One Size Does Not Fit All:
An Analysis of Agglomeration-Firm Fit on New Manufacturing Firm Performance

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Abstract: Firms benefit from their local agglomerations when there is a distinct fit between accessible agglomeration assets and firm needs. Operationally, we sample and identify new manufacturing firms in identical industries that are born in seemingly similar but marginally different agglomerated counties. We define horizontal agglomeration as geographies with greater co-location of own-industry establishments, and vertical agglomeration as geographies with greater co-location of industry suppliers. On average, new manufacturing firms report performance gains in horizontal agglomeration relative to vertical agglomeration. Regions with anchors amplify this effect. Separately, firms operating with downstream production report increased performance when in vertically agglomerated regions. Lastly, new manufacturing firms located away from the industry-dominant agglomeration structure report higher performance. One type of agglomeration does not fit all new firms.

Keywords: Agglomeration, Manufacturing, New Firms, Performance, Regional Economics, R&D, Production

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1. INTRODUCTION

Regions are heterogeneous in their ability to support firms, endure shocks, and grow. It is well documented that certain regions are uniquely positioned to leverage distinct returns from industry co-location, concentration, and clustering (Feldman, 1994; Delgado, Porter, & Stern, 2014). As a result, regions with strong industrial clusters often report higher rates of market growth, increased levels of entrepreneurship, and favorable outcomes for firms (Delgado, Porter, & Stern, 2010). While firms in agglomerated economies face a tradeoff between exposing themselves to increased competition versus gaining access to valuable resources (Alcácer & Zhao, 2012; Alcácer, Deszo, & Zhao, 2015), there is a grounded understanding that, on average, firms benefit from agglomeration economies given that such externalities lower costs and yield competitive advantage (Marshall, 1890; Ellison & Glaeser, 1997; Porter 2003).

Nevertheless, firms do not uniformly benefit from their surrounding agglomerations. This is in part due to the capabilities of the firm, but also due to the structure of the surrounding agglomeration itself. Building upon the latter, recent work reveals that agglomeration economies vary in their composition and characteristics across both regional and industrial dimensions (Ellison et al., 2010; Diodato et al., 2018). For example, medical device and biopharmaceuticals around Boston, Massachusetts; automotive manufacturing around Detroit, Michigan; and semiconductor manufacturing in Washington County, Oregon are all strong industrial clusters with unique agglomeration assets. Structurally, these agglomeration assets generate distinct, geographically limited externalities from their unique regional resources (Rosenthal & Strange, 2003; Rosenthal & Strange, 2001, Duranton & Overman, 2005).

For firms to benefit from agglomeration economies, there must be a fit or ease of alignment between the accessibility and type of agglomeration asset and the needs of the firm

operating within a broader product, technology, and industry context. Depending on the underlying costs in the industry, as well as the position along the value chain, firms might benefit from certain agglomeration assets or find it easier to reduce certain costs over others (Glaeser & Kohlhase, 2004; Alcácer & Chung, 2007; Diodato et al. 2018). Again, while we know agglomerations can yield favorable returns (i.e., Porter 2003), we lack sufficient understanding about the nuance and heterogeneity between the type of agglomeration and individual needs of the firm, or *agglomeration-firm fit.* We seek to make contributions in this regard.

In this study, we examine firm performance across differentially agglomerated regions. Recent work documents varieties of agglomeration by identifying two distinct attributes of regions and their local agglomeration externalities (Kalathil et al., 2025). This includes regions where industries are surrounded by other firms that produce similar outputs but few suppliers (i.e., horizontal agglomeration), and regions where industries are disproportionately surrounded by suppliers with few firms that produce similar outputs (i.e., vertical agglomeration).

To assess firm performance, we focus on *new manufacturing firms* (de-novo entrepreneurial entry) that are born in relatively highly agglomerated regions and then trace their performance as measured by sales and employment over the first five years of operation. We justify this choice as follows. New firms are especially reliant on their external environment for resources, knowledge, and market access (Glaeser, Kerr, & Ponzetto, 2010). These firms often lack the ability to directly shape or control local agglomeration structures given their nascency and limited structure (Stinchcombe, 1965). As such, new firms are plausibly more susceptible to nuance along marginal variations in regional agglomeration, making this a salient sample of organizations through which we can examine our core research questions.

Operationally, we sample and identify new manufacturing firms in identical industries that are born in seemingly similar but marginally differently agglomerated counties. To differentiate between types of agglomeration across counties, we use a newly available decomposition of agglomeration at the county and industry level. This decomposition enables us to distinguish differential trends between horizontally and vertically agglomerated economies.

We argue that firms benefit from their local agglomerations when there is a distinct fit between accessible and available agglomeration assets and firm needs. We motivate and test a series of additional hypotheses around how the agglomeration-firm fit varies with regional- and industry-specific features. Regional features, such as proximity of a firm to anchor-tenant firms and anchor exits, govern the accessibility and availability of agglomeration assets. Industrial features, such as placement along the value chain (i.e., upstream versus downstream production), govern the relevancy of these assets to firm needs. In addition, we examine features of skewed positioning for the firm relative to the industry-dominant agglomeration structure.

Our results reveal distinct trends. On average, new manufacturing firms report performance gains in horizontal agglomerations relative to vertical agglomerations. However, specific agglomeration economies and features are more effective for firms in certain contexts than others. In assessing regional heterogeneity, we report that the presence of an anchor firm amplifies performance in horizontally agglomerated regions, but that the exit of an anchor firm differentially benefits firms depending on the capabilities of the new firm. Separately, certain agglomeration assets appear more effective for specific industries depending on where the new firm is operating along the value chain. Here, we untangle industry heterogeneity and demonstrate that firms operating with downstream production report increased performance when in vertically agglomerated regions. Finally, we report higher firm performance for new

firms located away from the industry-dominant agglomeration structures. Altogether, these results suggest that one size does not fit all.

This research offers several implications for firm strategy and regional economics. Importantly, different types of agglomeration offer distinct benefits for firms. Beyond firm capabilities, the appropriability of agglomeration assets also depends on access to underlying transaction costs, information asymmetries, switching costs, and frictions in network formation. Furthermore, our results suggest that regional and industrial characteristics mediate the type of market failures that influence the appropriability of agglomeration assets for firms.

2. VARIATION OF AGGLOMERATION ASSETS & COMPETITIVE ADVANTAGE

The set of agglomeration resources that firms can benefit from, as well as an individual firm's ability to appropriate such resources, changes across settings and over time (Audretsch & Feldman, 1996; Helper & Henderson, 2014). Firms have heterogenous needs, and agglomeration economies have heterogenous features, motivating our central research question: *how and under what conditions do firms benefit from agglomeration economies*?

The principles of agglomeration suggest that agglomeration economies are driven by economies of scale (Krugman, 1980), primarily acting through reduced costs of labor, knowledge, or transportation. To impact firm performance, these economies of scale and reduced costs must also offer competitive advantage. The challenge lies in identifying which agglomeration assets translate into competitive advantages, as location-based performance is confounded by sorting, selection, and spillover effects (i.e., Faggio, Silva, & Strange, 2017).

As a foundational framework to explore the fit between local agglomeration assets and firm needs, we leverage a decomposition of agglomeration at the county and industry level that differentiates between horizontal and vertical characteristics of regional agglomeration (Kalathil

et al., 2025). Formally, horizontal agglomeration offers access to peer spillovers (i.e., own-industry co-location), namely shared labor pools and knowledge spillovers; while vertical agglomerations offer access to supply chain spillovers (i.e., co-location with suppliers), or proximity to suppliers and the potential for developing strong regional supplier relations. Using this framework, we explore how firms differentially benefit from local agglomeration assets. Moreover, we present several hypotheses around the performance implications for new firms in differential forms of agglomeration. This includes consideration of regional and industrial variation in how firms benefit from access to horizontal or vertical assets, in addition to variation in skewed positioning by industry. We discuss and motivate each in turn.

Agglomeration-Firm Fit—Differential Forms of Agglomeration

The foundational concept of agglomeration includes three prominent externalities driving co-location**:** knowledge sharing, thick labor markets, and supplier economies of scale (Marshall, 1890). The available benefits from the local construction of these Marshallian externalities not only define factor pools but also delimits appropriability (Alcácer & Chung, 2014; Alcácer, Deszo, & Zhao, 2015). Recent scholarship by Kalathil et al. (2025) illustrates how horizontal and vertical forms of agglomeration distinctly correlate and align with these externalities.

Building upon this most recent study, horizontally agglomerated assets are associated with access to knowledge spillovers and shared labor pools. Substantiating this claim, Buzard and Carlino (2013) show that the spatial concentration of firms undertaking R&D efforts is more pronounced than it is for firms generally, with distinct geographic spillovers (Audretsch & Feldman, 1996; Feldman & Audretsch, 1999). Regionally, these clusters of "ideas in the air" define a localized idea-space that firms can tap into and benefit from (Autant-Bernard et al., 2007; Hmaddi et al., 2025). In such settings, targeted R&D investment can increase regional

rates of innovation and patenting through proximate geographic spillovers (Myers & Lanahan, 2022). Similarly, shared labor pools and access to skilled workers have been shown to have local spillovers. These spillovers can be driven by employee-spinoffs (Klepper, 2009) and through a shared occupation (Neffke & Henning, 2013) and industry (Neffke & Henning, 2008) space.

Contrastingly, vertically agglomerated assets are associated with access to regional supplier networks. Here, existing and enduring relationships play a particularly strong role in coordinating supplier networks (Helper & Henderson, 2014), and local conditions can influence rates of network formation and failure when new firms try to integrate into these networks (Schrank & Whitford, 2011; Brandt, Schrank, & Whitford, 2018). Leveraging such relationships and assets requires a sufficient level of absorptive capacity (Cohen & Levinthal, 1990; Zahra & George, 2002). Large firms, compared to new firms, are better positioned in this regard. Established firms tend to pursue different strategies and have distinct roles in coordinating and governing sectoral and cross-sectoral supplier networks and linkages (Lee & Gereffi, 2021). Whereas new firms face greater hurdles in accessing existing supplier networks; these firms are earlier in the prototyping process and do not yet have large-scale production requirements and orders (Zhao & Ziedonis, 2020).

Given the differences in features and assets between horizontal and vertical agglomeration, we expect, on average, higher levels of firm performance in horizontally agglomerated regions, relative to the counter-factual of being in vertically agglomerated regions near suppliers. In a global market, where firms sell beyond their local markets, the risk of additional competition is outweighed by horizontal assets, which, on average, are easier to access, appropriate, and absorb. Moreover, we argue that this trend especially holds for new firms. Research finds that knowledge spillovers and shared labor reach firms of all size,

including new and small ones (Meyers & Lanahan, 2022; Hmaddi et al., 2025). Conversely, supply-chain effects are likely less appropriable for new firms given that they require more significant transaction costs to establish relationships. This brings us to our first hypothesis.

Hypothesis 1 (H1)*: Horizontally agglomerated industry structures, compared to vertically agglomerated industry structures, will increase performance for new manufacturing firms.*

Regional Formation and Access to Agglomeration Assets

We surmise that regional features influence the availability and accessibility of agglomeration assets for new firms. Here, we consider the additional presence of large anchor-tenant firms in differently agglomerated areas. These large organizations make significant local investments to establish economies of scale, bolster local economic density, and coordinate local agglomeration assets. Contrastingly, an agglomeration economy without a large, coordinating anchor likely lacks coherent agglomeration assets for new firms to benefit from (e.g., local workforce training programs, conferences, programs with universities, and capital access).

To elaborate on instances of the former, regions with large anchor firms represent cases with a sufficient concentration and coordination of activity, but where access to these resources might vary. Critically, these organizations generate disproportionate rates of spillovers via resources made available from of their distinct "anchor tenant" positioning (Agarwal & Cockburn, 2003). This especially holds for firms engaged in R&D-intensive activities (Audretsch & Lehmann, 2005). At the same time, such large tenants can also restrict access to externalities from scale through mechanisms such as non-competes (Marx & Fleming, 2007), patents, and exclusive supplier agreements.

In settings with an anchor firm, we argue that these organizations will disproportionately enhance assets to new firms in horizontally agglomerated regions compared to those in vertically agglomerated ones. While anchor firms can provide supply chain connections (Lee & Gereffi,

2021), they also bolster R&D activity and the local talent pool. In following with the prior argumentation, the latter set are more easily accessible and appropriable to new firms.

The effect of anchor firms on vertically agglomerated economies is less clear. Without large OEMs, local supplier networks often would not exist. These supplier networks are not well suited to support new manufacturing firms that often have production volumes in smaller rather than larger scales. Two mechanisms likely decrease the usefulness of vertical agglomeration assets coordinated by anchors for new firms: (1) the assets might not solve a first order cost problem (e.g., global supply chains might be cheaper short-term); and (2) the local coordinating actor has a higher ability to exclude access to vertical agglomeration externalities.

While it is easier to exclude access to supply chain relations, labor pools and knowledge spillovers cannot be constrained as rigidly. These less tangible assets permeate economies. Hence the presence of anchors within horizontally agglomerated economies will likely amplify synergistic returns from such spillovers. This brings us to the first part of our second hypothesis.

Hypothesis 2a (H2a)*: The presence of anchor firms coupled with a horizontally agglomerated industry structure, compared to vertically agglomerated industry structures, will amplify performance for new manufacturing firms.*

The case of anchor firms also represents an opportunity to examine how new firms benefit from agglomeration assets when a local coordinating, and potentially excluding, anchor exits a regional market. Such an exit could be driven by declining growth rates, or it might represent a strategic decision made by the large firm. These events can leave behind significant local assets, ranging from workers to physical infrastructure and other less mobile assets.

The exit of anchor firms can occur for a variety of reasons, beyond the death of a specific firm or product category. Regional exit can occur as headquarters move across, or as firms outsource production (Autor et al., 2016). The exit of a large anchor firm creates an environment

where coherent agglomeration economies exist but now lack a local coordinating actor. Here, regional institutions matter for how anchor-driven agglomeration assets are recycled into the local economy (Spigel & Vinodrai, 2021). However, we expect new firms to vary in their ability to absorb the newly available assets (Cohen & Levinthal, 1990). This is based both on their internal capabilities, but also on the relevancy of the available assets to the new firm's needs.

Large anchors often represent local coordinating actors that manage regional supplier networks (Helper and Henderson, 2014) and rely on specialized supplier relationships. When large anchors exit, especially to offshore production, they might also change the regional suppliers that they rely on (Fuchs & Kirchan, 2010), leaving local suppliers in the exited region without a large customer to supply. These local suppliers either need to find new markets, or new customers in existing markets, to serve. Accordingly, we expect such an exit to create an opportunity between new firms and newly accessible vertical agglomeration assets. At the same time, horizontal assets might not be as useful to new firms. Former employees of anchors can start spin-offs or join existing firms, which might increase the intensity of local competition. The remaining, smaller firms might not have the capital or relationships to continue local training programs or collaborations with universities and larger organizations that tend to facilitate horizontal spillovers. This brings us to the second part of our second hypothesis.

