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Entrepreneurship and Employment: The Simultaneous Impacts of Establishment Births versus Deaths on Regional Employment across the United States*

Eunsuk Hong^a and In Hyeock (Ian) Lee^b

^a*School of Finance and Management, SOAS University of London, UK.*

^b*Management Department, Quinlan School of Business, Loyola University Chicago, USA.*

Abstract: This study investigates the non-linear effects of establishment births versus deaths on regional employment, which show asymmetric pathways between intra-regional versus inter-regional spillovers. Using state-year data on establishment births, deaths, and employment for service sectors in the 48 contiguous U.S. states from 1980 to 2014, the study implements three-stage least squares (3SLS) regressions to test competing forces of multiplier versus competition effects, with endogeneity and spatial and temporal dependencies addressed. Empirical results support the following ‘four’ non-linear, asymmetric relationships as hypothesized: (i) establishment births initially increase total employment within a focal U.S. state, but decrease it with excessive establishment births within the state (i.e., inverted U-shaped); (ii) establishment births in the neighboring states of a focal U.S. state initially decrease total employment in the focal state, but increase it with excessive establishment births in the neighboring states (i.e., U-shaped); (iii) establishment deaths initially decrease total employment within a focal U.S. state, but increase it with excessive establishment deaths within the state (i.e., U-shaped); and (iv) establishment deaths in the neighboring states of a focal U.S. state initially increase total employment in the focal state, but decrease it with excessive establishment deaths in the neighboring states (i.e., inverted U-shaped). These findings also hold at the fine-grained geographic level of metropolitan statistical areas (MSAs) and under diverse contextual conditions. The study contributes to the literature by testing the theoretical thresholds at which the dominance between multiplier and competition effects can be reversed in non-linear pathways, and by empirically estimating the asymmetric interdependences of regional employment between intra-regional versus inter-regional spillovers of establishment births and deaths.

Keywords: Establishment births, Establishment deaths, Regional employment, Intra-regional effects, Inter-regional effects

JEL Codes: C35, J21, R12

*Corresponding Author: Eunsuk Hong, E-mail: eh19@soas.ac.uk

1. INTRODUCTION

Entrepreneurship involves the exploitation of innovative ideas and new business opportunities (Shane and Venkataraman, 2000), resulting in new firm creation (Gartner, 1990; Aldrich, 2010). Numerous studies have recognized entrepreneurship as a powerful engine for employment growth through new firm formation (e.g., Fritsch and Mueller, 2004; Knoben et al., 2011). This is primarily because new firms create competitive pressure that forces existing firms to perform more efficiently and hire more employees. Additionally, new firms act as vehicles for introducing innovation, which fosters long-term economic growth accompanied by new job opportunities (e.g., van Stel and Storey, 2004; van Stel and Suddle, 2008; Ayyagari et al., 2014; Xu et al., 2021; Yang and Zhang, 2021).

Despite this apparent impact of new firms on employment as emphasized in previous studies, several debates in the literature highlight the complexity of the entrepreneurial process leading to final employment levels. First, entrepreneurship is a dynamic process of mobilizing resources and opportunities to create new firms (Gartner, 1990; Fotopoulos and Spence, 2001; Aldrich, 2010; Knoben et al., 2011). However, given the scarce resources and limited business opportunities available in a regional economy, successful founding activities are often the exception rather than the rule. This is demonstrated by the ‘valley of death,’ which illustrates the high rate of new business failures (i.e., firm deaths) during the entrepreneurial process (Fotopoulos and Spence, 2001) — a phenomenon that is expected to constrain and even decrease employment opportunities in a regional economy.

Second, the contrasting effects of firm births and deaths may influence job creation and subsequent employment levels in a regional economy through the interplay of ‘positive’ and ‘negative’ externalities from agglomeration. The literature on ‘multiplier’ versus ‘competition’ effects (Johnson and Parker, 1994, 1996; Cole, 2000; Fritsch and Mueller, 2004; Lu et al., 2008; Fritsch and Schindele, 2011; Resende et al., 2015; Gajewski and Kutan, 2018) provides a theoretical lens for explaining the effects of firm births versus deaths on employment in a geographic region. The former builds on Marshallian gains (Marshall, 1920) from agglomeration economies, whereas the latter results in congestion costs (e.g., Johnson and Parker, 1994, 1996; Cooper and Folta, 2000) stemming from agglomeration diseconomies.

For example, whenever new firms are born, this may signal the existence of lucrative business opportunities available in a regional economy, which should encourage other entrepreneurs to establish new firms, thereby creating additional jobs (i.e., the multiplier effects of firm births). Considering that the process of founding activities is sectoral (Audretsch and Belitski, 2021, 2023), such ‘positive’ multiplier effects of firm births on new jobs may occur either within the same sectors in the form of intra-industry ‘specialization’ spillovers (Marshall, 1920; Acs et al., 2007; Audretsch and Belitski, 2020; Barboza and Pede, 2024; Barboza and Braga, 2025) or across diverse sectors as inter-industry ‘diversity’ spillovers (Jacobs, 1969; Acs et al., 2007; Audretsch and Belitski, 2020; Barboza and Pede, 2024; Barboza and Braga, 2025). However, new firms may also increase the level of competition among diverse participants in proximity, generating ‘negative’ congestion costs (e.g., Folta et al., 2006; Lee et al., 2014; Sun et al., 2017; Cole, 2018). Beyond a certain threshold, this intensified competition may constrain additional firm births and may even cause the death of some new firms, undermining employment opportunities in a regional economy (i.e., the competition

effects of firm births).

Likewise, whenever firm exits are observed, this may signal unfavorable business environments to entrepreneurs in a regional economy, which should discourage them from conducting founding activities, thereby decreasing job creation therein (i.e., the multiplier effects of firm deaths). However, firm deaths may also decrease the level of competition for scarce resources and limited business opportunities in proximity. This reduced competition, in turn, may boost founding activities after a certain threshold, ultimately generating employment opportunities (i.e., the competition effects of firm deaths).

Third, the interconnectedness between firm births and deaths affecting job creation and employment in a regional economy may not be confined to a single region but may instead spill over to neighboring regions. For example, entrepreneurs' learning-by-doing capabilities leading to new firms (Bloom et al., 2020; Barboza et al., 2023) and their access to financial resources critical for founding activities (Pijnenburg and Kholodilin, 2014) have been recognized to spill over within a focal region as well as to its neighbors. In addition, the knowledge spillover theory of entrepreneurship (Audretsch and Lehmann, 2005; Agarwal et al., 2007; Audretsch and Keilbach, 2007; Acs et al., 2009; Knoben et al., 2011; Acs et al., 2013; Audretsch et al., 2021, 2025; Barboza and Pede, 2024; Barboza and Braga, 2025) posits that entrepreneurs' founding activities are subject to spatial interdependencies across neighboring regions (Plummer, 2010), partly due to the sticky nature of geographic knowledge spillovers. As a result, firm births and deaths in one region may be influenced by those in neighboring regions, thereby altering job creation and employment opportunities across neighboring regions.

Given the previous debates concerning firm births, deaths, and regional employment in the spatial entrepreneurship and regional science literature, the main objectives of this study are three-fold. First, it aims to add the other side of entrepreneurship (i.e., firm deaths) as an equally important determinant of employment opportunities from a geographic perspective to reflect a potential simultaneity among firm births, deaths, and regional employment. Second, it attempts to disentangle the competing forces of multiplier vs. competition effects for both firm births and firm deaths, which may result in non-linear employment effects in a region. Third, it also attempts to incorporate spatial spillovers to neighboring regions into the aforementioned relationships to detect intra-regional versus inter-regional effects of firm births and deaths on regional employment.

To accomplish these objectives, this study operationalizes firm births and deaths using establishment births and deaths, respectively,¹ and explores the following research questions on the determination of regional employment from a geographic perspective: (1) in which ways do establishment births affect total employment (i) within a focal region and (ii) between the focal region and its neighboring regions? and (2) in which ways do establishment deaths affect total employment (iii) within a focal region and (iv) between the focal region and its neighboring regions? The study addresses these questions empirically using secondary public data for service sectors from the U.S. Bureau of Economic Analysis and the U.S. Cen-

¹The U.S. Census Bureau's Business Dynamics Statistics (BDS) offers data at two levels: the firm, defined as a legal entity, and the establishment, defined as a single physical location. Since a firm can have multiple establishments, this study uses establishment-level data for greater geographic precision, data stability, and more accurate job creation tracking.

sus Bureau, covering the 48 contiguous states in the U.S. over 35 years from 1980 to 2014. It focuses on the relatively homogeneous group of service sectors to evaluate the interconnectedness among establishment births, deaths, and regional employment, because service outputs are characterized by the inseparable and location-bound nature of their production, delivery, and consumption in a proximate geographic region (Campbell and Verbeke, 1994; Lee et al., 2016).

This paper is organized as follows. The next section presents theoretical foundations and four hypotheses to be tested in this study. Section 3 outlines the empirical research design, including a description of the data, measures, and econometric models used. Section 4 discusses the main results and findings from the empirical analyses in detail. Finally, the paper concludes with key conceptual and empirical contributions, practical and policy implications, and limitations to guide future research.

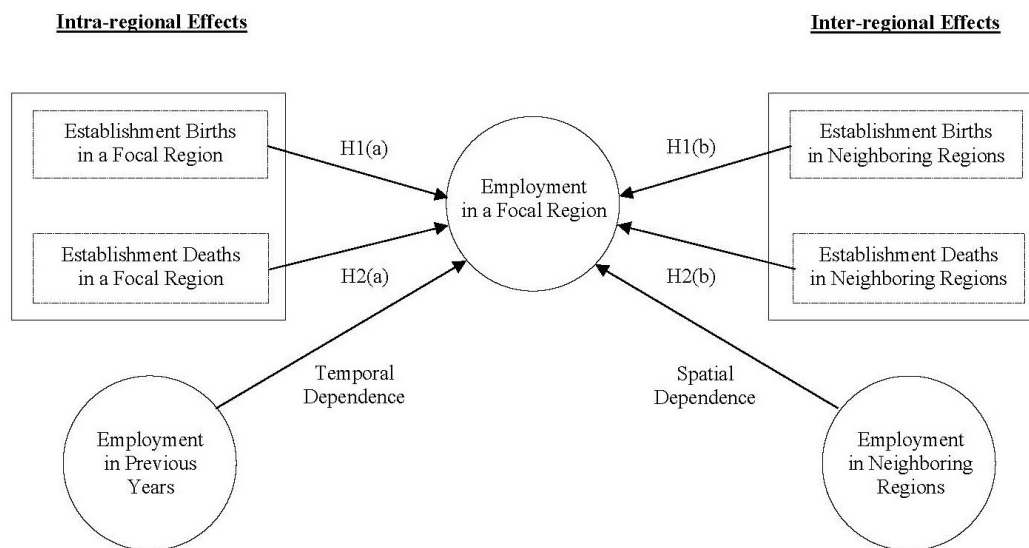
2. THEORETICAL FOUNDATIONS AND HYPOTHESES

2.1. Conceptual Framework: A Geographic Approach

The conceptual framework of this study is presented in Figure 1. It posits that the level of employment in a focal region is determined by (i) establishment births within the same focal region through intra-regional effects and (ii) establishment births from its neighboring regions through inter-regional effects [i.e., H1(a) and H1(b)]. It also posits that regional employment is shaped by (iii) establishment deaths within the same region and (iv) establishment deaths from its neighboring regions via intra-regional vs. inter-regional channels [i.e., H2(a) and H2(b)]. This is because firm activities are spatially interdependent through geographic spillovers, and hence, establishment births and deaths are likely to spill over to other entrepreneurs and new firm owners in proximity, resulting in contrasting employment opportunities in a focal region. The conceptual framework also shows the possibility of spatial dependence in regional employment (i.e., correlations across neighboring regions), in addition to temporal dependence (i.e., correlations over time), which needs to be explicitly accounted for when capturing the final level of employment in a regional economy.

