility potential is high (David & Rosenbloom, 1990).

the firm from having to hire and train (in the current period) any additional workers it might need in anticipation of future growth (Krugman, 1994).

Specialized Suppliers

The geographic concentration of firms in an industry also enables firms to share local sources of specialized intermediate goods and services. Like a pooled labor market, a concentration of specialized suppliers and service providers enables a firm to outsource some activities as it shares an input base with other industry firms (Holmes, 1998). The traditional film studio of the past, for example, has given way to filmmakers in Los Angeles having access to highly specialized services such as costume rentals, film processing, or special visual effects (Sorenson & Baum, 2003). More important, the benefits of a local market for specialized supply may be greatest when the production of intermediate goods is subject to increasing returns to scale. Thus, as firms increasingly agglomerate, intermediate goods may be produced by larger plants, now free to rise to above minimum efficient scales, rather than being redundantly and inefficiently produced by a set of dispersed smaller plants (Storper, 2000). Indeed, Krugman (1994) argues that increasing returns to scale is both necessary and sufficient to foster industry agglomeration.

Knowledge Spillovers

Knowledge spillovers are one of the more ubiquitous concepts in economic and management research. New growth theory, for example, incorporates knowledge—along with the traditional inputs of capital and labor—into theoretical models of productivity and growth in which knowledge not only makes the firm that created it more productive, it also spills over to other firms to improve their capabilities (Romer, 1986, 1987, 1990). It follows from this reasoning that in the absence of spillovers, each firm would bear the full cost of developing the knowledge needed for its operations and ultimate success. Moreover, Romer's notion of spillovers reflects similar arguments made by Marshall (1920) as well as Kenneth Arrow (1962); these knowledge spillovers are sometimes referred to as Marshall—Arrow—Romer (MAR) externalities and relate specifically to the flow of knowledge within industries[3] (Glaeser, Kallal, Scheinkman, & Shleifer, 1992).

From a geographical perspective, there is evidence that knowledge spillovers are

[3] This is in contrast to "Jacobs spillovers" or the flow of knowledge between firms in different industries (Jacobs, 1984).

geographically restricted to the region where the knowledge was created (Jaffe, 1989; Jaffe, Trajtenberg, & Henderson, 1993; Varga, 1998). Using data at the level of the metropolitan statistical area (MSA), studies suggest that knowledge spillovers are limited to a range of approximately 50 to 75 miles in radius from the knowledge source (Anselin, Varga, & Acs, 1997; Anselin, Varga, & Acs, 2000). Intuition suggests that this is a function of the typical distances traveled by car for daily business purposes (Acs, 2002), but it may also be suggestive of other factors including social network structures (Sorenson, 2003), worker mobility patterns (Almeida, Grant, & Phene, 2002; Almeida & Kogut, 1997, 1999; Song, Almeida, & Wu, 2003), and the location preferences of entrepreneurs (Buenstorf & Klepper, 2004; Zucker, Darby, & Armstrong, 2002).

The Scope of Agglomeration Economies

Since it is nearly impossible to isolate empirically a single source of agglomeration economies, most studies focus on what Rosenthal and Strange (2004) refer to as the *scope* of agglomeration economies. Assuming the effect of agglomeration economies on the uses or optimal quantities of inputs is uniform across all factors (i.e., the effect is Hicks neutral[4]), then the firm's production function can be expressed as y = g(A)f(x), where y is the firm's productive output (often measured in terms of sales or gross revenues), x represents the usual inputs of labor, capital, knowledge, land, and other materials, and A characterizes the local environment in proximity to the firm's operations. In terms of profits, the profit function can be expressed as π = g(A)f(x)—c(x) (i.e., profits equal revenues minus costs).

The central issue, of course, is to estimate the effects of agglomeration (A) in a way that is meaningful. As Rosenthal and Strange (2004) summarize, the total effect of agglomeration generated by the set of local firms *J* and experienced by firm (*i*) can be expressed as $A_i = \sum q(x_i, x_j)a(G_{ij}, I_{ij}, T_{ij})$; this expression suggests that the effects of industry concentration are shaped by the characteristics of the firm's immediate environment. The first term, $q(x_i, x_j)$, reflects the idea that the magnitude of the effect depends on the organizational scale of both firm *i* and firm *j* as indicated by the total amount of the inputs *x* used by either firm. The second term, $a(G_{ij}, I_{ij}, T_{ij})$, refers to the geographic, industrial, and temporal distances, respectively, between firm *i* and firm *j*. Geographic distance refers to the physical distance between the two firms, industrial distance is the degree to which the productive activities within the two firms are

[4] The assumption of Hicks neutrality is consistent with evidence found by Henderson (1986).

similar, and temporal distance is based on the idea that a firm may experience today the effect of a spatial interaction with another firm in the past. Thus, given the full expression, any agglomeration effect is comprised of four dimensions: the *industrial scope*, the *geographic scope,* the *temporal scope,* and the *organizational scope* of agglomeration economies.

Although the empirical literature on agglomeration economies goes back 30 or more years, recent studies have begun to take advantage of more geographically refined data now available at smaller geographic scales (i.e., counties, zip codes, and street addresses). Rosenthal and Strange (2004), in their review of the empirical literature, suggest that the study closest to their ideal for a productivity-based examination of agglomeration economies is one by Henderson[5] (2003). In this instance, Henderson employs a panel of plant-level data obtained from the US Bureau of the Census Longitudinal Research Database (LRD) that allows him to explore the importance of agglomeration economies across all four dimensions—the geographic scope, industrial scope, temporal scope, and organizational scope. In doing so, Henderson finds that (1) within-industry agglomeration economies are strong in high tech sectors but not in the machinery sectors; (2) within-industry economies carry forward for as many as 5 years, but not to 10 years; (3) agglomeration effects are highly localized within counties; (4) independent (i.e., single-establishment) plants benefit more from agglomeration economies than do corporate (multi-establishment) plants; and (5) between-industry agglomeration economies, with the exception of corporate plants in machinery industries, are not apparent.

As for plant size effects, Henderson (2003) finds no evidence that the size of agglomerated plants (measured by number of employees) positively influences the productivity of plants in either high tech or machinery industries. Instead, he finds that only the *number* of localized plants within the industry has such a positive effect. He interprets this to suggest that within-industry agglomeration economies are generated by the presence, rather than by the size, of other plants. In contrast, Rosenthal and Strange (2003) using Dun and Bradstreet data at the ZIP code level, find that *smaller* plants generate stronger agglomeration economies than do larger establishments. Both Henderson (2003) and Rosenthal and Strange (2003) also find that small plants enjoy greater agglomeration benefits than do larger plants.

[5] Henderson's (2003) use of the Longitudinal Research Database required him to become a sworn "employee" of the US Census Bureau and to complete the work at one of the Census research centers located throughout the United States; according to Rosenthal and Strange (2004), the costs to access the data were considerable. Thus, while Rosenthal and Strange (2004) hold up Henderson's study as a benchmark on which to evaluate future studies, they clearly recognize that many scholars will have no recourse but to work with less than ideal data.

