



## DOES AGGLOMERATION MATTER EVERYWHERE?: NEW FIRM LOCATION DECISIONS IN RURAL AND URBAN MARKETS\*

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**ABSTRACT.** We test whether commonly used measures of agglomeration economies encourage new firm entry in both urban and rural markets. Using new firm location decisions in Iowa and North Carolina, we find that measured agglomeration economies increase the probability of new firm entry in both urban and rural areas. Firms are more likely to locate in markets with an existing cluster of firms in the same industry, with greater concentrations of upstream suppliers or downstream customers, and with a larger proportion of college-educated workers in the local labor supply. Firms are less likely to enter markets with no incumbent firms in the sector or where production is concentrated in relatively few sectors. The same factors encourage both stand-alone start-ups and establishments built by multiplant firms. Commuting decisions exhibit the same pattern as new firm entry with workers commuting from low to high agglomeration markets. Because agglomeration economies are important for rural firm entry also, policies encouraging new firm entry should focus on relatively few job centers rather than encouraging new firm entry in every small town.

### 1. INTRODUCTION

Agglomeration economies are commonly cited as a reason for the growth of cities.<sup>1</sup> New firms are attracted by the possibility of lower production costs or enhanced revenue streams made possible by locating close to customers or other firms. However, studies differ as to the source of these positive externalities.<sup>2</sup> Some agglomeration economies are related to availability of or proximity to production input factors and buyers. Being close to upstream input suppliers or downstream customers lowers transportation costs and may improve information flows between producers and consumers (Jofre-Monseny, Marín-Lopez, and Viladecans-Marsal, 2011; Ellison, Glaeser, and Kerr, 2010). Large

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<sup>1</sup>For reviews on agglomeration economies, see Duranton and Puga (2014), Puga (2010), Glaeser and Gottlieb (2009), and Rosenthal and Strange (2004).

<sup>2</sup>Duranton and Puga (2004) explain agglomeration economies using three mechanisms: sharing, matching, and learning. Firms can receive benefits from sharing facilities and infrastructures, input suppliers and a labor pool. Firms and workers, and buyers and sellers can have better matching in a larger market. New technologies and business practices can be developed and diffused faster in a larger market. The intensity and composition of production activity influences the mechanisms.

concentrations of educated workers may hasten adaptation of new ideas and lower the costs of labor turnover (Shapiro, 2006; Moretti, 2004). Having a cluster of similar firms may hasten innovation and improve firm productivity because firms can learn from one another or because they can share a larger specialized labor pool (Porter, 2003). Having a highly diversified mixture of firms may improve cross-fertilization of ideas across different firms (Glaeser et al., 1992; Feldman and Audretsch, 1999). Local monopoly allows firms to grow much larger which may enable them to exploit the rents from new innovation without risk that the returns will be lost to competitors (Marshall, 1920).

Most previous studies of agglomeration have focused on growth occurring in cities. By definition, rural areas lack agglomeration and so they would seem to lack these productive advantages that benefit firms in cities. Yet rural areas are diverse, and there is a continuum of sizes along which agglomeration economies may operate. We investigate whether the positive effect of concentrations of economic activity exist in places that are smaller than what we commonly identify as urban. Furthermore, we investigate whether local factors related to agglomeration economies might have different signs or magnitudes of impacts between urban and rural areas.<sup>3</sup> For example, proximity to input suppliers might be more important in rural areas than in urban areas because of the costs of transporting raw materials relative to finished goods (Kilkenny, 1998). Rural firms may be less concerned with the availability of educated workers if they are more concentrated in less-skilled and less technology-oriented industries such as retail or personal services compared to urban firms (Renski and Wallace, 2012).

We use a data set on the location decisions of new firms in Iowa and North Carolina to examine how local agglomeration economies influence firm start-ups, and whether agglomeration economies have different effects on the location choices of rural and urban start-ups. If agglomeration generates productivity or cost advantages to firms in a local market, they should have the greatest influence on firms at the time of entry. Because a new venture can open anywhere in principle, firms will assess the value of local agglomeration and other market factors as they decide where to locate. It is costly to relocate once the entry occurs, and so aggregate growth measures that are heavily weighted toward incumbent firms such as local employment or local output growth will reflect past levels of market factors that may no longer apply.

Another advantage to our use of new firm entry as a measure of market response to agglomeration is that local market factors are pre-determined and outside the control of nascent firms. This reduces the problem of reverse causality between agglomeration measures and more commonly used measures of economic performance such as growth in the numbers of firms or workers. For example, there may be a positive correlation between the number of firms and the proportion of college-educated workers due to the mobility of educated workers rather than spillover productivity effects from a concentration of educated workers. However, the entry of one new firm will not alter the concentration of educated workers in the labor market, but a new firm will enter a market with more college-educated workers if the firm can benefit from the spillover productivity benefits. If educated workers do not have spillover effects, new firms would not react to the current distribution of educated workers.<sup>4</sup>

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<sup>3</sup>Rural firms have different characteristics compared to urban firms. See Renski and Wallace (2012) for simple rural–urban comparison of new firms. Differences are found in terms of industries that new firms enter, employment growth within four years after their opening, types of their major clients and education level of owners. Also, see Renski (2008) for a rural–urban comparison of new firm entry, survival, and growth. See Yu, Orazem, and Jolly (2011) for rural–urban comparison of firm longevity.

<sup>4</sup>Jofre-Monseny et al. (2011) and Rosenthal and Strange (2003) advanced similar arguments to justify their focus on new firm location decisions.

We investigate the effect of six measures of agglomeration on firm incentives to locate in an urban or rural market: the number of incumbent firms in the industry; the absence of any incumbent firms in the industry; the degree of industrial diversity; proximity to upstream firms; proximity to downstream firms; and the proportion of college-educated in the adult population. Our results indicate that the same agglomeration measures that have been associated with urban economic growth are important for rural firm entry as well. The pattern holds for both all firms and manufacturing firms, and for both stand-alone ventures and multiplant firms looking to expand into new markets. The pattern holds for rural firm entry regardless of whether the area is adjacent to or distant from an urban area. Commuters are attracted to the same agglomeration factors that attract new firm start-ups. As a result, even in rural areas, production would be predicted to concentrate increasingly in relatively few locations with workers commuting from the surrounding communities that lack the ability to offer sufficient agglomeration economies.

This paper is organized as follows. In the next section, we review the few studies using a rural–urban comparison to examine agglomeration economies, and discuss different theories in local agglomeration economies. In Sections 3 and 4, we explain our empirical strategy and define our agglomeration measures. In Sections 5 and 6, we provide estimation results and conduct robustness checks of our results using an employment-based analysis. Lastly, we test the role of agglomeration economies in commuting and discuss the policy implications of our results.

## 2. LITERATURE REVIEW

While scholars generally agree on the existence of productive spillovers in cities, they disagree on which local attributes are critical to the existence of the externalities. We focus on six local attributes that have figured prominently in the literature: clusters of similar firms, the ability to exert monopoly power, industrial diversity, proximity to upstream and downstream firms, and concentrations of educated workers.

Marshall (1920) argued that there is an advantage for firms in the same industry to locate near one another because workers and firms learn from each other and the learning helps them develop new ideas.<sup>5</sup> Specialization in a given type of production allows firms to share in a pool of workers with similar skills and saves transportation cost of materials. In addition, new firms will enter as upstream suppliers of inputs for the cluster of firms in the industry.

Marshall also argued that larger firms have advantages over a larger number of small firms because of returns to scale in innovation and because firms can better internalize the returns to their innovation.<sup>6</sup> A single large firm might be most able to capitalize on

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<sup>5</sup>“When an industry has thus chosen a locality for itself, it is likely to stay there long: so great are the advantages which people following the same skilled trade get from near neighbourhood to one another. The mysteries of the trade become no mysteries; but are as it were in the air, and children learn many of them unconsciously. Good work is rightly appreciated, inventions and improvements in machinery, in processes and the general organization of the business have their merits promptly discussed: if one man starts a new idea, it is taken up by others and combined with suggestions of their own; and thus it becomes the source of further new ideas. And presently subsidiary trades grow up in the neighbourhood, supplying it with implements and materials, organizing its traffic, and in many ways conducing to the economy of its material.” (Marshall, 1920, p. 271)

<sup>6</sup>As an example of how larger firms have greater innovation capacity, Marshall states that “[in the pottery trade, a small manufacturer] cannot afford even to make experiments with new patterns and designs except in a very tentative way.” (Marshall, 1920, p. 281)

their innovations, although that would presumably limit the spillovers to other firms.<sup>7</sup> Schumpeter (1942) extended this line of reasoning and argued that firms have no incentive to enter perfectly competitive markets because they will not be able to exploit the full advantages of their innovations.<sup>8</sup>

Porter (1990) followed Marshall in arguing that clusters of similar specialized firms increases the productivity of all the firms through knowledge spillovers. However, he expanded on Marshall to include other firms in the industry as well as upstream suppliers and downstream customers in the cluster. Interaction and information flows across firms within a cluster promote technological innovation.<sup>9</sup> Helsley and Strange (2002) also support importance of various input suppliers. In contrast to Marshall (1920) and Schumpeter (1942), Porter argued that competition helps technological innovation because competitive pressure makes firms adopt and develop new technology to survive.

Jacobs (1969) believed that technology innovation came from industrial diversity rather than industrial specialization. She suggested that seemingly unrelated ideas can provide breakthroughs to achieve technological innovation.<sup>10</sup> Following Jacobs, Lucas (1988) also emphasized the role of interactions between people as the rationale for cities. However, Lucas emphasized that it was concentrations of skilled people that were particularly important for the generation of a human capital externality. Productive interactions between educated people make each of them more productive than they would be in isolation. These externalities counteract the natural tendency of cities to fly apart because concentrations of economic activity bid up the costs of land, labor, and other factors of production.