Such spillovers of positive and negative externalities in firm activities have traditionally been discussed in the context of industrial agglomeration from a sectoral perspective, resulting in the long-time debate on ‘specialization’ spillovers within homogeneous sectors (Marshall, 1920; Acs et al., 2007; Audretsch and Belitski, 2020; Barboza and Pede, 2024; Barboza and Braga, 2025) and ‘diversity’ spillovers across heterogeneous sectors (Jacobs, 1969; Acs et al., 2007; Audretsch and Belitski, 2020; Barboza and Pede, 2024; Barboza and Braga, 2025). Furthermore, spillovers are also recognized as being location-bound and sticky, with decaying (Barboza and Pede, 2024) or asymmetric effects (Barboza and Braga, 2025) along bordering regions. This implies that they still flow across geographic regions (Carboni, 2013). Hence, employment opportunities generated in a focal region may be affected by relevant spillovers of firm activities, such as establishment births and deaths, originating within the same region and from its neighboring regions.

For example, entrepreneurs in neighboring regions may be equipped with better learning-by-doing capabilities than their counterparts in non-neighboring distant regions (Bloom

Figure 1: Conceptual Framework

et al., 2020; Barboza et al., 2023). This is because spillovers of founding activities can take place through entrepreneurs' observations and applications of new business ideas (Aldrich and Martinez, 2001) across bordering regions. In addition, access to start-up capital, a critical resource for founding activities, is not confined to the same geographic region (Pijnenburg and Kholodilin, 2014). The knowledge spillover theory of entrepreneurship (Audretsch and Lehmann, 2005; Agarwal et al., 2007; Audretsch and Keilbach, 2007; Acs et al., 2009; Knoblen et al., 2011; Acs et al., 2013; Audretsch and Belitski, 2021; Audretsch et al., 2025; Barboza and Pedde, 2024; Barboza and Braga, 2025) indicates that technological and scientific knowledge conducive to entrepreneurs' founding activities may also be transferred either within a proximate region or to bordering locations. This results in a spatially uneven distribution of new firms accompanied by different levels of job opportunities across geographic spaces (Barboza and Pedde, 2024).

Therefore, the importance of intra-regional vs. inter-regional spillovers of establishment births and deaths on regional employment becomes apparent when a geographic approach is adopted as in this study. When geographic borders are drawn on the map of a single country, multiple locational options become available for entrepreneurs and their new firms. As such, a focal region and its neighboring regions may possess a substitutable relationship as alternative locations for entrepreneurs' founding activities. This means that greater competitiveness in neighboring regions may make the focal region relatively less attractive as a locational site for new firms. It may even encourage new firm owners in the focal region to relocate their existing operations to neighboring regions to take advantage of the stronger competitive benefits offered there.

It should be noted that a geographic approach using spatial borders on a country's map creates a two-dimensional space, rather than a linear one, between a focal region and its bordering neighbors (Plummer, 2010). Therefore, while intra-regional effects take place within a

Figure 2: A Geographic Approach

Neighboring Region #1	Neighboring Region #2	Neighboring Region #3
Neighboring Region #4	Focal Region A	Neighboring Region #5
Neighboring Region #6	Neighboring Region #7	Neighboring Region #8

single focal region, inter-regional effects emanate from the focal region's multiple neighboring regions and influence the focal region collectively. As a result, inter-regional effects may not weaken monotonically relative to intra-regional effects with an increasing distance between a focal region and its neighboring regions. This feature becomes particularly evident when a spatial weight matrix W is used in an empirical setting (Plummer, 2010).² For example, in the two-dimensional space illustrated in Figure 2, where Focal Region A is surrounded by eight neighboring regions #1–#8, their inter-regional effects on Focal Region A are not simply from one neighboring region (e.g., #5). Instead, they represent composite and weighted effects from all eight neighboring regions surrounding the focal region. This feature reinforces the substitutable relationship between a focal region and its bordering neighbors on a two-dimensional geographic space, as depicted in Figure 2.

2.2. Intra-regional vs. Inter-regional Effects of Establishment Births on Regional Employment

When entrepreneurs establish new firms to exploit business opportunities within a region, this may foster additional founding activities there, thereby multiplying the births of additional firms and creating new job opportunities as positive externalities (i.e., the multiplier effects of establishment births). Building on Marshallian gains from agglomeration economies due to labor pooling, specialized input-output sharing, and information and knowledge spillovers (Marshall, 1920), previous studies provide diverse theoretical rationales supporting the multiplier effects of establishment births, resulting in increased employment opportunities locally. At the individual level, new firms established in a region can serve as role models, expanding a pool of local entrepreneurs. Successful establishment births observable within the same region often encourage local entrepreneurs to imitate and apply such successful founding strategies to their own business opportunities (Aldrich and Martinez, 2001). At the firm level, newly established firms can generate additional collaboration and networking opportunities for other local entrepreneurs via vertical input-output relationships. This is because small and young firms commonly depend on external resource providers within their locality (Cooper and Folta, 2000) to overcome their double liabilities of smallness and newness (Aldrich and Auster, 1986; Katz and Gartner, 1988). As such, successful establishment births provide new sources of backward and/or forward partnerships along value chains (Lipparini and Sobrero, 1994), spurring additional founding activities in the same locality. At the macro level, successful establishment births usually signify favorable business environ-

²A detailed explanation of the spatial weight matrix used in this study is provided in Section 3.2.1.

ments in the region with a strong pool of tangible and intangible resources accessible within it (e.g., robust local demand, regional innovation, concentrated supporting industries, local government support). These conditions are conducive to subsequent founding activities by other entrepreneurs, with the information and knowledge about them disseminated in the same region (Armington and Acs, 2002; Lee et al., 2004; Basile et al., 2017).

However, such positive externalities do not last forever within a region. Instead, excessive establishment births begin to generate deterrent forces on entrepreneurs' founding activities within the same region in the form of negative externalities due to intensified competition (i.e., the competition effects of establishment births). Consequently, excessive establishment births in a region may lead to substantial congestion from agglomeration diseconomies (Johnson and Parker, 1994, 1996; Cole, 2000; Lu et al., 2008; Gajewski and Kutan, 2018), resulting in reduced employment opportunities in proximity. For example, given the limited resources and customers in a locality, newly established firms must compete more fiercely to secure access to them (Cooper and Folta, 2000). This intense competition often leads to the closure of some existing firms in the local market. As the number of establishment births grows in a region, it also increases various congestion costs (e.g., transportation costs, labor wages, real estate costs) for participants in the region (Folta et al., 2006). These increased costs further undermine potential profit margins for local businesses, leading to exit decisions from the congested market. Consequently, some businesses may seek to relocate their operations to other regions (Pellenbarg et al., 2002).

Considering that establishment births are a source of both Marshallian gains and deterrent costs to other founding activities in the same region, the ultimate effects of establishment births on regional employment will depend on which forces dominate between the multiplier and competition effects. The above discussion implies that multiplier effects dominate initially, but competition effects dominate later. This results in a non-linear, inverted U-shaped pattern, as stated in the following hypothesis.

Hypothesis 1(a): Total employment in a focal region is related to establishment births within the same region in a non-linear inverted U-shaped fashion, such that the former increases initially but declines after a certain threshold in the latter.

With geographic borders drawn in a country, a focal region and its neighboring regions possess a substitutable nature as alternative locational options for entrepreneurs' founding activities. Hence, when entrepreneurs consistently establish new firms in neighboring regions, this indicates that those neighboring regions provide stronger locational advantages for founding activities than the focal region may offer. These advantages include superior access to scarce resources and customers, innovative ideas, and new business opportunities that entrepreneurs can exploit. The competitiveness of neighboring regions (compared to the focal region) can be maximized when they offer: (a) new role models to be imitated by an expanded pool of local entrepreneurs (Aldrich and Martinez, 2001); (b) localized input-output relationships resulting in backward/forward business partners for collaboration (Lipparini and Sobrero, 1994); and/or (c) favorable business environments accessible to local participants (Armington and Acs, 2002; Lee et al., 2004). These factors are the main sources of the multiplier effects from establishment births (Johnson and Parker, 1994, 1996; Cole, 2000;

Fritsch and Mueller, 2004; Lu et al., 2008; Barboza and Pede, 2024) that are translated to increased employment opportunities in neighboring regions. Therefore, stronger competitiveness in neighboring regions may make the focal region relatively less attractive. This may even encourage individuals and established firms in the focal region to relocate their operations to neighboring regions. Consequently, employment opportunities in the focal region are likely to decrease due to the substitutable nature of the geographically bordering regions.

However, as the number of establishment births in neighboring regions continues to grow, these regions may begin to lose their competitive edge due to intensified competition, which constrains entrepreneurs' additional founding activities (Johnson and Parker, 1994, 1996; Cole, 2000; Lu et al., 2008; Gajewski and Kutun, 2018), resulting in reduced employment opportunities there. As competition for scarce resources and limited customers becomes fiercer (Cooper and Folta, 2000) and congestion costs continue to rise (Folta et al., 2006) in neighboring regions, the focal region may start to recover its relative attractiveness as an alternative locational site for entrepreneurs' founding activities. In addition, the enhanced competitiveness of the focal region may help it accommodate new firms relocated from neighboring regions due to its better business environments (Pellenbarg et al., 2002). Both factors are likely to increase employment opportunities in the focal region due to the substitutable nature of the geographically bordering spaces.

These discussions signify that the effects of establishment births in neighboring regions spill over to entrepreneurs and new firm owners in the focal region. Furthermore, the effects of establishment births from neighboring regions on total employment in the focal region are opposite to those generated by establishment births within the same focal region. Therefore, at a low level of establishment births in neighboring regions, multiplier effects dominate competition effects there, which in turn decreases establishment births in the focal region with decreased employment opportunities. However, at a high level of establishment births in neighboring regions, competition effects dominate multiplier effects there, which in turn increases establishment births in the focal region with increased employment opportunities. Both pathways indicate a non-linear, U-shaped pattern, as hypothesized next.

Hypothesis 1(b): Total employment in a focal region is related to establishment births in its neighboring regions in a non-linear U-shaped fashion, such that the former declines initially but increases after a certain threshold in the latter.

2.3. Intra-regional vs. Inter-regional Effects of Establishment Deaths on Regional Employment

When newly established firms continuously close down in a region, this phenomenon of establishment deaths may result in multiplying the failures of other firms within the same region (i.e., the multiplier effects of establishment deaths) (Johnson and Parker, 1994, 1996; Cole, 2000; Lu et al., 2008; Resende et al., 2015). It may indicate a potential collapse of Marshallian gains from agglomeration economies (Marshall, 1920) within the same region, which may also deter entrepreneurs' founding activities there, resulting in reduced job opportunities in proximity. Such opposite forces to Marshallian gains can take place because

the observed deaths of new firms in a region may signify: (a) a lack of successful role models nearby, reducing the perceived chances of business success and thereby shrinking the pool of local entrepreneurs; (b) sudden disruptions of localized input-output relationships among backward/forward partners; and/or (c) unfavorable external business environments prevalent within the same region. All of these factors are expected to decrease employment opportunities available in proximity.

However, as the number of new firms in a region diminishes due to these multiplier effects of establishment deaths, the level of competition in the vicinity begins to decrease. After a certain threshold of establishment deaths, this reduced competition may start to encourage entrepreneurs to reconsider exploiting local business opportunities that are more viable than before due to mitigated rivalry in the same region (i.e., the competition effects of establishment deaths) (Johnson and Parker, 1994, 1996; Cole, 2000; Lu et al., 2008). With the reduced competition, entrepreneurs' access to local resources and customers becomes easier, and their congestion costs also decrease within the region. These changes help revive local business opportunities with new jobs under more favorable business environments. Such improvements in the competitive landscape and the region's recovery of positive externalities may boost founding activities by local entrepreneurs as well as attract marginal firms from other neighboring regions, resulting in increased employment opportunities in proximity.

