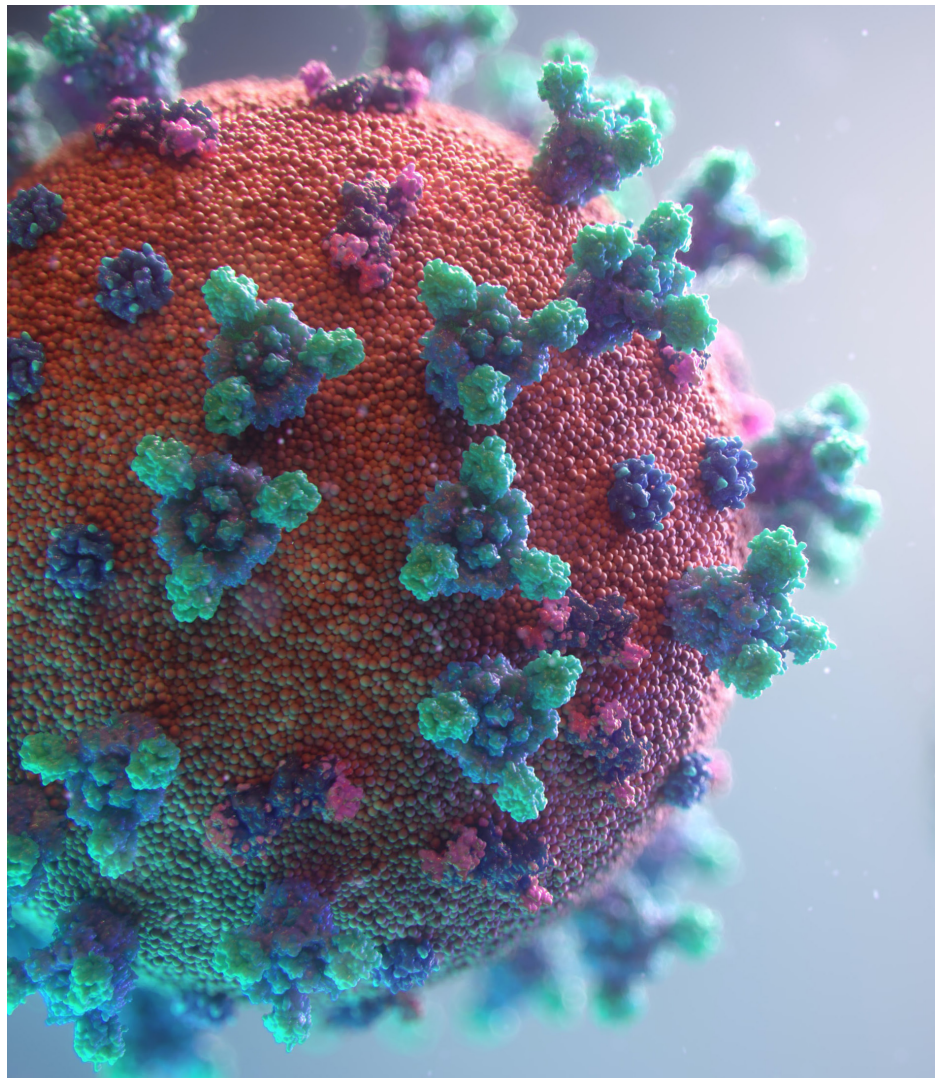




HOW DOES HAWAII'S ECONOMIC GEOGRAPHY AFFECT ITS HEALTHCARE INDUSTRY?

APRIL 22, 2024





UHERO

THE ECONOMIC RESEARCH ORGANIZATION
AT THE UNIVERSITY OF HAWAII

How does Hawai'i's economic geography affect its healthcare industry?

©2024 University of Hawaii Economic Research Organization.
All rights reserved.

This work was funded by the University of Hawai'i System Rural Health Research and Policy Center through grant No. GE1HS47344 from the U.S. Department of Health and Human Services, Health Resources and Services Administration.

Steven Bond-Smith

Assistant Professor

Daniela Bond-Smith

Data Scientist and Research Economist

Victoria Rhinebolt

Graphic Design and Layout

2424 MAILE WAY, ROOM 540 • HONOLULU, HAWAII 96822
(808) 956-7605 • UHERO@HAWAII.EDU

EXECUTIVE SUMMARY

This report draws new perspectives on the healthcare industry in Hawai'i based on research in *Spatial Economics* and *Economic Geography*. These refer to the study of spatial aspects of economic activity by economists and human geographers respectively, who each use very different methods and place emphasis on different factors. The report draws on both of these literatures and partially reconciles these methods and perspectives to understand how Hawai'i's healthcare industry might differ from other places.

Firstly, Hawai'i's small size and isolation affects where and how healthcare services are offered. Economies of scale, economies of scope, and external increasing returns to scale, combined with spatial transaction costs and transportation costs, all push healthcare services to locate in more central places. Yet Hawai'i's island geography is likely to also generate this pattern at a county or island scale that decentralizes some services from the state level to centralized locations within each island/county. Hawai'i's small scale, and the small scale on each of the neighbor islands, means that healthcare in Hawai'i is likely to face lower productivity or higher costs than in other places because it is less able to take advantage of increasing returns to scale or economies of scale. The state's small scale may also contribute to limited competition in many sectors, including healthcare, hampering innovation and growth. These types of pressures are not unique to the healthcare industry and also contribute to Hawai'i's specialization in tourism and its higher cost of living.

Hawai'i's natural amenities and constrained housing supply add to elevated housing costs and generate a more compressed wage distribution with higher wages for low-wage jobs and lower wages for high-wage jobs compared to the mainland. This may also contribute to a tighter labor market in Hawai'i that doesn't reflect the performance of its economy in a comparable way to other places. While policymakers are promoting diversification beyond Hawai'i's specialization in tourism, its small scale, isolation, open economy, and specialization poses obstacles to introducing new industries and limits productivity growth. Non-tradable sectors such as healthcare remain in Hawai'i due to the necessity of providing services locally, but face higher costs or lower productivity. If cost reimbursement rates (e.g. from Medicare) are set at a national level that does not reflect local productivity in Hawai'i, it would imply shortages in the supply of healthcare services.