The Research Question

The central research question addressed in this study is, what is the effect of new plant entry on the profits of local new firms? Both the studies of Henderson (2003) and Rosenthal and Strange (2003)—as well as the other research reviewed by Rosenthal and Strange (2004)—are focused on plant productivity rather than on firm profitability. Indeed, there are very few studies of agglomeration effects on firm profitability (Rammer, 1998) despite recognition that firm profits—i.e., revenues *and* costs—are a superior indicator of firm performance compared to productivity alone (Rigby, 1991); most examples of profit-based studies employ non-U.S. data (Bayldon, Woods, & Zafiris, 1984; Coombes, Storey, Waston, & Wynarczyk, 1991; Fothergrill, Gudgin, Kitson, & Monk, 1985; Rigby, 1990). The lack of profit-based studies is chiefly a function of the fact that profit data are hard to come by whereas output data—especially aggregated to the county or MSA level—are generally more available. Profit-based studies offer the potential for richer examinations of the scope of agglomeration economies chiefly by allowing consideration of the effects of the geographic concentration of firms on both productivity and costs.

In addition, where studies have assessed the impact of agglomeration economies on the rate of new firm formation in a particular region (Armington & Acs, 2002; Rosenthal & Strange, 2003), none (to my knowledge) have assessed the impact of new plant entry on the productivity or profit performance of new firms. In other words, new firms or plants have been considered as a dependent variable, but not it seems as an independent variable. Consideration of the temporal scope of agglomeration economies as suggested by Rosenthal and Strange (2004) suggests that any positive effects of agglomeration *take time* to develop. Thus, it seems more reasonable that the contemporaneous effect of new plant entry is *negative* especially when considered in the context of profits rather than productivity.

Indeed, the added competition for inputs posed by new entrants might well raise the operating costs of local incumbents in the near term before the entrant has time to contribute to any positive local externalities. Moreover, since new firms are well known to be particularly vulnerable to competitive pressures and face a higher risk of closure (Headd, 2003), it seems that the effects of new plant entry are particularly germane to the performance of new firms in the early critical stages of growth.

HYPOTHESES OF ENTRY, AGGLOMERATION, AND FIRM PROFITS

I take, as given, the premise that the generation of agglomeration economies by a new plant takes time to develop, and I further make the conjecture that the *sources* of agglomeration economies operate in the ways described above. In addition, by expressing the incumbent firm's profit function as $\pi = g(A)f(x) — h(A)c(x)$, I further assume that the effects of agglomeration on productivity (g) operate differently and independently from the effects on input costs (h). In general, the first term in the profit function accounts for agglomeration economies while the second term incorporates the spatial competition for productive inputs (x). The influence of spatial competition, as with agglomeration economies, is expected to diminish as the industrial, geographic, and temporal distances between plants and firms increase and vary according to the relative size or scale of the operations.

To see how, consider a model of spatial duopsony (Zhang & Sexton, 2001). A single-plant "focal" firm, I, is located at one end of a linear "main street" economy with a finite length, R, and combines an intermediate good with other inputs to produce a single product. The suppliers of the intermediate good are continuously distributed along the main street and will sell their intermediate good to the focal firm for any positive price (w). The focal firm offers a "mill price" (m_I) for the intermediate good, requiring suppliers to bear the cost of delivery.

As a result, a supplier located at a distance, r, faces a net supply price, w, equal to the mill price less the cost of transport (sr). Given this relationship, the suppliers nearest to the focal firm's location, I, will sell the intermediate good in greater quantity than those located further away from the focal firm's front gate. Indeed, at some distance from the focal firm's location (i.e., when m = sr), suppliers can no longer sell the intermediate good to the focal firm profitably; this distance marks the "local market boundary" of the focal firm.[6]

Now suppose that an entrant, E,—identical to the focal firm, I, in all respects—locates at the opposite end of the main street. Assuming the entrant establishes a mill price, m_E, equal to the mill price offered by the focal firm, and suppliers face the same transfer costs to the entrant's location, the suppliers along the main street will sell to the nearest firm. As a result of firm E's

[6] Also, by assuming that the suppliers of the intermediate good all share an identical supply curve that passes through the origin and with an elasticity of 1, the area under the net price cost curve (w = m – sr) equals the total quantity of the intermediate good supplied to the focal firm. Since a monopsonist is indifferent between adopting a mill price or uniform delivered price policy when facing a linear supply curve, this assumption makes it possible to focus on the performance consequences of entry and the monopsonist's pricing strategy as opposed to the effects of the shape of the supply curve (Zhang & Sexton, 2001).

entry, the boundary of the focal firm's local market area is reduced to where the net supply price (w) offered by the focal firm and the entrant are equal. Thus, firm E's entry may now be defined as *local competitive entry*, whereby the entry results in an invasion of the focal firm's local market area (i.e., overlapping local market areas) and a corresponding challenge to the focal firm's spatial monopsony position.[7]

Provided the proportion of the intermediate good required by the focal firm to produce its product is fixed, at least in the short run, it may respond in one of two ways to local competitive entry. First, the focal firm may leave the mill price unchanged and concede to the entrant by accepting a reduced quantity of supply. Since the focal firm produces output in proportion to the quantity of the intermediate good used, it must reduce the output of its finished product and face a reduction in revenues that exceeds any reduction in costs. Second, if the focal firm prefers to maintain the current output of the finished product, it may confront the entry by altering its mill price. The simplest response is for the focal firm to raise the mill price from m_I to m_I^* in an effort to "win back" some of its local market area and return the supply of the intermediate good to pre-entry levels. This response, however, is costly since the firm pays a premium (m_I^*—m_I) to obtain the original quantity of supply.[8]

Generalizing from the spatial duopsony model, it seems that the immediate effect of local competitive entry erodes the focal firm's profitability. The entrant seems to quickly transmit this effect to the focal firm since spatial competition operates through local input prices and likely precedes the onset of any positive agglomeration economies the entrant might generate.

> Hypothesis 1: *Ceteris paribus*, local entry is negatively related contemporaneously to the profitability of the focal firm.

The effect of local competitive entry on a focal firm's performance, however, is dependent on a range of conditions that have remained constant in the discussion thus far. Indeed, it seems to follow that if the entrant is smaller (larger) in scale and thus demands less (more) of the intermediate good than does the focal firm, then the focal firm's profits will be

[7] The entrant does not need to locate within the focal firm's local market area to have a competitive effect. It is only necessary for the focal firm's and entrant's local market areas to overlap so that they compete for the same suppliers.
[8] A different possibility is that the focal firm will abandon its mill price in favor of uniform delivery (UD) pricing intended to absorb some or all of the suppliers' transport costs. This, however, proves as costly to the firm as raising the mill price when transport costs are particularly high (i.e., s >> 0) (Zhang & Sexton, 2001).

eroded to a lesser (greater) extent than if the scale of the entrant and focal firm were of the same size. Thus,

> Hypothesis 2: *Ceteris paribus*, the greater the entrant's size, the more negative the relationship between focal firm performance and local entry.