Hypothesis H2b (H2b)*: The exit of an anchor firm coupled with a vertically agglomerated industry structure, compared to horizontally agglomerated industry structures, will amplify performance for new manufacturing firms.*

Industry Production and Varying Demands of Agglomeration Assets

We posit that industry features also influence the appropriability of assets between horizontal and vertical patterns of agglomeration. Industrially, firm needs can vary based on the R&D intensity of their activities (Fuchs et al., 2020), as well as their relative position along the

value chain (Delgado & Mills, 2020). Differentiating between supplier dominated, production intensive, and science-based industries dates to Pavitt (1984) who created a taxonomy for understanding sectoral rates of technical change.

Firms operating in industries with more R&D intensity (i.e., biopharmaceuticals) require greater human, physical, and financial capital to discover new ideas and technologies (Bloom et al., 2014). We expect firms located in horizontally agglomerated regions where discounted access to local, specialized labor, and/or knowledge perform better than if they were in vertically agglomerated settings. Regional R&D agglomeration assets, which are prevalent in horizontally agglomerated regions, help firms lower their R&D costs and build a competitive advantage. Such cases are more prevalent among industries that are further upstream and less differentiated.

Contrastingly, we expect firms located in vertically agglomerated regions to perform better if they operate in industries where proximity to suppliers might offer a competitive advantage. This applies to firms operating in production intensive industries that are further downstream. Such advantages may persist via mechanisms such as reduced lead times, faster design cycles, lower costs, and increased yields (Alcácer & Chauvin, 2025; Meliciani & Savona, 2015; Alcácer, & Delgado, 2016). This brings us to our third set of hypotheses.

Hypothesis H3a (H3a)*: Horizontally agglomerated industry structures, compared to vertically agglomerated industry structures, will amplify the performance for new manufacturing firms in more upstream intensive industries.*

Hypothesis H3b (H3b)*: Vertically agglomerated industry structures, compared to horizontally agglomerated industry structures, will amplify the performance for new manufacturing firms in more downstream intensive industries.*

Differential Positioning across Agglomeration Patterns

Existing research demonstrates that agglomeration externalities have diminishing marginal returns over geographic distance (Myers & Lanahan, 2022; Rosenthal & Strange, 2003;

Feldman, 1994). We extend this question and return to work on economies of scale (Krugman, 1980) to consider whether agglomeration effects have diminishing returns to scale. Certain industries likely agglomerate in specific, consistent patterns. As previously established, each industry coordinates a range of demands producing differential patterns across national trends of agglomeration (Delgado & Porter, 2014; Feser & Bergman, 2000).

Drawing upon the central tenets of strategy (Porter, 1980), in regions with high levels of overall agglomeration, we argue that firm location that deviates from the dominant structure of agglomeration likely yields discernable benefits. Such a setting can be view as "going against the stream" by deviating from the industry standard (Hoskisson et al., 1999). When industry agglomeration patterns are very skewed, we might expect competition to be higher in regions that follow the dominant form of agglomeration, and potentially less differentiation between companies that have access to similar (if not identical) agglomeration assets. In contrast, firms that operate in regions that deviate from the industry norm might benefit from unique agglomeration assets that enable differentiation. In this manner, such an outlying positioning can provide unique opportunities for firms.

We argue this holds across both forms of agglomeration. For industries with dominant horizontal agglomeration patterns, we expect better performance outcomes for new firms born in counties with high relative rates of vertical agglomeration. Similarly, for industries with dominant vertical agglomeration patterns, we expect better performance outcomes for new firms born in counties with high relative rates of horizontal agglomeration. The firm's distinct position, relative to its competitors, provides unique access to resources that offer competitive positioning.

If agglomeration assets follow identical patterns, then beyond a certain point, they yield competitive parity for firms in the industry. Whereas, for firms uniquely positioned, operating in

regions that deviate from the modal form of agglomeration, they gain positional advantage. The agglomeration assets in these distinct settings are more likely to help firms create a competitive advantage by enabling differentiation from industry competitors. We offer the final hypothesis.

Hypothesis H4 (H4)*: New manufacturing firms that deviate from the industry's dominant agglomeration structure will have higher performance returns compared to those located in the dominant structure.*

Appendix Figure A1 summarizes our hypotheses and argumentation, illustrating the different scenarios of agglomeration-firm fit, and the directionality of our hypotheses.

3. EMPIRICAL SETTING

We narrow the industry setting to manufacturing. In contrast to other industries (i.e., software and/or professional services), manufacturing is reliant on essential physical features making such an industrial setting salient for the study of regional agglomeration. Not only is there considerable variation in R&D intensity, reliance on physical inputs, value added, and labor intensity across such industries (Fuchs et al., 2020), this variation yields distinct production capabilities (Autor et al., 2013). Importantly, supply chain linkages are more clearly defined from the sequence of upstream inputs to downstream outputs making it feasible to exploit differential activity between various forms of agglomeration.

4. RESEARCH DESIGN

Fundamentally, we are interested in examining the differential effect in the form of regional agglomeration on firm performance. To examine this question, we sample from the population of US new manufacturing firms (31 – 33 NAICS). Moreover, we leverage granular measures of industrial agglomeration to distinguish highly agglomerated geographies with subtle, yet distinct, variation between the industry structure of horizontal and vertical agglomeration activity. Overall, we set up a between-firm comparison. To account for firm dynamics, we leverage variation in regional agglomeration where the new manufacturing firm is

located at the time of firm founding on the outcome of firm performance (i.e., sales and employment) after two, three, four, and five years of activity, respectively, given that data is not available at firm age one. Appendix Figure A2 provides a six-step illustration of our sampling strategy by geography and firm selection; we discuss each step in turn. Section 1 in Appendix A provides details on data construction.

Step 1: Varieties of Regional Agglomeration: Following expansive scholarship on measuring agglomeration, we combine employment and establishment data from the 2019 US Census County Business Patterns with commodity use and supply data from the Bureau of Economic Analysis 2017 Input-Output Accounts. To benchmark industry activity across the breadth of US manufacturing, we trace the co-location of a given industry (*i*) with *all other manufacturing industries* within a specific geographic radius of industry (*j*). We combine measures of industry activity across value chains with measures of geographic heterogeneity in manufacturing activity to identify varieties of agglomeration.

With this granular level of geographic and industry detail, we follow Kalathil et al. (2025) to compute *two* measures of agglomeration—vertical agglomeration and horizontal agglomeration—by county-industry, respectively (i.e., 5-digit FIPS code and 6-digit NAICS classification). For each county (i.e., FIPS) with manufacturing activity in the US, we compute an average level of horizontal and vertical agglomeration in that county by taking the mean level of horizontal (or vertical) agglomeration across all industries located within that county. We illustrate this variation in agglomeration by county in Step 1 of Appendix Figure A2.

Step 2: Select FIPS with Leading Agglomeration Activity: To ensure greater comparability in regional capabilities, we narrow the sample of US counties to those with equal to or greater than national average measures of horizontal *and* vertical agglomeration. This

designates counties with relatively high measures of general agglomeration. We illustrate this technique in Step 2 of Appendix Figure A2 by focusing on the set of counties with the blue designation.

Step 3: Parse Apart Leading Agglomeration Activity by FIPS x NAICS: Next, we plot relative rates of agglomeration by FIPS *and* NAICS (rather than FIPS only).[1] We benchmark relative rates of horizontal/vertical agglomeration to the average rate within highly agglomerated counties (instead of benchmarking across the nation as a whole). We illustrate this variation in Step 3 of Appendix Figure A2.

Step 4: Define Margins within Leading Quadrant Agglomeration Activity: To define the differential margins of agglomeration, we focus on the set of FIPS x NAICS with relatively high rates of horizontal agglomeration (and low rates of vertical agglomeration) as well as those that have relatively high rates of vertical agglomeration (and low rates of horizontal agglomeration). This subset of observations removes many "superstar" counties that have high rates of both types of agglomeration.

To ensure that our two margins of agglomerations are sufficiently distinct from one another, we further narrow our sample to focus on FIPS x NAICS with more than one standard deviation above the high-agglomeration average of horizontal (vertical) agglomeration, and less than one standard deviation below the high-agglomeration average of vertical (horizontal) agglomeration. We illustrate this marginal designation in Step 4 of Appendix Figure A2; 2779 FIPS x NAICS observations fall within the vertically agglomerated margin; 2928 FIPS x NAICS observations fall within the horizontally agglomerated margin.

[1] Following Kalathil et al. (2025), we take the county-mean level of horizontal and vertical agglomeration across all the industries that operate in a county. We log-normalize these variables to create a measure of the "elasticity" of agglomeration for the county and then standardize the variables to center them around the mean-county-level horizontal and vertical agglomeration across the data.

Step 5: Identify Industry Pairs within Margins: Among the set of FIPS x NAICS observations as illustrated in Step 4, we identify the set of industries with counties in *both margins* (i.e., defining county-pairs). Two hundred and fifty-two industries meet this specification; this set of 252 industries is present in 182 (119) vertically (horizontally) agglomerated counties in both margins, respectively. Overall, this approach enables us to leverage marginal variation in agglomeration type by selecting county-pairs with disproportionate access to industry peers or supply chain resources, respectively, while ensuring the location has a sufficiently high level of overall agglomeration and holding industry constant.

Step 6: Identify Population of New Manufacturing Firms in County-Paired Margins: With interest in examining firm performance, we identify the population of new manufacturing firms within the set of agglomeration parameters. As a baseline, we construct an initial sample of firms drawing from the National Establishment Time Series (NETS) database. NETS is collected by Dun & Bradstreet and traces credit activity in the US. This proprietary source includes over 82.4 million US establishments from 1990 – 2021 and reports annual detail on a range of characteristics that include location, industry, and performance measures. This rich source offers a nationally representative sample of startup activity in the US, reporting approximately 90 percent of new registration activity reported by the US Secretary of State (Lanahan et al., 2025).

We limit the sample of new manufacturing firms based on the following specifications: (1) single establishment; (2) US-owned; (3) operating in manufacturing as designated by their 6-digit NAICS classification; and (4) founded between 2012 and 2015. With an interest in tracing new manufacturing firms over their initial years of operation, we trace each firm from founding up to firm age five. As such, we construct an unbalanced panel[2] spanning 2012 to 2019, which

[2] We construct an unbalanced panel given the prevalence of firm exit over the initial years of firm operations; 30 percent of firms exit by firm age five.

both aligns closely with the estimation of the agglomeration measures (as developed by Kalathil et al., 2025) and avoids the confounding impacts of COVID-19.

Importantly, with details on the 6-digit NAICS and 5-digit FIPS for each new manufacturing firm, we precisely merge the firm sample to the list of county pairs within the margins as illustrated in Step 5 of Appendix Figure A2. This limits the sample to 14,456 new manufacturing firms. Roughly 64 percent of these new manufacturing firms are in counties with features of leading horizontal agglomeration (n = 9306), with approximately 36 percent of these new manufacturing firms in counties with features of leading vertical agglomeration (n = 5105). We illustrate this in Step 6 of Appendix Figure A2.

Step 7: Identification Considerations and Substantiation: Whether the new manufacturing firm has access to stronger proximate horizontal or vertical activity within their respective county and industry can be, to some extent, thought of as "geographically random." While we acknowledge that new manufacturing firm location is endogenous, driven by various factors that include, but are not limited to, access to resources and capital constraints (e.g., Stuart & Sorenson, 2003; Geroski, Mata, & Portugal, 2010; Glaeser, Kerr, & Kerr, 2015). We assume that nuanced and technical detail about the margin of regional agglomeration patterns that we exploit is neither easily accessible nor likely leveraged by founders on average. As such, we treat this margin of variation as *plausibly* exogenous. We additionally assume that only a subset of new firm owners is mobile or strategic (to this extent) in their choice of location (Guzman, 2024).

We address some of the tradeoff between competition and co-location by focusing on the subset of firms that are born in economically dense population centers, representing firms that co-locate with others (Steps 1-3 in Appendix Figure A2). We then focus on firms that locate outside of the highest agglomerated regions (where location sorting is likely most prevalent).

While still economically dense and active population centers, these "off-axis" regions (Steps 5 and 6 in Appendix Figure A2) do not include the leading counties and industries.

For example, in the case of machine tool manufacturing, the largest clusters of activity are in the leading counties in Ohio and Michigan (Appendix Figure A3). However, the "off-axis" counties, which we leverage for sampling in this study, are in non-leading counties (Appendix Figure A4). Here, the vertically agglomerated counties include Sanilac County in Michigan, Broward County in Florida, and Adams County in Colorado, and the horizontally agglomerated counties include Eerie County in New York. New manufacturing firms are likely not selecting locations between this more restricted subset as these locations are not marginally proximate. As such, we argue that firm selection is less of a concern given this design specification.

We are, of course, unable to discern the causal estimates given that we leverage observational data. Nevertheless, we build a design to reduce bias as best possible. Following the primary results, we include several empirical extensions to explore and validate these claims.

Variables

Firm Sales is the primary dependent variable of firm performance. With firm-year data spanning 2012 to 2019, drawing from firms founded 2012 to 2015, we adjust annual sales for inflation using the Bureau of Labor Statistics Consumer Price Index (setting January 2023 as the base). *Firm Employment* serves as an additional dependent variable, capturing an alternative measure of early-stage firm performance. We rely on FTE (full-time equivalent) estimates.

Both dependent variables exhibit a right skew in their distribution. For the regression analysis, we adjust the functional form and estimate the inverse hyperbolic sine (arcsinh) to normalize the distribution. This transformation is analogous to a logarithm adjustment. Thus, we interpret the coefficients as a percent change, yet it accounts for observations equivalent to zero

(Burbidge, Magee, & Robb, 1988). For the descriptive statistics, we report both variables in level form. For *Firm Sales*, we report annual adjusted sales in level form and scale by millions. To account for skew, we follow a common approach in organizational studies and winsorize the data, at 1 and 99 percent (Marquis, Toffel, & Zhou, 2016).

Agglomeration is the key explanatory variable. Operationally, we estimate this construct as a binary measure—horizontal agglomeration is coded one. Vertical agglomeration is coded zero, serving as the referent. Step 5 in Appendix Figure A2 illustrates the differential margin.