This also affects the range of job types and the composition of Hawai'i's workforce, which may affect the types of activities that the healthcare industry can viably host in Hawai'i, and imply a greater need for recruitment from out of state than in other places. The higher cost of living also implies a tighter-than-usual labor market, as residents face higher living costs to remain in Hawai'i compared to elsewhere, exacerbating recruitment difficulties. This is compounded because the ability to recruit from out-of-state may be more difficult in Hawai'i due to its isolation—a particular challenge for the healthcare industry which frequently has to recruit from out-of-state. The combination of natural amenities, limited land availability, and greater planning regulations further increases housing costs. Spatial sorting implies that lower-income residents leave and higher-income migrants move in, adding to cost of living pressures and discontent with Hawai'i's reliance on tourism and its impact on kama'āina. Lastly, spatial equilibrium means that shortages will emerge whenever fees for healthcare services, and wages for healthcare professionals are set by methods that do not reflect regional price or productivity differences in Hawai'i, implying labor shortages for healthcare professions. All of these pressures are likely to be particularly pronounced in Hawai'i's most rural and isolated communities.

1. INTRODUCTION

The healthcare sector in Hawai'i is facing significant challenges. The COVID-19 pandemic exacerbated a healthcare workforce shortage, increasing to 17% of positions remaining open in a 2022 survey of providers (HAH, 2022). These issues are compounded by economic circumstances faced by providers, workers, and residents that are likely related to Hawai'i's unique economic geography. Addressing these challenges requires specific provisions for Hawai'i in national health policy work. Therefore, understanding the spatial and geographic mechanisms that make Hawai'i's healthcare industry different from other places is essential to tailoring provisions to address these challenges. On this basis, this report draws new perspectives on the healthcare industry in Hawai'i based on research in *Spatial Economics* and *Economic Geography*. These refer to the study of spatial aspects of economic activity by economists and geographers respectively, who each use very different methods and place emphasis on different factors. The report draws on both of these literatures to partially reconcile these methods and perspectives to understand how Hawai'i's healthcare industry might differ from other places.

Spatial Economics, or *Urban and Regional Economics* typically relies on the concept of *spatial equilibrium* in which all people have individually chosen the locations that make them better off. Such models explain the occurrence of cities, productivity differences between rural areas and cities (known as agglomeration economies), the shape of cities, spatial sorting of different types of people and housing within and between cities, the industrial structures of different places, and the characteristics of trade, but consign questions about *where* these structures emerge in the first place to accidents of history. On the other hand *Economic Geography* places significant emphasis on the geographical locations where economic activity takes place. This focus considers factors like resource availability and unique characteristics, which are shaped by both historical and local factors. Geography is not considered an *accident* of history but the key determinant of where economic activity takes place. So-called 'proper' economic *geography* (as opposed to geographical *economics*) does not lend itself well to econometric methods that identify recurring causal patterns, as these methods are inadequate for capturing the consequences of the specific circumstances and characteristics of *unique* places (Storper, 2011) like Hawai'i. This report considers perspectives from both spatial economics and economic geography to inform an understanding of how spatial factors affect the economy of Hawai'i and its healthcare industry.

Hawai'i's economic geography is very different from the contiguous states. While it is commonly understood that Hawai'i's isolation affects prices in Hawai'i due to transportation costs and logistical challenges, there is a lack of understanding regarding how Hawai'i's unique geographic circumstances otherwise affect Hawai'i's economy, and specifically affect its healthcare industry. Hawai'i is the only island state in the US. It is particularly distant from centers of global economic activity—it is separated from the continental US by about 2,500 miles of ocean—creating some unique difficulties and economic conditions, particularly for health services. Its counties represent separate islands with widely different geographies. Its population centers vary from a bustling metropolis in Honolulu with a metropolitan statistical area population of almost one million people on the island of O'ahu, to smaller cities of Hilo and Kahului on the Big Island and Maui respectively, to tourist destinations such as Kona or the island of Kaua'i, and to very rural and sparsely populated places such as the island of Moloka'i. As a result, spatial economic mechanisms do not affect the state evenly across the islands. The various combinations of scale, distance, islands, and population distribution create distinct challenges for Hawai'i as a whole and locational disadvantages for rural areas and the neighbor islands.

Hawai'i's small size and isolation are likely to affect productivity. At 1.4 million people, Hawai'i is not the smallest state, but its small size has a much more pronounced effect because of its isolation. *Internal* increasing returns to scale (or economies of scale) refers to the productivity benefits of a larger factory or business, so smaller business units serving a local Hawai'i market are likely to be less productive than equivalent larger businesses on the mainland. Similarly, *external* increasing returns to scale refers to the productivity benefits from the scale of economic activity external to the business such as the scale of cities, industrial clusters, market size, or local Research and Development (R&D), so businesses located in Hawai'i are likely to be less productive than equivalent businesses in larger markets on the mainland. The lack of external scale reinforces Hawai'i's specialization in tourism and creates challenges for other industries (Bond-Smith and Ilamkar, 2023).

Specialization creates both short and long term risks. Hawai'i's economy is periodically rocked by economic fluctuations that affect tourist numbers (Bond-Smith and Fuleky, 2022). But its specialization in tourism also means that

Hawai'i's economy has lagged behind other states in terms of long-run per capita GDP growth and income growth for decades, as real (inflation adjusted) tourism spending has remained relatively flat in spite of rising tourist numbers. These productivity challenges affect any industry with internal economies of scale—which is characteristic of many dimensions of healthcare—and any industry with external increasing returns to scale—which is also characteristic of healthcare. It means that many industries face higher costs or lower productivity in Hawai'i than elsewhere. For tradeable industries, such as manufacturing, these industries will tend to be much smaller in Hawai'i or not exist at all. But non-tradable industries and especially non-tradable services such as healthcare—where those services are required to be provided locally—cannot avoid these costs by locating elsewhere. This also influences the industrial structure of Hawai'i's economy and the types of jobs that exist. For example, Hawai'i has a much smaller share of scientists and engineers than other states and those scientists and engineers produce fewer patents (Bond-Smith, 2024).

Hawai'i's endowment of natural amenities pushes up the cost of housing and doing business, but reduces the wages that are required to attract higher-income workers when they are willing to forego higher wages in order to access and enjoy the amenities of living in Hawai'i. This compresses the wage distribution with higher wages for low-wage jobs and lower wages for high-wage jobs. The higher cost of living in Hawai'i may contribute to a tighter labor market than elsewhere, as unemployed workers may need to take on part time work or relocate out-of-state. Tighter than average labor markets creates challenges for recruitment because it will require new employees to relocate from out of state more often than would be required in other places. Convincing new recruits to relocate may also be more challenging in Hawai'i due to its isolation, thousands of miles away from friends and family. Limited developable land combined with a highly-regulated construction sector generates an inelastic housing supply (meaning that the construction of new homes does not respond much to changes in house prices) and increases housing costs. Spatial sorting describes how people move to the places that make them better off leading to the spatial equilibrium. Combined with an inelastic housing supply it implies an outflow of lower-income residents and an inflow of higher wealth transplants exacerbating the flow of kama'āina leaving the state. Overall, the combination of forces generated by Hawai'i's economic geography increases the cost of living in Hawai'i and challenges the ability to recruit new workers for almost every industry, but these pressures are probably more acute in the healthcare sector compared to other industries due to the nature of the skilled workforce required, the need to recruit from out-of-state, and the potential for revenues and wages to be set by national or industry benchmarks that may not be sufficient.