The empirical research investigating the effects of agglomeration is mixed. The earliest study to examine the relative strength of these hypotheses empirically was Glaeser et al. (1992). They found that industrial diversity and local competition improve employment growth in cities. Rosenthal and Strange (2003) also found positive impacts of diversity and local competition on new firm entry. In contrast to the employment-based analysis in Glaeser et al. (1992), Cingano and Schivardi (2004) found that firm-level productivity was improved by specialization, but not by diversity and local competition.<sup>11</sup> Other studies have found that industrial clusters (specialization) foster more entrepreneurship and lead to higher employment growth (Porter, 2003; Delgado et al., 2010) and higher wages (Wheaton and Lewis, 2002). However, De Blasio and Addario (2005) did not find higher wages in clusters and Duranton (2011) found only modest sized cluster effects. Henderson, Kuncoro, and Turner (1995) found that specialization is important for mature manufacturing industries while industrial diversity is important for high-tech manufacturing industries.

<sup>7</sup>“[A multitude of comparatively small rival producers] could not afford to spend as much on improving methods of production and the machinery used in it, as a single large firm which knew that it was certain itself to reap the whole benefit of any advance it made.” (Marshall, 1920, p.484). Arrow (1962) and Romer (1986) also view competition as bad for innovation because innovators cannot be compensated for the spillovers from their innovations fully.

<sup>8</sup>“But perfectly free entry into a new field may make it impossible to enter it at all. The introduction of new methods of production and new commodities is hardly conceivable with perfect—and perfectly prompt—competition from the start.” (Schumpeter, 1942, pp. 104–105)

<sup>9</sup>“Once a cluster forms, the whole group of industries becomes mutually supporting. Benefits flow forward, backward, and horizontally. [...] Interconnections within the cluster, often unanticipated, lead to the perception of new ways of competing and entirely new opportunities.” (Porter, 1990, p. 151)

<sup>10</sup>“The greater the sheer numbers and varieties of divisions of labor already achieved in an economy, the greater the economy’s inherent capacity for adding still more kinds of goods and services.” (Jacobs, 1969, p. 57)

<sup>11</sup>Their replication of the employment analysis was consistent with Glaeser et al.

In line with Lucas (1988), Rauch (1993), and Moretti (2004) found empirical evidence that a concentration of college graduates improves productivity of all firms in the market. The external productivity spillovers are larger when the concentration of educated workers is largest in technologically similar firms, in firms that cite similar patents, and in firms that are upstream suppliers or downstream customers. Winters (2013) and Shapiro (2006) also found that the probability of being employed and local employment growth were higher in areas with relatively large concentrations of skilled workers, respectively. Glaeser and Maré (2001) found that wages grow faster in cities, presumably due to faster human capital accumulation. As for upstream and downstream links, Jofre-Monseny et al. (2011), Ellison et al. (2010), and Glaeser and Kerr (2009) found evidence supporting the importance of upstream and downstream linkages. The estimated magnitude of agglomeration effects on productivity varies widely across studies depending on the context (Melo, Graham, and Noland, 2009).

While the bulk of the research on agglomeration effects has focused on cities, there are a number of existing studies that highlight the importance of agglomeration in rural areas. Given that rural firms have different characteristics than urban firms (Renski, 2008; Yu et al., 2010; Renski and Wallace, 2012), they may react to local agglomeration factors differently or not at all. To our knowledge, Gabe (2003) is the only study to compare rural and urban agglomeration economies, although he only studied responses to local specialization rather than a menu of agglomeration measures.

Rural places can experience agglomeration economies in two ways. Because the benefits of agglomeration attenuate with distance (Rosenthal and Strange, 2003, 2008), remote rural communities would need to experience agglomeration due to sufficient intensity in a sector to affect local economic performance. Research has shown that rural industry clusters increase employment (Henry and Drabenstott, 1996) and local wages (Gibbs and Bernat, 1997). Barkley, Henry, and Kim (1999) showed that larger firm clusters in an industry lead to faster employment growth for growing industries in non-metropolitan areas. Gabe (2005) found that greater specialization in a rural firm's own industry increased its capital investment, but the effect is relatively modest.<sup>12</sup>

On the other hand, agglomeration economies can spill over to surrounding areas so that rural areas can access urban agglomeration benefits through commuting (Partridge, Ali, and Olfert, 2010). For this reason, positive impacts of urban agglomeration are found in rural areas within a commuting distance of cities (Barkley et al., 1996; Partridge et al., 2007, 2008). In principle, urban agglomeration can have positive or negative impacts on rural areas depending on commuting and migration flows, and the relocation of firms (Renkow and Hoover, 2000; Wu and Gopinath, 2008). For example, if urban residents move to adjacent rural towns and commute to urban areas, rural towns may experience spread: positive economic impacts from urban agglomeration. If instead of commuting, rural residents move to the urban center, agglomeration would result in backwash, causing rural communities to decline.

Establishment location decisions may respond differently to local agglomeration if the plant is part of a multiplant firm rather than a stand-alone firm. For example, a multiplant firm may be less sensitive to local upstream suppliers or downstream customers if the plant is part of an integrated but geographically dispersed supply chain. Previous research has found that stand-alone start-ups are more sensitive to local agglomeration factors such as industrial diversity (Glaeser et al., 2010), sectoral firm clusters (Henderson, 2003), and

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<sup>12</sup>Naturally occurring clusters attract new firm entry presumably because of some underlying local competitive advantage. This is different than trying to create industry clusters as a result of sector-specific government policies. We agree with an anonymous referee that the empirical evidence on the success of government fostering of clusters is decidedly mixed (Feser, Renski, and Goldstein, 2008; Duranton, 2011).

the available supply of educated workers (Barkley and Keith, 1991). None of these studies compared the impact of agglomeration economies on stand-alone versus expansion start-ups across rural and urban locations.

### 3. MODEL

We want to examine the possible effects of agglomeration on firm decisions on where to locate. To that end, we sketch an empirically tractable model in which an entrepreneur decides where to locate a new establishment, given information on the nature of the business and its anticipated profitability across all possible locations. To begin, assume that the firm has  $C$  possible markets in which to locate ( $c = 1, \dots, C$ ). We assume these markets follow county boundaries. Each market has up to  $K$  sectors ( $k = 1, \dots, K$ ). Note that the absence of a sector represents a potential entry opportunity for a monopolist.

Price-taking firms maximize their profit in two stages. In the first stage, firm  $i$  in sector  $k$  computes its expected profit in each market  $c$ . Given those computations, the firm chooses the location with maximum profit ( $\pi_{ik}^*$ ) in the second stage.<sup>13</sup> Expected profit is given by:

$$(1) \quad \pi_{ik}^* \equiv \text{Max}_c \pi(\mathbf{m}_{\mathbf{k}c}, \mathbf{z}_c, p_k, w_c, r_c).$$

The vector of local agglomeration measures,  $\mathbf{m}_{\mathbf{k}c}$ , affects expected profit in county  $c$  by altering anticipated production costs. The vector of control variables,  $\mathbf{z}_c$ , includes local demand shifters amenities, fiscal policy, and dummy variables for county characteristics and state. Local demand shifters and fiscal policy influence production quantity and firm profit. Amenities influence firm profit through local wages. The dummy variables reflect common unobservable effects for all firm entrants in a county group and the state in which county  $c$  is located. Firm profit ( $\pi$ ) increases in the sector-specific market price,  $p_k$ , which we assume is equal across areas, and decreases in local wages ( $w_c$ ) and capital rents ( $r_c$ ).

We define the vector of local agglomeration measures ( $\mathbf{m}_{\mathbf{k}c}$ ) to include measures based on the conceptual and empirical studies reviewed in the previous section:

$$(2) \quad \mathbf{m}_{\mathbf{k}c} \equiv [CLU_{kc}, MON_{kc}, CON_c, UP_{kc}, DOWN_{kc}, EDU_c].$$

The variables represent cluster specialization in the sector ( $CLU_{kc}$ ); the absence of any firms in the sector which would provide a local monopoly opportunity ( $MON_{kc}$ ); local industrial concentration ( $CON_c$ ); local access to upstream suppliers ( $UP_{kc}$ ) and downstream customers ( $DOWN_{kc}$ ) of firms in the sector; and the local availability of college-educated workers ( $EDU_c$ ).

The first attribute corresponds to Marshall's (1920) and Porter's (1990) emphasis that a concentration of firms specialized in a single industry improves productivity through shared knowledge and a shared pool of specialized labor. The second reflects the presumption that a single firm can internalize the local knowledge and innovate at a lower cost than can a large number of small firms, points emphasized by Marshall (1920), Arrow

<sup>13</sup>Our assumption of expected profit maximization may not be true. First, people may not compute expected profit correctly, and second, they may be maximizing expected utility, placing a big weight on the location at the expense of the profitability of the firm. However, the reduced form specification we use tests whether the theorized relationships between agglomeration and profit carry over to firm location choices. Our results are consistent with these well-established theories.

(1962), Romer (1986), and Schumpeter (1942).<sup>14</sup> The third reflects Jacobs' (1969) emphasis on a diverse mix of firms in contrast to the preference for specialization emphasized by Marshall and Porter. The fourth and fifth reflect upstream and downstream clusters that are mentioned prominently in Marshall, Porter, and Ellison et al. (2010). The last is related to Lucas's (1988) emphasis on shared pools of high quality labor.