Once entry has occurred, however, it is expected that the entrant will start contributing to positive agglomeration economies as it matures and grows in scale. One can only guess, however, how long it might take for an entrant to start generating such positive externalities, but intuition suggests that the generation of agglomeration economies by an entrant depends on it passing the most critical phase of its growth. If new firms face the highest risk of closure within the first two to four years of operation (Headd, 2003), it seems reasonable to conjecture that any positive externalities generated by entrants do not become a significant influence on focal firm performance until at least two years after, and per Henderson (2003), within five years of the entrant's arrival. Thus,

> Hypothesis 3: *Ceteris paribus*, once the entrant has established itself, local entry is positively related to the performance (i.e., profitability) of focal firms.

In the context of the duopsony model, the performance-eroding effect of local competitive entry might be blunted if the focal firm's production technology allows one input to be substituted for another. This could be achieved by making the production technology more efficient in terms of the processing of the intermediate good (i.e., increasing the marginal product of the intermediate good) or by developing an alternative process that might use, but does not require, the intermediate good as an input (i.e., making the focal firm's demand for the intermediate good more elastic)[9] (Rosegger, 1996). Provided the intermediate good is not a critical determinant of the finished product's favorable characteristics (e.g., quality), all things equal, the latter change is the preferable solution; the problem is that this kind of radical innovation—technological change that renders prior knowledge obsolete—is very difficult to achieve (Utterback, 1996). One would expect, then, that a focal firm's superior technological

[9] To be clear, increasing the marginal product of the intermediate good does not lead necessarily to increasing returns to scale. To see this, consider the incumbent's Cobb-Douglas production function in which the output quantity, Q, equals $\lambda Z^{\alpha}G^{\beta}$. While the marginal product of the intermediate good is a function of parameter β, increasing returns to scale is indicated by $\alpha + \beta > 1$.

capabilities would enable it to "innovate around" the competitive challenge posed by the local entrant.[10] Technological capabilities are defined as the firm's ability to combine existing technological resources, including codified knowledge and human capital, in the development of new products and processes (Dierickx & Cool, 1997). Thus,

> Hypothesis 4: The greater the focal firm's technological capabilities, the less negative the relationship between focal firm performance and local entry.

TESTING THE THEORETICAL ARGUMENTS

Sample

I tested the hypotheses using 15 years (1990 to 2004) of financial performance and county-level census data collected for an initial sample of 377 "focal" firms making an initial public offering (IPO) between 1990 and 1993. The time period for the study is determined by the earliest availability of establishment birth data from the County Business Patterns database. There were only 104 IPO events in 1990, which is too few for an adequate sample. By taking advantage of the Securities and Exchange Commission (SEC) requirement that a firm publicly disclose financial information for the three years prior to the IPO, I identified an adequate sample of firms by pooling the set of firms that went public between 1990 and 1993.

To do so, I started by identifying the population of IPO events between 1990 and 1993. Since this population includes all types of security offerings, I followed the Field/Ritter procedures (Field & Karpoff, 2002; Loughran & Ritter, 2004) to reduce the sample to the domestic operating firms of interest. Following these procedures, I removed the offers with a price below $5 per share (i.e., penny stock offers), unit offers (i.e., two or more packaged securities), foreign offers (i.e., American depository receipts, ADRs), closed-end funds (i.e., mutual funds), partnerships, real estate investment trusts (REITs), and firms not listed in the Center for Research on Security Prices (CRSP) database.[11]

Following that, I retained firms in the manufacturing (SIC 2000-3999) and service sectors (SIC 7000-8999) and then dropped the firms that were nine years old or older in 1990. This resulted in a total of 502 firms. Next, to allow for control of industry effects, I dropped firms in

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[10] This conclusion directly contradicts that of Flyer and Shaver (2003). In their spatial duopoly model, they find that the performance of the technologically superior incumbent is *eroded* by entry.

[11] Excluding firms not listed in the CRSP database removes foreign firms going public in the U.S. without ADRs.

those industries having two or fewer observations in any particular year. This yields 377 firms in 42 industries and—due to firms exiting the sample during the study period—3,833 firm-year observations. Additional factors reducing the sample size are discussed at the end of this section.

Data Sources

The databases I accessed for this study include Standard and Poor's Compustat North America database (which includes the Industrial Annual and Business Segment files), Thomson Financial's SDC Plantinum (which includes the VentureXpert IPO database), the US Census Bureau's County Business Patterns database, and the Regional and Industrial Accounts data from the Bureau of Economic Analysis. Compustat financial data are augmented as necessary with annual report (10-K) data on file at the Securities and Exchange Commission's Office of Filings and Information Services. The establishment birth data used to measure the rates of local entry and exit are based on unpublished tabulations ordered from the US Census Bureau's County Business Patterns database. The use of the tabulations is explained in detail in the discussion of the independent variable definitions and calculations.

Dependent Variable

I used the focal firm's return on assets (ROA) as the primary measure of performance since the earnings generated per dollar of total investment is widely accepted as the most comprehensive measure of firm performance in the empirical literature (Barber & Lyon, 1996). I used the Compustat data to calculate ROA as operating income (i.e., earnings before interest and taxes) divided by total assets. See Appendix 1 for more information on this variable.

Independent Variables of Interest

Local Entry Rate.

I used the establishment birth tabulations from the County Business Patterns (CBP) database to calculate the rate of all establishment births[12] in the current period (t) in counties within 75 miles of the focal firm's location. To do so, I used geographic information system (GIS) software to sum the establishment *births* in those counties whose centroids are within 75 miles of the focal firm's location. I repeated this procedure to sum the *existing* establishments within 75 miles of the focal firm's location. I then divided the total number of establishment births by the number of existing establishments in the prior year. *Local Entry Rate* is thus

[12] The "birth" in the current period (t) is defined as an establishment having positive payroll in current year (t), but no payroll in the previous year (t –1).

interpreted as the proportion of establishment births in the current year to the number of existing establishments in the prior year (Rosenthal & Strange, 2003).[13]

Local Entry Size.

To test the relationship between entrant size and firm performance, I used the CBP data to calculate the average employment per local entrant. Thus, *Local Entry Size* is the number of workers employed by local entrants divided by the number of local entrants. I estimated the averaged number of workers per establishment birth within 75 miles of the focal firm's location. To do so, I first averaged the number of workers per establishment birth for each county and then average the county-level results across all those counties with centroids within 75 miles of the focal firm's location.

Technological Capabilities.

To test whether a focal firm may be insulated from the negative competitive influences of local entry by its greater technological capabilities, I operationalize Technological Capabilities by a measure of the firm's R&D intensity (Cohen & Klepper, 1992; Mauri & Michaels, 1998). Using the Compustat data, I defined the focal firm's R&D intensity as total expenditures on research and development divided by the firm's total sales; since R&D budgeting likely occurs in the prior year, the denominator (total sales) is lagged by one year in the calculation.

