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Searching for Isard's Regional Essence

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Abstract: At the inception of the Southern Regional Science Association in the early 1960s, Walter Isard maintained that areal regions are fundamental units of observation and analysis. To this day, understanding the special significance of regions motivates much of our empirical research. In my address, I argue that regional fixed effects estimates from regression analysis can help us comprehend the distinctive character of areal units. This paper offers two examples from my research. First, I present the results of a regression model that explains regional knowledge spillovers in U.S. counties. Santa Clara County (Silicon Valley) has by far the largest fixed effect estimate of any U.S. county. Overall, the county level fixed effects for knowledge spillovers follow a pattern of rapid exponential decay. Next, I inspect neighborhood fixed effects taken from a hedonic housing price model of the Charleston, South Carolina region. The results suggest a clear preference for coastal proximity as reflected in house prices. For neighborhoods away from the coast, the fixed effects estimates exhibit a steep decline toward zero. Like Silicon Valley's regional advantage in knowledge, beachfront neighborhoods benefit from an exclusive, time invariant advantage that is hard, if not impossible, to replicate in space.

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JEL Codes: R10, R23, R30

1. INTRODUCTION

The Southern Regional Science Association (SRSA) owes its existence in large part to Walter Isard's revelation that the region represents a distinct and elemental unit of analysis. The founding father of regional science wrote, "The region has its own 'essence' which can be grasped in full only by tools, hypotheses, models, and data processing techniques specifically designed for regional analysis" (Isard, 1956). In 1962, Isard helped establish our association, originally called the Southern Section of the Regional Science Association. As an academic evangelist for the new discipline, he brought his vision to Chapel Hill and presented one of four seminal papers at the "Exploratory Organization Meeting" (Durden and Knox, 2000). To this day, his conviction that the "region has its own essence" encapsulates the mission of the SRSA. The website of the North American Regional Science Council prominently displays Isard's statement of purpose.

To be sure, "essence" has a metaphysical ring to it. Certainly, Isard is not imploring us to use scientific tools to search for some mystical spirit that lies beyond the appearances of the real world. Instead, I consider Isard's essence to mean that the region is fundamental and necessary, and importantly, something that we can detect and measure through empirical research.

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In my SRSA Fellows Address, I will review how the empirical tools we have developed since the inception of our association enable us to discern the essence of regions. Through ongoing research, the fundamentals of regions can "be grasped in full," as Isard suggested. The unifying theme of regional science, which covers migration, industry location, housing, and other real-world subjects, is that we analyze data assembled in bounded (or areal) units to study.

Specifically, I contend that spatial units like counties and neighborhoods have quantifiable identities. In regional statistical analysis, we often introduce regional fixed effects. These fixed effects capture the regional heterogeneity that is otherwise "unobserved." In regression analysis, fixed effects hold constant the unique character of regions and thus serve as controls that help isolate and accurately estimate particular influences—for example, the role of regional incentives on industrial location choices. Yet, published research papers do not usually report the fixed effect estimates. By not examining these results for fixed effects, we may overlook important information that can help us determine what is essential about regions.

In this paper, I will draw on my recent research to demonstrate how the estimates for fixed effects help us quantify the special identity of regions. I also make a larger point about our own identity as an association, as reflected in Isard's mission statement. Our objective is to develop "tools, hypotheses, models, and data processing techniques specifically designed for regional analysis." Advancing statistical and data analytic techniques are fundamental concerns of everyone who labors in the vineyard of regional analysis. In an age where it has become alarmingly acceptable to dismiss the scientific method in favor of "fake news" and "alternative facts," our association's empirical research provides a valuable service.

In the first section of the paper, I set the stage for my Fellows Address by discussing how I came to appreciate regional science for its enduring commitment to empirical research. To use Andy Isserman's (2010) apt phrase, all of us in this association are voyagers on an academic "space odyssey." I began mine when I presented my first paper at the annual meeting of the SRSA in 1985. At the time, I was a graduate student who had the privilege of working with regional forecasting pioneer Norm Glickman and Niles Hansen, one our first SRSA Fellows. Like many young scholars who are attracted to our association, I sought to acquire empirical skills and apply them to understanding pressing economic development problems.

Next, I review the fundamental basis of our empirical research: the region. Mostly, we analyze data in areal units and thus we are not engaged in pure spatial analysis. Following this section, I discuss how fixed effect regression can be used to assess the essence of these regional (areal) units. I argue that this statistical technique helps us "grasp the whole" that Isard inspired us to investigate.

The paper presents two examples of fixed effects as measures of regional essence: (1) U.S. county-level knowledge spillovers and the unique identity of Silicon Valley; and (2) neighborhoods fixed effects and preference for coastal real estate in the Charleston, South Carolina region. In both cases, we will see that fixed effects exhibit exponential decay. The results reveal that regions like Silicon Valley or neighborhoods like the Beachside of Charleston have a distinct essence that is hard to reproduce elsewhere.