We define the vector of control variables ( $\mathbf{z}_c$ ):

$$(3) \quad \mathbf{z}_c \equiv [INC_c, AMENITY_c, TAX_c, EXP_c, URB_c, R\_ADJ_c, R\_BIG_c, NC_c],$$

where  $INC_c$  is median household income in county  $c$  which indexes local demand for goods and services,  $AMENITY_c$  is an index of amenity values,  $TAX_c$  is the total tax revenue per capita, and  $EXP_c$  is total general direct government expenditures per capita. These amenity and policy-related variables have been considered in empirical studies analyzing local economic growth (e.g., Wu and Gopinath, 2008). We also use a series of dummy variables to indicate county size and state. Using the Rural–Urban Continuum Codes (RUCC) from Economic Research Service, U.S. Department of Agriculture,  $URB_c$  indicates the county is considered urban or metropolitan (RUCC = 0–3);  $R\_ADJ_c$  indicates the county is rural and adjacent to a metropolitan area (RUCC = 4, 6, 8);  $R\_BIG_c$  indicates the county is rural and has an urban population of 2,500 or more (RUCC = 4–7); and  $NC_c$  indicates the county is located in North Carolina.  $R\_ADJ_c$  addresses the access of rural counties to urban agglomeration economies because agglomeration economies attenuate with distance (Rosenthal and Strange, 2003, 2008).

We assume a spatial equilibrium where wages and capital costs are adjusted to agglomeration measures ( $\mathbf{m}_{kc}$ ) affecting firm productivity (Rosen, 1979; Roback, 1982). If markets are competitive, firms will expect to make zero economic profits in the long run in all areas. If the agglomeration level  $\mathbf{m}_{kc}$  changes over time, lower production costs and increase profits in sector  $k$  and county  $c$ , market  $kc$  will attract additional entry relative to other markets. Entering firms will bid up the input prices for labor and capital until expected profits from additional entry are reduced back to zero. That suggests that in the long run equilibrium, wages and rents will be represented as functions of  $\mathbf{m}_{kc}$ . As Shapiro (2006) shows, both local wages and local rents respond to local amenities and access to productive externalities.

We assume that the firm makes its decision based on the information available on market conditions in the year just prior to entry, so that expected profits are a function of agglomeration measures in year  $t - 1$ . The linear approximation to the reduced-form profit function of firm  $i$  in industry  $k$ , county  $c$  and year  $t$  is given by:

$$(4) \quad \pi_{ikct} \equiv \mathbf{m}'_{kct-1} \gamma_m + \mathbf{z}'_{ct-1} \gamma_z + \varepsilon_i + \varepsilon_k + \varepsilon_t + u_{ikct},$$

where the error terms  $\varepsilon_i$  and  $\varepsilon_k$  reflect common unobserved elements that influence profit for firm  $i$  across all locations and industry  $k$  profits across all firms. The temporal shock,  $\varepsilon_t$ , is a common shock to all firm entrants across all locations in year  $t$ . The last term  $u_{ikct}$  is a random shock to profits for firm  $i$  in county  $c$  that is assumed to be uncorrelated with all other factors.<sup>15</sup>

<sup>14</sup>Alternatively, the local monopoly variable may represent negative signal to new firms. In other words, no incumbent firms in the industry in the county may mean that the industry does not have advantage in the county.

<sup>15</sup>Our empirical approach has a possible identification issue from unobservable time-varying location-specific factors. For example, local government incentives might encourage firms in the same industry to be concentrated in one location. In this case, our specialization variable would be biased. We test this issue using different years (2003–2004) of new firm entry. We find consistent estimation results, which suggests

Each new firm entrant in year  $t$  chooses one of the potential  $C$  areas to enter, based on anticipated profitability. We define the dichotomous variable  $E_{ikct} = 1$  if the firm opts to enter area  $c$  in year  $t$  and  $E_{ikct} = 0$  otherwise.  $E_{ikct} = 1$  if  $\pi_{ikct} - \pi_{ikc't} \geq 0 \forall c' \neq c$ . From the specification for profit in equation (4), we have

$$(5) \quad E_{ikct} = 1 \text{ if } (\mathbf{m}'_{kct-1} - \mathbf{m}'_{kc't-1}) \gamma_m + (\mathbf{z}'_{ct-1} - \mathbf{z}'_{c't-1}) \gamma_z > \zeta_{ikct} \forall c' \neq c,$$

where  $\zeta_{ikct} \equiv u_{ikc't} - u_{ikct}$ . Note that the common firm-, sector-, and time-specific economic shocks  $\varepsilon_i$ ,  $\varepsilon_k$ , and  $\varepsilon_t$  are differenced away because they do not affect relative profitability across markets. That leaves the pure random error term,  $u_{ikct}$  which we assume follows the type-1 extreme distribution. We estimate equation (5) using the conditional logit estimator.<sup>16</sup>

#### 4. DATA

In our application, firms are selecting from  $C = 199$  possible county locations because Iowa has 99 counties and North Carolina has 100. Our sample is commercial establishments that entered a county in Iowa and North Carolina over three years (2000–2002). We chose the sample years to align with the availability of Census data. We restrict the sample to firms with a clear profit motive, excluding nonprofit organizations, government agencies, and firms with a public service emphasis such as museums or historical sites. We also remove firms in agriculture and mining. These firms cannot move freely across locations as their entry decision is affected by site-specific land or resource availability.<sup>17</sup> Our sample has 191,191 establishments; 68 percent of them are urban start-ups.

Establishment attributes such as location, industry and ownership are obtained from the National Establishment Time Series (NETS).<sup>18</sup> The database provides information on the universe of all establishments that opened for business in Iowa and North Carolina in 2000–2002. The database also includes DUNS (Data Universal Numbering System) numbers of establishments and of their headquarters or parent companies. If an own DUNS number is the same as that of a headquarters or a parent company, the establishment is considered a “stand-alone start-up.”<sup>19</sup> Otherwise, it is considered an “expansion start-up.” Urban (rural) expansion start-ups are about 8 percent (6 percent) of urban (rural) start-ups in the sample period. We use three-digit and four-digit North American Industry Classification System (NAICS) codes used in 1997 Standard Use Table from the

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that our main results are robust to unobservable time-varying location-specific factors. Estimates and elasticities are available upon request.

<sup>16</sup>We used STATA command “multin” in a package named “groupcl” to estimate the grouped conditional logit. See Guimaraes and Lindrooth (2007) for information on the estimator. ([http://www.stata.com/meeting/5nasug/NASUG\\_Guimaraes.pdf](http://www.stata.com/meeting/5nasug/NASUG_Guimaraes.pdf), accessed on June 19, 2014).

<sup>17</sup>The following industries are excluded: Agriculture (two-digit NAICS: 11), Mining (21), Postal Service (three-digit NAICS 491), Monetary Authorities-Central Bank (521), Nursing and Residential Care Facilities (623), Social Assistance (624), Museums, Historical Sites, and Similar Institutions (712), Religious, Grant-making, Civic, Professional and Similar Organizations (813), Private Households (814), and Public Administration (92).

<sup>18</sup>See Kunkle (2011) for advantages of NETS database compared to public data such as Quarterly Census of Employment and Wages (QCEW). (<http://exceptionalgrowth.org/insights/NETSvsES-202.pdf>, accessed on July 2, 2014). Differently from public data based on unemployment insurance filing, NETS data include very small establishments such as sole proprietors. Excluding establishments having less than three employees does not change our main findings. Estimates and elasticities are available upon request.

<sup>19</sup>According to personal communication with Walls & Associates who compile the NETS data, the criterion holds except in rare cases.



Bureau of Economic Analysis to define industries. The total number of industries is  $K = 112$ .

Our agglomeration measures include four that are industry-location-specific ( $CLU_{kc}$ ,  $MON_{kc}$ ,  $UP_{kc}$ , and  $DOWN_{kc}$ ) and two that are location-specific ( $CON_c$  and  $EDU_c$ ). Cluster specialization ( $CLU_{kc}$ ) is measured as the relative size of the proportion of establishments in industry  $k$  in county  $c$  to the proportion of establishments in industry  $k$  in Iowa and North Carolina:<sup>20</sup>

$$CLU_{kc} = \frac{\text{Establishments in } k, c}{\text{All establishments in } c} / \frac{\text{Establishments in } k \text{ in Iowa and North Carolina}}{\text{All establishments in Iowa and North Carolina}}.$$

The local monopoly index ( $MON_{kc}$ ) takes a value of 1 if county  $c$  has no incumbent firm in industry  $k$ , and 0 otherwise. Access to upstream ( $UP_{kc}$ ) or downstream ( $DOWN_{kc}$ ) firms measures the relative availability of suppliers and customers in industry  $k$  in county  $c$ . These measures are constructed with data on purchases and sales by industry from the 1997 Standard Use Table, Bureau of Economic Analysis.

$$UP_{kc} \equiv \sum_s \frac{N_{sc}}{N_s} \cdot \frac{\text{Input}_{s \rightarrow k}}{\text{Input}_k} \cdot 100 \quad \forall s \neq k,$$

where  $N_{sc}$  is the number of establishments in an upstream industry  $s$  in county  $c$ , and  $N_s$  is the number of establishments in industry  $s$  in Iowa and North Carolina. The second term is the proportion of input purchases made by firms in industry  $k$  from industry  $s$ .

Similarly, the proximity to downstream firms is

$$DOWN_{kc} \equiv \sum_s \frac{N_{sc}}{N_s} \cdot \frac{\text{Output}_{k \rightarrow s}}{\text{Output}_k} \cdot 100 \quad \forall s \neq k,$$

where  $N_{sc}$  is the number of establishments in a downstream industry  $s$  in county  $c$ , and  $N_s$  is the number of establishments in industry  $s$  in Iowa and North Carolina. The second term is the proportion of output purchases made by firms in industry  $s$  from industry  $k$ .