We augment the dataset with a series of controls that are internal and external to the new firm to account for plausible confounding factors that may impact the primary relationship of interest lying at the intersection of regional agglomeration and firm performance. Namely, we include measures of firm ownership—*Minority Owned* and *Female Owned* (Mathias, William, & Smith, 2015; Joshi, Inouye, & Robinson, 2018). Additionally, we include a set of dummies for *Firm Size* to control for variation in capabilities during the early life cycle (Wennberg & Lindqvist, 2010).[3] For external factors, we include an indicator for the presence of a headquartered anchor firm, *Anchor HQ*, which is aligned with the new manufacturing firm's proximate 5-digit FIPS county and 6-digit NAICS designations. Operationally, *Anchor HQ* is both formally listed as the "headquarter" establishment and employs more than 250 employees (FTE). Lastly, we include a set of indicators for local housing costs, *Fair Market Rent*, that capture the quartile distribution of annual county housing costs as reported by the US Housing and Urban Development.[4] With an emphasis on new firms, we argue that cost of living impacts

[3] Dummies include: Emp Bin 1 (1 – 9 FTE); Emp Bin 2 (10 – 19 FTE); Emp Bin 3 (20 – 49 FTE); Emp Bin 4 (50 – 99 FTE); Emp Bin 5 (100 – 249 FTE); Emp Bin 6 (250 – 499 FTE); and Emp Bin 7 (500+ FTE).
[4] Source: Fair Market Rents (40th PERCENTILE RENTS) | HUD USER (Accessed December 15, 2024). We draw from estimates of fair market rent for 2-bedroom accommodations, adjusting for annual inflation.

the calculus of firm founding in addition to firm and industry resource access (Florida & Mellander, 2016; Fischer, Meissner, & Vonortas, 2022).

Descriptive Statistics

Table 1 reports descriptive statistics at founding for the full sample of new manufacturing firms (n = 14,456). This includes details on the key dependent variables and controls. Moreover, we report details on various cross-sections to illustrate firm dynamics over the first five years of activity. Columns 1 – 5 report descriptive statistics for the full sample, while columns 6 – 8 report comparison of means along the margin of the key explanatory variable, *Agglomeration*. Column 6 reports for the sub-sample of firms founded in counties with leading vertical agglomeration aligned to that new firm's specific industry. Contrastingly, Column 7 reports for the sub-sample of firms founded in counties with leading horizontal agglomeration aligned to that new firm's specific industry.

Several descriptive trends emerge. First, we report economically larger levels of *Firm Sales* and *Firm Employment* for new manufacturing firms located in horizontally agglomerated counties than those in vertically agglomerated counties. Contrastingly, we report comparable ownership features across both groups with approximately 15 percent *Female Owned* and three percent *Minority Owned*. Of note, the comparability in ownership features attest to internal validity claims pertaining to firm location selection around the design; we do not observe differences in firm ownership across the margin of agglomeration.

Separately, many new manufacturing firms are in the following states—California (30 percent), Florida (13 percent), and Texas (11 percent), with disproportionately higher rates of horizonal agglomeration in California and, contrastingly, disproportionately higher rates of vertical agglomeration in Florida and Texas. Roughly, one-quarter of new manufacturing firms

reside in counties with *Anchor HQ* firms, with new manufacturing firms in horizontally agglomerated counties leading the trend by two-fold. At the same time, headquartered anchored firms, *Anchor HQ*, are more likely to exit the county for those new manufacturing firms in horizontally agglomerated areas. Lastly, the cost of living varies; prices are higher for new manufacturing firms located in counties with leading horizontal agglomeration.

< Table 1 about here >

Primary Model

We leverage cross-sectional features of the data to estimate the regression with an exhaustive set of industry, state, and founding year dummies (Eq. 1).[5]

Eq. 1 $$Y_{it} = f(Agglomeration_i, Controls_{it}, Founding\ Year_i, NAICS_i, State_i,\ \varepsilon),$$

where *i* denotes the new manufacturing firm and *t* denotes the year, spanning firm age two, three, four, and five years old. *Y* refers to firm performance as measured either as *Firm Sales* or *Firm Employment* (arcsinh). Operationally, we estimate the model for each outcome and firm age separately, yielding insight on between-firm comparisons.[6]

Most notably, we are interested in the estimate for the *(Horizontal) Agglomeration* indicator, where vertical agglomeration serves as the referent. The set of *Founding Year* dummies controls for annual macro-economic trends; moreover, we include *Industry* and *State* dummies based on the 3-digit NAICS specification and location of the new manufacturing firm.[7] We include the list of *Control* variables to account for internal and external factors that may confound the primary relationship. For time-varying controls, we include the measure based on

[5] We utilize `reghdfe` using Stata 18, allowing for high-dimensional fixed effects.
[6] We do not estimate firm fixed effects. We are interested in *between* firm variation along the differential margin. Firm fixed effect models leverage *within* firm variation. The latter is incommensurate with the former.
[7] To ensure model parsimony, we include more aggregated sets of dummies for location and industry (i.e., including state dummies rather than county and 3-digit NAICS dummies rather than 6-digit NAICS).

the age of the firm when measuring the outcome (i.e., firm age two, three, four, or five years, respectively). Lastly, we cluster the standard errors by 6-digit NAICS to account for autocorrelation by industry, which we leverage in sampling the new manufacturing firms (refer to Steps 5 – 6 in Appendix Figure A2).

5. RESULTS

Appendix Table A1 reports the baseline regression results for Eq. 1; columns 1 to 4 report for the outcome *Firm Sales* (arcsinh), spanning performance activity at firm age two, three, four, and five years, while columns 5 to 8 report for the outcome *Firm Employment* (arcsinh) over the same life cycle, respectively. Where we find evidence of an effect, the results for (*Horizontal*) *Agglomeration* are consistently positive. Directing attention to activity at firm age two, the differential effect of residing in a county with heightened levels of horizontal agglomeration, compared to new manufacturing firms in the same industry yet located in counties with heightened vertical agglomeration activity, is associated with an increase in *Firm Sales* by 10.1 percent (standard error (SE) 0.055). This positive effect persists with performance benefits across firm ages three to five years as well. The effect for *Firm Employment* is not conclusive.

Figure 1 illustrates these results with coefficient plots for *Agglomeration* on both measures of firm performance with 90 and 95 percent confidence intervals. Coefficients above zero report performance benefits from horizontal agglomeration, while the absolute value of coefficients below zero report performance benefits from vertical agglomeration. Panel A reports for the dependent variable, *Firm Sales* (arcsinh), and Panel B reports for *Firm Employment* (arcsinh). Again, where we find evidence of an effect, new manufacturing firms with proximate access to horizontal agglomeration, compared to those with access to vertical agglomeration, report greater early-stage performance. This provides support for H1.

< Figure 1 about here >

Additionally, turning back to the set of regressors reported in Appendix Table A1, we report consistent effects across the range of controls. Namely, minority and, separately, female owned firms are associated with lower firm performance. Moreover, firms of smaller size lower performance. However, proximity to an anchor increases firm performance.

Regional and Industry Variation Across Agglomeration Patterns

Looking beyond aggregate trends, we exploit heterogeneity in the sample by distinguishing specific regional and industry characteristics that impact the agglomeration firm-fit. These factors include leveraging the proximity of the new manufacturing firm to a headquartered anchor in their industry, and, separately, the position of the firm's industry along the value chain from upstream to downstream activity. Operationally, we stratify the sample and estimate Eq. 2 on the respective sub-sample.

Eq. 2 $$(Y_{it}|Firm\ Fit\ Factor = 1) = f(Agglomeration_i, Controls_{it}, Dummies_i, \varepsilon)$$

To elaborate, first we discern variation by region by identifying the population of headquartered anchors to discern the presence (or not) of an anchor firm proximate to new manufacturing firms in the sample. We match by 6-digit NAICS and 5-digit FIPS. Separately, we trace anchor exit activity, identifying every instance where an anchor moved away from the county when the new manufacturing firm was founded.[8]

Separately, we leverage details on personal consumption expenditures by industry to distinguish the industry position along the broader value chain.[9] As Delgado and Mills (2020) demonstrate, supply-chain businesses behave differently than consumer businesses, and these

[8] When leveraging this feature, we no longer include *Anchor HQ* as a regressor in Eq. 2.
[9] Source: Personal Consumption Expenditures Price Index | U.S. Bureau of Economic Analysis (BEA) (Accessed March 6, 2025).

industries can be separated from one another based on the percentage of outputs sold to personal consumption expenditures. Per this methodology, all manufacturing businesses are supply-chain businesses, in that personal consumption expenditures account for less than 37 percent of industry sales. However, we take this methodology one step further to distinguish between manufacturing industries and note that industries with less than 15 percent of personal consumption expenditures account for industries positioned more *upstream* in the value chain, while those with more than 15 percent personal consumption expenditures account for greater *downstream* activity. Operationally, we drop industry dummies here.

For ease of reporting the regression results, we report the results from Eq. 2 in a similar format to Figure 1 (Panels A reports for the dependent variable of *Firm Sales* and Panel B for *Firm Employment*; coefficients above zero report performance benefits from horizontal agglomeration, while the absolute value of coefficients below zero report performance benefits from vertical agglomeration). Here, we report the key coefficients for *Agglomeration* with 90 and 95 percent confidence intervals on firm performance. We discuss the results in turn.

Figure 2 reports the results from regional features by distinguishing the presence, absence, and exit of anchor firms. Most prominently, we report consistent and positive performance benefits from horizontal agglomeration for new manufacturing firms proximate to an anchored HQ firm. This offers support for H2a. Intuitively, this set of results align with the primary results (Figure 1). Namely, proximity to peer firms (i.e., those operating in the same industry) disproportionately increases performance for new manufacturing firms. Of note, we report inconclusive results where there is not an anchor firm suggesting that anchors play an essential role in facilitating knowledge spillovers and shared labor.

The results for anchor exit, however, depend on the firm's maturity and capabilities. We report performance benefits from vertical agglomeration for new manufacturing firms at age 2. Though the effect switches and we report performance benefits from horizontal agglomeration by firm age 5. This reveals a more nuanced result than what we hypothesized for H2b. Here, the capabilities of the new manufacturing firm, which vary as they age from founding to firm age 5, appear to impact how the firm appropriates returns from anchor exits. The very young manufacturing firm appears to benefit more from vertical spillovers, either because these supplier relationships are more relevant to firm needs, or because the young firm is less able to leverage the remaining assets from horizontal spillovers. However, more mature firms, that might also have greater capabilities, appear to benefit more from horizontal spillovers when an anchor exits. While anchor exit is likely disruptive to a region, this activity reveals economic opportunities (and liabilities) for firms to leverage when the anchor vacates a region. Our model enables us to document when and how firms can adjust to such changes.

< Figure 2 about here >

Second, when discerning the industry position along the value chain, we find evidence that horizontal agglomeration, compared to vertical agglomeration, decreases new manufacturing firm performance for industries operating more downstream. Interpreting this differential effect another way, vertical agglomeration increases performance, compared to horizontal agglomeration, for firms operating more downstream on the supply chain. This effect holds across both outcomes reported in Panels A and B of Figure 3 and offers support for H3b. We do not report consistent results for H3a.

< Figure 3 about here >

Distributional Trends Across Agglomeration Patterns

Now, we exploit heterogeneity in the distribution of agglomeration by industry. With detail on national trends (refer to Steps 1 – 4 in Appendix Figure A2), we identify industries with greater overall skew towards horizontal or vertical forms of agglomeration. This enables us to assess whether firms located in outlying agglomerated regions perform in a differential manner. To assess activity along the skew, we begin with the set of 252 industries with presence in both margins (refer to Step 5 of Appendix Figure A2). Then, we define the subset of industries (i.e., 6-digit NAICS) where 90 percent of counties in that industry align with *either* horizontal *or* vertically agglomeration; this defines the sets of horizontal skew and vertical skew, respectively.[10] We employ the same stratification approach as utilized above to estimate Eq. 2.

We report distinct and contrasting trends in Figure 4. Most notably, the differential effect of horizontal agglomeration (compared to vertical agglomeration) increases performance for new manufacturing firms in industries with an overall skew towards vertical agglomeration. This holds for both sets of outcomes (reported in Panels A and B). Additionally, we report contrasting evidence from the counter perspective, though the results are most consistent in Panel B. The differential effect of horizontal agglomeration (compared to vertical agglomeration) decreases *Firm Employment* for those industries with an overall skew towards horizontal agglomeration. In other words, new manufacturing firms positioned in an outlying manner to the dominant form of agglomeration report performance benefits. This offers support for H4.

< Figure 4 about here >

[10] We illustrate this feature of agglomeration skew with two exemplary cases. First, consider the motor vehicle electrical and electronic equipment manufacturing industry, NAICS 336320. Not only is this industry skewed towards horizontal agglomeration; this skew reflects the sampling of firms as well. Sixteen firms in the 336320 NAICS industry are in one of 16 horizontally agglomerated counties, while three firms are in the single vertically agglomerated county (i.e., in this case Alachua County, Florida). We can find an example of a vertically skewed industry in dental equipment and suppliers manufacturing industry, NAICS 339114. Here, this industry is skewed towards vertical agglomeration, which mirrors the sampling of firms as well. Namely, 19 firms in the 331194 NAICS industry are in one of 24 vertically agglomerated counties, while four firms are in the single horizontally agglomerated county (i.e., in this case Salt Lake County, Utah).

Validity Extensions

Given that we ensure a sufficient baseline of overall agglomeration activity, we assume firm founding in either form of agglomeration is, in essence, approximately random. We assume they select into highly agglomerated areas but are unaware of marginal differences in the form of agglomeration. Empirically, we leverage granular detail on industry structure that is not available to founders. Nevertheless, we explore the validity of this assumption with two extensions.

First, we split the sample of firms based on sales capacity. As a baseline, Appendix Figure A5 illustrates the distribution of agglomeration patterns in this manner. Overall, (and in alignment with mean trends) new manufacturing firms are more likely to be in horizontally agglomerated areas than vertically agglomerated. Appendix Figure A6 examines this further and bifurcates the sample by sales capacity. Column A includes the sub-sample of firms with limited sales capacity (less than $1M), while Column B reports for those with greater sales. Moreover, we re-report the four sets of results that align with Figures 3 – 6, respectively and uncover revealing trends. Most generally, the results in Column A – reporting for firms with limited sales capacity—align with the primary results reported in Figures 3 to 6. There is greater noise among the set of results in Column B. This suggests that new manufacturing firms with less capabilities are driving the overall effect. We speculate that firms with greater capacity are more susceptible to selection concerns—as they likely have access to greater resources and strategic choice. However, where we find evidence of an effect, the effect of agglomeration structure on firm performance persists among those firms with less capacity. This result qualifies how we understand the effects of agglomeration-firm fit.

Second, for the main analysis we designate the geography of agglomeration activity by *county* specification. This offers the most granular specification of industry structures based on

publicly available administrative data. However, here, we re-construct the sample using the larger set of economic areas (EA) rather than counties (FIPS) as the geographic designation. Delgado et al. (2014, 2016) among others have used this geographic designation to trace agglomeration activity. To be clear, in every instance of county designation, we replace it with EA designation (this not only includes derivation of agglomeration measures but also of controls). If the trends are consistent with this alternative geographic designation, then we reduce concerns of selection by minimizing the threat that founders locate in a county along a geographic margin. Though, we also face a tradeoff, since appropriation of agglomeration benefits for new manufacturing firms by EA are distinct from the county level. In short, we may introduce separate construct validity issues. Nevertheless, we proceed.