2. EMPIRICAL EPIPHANY

With one notable exception, universities and colleges do not offer regional science degree programs. SRSA past-president Michael Lahr is a rare case in that he received B.A., M.A., and

Ph.D. degrees in regional science at the University of Pennsylvania. Walter Isard set up the department at Penn in the 1950s, but the university closed the program in 1993. With those options no longer available, students get exposure to regional science through economics, geography, or other subject areas.

For me, discovering regional science came as an epiphany after disillusionment with the lack of concern in economics for empirical analysis while I was in graduate school. I first intended to study macroeconomics. Yet the field pivoted away from empirical research in the late 1970s and early 1990s. Macroeconomics became theoretically dogmatic, largely unscientific, and increasingly divorced from reality.

At its best, macroeconomics blends theory, empirical research, and policy. The field blossomed in the 1950s and 1960s, with an emphasis on statistical research, including the development of practical macroeconomic forecast models. With an early interest in forecasting, I was motivated to study how financial instability influenced the macroeconomic business cycle. In graduate school, however, I was shocked to learn that the financial sector's crucial, systemic role was dismissed by the theoretical orthodoxy. Moreover, I was interested in learning how policy can be used to mitigate the damage caused by recurring recessions and depressions. Yet in the mid- to late-1970s, macroeconomics moved away from its policy-driven Keynesian origins to "policy neutral" New Classical models. These models were built on unrealistic rational expectations and perfect foresight assumptions. After some mathematical gymnastics, these models attempt to show that omniscient agents anticipate and neutralize macroeconomic policy interventions. From this perspective, the notion that macroeconomic policy can affect the trajectory of the business cycles was considered a Keynesian conceit that was attacked by prominent critics, notably at the University of Chicago. Yet during the late-1970s, the conceits of New Classical macroeconomics became the conventional economic wisdom as it spread across college campuses.

I witnessed this retreat from empirical inquiry to mathematical abstraction in graduate school. Nevertheless, the models were respected for their "rigor" and many students accepted the underlying theoretical premises, notwithstanding the lack of empirical support. This is perhaps not surprising, given the effort required to master the complexity of macroeconomic models. To quote an adage often attributed to Kenneth Boulding, "Mathematics brought rigor to economics. Unfortunately, it also brought mortis."

Despite a lack of empirical support, this line of speculative inquiry became the dominant paradigm. Simplified, yet unsubstantiated assumptions about human behavior became deeply embedded in the "dynamic stochastic general equilibrium" models that dominate macroeconomic thinking to this day.

Some 40 years later, the prominent growth theorist and urban economist Paul Romer validated my decision to abandon macroeconomics in the 1970s. In a biting critique, Romer (2016) attacked macroeconomic growth theorists for abandoning science. His criticism is devastating. Romer writes, "For more than three decades, macroeconomics has gone backwards." Romer inveighs against macroeconomists for "mathiness" and for abandoning science. He claims macroeconomic growth theorists became more concerned with controlling journals, acting as thought police, insisting dogmatically on assumptions that ignore the real world, while eschewing empirical investigation. He said they are "more committed to friends than facts." Romer (2016, p.12) summarized macroeconomics with biting satire: "Assume A, assume B, ... blah blah blah ... and so we have proven that P is true."

Romer's lament is unfortunate because macroeconomics research plays a critical role in policy throughout the world. Central bank economists need models that can explain and track the business cycle. The atrophied state of macroeconomics became obvious during the Great Recession of 2007-2010, when financial instability played a prominent role in engendering massive job losses. Yet the prevailing business cycle theory ruled out the possibility of an economic crisis emanating from the financial sector.

In contrast, I found regional science elevates empirical analysis over orthodox theory. I had an opportunity to study with Wassily Leontief, one of the early critics of excessive economic abstraction and a lack of serious empirical research. Leontief is best known as the inventor of the input-output model, one of the most practical economic techniques. He contended that much of economics research "lags intellectually," and lambasted its "splendid isolation" from other disciplines (Leontief, 1982, p. 107). Reflecting economic theory in the 1980s, he wrote,

> "Not having been subjected from the outset to the harsh discipline of systematic fact finding, traditionally imposed on and accepted by their colleagues in the natural and historical sciences, economists developed a nearly irresistible predilection for deductive reasoning ... The aversion of the great majority of the present-day academic economists for systematic empirical inquiry [is best revealed by] the methodological devices they employ to avoid or cut short the use of concrete factual information" (Leontief, 1982, pp. 104–107).

In the tradition of luminaries like Leontief, regional science has always kept grounded in "systematic empirical inquiry." The Nobel Laureate would no doubt be pleased to see that his data-driven techniques are relevant today in economic impact studies, cluster analysis, and interregional modeling (Dietzenbacher, Lenzen, Los, Guan, Lahr, Sancho, Suh, and Yang, 2013; Jackson, 2015).

Moreover, regional science embraces theories that generate testable hypotheses, as would be expected of a discipline that calls itself a science. For example, agglomeration theory, first put forth by Marshall (1920), offers a cogent explanation of the process of economic development (Henderson 1974; Fujita and Thisse, 2002). Agglomeration research has built on Marshall's original insights and has produced a large stream of literature devoted to testing the tenets of this theory against the best available data (Rosenthal and Strange, 2001).