These discussions on the multiplier vs. competition effects of establishment deaths suggest that the former dominates the latter at a low level of establishment deaths within a region. However, this relationship could reverse at a high level of establishment deaths within the same region. Consequently, establishment deaths are expected to influence total employment within the same region in a non-linear, U-shaped manner, as stated in the following hypothesis.

Hypothesis 2(a): Total employment in a focal region is related to establishment deaths within the same region in a non-linear U-shaped fashion, such that the former declines initially but increases after a certain threshold in the latter.

Given the substitutable nature between a focal region and its neighboring regions with geographic borders within a country, the effects of establishment deaths in the neighboring regions on total employment in the focal region are also expected to be opposite to those taking place within the same focal region. When newly established firms in neighboring regions continuously fail due to the multiplier effects of establishment deaths there, this signals a lack of locational competitiveness in those regions (compared to the focal region). They lack successful role models, effective backward/forward network relationships, and/or business-friendly environments conducive to founding activities (Johnson and Parker, 1994, 1996; Cole, 2000; Lu et al., 2008; Resende et al., 2015). These uncompetitive business landscapes in neighboring regions are likely to result in a limited pool of local entrepreneurs, collapsed input-output collaborations locally, and/or insufficient entrepreneurship, which consequently constrains employment opportunities there. These locational disadvantages in neighboring regions often make the focal region more attractive and competitive as a substitutable site for entrepreneurs' founding activities. Consequently, some firms established in the neighboring regions may consider relocating to the focal region to continue their operations. Both factors

are likely to increase employment opportunities in the focal region due to the substitutable nature of the geographically bordering regions.

Conversely, as the number of establishment deaths in neighboring regions increases substantially, the level of local rivalry begins to decrease after a certain point (Johnson and Parker, 1994, 1996; Cole, 2000; Lu et al., 2008). This reduction in competition helps neighboring regions recover their competitive advantages as locational sites for entrepreneurs' founding activities. Under reduced competition, entrepreneurs in neighboring regions may benefit from easier access to local resources and customers, along with lower congestion costs. These improvements in neighboring regions' business landscapes may make the focal region relatively less attractive for entrepreneurs' founding activities. Moreover, neighboring regions' recovery of positive externalities could even help marginal firms relocate from the focal region to those more competitive neighboring regions. Both factors are likely to reduce employment opportunities in the focal region.

The above discussions on the multiplier vs. competition effects of establishment deaths in neighboring regions lead to two key implications. At a low level of establishment deaths in neighboring regions, multiplier effects dominate, reducing employment opportunities there. This makes the focal region more attractive by comparison, leading to increased employment in the focal region. At a high level of establishment deaths in neighboring regions, competition effects dominate as reduced rivalry helps neighboring regions recover their competitive advantages. This makes the focal region relatively less attractive, leading to decreased employment in the focal region. Both pathways indicate a non-linear, inverted U-shaped manner, as stated in the final hypothesis.

Hypothesis 2(b): Total employment in a focal region is related to establishment deaths in its neighboring regions in a non-linear inverted U-shaped fashion, such that the former increases initially but declines after a certain threshold in the latter.

3. RESEARCH DESIGN

3.1. Data and Sample

This study tests the proposed hypotheses concerning the effects of establishment births and deaths on regional employment using secondary public data for the 48 contiguous U.S. states from 1980 to 2014, yielding 1,680 state-year observations. The study period spans multiple business cycles, including the early 1980s downturn, 1990s expansion, the dot-com bust, and the 2008 financial crisis and subsequent recovery, allowing the study to observe relationships across multiple business cycles. The study focuses on the relatively homogeneous and location-bound service sectors³ because manufacturing firms often possess a non-location-bound nature, allowing them to achieve an optimal allocation of production processes using

³The service sectors in this study are defined according to the two-digit North American Industry Classification System (NAICS) and include: (1) Wholesale Trade (NAICS 42); (2) Retail Trade (NAICS 44-45); (3) Transportation and Warehousing (NAICS 48-49); (4) Information (NAICS 51); (5) Finance and Insurance (NAICS 52); (6) Real Estate and Rental and Leasing (NAICS 53); (7) Professional, Scientific, and Technical Services (NAICS 54); (8) Management of Companies and Enterprises (NAICS 55); (9) Adminis-

national and global production networks (Kogut and Kulatilaka, 1994; Lee et al., 2016). The state level of analysis is selected because it represents a critical, policy-relevant jurisdiction for labor market regulations and economic interventions in the U.S. context. States have substantial, constitutionally granted powers to set their own minimum wages, right-to-work laws, unemployment insurance, and tax policies, which directly shape local labor market conditions (Decker et al., 2014). Analysis at the state level allows the study to capture the effects of these discrete policy environments on regional employment, providing actionable insights for state-level policymakers.

Data on state-level regional employment in service sectors are drawn from the U.S. Bureau of Economic Analysis (BEA; <https://www.bea.gov>). Data on state-level establishment births and deaths in service sectors are from the Business Dynamics Statistics (BDS), compiled by the U.S. Census Bureau (<http://www.census.gov>).

3.2. Measures

3.2.1. *Dependent and independent variables*

The dependent variable for this study is the level of regional employment, measured as the logarithm of the total number of employees in service sectors in U.S. state i and in year t , denoted as $\ln \text{Emp}_{it}$. Following previous studies on regional economic structure (de Araújo et al., 2019; Kessing and Strozzi, 2017; Neumark and Kolko, 2010), this study uses the employment level rather than the growth rate to model employment as an equilibrium outcome shaped by establishment births and deaths and their spatial spillovers. To distinguish between intra-regional and inter-regional effects of establishment births and deaths on employment, the following four independent variables are constructed. First, the level of establishment births within a focal U.S. state is measured as the logarithm of the total number of establishment births in service sectors in state i and in year t , denoted as $\ln \text{Birth}_{it}$. Second, the level of establishment deaths within a focal state is measured as the logarithm of the total number of establishment deaths in service sectors in state i and in year t , denoted as $\ln \text{Death}_{it}$. Third, the level of establishment births in neighboring states is measured as the spatially weighted average of the total number of establishment births in service sectors in the contiguous states surrounding a focal state i , denoted as $\mathbf{W}_1 \cdot \ln \text{Birth}_{it}$. Here, $\mathbf{W}_1$ is a first-order contiguity spatial weight matrix that defines proximity based on shared borders. This study classifies two states as neighbors if they share a non-zero-length geographic boundary. Given this study's focus on the 48 contiguous U.S. states, $\mathbf{W}_1$ is a 48×48 matrix where each row and column corresponds to a state. The matrix is populated with binary values: $w_{ij} = 1$ if states i and j share a border, and $w_{ij} = 0$ otherwise. Diagonal elements w_{ii} are set to 0, as a state cannot be its own neighbor, and the matrix is symmetric ($w_{ij} = w_{ji}$), reflecting reciprocal border relationships. To ensure comparability, $\mathbf{W}_1$ is row-standardized by dividing each element in a row by the row sum (i.e., the total number of neighbors for that state). This adjustment gives greater weight to neighbors of states with fewer borders,

trative and Support, Waste Management and Remediation Services (NAICS 56); (10) Educational Services (NAICS 61); (11) Health Care and Social Assistance (NAICS 62); (12) Arts, Entertainment, and Recreation (NAICS 71); (13) Accommodation and Food Services (NAICS 72); and (14) Other Services (except Public Administration) (NAICS 81).

mitigating bias from varying state sizes and neighbor counts. Thus, $\mathbf{W}_1 \cdot \ln \text{Birth}_{it}$ captures the inter-regional spillover effects of establishment births on employment in the focal state. Fourth, the level of establishment deaths in neighboring states is measured analogously as $\mathbf{W}_1 \cdot \ln \text{Death}_{it}$, reflecting the inter-regional spillover effects of establishment deaths on employment in the focal state.

3.2.2. Control variables

The relationship between regional employment and establishment births or deaths may be influenced by other locational factors. Consistent with the previous literature, we incorporate three control variables to account for these determinants. The first control variable is the temporal autocorrelation of regional employment, captured by the n -year lagged regional employment level in service sectors in state i ($\ln \text{Emp}_{i,t-n}$). $\ln \text{Emp}_{i,t-n}$ accounts for path dependence, as current employment in a state may depend on its historical levels. The optimal lag length n is determined through panel unit root tests. The second control variable is the spatial autocorrelation of regional employment ($\mathbf{W}_1 \cdot \ln \text{Emp}_{it}$), which reflects the potential influence of neighboring states' employment on a focal state. $\mathbf{W}_1 \cdot \ln \text{Emp}_{it}$ is constructed using the same 48 (states) $\times$ 48 (states) row-standardized first-order contiguity spatial weight matrix, $\mathbf{W}_1$. The third control variable is per capita personal income in each state ($\ln \text{PCPI}_{it}$), measured as the logarithm of per capita personal income in state i and year t , obtained from the U.S. Census Bureau's Business Dynamics Statistics (BDS). $\ln \text{PCPI}_{it}$ controls for state-level income and purchasing power.⁴ Finally, this study includes state-fixed effects (τ_i) and year-specific fixed effects (μ_t) to account for unobserved time-invariant state heterogeneity (e.g., culture, policies) and common temporal shocks (e.g., national recessions), respectively.

3.3. Econometric Model

To test the four hypothesized non-linear relationships, this study specifies the following regression equation:

$$\begin{aligned} \ln \text{Emp}_{it} = & \beta_0 + \beta_1 \ln \text{Birth}_{it} + \beta_2 (\ln \text{Birth}_{it})^2 + \beta_3 \ln \text{Death}_{it} + \beta_4 (\ln \text{Death}_{it})^2 \\ & + \beta_5 \mathbf{W}_1 \cdot \ln \text{Birth}_{it} + \beta_6 \mathbf{W}_1 \cdot (\ln \text{Birth}_{it})^2 + \beta_7 \mathbf{W}_1 \cdot \ln \text{Death}_{it} \\ & + \beta_8 \mathbf{W}_1 \cdot (\ln \text{Death}_{it})^2 + \beta_9 \ln \text{Emp}_{i,t-n} + \beta_{10} \mathbf{W}_1 \cdot \ln \text{Emp}_{it} \\ & + \beta_{11} \ln \text{PCPI}_{it} + \tau_i + \mu_t + \varepsilon_{it} \end{aligned} \quad (1)$$

where τ_i and μ_t capture state- and year-specific fixed effects, respectively, and ε_{it} is an error term. The lag length n in $\ln \text{Emp}_{i,t-n}$ is set to its optimal value based on panel unit root test results.

⁴Broader controls (e.g., state GDP, population, total establishments) were initially tested but caused severe multicollinearity, with pairwise correlations exceeding 0.90 among themselves and with $\ln \text{Birth}_{it}$ and $\ln \text{Death}_{it}$. In contrast, $\ln \text{PCPI}_{it}$ exhibited only moderate correlations with other controls ($\gamma < 0.60$) and low correlations with the key independent variables ($\gamma < 0.20$), making it a suitable control that avoids multicollinearity.