Section 2 of Appendix A outlines our data construction efforts to rebuild the sample (this mirrors the approach outlined in Appendix Figure A2). Appendix Figure A7 (Panels A – D) reports the results with EA designation; this aligns with the primary results reported in Figures 1 to 4. Overall, the results are noisier than the primary set of results. In Panel A, where we report an effect, we find that horizontal agglomeration increases firm performance (though this effect does not persist over time); this is consistent to the main set of results reported in Figure 1. In Panel B, we do not report an effect. Though, again, the results from Figure 2 may emphasize that closer geographic proximity is necessary to impact firm performance in this setting around anchor impact; this aligns with evidence from Myers and Lanahan (2022) documenting a greater intensity of geographic spillovers to the *county* designation. In Panel C, where we report an effect, we find consistent results that vertical agglomeration increases firm performance in more downstream activity; this is consistent to the main set of results reported in Figure 3. Lastly, the results in Panel D are consistent for industries skewed vertically. Interestingly, here, we

document an overall benefit from horizontally agglomeration for firms in skewed industries. We interpret these results at the EA designation cautiously. Generally, they are consistent with the primary results that derive agglomeration activity at the county designation.

Altogether, new manufacturing firms with less resources and capabilities are driving the overall effect. Nevertheless, the consistency of the results suggests that selection is a minimal design concern. By using observational data, we are unable to estimate causal effects; our design and these extensions provide valuable insights for understanding agglomeration-firm fit.

6. DISCUSSION

Standard measures of agglomeration have made it difficult to estimate the realized returns from varieties of agglomeration for individual firms (e.g., Porter, 2003; Ellison et al., 2010; Neffke & Henning, 2008; Diodato et al., 2018). Rather, existing studies have leveraged more aggregate measures of performance, such as regional or industry measures of employment, establishments, and wages (e.g., Boschma & Iammarino, 2009; Delgado et al., 2016; Jun et al., 2020; Farinha et al., 2019). Nevertheless, firms do not uniformly benefit from agglomeration assets, and agglomeration assets themselves are heterogenous in their characteristics, accessibility, and appropriability.

We offer novel contributions by estimating the returns for firm performance from horizontal and vertical forms of agglomerations. This new decomposition of agglomeration activity allows us to identify where firms are surrounded by horizontal agglomeration assets (i.e., R&D assets, shared labor pools), compared to when they are surrounded by vertical agglomeration assets (i.e., supplier networks). Agglomeration assets primarily benefit firms through lowering costs or generating opportunities for competitive advantage, and certain agglomeration assets are more effective at meeting firm needs at a given point in time than

others. Broadly, we argue that in effective agglomeration economies (i.e., agglomeration economies where local assets improve firm performance), agglomeration assets are not only available and accessible but also fit the temporal and technological needs of firms.

Drawing from the population of new US manufacturing firms founded between 2012 – 2015 and tracing their performance activity over their first five years of operations, we document the realized returns from heterogenous agglomerations on *individual* firm performance. Appendix Figure A8 provides an overview of the results. This figure mirrors the structure of Appendix Figure A1, which outlines the various hypotheses; however, here, we synthesize the results. This includes the set of supportive and unexpected results.

On average, horizontal agglomerations over vertical agglomerations appear to be correlated with higher sales and employment. We argue that this broad dynamic stems from the generally less-excludable nature of horizontal agglomeration assets. This benefit is enhanced with the presence of large anchor firms that bolster access to such assets. For the contrasting event, instances where anchor firms exit a region, we find that the impact of agglomeration-firm fit is more nuanced. While we hypothesized that vertical agglomeration would offer greater benefits in such settings, we uncover a dynamic trend whereby access to vertical agglomeration is more advantageous to the firm at a very young age. And yet, access to horizontal agglomeration offers greater benefits from anchor exit for new firms with greater capabilities (i.e., those slightly older in age and maturity).

Additionally, we uncover cases where there is a better fit between vertical agglomeration assets and firm needs. Most notably, new manufacturing firms in further downstream industries see higher performance when they are born in vertical agglomerations over horizontal agglomerations. Finally, we further demonstrate that there is no dominant form of agglomeration.

Firms in regions that deviate from the industry-modal form of agglomeration increase firm performance. Altogether, we confirm that one size (or form of agglomeration) does *not* fit all; there is no dominant or optimal fit of agglomeration to increase performance for new manufacturing firms. Rather, these results shed light on the nuance and conditions where certain forms of agglomeration improve firm fit.

Fundamentally, while rooted in scholarship on agglomeration, our results advance the core research around firm strategy (Porter, 2008; Barney, 1991; Teece et al., 1997), uncovering where regional capabilities can complement or substitute firm capabilities to lower costs or create competitive advantage. Our results support the theory that different types of agglomeration have different benefits. The appropriability of agglomeration assets is not constant by firm size, sector, or other characteristics. At the same time, there are frictions in the local market of agglomeration economies that increase the costs of interfacing with agglomeration assets, including transaction costs, information asymmetries, switching costs, and frictions in network formation. Importantly, the existence of economies of scale does not guarantee an effective agglomeration economy. Firms should be cautious about depending too heavily on their external environment and ensure that they are aligning their strategy with the available and accessible local agglomeration assets. Nevertheless, these results provide a clearer strategic roadmap for firms, especially nascent firms, when navigating opportunities in their external landscape.

Despite the novel contributions of this study, more work remains. We acknowledge that this study is limited by industrial (i.e., manufacturing) and geographic (i.e., US-based) scope. While this specific context enabled us to discern variation in agglomeration form, future work could expand the scope to an even broader set of industries and geographies to understand the generalizability of these results. Moreover, future work could begin to account for dynamic

change in regional patterns of industry or trends among more established and larger organizations. Certainly, appropriating the various assets of agglomeration will vary based on the capability of the firm. While we focus on one type of organization, young manufacturing firms, this likely varies by firm size and capacity, with more established firms varying in their ability to appropriate agglomeration assets. Again, more work remains in this exciting domain.

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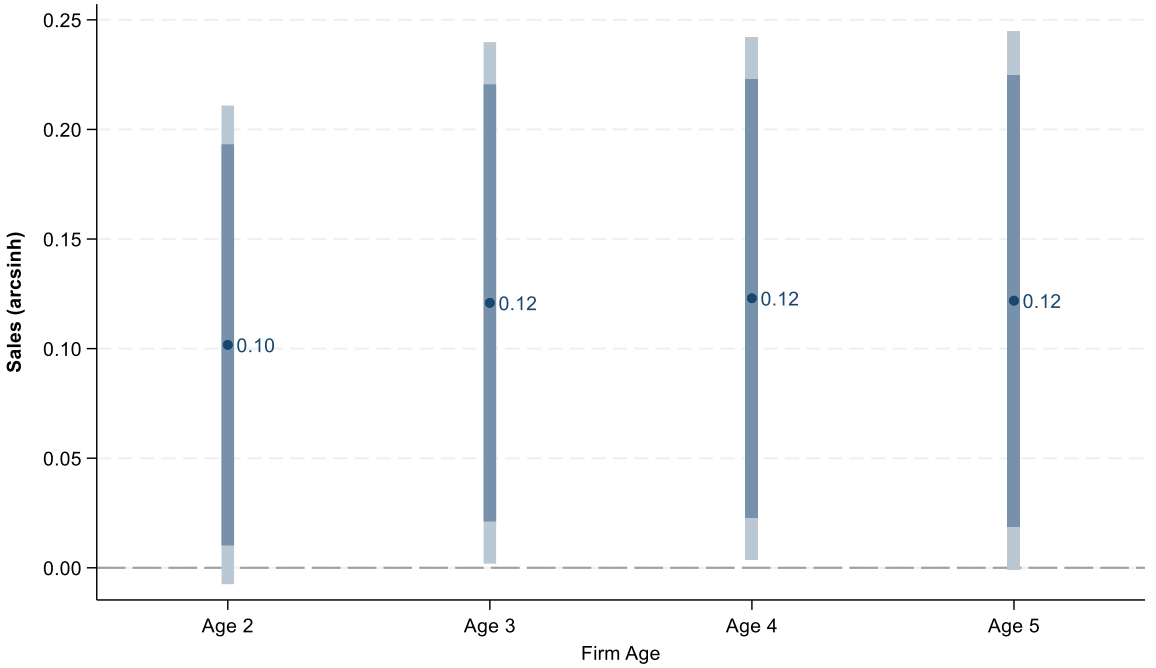
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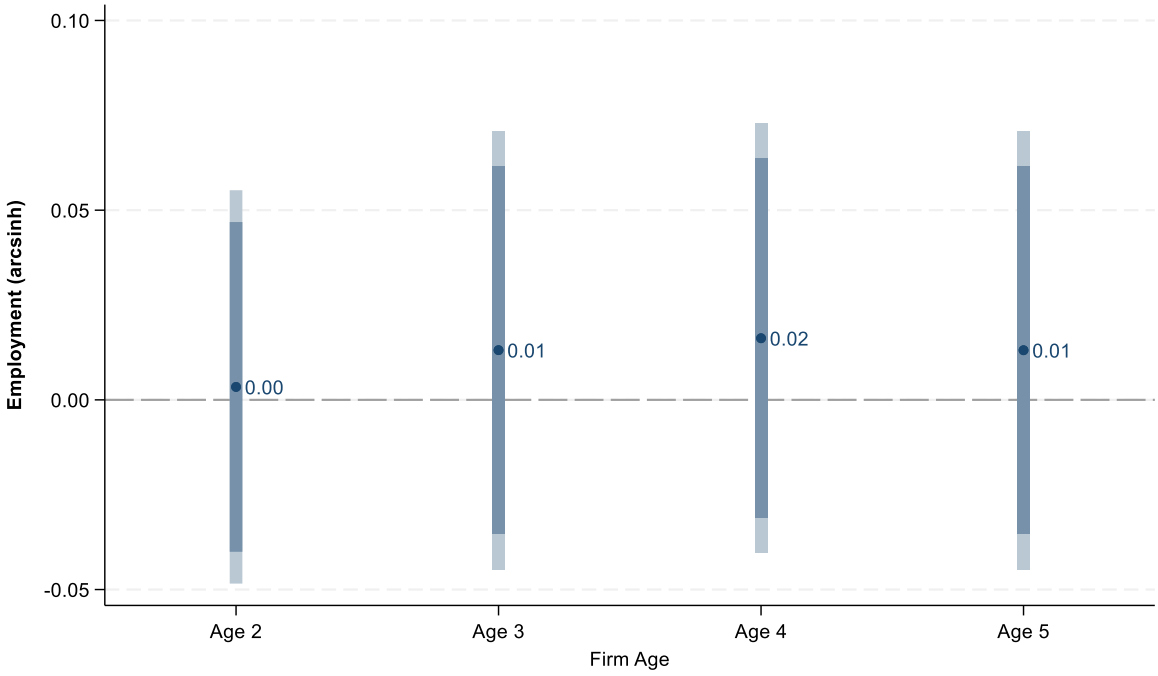
TABLE 1: Cross-sectional Descriptive Statistics

	(1) Count	(2) Mean	(3) SD	(4) Min	(5) Max	(6) Vertical	(7) Horizontal	(8) t-statistic
Firm Sales ($1m's), age 2	14456	2.03	7.84	0.04	64.00	1.68	2.22	-4.12
… age 3	13478	1.93	7.08	0.04	57.18	1.57	2.14	-4.69
… age 4	12233	2.05	7.34	0.04	59.52	1.70	2.24	-4.01
… age 5	10964	2.07	7.22	0.04	56.88	1.68	2.29	-4.50
Employment (FTE), age 2	14456	11.71	74.38	1.00	5000.00	9.83	12.75	-2.44
… age 3	13478	11.83	74.97	1.00	5000.00	9.83	12.94	-2.51
… age 4	12233	11.96	62.24	1.00	3275.00	10.58	12.71	-1.80
… age 5	10964	12.34	64.53	1.00	3275.00	10.79	13.18	-1.83
URM owned	14456	0.17	0.37	0.00	1.00	0.16	0.17	-1.20
Female owned	14456	0.15	0.35	0.00	1.00	0.15	0.15	-0.57
Minority owned	14456	0.03	0.18	0.00	1.00	0.03	0.03	-0.67
California	14456	0.30	0.46	0.00	1.00	0.23	0.35	-15.83
Florida	14456	0.13	0.34	0.00	1.00	0.14	0.13	2.24
Texas	14456	0.11	0.31	0.00	1.00	0.15	0.08	11.45
New York	14456	0.04	0.20	0.00	1.00	0.03	0.05	-4.78
Arizona	14456	0.05	0.22	0.00	1.00	0.03	0.06	-7.62
Illinois	14456	0.04	0.20	0.00	1.00	0.04	0.04	0.90
Washington	14456	0.03	0.17	0.00	1.00	0.03	0.03	0.71
HQ Anchor (NAICS & FIPS)	14445	0.25	0.43	0.00	1.00	0.13	0.32	-28.57
HQ Anchor Exit	14445	0.03	0.17	0.00	1.00	0.01	0.04	-11.59
Fair Market Housing Rate	14456	1489.74	392.91	735.84	2884.14	1403.03	1537.72	-19.42
PCE < 15%	8701	0.84	0.36	0.00	1.00	0.92	0.78	19.50
RD NAICS (MFG referent)	14456	0.14	0.35	0.00	1.00	0.14	0.15	-2.32
Unique Firms	14456					9306	5150	

Notes: Columns 1 – 5 report descriptive statistics for full sample of manufacturing firms. Unless otherwise noted, we report activity at firm founding. Columns 6 – 8 report detail for comparison of means. Column 6 (7) reports for sub-sample of firms located in leading vertical (horizontal) agglomerated county. Column 8 reports the t-statistic from the comparison of means.