To corroborate agglomeration and other regional theories, present day researchers have access to advanced statistical techniques. We have greatly improved methods and much better data compared with what was available to pioneers like Isard and Leontief. For example, with large data sets, it is computationally feasible to introduce high-dimensional fixed effects (Guimarães and Portugal, 2010). With this method, we can control for hundreds, if not thousands of regional units in regression analysis. I focus on this technique because as the Introduction averred, regional fixed effect estimates can also help us detect what Isard meant by the essence of regions.

3. IDENTIFYING REGIONS

A regional fixed effect implies that the region itself has a measurable influence on subjects that interest us like agglomeration, industry location, and migration. As opposed to point estimates used in spatial (distance) analysis, we typically take areal units as the basis for our observations in statistical research. These units are then treated as having a time-invariant nature. I next review what we have come to accept as these regional units, before discussing fixed effect regression as a way to understand the essence of regions.

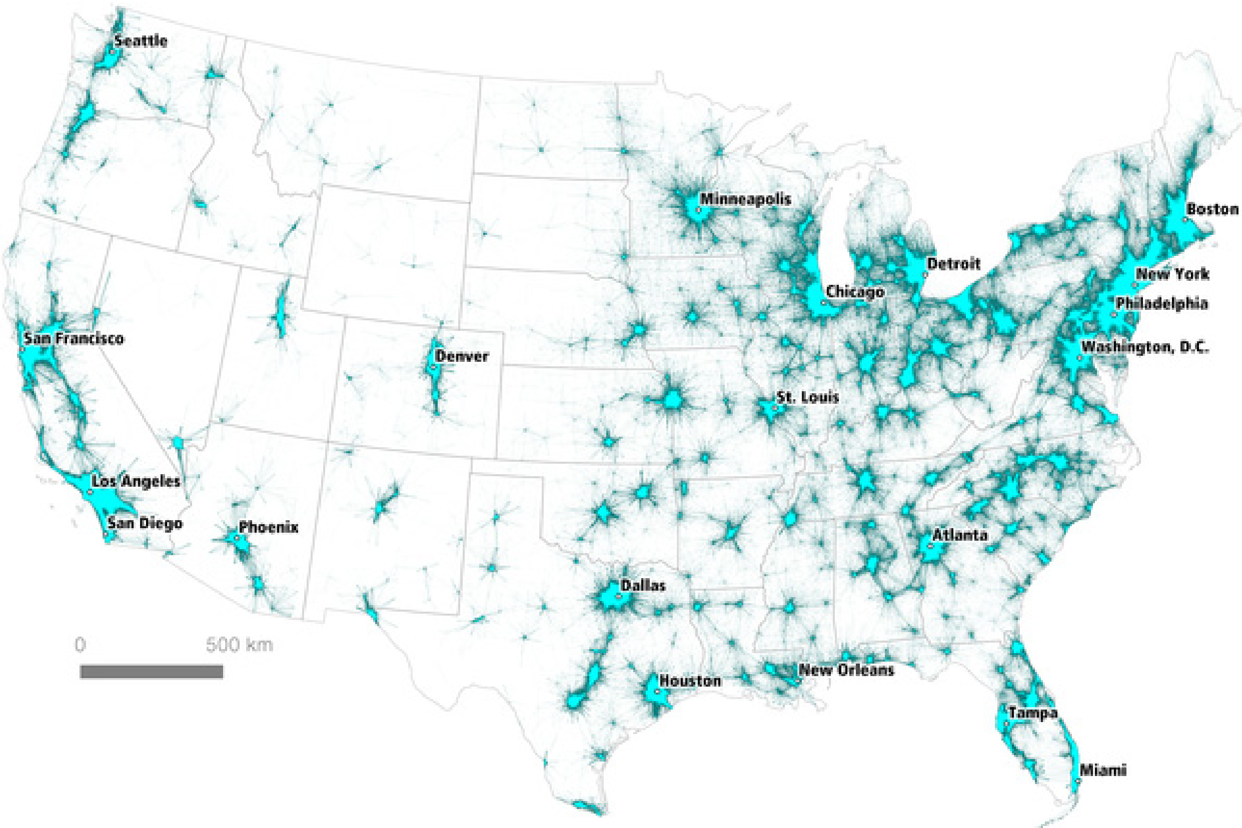
Both theoretical and empirical approaches help us define regional boundaries. Everyone in our field is familiar with central place theory. In his attempt to define the ideal region, Walter Christaller took an abstract approach. Like Plato's ideal forms, the hexagons of central place theory are an elegant depiction of the space-economy. Yet few regional researchers use this pure theory in current research. In fact, central place theoretical abstraction provides an example of Leontief's (1982) complaint about the aversion to empiricism; that is, it is a way "to avoid or cut short the use of concrete factual information." This approach might have been appealing in the 1930s when there was a dearth of data for regional analysis. It would seem to be impractical, although Christaller believed he could impose this idealized honeycomb space-economy on the real world. Remarkably, he proposed to use these "pure" forms in planning the regional development of "empty space" in Eastern Europe after Germany eliminated non-Aryans and regions were re-settled (Barnes and Minca, 2013). Fortunately, the abstraction never became reality, as the Nazis never had a chance to implement Christaller's central place design.