The report is structured as follows. The section below introduces and compares spatial or urban and regional economics with economic geography. Two subsequent sections deal with the main spatial dimensions that affect Hawai'i's economy in ways that differ from other places—specifically Hawai'i's small scale and extraordinarily open economy, and its local endowment of natural amenities. With each section, these effects are interpreted in terms of impacts on the healthcare sector. Section 5 discusses other aspects of local geography including Hawai'i's mountainous islands, Hawai'i's isolation, local competition issues, and housing, to draw conclusions about the cost of living and its impact on Hawai'i's labor market. Section 6 summarizes the perspectives in this report specifically for the healthcare sector and provides some concluding remarks about the need for further research to confirm the hypotheses raised in this report in order to determine appropriate responses from policymakers and healthcare organizations.

2. SPATIAL ECONOMICS VS ECONOMIC GEOGRAPHY

Spatial economics, or *urban and regional economics* adds a spatial dimension to standard mainstream economic frameworks built around the concept of equilibrium at the marginal unit. In contrast, *economic geography* is where geographers ask economic questions using a context-specific geographic framework. Spatial economics and economic geography are two distinct approaches to address questions about where economic activity takes place and why it differs between places. But they have very different, yet related explanations for the uneven spatial distribution of economic activity. This report draws on both of these approaches, and attempts to partially reconcile these perspectives to understand their conclusions. What makes this study particularly unique is that the focus on Hawai'i and healthcare generates unique perspectives on how Hawai'i's healthcare industry is likely to differ from other places.

2.1 Spatial Economics

Economic models are typically based on the incentives that create forces in the economy towards an equilibrium where those forces are balanced at the last unit of production (supply) and consumption (demand). In standard economic theories, equilibrium is typically 'aspatial', meaning absent of spatial characteristics such as location and distance, but also absent of the *determinants* of spatial characteristics. Standard economic theories therefore explain differences between places mostly as a result of different institutions (rules, regulations etc.) and endowments of factors of production (resources, skills etc.). But this approach does not adequately explain why places with similar institutions can have such different economic outcomes. For example, standard economic theory doesn't explain why Hawai'i's economy looks so different from say, New York City or Appalachia, other than its underlying factor endowments. Explaining the causes of differences between places requires understanding how the geography between market actors affects their costs and decisions, but also understanding how geography itself is shaped by economic forces. That is, it requires explaining (i) how spatial transaction costs are affected by underlying factor endowments which make some places more productive than others, and (ii) how spatial transaction costs generate underlying forces that generate uneven factor endowments in the first place.

When economic frameworks include spatial transaction costs such as transport and communication costs, it accounts for the costs imposed when the two parties are in different locations. Such models make assumptions about geography in order to specify the costs of doing business between places. Alternatively, geography becomes *endogenous*—or determined by the model itself—when it accounts for *location* choices in response to spatial transaction costs (Bond-Smith and McCann, 2022). This endogenous geography captures the forces that drive the uneven spatial distribution of economic activity. This approach relies on the concept of *spatial* equilibrium in which a person can not be made better off by relocating, even if there are differences between places. In spatial models, various forces pull people together or push them apart. The combination of concentration and dispersion forces determines the spatial distribution of economic activity in spatial equilibrium by equalizing at the margin. Spatial equilibrium generates uneven outcomes in levels, meaning that some places are better off than others but those differences tend to be embedded into the cost of land and property that allow residents to access those advantages. Such models explain the occurrence of cities, agglomeration economies (productivity advantages of cities), the shape of cities, spatial sorting of people and housing, the industrial structures of different places, and the characteristics of trade, but questions about *where* these structures emerge in the first place are designated as accidents of history.

2.2 Economic Geography

Human geography starts from a framework of local, context specific forces that shape people's decisions. One component is *economic geography*, which adds an economic framework to this complex local geography, to explain local nuances about the location and spatial distribution of economic activity. In this framework geographic characteristics are no longer an *accident* of history but the key determinant of where economic activity takes place. So-called 'proper' *economic geography* (as opposed to *geographical economics*) does not lend itself well to econometric methods that identify recurring causal patterns, as these methods are inadequate for capturing the consequences of the specific circumstances and characteristics of unique places (Storper, 2011) like Hawai'i that are unlike anywhere else.

Economic geographers place significant emphasis on the geographical locations where economic activity takes place. This focus considers factors like resource availability and unique local characteristics, which are shaped by both historical

and internal factors. The geographical approach acknowledges that market clearing (where quantity supplied equals quantity demanded) often resembles an auction-like process that accumulates excess returns which are incompatible with most models of equilibrium (Storper, 2011). The consequences of these processes lead to widely different outcomes in different places that subsequently influence the future states of the economy and specific places in particular.

2.3 Spatial-economy and and economic-geography perspectives of Hawai'i

The unique geography of Hawai'i can be described by the various geographic characteristics identified by economic geographers that need to be interpreted alongside the mechanisms that drive the spatial equilibrium, to give a spatial explanation for how Hawai'i's economy differs from other places. In its simplest form, Hawai'i's distance from the mainland results in higher costs to provide goods and services, increasing prices and reducing real wages. More complex explanations account for increasing returns to scale, amenity effects, and responses in housing and labor markets to capture the impact of geography on the cost of living and the downstream impacts on Hawai'i's economy.

Increasing returns to scale (or economies of scale) recognizes how output changes in relation to the scale of inputs to production. For example, a larger hospital probably has lower costs per patient than a smaller hospital due to a share of administration costs that can be shared across a larger number of patients. Increasing returns to scale can also be external to a business. For example, many healthcare providers will benefit from clustering alongside complementary services, from labor market pooling in larger cities, and from productivity spillovers when there is a large R&D sector. Both internal and external increasing returns to scale, combined with spatial transaction costs, pull healthcare services to cluster together, in larger cities and more central locations. For Hawai'i, it means that healthcare services will generally be centralized in Honolulu, and central locations on each of the neighbor islands, or that some services are not offered at all in Hawai'i because they cluster in even more central locations on the mainland.