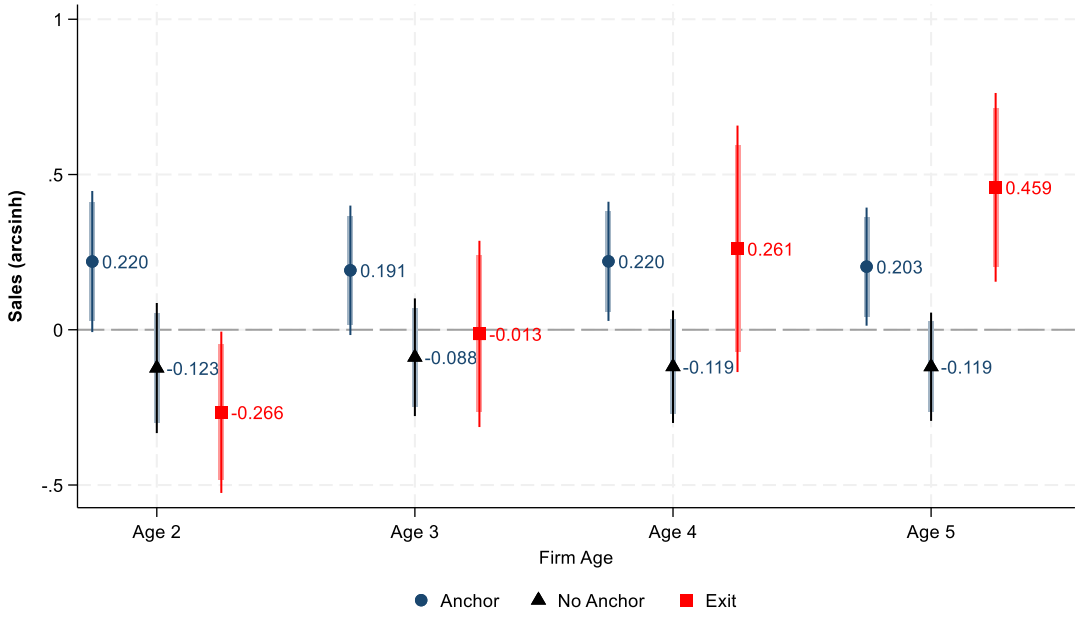
Panel A: DV - Firm Sales



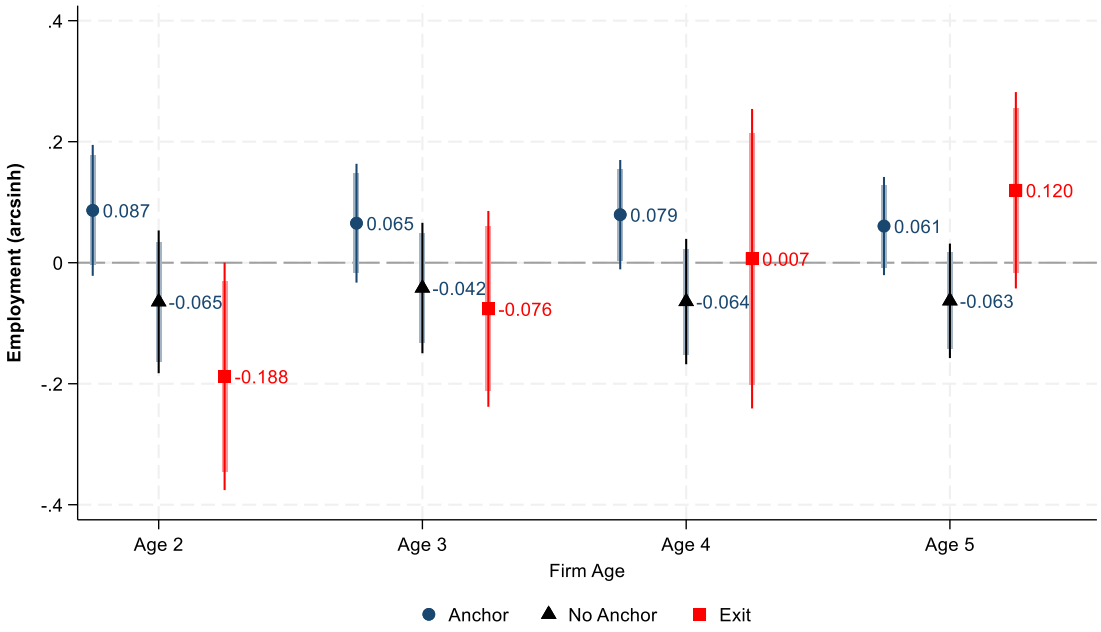
Panel B: DV - Firm Employment

FIGURE 1: Coefficient Plot of Primary Regression Results

Notes: Dependent variable denoted along y-axis. We report coefficients for (*Horizontal*) *Agglomeration* (Eq. 1). We indicate the 90th and 95th percent confidence intervals. Refer to Appendix Table A1 for detail on model specification.



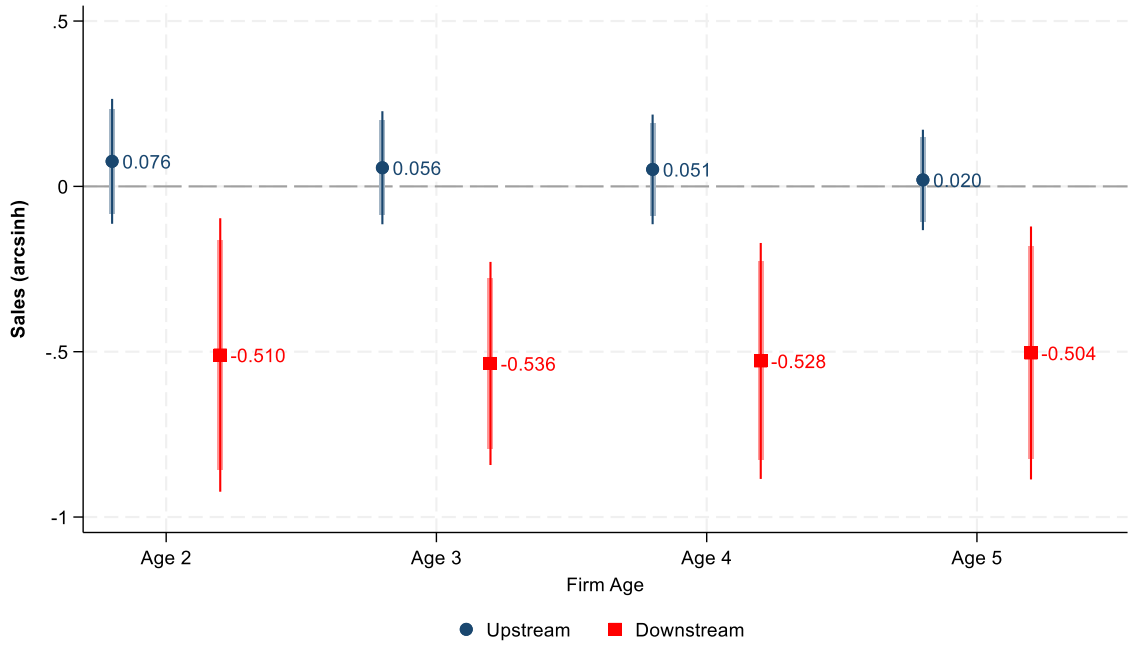
Panel A: DV – Firm Sales



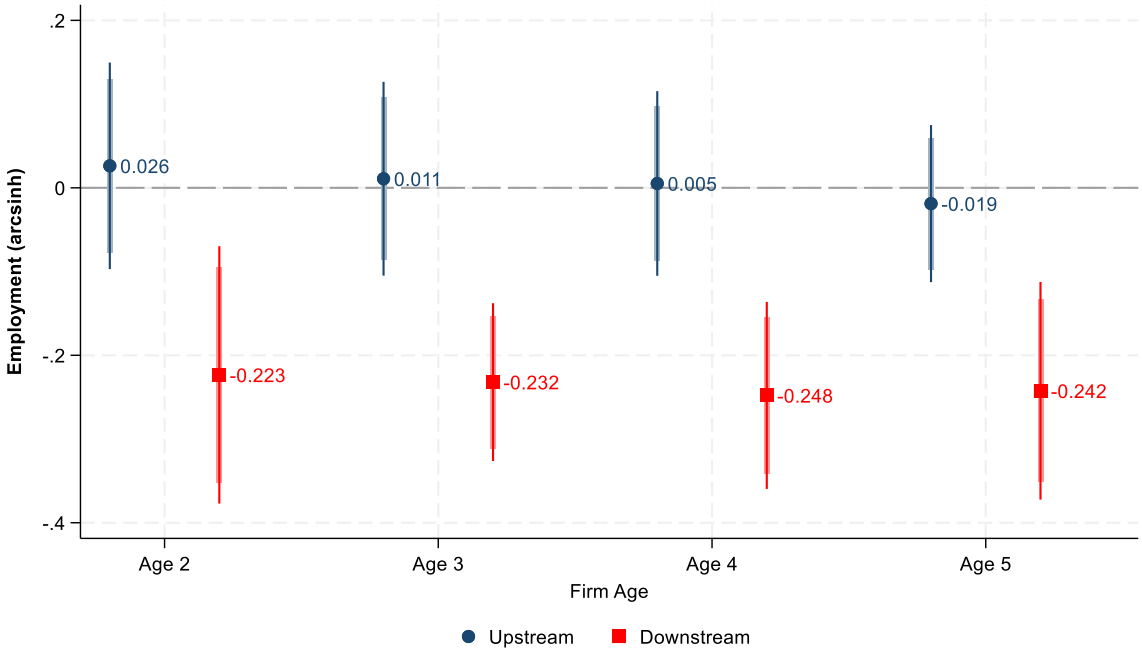
Panel B: DV – Firm Employment

FIGURE 2: Heterogeneity Assessment – Regional Variation

Notes: Dependent variable denoted along y-axis. We report coefficients for (*Horizontal*) *Agglomeration* (Eq. 2). We indicate the 90th and 95th percent confidence intervals. Figure mirrors format of Figure 1 with different stratification techniques exploiting Firm Fit Factors. Legend denotes the sample specification, accordingly. Given our interest in regional heterogeneity, we do not include anchor dummies in model.



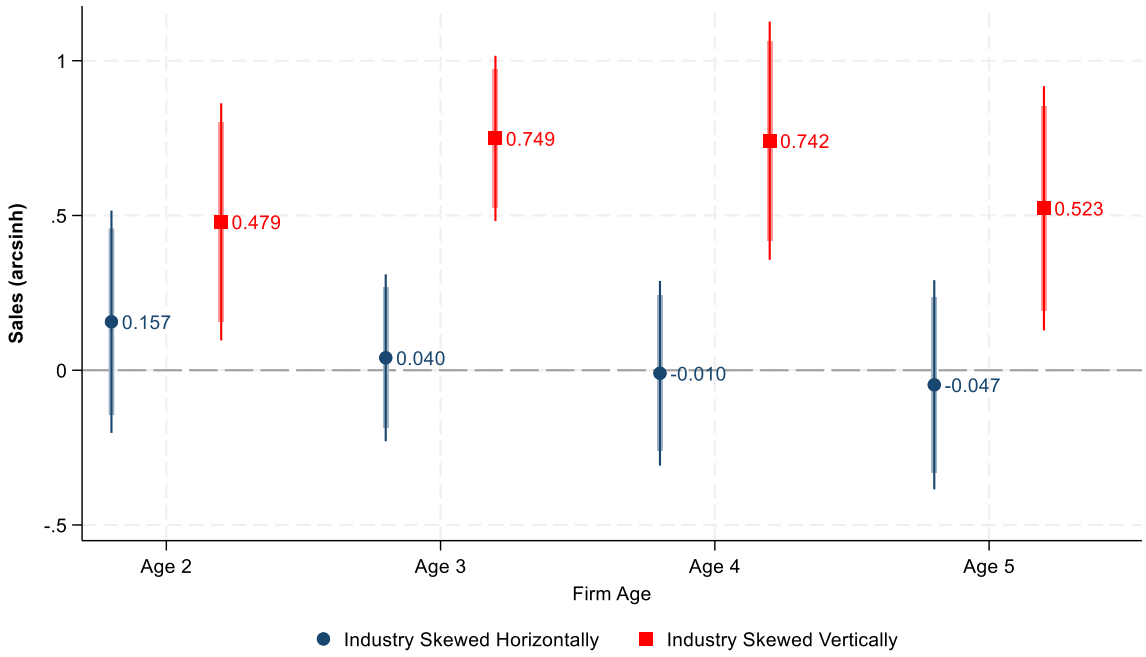
Panel A: DV – Firm Sales



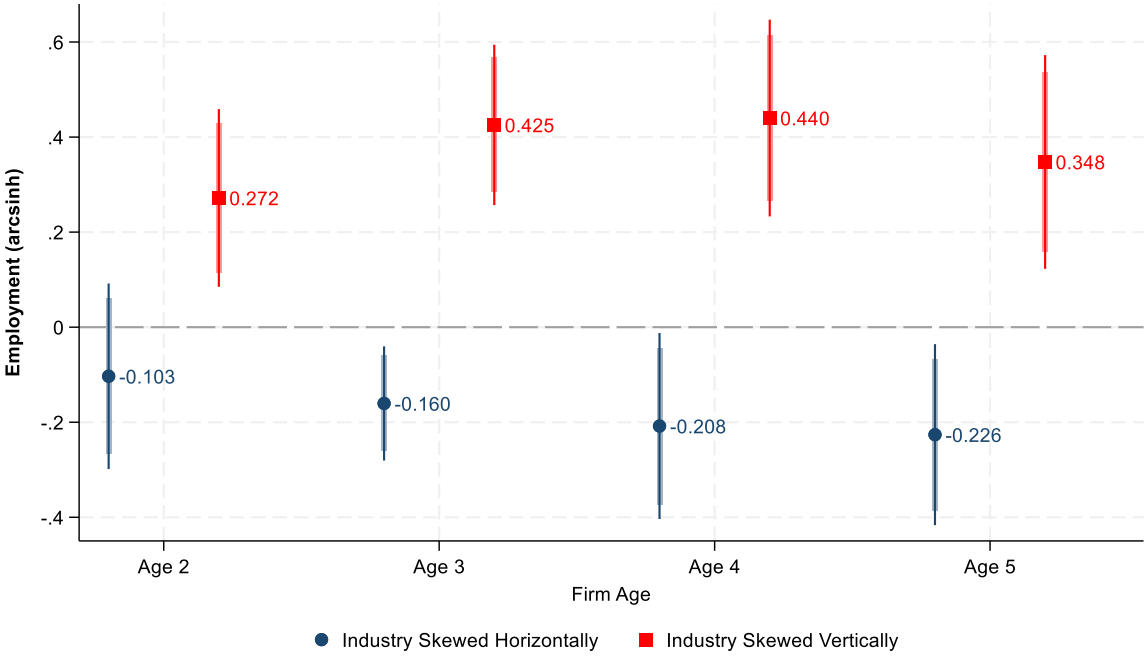
Panel B: DV – Firm Employment

FIGURE 3: Heterogeneity Assessment – Industry Variation

Notes: Dependent variable denoted along y-axis. We report coefficients for (*horizontal*) *Agglomeration* (Eq. 2). We indicate the 90th and 95th percent confidence intervals. Figure mirrors format of Figure 1 with different stratification techniques exploiting Firm Fit Factors. Legend denotes the sample specification, accordingly. Given our interest in industry heterogeneity, we do not include industry dummies in model.