This is not to say that abstract regional analysis should be disregarded altogether, however. In his excellent history of regional science, Isserman (1993) noted that Isard recognized early on that "abstract spatial theorizing" was part of how we can comprehend regional essence (Isard, 1956). Nevertheless, Isard largely dismissed the pursuit of ideal regional forms as intractable. He argued that we must collect and analyze data in the areal units of the real world. Thus, in regional science, we are compelled to leave the realm of idealized spatial theory and analyze data within units that we often do not define. That is, we select regional units that provide the observations and most effective basis for testing our theories. Within these areal units, there will be "certain aspects of homogeneity or cohesion" (Isard, 1956). Hence, in his comprehensive history of regional science, Isserman (1993, p. 3) stressed, "The delineation of areal units or regions thus seems to be the necessary condition in this definition of regional science."

At the other end of the methodological spectrum from abstract theory, geographers have endeavored to define areal boundaries on a purely empirical basis. These scholars want to reconfigure space and not just accept the units imposed by administrative and legal jurisdictions, which are the basis for most regional data collection. An example is the megaregion defined by Dash and Rae (2016). The megaregion is delineated by commuting patterns and purports to create a basis for examining local labor markets. Where central place theory uses deductive logic to define regions, this form of pure empiricism relies on one measure (commuting) to establish regional boundaries. Dash and Rae (2016) write,

> "… the empirical problem of dividing space into discrete, bounded, internally-homogenous regions has long been a vexed problem for geographers, with attempts at providing an objective method for regionalization stretching back more than a century [and]… the goal of partitioning the United States into functional megaregions shows that the old problem of regional delineation remains very much alive—and unsolved."

Figure 1: U.S. Megaregions



Source: Dash Nelson G, Rae A. (2016) "An Economic Geography of the United States: From Commutes to Megaregions." PLOS ONE 11(11): e0166083. doi:10.1371/journal.pone.0166083

Figure 1 depicts megaregions for the U.S. Like theoretical geometric patterns, these reconstructed regions reveal something interesting about geographic patterns and, arguably regional essence. Yet they cannot be readily used for most regional research on industry location, migration, and other regional science concerns. They create visually pleasing maps, but the data needed to explore regions and test hypotheses about economic development are not readily available within these areas. Their utility for regional science has been therefore limited.

For the most part, we are limited to gather data according to the areal units defined by governments. For example, counties in the U.S. have been used for decades as the observational units for research. European research is based on areal units that are similar to U.S. counties (Guimarães, Figueiredo, and Woodward, 2000). Likewise, in Asia, Latin America, and Africa, administrative units like provinces contain the data used in most regional studies.

One major statistical development in our discipline has been econometric analysis that combines the commonly used regional (areal) data with spatial (distance) data. House price models, for instance, examine sales data that are given as points in space along with areal data for neighborhoods. Often, regression analysis used in migration and transportation studies combines data on the characteristics of originating and destination regions along with spatial data on distance between regions. LeSage (2014) provides a valuable overview of spatial econometrics assumptions and methods that are relevant to advancing this line of regional analysis.

With areal data, it is important to recognize that observations that are aggregated into states, provinces, counties, census tracts, or other administrative entities pose the modifiable areal unit problem (MAUP). When point-based measures of geographic phenomena (the location of firms, for example) are amassed into bounded regions, the observed values will differ according to how one defines the boundaries (Briant, Combes, and Lafourcade, 2010).

In some cases, researchers have aggregated the available data from administrative regions into alternative regional configurations. Taking U.S. counties as a starting point, for example, scholars can define regions that reflect local labor markets. An example taken from labor economics is the Commuting Zone approach of Autor, Dorn, and Hanson (2013). In this widely cited investigation of the impact of Chinese imports on U.S. regions, the authors cluster U.S. counties into 722 zones and then map publicly available employment and other county data, along with labor data Census Public Micro Use Areas into these regions. Even so, the reality is that our observations are aggregated into areal units, not given as precise points in space. Academics do not draw the borders for regional units.

To return to the question posed at the outset of my address: Do these areal units have any distinctive "essence?" Do they have "aspects of homogeneity or cohesion," as Isard argued?

I contend that the regions we use in our studies have an essence that we can appraise. My first example is Santa Clara County, which is universally known as Silicon Valley. As I argue in the next section, Santa Clara County may have a distinct value as a high-technology region that can be measured through regional fixed effect regression. I will draw on my analysis of knowledge spillovers in U.S. counties and show that Santa Clara County's technology-based knowledge spillovers are clearly distinct from other counties.

In my second example, I delve within the Charleston, South Carolina metropolitan region to explore the neighborhood as the key spatial unit in house price determination. Assembling the pertinent data for neighborhoods is crucial in modeling housing market decisions. In hedonic price models, we can introduce neighborhood fixed effects to capture unobserved, heterogeneity—the essence—of these local areas. Consequently, these fixed effect estimates can be used to quantify the unique character of neighborhoods.