Industrial concentration ( $CON_c$ ) is constructed using wage bill data obtained from the Quarterly Census of Employment, Bureau of Labor Statistics. The data set has 10 broad industry categories. Industrial concentration is measured by a Herfindahl-Hirschman Index computed as the sum of squared wage bill shares of industries in a county. It ranges in values from 0 to 1, where values closer to one indicate greater industrial concentration.<sup>21</sup> The human capital concentration ( $EDU_c$ ) is measured by the proportion of residents over age 25 with at least a two-year college degree in county  $c$ . The local demand shifter ( $INC_c$ ) is measured by median household income in county  $c$ . Our education and income measures were compiled from the 2000 Census. The amenity index,  $AMENITY_c$ , was compiled by the the Economic Research Service at USDA (McGranahan, 1999). The total tax revenue per capita,  $TAX_c$ , and total general direct government expenditures per capita,  $EXP_c$ , are compiled from the 1997 Census of Governments.

Summary statistics on key variables are reported in Table 1. Levels of agglomeration differ significantly between rural and urban counties. Rural counties are twice as likely to have a monopoly opportunity in a sector. Urban counties have much greater density of upstream suppliers and downstream customers. Rural counties are more concentrated in relatively few industries and have lower proportions of college-educated workers.

<sup>20</sup>This is also known as a location quotient.

<sup>21</sup>Industrial concentration based on output shares would be the most appropriate. Due to data availability, we use wage bill shares instead of output shares.

TABLE 1: Summary Statistics of Key Variables in Iowa and North Carolina

	Urban County				Rural County			
	Mean	Std. Dev.	Min.	Max.	Mean	Std. Dev.	Min.	Max.
$CLU_{kc}$ : Location quotient in $k, c$	1.05	1.05	0.00	16.43	0.77	1.39	0.00	36.15
$MON_{kc}$ : No incumbent in $k, c$	0.17	0.37	0.00	1.00	0.40	0.49	0.00	1.00
$UP_{kc}$ : Proximity to upstream firms	1.27	1.79	0.02	15.93	0.21	0.24	0.00	7.24
$DOWN_{kc}$ : Proximity to downstream firms	1.11	1.51	0.00	15.76	0.21	0.26	0.00	8.66
$CON_c$ : Herfindahl Index in county $c$	0.22	0.07	0.14	0.50	0.24	0.08	0.14	0.58
$EDU_c$ : Share of population with 14+ years of schooling in $c$	0.28	0.10	0.13	0.57	0.22	0.05	0.14	0.52
$INC_c$ : Median household income in $c$	40.36	5.20	30.98	54.99	34.47	4.20	25.18	42.43
$AMENITY_c$ : Natural amenity scale in $c$	-0.45	1.41	-3.07	2.18	-1.31	2.02	-4.86	3.33
$TAX_c$ : Taxes per capita	1.09	0.63	0.5	3.63	0.87	0.31	0.42	2.37
$EXP_c$ : Government expenditure per capita	2.06	0.66	0.71	3.98	2.33	0.61	1.17	4.36
# of counties	45				154			

Notes: The first six variables are as of 2000.  $INC_c$  is as of 1999;  $TAX_c$  and  $EXP_c$  are 1997 values. These three variables are measured in thousands of dollars. In the estimation,  $INC_c$  is scaled to millions of dollars. Rural counties are statistically different from urban counties in terms of  $EXP_c$  and the other variables at the 5 percent and 1 percent significance level in the two-sample  $z$ -test, respectively.

TABLE 2: Location Choice of New Firms in Iowa and North Carolina Counties in 2000–2002

Dependent Var: Choice of County	(1)	(2)	(3)	(4)
$CLU_{kc}$	–	–	0.28 (<0.01) <sup>***</sup>	0.28 (<0.01) <sup>***</sup>
$MON_{kc}$	–	–	-0.65 (0.03) <sup>***</sup>	-0.64 (0.03) <sup>***</sup>
$UP_{kc}$	–	–	0.15 (<0.01) <sup>***</sup>	0.13 (<0.01) <sup>***</sup>
$DOWN_{kc}$	–	–	0.05 (<0.01) <sup>***</sup>	0.05 (<0.01) <sup>***</sup>
$CON_c$	–	–	-1.31 (0.04) <sup>***</sup>	-1.23 (0.04) <sup>***</sup>
$EDU_c$	–	–	2.31 (0.03) <sup>***</sup>	2.40 (0.03) <sup>***</sup>
$INC_c$	116.37 (0.41) <sup>***</sup>	109.12 (0.45) <sup>***</sup>	18.58 (0.65) <sup>***</sup>	25.84 (0.71) <sup>***</sup>
$AMENITY_c$	–	0.05 (<0.01) <sup>***</sup>	–	0.02 (<0.01) <sup>***</sup>
$TAX_c$	–	0.09 (0.01) <sup>***</sup>	–	-0.22 (0.01) <sup>***</sup>
$EXP_c$	–	0.43 (0.01) <sup>***</sup>	–	0.27 (0.01) <sup>***</sup>
Log likelihood	-885,440.67	-873,779.10	-856,743.59	-856,190.59
# of est. / # of counties	191,191 / 199			

Notes: Estimates are based on the conditional logit estimation. Standard errors are in parentheses. \*\*\* significant at 1 percent, \*\* significant at 5 percent, \* significant at 10 percent. Estimates for control variables ( $URB_c, R\_ADJ_c, R\_BIG_c,$  and  $NC_c$ ) are not reported.

## 5. RESULTS

Table 2 illustrates the relative importance of agglomeration versus amenities and fiscal policy on new firm location decisions. The estimation results for the new firm entry (Equation 5) are reported in column (4). All factors are highly significant, due at least in part to the huge sample size. The most immediate way to assess the relative importance of agglomeration measures is to show how the log likelihood changes as these variables are deleted from the full model in column (4) compared to other exclusion restrictions. When the amenities and fiscal policies are removed, the log likelihood decreases by 0.06 percent (or 0.02 per measure) between columns (3) and (4), while the log likelihood falls by

2 percent (or 0.33 per measure) between columns (2) and (4) when the agglomeration measures are excluded. This suggests that the agglomeration measures are more important for new firm location decisions.

Referring to column (4), new firms are more likely to enter markets with existing firm clusters in the same industry and with better access to upstream and downstream firms and to educated workers. The opportunity for local monopoly lowers the probability of firm entry, as does greater industrial concentration. Firms are also more likely to locate in counties with higher per capita incomes, with higher amenity index values, higher government expenditures and lower taxes per capita.<sup>22</sup>

Table 3 shows how the agglomeration effects vary by market. The first three columns show the estimates for all industries. Column (1) provides estimates based on Equation (5), replicating results for column (4) in Table 2. Column (2) allows the agglomeration effects to vary between rural and urban markets using interaction terms between urban counties ( $URB_c$ ) and agglomeration measures. Column (3) further distinguishes the agglomeration effects between remote rural counties and rural counties adjacent to urban counties ( $R\_ADJ_c$ ). The direction of the effects of the agglomeration measures is consistent across rural and urban counties, although the magnitudes differ (columns (2) and (3)). In columns (4)–(6), we replicate the analysis limiting the sample to manufacturing firms in order to compare our findings with other studies that focused on manufacturing.<sup>23</sup> The results for manufacturing entrants are consistent with the overall sample.

We gain additional insights by converting these estimates into elasticities. Table 4a shows more clearly the relative magnitudes of the effects across urban, rural adjacent, and remote rural counties. Even though there are significant differences in magnitudes of effects across urban and rural markets, the differences are rarely economically important. Agglomeration measures matter in both markets and they matter similarly. This result is consistent with Gabe (2003) who finds that industry location quotients have positive effects on business openings in metropolitan, and both adjacent and nonadjacent nonmetropolitan counties in Maine. In fact, the only large difference is that rural firm entry is much more sensitive to the presence of upstream suppliers, and this is true for both adjacent and remote rural counties.

Among the agglomeration measures, new firm entry is most responsive to access to upstream firms, particularly in rural markets. Proximity to downstream customers also has a significant but smaller positive influence on new firm entry and again the effect is larger in rural markets. Our finding that firms are attracted by close proximity to upstream suppliers and downstream customers was first suggested by Marshall (1920) and is consistent with more recent conclusions regarding urban economic growth advanced by Helsley and Strange (2002), Glaeser and Kerr (2009), and Ellison et al. (2010) for urban markets. Skilled labor ( $EDU_c$ ) has the second largest positive impact on firm entry overall, and is the most important factor for manufacturing firms, a result consistent with the models of Romer (1986) and Lucas (1988), and with empirical findings reported by Moretti (2004). Consistent with Porter (1990), clusters of local firms in the same industry attract start-ups, while the chance for local monopoly power does not attract firms. Consistent with Jacobs (1969), firms are attracted by a more diverse mix of firms. However, the presence of a monopoly deters entry, suggesting that the benefits from captured rents from

<sup>22</sup>Note that counties can raise government expenditures without raising commensurate taxes because of transfers from the federal and state levels.

<sup>23</sup>When we limit the sample to manufacturing firms, we exclude three counties from the choice set because they had no manufacturing entrants during the sample period,  $C = 196$ .