Equation (1) suggests that establishment births and deaths are exogenous to regional employment. However, due to the interdependent relationships among $\ln Birth_{it}$, $\ln Death_{it}$, and $\ln Emp_{it}$, these variables are likely to be endogenous. To address this simultaneity, we specify the following two additional equations for establishment births ($\ln Birth_{it}$) and deaths ($\ln Death_{it}$), forming a system of equations to be estimated via three-stage least squares (3SLS) regressions:

$$\begin{aligned} \ln Birth_{it} = & \beta_0 + \beta_1 \ln Emp_{it} + \beta_2 (\ln Emp_{it})^2 + \beta_3 \ln Death_{it} + \beta_4 (\ln Death_{it})^2 \\ & + \beta_5 W_1 \cdot \ln Emp_{it} + \beta_6 W_1 \cdot (\ln Emp_{it})^2 + \beta_7 W_1 \cdot \ln Death_{it} \\ & + \beta_8 W_1 \cdot (\ln Death_{it})^2 + \beta_9 \ln Birth_{i,t-n} + \beta_{10} W_1 \cdot \ln Birth_{it} \\ & + \beta_{11} \ln PCPI_{it} + \tau_i + \mu_t + \varepsilon_{it} \end{aligned} \quad (2)$$

$$\begin{aligned} \ln Death_{it} = & \beta_0 + \beta_1 \ln Emp_{it} + \beta_2 (\ln Emp_{it})^2 + \beta_3 \ln Birth_{it} + \beta_4 (\ln Birth_{it})^2 \\ & + \beta_5 W_1 \cdot \ln Emp_{it} + \beta_6 W_1 \cdot (\ln Emp_{it})^2 + \beta_7 W_1 \cdot \ln Birth_{it} \\ & + \beta_8 W_1 \cdot (\ln Birth_{it})^2 + \beta_9 \ln Death_{i,t-n} + \beta_{10} W_1 \cdot \ln Death_{it} \\ & + \beta_{11} \ln PCPI_{it} + \tau_i + \mu_t + \varepsilon_{it} \end{aligned} \quad (3)$$

The dependent variables from these equations (e.g., $\ln Emp_{it}$, $\ln Birth_{it}$, $\ln Death_{it}$) are determined simultaneously, making the explanatory variables in each equation correlated with the error terms of the other equations. This simultaneity renders ordinary least squares (OLS) biased and inconsistent. 3SLS addresses this by using instrumental variables (IVs) to purge endogenous regressors of correlation with the error terms (Huggins and Thompson, 2012).

The instruments for the endogenous variables⁵ — $\ln Birth_{it}$, $\ln Death_{it}$, and $\ln Emp_{it}$ — are generated within the system. In Equation (1), $\ln Birth_{it}$ and $\ln Death_{it}$ are instrumented by their spatial lags ($\mathbf{W}_1 \cdot \ln Birth_{it}$ and $\mathbf{W}_1 \cdot \ln Death_{it}$) and temporal lags ($\ln Birth_{i,t-n}$ and $\ln Death_{i,t-n}$). Conversely, the spatial and temporal lags of $\ln Emp_{it}$ ($\mathbf{W}_1 \cdot \ln Emp_{it}$ and $\ln Emp_{i,t-n}$) from Equation (1) serve as IVs for $\ln Emp_{it}$ in Equations (2) and (3). This approach is valid, assuming spatial and temporal lags strongly correlate with their contemporary endogenous variables but not with contemporaneous error terms.

The 3SLS procedure proceeds in three stages: (1) regress each endogenous variable on all exogenous variables to generate IVs; (2) perform 2SLS for each equation using these IVs; and (3) estimate all equations simultaneously using the generalized least squares (GLS) approach of seemingly unrelated regression (SUR) to account for potential correlations in the error terms across equations. This yields consistent and efficient estimates (Greene, 2012).

⁵Although $\ln PCPI_{it}$ could be endogenous, this study treats it as exogenous. This is justified by its composition: per capita personal income comprehensively measures wages, proprietors' income, dividends, interest, rent, and government benefits. As a stock-like indicator of regional capacity, it captures pre-existing economic conditions that influence establishment births and deaths. However, it is not simultaneously determined by short-term establishment entries and exits.

4. EMPIRICAL RESULTS

Table 1 presents data on establishment births, deaths, and employment in U.S. service sectors from 1980 to 2014. Nationwide, total births reached 20.73 million while deaths reached 17.25 million, yielding a net increase of 3.48 million establishments.

Table 1: Establishment Births, Deaths and Employment in U.S. Service Sector by States, 1980–2014 (Unit: 10,000s)

State	Establishment Births	Establishment Deaths	Employment
Alabama	28.35	23.88	35.91
Alaska	5.42	4.32	5.51
Arizona	39.39	30.97	46.00
Arkansas	18.29	15.46	21.11
California	262.00	217.78	320.54
Colorado	43.02	34.29	46.93
Connecticut	24.35	21.12	40.07
Delaware	6.67	5.40	9.51
Florida	158.38	126.72	162.65
Georgia	63.64	51.27	78.31
Hawaii	9.08	7.60	13.56
Idaho	10.52	8.45	10.48
Illinois	83.89	71.92	134.44
Indiana	37.71	32.27	56.43
Iowa	19.74	17.66	29.81
Kansas	20.17	17.45	26.52
Kentucky	24.48	20.60	33.69
Louisiana	30.17	25.73	39.62
Maine	9.97	8.33	11.69
Maryland	37.12	30.42	54.85
Massachusetts	45.03	38.43	81.26
Michigan	60.07	52.41	91.04
Minnesota	35.54	29.15	57.80
Mississippi	17.10	14.67	19.87
Missouri	42.29	35.75	58.76
Montana	8.63	7.16	8.09
Nebraska	12.66	10.79	18.79
Nevada	17.31	13.16	22.31
New Hampshire	10.00	8.17	12.99
New Jersey	66.41	56.84	94.67
New Mexico	12.72	10.69	14.27
New York	146.16	125.74	207.05
North Carolina	56.65	45.18	72.68
North Dakota	5.31	4.42	6.98
Ohio	67.19	58.92	114.78
Oklahoma	25.65	21.77	30.05
Oregon	28.76	23.39	31.93
Pennsylvania	74.72	64.15	128.60
Rhode Island	7.29	6.30	10.61
South Carolina	27.71	22.37	33.66
South Dakota	6.10	5.10	7.54
Tennessee	38.43	31.98	53.95
Texas	158.65	128.07	199.30
Utah	17.70	13.69	21.31
Vermont	5.24	4.40	6.02
Virginia	51.02	40.51	71.27
Washington	47.47	38.24	54.33
West Virginia	10.32	9.13	13.77
Wisconsin	33.39	28.27	54.06
Wyoming	5.11	4.24	4.34
Total	2,073	1,725	2,780

Source: Authors' calculations using data from the U.S. Bureau of the Census, Business Dynamics Statistics (BDS), on state-level establishment births and deaths and employment in service sectors.

Total employment in service sectors was 27.8 million workers. A few large states dominate the counts. California leads with 2.62 million births, 2.18 million deaths, and 3.21 million in employment, accounting for roughly 12.64% of all births, 12.62% of all deaths and 11.53% of total employment. Other major contributors include Texas (1.59 million births, 1.28 million deaths, and 1.99 million employment), Florida (1.58 million births, 1.27 million deaths, and 1.63 million employment), and New York (1.46 million births, 1.26 million deaths, and 2.07 million employment). Together, these top four states - California, New York, Texas, and Florida - account for nearly 32% of all service sector employment during our study period.

4.1. Main Results

Table 2 reports the descriptive statistics and correlation matrix of the variables employed in this study. Notably, the Pearson correlations (i) between $\ln \text{Emp}_{it}$ and $\ln \text{Birth}_{it}$, (ii) between $\ln \text{Emp}_{it}$ and $\ln \text{Death}_{it}$, and (iii) between $\ln \text{Birth}_{it}$ and $\ln \text{Death}_{it}$ are exceptionally high, at 0.96, 0.98, and 0.99, respectively, and they are significant at the 1% level. This indicates a strong simultaneity among regional employment, establishment births, and establishment deaths, thereby supporting the use of a three-stage least squares (3SLS) regression model for the proposed system of equations.

Table 2: Descriptive Statistics and Correlation Matrix

	Obs.	M	SD	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
(1) $\ln \text{Emp}_{it}$	1,680	13.78	1.04	1.00											
(2) $\ln \text{Birth}_{it}$	1,680	8.92	0.96	0.96***	1.00										
(3) $\ln \text{Death}_{it}$	1,680	8.74	0.97	0.98***	0.99***	1.00									
(4) $W_1 \ln \text{Emp}_{it}$	1,680	13.71	0.81	0.24***	0.17***	0.20***	1.00								
(5) $W_1 \ln \text{Birth}_{it}$	1,680	8.87	0.63	0.24***	0.23***	0.23***	0.94***	1.00							
(6) $W_1 \ln \text{Death}_{it}$	1,680	8.69	0.64	0.27***	0.22***	0.25***	0.97***	0.98***	1.00						
(7) $\ln \text{Emp}_{i,t-1}$	1,632	13.78	1.04	0.99***	0.96***	0.98***	0.24***	0.23***	0.27***	1.00					
(8) $\ln \text{Emp}_{i,t-2}$	1,584	13.77	1.04	0.99***	0.96***	0.98***	0.24***	0.23***	0.27***	0.99***	1.00				
(9) $\ln \text{Birth}_{i,t-1}$	1,632	8.93	0.96	0.97***	0.99***	0.99***	0.17***	0.22***	0.23***	0.97***	0.96***	1.00			
(10) $\ln \text{Birth}_{i,t-2}$	1,584	8.93	0.96	0.97***	0.99***	0.99***	0.17***	0.22***	0.23***	0.97***	0.97***	0.99***	1.00		
(11) $\ln \text{Death}_{i,t-1}$	1,632	8.74	0.97	0.98***	0.98***	0.99***	0.20***	0.23***	0.25***	0.98***	0.98***	0.99***	0.99***	1.00	
(12) $\ln \text{Death}_{i,t-2}$	1,584	8.74	0.97	0.98***	0.98***	0.99***	0.20***	0.22***	0.25***	0.98***	0.98***	0.99***	0.99***	0.99***	1.00
(13) $\ln \text{PCPI}_{it}$	1,680	10.07	0.47	0.32***	0.12***	0.20***	0.23***	-0.01	0.12***	0.32***	0.32***	0.13***	0.13***	0.21***	0.22***

Note: The 1%, 5%, and 10% levels of significance are given as ***, **, and *, respectively. 47 state and 34 yearly dummies for unobserved fixed effects are not reported here.

Panel A of Table 3 presents the 3SLS regression results on the intra-regional versus inter-regional effects of establishment births and deaths on the level of regional employment in service sectors across the 48 contiguous U.S. states. Before interpreting the coefficients, the following three tests were conducted to validate the model of this study, which contains both temporally and spatially lagged dependent variables. First, the Levin-Lin-Chu (LLC) panel unit root test was conducted to assess stationarity. The results of the t^* -statistic, presented in Table 3, reject the null hypothesis of a unit root for all dependent variables at the 1% level, except for the establishment birth equation in Panel A of Table 3, which is significant at the 10% level. These findings indicate that the panel series of $\ln \text{Emp}_{it}$, $\ln \text{Death}_{it}$, and $\ln \text{Birth}_{it}$ are stationary in the sample of this study. Optimal lag lengths (i.e., $t - 2$ for Table 3) were determined using the Akaike Information Criterion (AIC). Second, the Kao panel cointegration test was conducted to examine long-term equilibrium relationships. The results of the Kao test, reported in Table 3, confirm cointegration among employment, establishment births, and deaths. The null hypothesis of no cointegration is

rejected at the 1% significance level by all three Dickey-Fuller t statistics, supporting the validity of the panel dynamic model structure of this study. Third, this study used Moran's I statistic⁶ to test for spatial autocorrelation (Moran, 1950; Anselin, 1996). The results of Moran's I tests, presented in Appendix Table A1, are positive and significant for all dependent variables for the main empirical model. These findings indicate that the current levels of employment, establishment births, and deaths in a focal state are correlated not only with their own past levels, as confirmed by the panel unit root and cointegration tests, but also with contemporaneous levels in neighboring states. Ignoring this dependency would violate the independence assumption of ordinary least squares (OLS) and risk producing biased estimates. Including spatially lagged variables (i.e., $\mathbf{W}_1 \cdot \ln \text{Emp}_{it}$, $\mathbf{W}_1 \cdot \ln \text{Birth}_{it}$, and $\mathbf{W}_1 \cdot \ln \text{Death}_{it}$) corrects for these spatial spillovers. Together, these test results support the use of an integrated empirical model that accounts for both temporal dependence (via time-lagged variables) and spatial dependence (via spatial-lagged variables).