The desirability of natural 'amenities' is a type of wealth endowment that appears in higher prices for housing and lower nominal wages for skilled workers who are "subsidized" by these natural amenities. As a result, the set of industries that thrive most in Hawai'i are the ones that benefit from this set of natural amenity advantages that are bound to Hawai'i and each of the neighbor islands (Bond-Smith, 2024): natural beauty, tropical climate, outdoor activities, host culture, and location. Primarily, these industries are tourism, real estate, and defense. Decades of complementary investment in tourism infrastructure and marketing—that reinforces the image of Hawai'i as the world's premier tropical tourist destination—expands the value of this wealth endowment. But rather than reinforcing further prosperity—as wealth accumulation might if it were based on innovation—this wealth endowment of natural amenities reinforces the price of real estate without benefits for productivity growth, further exacerbating economic challenges in Hawai'i. Combined with an inflexible supply of housing, this implies an outflow of residents displaced by forces seeking a spatial equilibrium with lower living costs and greater economic opportunities in the continental states. In turn, Hawai'i's lagging productivity growth (Bond-Smith, 2024) may contribute to a geography of discontent (Dijkstra et. al., 2020) as locals struggling with high costs and low income growth push back against an inflow of tourists and transplanted residents seeking to access Hawai'i's natural amenities. Related political pressures have led to restrictions on transient accommodations, but also contributes to limiting the development of agricultural land into housing or the densification of suburbs beyond single-family homes, further pushing up housing costs.

The unique economic geography of Hawai'i combined with spatial economic mechanisms contributes to and exacerbates many of the challenges facing the healthcare industry. For workers in the healthcare industry, the combination of the relatively smaller local scale of production, a relatively smaller market, the high cost of living, and natural amenities implies lower real wages. Furthermore, revenues in the healthcare sector can be set by national benchmarks and pay set by industry benchmarks. The combined high cost of living, low productivity, low real wages, and wage or revenue benchmarking may exacerbate shortages of both healthcare services and workers, especially on the neighbor islands or in rural areas.

3. THE LOCATION OF ECONOMIC ACTIVITY

Spatial equilibrium explains the location of economic activity in a number of ways. To reach spatial equilibrium, people migrate to places where they can command higher real wages, and capital is invested in places where there are higher returns. As a result, activity expands in locations that are more productive and contracts in places that are less productive. This is economically efficient because it allows the economy to generate more value for the same resources.

Transportation, commuting, and communication all add costs to economic activity that occurs between places, reducing productivity, and constrains the ability to reach spatial equilibrium. These effects are most felt in isolated places. Spatial transaction costs are mitigated by mechanisms that generate internal and external increasing or decreasing returns to scale. Increasing or decreasing returns recognize that changes in outputs are not proportional to changes in inputs. The combination of spatial transaction costs and increasing returns to scale drive interdependent decisions by firms and workers about their locations and the scale of production.

3.1 Spatial transaction costs

Spatial transaction costs recognize that there are costs when buyers and sellers are in different locations. While transportation costs are an obvious factor that explains higher prices and costs in Hawai'i, economic activities that involve commuting in order to meet face to face, and communication to exchange information, will also face higher costs for transactions between people on different islands and when people in Hawai'i conduct business with the mainland. Spatial transaction costs include transportation, communication, commuting costs, and any other frictions that affect economic exchanges between locations.

Spatial transaction costs also affect the frequency of transactions. When spatial transaction costs are low, it enables more frequent but smaller transactions to occur. When costs are higher, they occur less frequently. This means that the frequency and intensity of economic interactions between Hawai'i and other places in the US are much lower than in other places. To the extent that productivity is a result of the frequency and intensity of interactions, businesses in Hawai'i will be less productive than other places. For example, even if video conferencing software has made it easier to exchange information with people on the mainland, many transactions rely on building trust. This is probably especially true with healthcare services where a patient may feel more at ease meeting face-to-face than via telehealth. Building trust can often require face-to-face contact, such that electronic communication is complementary to face-to-face interaction. That is, a patient (or doctor) may need to build up trust with their health provider (or patient) in person, before they are willing to purely rely on remote or telehealth services. Even in absence of face-to-face contact, trust may also be increased if the provider is at least local, because they understand local norms and customs, meaning that electronic communication is also complemented by geographic and cultural proximity. Despite advances in technology, telehealth services from interstate may be restricted by state laws or insurance requirements for in-person visits. As a result of all of these factors, even if remote access and communication are essentially free (once broadband access is provided), there are still higher spatial transaction costs in Hawai'i than elsewhere.

Given Hawai'i's distance from the mainland, and particularly from major US cities and ports, spatial transaction costs contribute to higher costs in Hawai'i and lower productivity. Spatial transaction costs can be added to mainstream economic theories to explain the cost of doing business in different places, which partly explains higher prices and costs in Hawai'i than in the rest of the US. But spatial economic models also explain how spatial transaction costs affect decisions about the location and scale of economic activity. Spatial transaction costs reduce productivity in places that are more isolated or less densely populated, which incentivises people and economic activity to cluster together. Such clusters form denser cities, or larger markets and become more centrally located places in the network connecting cities. Furthermore, it induces firms in these more central locations to expand, since they are more competitive, and firms in more isolated places to contract or relocate. As spatial transaction costs decline, this allows people and business to spread out around central locations, but also creates a force towards more centrally located regions that offer access to the largest overall market (Krugman, 1991, Rossi-Hansberg, 2005). In many ways these forces have worked against Hawai'i, as it pulls activity towards the large "superstar" coastal cities on the mainland, and away from rural and isolated places.

3.2 Economies of scale, economies of scope, and external increasing returns to scale

Economies of scale (or internal increasing returns to scale) recognizes how output changes in relation to the scale of production. For example, if hospitals benefit from economies of scale, then expanding a hospital to accommodate twice as many beds and staff allows that hospital to complete *more* than twice the number of procedures. This is because some of the inputs to hospital services do not have to be replicated in the same quantities for each additional patient.

External increasing returns to scale recognizes the scale of factors *external* to the business. For example, a cluster of healthcare providers offering different but complementary services in the same location is more productive than when each operates individually in different locations because their customers benefit from accessing multiple services in one place. In this way, the external scale of the local healthcare industry creates productivity benefits for each of the local healthcare providers.

Both internal and external increasing returns to scale are key determinants of the location of economic activity and the cost of living, as well as the location of healthcare services, the scale and variety of healthcare services, and the cost of healthcare services in different locations.

Economies of scale

Economies of scale (or internal increasing returns to scale) is not a strictly spatial concept, but it has implications for the location and scale of economic activity in different places. For healthcare services, economies of scale imply that larger facilities have higher productivity than smaller facilities. This means that larger facilities require fewer inputs per patient, since they can be more productive than smaller facilities, or that larger facilities undertake higher-value procedures. If healthcare services have economies of scale, it implies that such services will tend to be offered in larger facilities because the cost of each procedure will be lower in a larger facility than a smaller facility.