4. THE ESSENCE OF HIGH-TECH REGIONS

Silicon Valley, situated just south of San Francisco, California, is the quintessential high-technology hub and the most revered innovative region in the world. Its brand is emulated everywhere: Silicon Hills, Forest, Beach, Prairie, Bayou, Canal, Harbor, and even Silicon Alley and Roundabout. In discussions I have with non-U.S.-based academics about the U.S. economy, they are much less interested in the determinants of the U.S. macroeconomic business cycle than in the dynamism of this region as a model for economic development.

Originally, Silicon Valley signified California's Santa Clara County. Its global reputation derives from the industry clusters and spinoffs that first developed around Stanford University in Palo Alto. The Silicon Valley namesake evokes its origin in the semiconductor industry, starting with Shockley Semiconductor Laboratory in 1956. Beyond the role of Stanford in cultivating engineering talent and spawning entrepreneurial activity, the county offered tax policies favorable to new business creation. Federally financed defense spending also contributed to the region's remarkable economic growth.

In many respects, Silicon Valley is unique. No other area of the world germinated more successful technology companies in the late 20th century, including Hewlett Packard, Apple, Cisco Systems, and Sun Microsystems. In the 21th century, the region has evolved from hardware to software activities, with renowned companies like Google, Facebook, eBay, and many more based in the region. Stretching beyond Santa Clara County, Silicon Valley has grown to include adjacent San Mateo County to the north. In a more expansive view of its boundaries, the region includes the Bay Area's San Francisco and Alameda Counties as well.

As Silicon Valley illustrates, regions have brand identities that connote much more than geography. While aspiring technology-intensive regions often attempt to imitate the Silicon Valley brand, the region stands apart as the perennial leader of innovation.

Santa Clara and surrounding counties possess a set of special features that enable the area's businesses to thrive. These attributes are hard to reproduce elsewhere. First, there is a high concentration of venture capital, outperformed only by nearby San Francisco (Florida, 2016). There is also a deep pool of engineering talent and other highly skilled labor. Moreover, the region enjoys a reputation as possessing an open and tolerant culture. As a result, it attracts a large number of U.S. migrants and immigrants to the high-technology milieu. Research universities like Stanford and Berkeley excel in science and technology, which further attracts and retains talent in the local area. An outsized share of all patenting activity in the U.S. reflects the extent of knowledge creation in Silicon Valley. The region has "far and away" the greatest concentration of patent applications (measured by location quotients) in the U.S. (Florida, 2013). More than anywhere, Silicon Valley's innovative activities spawn new products and services, with an engrained entrepreneurial ethos and high rate of business startups.

Above all, the region is an exceptional network of scientific and technical knowledge, with a great potential for local knowledge spillovers. Joining this exclusive club, however, comes with a high cost. Santa Clara County has the most expensive housing costs in the U.S. (Martin, 2016). It also had the nation's most highly priced office space, notably on Palo Alto's Sand Hill Road (O'Connell, 2015). Fortunately, Santa Clara County residents enjoy the highest median household income in the country; it is twice the U.S. average (Avalos, 2016).

Saxenian's (1996) *Regional Advantage* illuminates what makes Silicon Valley exceptional. Her argument is that the region's success goes beyond the robust agglomeration of technology-intensive industries like semiconductors and computers. Silicon Valley is unlike other information-communication-technology clusters. The principal regional advantage, according to Saxenian (1996), is a competitive business ecosystem that promotes learning. The positive externalities of this knowledge-based advantage of the local network compensates for the high cost of living and doing business.

The toolkit of contemporary regional science can be used to measure this unique regional identity and assess the essence of Silicon Valley as a knowledge economy. Along with colleagues, I have examined knowledge spillovers in U.S. counties (Figueiredo, Guimarães and Woodward, 2015). To probe the role of industry localization and distance decay in regional knowledge spillovers, our paper uses a gravity-type model with U.S. county-level fixed effects.

A large, but unsettled literature has examined local learning networks and the influence of proximity (distance) in knowledge spillovers. Our paper extends the line of inquiry that began with Jaffe, Trajtenberg, and Henderson (1993). This seminal paper used originating patents and patent citations to track local knowledge spillovers across regions. It appears that proximity to the source of knowledge matters, even in an age of pervasive internet access. Our study of U.S. patent citations revealed that doubling distance from the originating patent leads to a 25 percent decrease in the number of patent citations. In an extension of the Jaffe, Trajtenberg, and Henderson (1993) approach, we introduce county level agglomeration as a determinant. We find that industry agglomeration offsets the effect of distance from the source of knowledge (the originating patent). In sum, agglomeration (measured by employment and establishment concentration) has a positive impact on the number of patent citations in a U.S. county and industry, after controlling for distance from patent generation (the proximity effect).

In our regression model, we tested for patent citations across approximately 26 million observations. This large data set allows us to introduce high-dimensional fixed effects. Our regression has fixed effects for all cited patents, industries, and regions (approximately 3,000 U.S. counties).