Turning now to the main analyses, this study focuses on the intra- and inter-regional effects of establishment births and deaths on regional employment within a focal state. When evaluating the coefficients from the employment equation in Panel A of Table 3, this study finds a significantly positive coefficient on $\ln \text{Birth}_{it}$ and a significantly negative coefficient on $(\ln \text{Birth}_{it})^2$. This confirms an inverted U-shaped relationship between establishment births in a focal state and its employment, providing strong support for Hypothesis 1(a). As visualized in Figure 3(a), the relationship transitions from positive to negative at a threshold of approximately 6,438 annual establishment births ($\ln \text{Birth}_{it} = 8.77$). This pattern captures the shift from positive agglomeration economies to negative agglomeration diseconomies.

Conversely, the effect of establishment births in neighboring regions on a focal region's employment follows a U-shaped pattern. The employment equation exhibits a significantly negative coefficient on $\mathbf{W}_1 \cdot \ln \text{Birth}_{it}$ and a significantly positive coefficient on $\mathbf{W}_1 \cdot (\ln \text{Birth}_{it})^2$, providing strong support for Hypothesis 1(b). As shown in Figure 3(b), the spillover effect reverses at a neighbor threshold of approximately 1,808 establishment births ($\mathbf{W}_1 \cdot \ln \text{Birth}_{it} = 7.50$). This shift signifies that congestion in neighboring areas can redirect agglomeration benefits back toward the focal region.

A mirror-image logic applies to establishment deaths. This study identifies a U-shaped relationship between establishment deaths in a focal state and its regional employment. The employment equation shows a significantly negative coefficient on $\ln \text{Death}_{it}$ and a significantly positive coefficient on $(\ln \text{Death}_{it})^2$, strongly supporting Hypothesis 2(a). As visualized in Figure 3(c), the effect of establishment deaths on employment shifts from negative to positive at a threshold of approximately 10,199 annual establishment deaths ($\ln \text{Death}_{it} = 9.23$). This reflects how sufficient establishment exits can reduce competitive pressure and eventually stimulate renewed market entries.

⁶Moran's I statistic is defined as:

$$I = \frac{N}{\sum_i \sum_j w_{ij}} \cdot \frac{\sum_i \sum_j w_{ij} (x_i - \bar{x})(x_j - \bar{x})}{\sum_i (x_i - \bar{x})^2},$$

where x_i and x_j are the observations of the variables ($\ln \text{Emp}_{it}$, $\ln \text{Birth}_{it}$, or $\ln \text{Death}_{it}$) for state i and j ; $\bar{x}$ is the statewide mean; w_{ij} is the i - j element of the row-standardized spatial weight matrix $\mathbf{W}_1$; and $N = 48$ states. $\mathbf{W}_1$ is a first-order contiguity matrix, $w_{ij} = 1$ if states share a border, 0 otherwise.

Table 3: 3SLS Regression Results

Panel A: 48 Contiguous States in the U.S.			
Variable	Employment Equation	Establishment Birth Equation	Establishment Death Equation
<i>Constant</i>	-4.459*** [1.008]	5.572* [3.062]	4.711*** [1.256]
(1) Intra-regional Effects			
$\ln Birth_{it}$	3.529*** [0.442]		-1.226*** [0.345]
$(\ln Birth_{it})^2$	-0.201*** [0.026]		0.086*** [0.020]
$\ln Death_{it}$	-2.434*** [0.238]	-10.308*** [2.569]	
$(\ln Death_{it})^2$	0.132*** [0.013]	0.533*** [0.141]	
$\ln Emp_{it}$		7.734*** [2.253]	-0.110 [0.169]
$(\ln Emp_{it})^2$		-0.270*** [0.084]	0.010 [0.007]
(2) Inter-regional Effects			
$W_1 \cdot \ln Birth_{it}$	-1.056*** [0.178]	0.030 [0.147]	0.281 [0.215]
$W_1 \cdot (\ln Birth_{it})^2$	0.070*** [0.011]		-0.023* [0.013]
$W_1 \cdot \ln Death_{it}$	0.927*** [0.123]	3.478*** [0.898]	0.368*** [0.030]
$W_1 \cdot (\ln Death_{it})^2$	-0.060*** [0.007]	-0.188*** [0.051]	
$W_1 \cdot \ln Emp_{it}$	-0.161*** [0.032]	-3.576*** [1.102]	0.212 [0.157]
$W_1 \cdot (\ln Emp_{it})^2$		0.102*** [0.038]	-0.017*** [0.006]
(3) Controls			
$\ln PCPI_{it}$	0.038* [0.020]	-0.622*** [0.169]	-0.089*** [0.033]
$\ln Emp_{i,t-1}$	0.996*** [0.048]		
$\ln Emp_{i,t-2}$	0.184*** [0.051]		
$\ln Birth_{i,t-1}$		1.062*** [0.155]	
$\ln Birth_{i,t-2}$		0.934*** [0.172]	
$\ln Death_{i,t-1}$			0.458*** [0.025]
$\ln Death_{i,t-2}$			0.126*** [0.023]
Regional Fixed Effects	Yes	Yes	Yes
Yearly Fixed Effects	Yes	Yes	Yes
Levin-Lin-Chu (LLC) Test for Dependent Variables:			
<i>t</i> *-statistic	-4.618***	-1.582*	-2.943***
Avg. No. of Lags (AIC)	2.06	2.13	1.79
Kao Cointegration Test for Equations in 3SLS:			
Dickey-Fuller <i>t</i>	-32.623***	-23.081***	-24.471***
Modified Dickey-Fuller <i>t</i>	-45.499***	-34.699***	-31.207***
Augmented Dickey-Fuller <i>t</i>	-20.238***	-11.036***	-16.109***
No. of Observations	1,680	1,680	1,680
<i>R</i> ²	0.998	0.983	0.997
<i>F</i> -statistics	1.94e+06***	54,279.20***	668,053.25***

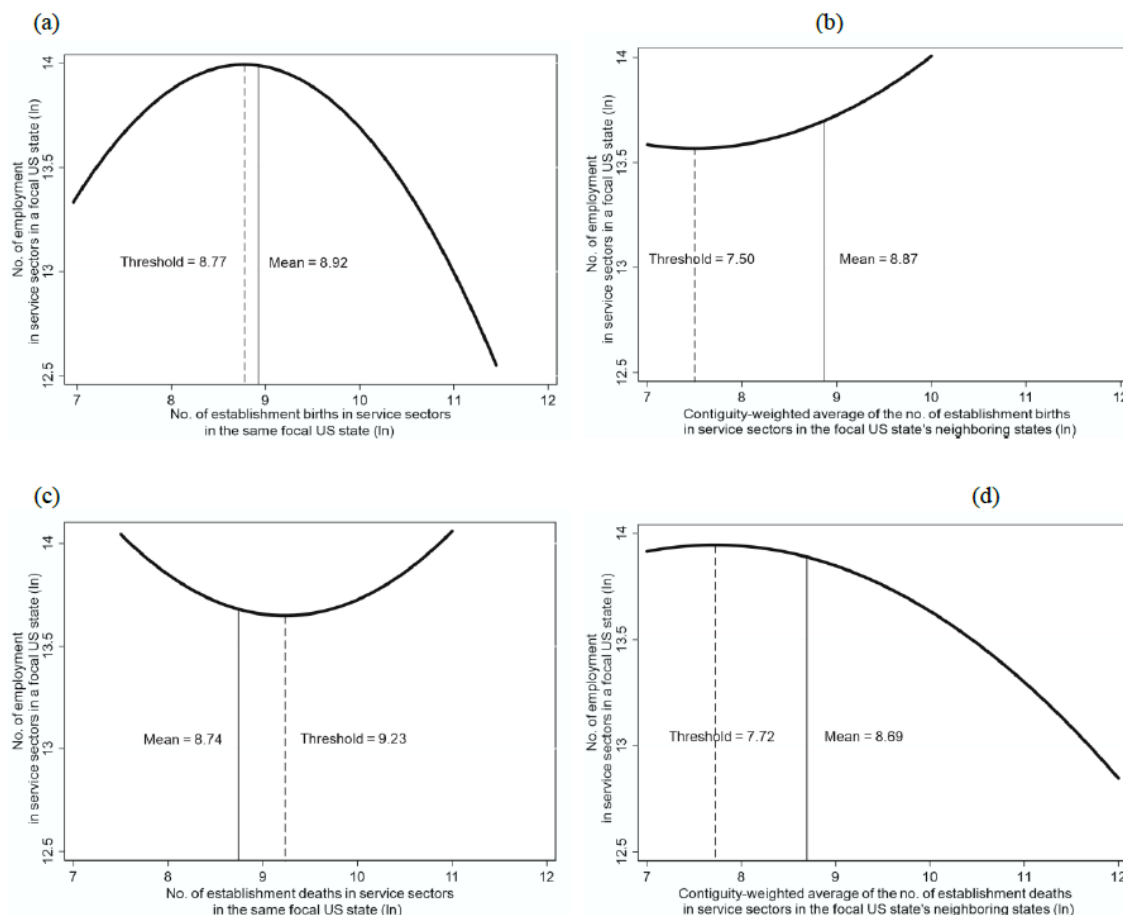
Note: Significance levels: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Numbers in [] are standard errors. Regional fixed effects: 47 U.S. states. Yearly fixed effects: 1980–2014. W_1 is a first-order contiguity-weighted matrix.

Table 3: 3SLS Regression Results (Continued)

Panel B: 67 Selected MSAs in the U.S.			
Variable	Employment Equation	Establishment Birth Equation	Establishment Death Equation
<i>Constant</i>	12.170*** [2.807]	21.597*** [8.000]	56.037*** [5.608]
(1) Intra-regional Effects			
$\ln Birth_{it}$	2.056*** [0.628]		-8.133*** [1.222]
$(\ln Birth_{it})^2$	-0.238*** [0.066]		0.800*** [0.128]
$\ln Death_{it}$	-4.901*** [0.392]	-11.722*** [2.318]	
$(\ln Death_{it})^2$	0.496*** [0.039]	1.186*** [0.240]	
$\ln Emp_{it}$		5.442*** [2.387]	-8.380*** [0.900]
$(\ln Emp_{it})^2$		-0.274** [0.119]	0.394*** [0.041]
(2) Inter-regional Effects			
$W_1 \cdot \ln Birth_{it}$	-0.420*** [0.156]	-0.007 [0.182]	1.629*** [0.340]
$W_1 \cdot (\ln Birth_{it})^2$	0.041** [0.016]		-0.198*** [0.035]
$W_1 \cdot \ln Death_{it}$	0.689*** [0.157]	1.362** [0.593]	-0.150 [0.112]
$W_1 \cdot (\ln Death_{it})^2$	-0.092*** [0.015]	-0.181*** [0.061]	
$W_1 \cdot \ln Emp_{it}$	-0.149 [0.101]	-0.811 [0.761]	1.048** [0.482]
$W_1 \cdot (\ln Emp_{it})^2$		0.008 [0.033]	-0.067*** [0.024]
(3) Controls			
$\ln PCPI_{it}$	-0.263* [0.138]	-1.205*** [0.383]	-1.696*** [0.286]
$\ln Emp_{i,t-1}$	0.845*** [0.061]		
$\ln Emp_{i,t-2}$	0.135*** [0.052]		
$\ln Birth_{i,t-1}$		0.199** [0.101]	
$\ln Birth_{i,t-2}$		0.217*** [0.075]	
$\ln Death_{i,t-1}$			0.021 [0.056]
$\ln Death_{i,t-2}$			-0.095* [0.054]
Regional Fixed Effects	Yes	Yes	Yes
Yearly Fixed Effects	Yes	Yes	Yes
Levin-Lin-Chu (LLC) Test for Dependent Variables:			
<i>t</i> *-statistic	-4.101***	-10.070***	-10.726***
Avg. No. of Lags (AIC)	1.63	2.01	1.91
Kao Cointegration Test:			
Dickey-Fuller <i>t</i>	-30.077***	-37.499***	-33.544***
Modified Dickey-Fuller <i>t</i>	-25.368***	-42.760***	-29.429***
Augmented Dickey-Fuller <i>t</i>	-21.785***	-21.156***	-20.736***
No. of Observations	2,345	2,345	2,345
<i>R</i> ²	0.985	0.692	0.931
<i>F</i> -statistics	214,084.11***	9,075.37***	41,963.43***

Notes: Significance levels: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Numbers in [] are standard errors. Regional fixed effects: 66 Metropolitan Statistical Areas (MSAs) in Delaware, New Jersey, New York, and Pennsylvania. Yearly fixed effects: 1980–2014. W_1 is a first-order contiguity-weighted matrix.