Economies of scale will mean that healthcare services are often going to be more expensive in Hawai'i than elsewhere in the country because of Hawai'i's smaller scale. Similarly, economies of scale also mean that offering healthcare services in more remote locations in Hawai'i will tend to be more expensive than in larger cities. For example, treating a patient in a hospital bed in Hilo may be more expensive than in Honolulu because its hospital is smaller. This means that some services will only be offered in Honolulu, and many services will not be offered at all in smaller, more rural/remote islands such as Moloka'i or Lāna'i.

On the other hand, some primary care services can be offered by very small clinics. This means that primary care probably doesn't have significant economies of scale. A primary care clinic probably needs to increase its staff and other inputs *in proportion* to the number of patients, known as constant returns to scale. As a result, primary care clinics can be located almost anywhere, and often in residential areas close to where their local patients live.

The exception is that there will be some degree of economies of scale up to the minimum viable scale where a small clinic can generate a standard return on investment. This means that there are very small or remote communities that would probably still struggle to host a primary care facility, because even a single clinic may be below the minimum viable scale. In these locations, residents may have to travel significant distances to even access many basic health care services, and especially specialist services, including potentially flying to another island. Other approaches may be required in these locations such as subsidies for healthcare services to remote communities, telehealth, or some combination of the two. But telehealth services may still not reach lower income households or some rural communities that may not have sufficient access to broadband services.

Economies of scope

Similarly, economies of scope is not a strictly spatial concept but it has similar implications to economies of scale. Economies of scope refers to productivity gains when a single business offers multiple types of products or services. For example, there is probably a degree of economies of scope when a primary care clinic, a pharmacy, and a pathology lab operate together within one facility, but there is probably very little economies of scope for combining primary care and dentistry within the same business.

Similar to economies of scale, economies of scope will tend to pull multiple services together into one larger business. For example, even if primary care does not have economies of scale, primary care is frequently offered in larger facilities because there are economies of scope with the many other services that primary care might also make use of. As with economies of scale, larger facilities will have a lower cost per procedure than smaller facilities. In Hawai'i, where economies of scale might be limited by the size of the population, economies of scope might offer a second-best alternative for achieving the productivity benefits of scale.

Economies of scope and scale can also interact. In the example of a primary care clinic and a pathology lab, there is probably significant economies of scale for the pathology lab if it can process tests for patients from multiple clinics. Therefore, this allows some primary care to be offered in a larger business hosting multiple services, and other smaller clinics to benefit from the economies of scope of a co-located pathology lab in one of those clinics, which is able to offer more competitive prices than a standalone pathologist.

External increasing returns to scale

External increasing returns to scale are business-enhancing factors related to the size of the economy or industry *outside* of the business/facility itself. External increasing returns to scale refers to changes in the productivity of a business in relation to the scale of factors outside of the business. As with economies of scope, there can also be productivity benefits when there is a greater range and number of other services offered nearby. External increasing returns refers to the scale of all activities outside the business and may relate to the scale of healthcare services elsewhere in the same city, to the scale of the city itself, or to the availability of suppliers.

External increasing returns to scale will present itself in the characteristics of healthcare facilities in different places. For example, a very small healthcare provider, offering only one service may be sustained in a large city because of the scale of the complementary services that are offered alongside by other healthcare providers. In a smaller city, such services may need to be offered by a larger facility offering multiple services to take advantage of economies of scope, since the scale of the local industry is not sufficiently large to sustain the smaller business. As a result, the degree of economies of scope and scale also varies by location. Similarly, large hospitals can afford significantly more redundancy because the costs are spread across a much larger patient base. Smaller rural hospitals don't have the resources of larger providers, so they need to compete in other ways. This leads to reduced redundancy, but longer waiting times. So while it is possible that ratios between provision and population end up relatively constant between communities, or even that smaller hospitals are at times more efficient, this may be due to economies of scale causing those facilities to make cuts elsewhere in order to serve a wider population in spite of their small scale. Yet to meet the same standard of healthcare, a small region served by only one small hospital may actually need to host a significantly larger share of redundant beds because its small size means that patient levels are more volatile. There will be multiple sources of internal and external increasing returns to scale for hospital and other healthcare services that present themselves in the nature of healthcare services in different ways.

External increasing returns to scale generates a coordination or hold-up problem (Matsuyama, 1991; Rodrik, 1996) because establishing a new small facility is not economically viable until the relevant external scale is already established. Relevant external scales can include general factors, such as the scale of the local labor market, as well as more specific factors such as the size of a local healthcare cluster. For example, it is probably easier to establish a specialist practice in a large city or in a cluster of healthcare providers, where an employer can be sure of finding staff with the specialist skills required. If that external scale also involves firms that benefit from external increasing returns, it creates a barrier to entry for any single firm, even though that barrier would be diminished if all potential entrants could coordinate investment. That is, there may be several specialist doctors in complementary fields of medicine who could all set up practices alongside each other in a local health care cluster, but no individual would be willing to set up in absence of the others. As a result, each individual specialist is incentivized to relocate out-of-state (or at least to Honolulu), depriving smaller scale locations of such a local healthcare cluster because the individuals couldn't coordinate their initial investments. The same dynamic limits the entry of businesses that could diversify Hawai'i's economy, exacerbating Hawai'i's specialization in tourism (Bond-Smith, 2024).

This means that in smaller or rural regions, where the external economy is insufficient, small healthcare providers are unable to enter and the region may be underserved. In this case, larger providers are required to take advantage of other scales to increase productivity, such as internal economies of scale and economies of scope. As a result, rural areas may be served by larger centralized healthcare facilities. Counterintuitively, larger cities may be able provide many of these types of services through a much larger number of smaller healthcare providers. This would also enable more competition in larger centers facilitating price competition and productivity improvements with the potential to pass on these benefits in lower costs to patients and higher wages to healthcare workers.

State licensing requirements in the healthcare industry may also generate a source of external increasing returns to scale in the US healthcare system, reducing productivity in smaller states. Small states face both a smaller pool of healthcare workers able to offer services in the state and higher relative costs to administer state licensing requirements. Similarly, healthcare providers in smaller states may face higher costs or time delays when recruiting healthcare workers from out-of-state.

The coordination problem can be overcome by industrial policy to establish the critical scale for a self-sustaining industry (Rodrik, 2004, 2008). Such policies can involve significant public investment (Rosenstein-Rodan, 1943; Murphy et. al., 1989), or can aim to stimulate private investment (Morck and Nakamura, 2007). For healthcare, if a region is underserved because of external increasing returns and a coordination problem, then public investment in an initial major facility or cluster of facilities, stimulates private investment in complementary healthcare services that might become self-sustaining once established.