See Appendix 1 for more information on the calculation of the independent variables.

Control Variables

Advertising Intensity.

I included *Advertising Intensity* as a control for three reasons. First, sustained advertising expenditures may capture some of the firm's intangible assets such as brand name and reputation (Mauri & Michaels, 1998). Second, advertising intensity is found to be significantly related to other measures of market power (Lee, 2002) and is often used in industry-level studies as a proxy for the height of entry barriers (Geroski, 1995). Finally, advertising intensity may proxy for the firm's sunk costs which deter entry and thus sustain the firm's pricing power (Baumol & Willig, 1981; Waring, 1996).

[13] Using county centroids to calculate the entry variable will introduce some noise to the variable. In particular, it may slightly overstate the count of births as a function of the size of the counties at the boundaries of the circle.

Localization and Agglomeration Density

To adequately isolate the effect of local entry on the performance of the focal firms, I included a number of control variables intended to capture other aspects and characteristics of the local economic environment in close geographic proximity to the focal firm. First, I defined *Localization* as a count of the number of existing establishments within 75 miles of the focal firm's location; this is the identical calculation used for the denominator of the local entry rate variable. Second, I defined *Agglomeration Density* as the average number of existing establishments per square mile for all the counties with centroids within 75 miles of the focal firm's location; I calculated this variable by averaging the number of establishments per square mile within each county and then averaged the county densities across all those counties with centroids within 75 miles of the focal firm's location.

Establishment Size.

Third, I estimated the average number of workers per existing establishment within 75 miles of the focal firm's location. To do so, I first averaged the number of workers per existing establishment for each county and then average the county-level results across all those counties with centroids within 75 miles of the focal firm's location.

Local Exit Rate.

Finally, I included a measure of the *Local Exit Rate*. The total number of establishments in any given year, captured here by the measure of localization, is equal to the number of establishments two years before plus the number of establishment entrants and minus the number of establishment exits. To fully account for the business patterns within each county, I include a measure of the rate of local exits in those counties with centroids within 75 miles of the focal firm's location. In this case, the number of establishment exits[14] in the current year is divided by the number of existing establishments in the prior year.

Model Specification and Estimation

I employed a dynamic "time-space" model, $y_{it} = \gamma y_{it-1} + \varphi[Wy_{j,\,t-1}]_i + X_{it}\beta + \mu_i + \varepsilon_{it}$, that includes both a temporal lag and a spatial lag of the dependent variable (Anselin, 2001). This specification accounts for a focal firm's performance being both (1) correlated with its performance in the previous year (i.e., serial correlation or γ) and (2) correlated with the

[14] The "exit" in the current period (t) is defined as an establishment having positive payroll in the previous year (t-1), but no payroll in the current year (t).

performance of neighboring firms in the current year (i.e., spatial correlation or φ). A temporal lag of the dependent variable is warranted since my hypotheses hinged on the idea that the changes in the independent variables affect firm performance over multiple time periods (Kennedy, 2003). The inclusion of a "spatial lag" of the dependent variable, while a less well-known technique, captures the extent to which the focal firm's performance is influenced by, or correlated with, the performance of neighboring firms in the sample (Anselin & Bera, 1998). In this model, X is the matrix of independent variables described below and the vectors γ, φ, β, μ and ε are the parameters to be estimated (Anselin & Bera, 1998). In this instance, μ_i is the panel-specific error term and ε denotes the random error term (LeSage, 1999).

To estimate the dynamic time-space model, I used the Arellano-Bond (GMM-Diff) estimator (for a complete discussion, see chapter 8 of Baltagi, 2005). This approach uses the first-differences (i.e., differences from period t-1 to period t) of all the relevant values in the data; the first-differencing removes the panel-specific error term, $\mu_{i,}$, which is correlated with the time lag, y_{it-1} , of the dependent variables, thus providing fixed effects (or within group) results. The resulting specification, $\Delta y_{it} = \gamma\Delta y_{it-1} + \varphi[\Delta W y_{j,\, t-1}]_i + \Delta X_{it}\beta + \Delta\varepsilon_{it}$, is not without its own statistical problems; these are resolved by using y_{it-2} as an instrument for the time-lag variable, Δy_{it-1}; in fact, the first-differencing allows for any of the endogenous variables in the model to be instrumented in the same way. In this study, since both advertising and R&D expenditures are decided upon with the intent of maximizing firm performance and are determined by the firm's performance in prior years, both are instrumented in the same manner as the time lag.

The use of the Arellano-Bond technique reduced the usable sample size by five focal firms. The first-differencing of the variables and the use of the instrument from the period at *t-2,* means that two observations per panel are automatically "lost;" the five firms dropped from the sample were those with only two years of observations. In addition, the hierarchical models in Table 2 use increasingly "deeper" lags of the local entry rate to test Hypothesis 3; these deeper lags result in a gradual reduction in the number of firms and observations. Further discussion of the model specification and estimation is provided in Appendix 2.

RESULTS

As shown in Table 1a, the average return on assets for the sampled focal firms is negative. This is not that unusual given that young, newly public firms often take several years to show a positive return to shareholders (Barber & Lyon, 1996). In addition, the coefficient for the temporal lag of the dependent variable is negative and significant in all the model estimates reported in Tables 2, 3, and 4. Typically, when estimating firm profits as a time-series function, the expected value of the temporal lag is positive with a value falling between 0 and 1 (Goddard & Wilson, 1999; Mueller, 1977). This is the case, as shown in Figure 1, with the *absolute* values of return on assets with a positive serial correlation of 0.65. In this instance, given the Arellano-Bond estimator in which the *first-differenced* values are estimated in time series, the negative coefficient suggests that the growth (or yearly change) in ROA from one year to the next varies considerably around the mean growth of the sample. More simply, it implies that the growth of these young firms is somewhat volatile, marked by some years of growth followed closely by other years of little, if not negative, growth. The negative serial correlation of the first-difference values of return on assets (-0.34) is shown in Figure 2.

The coefficient for the spatial lag is positive and significant in all the estimated models in Tables 2 through 4, indicating that the focal firm's change (i.e., first-differenced) in return on assets is positively correlated with the change from the prior year in the average return on assets for the firms in the sample within 75 miles of the focal firm's location. This is consistent with tests for spatial dependence in the return on assets variable indicating positive spatial correlation of both the absolute (Moran's I = 0.43, $p < 0.01$) and first-differenced (Moran's I = 0.23, $p < 0.01$) values of the dependent variable. This suggests that the operating performance of any focal firm in the sample is driven by the presence and corresponding performance of other firms within 75 miles of its location; this is consistent with the general conception of agglomeration externalities.