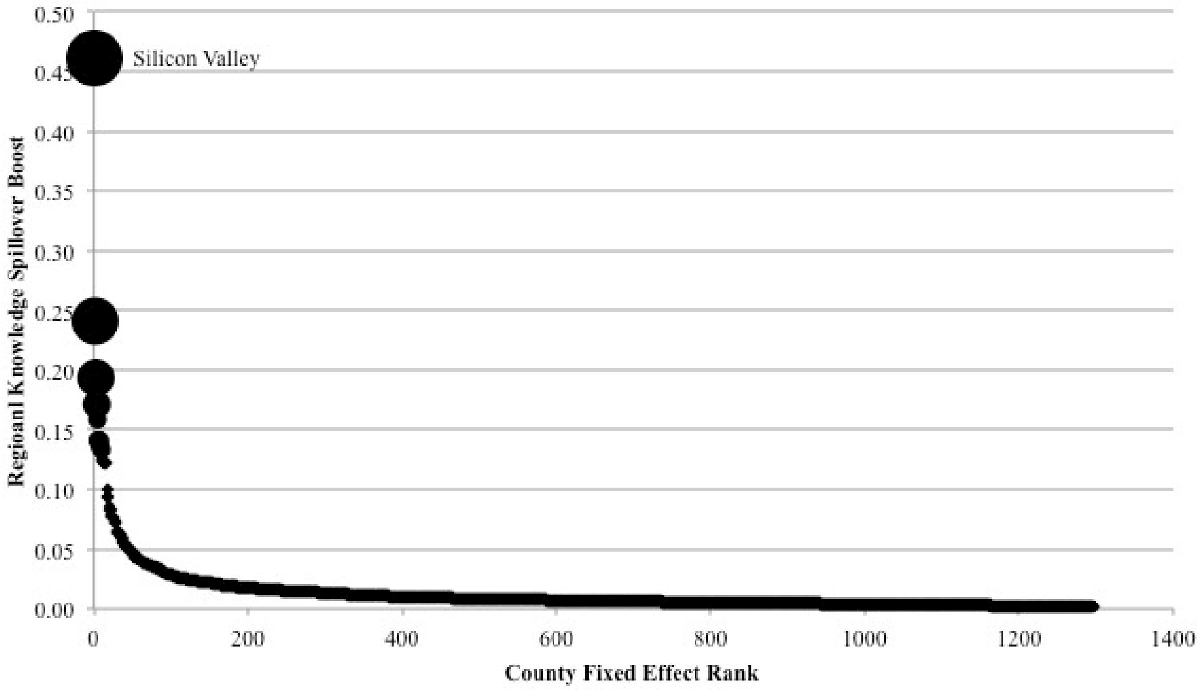
As discussed earlier, the U.S. county fixed effects can control for the time-invariant, heterogeneous influence of the areal unit. As is the usual practice, we did not report the county fixed effects estimates in our original paper (Figueiredo, Guimarães and Woodward, 2015). In preparing my SRSA address, however, I inspected the results from an alternative perspective, where fixed effects are not a mere control in the regression model. My hypothesis is straightforward: If Silicon Valley has an essential identity for learning, then the fixed effect estimate for Santa Clara County should rise significantly above all other county estimates. The proposition is that Silicon Valley has a distinctive identity as a regional network and should stand out in knowledge spillovers, even when controlling for agglomeration and distance effects on knowledge spillovers. Recall that the fixed effects represent the enduring nature, or the essence of the region.

Thus, before inspecting the results, I expected that the Santa Clara County estimate would exhibit a contribution to knowledge spillovers that would be far above other counties. The results uphold this hypothesis. With everything else identical in our Poisson-gravity model, Santa Clara County's fixed effect boosts knowledge spillovers by twice that of any other county. Controlling for agglomeration and distance from the originating pattern, the second highest U.S. county has about half of the knowledge spillovers as Santa Clara's. The next highest county has about a third.

Figure 2 displays the findings for all U.S. counties. We observe steep exponential decline for the regional fixed effects. Following Santa Clara County, the top ten regions include San Mateo County (often considered part of Silicon Valley), along with other high-technology regions like Seattle, Boston-Cambridge, San Diego, and Austin. Following the top ten counties, Figure 2 reveals that the county fixed effects then rapidly approach zero. In short, Santa Clara County generates knowledge spillovers (patent citations) far more than any other region, even after controlling for industry agglomeration and distance from the source of knowledge (patents).

Thus, the tools of regional science can quantify the special character of Silicon Valley as a locus of knowledge transfer and learning, as posited by Saxenian (1996). Given that the fixed effect estimates quantify the time-invariant, unobservable contribution of Silicon Valley, then presumably the results will not change rapidly. It appears it would be hard to replicate Silicon Valley's essential character as a learning region.

Figure 2: County Fixed Effects for Knowledge Spillovers



An extension of this analysis could investigate regional fixed effects in other contexts. Researchers could also examine the fixed effects of labor market regions following the Commuting Zone approach to regional units (Autor, Dorn, and Hanson, 2013). It would be interesting to see how the Silicon Valley special status as the most advanced technological region holds up to scrutiny in a wider definition of counties as compared with others across the U.S.

5. NEIGHBORHOOD IDENTITY

Along with counties and other administrative regions, neighborhoods are the subject of ongoing research, especially in the extensive literature on housing markets. Neighborhood identities are integral to housing market transactions. Every region has well-established names for places that all residents and homebuyers readily recognize. For example, realtors organize housing sales data in the Charleston, South Carolina region using neighborhood brands like "South of Broad" in the city's historic district and "Seaside" on the exclusive Isle of Palms.