Labor market pooling

One major source of external increasing returns to scale is labor market pooling. Labor market pooling refers to the larger pool of potential applicants and jobs available in a larger city. Given its importance for healthcare providers, we explain it in a stand-alone subsection here. Labor market pooling has two major benefits: reducing risk and higher quality labor market matches.

Risk is reduced for healthcare workers in a large labor market because they are able to search for a suitable job with another healthcare provider if they are made unemployed. Similarly, risk is reduced for healthcare providers in a large labor market such that if an employee were to leave, the provider will be more likely to find a local replacement with skills more suited to the position. Labor market pooling may be particularly important in healthcare, because of the specific skills required for particular healthcare services.

In small centers, there may be only one or very few other healthcare providers. If a worker is made unemployed, they may have to relocate to find a new employer, or work in a job that doesn't match their skills. Similarly, a healthcare provider in a small center may have to recruit new workers from outside of the local labor market and convince them to relocate, or retrain a local person who doesn't initially have the right skills. This implies that healthcare jobs may have lower quality matches in smaller labor markets and take much longer to fill. This would particularly affect the neighbor islands, especially on Kaua'i, Maui, Lana'i, and Moloka'i. It might also partially explain the differences in the share of unfilled positions across the islands (HAH, 2022).

External decreasing returns to scale

Some of these factors that pull economic activity into larger cities and more central locations also lead to negative externalities from density, such as congestion costs and higher rents. These factors can be collectively described as external *decreasing* returns to scale. Decreasing returns to scale pushes back against increasing returns and incentivises activity to relocate out from central locations, dispersing activity to other places. On average, decreasing returns to scale will always be less than the benefits of increasing returns scale, given that activity locates in cities, but these forces will be equal *at the margin* (or last unit to relocate) in spatial equilibrium. As a result, these push-pull forces enable services to be provided in more distant locations, though perhaps not at the same intensity as more central or densely populated locations.

Unfortunately, due to higher living costs in Hawai'i as a result of many factors such as amenity effects, limited space for development, and constraints on building, these dispersion forces do not necessarily operate in the same way in Hawai'i that they might elsewhere. Much of the amenity value (to be explained below in Section 4) is based on natural attributes, rather than endogenous benefits related to density. Therefore, congestion costs and land rents in Honolulu do not necessarily push facilities to locate in more rural parts of O'ahu, since there is little or no cost advantage.

3.5 The interaction between increasing returns and spatial transaction costs

Increasing returns to scale and economies of scope interact with spatial transaction costs to determine optimal location decisions and the distribution of economic activity in spatial equilibrium (Krugman, 1991). Spatial transaction costs refer to the cost of doing business between agents in different locations including transportation costs, communication costs, trust-building, commuting costs, and serendipity. Spatial transaction costs imply that the extent of increasing returns to scale for each facility gradually diminishes, since expansion of output requires serving customers in more distant locations, incurring greater spatial transaction costs. But in Hawai'i, each facility comes up against the limits of the number of local customers on island as accessing patients further away requires a cost-jump of flying between islands. This means that output typically occurs over a much smaller scale than in larger markets on the mainland where the contiguous geography means that patients face incremental costs to access a provider who is further away. This also has a number of implications for Hawai'i's economic geography and the geography of its healthcare industry.

Firstly, tradable products are pulled to locate close to larger markets because it is easier to access additional customers. This means that returns to scale diminish at a slower rate as a facility expands output. For Hawai'i, this means that many tradeable products are not usually produced locally, and are instead imported, with the exception of tourism. For non-tradable products and services (which must be provided locally), this force also pulls these activities towards larger centers, requiring customers to commute in order to access goods and services. The presence of large-scale hospitals in Honolulu, or in other central locations on each island, indicates that hospital services are likely to have economies of scale. Hawai'i's isolation and island geography means that non-tradables will often need to be provided on island, but within larger centers in each island or county. As a result, there are likely to be higher prices and costs in Hawai'i, due to both higher spatial transaction costs to import tradable goods, and lower economies of scale for locally producing non-tradable goods and services. Lower productivity tends to reduce real wages in Hawai'i. Empirical evidence confirms this hypothesis from spatial economics: that dense and central locations have greater variety and lower real prices (Handbury and Weinstein, 2014).

These patterns are also going to be true for healthcare. The types of healthcare services that face increasing returns to scale and some degree of spatial transaction costs will tend to be located in larger facilities, which will tend to be more centrally located in order to be more accessible to the greatest number of people. Thus people living in more central locations, and cities with larger populations like Honolulu, will have greater access to such services than those in more rural places or islands with much smaller populations. But, since healthcare services are essential to everyone, people living on the neighbor islands either require smaller local hospitals that are more expensive or face much higher costs to commute to another island. So it means that providing healthcare services to smaller or more rural communities will be much more expensive than would normally be the case in a contiguous geography where services can be provided from a larger, centrally located facility. These effects are likely to reduce access to and increase the cost of healthcare services in Hawai'i, especially in more rural areas.

Yet there are other nuances to this pattern related to Hawai'i's geography. In Hawai'i, economies of scale and scope also apply to explaining access to healthcare services in the state in general. That is, since Hawai'i is relatively small compared to much larger states and cities on the mainland, increasing returns to scale implies that it will be more expensive to offer these services in Hawai'i than much larger cities elsewhere. That is, large hospitals in Los Angeles would have lower costs per procedure than smaller hospitals in Honolulu or be able to undertake higher value procedures. A hospital in Honolulu, simply can't get big enough to reach the lower costs of a centrally located hospital in a very large city. Similarly, economies of scope probably means that hospitals in Hawai'i can offer a smaller range of procedures than their larger counterparts in California, and that residents in Hawai'i may even have to travel to the mainland to access particular procedures. This issue is exacerbated in Hawai'i by its non-contiguous geography. Smaller communities on the mainland

in close proximity to larger cities, may still benefit from large centrally located facilities that their residents access in nearby cities, which is not so easy from Hawai'i.

The combination of small scale, increasing returns to scale, and higher spatial transaction costs reduces the productivity of health service delivery in Hawai'i compared to other places. This means there are likely to be higher costs per patient visit to serve Hawai'i's population than elsewhere in the US. This effect will be exacerbated in less dense parts of the state, meaning that healthcare provision is concentrated in Honolulu, where healthcare provision has higher productivity than on the neighbor islands. This increases costs in Hawai'i—especially on the neighbor islands—and reduces the range of services available. The exception to the rule would be the central service locations on each of the neighbor islands that allow patients to sometimes avoid inter-island travel. These locations face higher costs than Honolulu, due to their smaller scale, but centralisation in a local service center in each county increases access for neighbor island populations who might otherwise have to travel to Honolulu if it weren't for Hawai'i's island geography.