TABLE 3: Location Choice of New Firms in Iowa and North Carolina Counties in 2000–2002

Dependent Var: Choice of county	All Industries						Manufacturing							
	(1)	(2)	(3)	(4)	(5)	(6)	(1)	(2)	(3)	(4)	(5)	(6)		
<i>CLU<sub>kc</sub></i>	0.28	(<0.01)***	0.23	(<0.01)***	0.20	(0.01)***	0.18	(0.01)***	0.14	(0.01)***	0.14	(0.01)***	0.11	(0.01)***
<i>MON<sub>kc</sub></i>	-0.64	(0.03)**	-0.38	(0.04)***	-0.40	(0.05)***	-0.42	(0.05)***	-0.29	(0.06)***	-0.29	(0.06)***	-0.25	(0.08)**
<i>UP<sub>kc</sub></i>	0.13	(<0.01)***	1.30	(0.02)***	1.65	(0.04)***	0.08	(0.01)***	0.77	(0.05)***	0.77	(0.05)***	0.58	(0.10)***
<i>DOWN<sub>kc</sub></i>	0.05	(<0.01)***	0.29	(0.01)***	0.51	(0.02)***	0.20	(0.01)***	0.34	(0.03)***	0.34	(0.03)***	0.91	(0.10)***
<i>CON<sub>c</sub></i>	-1.23	(0.04)***	-0.32	(0.06)***	-0.66	(0.10)***	-1.42	(0.22)***	-0.68	(0.30)***	-0.68	(0.30)***	-1.03	(0.51)**
<i>EDU<sub>c</sub></i>	2.40	(0.03)***	1.48	(0.07)***	2.16	(0.14)***	1.92	(0.18)***	2.60	(0.35)***	2.60	(0.35)***	3.28	(0.67)***
<i>URB<sub>c</sub> x <i>CLU<sub>kc</sub></i></i>	-	-	0.15	(0.01)***	0.18	(0.01)***	-	-	0.10	(0.01)***	0.10	(0.01)***	0.13	(0.02)***
<i>URB<sub>c</sub> x <i>MON<sub>kc</sub></i></i>	-	-	-0.05	(0.09)	-0.02	(0.09)	-	-	-0.20	(0.11)*	-0.20	(0.11)*	-0.22	(0.13)*
<i>URB<sub>c</sub> x <i>UP<sub>kc</sub></i></i>	-	-	-1.15	(0.02)***	-1.49	(0.04)***	-	-	-0.68	(0.05)***	-0.68	(0.05)***	-0.49	(0.10)***
<i>URB<sub>c</sub> x <i>DOWN<sub>kc</sub></i></i>	-	-	-0.25	(0.01)***	-0.46	(0.02)***	-	-	-0.15	(0.03)***	-0.15	(0.03)***	-0.72	(0.10)***
<i>URB<sub>c</sub> x <i>CON<sub>c</sub></i></i>	-	-	-2.49	(0.09)***	-2.11	(0.13)***	-	-	-1.65	(0.45)***	-1.65	(0.45)***	-1.24	(0.62)**
<i>URB<sub>c</sub> x <i>EDU<sub>c</sub></i></i>	-	-	0.40	(0.08)***	-0.25	(0.14)*	-	-	-0.87	(0.37)**	-0.87	(0.37)**	-1.50	(0.68)**
<i>R<sub>c</sub> x <i>ADJ<sub>c</sub></i> x <i>CLU<sub>kc</sub></i></i>	-	-	-	-	0.07	(0.01)***	-	-	-	-	-	-	0.06	(0.02)***
<i>R<sub>c</sub> x <i>ADJ<sub>c</sub></i> x <i>MON<sub>kc</sub></i></i>	-	-	-	-	0.07	(0.07)	-	-	-	-	-	-	-0.01	(0.12)**
<i>R<sub>c</sub> x <i>ADJ<sub>c</sub></i> x <i>UP<sub>kc</sub></i></i>	-	-	-	-	-0.37	(0.04)***	-	-	-	-	-	-	0.27	(0.11)**
<i>R<sub>c</sub> x <i>ADJ<sub>c</sub></i> x <i>DOWN<sub>kc</sub></i></i>	-	-	-	-	-0.24	(0.02)***	-	-	-	-	-	-	-0.61	(0.11)***
<i>R<sub>c</sub> x <i>ADJ<sub>c</sub></i> x <i>CON<sub>c</sub></i></i>	-	-	-	-	0.63	(0.13)***	-	-	-	-	-	-	0.64	(0.62)
<i>R<sub>c</sub> x <i>ADJ<sub>c</sub></i> x <i>EDU<sub>c</sub></i></i>	-	-	-	-	-1.08	(0.16)***	-	-	-	-	-	-	-1.01	(0.76)**
<i>INC<sub>c</sub></i>	25.84	(0.71)***	17.57	(0.72)***	17.56	(0.72)***	18.16	(3.48)***	18.85	(3.51)***	18.85	(3.51)***	18.42	(3.51)***
<i>AMENITY<sub>c</sub></i>	0.02	(<0.01)***	0.02	(<0.01)***	0.02	(<0.01)***	0.01	(0.01)***	<0.01	(0.01)***	<0.01	(0.01)***	>-0.01	(0.01)***
<i>TAX<sub>c</sub></i>	-0.22	(0.01)***	-0.23	(0.01)***	-0.27	(0.01)***	-0.15	(0.05)***	-0.18	(0.05)***	-0.18	(0.05)***	-0.22	(0.05)***
<i>EXP<sub>c</sub></i>	0.27	(0.01)***	0.24	(0.01)***	0.27	(0.01)***	0.14	(0.05)***	0.20	(0.05)***	0.20	(0.05)***	0.23	(0.05)***
Log likelihood	856,190.59		849,369.14		849,070.34		-34,300.41		-34,146.84		-34,146.84		-34,124.25	
# of est./# of counties			191,191/199						7,774/196					

Notes: Estimates are based on the conditional logit estimation. Standard errors are in parentheses. \*\*\* significant at 1 percent, \*\* significant at 5 percent, \* significant at 10 percent. Estimates for control variables (*URB<sub>c</sub>*, *R<sub>c</sub> x *ADJ<sub>c</sub>**, *R<sub>c</sub> x *BIG<sub>c</sub>**, and *NC<sub>c</sub>*) are not reported.

TABLE 4a: Elasticities of Agglomeration Measures on Probability of New Firm Entry: All Industries and Manufacturing

	All Industries					Manufacturing				
	Urban (1)	Rural (2)	Urban (3)	Rural: Adjacent	Rural: Remote	Urban (6)	Rural (7)	Urban (8)	Rural: Adjacent	Rural: Remote
				to urban (4)	from urban (5)				to urban (9)	from urban (10)
$CLU_{kc}$	0.23	0.19	0.21	0.20	0.17	0.15	0.12	0.13	0.12	0.10
$MON_{kc}$	{-0.37}	{-0.32}	{-0.35}	{-0.33}	{-0.33}	{-0.45}	{-0.27}	{-0.44}	{-0.24}	{-0.24}
$UP_{kc}$	0.25	0.58	0.31	0.70	0.74	0.15	0.33	0.12	0.28	0.25
$DOWN_{kc}$	0.06	0.12	0.09	0.18	0.20	0.10	0.13	0.18	0.30	0.35
$CON_c$	-0.20	-0.07	-0.26	-0.10	-0.15	-0.24	-0.16	-0.30	-0.19	-0.24
$EDU_c$	0.37	0.34	0.48	0.41	0.50	0.54	0.60	0.66	0.68	0.75
$INC_c$	0.63		0.63		0.67		0.66			
$AMENITY_c$	0.02		0.02		<0.01		>-0.01			
$TAX_c$	-0.21		-0.25		-0.17		-0.21			
$EXP_c$	0.53		0.61		0.45		0.52			

Note: Elasticities based on conditional logit results reported in Table 3.

TABLE 4b: Elasticities of Agglomeration Measures on Probability of New Firm Entry by Establishment Ownership

	Expansion start-up					Standalone start-up				
	Urban (1)	Rural (2)	Urban (3)	Rural: Adjacent	Rural: Remote	Urban (6)	Rural (7)	Urban (8)	Rural: Adjacent	Rural: Remote
				to urban (4)	from urban (5)				to urban (9)	from urban (10)
$CLU_{kc}$	0.20	0.17	0.19	0.17	0.16	0.23	0.20	0.21	0.19	0.17
$MON_{kc}$	{-0.53}	{-0.49}	{-0.60}	{-0.32}	{-0.32}	{-0.31}	{-0.28}	{-0.29}	{-0.35}	{-0.35}
$UP_{kc}$	0.16	0.34	0.20	0.42	0.44	0.28	0.65	0.37	0.86	0.90
$DOWN_{kc}$	0.11	0.21	0.16	0.31	0.34	0.05	0.09	0.08	0.17	0.19
$CON_c$	-0.18	-0.03	-0.43	-0.19	-0.34	-0.19	-0.07	-0.20	-0.04	-0.09
$EDU_c$	0.42	0.41	0.30	0.33	0.24	0.35	0.32	0.54	0.49	0.60
$INC_c$	0.82		0.32		0.59		0.44			
$AMENITY_c$	0.01		0.01		0.02		0.01			
$TAX_c$	-0.26		-		-0.21		-			
$EXP_c$	0.91		-		0.52		-			

Notes: Elasticities based on conditional logit results reported in Table 5. The results reported in brackets for monopoly opportunity  $MON_{kc}$  are proportional changes in the probability of firm entry going from the absence of a monopoly to the presence of a monopoly in the county-sector market.

innovation proposed by Marshall (1920), Arrow (1962), Romer (1986), and Schumpeter (1942) are outweighed by other costs associated with monopoly.<sup>24</sup>

Of the remaining factors, local income level is the most important for new firm location decisions. The elasticity for per capita government expenditures is more than twice the size of the elasticity with respect to per capita tax burden. While the

<sup>24</sup>We might get different answers if we were focusing on technology or R&D intensive sectors, but most firms in our study will not be producing new products, developing unique production processes, or creating intellectual property.

amenity index was statistically significant in Table 3, its elasticity is extremely small in Table 4a.<sup>25</sup>

These conclusions carry over to manufacturing firms as well: agglomeration economies have similar effects on new firm entry in urban markets, their adjacent rural neighbors, and their more remote rural counties. One other somewhat large difference is that the presence of a monopoly opportunity in the sector reduces the probability of manufacturing firm entry more in urban than in rural markets. Presumably, the lack of any incumbents in a sector has more information in larger markets because the presence of monopoly opportunities is less common than in smaller markets. It appears that monopoly opportunities are not attractive because they signal a lack of comparative advantage for the sector in that location.<sup>26</sup>

One implication of our findings is that local agglomeration continually adds to the number of firms entering a market. Even though the elasticities are similar between urban and rural markets, the levels of agglomeration are quite different as seen in Table 1. While agglomeration matters everywhere, it does not exist everywhere. An urban area whose agglomeration measures are 10 percent over or below the urban mean in a way to increase new firm entry probabilities in all the agglomeration measures except local monopoly ( $MON_{kc}$ ) will have 20 percent higher new firm entry; while, the corresponding value in a rural area is 3 percent higher new firm entry. On the other hand, rural areas that have atypically higher levels of agglomeration do attract new firms; a rural county at one standard deviation above or below the rural mean in a way to increase new firm entry probabilities in all the agglomeration measures except local monopoly will experience 26 percent more new firm entry. As a result, places with more concentrated activities will continually attract the greatest share of new firms while places that lack these agglomeration advantages will attract few new entrants.<sup>27</sup> This growth pattern results in a persistent hierarchy of city size as described in Central Place Theory (CPT) (Christaller, 1933).