Figure 3: Fitted Curves for (a) Intra-regional vs. (b) Inter-regional Impacts of Establishment Births and (c) Intra-regional vs. (d) Inter-regional Impacts of Establishment Deaths on the Level of Regional Employment in the U.S.



Note: Author's calculations based on data from the U.S. Bureau of Labor Statistics (BLS) and the U.S. Census Bureau.

Finally, this study identifies an inverted U-shaped relationship between a focal state's employment and establishment deaths in its neighboring states, as indicated by a significantly positive coefficient on $\mathbf{W}_1 \cdot \ln \text{Death}_{it}$ and a significantly negative coefficient on $\mathbf{W}_1 \cdot (\ln \text{Death}_{it})^2$, strongly supporting Hypothesis 2(b). As shown in Figure 3(d), the positive spillover effect turns negative beyond a neighbor threshold of approximately 2,253 establishment deaths ($\mathbf{W}_1 \cdot \ln \text{Death}_{it} = 7.72$). This indicates that low to moderate levels of business closures in neighboring regions initially benefit the focal region, likely through the relocation of workers, capital, or market share. However, once neighboring deaths exceed this threshold, the effect becomes negative, suggesting that excessive economic contraction in surrounding areas ultimately harms the focal region, possibly because reduced competition in neighboring regions leads to rebounding demand, reconstructed supply chains, or enhanced regional

reputation there.

When evaluating the elasticities of the four quadratic equations displayed in Figures 3(a)–3(d), their non-linear characteristics require measurement at two baseline points. The first baseline points are the mean values of $\ln \text{Birth}_{it}$, $\mathbf{W}_1 \cdot \ln \text{Birth}_{it}$, $\ln \text{Death}_{it}$, and $\mathbf{W}_1 \cdot \ln \text{Death}_{it}$. The second baseline points are then defined as the symmetrical points of those mean values on the opposite side of each threshold. These two baseline points are displayed in the sixth column of Table 4. The elasticities at two baseline points across Figures 3(a)–3(d), using the regression results reported in Table 3 (i.e., β_1 and β_2 in Table 4), are summarised in the last column of Table 4.

Table 4: Employment Elasticities at Pre- and Post-Threshold Baselines
(Based on Figures 3(a)–3(d) and Panel A of Table 3)

Figure	Quadratic equation at mean value of all other variables ($\ln Y = \ln \text{Emp}_{it}$)	β_1	β_2	Baseline	$\ln X$	X (App.)	Y (App.)	10% Elasticity: $10(\beta_1 + 2\beta_2 \ln X)$
3(a): $\ln X = \ln \text{Birth}_{it}$	$\ln Y = -1.484 + 3.529 \ln X - 0.201(\ln X)^2$	3.529	-0.201	Pre-th.	8.62	5,541.33	1,203,566	0.64%
				Threshold	8.77	6,438.19	1,209,648	
				Post-th.	8.92	7,480.05	1,204,808	-0.57%
3(b): $\ln X = \mathbf{W}_1 \cdot \ln \text{Birth}_{it}$	$\ln Y = 17.530 - 1.056 \ln X + 0.070(\ln X)^2$	-1.056	0.070	Pre-th.	6.13	459.44	879,422	-1.98%
				Threshold	7.50	1,808.04	764,885	
				Post-th.	8.87	7,115.29	865,141	1.86%
3(c): $\ln X = \ln \text{Death}_{it}$	$\ln Y = 24.886 - 2.434 \ln X + 0.132(\ln X)^2$	-2.434	0.132	Pre-th.	8.74	6,247.90	887,337	-1.27%
				Threshold	9.23	10,198.54	860,780	
				Post-th.	9.72	16,647.20	889,564	1.32%
3(d): $\ln X = \mathbf{W}_1 \cdot \ln \text{Death}_{it}$	$\ln Y = 10.367 + 0.927 \ln X - 0.060(\ln X)^2$	0.927	-0.060	Pre-th.	6.75	854.06	1,077,540	1.17%
				Threshold	7.72	2,252.96	1,141,121	
				Post-th.	8.69	5,943.18	1,079,200	-1.16%

Note: The elasticity in a log-log quadratic equation, $\ln Y = \beta_0 + \beta_1 \ln X + \beta_2 (\ln X)^2$, is measured as: $\frac{\% \Delta Y}{\% \Delta X} = \beta_1 + 2\beta_2 \ln X$. The constant term (β_0) incorporates the effects of all other right-hand-side variables evaluated at their sample means.

For the intra-regional impact of establishment births on employment captured in Figure 3(a), a 10% increase in establishment births raises the level of local employment by 0.64%, from 1,203,566 to 1,211,269 at a pre-threshold baseline ($\ln \text{Birth}_{it} = 8.62$, or approximately 5,541 establishment births), but reduces employment by 0.57%, from 1,204,808 to 1,197,941 at a post-threshold baseline ($\ln \text{Birth}_{it} = 8.92$, or approximately 7,480 establishment births). For the inter-regional impact of establishment births on employment displayed in Figure 3(b), a 10% increase in neighboring establishment births draws employment away from the focal region by 1.98%, from 879,422 to 862,009 at a pre-threshold baseline ($\mathbf{W}_1 \cdot \ln \text{Birth}_{it} = 6.13$, or approximately 459 neighboring establishment births), but generates a positive employment spillover of 1.86% to the focal region, from 865,141 to 881,233 at a post-threshold baseline ($\mathbf{W}_1 \cdot \ln \text{Birth}_{it} = 8.87$, or approximately 7,115 neighboring establishment births). For the intra-regional impact of establishment deaths on employment reported in Figure 3(c), a 10% increase in establishment deaths reduces employment by approximately 1.27%, from 887,337 to 876,068 at a pre-threshold baseline ($\ln \text{Death}_{it} = 8.74$, or approximately 6,248 establishment deaths), but is associated with a 1.32% increase in employment, from 889,564 to 901,306 at a post-threshold baseline ($\ln \text{Death}_{it} = 9.72$, or approximately 16,647 establishment deaths). For the inter-regional impact of establishment deaths on employment presented in Figure 3(d), a 10% increase in neighboring establishment

deaths boosts employment in the focal region by 1.17%, from 1,077,540 to 1,090,147 at a pre-threshold baseline ($\mathbf{W}_1 \cdot \ln \text{Death}_{it} = 6.75$, or approximately 854 neighboring establishment deaths), but reduces employment in the focal region by 1.16%, from 1,079,200 to 1,066,681 at a post-threshold baseline ($\mathbf{W}_1 \cdot \ln \text{Death}_{it} = 8.69$, or approximately 5,943 neighboring establishment deaths).

For the control variables, first, the coefficient for the spatial lag of regional employment ($\mathbf{W}_1 \cdot \ln \text{Emp}_{it}$) is significantly negative. This suggests a substitutable relationship between focal and neighboring regions, where bordering regions compete for jobs such that employment gains in one region come at the expense of nearby regions, indicating a potential zero-sum reallocation of regional labor market activity. Notably, this pattern persists despite the underlying spatial clustering in economic activity, confirmed by the significant positive Moran's I statistics reported in Appendix Table A1. In other words, while neighboring regions tend to have similar levels of employment (positive spatial autocorrelation), marginal changes follow a competitive, zero-sum pattern, implying that regions share similar structures but still compete directly for mobile jobs and workers. Second, the positive and significant coefficients for the time lags of regional employment ($\ln \text{Emp}_{i,t-1}$ and $\ln \text{Emp}_{i,t-2}$) indicate strong persistence in regional employment. This means past employment levels significantly influence current levels, suggesting that regional labor markets adjust gradually and that any economic shocks or policy effects will have lasting impacts over time. Third, the positive and significant coefficient for the per capita personal income variable ($\ln \text{PCPI}_{it}$) suggests that wealthier regions, with stronger purchasing power and economic activity, tend to support higher employment levels, reinforcing the link between local prosperity and job creation.

4.2. Robustness Test Results

To ensure the robustness of the empirical findings reported in Panel A of Table 3, this study conducts several robustness tests. First, state boundaries may not perfectly align with the primary spatial economic regions for new firms, and hence states may not map directly onto the geographic scales of the entrepreneurial process and its resulting regional employment levels. To address this concern, this study conducts robustness checks using 67 metropolitan statistical areas (MSAs) in the four major Mid-Atlantic states — Delaware, New Jersey, New York, and Pennsylvania — as an alternative unit of analysis, following previous research on firm dynamics and entrepreneurship using selected MSAs (Cole, 2000, 2018; Rosenthal and Strange, 2005). This region features a dense, interconnected network of MSAs that are both geographically contiguous and economically integrated, providing a suitable setting for testing cross-regional spillovers at a sub-state scale. This study reports these estimation results in Panel B of Table 3. This robustness exercise confirms that the core findings are not an artifact of state-level aggregation. The key nonlinear and asymmetric relationships remain statistically and qualitatively consistent across both geographic scales, strengthening the validity of the conclusions.