Panel A: DV – Firm Sales



Panel B: DV – Firm Employment

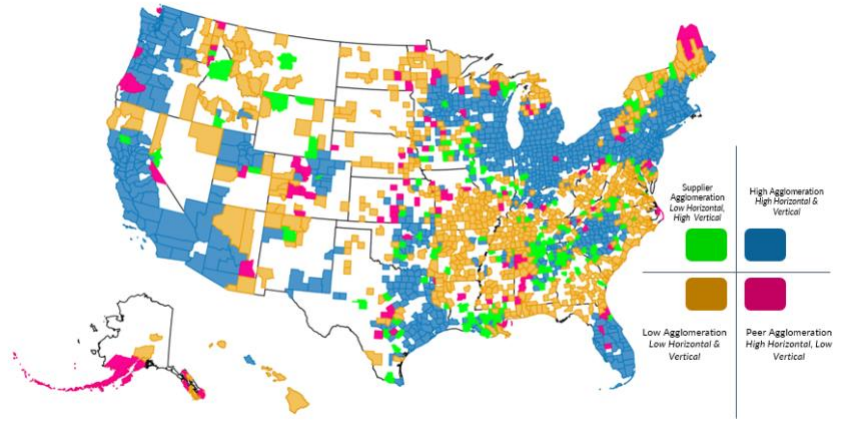
FIGURE 4: Heterogeneity Assessment – Differential Positioning

Notes: Dependent variable denoted along y-axis. We report coefficients for (*horizontal*) *Agglomeration* (Eq. 2). We indicate the 90th and 95th percent confidence intervals. Figure mirrors format of Figure 1 with different stratification techniques exploiting Firm Fit Factors. Legend denotes the sample specification, accordingly.

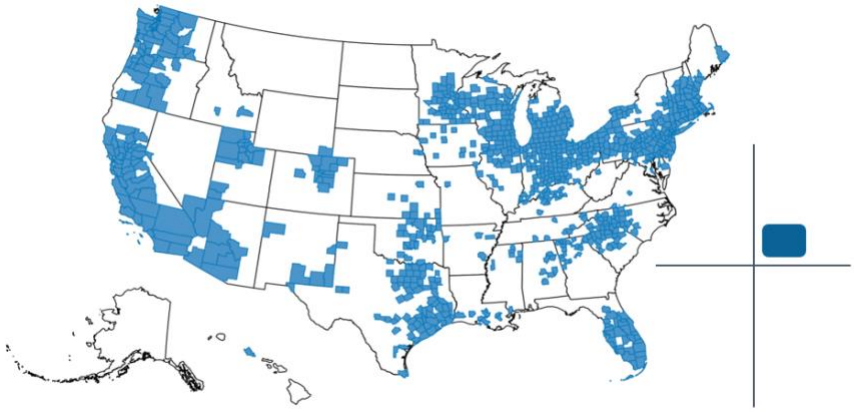
Appendix Figure A1: Illustration of Hypotheses of Agglomeration-Firm Fit on Increasing Performance for New Manufacturing Firms

	Horizontal Agglomeration	Vertical Agglomeration
H1: Baseline	**On average: Knowledge spillovers and shared labor pools are easier to access to appropriate**	On average: Supply-chain effects are likely less appropriable given that they require more significant transaction costs to establish relationships
H2a: Regional Variation	**Anchor Presence: Such regions represent cases where there is likely sufficient concentration and coordination of activity, which likely generate disproportionate rates of knowledge and labor spillovers**	Anchor Presence: Supplier networks are not well suited to support new manufacturing firms that often have production volumes in small rather than large scales. Moreover, the local coordinating actor has a higher ability to exclude access to vertical agglomeration externalities
H2b: Regional Variation	Anchor exit: Creates an environment where coherent agglomeration economies exist but now lack a local coordinating actor; smaller firms likely do not have the capital or relationships to continue local training programs or collaborations that facilitate horizontal spillovers	**Anchor exit: Creates an opportunity where regional suppliers may need to find new local customers and partners**
H3: Industry Variation	**Upstream positioning: Firms operating in industries with more R&D intensity benefit from horizontally agglomerated regions where there is discounted access to local, specialized labor and/or knowledge**	**Downstream positioning: Proximity to suppliers may offer a competitive advantage given access to reduced lead times, faster design cycles, lower costs, and increased yields**
H4: Differential Positioning	**Skewed positioning to industry-dominant agglomeration structure: Firm's distinct position, relative to its competitors, provides unique access to resources that offer competitive positioning**	

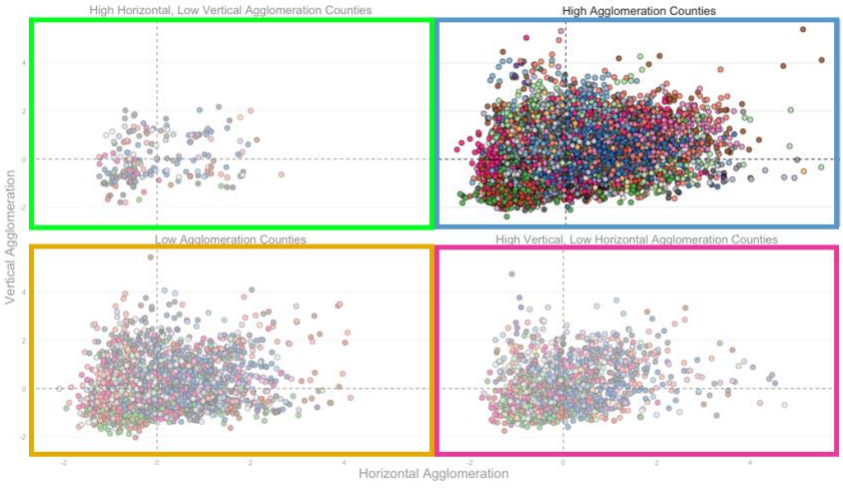
Notes. The outcome across all hypotheses pertains to *increasing performance for new manufacturing firms*. Bolded text illustrates our hypothesized form of agglomeration leading to increased firm performance for new manufacturing firms. Underlined detail emphasizes our Firm Fit Factor.



Step 1: Begin with sample identifying variation in county agglomeration across U.S. (Kalathil et al., 2025).

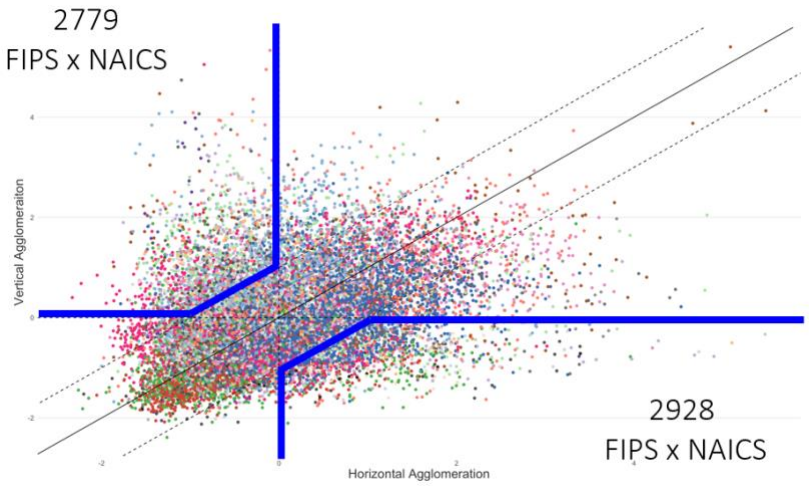


Step 2: Narrow sample to counties (i.e., FIPS) with blue designation reporting high levels of horizontal and vertical agglomeration.

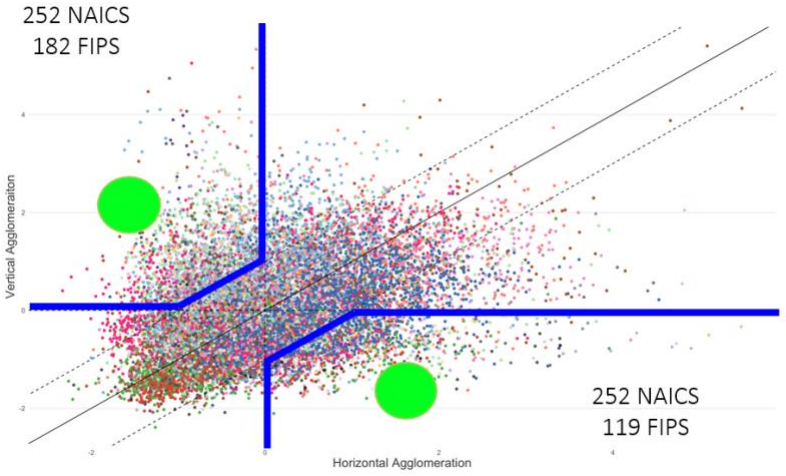


Step 3: Unpack sub-sample of FIPS in blue quadrant by illustrating FIPS x NAICS values of agglomeration.

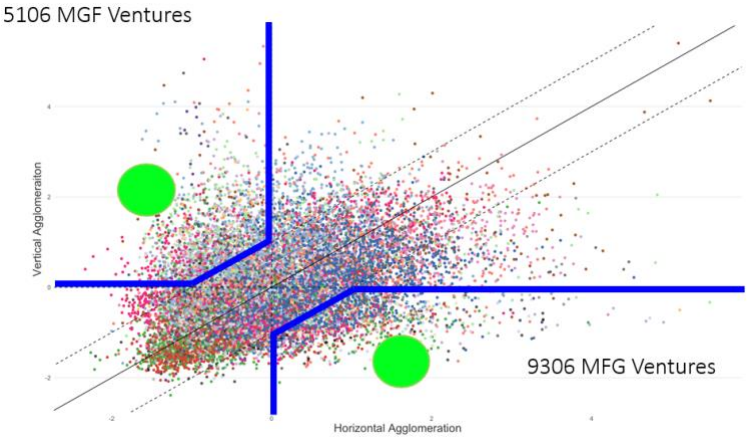
Note: figure continues next page.



Step 4: Identify margin of agglomeration, as designated by thick blue lines. 2779 FIPS x NAICS qualify as leading vertically agglomerated; 2928 FIPS x NAICS qualify as leading horizontally agglomerated.



Step 5: Identify set of NAICS with presence in both margins of agglomeration (252 NAICS meet designation). The large green circle illustrates a NAICS pair that is present in both agglomerated places. This includes 182 (119) counties in the margin of vertically (horizontally) agglomerated counties.



Step 6: Identify the population of new MFG firms founded between 2012 – 2015 that meet the NAICS x FIPS designation. 5106 (9306) firms are in vertically (horizontally) agglomerated counties.

Appendix Figure A2: Illustration of Sampling Design (Steps 1 – 6)

Appendix A: Data Construction

Section 1: Primary Agglomeration Construction (by county – industry designation)

- Industry
  - Manufacturing scope
  - 252 6-digit NAICS
- County
  - U.S. geography
  - 5-digit FIPS designation
  - 119 counties fall within horizontal designation
  - 182 counties fall within vertical designation
- Industry x County
  - Horizontal agglomeration: 2928 unique FIPS x NAICS
  - Vertical agglomeration: 2779 unique FIPS x NAICS

Firm Sampling

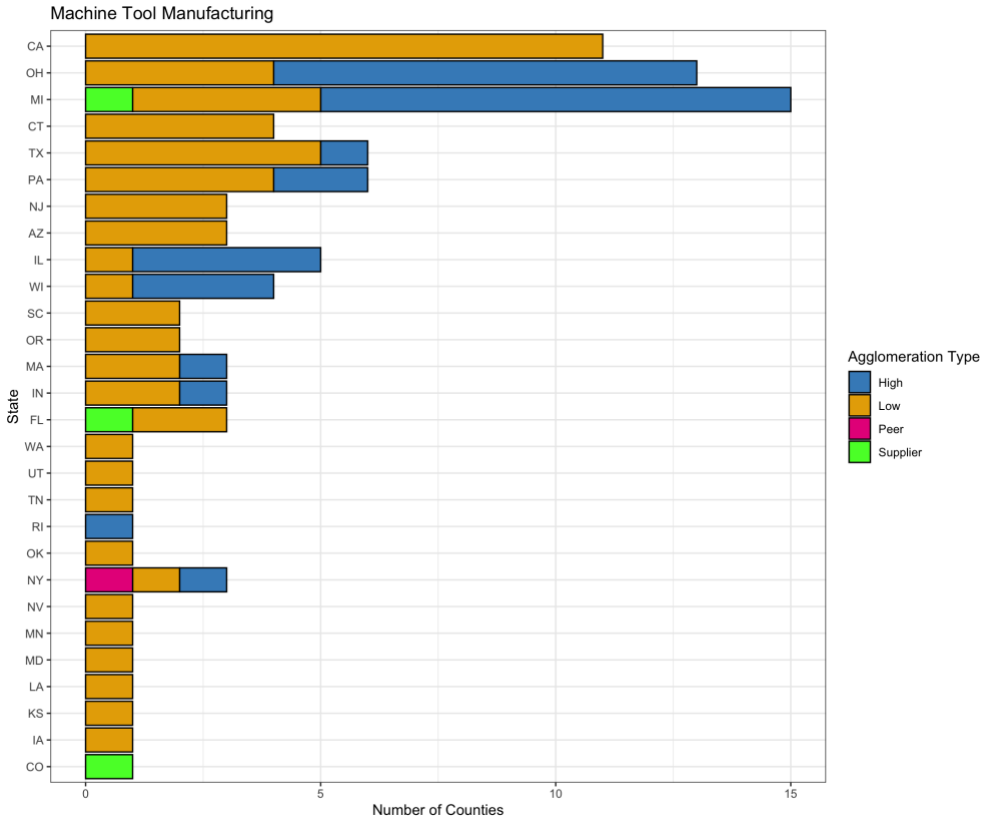
- Identify population of firms that meet following specifications
  - Founded 2012 – 2015
  - US owned
  - Single establishment
  - 252 6-digit MFG NAICS
  - 16,107 firms meet this designation
  - Trace firms over the first 5 years of operations
    - Sample as of firm age 2: 14,456 (11 percent attrition)
    - Sample as of firm age 3: 13,801 (5 percent attrition)
    - Sample as of firm age 4: 12,937 (6 percent attrition)
    - Sample as of firm age 5: 12,089 (7 percent attrition)

Section 2: Data Extension – Agglomeration Construction with EA designation (by economic area – industry designation)