Next, we test whether stand-alone start-ups are attracted by different agglomeration factors than expansion start-ups. These results are reported in Table 5. The first three columns show the estimates for expansion start-ups; the next three columns show the estimates for stand-alone start-ups. The estimated impacts of agglomeration measures on stand-alone start-ups and on expansion start-ups are consistent between urban and rural areas. The one exception is that industrial concentration ( $CON_c$ ) does not appear to matter for expansion start-ups in rural areas, but does matter in urban areas. Table 4b reports the elasticities for each firm type. Measured agglomeration effects on new firm entry are similar for expansion and stand-alone start-ups in urban, rural adjacent, and remote rural counties.

Our finding that agglomeration measures have similar impacts on firm entry in rural counties adjacent to or remote from a metropolitan area may seem surprising in

<sup>25</sup>Recent studies by Rickman and Rickman (2011) and Rickman and Guettabi (2015) document a decline in the role of amenity attractiveness in explaining nonmetropolitan population and employment growth.

<sup>26</sup>The proportional change in new firm entry probability for local monopoly is calculated for each observation and averaged across all observations. For each observation, that is calculated as follows:  $\frac{P(E_{ikc}=1|MON_{kc}=1)-P(E_{ikc}=1|MON_{kc}=0)}{P(E_{ikc}=1|MON_{kc}=status\ quo)}$  where  $P(E_{ikc}=1|MON_{kc}=1)$  is a fitted probability that firm  $i$  in industry  $k$  chooses county  $c$  when there is no incumbent firm in that industry county.  $P(E_{ikc}=1|MON_{kc}=status\ quo)$  is a fitted choice probability when local monopoly is the same as the *status quo*.

<sup>27</sup>It is important to note that we are not considering congestion effects, which provide a “check” on increasing levels of concentration. The costs of commuting and other urban diseconomies limit city size and therefore city growth (Henderson, 2012).

TABLE 5: Location Choice of New Firms by Establishment Ownership: Iowa and North Carolina Counties in 2000–2002

Dependent Var: Choice of County	Expansion Start-Up			Stand-alone Start-Up		
	(1)	(2)	(3)	(4)	(5)	(6)
<i>CLU<sub>kc</sub></i>	0.25 (0.01) <sup>***</sup>	0.20 (0.01) <sup>***</sup>	0.18 (0.02) <sup>***</sup>	0.29 (<0.01) <sup>***</sup>	0.23 (0.01) <sup>***</sup>	0.19 (0.01) <sup>***</sup>
<i>MON<sub>kc</sub></i>	-0.75 (0.10) <sup>***</sup>	-0.62 (0.11) <sup>***</sup>	-0.38 (0.14) <sup>***</sup>	-0.59 (0.04) <sup>***</sup>	-0.33 (0.04) <sup>***</sup>	-0.43 (0.05) <sup>***</sup>
<i>UP<sub>kc</sub></i>	0.11 (0.01) <sup>***</sup>	0.79 (0.04) <sup>***</sup>	1.01 (0.08) <sup>***</sup>	0.14 (<0.01) <sup>***</sup>	1.45 (0.02) <sup>***</sup>	2.01 (0.04) <sup>***</sup>
<i>DOWN<sub>kc</sub></i>	0.11 (0.01) <sup>***</sup>	0.52 (0.03) <sup>***</sup>	0.84 (0.08) <sup>***</sup>	0.05 (<0.01) <sup>***</sup>	0.24 (0.01) <sup>***</sup>	0.48 (0.02) <sup>***</sup>
<i>CON<sub>c</sub></i>	-1.60 (0.17) <sup>***</sup>	-0.12 (0.23) <sup>***</sup>	-1.45 (0.43) <sup>***</sup>	-1.22 (0.05) <sup>***</sup>	-0.30 (0.06) <sup>***</sup>	-0.38 (0.11) <sup>***</sup>
<i>EDU<sub>c</sub></i>	2.23 (0.13) <sup>***</sup>	1.76 (0.28) <sup>***</sup>	1.05 (0.54) <sup>*</sup>	2.39 (0.04) <sup>***</sup>	1.37 (0.07) <sup>***</sup>	2.61 (0.14) <sup>***</sup>
<i>URB<sub>c</sub> x <i>CLU<sub>kc</sub></i></i>	-	0.14 (0.02) <sup>***</sup>	0.16 (0.02) <sup>***</sup>	-	0.15 (0.01) <sup>***</sup>	0.19 (0.01) <sup>***</sup>
<i>URB<sub>c</sub> x <i>MON<sub>kc</sub></i></i>	-	-0.05 (0.21) <sup>***</sup>	-0.33 (0.23) <sup>***</sup>	-	-0.03 (0.10) <sup>***</sup>	0.07 (0.10) <sup>***</sup>
<i>URB<sub>c</sub> x <i>UP<sub>kc</sub></i></i>	-	-0.67 (0.04) <sup>***</sup>	-0.87 (0.08) <sup>***</sup>	-	-1.29 (0.02) <sup>***</sup>	-1.84 (0.04) <sup>***</sup>
<i>URB<sub>c</sub> x <i>DOWN<sub>kc</sub></i></i>	-	-0.42 (0.03) <sup>***</sup>	-0.74 (0.08) <sup>***</sup>	-	-0.20 (0.01) <sup>***</sup>	-0.44 (0.02) <sup>***</sup>
<i>URB<sub>c</sub> x <i>CON<sub>c</sub></i></i>	-	-3.04 (0.35) <sup>***</sup>	-1.74 (0.51) <sup>***</sup>	-	-2.45 (0.10) <sup>***</sup>	-2.32 (0.13) <sup>***</sup>
<i>URB<sub>c</sub> x <i>EDU<sub>c</sub></i></i>	-	0.29 (0.30) <sup>***</sup>	0.91 (0.55) <sup>*</sup>	-	0.51 (0.08) <sup>***</sup>	-0.90 (0.15) <sup>***</sup>
<i>R<sub>ADJ<sub>c</sub></sub></i> x <i>CLU<sub>kc</sub></i>	-	-	0.05 (0.03) <sup>*</sup>	-	-	0.08 (0.01) <sup>***</sup>
<i>R<sub>ADJ<sub>c</sub></sub></i> x <i>MON<sub>kc</sub></i>	-	-	-0.51 (0.23) <sup>**</sup>	-	-	0.10 (0.07) <sup>***</sup>
<i>R<sub>ADJ<sub>c</sub></sub></i> x <i>UP<sub>kc</sub></i>	-	-	-0.23 (0.09) <sup>**</sup>	-	-	-0.42 (0.04) <sup>***</sup>
<i>R<sub>ADJ<sub>c</sub></sub></i> x <i>DOWN<sub>kc</sub></i>	-	-	-0.39 (0.08) <sup>***</sup>	-	-	-0.27 (0.03) <sup>***</sup>
<i>R<sub>ADJ<sub>c</sub></sub></i> x <i>CON<sub>c</sub></i>	-	-	1.67 (0.51) <sup>***</sup>	-	-	0.59 (0.13) <sup>***</sup>
<i>R<sub>ADJ<sub>c</sub></sub></i> x <i>EDU<sub>c</sub></i>	-	-	1.09 (0.61) <sup>*</sup>	-	-	-1.34 (0.16) <sup>***</sup>
<i>INC<sub>c</sub></i>	26.88 (2.68) <sup>***</sup>	23.03 (2.75) <sup>***</sup>	9.06 (2.48) <sup>***</sup>	25.53 (0.73) <sup>***</sup>	16.65 (0.75) <sup>***</sup>	12.28 (0.69) <sup>***</sup>
<i>AMENITY<sub>c</sub></i>	0.01 (0.01) <sup>***</sup>	0.01 (0.01) <sup>***</sup>	0.01 (0.01) <sup>***</sup>	0.02 (<0.01) <sup>***</sup>	0.02 (<0.01) <sup>***</sup>	<0.01 (<0.01) <sup>***</sup>
<i>TAX<sub>c</sub></i>	-0.21 (0.04) <sup>***</sup>	-0.28 (0.04) <sup>***</sup>	-	-0.22 (0.01) <sup>***</sup>	-0.23 (0.01) <sup>***</sup>	-
<i>EXP<sub>c</sub></i>	0.33 (0.03) <sup>***</sup>	0.41 (0.03) <sup>***</sup>	-	0.26 (0.01) <sup>***</sup>	0.23 (0.01) <sup>***</sup>	-
Log likelihood	-59,646.70	-59,287.58	-59,351.09	-796,135.48	-789,658.68	-790,526.52
# of est./# of counties		14,115/199			177,076/199	

Notes: Standard errors are in parentheses. \*\*\* significant at 1 percent, \*\* significant at 5 percent, \* significant at 10 percent. Estimates for control variables (*URB<sub>c</sub>*, *R<sub>ADJ<sub>c</sub></sub>*, *R<sub>BIG<sub>c</sub></sub>*, and *NC<sub>c</sub>*) are not reported. *TAX<sub>c</sub>* and *EXP<sub>c</sub>* are excluded in columns (3) and (6) due to nonconvergence in estimation.

that adjacency to urban areas has been found to be critical in the rural development literature.<sup>28</sup> The explanation is that agglomeration matters everywhere, but agglomeration is not present everywhere. Areas adjacent to metropolitan areas are more agglomerated than more remote rural areas and that explains their growth advantage. Proximity to an urban center undoubtedly has advantages for growth (Partridge et al., 2008) which leads to the accumulation of agglomeration measures in adjacent counties that induce additional growth.