This study performs four additional robustness checks: (i) estimating the model using sub-industry samples within the service sectors — specifically wholesale trade, retail trade, and finance and insurance, chosen for their highly location-bounded nature — to examine

Table 5: Robustness Test Results – Employment Equation

	1. Wholesale (3SLS)	2. Retail (3SLS)	3. Finance & Insurance (3SLS)	4. Normalization: 1,000 Pop. (3SLS)	5. W_2 : 2nd-order Contiguity (3SLS)	6. System GMM
<i>Constant</i>	-0.801 [2.748]	-0.463 [4.276]	-9.798*** [2.921]	0.401*** [0.117]	-2.867*** [1.061]	1.706 [1.223]
(1) Intra-regional Effects						
$\ln Birth_{it}$	3.664*** [0.702]	36.929*** [10.94]	4.571*** [1.423]	0.373*** [0.049]	2.667*** [0.382]	0.832* [0.416]
$(\ln Birth_{it})^2$	-0.325*** [0.061]	-2.686*** [0.782]	-0.330*** [0.112]	-0.164*** [0.028]	-0.148*** [0.022]	-0.046* [0.026]
$\ln Death_{it}$	-4.330*** [0.774]	-37.650*** [11.84]	-2.492*** [0.382]	-0.197*** [0.028]	-2.148*** [0.217]	-1.474*** [0.537]
$(\ln Death_{it})^2$	0.373*** [0.065]	2.574*** [0.817]	0.138*** [0.025]	0.054*** [0.019]	0.113*** [0.012]	0.072** [0.029]
(2) Inter-regional Effects						
$W_1 \cdot \ln Birth_{it}$	-0.814** [0.328]	-20.083*** [5.395]	-1.845** [0.769]	-0.211*** [0.043]		-0.308*** [0.111]
$W_1 \cdot (\ln Birth_{it})^2$	0.070** [0.028]	1.512*** [0.400]	0.136** [0.062]	0.125*** [0.026]		0.028*** [0.006]
$W_1 \cdot \ln Death_{it}$	1.297*** [0.375]	20.038*** [5.782]	1.574*** [0.253]	0.053* [0.033]		0.622** [0.251]
$W_1 \cdot (\ln Death_{it})^2$	-0.129*** [0.033]	-1.395*** [0.406]	-0.109*** [0.019]	-0.043* [0.026]		-0.036*** [0.012]
$W_1 \cdot \ln Emp_{it}$	0.133 [0.095]	-1.907*** [0.513]	-0.536*** [0.157]	0.017 [0.017]		-0.166 [0.140]
$W_2 \cdot \ln Birth_{it}$					-0.320* [0.186]	
$W_2 \cdot (\ln Birth_{it})^2$					0.030*** [0.011]	
$W_2 \cdot \ln Death_{it}$					0.888*** [0.145]	
$W_2 \cdot (\ln Death_{it})^2$					-0.056*** [0.008]	
$W_2 \cdot \ln Emp_{it}$					-0.329*** [0.046]	
(3) Controls						
$\ln PCPI_{it}$	-0.002 [0.117]	-0.132 [0.199]	0.332 [0.158]	-0.006 [0.011]	0.030 [0.018]	0.066 [0.059]
$\ln Emp_{i,t-1}$	1.049*** [0.077]	2.854*** [0.588]	1.259*** [0.143]	0.922*** [0.012]	1.009*** [0.043]	0.888*** [0.471]
$\ln Emp_{i,t-2}$		0.239 [0.278]	0.507*** [0.116]		0.167*** [0.045]	0.306 [0.297]
<i>Regional Fixed Effects</i>	Yes	Yes	Yes	Yes	Yes	Yes
<i>Yearly Fixed Effects</i>	Yes	Yes	Yes	Yes	Yes	Yes
Levin-Lin-Chu (LLC) Test for Dependent Variables:						
t^* -statistic	-5.718***	-2.892***	-2.486***	-4.979***	-4.618***	-4.618***
Avg. No. of Lags (AIC)	0.85	1.98	1.88	0.98	2.06	2.06
Kao Cointegration Test:						
Dickey-Fuller t	-23.405***	-29.904***	-14.316***	-25.356***	-33.372***	-32.623***
Modified DF t	-20.284***	-32.790***	-5.068***	-32.869***	-46.298***	-45.499***
Augmented DF t	-12.782***	-15.254***	-3.693***	-16.025***	-20.942***	-20.238***
<i>No. of Observations</i>	1,680	1,680	1,680	1,680	1,680	1,680
<i>No. of Instruments</i>						55
<i>Hansen's J test</i>						(0.658)
<i>Difference-in-Hansen test</i>						(0.321)
<i>AR(1) in Differences</i>						(0.002)
<i>AR(2) in Differences</i>						(0.154)
<i>R-sq</i>	0.987	0.552	0.863	0.994	0.998	
<i>F-statistics</i>	101,855.98***	31,176.06***	31,381.67***	306,411.55***	2.39e+06***	10.14***

Notes: Numbers in [] are standard errors. Regional fixed effects: 47 U.S. states. Yearly fixed effects: 1980–2014. W_1 and W_2 are first-order and second-order contiguity-weighted matrices, respectively. Significance levels: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

whether the main findings are consistent across these location-bound service sub-sectors, rather than being an artifact of pooling all sub-sectors together; (ii) normalizing establishment births, deaths, and regional employment per 1,000 population to account for cross-state differences in market size; (iii) using a second-order contiguity weight matrix ($\mathbf{W}_2$) that includes both first-order and secondary bordering regions (i.e., neighbors of neighbors) to capture distance effects beyond immediate neighbors, in contrast to the first-order binary contiguity weight matrix ($\mathbf{W}_1$) used in the main analysis; and (iv) employing System GMM estimators (Blundell and Bond, 1998), which account for joint serial and spatial dependencies and potential endogeneity of explanatory variables, to address endogeneity concerns.⁷

As reported in Table 5, the coefficients for key hypothesized variables remain qualitatively similar to the main findings for Hypotheses 1–2 reported in Panel A of Table 3 across all these specifications. This confirms that the findings are robust to alternative industry definitions, population scaling, expanded geographic proximity measure, and the System GMM estimator.

5. DISCUSSION AND CONCLUSION

Using the geographic data on the 48 contiguous U.S. states from 1980 to 2014, this study investigated the spatial effects of establishment births vs. deaths on total state-level employment, in the context of both intra-state and inter-state spillovers. The main findings from the study are two-fold. First, establishment births in a U.S. state were shown to exert non-linear ‘inverted U-shaped’ effects on total employment within the same state (i.e., intra-regional effects of establishment births). However, establishment births in the neighboring states of a U.S. focal state were shown to exert non-linear ‘U-shaped’ effects on total employment in the focal state (i.e., inter-regional effects of establishment births), demonstrating opposite patterns between the ‘intra-regional’ vs. ‘inter-regional’ spillovers. Second, establishment deaths in a U.S. state were shown to exhibit non-linear ‘U-shaped’ effects on total employment within the same state (i.e., intra-regional effects of establishment deaths). Conversely, establishment deaths in neighboring states were shown to exhibit non-linear ‘inverted U-shaped’ effects on the total employment in the focal U.S. state (i.e., inter-regional effects of establishment deaths), confirming the contrasting patterns between the ‘intra-regional’ vs. ‘inter-regional’ effects.

This study makes several key theoretical contributions to the previous literature on spatial entrepreneurship and regional employment, particularly through theoretical elaboration and integration. First, given that entrepreneurship is a boosting engine for job creation in a regional economy, numerous studies have investigated the phenomenon of ‘births’ of new firms established by entrepreneurs. For example, variations in new firm creations across geographic regions are largely driven by entrepreneurs’ access to either (a) input-side supply

⁷This study employs the System GMM method of Blundell and Bond (1998), estimating Eq. (1) as a system of level and differenced equations, using lagged first differences and lagged levels as instruments. Following Roodman (2009), we apply Hansen’s J tests, Difference-in-Hansen tests, and serial correlation tests of significant AR(1) but insignificant AR(2), with Windmeijer’s (2005) finite-sample correction. As shown in the last column of Table 5, the System GMM passes all specification tests, confirming valid instruments and no serial correlation in the original error terms.

factors, such as affordable labor forces (Fritsch and Falck, 2007; Mukherjee et al., 2012), intermediary partners in value chains (Kalnins and Chung, 2004; Berchicci et al., 2011), governmental promotion programs (Ibata-Arens, 2009; Shin et al., 2014), and even knowledge spillovers from universities and other startups (Audretsch et al., 2005; Audretsch and Keilbach, 2007; Agarwal et al., 2007), or (b) output-side demand factors, such as the size of local markets and their growth potential (Armington and Acs, 2002; Carod and Antolín, 2004). Although intuitive and comprehensive, however, these studies did not consider adequately the other side of entrepreneurship in the form of new business failures, which may stifle new job opportunities in a regional economy. This study brings the issue of ‘deaths’ of newly established firms to the forefront as a simultaneous determinant of employment opportunities in a region, a topic that has been underexplored in the literature on new firm creation and its spatial heterogeneity.

Second, although prior research on the deaths of established firms has been relatively scant, there have been several notable exceptions in the literature. For example, Johnson and Parker (1994, 1996) and Love (1996) estimate the temporal dependence of firm deaths, in addition to that of firm births, in the United Kingdom counties. Shrestha et al. (2007) conceptualizes job growth in a region as a net result of job creation from firm births and job destruction from firm deaths over a specific period. Cole (2000) demonstrates a dense connectivity among firm births, deaths, and local economic conditions as mutually reinforcing in the context of manufacturing sectors in Pennsylvania. Carpenter et al. (2020) detects a positive relationship between local bank concentration and business deaths in rural counties from a perspective of serial entrepreneurship. This study complements these notable studies by adding an interplay between (a) a ‘multiplier’ process whereby establishment births and deaths may lead to additional establishment births and deaths in the future and (b) a ‘competition’ process whereby establishment births and deaths may result in subsequent establishment deaths and births, respectively, within the same region. Building on the contrasting pathways of multiplier vs. competition effects, this study disentangles the ‘non-linear’ relationships between each of establishment births vs. deaths and total employment within a region (i.e., intra-regional employment effects), which could be either inverted U-shaped or U-shaped, respectively.

Third, this study also contributes to the literature on positive vs. negative externalities in agglomeration from a geographic perspective, which may spill over across geographically bordering regions. Traditionally, agglomeration economies vs. diseconomies have been discussed in the context of industry-specific effects. For example, specialization spillovers emphasize Marshallian externalities (Marshall, 1920), which are circulated among participants in the same industrial sectors in the form of intra-industry spillovers, whereas diversity spillovers indicate Jacobian externalities (Jacobs, 1969), which transmit across different industrial sectors, resulting in inter-industry knowledge spillovers. Both spillovers are critical for new firm creation and subsequent job opportunities, because new ideas about products and production methods can be readily exchanged among participants operating in either homogeneous or heterogeneous industrial sectors, which may further spark their product and process innovation leading to additional founding activities. Whenever a substantial number of new firms are established through either intra-sectoral specialization or inter-sectoral diversity, however, competition effects are expected to emerge, and these effects are likely to bring

about substantial congestion costs (Folta et al., 2006; Lee et al., 2014; Sun et al., 2017; Cole, 2018) that may discourage entrepreneurs' future founding activities.

Building on the industry-level conceptualization of positive vs. negative externalities in agglomeration, Saboe and Condliffe (2015) examines how they affect an emergent entrepreneur's decision to launch a new firm, and shows that specialization and diversity spillovers are significant only in dense locations. Barboza and Pede (2024) demonstrates asymmetric effects of intra-sectoral specialization vs. inter-sectoral diversity on new firm creation in the context of Italian innovative startups. Using the same Italian sample, Barboza et al. (2023) decomposes the sources of employment productivity gains in Italian innovative startups into (i) specialization, (ii) diversity, and (iii) competition spillovers, with the strongest effects from specialization. This study extends the prior research on industry-specific spillovers by incorporating a spatial dimension to capture 'intra-regional' vs. 'inter-regional' spillovers of establishment births and deaths in the geographic context (Plummer, 2010). Most importantly, in line with Barboza and Braga's (2025) recent insights on the asymmetric cross-border knowledge spillovers of concentration vs. dispersion in innovative startups across the Italian bordering territories, it uncovers 'asymmetric' effects between the two geographic spillovers within the same region vs. across neighboring regions. For example, regarding the total employment in a focal U.S. state affected by establishment births and deaths in its neighboring states (i.e., inter-regional employment effects), it identifies reversed asymmetric functional forms compared to the intra-state counterparts taking place within the same U.S. state. Taken together, this study demonstrates that the asymmetric spatial spillovers of agglomeration externalities – whether positive or negative – operate not only across industry sectors but also across geographic borders, revealing that intra-regional and inter-regional employment effects follow opposite and non-linear pathways in response to establishment births and deaths.