Table 2 reports the results for testing Hypotheses 1 and 3. In the first hypothesis, I suggested local entry in the contemporaneous period has a negative effect on the operating performance of focal firms. The negative and significant coefficient in Model 1 of Table 1 provides support for this hypothesis. The third hypothesis is based on the notion that any positive externalities transmitted by entrants take time to develop and, in particular, will not become a significant factor in a focal firm's performance until the entrant has "established itself." Given the empirical evidence regarding the risk of business closures in the US economy, an entrant is thought to have established itself after two years of operation. Thus, the coefficient for the effect of local entry on focal firm performance is hypothesized to turn positive at a three-year lag as it does in Model 4 of Table 1. Thus, Hypothesis 3 is supported.

Table 3 reports the results of a test of Hypothesis 2. In this case, the increasing size of the entrants, on average, is argued to make the negative effect of local entry on firm performance more negative. The negative and significant coefficient for the local entry rate by local entry size interaction in Model 2 of Table 3 provides general support for this hypothesis. A plot of the interaction shown in Figure 3, however, implies that the size of the entrant has no significant effect when the rate of local entry is high. In contrast, where the rate of local entry is relatively low, only there does the size of the entrant have a significant effect. This suggests that the influence of the entrant size diminishes in importance as a driver of focal firm performance as the rate of local entry increases.

Finally, Table 4 provides a test of Hypothesis 4. Here, the greater the focal firm's technological capabilities (as measured by R&D intensity), the less the focal firm is susceptible to the negative contemporaneous effect of local entry. The positive and significant coefficient for local entry rate by technological capabilities interaction term supports Hypothesis 4. Indeed, the plot of the interaction shown in Figure 4 implies that focal firms with greater technological capabilities are well insulated from the profit-eroding influence of entry. As depicted, it seems that the competitive pressures introduced by local entrants diminish the profits of *only* the focal firms with low R&D intensities.

DISCUSSION

Insights for Policy and Practice

In various regions of the United States, state and municipal economic development authorities are increasingly turning to policies designed to nurture and support home-grown businesses as a way to achieve their regional growth objectives (Small Business Administration, 2006). The "economic gardening" program started by Mr. Christian Gibbons and the city of Littleton, Colorado, exemplifies this approach to economic development (Gibbons, 2005b). As Gibbons puts it, "We believe entrepreneurs drive economies—period" (Gibbons, 2005a). While the city's sales tax revenues have tripled over the past 20 years, no city money has been spent on attracting an established firm to relocate to Littleton. The apparent success of the Littleton program has led areas like Santa Fe, Berkeley, Lancaster County (PA), and regions in Northern

Ireland and New Zealand to initiate similar programs (Gibbons, 2005a; Small Business Administration, 2006).

It would seem reasonable for entrepreneurs to object to any competitive threat enabled and supported at public expense. Thus, what is the city of Littleton to do if the performance of the firms founded in previous years is adversely affected by the arrival of new firms now and in the future? Should it direct its efforts to supporting a diversity of new ventures or only those in a set of preferred industries? Should it encourage businesses to tightly co-locate or to spread out within the city borders? As the literature review above suggests, there is a paucity of profit-based empirical evidence upon which to base an answer to these questions.

This study, however, does provide some insight for both policy and practice. The results here suggest that it is the newest of entrants, i.e., those less than 3 years of age, that pose the greatest competitive threat to a established firm's performance. Indeed, the results imply that firms will do well to befriend, and perhaps even support by means of collaborations and alliances, other established firms in the immediate area. In addition, the findings in this study suggest that (1) the effect of larger sized entrants is a bigger factor in those areas with relatively low rates of local entry and (2) that firms with greater technological capabilities are less affected by local entry. Although these finding are subject to different interpretations and require further analysis, it may be that policies designed to promote economic development by means of new entrepreneurial activity (presumably resulting in smaller-scale entrants) *and* traditional re-location incentives (likely resulting in larger-scale entrants) may be self-defeating. On the other hand, it may be that such policies may work best when promoting the entry of particularly knowledge-intensive firms since they seem well insulated from the effects of local entry.

Insights for Research

Most studies to date, both in management and spatial economics, initiate the discussion of agglomeration economies by first conceptualizing a representative region (e.g., Silicon Valley or Route 128) and then discussing the performance of firms within those regions (Martin, 1999). The conceptualization of a region, or any other geographic construct such as a cluster or district, is often arbitrary and subjective (Scotchmer & Thisse, 1992). In contrast, this study provides a basis for empirically disentangling the multiple dimensions of agglomeration economies in a way not dependent on a priori conceptions of geographic space (e.g., political boundaries). Indeed, the advantage of the spatial duopsony model is that it avoids the problem of thinking of geographic space in terms of firms within "containers" (e.g., counties or MSAs) in favor of viewing firms as discrete "points" with relative locations and distances between them. This seems to provide two insights for future research.

First, the theoretical model in this study can address questions regarding the performance implications of the entrepreneur's choice of location at the most micro level of analysis. In other words, the merits of locational choice can be analyzed by state (e.g., Massachusetts versus California), by region (e.g., Silicon Valley versus Route 128), by municipality (e.g., San Jose versus Palo Alto), by street corner, and so on. In addition, the model developed in this study can also assess the performance merits of locational choice in relation to other factors such as the proximity of a research university, transportation hub, and the like. This latter ability is of particular interest given evidence, for example, that firms in the biotechnology industry tend to locate near the research university where its "star scientist" is employed (Zucker, Darby, & Armstrong, 1998). Is it the case, for example, that some biotech firms will outperform others based on the distance between the firms and the university?

Second, theoretically modeling the spatial interaction of firms in terms of discrete points necessitates the use of cutting-edge spatial econometric techniques, especially when the level of spatial analysis is expressed in fractions of a mile (Hoover & Giarratani, 1999). These techniques make it possible to control for, and explore, the spatial structure of economic interactions. By this I mean that the spatial econometric "toolbox" includes not only methods for detecting the spatial structure of the economy, but also the tools to isolate and characterize that spatial structure. In the context of this study, this makes it possible to determine which ventures are outperforming others, where they are located, whether the key factors determining such performance differences are internal or locally external to the firm, and, most important, how and to what extent the strategies and tactics of the firm complement, or compensate for, any spatial effects.

CONCLUDING REMARKS

It would appear, at first consideration, that the industrial economics view of entry eroding the performance of established firms is directly at odds, if not mutually exclusive, with the spatial economics perspective of the geographic concentration of firms enhancing the operating performance of those firms. By building on the assumption that positive agglomeration spillovers follow the onset of negative pecuniary effects of competition, this study seems to suggest a way toward resolving the conflict in these two important streams of theory.

Modeling the spatial interaction of firms in a dynamic context might be one way of resolving this tension, but doing so in this study came at the price of building on several stylized assumptions. This, however, should be viewed as an opportunity to explore both theoretically and empirically how the hypotheses put forth in this study change, if at all, by relaxing, altering, or eliminating some of the assumptions. A good place to start is altering the assumption of linear transport costs to allow for long-haul discounts for the shipping of goods being explored by economic geographers (Hoover & Giarratani, 1999). Other avenues of exploration could follow, but the essential point to consider is that the improvements in methods, availability of rich datasets, and advancing theoretical framework only enhance the exploration of new firm creation and performance as well as regional economic development.