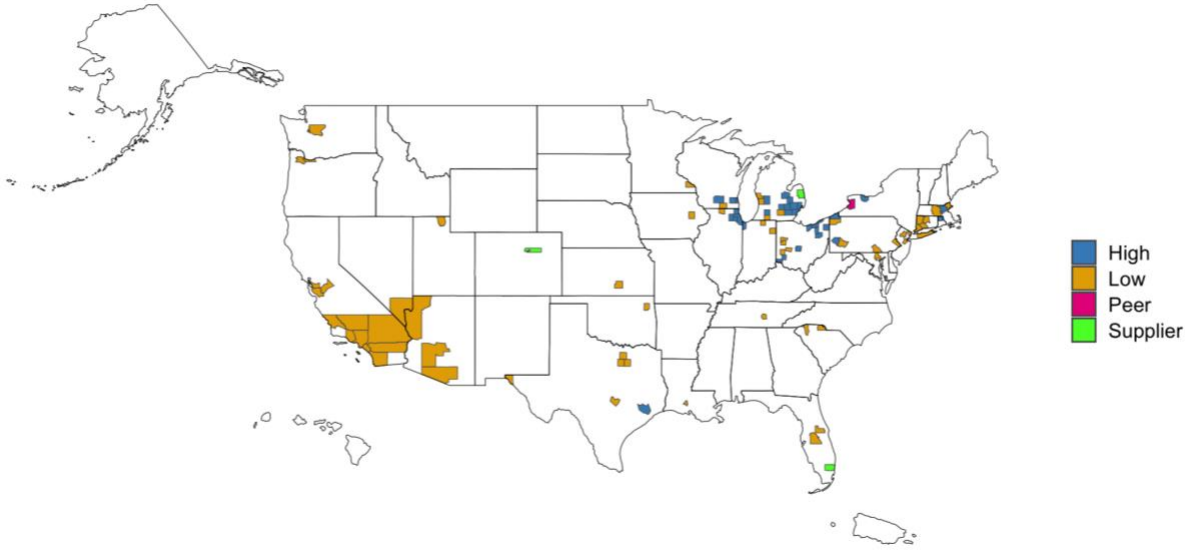
- Industry
    - Manufacturing scope
    - 170 6-digit NAICS
- Economic Areas (total of 179 US EA)
    - U.S. geography
    - 5-digit FIPS designation
    - 30 counties fall within horizontal designation
    - 34 counties fall within vertical designation
- Industry x County
    - Horizontal agglomeration: 966 unique EA x NAICS
    - Vertical agglomeration: 844 unique EA x NAICS

Firm Sample

- Identify population of firms that meet following specifications
    - Founded 2012 – 2015
    - US owned
    - Single establishment
    - 170 6-digit MFG NAICS
    - 19,387 firms meet this designation
    - Trace firms over the first 5 years of operations
        - Sample as of firm age 2: 17,419 (10 percent attrition)
        - Sample as of firm age 3: 16,681 (4 percent attrition)
        - Sample as of firm age 4: 15,659 (6 percent attrition)
        - Sample as of firm age 5: 14,589 (7 percent attrition)



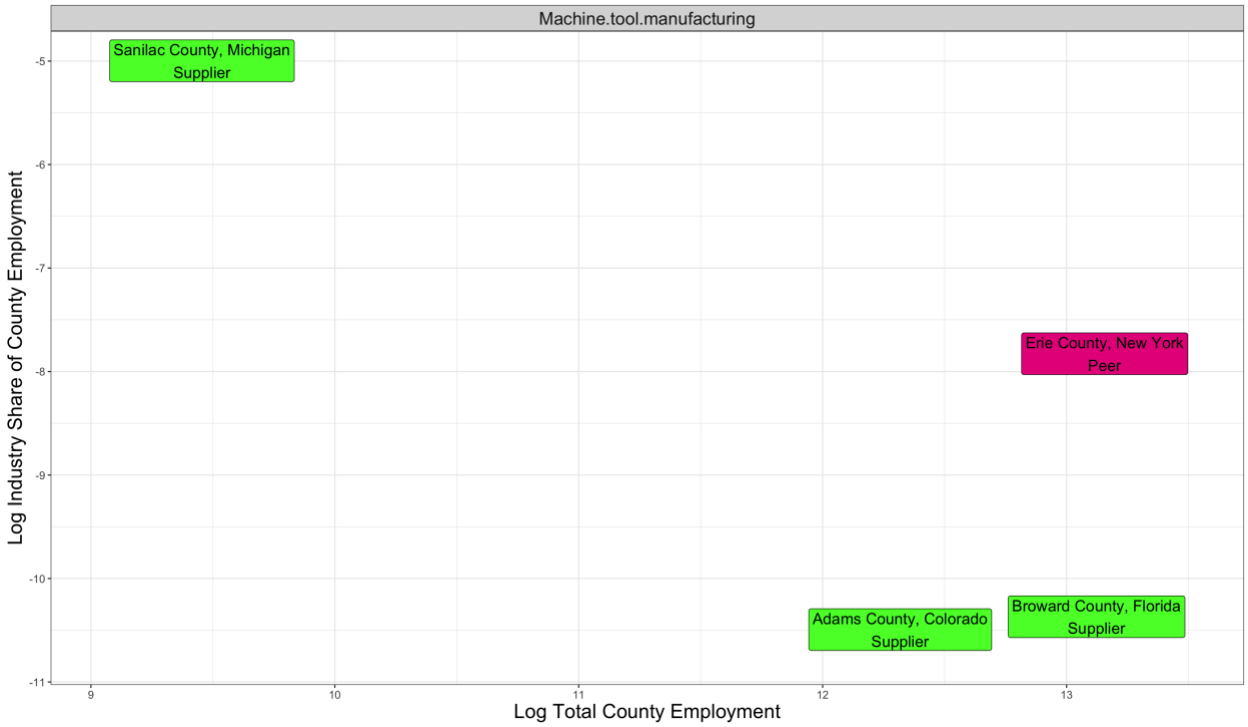
Panel A: Count of Counties by Agglomeration Type



Panel B: Geographic Illustration of Counties by Agglomeration Type

Appendix Figure A3: County Distribution by Agglomeration Type for Machine Tool Manufacturing (NAICS 333517)

Notes: Focusing on the sub-sample of highly-agglomerated counties displayed in Step 4 of Figure 2, we illustrate the counties based on if the rate of horizontal and vertical agglomeration are: 1) High Agglomeration - both are above the average level of horizontal (vertical) agglomeraiton across highly agglomerated counties; 2) Low Agglomeration - both are below the average level of horizontal (vertical) agglomeraiton across highly agglomerated counties; 3) Peer Agglomeration – horizontal agglomeration is above average, but vertical agglomeration is below; and 4) Supplier Agglomeration – horizontal agglomeraiton is below average, but vertical agglomeration is above. We plot the total number of counties that fall into each of these designations across states in a specific industry: Machine Tool Manufacturing (NAICS 333517).



Appendix Figure A4: Counties Used for Sampling of Firms from Machine Tool Manufacturing

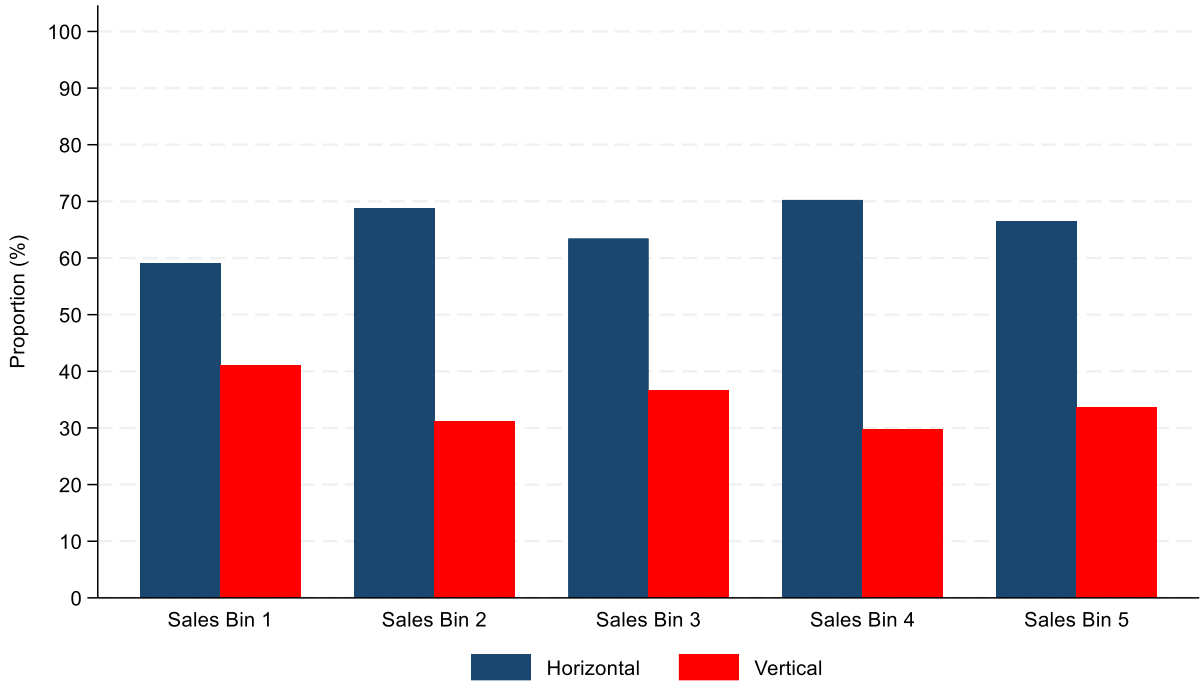
Notes: As an illustration, for the industry Machine Tool Manufacturing (NAICS 333517), we sample from this set of counties for analysis. Here, we plot the set of counties based on the log-total employment in these counties, and the log of industry share of county employment in a specific industry.

Appendix Table A1: Primary Regression Results (Eq. 1)

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	DV - Firm Sales (arcsinh)				DV - Firm Employment (arcsinh)			
Agglomeration	0.101	0.121	0.122	0.122	0.003	0.013	0.016	0.013
	(0.055)	(0.060)	(0.061)	(0.062)	(0.026)	(0.029)	(0.029)	(0.029)
Minority Owned	-0.121	-0.166	-0.237	-0.214	-0.094	-0.153	-0.195	-0.173
	(0.065)	(0.062)	(0.060)	(0.059)	(0.038)	(0.037)	(0.042)	(0.039)
Female Owned	-0.137	-0.169	-0.192	-0.178	-0.043	-0.066	-0.083	-0.073
	(0.031)	(0.033)	(0.032)	(0.033)	(0.016)	(0.017)	(0.019)	(0.019)
Anchor	0.189	0.180	0.164	0.173	0.073	0.056	0.043	0.043
	(0.052)	(0.050)	(0.048)	(0.049)	(0.025)	(0.025)	(0.024)	(0.024)
Emp Bin 1 (1-9)	-5.029	-4.796	-4.832	-4.795	-5.643	-5.517	-5.393	-5.447
	(0.111)	(0.103)	(0.097)	(0.098)	(0.090)	(0.098)	(0.081)	(0.086)
Emp Bin 2 (10 - 19)	-3.494	-3.265	-3.294	-3.217	-4.414	-4.300	-4.179	-4.210
	(0.123)	(0.113)	(0.100)	(0.097)	(0.091)	(0.100)	(0.084)	(0.088)
Emp Bin 3 (20 - 49)	-2.247	-2.103	-2.205	-2.200	-3.487	-3.413	-3.347	-3.395
	(0.126)	(0.117)	(0.103)	(0.103)	(0.092)	(0.100)	(0.081)	(0.086)
Emp Bin 4 (50 - 99)	-1.303	-1.126	-1.259	-1.136	-2.599	-2.566	-2.505	-2.509
	(0.153)	(0.139)	(0.127)	(0.119)	(0.097)	(0.104)	(0.087)	(0.091)
Emp Bin 5 (100 - 249)	-0.538	-0.517	-0.562	-0.615	-1.823	-1.800	-1.743	-1.789
	(0.130)	(0.129)	(0.120)	(0.126)	(0.094)	(0.103)	(0.086)	(0.089)
Emp Bin 6 (250 - 499)	0.091	0.168	0.081	0.103	-0.888	-0.875	-0.833	-0.878
	(0.109)	(0.107)	(0.095)	(0.098)	(0.094)	(0.105)	(0.081)	(0.084)
Fair Market Rent (Q1)	0.024	0.017	-0.027	-0.043	-0.013	0.014	-0.019	-0.043
	(0.050)	(0.046)	(0.053)	(0.054)	(0.028)	(0.028)	(0.032)	(0.031)
Fair Market Rent (Q2)	-0.048	-0.012	-0.017	-0.025	-0.034	-0.015	-0.014	-0.019
	(0.045)	(0.042)	(0.043)	(0.044)	(0.028)	(0.027)	(0.028)	(0.025)
Fair Market Rent (Q3)	-0.041	-0.029	-0.002	-0.033	-0.000	0.005	0.022	0.004
	(0.033)	(0.030)	(0.038)	(0.038)	(0.017)	(0.020)	(0.021)	(0.021)

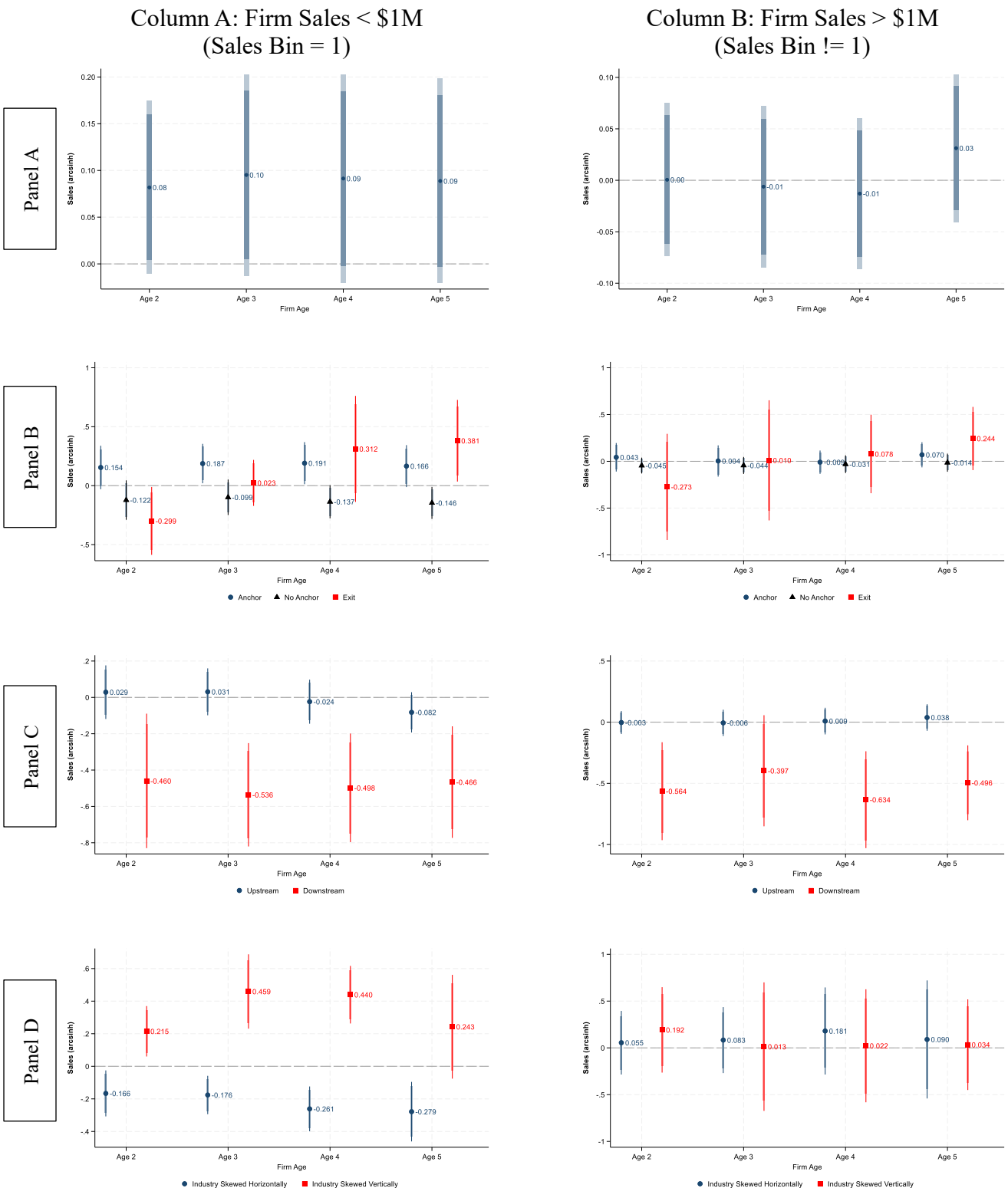
Constant	18.182	18.010	18.141	18.109	7.400	7.336	7.293	7.353
	(0.131)	(0.124)	(0.115)	(0.118)	(0.092)	(0.100)	(0.084)	(0.087)
Firm Observations	14,443	13,787	12,923	12,076	14,443	13,787	12,923	12,076
R-squared	0.675	0.660	0.639	0.637	0.780	0.759	0.732	0.734
Cross-section	Age 2	Age 3	Age 4	Age 5	Age 2	Age 3	Age 4	Age 5

Notes: Dependent variables: *Firm Sales* (arcsinh) reported in Columns 1 – 4 and *Firm Employment* (arcsinh) reported in Columns 5 – 8. We adjust firm age across Columns 1 – 4 and 5 – 8 from age two, three, four, and five years, respectively. (*Horizontal*) *Agglomeration* serves as primary explanatory variable, vertical agglomeration serves as referent. We utilize `reghdfe` using Stata 18, allowing for high-dimensional fixed effects that include year, industry, and state dummies. Standard errors clustered by 6-digit NAICS to account for autocorrelation by industry reported in parentheses.