Yet, a neighborhood is an informal rather than an official administrative designation. The private market, not the government, delineates neighborhoods. Nevertheless, most homebuyers accept the neighborhood identities defined by the private sector in selecting homes. Real estate agents recognize the impossibility of the buyer's ability to appraise all local characteristics and make detailed comparisons across the relevant region. Thus, real estate agents define and market sub-regional brands and homebuyers search for properties using these neighborhoods or subdivisions.

Essentially, neighborhoods encompass a package of externalities (positive and negative) that enable buyers and sellers to sort, select, and negotiate home prices. Most scholarly studies, however, view house price determination as a more complex process. In the standard hedonic housing theory, buyers optimize their preferences across a broad set of *particular* location characteristics like school quality, crime, shopping, and other local characteristics (Rosen, 1974). The hedonic housing price regression model, however, does not clearly postulate the full array of local attributes that should matter in the real estate market. Indeed, the list of potential neighborhood characteristics is long and varied. Accordingly, researchers in housing economics decide what variables should be included in the bundle, depending on their interest and available data.

The emphasis on studying the influences of particular local attributes tends to obscure the neighborhood identity as integral to the housing decision process. In an alternative to the standard optimization theory, we can view the neighborhood as a heuristic that streamlines the local data used to assess housing values. As understood in behavioral economics, heuristics represent mental shortcuts or rules of thumb. Heuristics provide an alternative "fast-thinking" process based on intuition that contrasts with "slow," rational decision-making put forth in most economic models (Kahneman, 2003). Effectively, neighborhoods bundle both observable and unobservable local attributes to simplify an otherwise complex decision-making process.

In house price models, fixed effects can provide estimates for the unique value of a neighborhood. Yet, while researchers include neighborhood fixed effects as a control in housing market studies, they rarely report the estimates (Bogin and Nguyen-Hoang, 2014; Zahirovic-Herbert and Turnbull, 2009).

In this address, I decided to explore fixed effect estimates to see whether they reflected neighborhood brands. I draw on a recent research paper on housing price determination in the Charleston, South Carolina region (Woodward, Von Nessen, and Guimarães, 2017). Again, the fixed effect should capture the heterogeneous features of the local area and account for a multitude of observable and unobservable local amenities. It should pick up the neighborhood's identity and provide a measure of the whole, not the just the particulars like school quality, sidewalks, crime, transport access, and natural amenities.

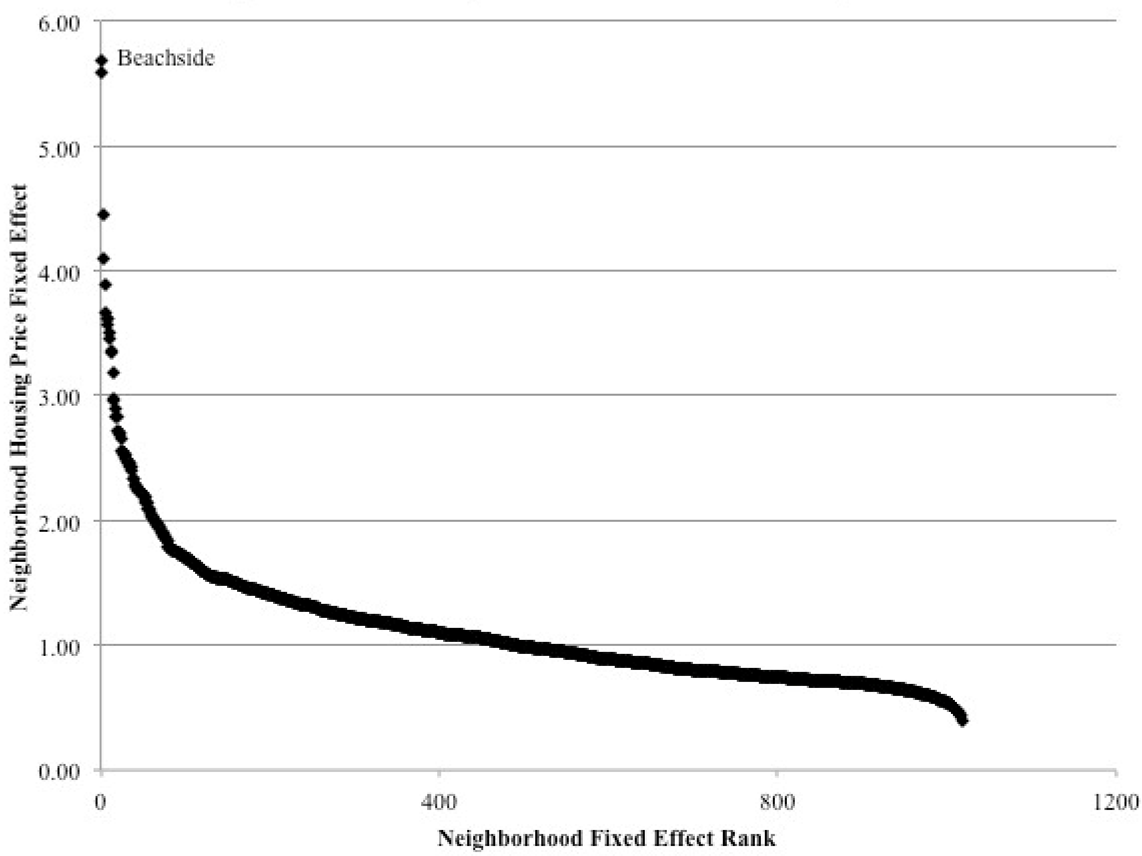
There are 1,234 neighborhoods/subdivisions in the Charleston, South Carolina region (Berkeley, Charleston, and Dorchester Counties). Our dataset contains 50,896 observations for single-family home sales from 2003 through 2007. We employ a hedonic model where the natural log of the sale price of the house is regressed as a function of the explanatory variables, as commonly found in the literature.