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TABLES

Table 1a: Descriptive Statistics

Variable	Mean	Std. Dev.	Min	Max
Return on Assets	-0.16	0.74	-12.78	12.00
Technological Capabilities	0.20	0.20	0.00	1.00
Advertising Intensity	0.01	0.09	0.00	4.33
Agglomeration Density	35.31	23.69	1.23	108.10
Localization	39730.95	37339.57	300.00	239571.00
Establishment Size	17.21	3.09	5.34	28.46
Local Exit Rate	0.11	0.01	0.06	0.16
Local Entry Rate	0.12	0.02	0.00	0.22
Local Entry Size	50.23	563.21	0.00	13762.00

Table 1b: Correlations

Variable	1	2	3	4	5	6	7	8
1. Return on Assets	1							
2. Technological Capabilities	-0.53	1						
3. Advertising Intensity	-0.14	0.06	1					
4. Agglomeration Density	-0.05	0.01	0.12	1				
5. Localization	-0.03	-0.07	0.13	0.35	1			
6. Establishment Size	0.12	-0.06	-0.12	0.15	0.01	1		
7. Local Exit Rate	0.05	-0.09	0.14	-0.10	0.13	-0.22	1	
8. Local Entry Rate	0.03	-0.09	-0.3	-0.32	-0.02	0.06	0.30	1
9. Local Entry Size	-0.06	0.05	-0.01	-0.04	-0.08	-0.13	0.02	-0.01

Table 2: Hypotheses 1 and 3 (Arellano-Bond Robust Estimates)

Return on Assets	Model 1	Model 2	Model 3	Model 4
ROA (time lag)	-0.746	-0.817	-0.849	-1.012
	[2.35]**	[2.83]***	[3.15]***	[5.32]***
ROA (spatial lag)	0.236	0.182	0.179	0.183
	[3.05]**	[3.31]**	[3.32]**	[3.29]**
Technological Capabilities (Lag 1)	-0.001	-0.001	-0.001	-0.001
	[0.81]	[0.81]	[0.83]	[0.80]
Advertising Intensity (Lag 1)	-1.256	-1.638	-2.284	-1.589
	[1.12]	[1.33]	[1.47]	[0.81]
Agglomeration Density (Lag 1)	0.017	0.029	-0.001	-0.024
	[0.51]	[0.78]	[0.03]	[0.53]
Establishment Size (Lag 1)	-0.109	-0.092	-0.152	-0.254
	[1.42]	[1.47]	[1.66]*	[2.58]***
Localization (Lag 1)	0.00	0.00	0.00	0.00
	[0.93]	[0.82]	[1.19]	[1.45]
Local Exit Rate (Lag 0)	10.631	11.166	13.587	9.854
	[1.32]	[1.37]	[1.53]	[1.25]
Local Entry Rate (Lag 0)	**-3.367**	**-4.436**	**-3.999**	**-6.234**
	[2.20]**	**[2.25]****	**[1.92]***	**[2.76]*****
Local Entry Rate (Lag 1)		-4.87		
		[1.58]		
Local Entry Rate (Lag 2)			3.807	
			[1.52]	
Local Entry Rate (Lag 3)				**5.475**
				[2.51]**
Constant	0.001	-0.005	0.043	0.102
	[0.04]	[0.15]	[0.85]	[1.55]
Number of Observations	2437	2437	2074	1757
Number of Firms	371	347	326	301

Robust z statistics in brackets

One-Tailed Tests: * significant at 5%; ** at 2.5%; *** at 1%

Table 3: Hypothesis 2 (Arellano-Bond Robust Estimates)

Return on Assets	Model 1	Model 2
ROA (time lag)	-0.715	-0.718
	[2.15]**	[2.17]**
ROA (spatial lag)	0.236	0.182
	[3.05]**	[3.31]**
Technological Capabilities (Lag 1)	0.00	0.00
	[0.71]	[0.86]
Advertising Intensity (Lag 1)	-1.085	-1.092
	[2.77]***	[2.77]***
Agglomeration Density (Lag 1)	-0.006	-0.005
	[0.16]	[0.14]
Localization (Lag 1)	0.00	0.00
	[1.18]	[1.26]
Establishment Size (Lag 1)	-0.108	-0.102
	[1.42]	[1.34]
Exit Rate	8.517	8.64
	[1.30]	[1.33]
Local Entry Rate (Lag 0)	**-2.947**	**-2.633**
	[2.05]**	**[1.86]***
Local Entry Size (Lag 0)	**0**	**0.003**
	[1.94]*	**[3.12]*****
Entry Rate * Entry Size		**-0.024**
		[2.85]***
Constant	-0.008	-0.006
	[0.23]	[0.18]
Number of Observations	2437	2437
Number of Firms	371	371

Robust z statistics in brackets

One-Tailed Tests: * at 5%; ** at 2.5%; *** at 1%

Table 4: Hypothesis 4 (Arellano-Bond Robust Estimates)

Return on Assets	Model 1	Model 2
ROA (time lag)	-0.746	-0.758
	[2.35]**	[2.45]**
ROA (spatial lag)	0.179	0.183
	[3.32]**	[3.29]**
Technological Capabilities (Lag 1)	**-0.001**	**-0.021**
	[0.81]	**[3.28]*** **
Advertising Intensity (Lag 1)	-1.256	-1.346
	[1.12]	[1.21]
Agglomeration Density (Lag 1)	0.017	0.011
	[0.51]	[0.31]
Establishment Size (Lag 1)	-0.109	-0.101
	[1.42]	[1.34]
Localization (Lag 1)	0.00	0.00
	[0.93]	[1.12]
Local Exit Rate (Lag 0)	10.631	12.436
	[1.32]	[1.60]
Local Entry Rate (Lag 0)	**-3.367**	**-3.806**
	[2.20] **	**[2.27]** **
Local Entry Rate * Tech. Capabilities		**0.133**
		[3.29]* **
Constant	0.001	0.01
	[0.04]	[0.29]
Number of Observations	2437	2437
Number of Firms	371	371