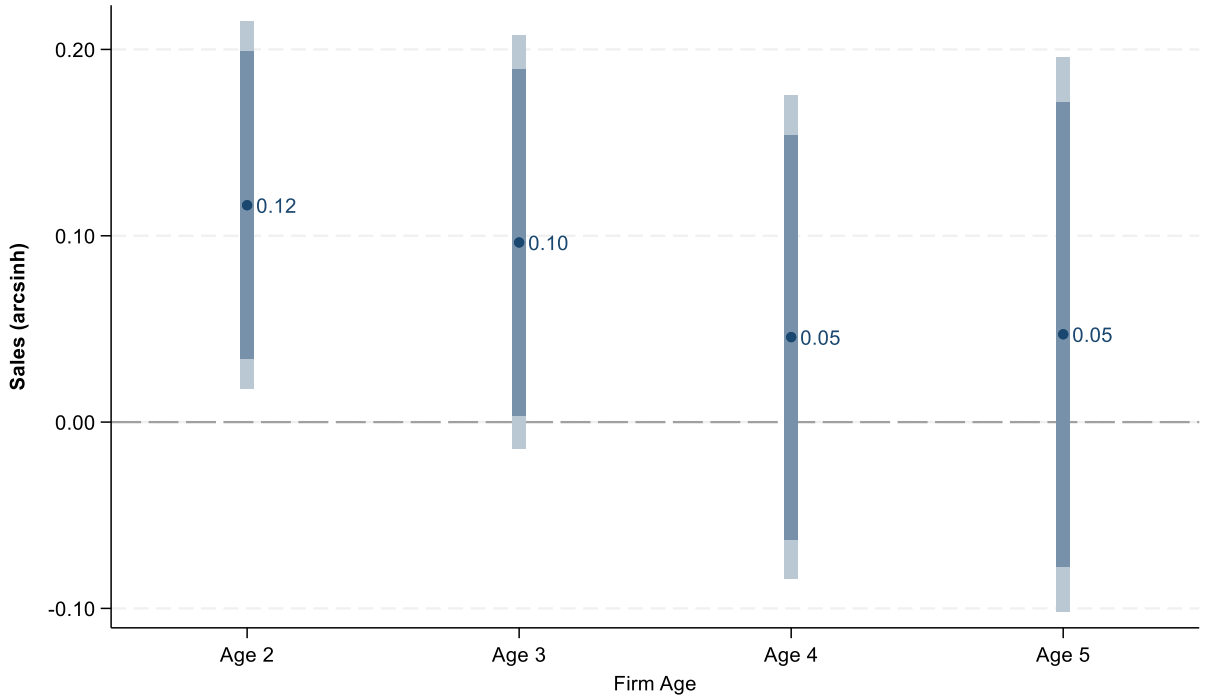
Appendix Figure A5: Distribution of Agglomeration Type by Sales Binning

Notes: Sales Bin 1 (< $1 M); Sales Bin 2 ($1 – 5 M); Sales Bin 3 ($5 – 10 M); Sales Bin 4 ($10 – 50 M); Sales Bin 5 (> $50 M).

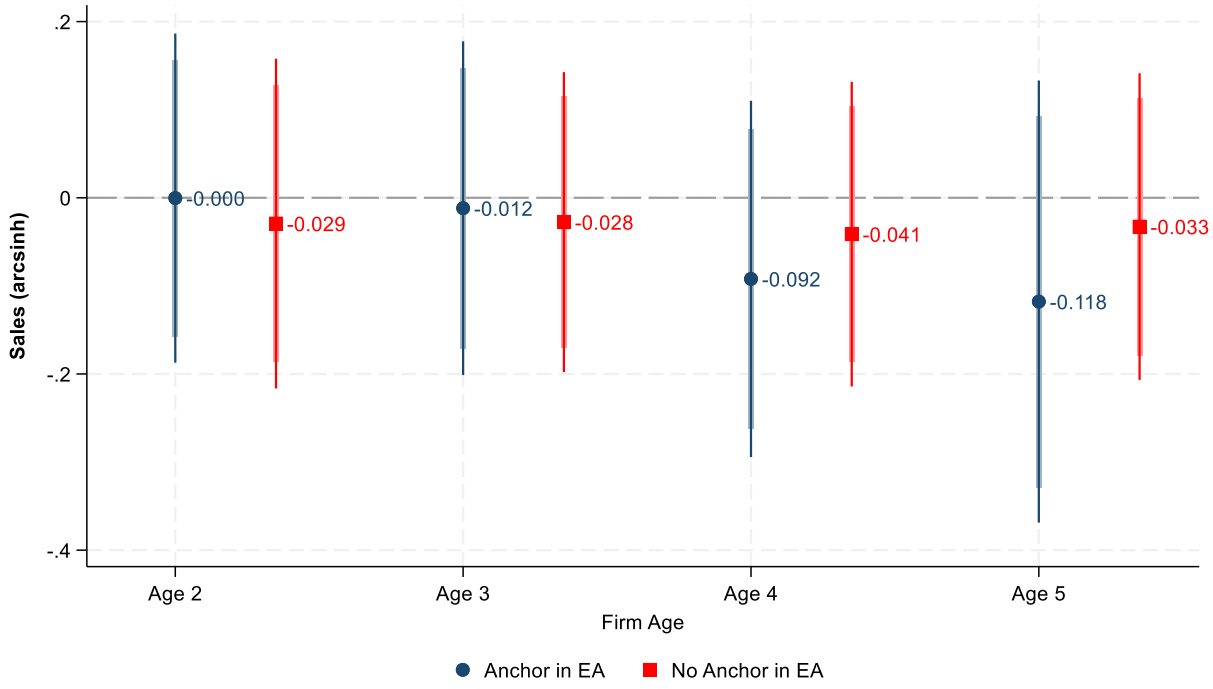


Appendix Figure A6: Re-estimation with Sample Bifurcation by Sales Capacity

Notes: Firm Sales (arcsinh) is dependent variable. Panels A – D align with Figures 3 – 6, respectively.

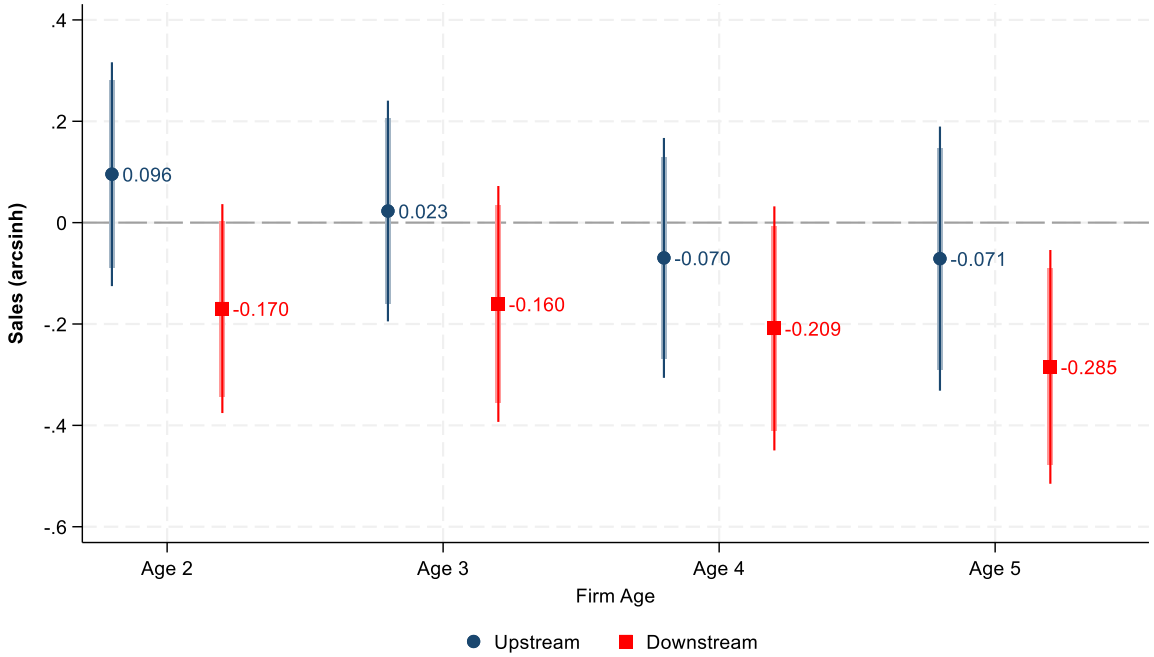


Panel A: Baseline

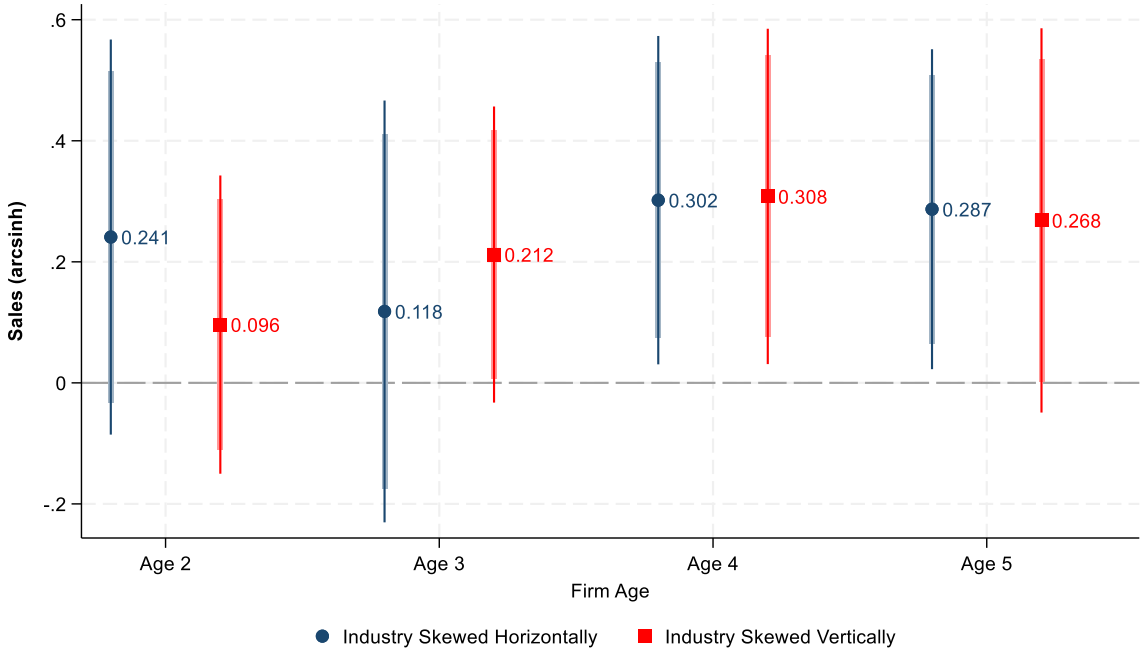


Panel B: Regional Heterogeneity

Notes: Panels C and D on next page.



Panel C: Industry Heterogeneity



Panel D: Agglomeration Skew

Appendix Figure A7: Agglomeration Extension (EA designation)

Notes: Firm Sales (arcsinh) is dependent variable. Panels A – D align with Figures 3 – 6, respectively.

Appendix Figure A8: Illustration of Results Around Agglomeration-Firm Fit on Increasing Performance for New Manufacturing Firms

	Horizontal Agglomeration	Vertical Agglomeration
H1: Baseline *Supported*	**On average: Knowledge spillovers and shared labor pools are easier to access to appropriate**	On average: Supply-chain effects are likely less appropriable given that they require more significant transaction costs to establish relationships
H2a: Regional Variation *Supported*	**Anchor Presence: Such regions represent cases where there is likely sufficient concentration and coordination of activity, which likely generate disproportionate rates of knowledge and labor spillovers**	Anchor Presence: Supplier networks are not well suited to support new manufacturing firms that often have production volumes in small rather than large scales. Moreover, the local coordinating actor has a higher ability to exclude access to vertical agglomeration externalities
H2b: Regional Variation *Partially Supported*	**Anchor exit: Creates an environment where coherent agglomeration economies exist but now lack a local coordinating actor.** **More mature young firms can access horizontal spillovers.**	**Anchor exit: Creates an opportunity where regional suppliers may need to find new local customers and partners.** **Firms leverage this opportunity at a young age.**
H3: Industry Variation *Partially Supported*	Upstream positioning: Firms operating in industries with more R&D intensity benefit from horizontally agglomerated regions where there is discounted access to local, specialized labor and/or knowledge	**Downstream positioning: Proximity to suppliers may offer a competitive advantage given access to reduced lead times, faster design cycles, lower costs, and increased yields**
H4: Differential Positioning *Mostly Supported*	**Skewed positioning to industry-dominant agglomeration structure: Firm's distinct position, relative to its competitors, provides unique access to resources that offer competitive positioning**	

Notes. Figure A8 mirrors the format of Figure A1 yet reveals results from regression analyses. Bolded text illustrates where we report evidence of support of agglomeration-firm fit on increased firm performance for new manufacturing firms