#### *Local Agglomeration Measures and Urban and Rural Growth Using Aggregate Data*

As a robustness check, we examine the impact of county-level agglomeration measures on employment growth. We measure our agglomeration factors in the year 2000 and test how these factors affect local county-by-industry employment 10 years later, in 2010. The unit of observation is the industry–county pair. We have 21,890 industry–county pairs across the two states.<sup>29</sup> Due to many industry–county pairs having no positive local industry employment in either 2000 or 2010, our dependent variable is a dummy variable which has a value of 1 if employment in the industry–county pair increased between 2000 and 2010, and 0 otherwise. We estimate a binary logit model with the same set of explanatory variables as in our previous analysis<sup>30</sup>. Hence, this is a net employment growth measure where employment growth can occur from both new and incumbent firms.

We find that the agglomeration measures have similar signs and magnitudes of elasticities between urban and rural areas and regardless of the adjacency to urban areas, which is consistent with our previous analysis. As shown in column (2) of Table 6, the estimated coefficients have the same signs in urban and rural markets. Only two of the coefficients differ significantly between urban and rural markets. The presence of sectoral clusters lower employment in both markets, with the larger effect in urban areas. Monopoly opportunity retains its negative effect on employment growth but the effect is now larger in rural areas. None of the coefficients differ between adjacent and remote rural counties.

The elasticities by market type are reported to the right of the estimates in Table 6. The main differences between these results based on the aggregated data on net employment growth and our previous results based on firm entry are the much smaller elasticities and the switched signs on cluster specialization ( $CLU_{kc}$ ). There may be a negative relationship between productivity and employment. As pointed out in Cingano and Schivardi (2004), if the price elasticity of demand is inelastic in an industry, productivity improvements can reduce revenue and labor demand. However, the simple correlation between output per worker and aggregate hours employed from 1947–2013 is 0.98, using the U.S. Bureau of Labor Statistics' Major Sector Productivity Series for the nonfarm business sector, so the empirical basis for the argument is suspect.

A more compelling argument for the smaller elasticities in Table 6 compared to Table 4a is that at the market level of aggregation, current employment is a primarily the

<sup>28</sup>For extensive discussion on rural–urban interdependency for rural development, see Castle, Wu, and Weber (2011), Olfert and Partridge (2010), Irwin et al. (2010), and Partridge et al. (2008).

<sup>29</sup>There are 22,288 potential industry–county pairs with 112 industries and 199 counties. We excluded two industries or 398 industry–county pairs because they did not have any new firm entrants in 2001 and so those sectors would not have been included in our previous analysis.

<sup>30</sup>When we use changes in employment numbers, we obtain similar results, except that the  $MON_{kc}$  measure becomes large and positive. This result is definitional; any entry into a county that previously had no incumbent firms will increase employment in that sector. The negative effect of monopoly is suppressed because you cannot lower employment from zero.



TABLE 6: Robustness Check: Probability of Sectoral Employment Growth in Iowa and North Carolina Counties in 2000–2010

Dependent Var: Whether or Not Employment in Industry $k$ in a County $c$ Increases between 2000 and 2010	(1)	(2)	(3)
$CLU_{kc}$	-0.39 (0.02)***	-0.35 (0.02)***	-0.32 (0.03)***
$MON_{kc}$	-1.61 (0.04)***	-1.66 (0.04)***	-1.69 (0.06)***
$UP_{kc}$	-0.03 (0.03)	0.04 (0.08)	0.06 (0.12)
$DOWN_{kc}$	> -0.01 (0.03)	0.04 (0.07)	0.05 (0.12)
$CON_c$	-0.51 (0.21)**	-0.38 (0.23)*	-0.56 (0.36)
$EDU_c$	0.48 (0.29)*	0.52 (0.41)	0.40 (0.61)
$URB_c \times CLU_{kc}$	-	-0.17 (0.05)***	-0.20 (0.05)***
$URB_c \times MON_{kc}$	-	0.40 (0.11)***	0.44 (0.11)***
$URB_c \times UP_{kc}$	-	-0.06 (0.09)	-0.08 (0.13)
$URB_c \times DOWN_{kc}$	-	-0.03 (0.08)	-0.04 (0.13)
$URB_c \times CON_c$	-	-0.59 (0.55)	-0.40 (0.62)
$URB_c \times EDU_c$	-	-0.24 (0.52)	-0.12 (0.69)
$R\_ADJ_c \times CLU_{kc}$	-	-	-0.07 (0.04)
$R\_ADJ_c \times MON_{kc}$	-	-	0.07 (0.09)
$R\_ADJ_c \times UP_{kc}$	-	-	-0.02 (0.16)
$R\_ADJ_c \times DOWN_{kc}$	-	-	0.00 (0.15)
$R\_ADJ_c \times CON_c$	-	-	0.34 (0.46)
$R\_ADJ_c \times EDU_c$	-	-	0.18 (0.74)
$INC_c$	26.82 (4.77)***	26.25 (4.89)***	26.13 (4.90)***
$AMENITY_c$	0.03 (0.01)***	0.03 (0.01)**	0.03 (0.01)**
$TAX_c$	-0.07 (0.06)	-0.08 (0.06)	-0.08 (0.06)
$EXP_c$	0.03 (0.04)	0.04 (0.04)	0.05 (0.04)
Log likelihood	-13,658.98	-13,628.55	-13,625.03
# of industry–county pairs	21,890	21,890	21,890

Notes: Estimates from the binary logit estimation are reported. Standard errors are in parentheses. \*\*\* significant at 1 percent, \*\* significant at 5 percent, \* significant at 10 percent. Elasticities or proportional changes in choice probability are reported in brackets. Estimates for control variables ( $URB_c$ ,  $R\_ADJ_c$ ,  $R\_BIG_c$ , and  $NC_c$ ) are not reported.

aggregation of past employment decisions made by firms that entered the market under past market conditions and agglomeration levels. Costs of relocation are prohibitive, and so firms may not be in their best location given current market conditions. Consequently, the link between agglomeration measures and the growth of incumbent firms must be weaker than the link between agglomeration factors and the location decisions of entering firms.

More importantly, our conditional logit specification estimating equation (5) controls for the unobserved firm profit component,  $\varepsilon_i$ , while the estimation using the county aggregate net sectoral employment data does not. These unobserved firm fixed effects are likely to affect the pace of future firm investment, employment, and production decisions, so they will create unobserved location-specific profitability and productivity factors that are almost certainly correlated with the observed agglomeration measures. Hence, the coefficients and the elasticities in Table 6 are biased and will not yield reliable inferences regarding the role of agglomeration on county-sector growth.

### *Agglomeration Economies and Commuting Patterns*

As a second robustness check, we examine the linkage between agglomeration economies and commuting patterns. In theory, agglomeration will raise location-specific productivity, some of which will be captured by workers in the form of higher wages. That will create an incentive for workers in low agglomeration locations to move to or commute to locations with greater agglomeration levels. Importantly, the cost of switching job locations within a two to three county radius is relatively low compared to the potential returns and so commuting decisions can respond more elastically to changing market conditions than can firms.

There is evidence suggesting that commuting is sensitive to local job growth. Renkow (2003) found that a substantial portion (one-third to one-half) of new jobs is taken by commuters. Khan, Orazem, and Otto (2001) found that economic growth in one community positively interacts with growth in nearby communities, possibly through commuting. Because we show that agglomeration increases new firm entry, we can conjecture that commuting is sensitive to agglomeration economies as well. However, testing this hypothesis has been limited due to the difficulty in measuring magnitudes of local agglomeration economies. Recent commuting studies measured the spillover of urban agglomeration economies to rural towns using the distance between urban centers and rural towns (Partridge et al., 2010; Ali, Olfert, and Partridge, 2011), but this measure does not capture variations in agglomeration economies within rural or urban areas.

To test the importance of these agglomeration economies on commuting patterns, we consider a commuting destination decision of workers. Suppose that a worker  $i$  living in a home county  $h$  ( $h = 1, \dots, H$ ) chooses a county  $d$  for work ( $d = 1, \dots, D$ ).  $D$  counties are located within commuting distance which we set arbitrarily at 100 miles from her home county. The choice set of potential counties of work varies with the location of each county of residence.<sup>31</sup>

We assume a latent utility function of worker  $i$  living in a home county  $h$  and working in a county  $d$  below. As in our analysis of new firm entry, we assume a spatial equilibrium model where wages and rents are functions of local factors affecting firm productivity

<sup>31</sup>In our commuting data, 94 percent of workers commuting within a state (Iowa or North Carolina) commute to a county within 100 miles from their home county. Both North Carolina and Iowa have metropolitan areas that cross state lines, making it difficult to distinguish agglomeration levels across counties with in the same metropolitan area. We do not allow commuting across states because of limited data availability.

(Rosen, 1979; Roback, 1982). Workers choose the county for work that gives them the highest utility conditional on residing county  $h$ :

$$(6) \quad U_{ihd} = \beta_A \frac{AE_d}{AE_h} + \beta_D DIST_{hd} + \beta_U URB_d + \beta_F \frac{FIRM_d}{FIRM_h} + \varepsilon_h + u_{ihd}.$$

The explanatory variables are lagged and predetermined at the time of the commuting destination decision. For notational convenience, we omit a subscript for time period.