Robust z statistics in brackets

One-Tailed Tests: * at 5%; ** at 2.5%; *** at 1%

FIGURES

Figure 1

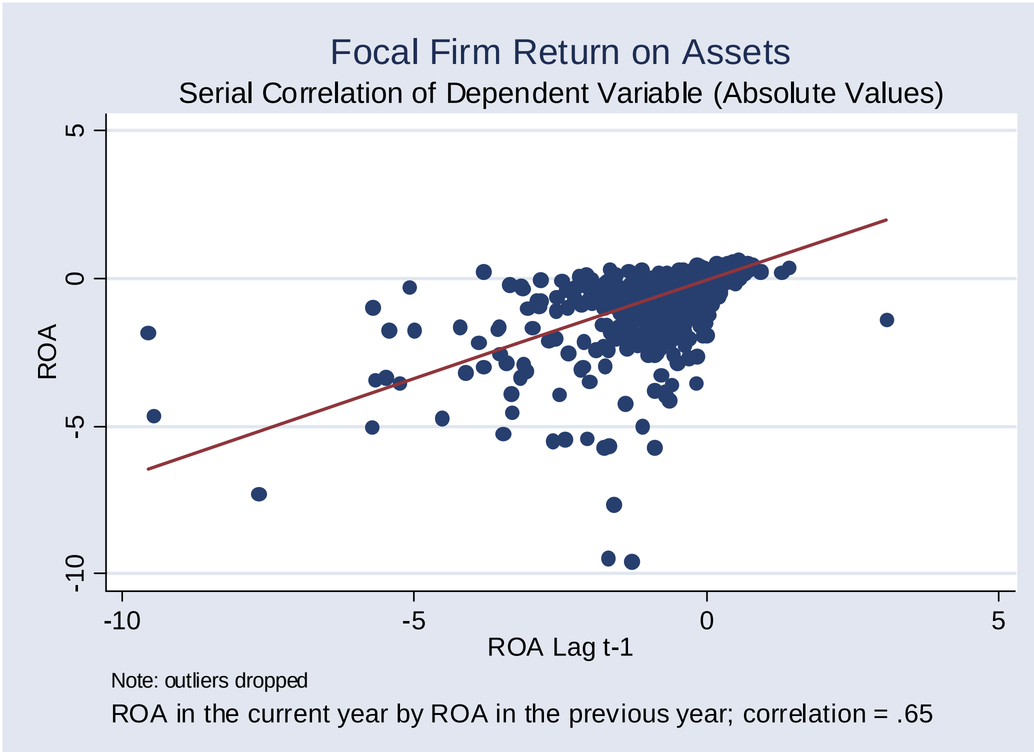


Figure 2

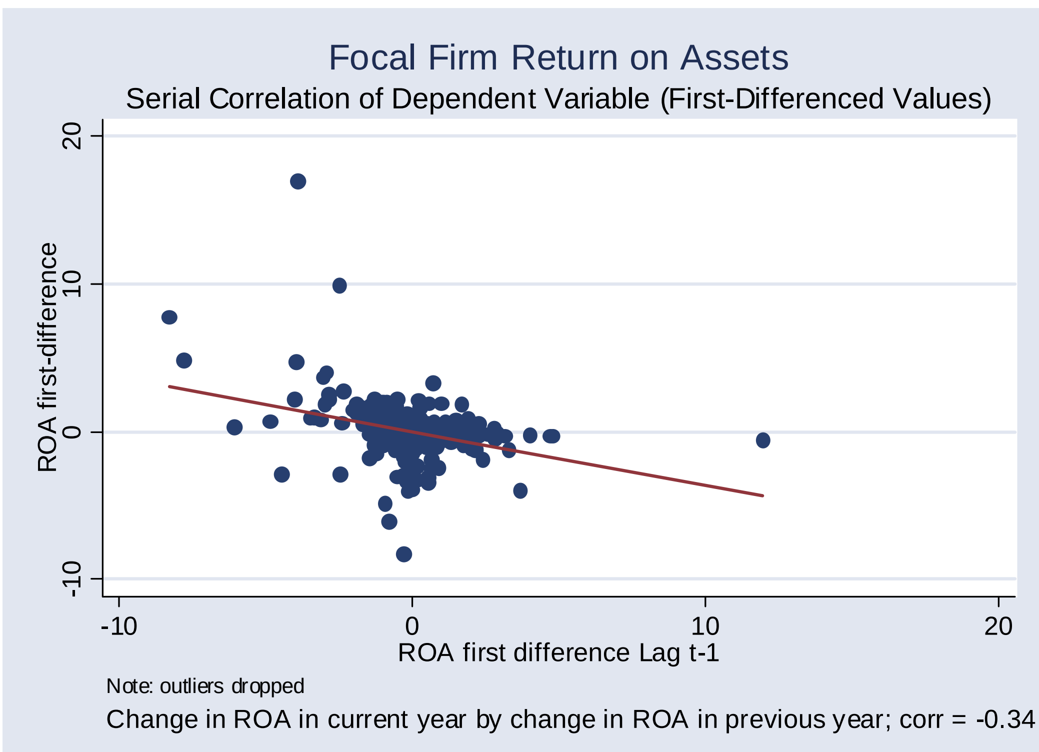


Figure 3

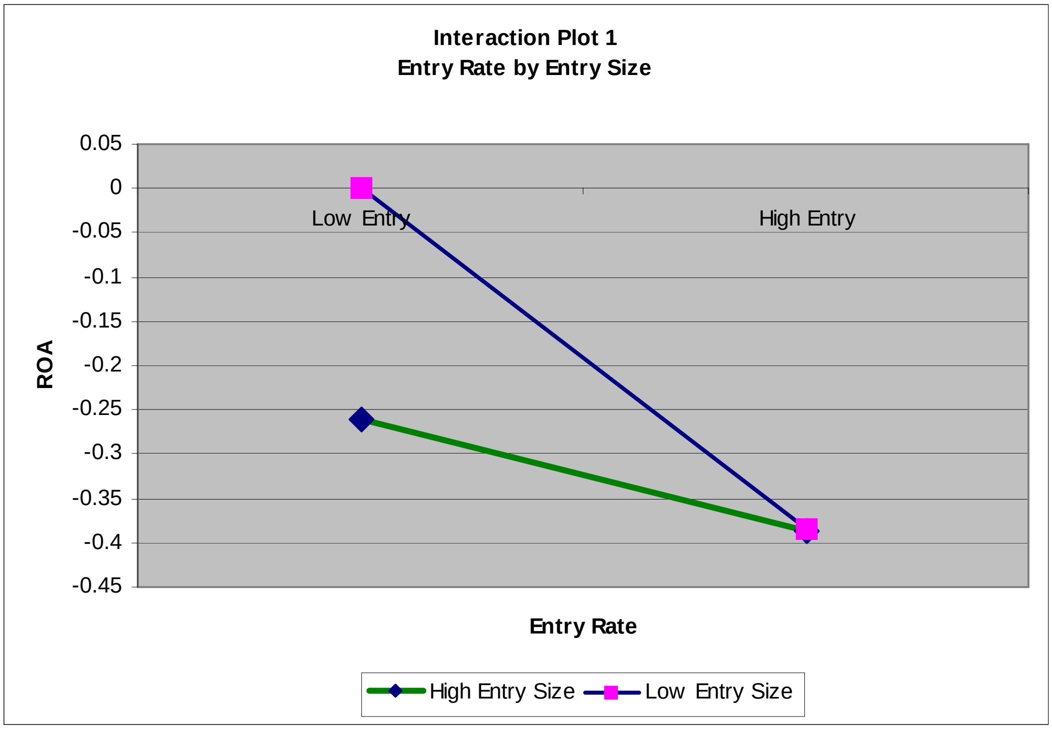
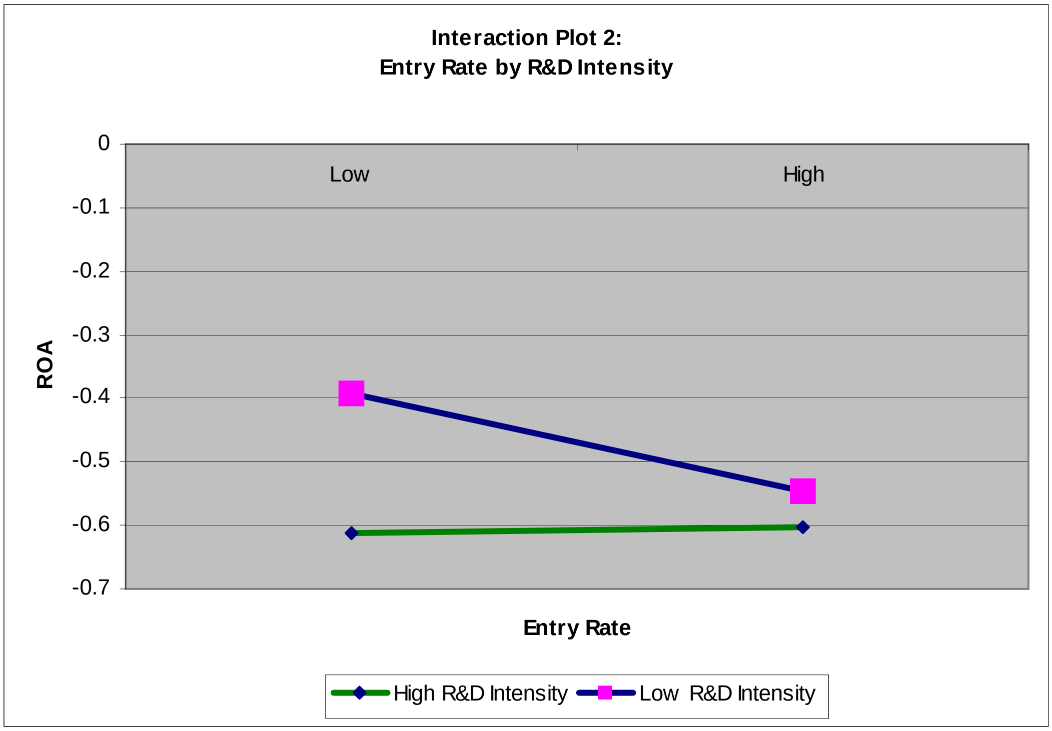