This study also makes several important empirical contributions by providing novel empirical evidence that advances the literature on spatial entrepreneurship and regional employment in the following ways. First, this study makes an empirical contribution by quantifying the contrasting intra-regional vs. inter-regional effects of establishment births and deaths on regional employment in the U.S. using the country's state-level geographic data accumulated over 35 years. Specifically, the estimates derived from the first-order contiguity matrix ($\mathbf{W}_1$) allow this study to quantify how economic changes in geographically bordering states, measured by establishment births and deaths, propagate to the focal state with both temporal and spatial dependencies of the state employment controlled. Such quantifications of the non-linear impacts of establishment births and deaths on total employment within a focal state and across neighboring states provide empirical evidence of Marshallian gains (Marshall, 1920) that may spill over both intra-regionally and inter-regionally through bordering spaces. Thus, this study is among the first to empirically demonstrate how intra-regional vs. inter-regional employment effects may follow asymmetric pathways when establishment births and deaths exert the contrasting multiplier and competition effects across state borders.

Second, beyond identifying the functional forms of these relationships, this study provides quantified elasticity estimates that reveal the substantive magnitude of these effects. By calculating employment impacts at pre-threshold and post-threshold baselines, the study

shows that the positive and negative effects of establishment births and deaths on regional employment are not merely statistically significant but also economically meaningful. These findings highlight the substantive importance of accounting for spatial interdependence in empirical research on regional employment.

In addition to the aforementioned contributions to the literature, this study offers useful managerial and public policy implications with actionable insights. For corporate managers or entrepreneurs, they are advised to take dynamic spatial spillovers into account when deciding on establishment locations. A region experiencing a surge in establishment births may offer vibrant ecosystems in the short term, but it also signals future competition and congestion. Conversely, a region with a recent wave of establishment exits may signal its short-term weakness, but it also lowers entry barriers and local rivalry in the medium term. Therefore, establishment locations need to be evaluated in relation to their geographic context, using spatial data on entrepreneurial dynamics – establishment births and deaths – in a focal region as well as across its neighboring regions to time market entry and/or exit optimally and strategically.

For state and federal policy-makers, they are advised to consider establishing inter-regional compacts for entrepreneurial development, in which neighboring jurisdictions may share real-time spatial data on establishment entries, exits, and employment; coordinate infrastructure investments to avoid duplicative programs; and design incentive packages that reward establishment founders for creating cross-border supply chains or labor markets. In particular, federal policies can be pivotal in fostering inter-jurisdictional coordination process. For example, federal agencies could require spatial impact assessments for major economic development grants, ensuring that such developmental programs are evaluated not only on intra-jurisdiction outcomes, but also on their effects on neighboring regions. This approach would institutionalize the spatial interdependencies in building effective place-based policies. Federal policy-makers are also advised to recognize that their traditional ‘one-size-fits-all’ approach at the national level may not be effective in promoting employment at the local level (Barboza and Braga, 2025), because the non-linear impacts of establishment births and deaths on state-level employment opportunities may vary across geographic spaces in opposite ways.

Several limitations are acknowledged in this study, which could guide future research. First, entrepreneurship was defined as the creation of new firms (Gartner, 1990; Aldrich, 2010), and measured using establishment births in this study. However, new firms can be established by (i) necessity vs. opportunity entrepreneurs, and by (ii) individuals vs. entrepreneurial teams, which may affect regional employment differently. Similarly, establishment deaths were defined and measured as the opposite concept to establishment births. However, establishment deaths can occur for diverse reasons (e.g., bankruptcy, voluntary liquidations, mergers and acquisitions, firm growth, relocation, etc.), each potentially exerting differential impacts on regional employment. Second, partly due to data availability, this study utilized state-level geographic data. Although it also conducted robustness checks with 67 metropolitan statistical areas (MSAs) in Delaware, New Jersey, New York, and Pennsylvania, more sophisticated empirical studies will be possible using an alternative geographic unit of analysis, such as Commuting Zones (CZs), with fine-grained, micro-level data on establishment births, deaths, regional employment, and their mobility. Third, the

study utilized state-level data up to the period just prior to the recent decade marked with significant structural shifts in the U.S. such as the rise of the platform economy and gig work and the global pandemic. Therefore, future studies would provide complementary insights to this study if they embarked upon examining how such recent external shocks and their resulting policy reforms have altered the geographic effects of establishment dynamics on regional employment across the U.S. state borders. Fourth, while agglomeration theory distinguishes between intra-industry (specialization) and inter-industry (diversity) spillovers, the geographic approach utilized in this study does not allow the study to isolate or test these distinct industrial-linkage mechanisms. This important distinction could be addressed in future studies using disaggregated subsector-level data to investigate relatedness across industries over time. Fifth, as this study is based on a single country, the U.S., its findings require verification in other national contexts for generalization. Finally, although the study included state and yearly dummies to capture unobserved region- and year-specific fixed effects, it could not control for all aspects of spatial and temporal heterogeneity across the U.S. over 35 years, which might have affected state-level employment opportunities. Much remains to be investigated in this research area, and we hope that others will join us in addressing these important issues.

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APPENDIX

Table A1: Moran's I Statistics for $\ln Emp_{it}$, $\ln Birth_{it}$ and $\ln Death_{it}$ in
Table 3

Panel A: 48 Contiguous States in the U.S.				Panel B: 67 Selected MSAs in the U.S.		
Year	Employment Equation ($\ln Emp_{it}$)	Estab. Birth Equation ($\ln Birth_{it}$)	Estab. Death Equation ($\ln Death_{it}$)	Employment Equation ($\ln Emp_{it}$)	Estab. Birth Equation ($\ln Birth_{it}$)	Estab. Death Equation ($\ln Death_{it}$)
1980	0.194**	0.173**	0.177**	0.112	0.147*	0.128*
1981	0.192**	0.162*	0.192**	0.113	0.151**	0.115
1982	0.189**	0.157*	0.181**	0.118	0.139*	0.108
1983	0.190**	0.167*	0.190**	0.117	0.166**	0.141*
1984	0.194**	0.186**	0.191**	0.101	0.143*	0.156**
1985	0.202**	0.173**	0.173**	0.099	0.154**	0.146*
1986	0.211**	0.181**	0.165*	0.115	0.159**	0.143*
1987	0.214**	0.187**	0.160*	0.116	0.162**	0.127*
1988	0.217**	0.189**	0.167*	0.120#	0.158**	0.142*
1989	0.217**	0.204**	0.170**	0.121#	0.167**	0.148*
1990	0.216**	0.201**	0.187**	0.118	0.196**	0.186**
1991	0.217**	0.196**	0.196**	0.109	0.171**	0.200**
1992	0.211**	0.183**	0.189**	0.108	0.169**	0.166**
1993	0.211**	0.190**	0.182**	0.109	0.175**	0.175**
1994	0.209**	0.188**	0.192**	0.109	0.160**	0.158**
1995	0.212**	0.189**	0.191**	0.111	0.186**	0.157**
1996	0.211**	0.186**	0.185**	0.114	0.193**	0.172**
1997	0.213**	0.193**	0.185**	0.122#	0.197**	0.168**
1998	0.213**	0.190**	0.194**	0.117	0.201***	0.175**
1999	0.209**	0.189**	0.197**	0.117	0.208***	0.165**
2000	0.208**	0.195**	0.203**	0.129*	0.209***	0.185**
2001	0.202**	0.177**	0.195**	0.131*	0.202***	0.186**
2002	0.205**	0.177**	0.183**	0.130*	0.220***	0.196**
2003	0.206**	0.170**	0.170**	0.132*	0.215***	0.212***
2004	0.207**	0.172**	0.164*	0.132*	0.212***	0.226***
2005	0.205**	0.176**	0.179**	0.139*	0.244***	0.213***
2006	0.202**	0.168*	0.173**	0.143*	0.213***	0.198**
2007	0.195**	0.179**	0.179**	0.141*	0.209***	0.213***
2008	0.191**	0.173**	0.178**	0.140*	0.205***	0.200**
2009	0.186**	0.166*	0.183**	0.126*	0.194**	0.234***
2010	0.185**	0.149*	0.180**	0.129*	0.215***	0.216***
2011	0.188**	0.152*	0.173**	0.127*	0.209***	0.223***
2012	0.185**	0.143*	0.171**	0.133*	0.228***	0.214***
2013	0.181**	0.137*	0.164*	0.127*	0.198**	0.218***
2014	0.178**	0.139*	0.165*	0.130*	0.220***	0.215***
No. of Obs.	1,680	1,680	1,680	2,345	2,345	2,345

Notes: t -statistics are reported in brackets. Statistical significance at the 1%, 5%, and 10% levels is denoted by ***, **, and *, respectively.

Table A2: Moran's I Statistics for $\ln Emp_{it}$ in Table 5

Year	1. Wholesale (3SLS)	2. Retail (3SLS)	3. Finance & Insurance (3SLS)	4. Normalization: 1,000 Pop. (3SLS)	5. W_2 : 2nd-order Contiguity (3SLS)	6. System GMM
1980	0.161*	0.216**	0.182**	0.228***	0.194**	0.194**
1981	0.161*	0.213**	0.171**	0.227***	0.192**	0.192**
1982	0.163*	0.208**	0.199**	0.217**	0.189**	0.189**
1983	0.162*	0.207**	0.176**	0.246***	0.190**	0.190**
1984	0.155*	0.210**	0.178**	0.237***	0.194**	0.194**
1985	0.157*	0.210**	0.190**	0.237***	0.202**	0.202**
1986	0.169**	0.224**	0.200**	0.252***	0.211**	0.211**
1987	0.186**	0.235***	0.197**	0.314***	0.214**	0.214**
1988	0.191**	0.239***	0.216**	0.319***	0.217**	0.217**
1989	0.193**	0.235***	0.224**	0.311***	0.217**	0.217**
1990	0.196**	0.236***	0.219**	0.276***	0.216**	0.216**
1991	0.193**	0.225**	0.233***	0.263***	0.217**	0.217**
1992	0.186**	0.220**	0.231***	0.235***	0.211**	0.211**
1993	0.185**	0.219**	0.229***	0.244***	0.211**	0.211**
1994	0.176**	0.223**	0.215**	0.208**	0.209**	0.209**
1995	0.177**	0.225**	0.216**	0.188**	0.212**	0.212**
1996	0.182**	0.227**	0.222**	0.192**	0.211**	0.211**
1997	0.187**	0.228**	0.223**	0.208**	0.213**	0.213**
1998	0.183**	0.226**	0.213**	0.192**	0.213**	0.213**
1999	0.181**	0.222**	0.205**	0.196**	0.209**	0.209**
2000	0.184**	0.220**	0.197**	0.209**	0.208**	0.208**
2001	0.185**	0.212**	0.195**	0.194**	0.202**	0.202**
2002	0.186**	0.213**	0.204**	0.265***	0.205**	0.205**
2003	0.193**	0.212**	0.196**	0.282***	0.206**	0.206**
2004	0.192**	0.217**	0.182**	0.305***	0.207**	0.207**
2005	0.185**	0.212**	0.173**	0.327***	0.205**	0.205**
2006	0.193**	0.211**	0.164*	0.313***	0.202**	0.202**
2007	0.180**	0.203**	0.158*	0.296***	0.195**	0.195**
2008	0.169**	0.200**	0.157*	0.323***	0.191**	0.191**
2009	0.168*	0.195**	0.158*	0.388***	0.186**	0.186**
2010	0.165*	0.192**	0.164*	0.422***	0.185**	0.185**
2011	0.166*	0.195**	0.155*	0.417***	0.188**	0.188**
2012	0.153*	0.190**	0.169*	0.414***	0.185**	0.185**
2013	0.157*	0.186**	0.142*	0.382***	0.181**	0.181**
2014	0.150*	0.184**	0.142*	0.387***	0.178**	0.178**
No. of Obs.	1,680	1,680	1,680	1,680	1,680	1,680

Notes: t -statistics are reported in brackets. Statistical significance at the 1%, 5%, and 10% levels is denoted by ***, **, and *, respectively.