The first term in equation (6) is the ratio of the agglomeration economy at the destination county relative to the county of residence. Based on equation (5), we create the agglomeration index for each industry-county pair by

$$AE_{ikc} \equiv \frac{\exp(\mathbf{m}'_{kc} \cdot \gamma_m + \mathbf{m}'_{kc} \cdot URB_c \cdot \gamma_{mu} + \mathbf{m}'_{kc} \cdot RADJ_c \cdot \gamma_{ma})}{\sum_c \exp(\mathbf{m}'_{kc} \cdot \gamma_m + \mathbf{m}'_{kc} \cdot URB_c \cdot \gamma_{mu} + \mathbf{m}'_{kc} \cdot RADJ_c \cdot \gamma_{ma} + \mathbf{z}'_c \cdot \gamma_z)},$$

where the coefficients are taken from Table 2. This index is the contribution of the six agglomeration economy measures to the probability of new-firm entry in county  $c$ , relative to the probability of entry across all counties. We take the average across all firms to obtain the unconditional county-level index of  $AE_c$ . Note that the ratio will be greater than one when a county within 100 miles has a larger level of agglomeration than the home county. When  $h = d$ , meaning the worker lives and works in the home county, the ratio is 1. If agglomeration raises productivity, they should raise wages as well, and so a county  $d$  with a high level of agglomeration should attract more commuters from neighboring counties.

Commuting distance from a home county  $h$  to a county  $d$  ( $DIST_{hd}$ ) raises the cost of commuting, and so probability of commuting should decrease as distance increases.  $URB_d$  indicates whether the commuting destination  $d$  is urban, and captures unobservable local factors other than our observed agglomeration measures that may influence commuting.  $FIRM_d / FIRM_h$  is the proportion of existing firms in county  $d$  relative to in county  $h$ . We add  $FIRM_d / FIRM_h$  to take out the effect of relative county size so that the relationship between agglomeration measures and commuting patterns is not just a reflection of county size. The error term,  $\varepsilon_h$ , represents home-county-specific unobservable impacts, and is differenced away in the conditional logit estimation because it does not affect the relative utilities across counties. We assume that  $u_{ihd}$  is a random error not correlated with the explanatory variables. We estimate the utility function using the conditional logit estimation.<sup>32</sup> This framework is similar to the population migration study of Davies, Greenwood, and Li (2001).

We obtain commuting patterns in Iowa and North Carolina from the 2006–2010 American Community Survey County-to-County Worker Flow File, U.S. Census Bureau. Distances between the geographical centroids of two counties were compiled using the County-to-County Distance Matrix at the Center for Transportation Analysis, Oak Ridge National Laboratory. Rural–urban classification is the same as in the previous new-firm entry analysis. The number of existing firms is aggregated from the firm-level data in the NETS in year 2000.

Results are reported in Table 7 with elasticities in brackets. Consistent with the analysis of new firm entry, there is a very strong positive relationship between our estimate of the effect of agglomeration measures on firm entry and the probability of in-commuting. Thus, the same agglomeration factors that encourage firm entry also atypically attract workers from other counties. The effect remains strong even when we control for the relative number of firms and the urban designation of the county. The literal interpretation is

<sup>32</sup>We used the grouped conditional logit with a STATA command “multin.”

TABLE 7: Effects of Agglomeration Economies on Location of Work in 2006–2010

	All Workers			Workers Living in Urban Counties		Workers Living in Rural Counties	
	(1)	(2)	(3)	(4)	(5)	(6)	
$AE_d/AE_h$	0.29 (<0.01)*** [0.29]	0.22 (<0.01)*** [0.22]	0.27 (<0.01)*** [0.28]	0.15 (<0.01)*** [0.15]	0.62 (<0.01)*** [0.56]	0.52 (<0.01)*** [0.47]	
$DIST_{hd}$	-0.12 (<0.01)*** [-7.66]	-0.13 (<0.01)*** [-7.78]	-0.12 (<0.01)*** [-7.62]	-0.13 (<0.01)*** [-7.85]	-0.13 (<0.01)*** [-7.84]	-0.13 (<0.01)*** [-7.85]	
$URB_d$	1.32 (<0.01)*** [1.99]	1.09 (<0.01)*** [1.49]	1.29 (<0.01)*** [1.89]	0.90 (<0.01)*** [1.12]	1.38 (<0.01)*** [2.24]	1.30 (<0.01)*** [2.02]	
$FIRM_d / FIRM_h$	-	0.06 (<0.01)*** [0.02]	-	0.14 (<0.01)*** [0.05]	-	0.02 (<0.01)*** [<0.01]	
Log likelihood	-5,293,688	-5,228,885	-3,120,020	-3,064,266	-2,134,452	-2,132,170	
# of obs.	5,224,042		3,351,099		1,872,943		

Notes: Dependent variable is a dichotomous indicator of whether the worker works in the county. County choice is limited to all counties within 100 miles of residence. Estimates from the conditional logit are reported. Standard errors are in parentheses. Elasticities or proportional changes in choice probability are in brackets. \*\*\* significant at 1 percent, \*\* significant at 5 percent, \* significant at 10 percent. We do not consider cross-state commuting due to data availability.

that a 10 percent increase in the probability of new firm entry in a county attributable to growth in agglomeration results in a 2 percent increase in the probability of in-commuting from a county within a 100 mile radius. Meanwhile, distance has a strong negative effect on the probability of commuting, whether from a rural or urban county of residence.

The adverse impact of distance on commuting is of like magnitude for urban and rural residences. However, the attraction of greater agglomeration in a neighboring county is three times larger (0.47 vs. 0.15) for rural county residents compared to urban county residents. As a result, a given incremental return in relative agglomeration will attract rural in-commuters from a greater distance than for urban in-commuters.

## 6. DISCUSSION: INTEGRATION BETWEEN SMALL AND LARGE RURAL TOWNS

We have shown that the same agglomeration measures that have been associated with urban economic growth are important for rural economic growth as well. The pattern holds for both stand-alone ventures and for multiplant firms looking to expand into new markets. The relative sizes of the elasticities of the agglomeration measures are consistent between urban and rural areas regardless of industry classification (all industries vs. manufacturing) and establishment ownership (stand-alone vs. expansion). These findings of similar agglomeration elasticities across rural and urban markets are consistent with the recent results reported by Glaeser and Gottlieb (2008) across metropolitan regions and Kline and Moretti (2014) in the Tennessee Valley Authority. Commuters are attracted to the same agglomeration factors that attract new firm start-ups.

Our results have two useful implications to theories in local agglomeration economies. First, our results can test several theories related to agglomeration economies for rural areas similar to Glaeser et al. (1992) did for urban areas. Our results imply that the most attractive areas for new firm entry are diverse economies with proximate upstream and downstream firms, an available educated workforce and a ready number of firms already in the sector. Our results support the various theories of local economic growth including Jacobs' (1969) importance of diversity, Porter's (1990) emphasis on clusters, Lucas's (1988) and Romer's (1986) endogenous growth based on concentrations of an educated workforce and Marshall's (1920) theory of proximate upstream and downstream firms. But we find no support for Marshall's and Schumpeter's (1942) view that monopoly opportunity invites entry in order to exploit first mover rents; in contrast, more competitive markets seem to induce firm entry.

Second, our results provide a dynamic context for CPT initiated by Christaller (1933). One of the key components in CPT is a persistent urban hierarchy; larger cities have more industries because higher ordered industries require higher demand thresholds. As mentioned in Mulligan et al. (2012), CPT does not have a sufficient dynamic explanation of how urban hierarchy persists. Our finding that agglomeration attracts new firm entry relative to less agglomerated markets means that the most agglomerated will get the largest annual infusion of new firms. Consequently, agglomeration economies are a key reason that the urban hierarchy persists.

Based on our findings, we expect that rural communities with higher agglomeration economies will serve as regional centers of economic activity with their surrounding communities providing labor and customers who commute in. Glaeser and Gottlieb (2008) and Kline and Moretti (2014) argue that the finding of common agglomeration elasticities across areas cannot justify place-based government intervention. Our results also suggest that there is no additional advantage to agglomeration in urban areas relative to rural areas that have higher agglomeration endowments. However, rural communities that do not have a critical mass of firm clusters, upstream suppliers, downstream customers and educated labor will find it difficult to attract new start-ups. Policies aimed at encouraging

new firm entry in dispersed small towns that lack agglomeration externalities would be much more expensive and will likely fail (Barkley and Henry, 1997). In addition, recruiting new firms that do not exist in the rural town would require additional costs because no incumbent firms in the industry would be a signal that the industry has no advantages in the town. The more promising strategy is to target new firm recruitment to the relatively few rural markets that have managed to foster sufficient agglomeration economies that they can attract both firms and commuting workers.<sup>33</sup> Coupled with policies to help lower the costs of commuting for rural workers in the more remote regions surrounding these towns, such as funding for childcare centers in rural areas, this strategy may also help reduce rural poverty (Partridge and Rickman, 2008).

Our findings call into question the efficacy of rural development policies that aim to improve economic growth in all rural towns. A “greatest potential” type approach that targets rural towns with growth potential, as evidenced by the existence of agglomeration economies, and promotes them as local job centers would be economically promising. While that means many small rural towns will continue to experience population loss, overall, a more targeted policy may stabilize regional rural population.

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<sup>33</sup>Our approach can be compared with Kilkenny and Johnson (2007), Olfert, and Partridge (2010). Kilkenny and Johnson argued in favor of community-level adjustments to make fewer, larger and more prosperous rural communities. While their goal is similar to ours, their approach is different. They suggest merging small rural towns jurisdictionally or physically while we suggest integration between small rural communities and rural regional job centers, possibly through better roads and improved telecommunications. Olfert and Partridge emphasized the integration between rural towns and urban centers to take advantage of the spillover of urban agglomeration economies to rural towns. Their approach focuses on in-migration from urban areas and out-commuting to urban areas, while we focus on job creation in large rural towns with in-commuting from surrounding smaller rural communities.

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