Figure 4



APPENDIX 1

Dependent Variable

Theoretical Construct	Variable	Interpretation	Calculation	Comments / Data Sources
Firm Performance	Return on Assets	Focal firm (i) operating income in year (t) from each dollar of assets held by the firm.	$ROA_{it} = \frac{Operating\ Income_{it}}{Total\ Assets_{it}}$	In current dollars (millions). ROA is widely considered the most appropriate measure of firm performance. Compustat

Independent Variables of Interest

Theoretical Construct	*Variable*	*Interpretation*	*Calculation*	*Comments / Data Sources*
Technological Capabilities	R&D Intensity	Focal firm (i) R&D expenditures in year (t) per dollar of total sales in year (t-1).	$R_{it} = \frac{R\&D\ Expenditures_{it}}{Sales_{i,t-1}}$	In current dollars (millions). Sales variable (i.e., denominator) lagged one year since R&D funds are typically budgeted in the previous year. Compustat
Local Entry Rate	Local Entry Rate	All single and multi-establishment births in year (t) within 75 miles (r) of focal firm (i) divided by all establishments in the prior year (t-1) with 75 miles of the focal firm's (i).	$E_{itr} = \frac{\left(\sum Est.Births_{itr}\right)}{\sum No.ofEstablishments_{i,t-1,r}}$	Expressed as a proportion. US Census
Local Entry Size	Local Entry Size	The number of persons employed by new establishments (births) within 75 miles (r) of the focal firm (i) divided by the number of establishment births within 75 miles of the focal firm (i).	$ES_{itr} = \frac{\sum Est.Births\ Employees_{itr}}{\sum Est.Births_{itr}}$	Captures the average size in persons of the establishment births in the current year. US Census

Control Variables

Theoretical Construct	*Variable*	*Interpretation*	*Calculation*	*Comments / Data Sources*
Control Variables	Advertising Intensity	Focal firm (i) advertising expenditures in the current period (t) as a proportion of the firm's total sales.	$Adv_{it} = \frac{AdversistingExpenditures_{it}}{Sales_{it}}$	In current dollars (millions). Compustat
	Localization	The count of all establishments in the prior year (t-1) within 75 miles (r) of the focal firm's (i) location.	$L_{itr} = \left(\sum Establishments_{i,t-1,r}\right)$	US Census
	Agglomeration Density	The number of persons employed by new establishments (births) within 75 miles of the focal firm's (i) location divided by the number of establishment births within 75 miles of the focal firm's (i) location.	$D_{itr} = \frac{\sum No.ofEstablishments_{itr}}{SquareMiles_{itr}}$	US Census.
	Establishment Size	The number of persons employed by existing establishments within 75 miles of the focal firm's (i) location divided by the number of establishment births within 75 miles of the focal firm's (i) location.	$LS_{itr} = \frac{\sum EstablishmentEmployees_{itr}}{\sum No.ofEstablishments_{itr}}$	US Census.

APPENDIX 2

Spatial Weights Matrix

In the dynamic time-space model, the spatial lag, Wy, characterizes spatial dependence in the dependent variable, y, where φ is the spatial correlation coefficient to be estimated and W is the "spatial weights matrix" that defines the set of neighbors, *j*, in proximity to the focal firm (LeSage, 1999). The specification of a spatial weights matrix is somewhat arbitrary as there are no formal guidelines to guide the choice of the "correct" criteria for defining the focal firm's neighbors (Anselin, 2002; Anselin & Bera, 1998). As a result, I assume the neighborhood set includes those firms within 150 miles of the focal firm's location. This distance is twice the distance assumed for the effect of local entry because an entrant located halfway between two focal firms at such a distance will affect both uniformly; the distance is also consistent with evidence provided by Anselin, Varga, and Acs (1997).

Spatial Lag Estimation

Armed with the spatial weights matrix, the spatial lag variable, Wy_{ij}, is the average return on assets for all the focal firms, *j*, within 150 miles of the focal firm, *i*. The variable captures, and controls for, the spatial correlation, over and above the serial correlation, in the dependent variable. It should be noted that the spatial lag variable in the dynamic time-space model is also lagged temporally by one period (t-1). This is done to reflect the idea that the influence of one firm's performance on the neighboring firm's performance takes time (at least one year) to be transmitted. This specification also resolves yet another statistical complication: when the spatial lag is estimated in the contemporaneous period (t), the Arellano-Bond estimator does not take into account a key restricting condition on the value of the spatial correlation (φ), which is then overestimated. When the spatial lag is lagged temporally by one period, this restricting condition disappears and the resulting estimates are unbiased. (Anselin, 2001).