As explanatory variables, we start with the fundamental determinants: the home's age, size, and structural characteristics. We then add the neighborhood fixed effect to the model.

Our regression model yielded a good fit for the data with just the independent variables for age, size, and structural characteristics used to explain house price variation. Even so, introducing the neighborhood fixed effect has a noticeable influence on regression results. When we add the neighborhood fixed effect, the adjusted R^2 increased from 0.66 to 0.92.

For this address, I took a closer look at the fixed effect estimates for neighborhoods. Everything else held constant, I find that a house in a neighborhood with the highest fixed effect estimate (Beachside) is valued 14.5 times higher than a similar house with the lowest fixed effect. As expected, Charleston's other beach communities around the Isle of Palms, like Wild Dunes and the highly desirable downtown historic districts (areas designated as situated in a national landmark), rank in the top ten. As for the lowest valued neighborhood (Rosemont), an

Figure 3: Charleston Neighborhood Fixed Effects for Housing Prices



interstate highway built in the 1960s permanently ruined the poor residential area and substantially lowered its property values.

Figure 3 displays the neighborhood fixed effects for the Charleston region. As we saw with knowledge spillovers across U.S. counties, the fixed effect estimates exhibit rapid exponential decay. Thus, it appears that the neighborhood itself can have a profound influence on house prices. The gains accrue mostly to exclusive neighborhoods, notably Beachside on the Isle of Palms.

Like Silicon Valley as a knowledge hub, Beachside's elite livability attributes are difficult, if not impossible to reproduce elsewhere. Real estate agents promote the neighborhood as having "all the amenities you would want" with a "central location." The "family friendly estate is just a short walk from the Atlantic and her beautiful beaches where private access is available." It offers "hard-packed sand perfect for bike riding." Realtors promote the area as having "no high-rise condos to block views or crowd the beach" and as a "quiet community with a lot to offer apart from its proximity to the beach." For this package of amenities, homebuyers paid 14.5 times more than the lowest valued neighborhood, holding constant the size, age, and structural characteristics of homes in the region. The near-zero estimates for most fixed effects (see Figure 3) suggest that neighborhood brands generally have a limited impact on house prices.

Instead, the results shown in Figure 3 imply that people strongly desire to reside near the ocean. The fixed effect picks up the desire for beachfront living. In an age of rising sea levels, this inference may seem counter-intuitive. Yet, there is also historical evidence that the preference for coastal property is unchanging in the Charleston region. Even after Hurricane Hugo's punishing winds and extensive flooding devastated the Isle of Palms in 1989, neighborhoods like Beachside proved to be resilient. Initially, the shocking images of the catastrophe following the Category 4 storm could lead casual observers to believe that people would never return to live near the ocean. The hurricane uplifted homes from their foundations and threw them back away from the coastline. The storm severely damaged bridges that provide the only access to the Isle of Palms. Nevertheless, after the rebuilding effort in the 1990s, new and remodeled homes near the ocean in the Charleston region are worth considerably more than ever. As the fixed effect estimate reveals, Beachside's exclusive brand remains unharmed in the local housing market.

6. CONCLUSION

It is a genuine honor to be named a Distinguished Fellow of the Southern Regional Science Association. As my address reveals, graduate studies in economics left me disillusioned until I found regional science and its germane and ever-evolving empirical research.

Over the course of my career, I have been continually inspired by the quality of empirical research that we present at our annual conferences and publish in journals like the *Review of Regional Studies*. Across a range of topics, this research has consistently answered Isard's charge to advance and apply empirical techniques as we seek to ascertain the essence of regions.

As an illustration, I contend that fixed effect regression is a technique that can help us measure the "aspects of homogeneity or cohesion" of the areal regions we accept as our basic observational units. For this address, I drew on previous research to explore high-technology regions and neighborhood identities through fixed effects. These cases suggest that areal units have an uneven significance. Some counties (Santa Clara) or neighborhoods (Beachside) appear to have a special character. These areas benefit from observable and unobservable attributes that are hard to reproduce. The top regional and local areas stand apart from all others. It will be interesting to see if this conclusion holds up in future research using fixed effect regression and other regional science methods.

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