Different components of the healthcare system have very different geographies due to differing degrees of economies of scale and scope that interact with spatial transaction costs and commuting costs. Understanding the exact geography of different services requires a more detailed analysis and detailed knowledge of those services than the discussion here. While constant returns to scale for primary care (at least above the minimum viable scale for a small clinic) will likely allow these services to be available in most towns across Hawai'i, hospitals and other healthcare services will be more concentrated in the largest cities. The nature of Hawai'i's island geography means that some relatively small centers on the neighbor islands may still host some of these services to avoid patients traveling to O'ahu, but they will have a greater cost than in Honolulu due to their small scale. Similarly, economies of scope will mean that these hospitals in smaller centers may not offer the full range of services. And economies of scope means that some services may not even be offered in Hawai'i at all, such that residents have to seek these specialist services on the mainland.

These mechanisms imply uneven provision and costs for healthcare services in different places on each island, as well as lower access to healthcare in Hawai'i than in other states. Those people living in more central locations and on O'ahu, in communities with larger populations, will have greater access and lower costs for some services than those living on islands with much smaller populations or in rural areas. Even when that access is available, economies of scale and scope imply that each procedure will be more expensive to provide in Hawai'i than in other states and more expensive on less populated islands.

4. NATURAL AMENITIES

Both geographers and economists pay close attention to the role of amenities. Beaches, scenery, culture, climate, access to leisure, and any other amenity enjoyed in Hawai'i all contribute to the well-being of residents and visitors. Hawai'i's rich endowment of natural amenities has several effects on how Hawai'i's economy functions. Firstly, the value of natural amenities is capitalized into the cost of housing in Hawai'i as the prerequisite for being a resident, or the cost of a vacation in Hawai'i for visitors. The higher capitalized cost of land then also contributes to a higher cost of doing business, higher business operating expenses, and higher consumer prices. Yet many residents of Hawai'i or people relocating to Hawai'i may be willing to sacrifice some of their income in order to live in Hawai'i and access these public amenities. And thirdly, these natural amenities are also the key factor of production for the tourism industry, contributing to the industrial structure of Hawai'i. These effects on Hawai'i's economy may have stronger impacts on the healthcare industry than in other places, especially when worker shortages require recruitment from out of state.

4.1 The “price” of natural amenities

Many natural amenities could be considered to be public goods, but this does not mean they are “free”. The term “public good” refers to goods or services which are not used up when used by more people (known as non-rival) and in which access cannot be easily restricted to those who have paid for them (non-excludable). This means that natural amenities are usually free to use and enjoy, but can be at risk of overuse. While natural amenities are free to use, the well-being provided by these natural amenities means that people place a high value on the opportunity to access them. And to access the natural amenities in Hawai'i, a person needs to be resident or on vacation. That is, the demand for enjoying

Hawai'i's natural amenities—accessed by being resident or visiting Hawai'i—translates into a higher willingness to pay for housing or vacations in Hawai'i. Those who choose to live in Hawai'i (and vacation in Hawai'i) also probably value Hawai'i's natural amenities higher than those who choose to live elsewhere. Economists use the term *spatial sorting* to describe this selection effect. Combined with inflexible housing, hotel, and transport markets, this selection of people with a higher willingness to pay for access to Hawai'i's natural amenities is capitalized into the price of housing (Albouy, 2016) and the cost of vacations (Boto-García and Leoni, 2023).

Economists and geographers have estimated the value associated with natural amenities using two types of methods: hedonic pricing methods and migration methods. Hedonic pricing deconstructs the price of a market good—such as housing—by attributing shares of its value to certain good characteristics (i.e., length of a nearby beach, distance to the coast, scenery etc.) to identify the value of natural amenities. Migration methods consider the extent that climate and natural landscapes—such as the natural amenities found in Hawai'i—generated significant population increases and regional growth (Ullman 1954; Graves 1976, 1980) by incentivising people to move. Both of these methods show how natural amenities translate into effects on local development and the price of housing (Waltert and Schläpfer, 2010).

With a higher willingness to pay for access to these amenities, economists would usually expect supply to respond. While the supply of natural amenities is fixed, the supply of infrastructure to access them, and the supply of housing or accommodation nearby is not. However, the infrastructure to visit natural amenities is usually also treated as a public good, and the supply of housing, hotels, and transportation infrastructure is highly regulated. This means that the quantity of housing, hotels, road infrastructure, and transportation services supplied to the market does not necessarily respond to higher demand, meaning that demand may be capitalized into higher prices for housing in Hawai'i and visiting Hawai'i.

As some natural amenities reach capacity limits, governments in Hawai'i have started to change the way that these places are accessed in order to limit overuse. By charging an access fee to non-residents to snorkel in Hanauma Bay or to hike up Lē'ahi (Diamond Head), and limiting numbers, these natural amenities remain public goods for residents, but are essentially private goods for visitors. This would still imply that the value of these natural amenities is capitalized into the prices of homes, but not necessarily into the price of hotels. As a result, the state can extract some of that value and use this funding for maintaining Hawai'i's ecological resources, meaning that other funds are also available to provide services to residents. The extent that natural amenities are rationed by a user-pays access price can reduce its impact on the price of housing.

The higher cost of housing and land also translates into higher costs for other products and services. Businesses operating in Hawai'i have higher rents that are passed on to consumers. This will be especially so for industries that require a lot of space for inventory. This may partially explain the lack of manufacturing in Hawai'i and why Hawai'i's economy has long been dominated by services. Overall, it translates to a higher price of housing and a higher cost of living for Hawai'i residents.

This higher cost of living can make it harder for many people to justify moving to Hawai'i and may incentivise many Hawai'i residents to leave the state. A 2019 survey found that 47% of residents who were thinking of moving out of Hawai'i attributed their decision to the high cost of living (Pacific Resource Partnership, 2019). UHERO recently examined how the purchasing power increased for migrants who left Hawai'i for another state from 2019 to 2020 (Bonham et. al., 2023).

For those born in Hawai'i, the interpretation is slightly different. Higher housing costs in Hawai'i provide an incentive to relocate to the mainland. This means that there is still a spatial sorting mechanism for kama'āina (as well as for migrants to Hawai'i) choosing to not relocate out of state because they value Hawai'i's amenities and pay for access to those amenities in their housing costs. But kama'āina are likely to also hold value in the cultural and community benefits of living close to family or in the place they grew up. This community holds social capital, which refers to the social relationships that create productive benefits. For example, health professionals who also grew up in the culture in Hawai'i are probably able to offer a more trusted health service to their local community than someone from outside that culture. Therefore kama'āina are faced with higher costs to sustain their local communities than people in mainland communities without Hawai'i's endowment of natural amenities. As a result, many kama'āina now live on the mainland, but are probably more likely to return to Hawai'i—if they have the opportunities and incomes to do so—and would be able to provide a better health service to their communities than other recruits from out-of-state. This would explain how it is probably easier

to recruit kama'āina from out-of-state than to recruit transplanted residents, though the same wage and cost-of-living pressures will apply due to spatial sorting. Nonetheless, spatial sorting of kama'āina to the mainland means that health services in Hawai'i may be faced with higher costs, less trust, or lower quality compared to other communities on the mainland since local social capital may be diminished by the spatial sorting of kama'āina relocating out-of-state.

4.2 Amenity effects on wages

The price of housing, hotels, and flights isn't the only way that demand for natural amenities in Hawai'i translates into costs for the opportunity to access them. The ability to access natural amenities means that many people may be willing to forgo higher wages elsewhere in order to reside in Hawai'i. Rather than pushing up the cost of living, this means that workers may accept lower pay for the same job (Graves 1980; Henderson 1982; Graves and Linneman 1979; Rosen 1979), if it allows them to live in Hawai'i because they also enjoy the non-monetary benefits of Hawai'i's amenities. Similarly, both Hawai'i residents and those relocating to Hawai'i may be willing to accept poorer job market matches in Hawai'i, because it still allows them to enjoy Hawai'i's natural amenities, but confirming this requires additional research. While cost-of-living effects increase wages at the bottom end of the wage distribution, as efficiency drives comparable real wages, amenity effects have a negative impact on wages for higher-skill jobs as higher paid workers are willing to accept non-monetary benefits from natural amenities. As a result, amenity effects help to explain why Hawai'i has a more compressed wage distribution than other states.

While spatial equilibrium and spatial sorting implies that current residents probably value natural amenities higher than those who live out of the state there are significant costs of isolation from family and friends for those who did not grow up in Hawai'i. This implies that there is probably a disamenity effect in the islands of distance from family and friends. It is also possible that this disamenity for transplanted residents grows over time as the frequency of visits from contacts on the mainland decreases, though there is no research to draw upon yet on this point. At the same time the network of local relationships developed by new residents might mitigate that disamenity. If new residents have difficulty settling in, the disamenity effect would eventually incentivise return migration, generating difficulty in staff retention. This would imply that transplanted residents may require higher pay to relocate to or to remain in Hawai'i and that there would be improvements in retention if new residents or their employers invest in the social capital of transplanted residents. For returning kama'āina, where the benefits of natural amenities are reinforced by cultural and familial ties and proximity to family and friends, such recruitment and retention issues are probably much smaller. As such, it may be beneficial for healthcare employers to specifically recruit or train kama'āina who are more likely to both return to Hawai'i and remain in the long term, despite potentially lower wages in Hawai'i than in many of the continental states.

The amenity effects on wages implies that employers in Hawai'i can potentially pay less to attract skilled workers to relocate to Hawai'i than they would have to pay in other places, relative to the cost of living in each place. However, the scope to do so is likely to be lower in non-tradable industries like healthcare than it would be in tradeable services because these services can only be provided locally. Tradeable industries have the ability to contract in Hawai'i and expand in other places. This means that tradeable industries probably allow a greater ability to select people who place higher value on natural amenities since there is greater propensity to locate elsewhere rather than pay a higher wage. But the scale of non-tradable industries is dependent on the size of the local population and cannot reduce in size. If non-tradable industries cannot shrink to the same extent as tradeable industries then they cannot reduce wages in response to amenity effects by the same extent. As a result, the healthcare industry may not be able to take advantage of reduced wages due to amenity effects to the same extent as tradeable industries. This would imply a smaller compression of wages in the healthcare industry and a higher median wage level than in comparable professions in tradeable industries.

However, fee-for-service Medicare payments are determined using geographic practice cost indexes (Institute of Medicine, 2012) that partially benchmark physician work costs against the wages of similarly skilled professions in other industries including tradeable industries.¹ The purpose of this cost benchmarking regulation is for the price of publicly-funded services to reflect the productivity of providers and the underlying costs of services including factors like amenity

¹ There are nine occupation groups used in the WORK GPCI calculation. See Kersell et. al. (2022) "Final Report for the CY 2023 Medicare PFS Update to the GPCIs and MP RVUs. Medicare Physical Fee Schedule (PFS): Geographic Practice Cost Indices (BPCI) and Malpractice Relative Value Units (MP RVUs)", Actuarial Research Corporation, October 20.

effects. Assuming that the distribution of value placed on amenities is similar for professionals in different industries, and that there is a large diversified pool of comparable professionals, this benchmark is probably a good comparison to a fair wage rate in most places. But in Hawai'i, where many of these tradable sectors are small while non-tradable sectors are unable to reduce in size, the benchmark may tend to under-estimate the appropriate market-clearing wage because the marginal professional in a non-tradable sector like healthcare is likely to value the amenity benefits lower than the marginal professional in a tradable industry. Similar issues could also occur for insurance reimbursements if fees are also based on benchmarks against tradable industries. As a result, reimbursements based on geographic practice cost indexes may be insufficient to clear the market in Hawai'i generating a shortage of workers and unfilled positions. This may help to explain at least part of the current healthcare worker shortage in Hawai'i. We have not examined these questions directly, but the hypotheses could be tested with suitable data.

Similarly, amenity effects may also not benefit the most remote places in Hawai'i, such as on Moloka'i and Lāna'i. With the additional isolation of these places, many people are likely to be very hesitant to relocate. As such, it might be necessary to pay more to convince doctors to locate on Moloka'i and Lāna'i. Healthcare services would also benefit substantially from the opportunity to recruit local or formerly-local residents. On this basis, if healthcare providers can support skill development by locals, it may help to address some of the more acute worker shortages. However, the inability to align training decisions with long-term employment decisions may constrain their ability to do so. This coordination problem is a type of market failure that could be partly addressed by governments (whether Federal, State or County) supporting healthcare industry training for current and former residents of more remote islands and communities.

4.3 Amenity effects on industry

While natural amenities are usually considered public goods, they can also be thought of as a factor of production for the tourism industry. Hotels, airlines, restaurants and other tourism services make use of Hawai'i's climate, scenery, and host culture to attract and serve customers, whereas customers of other industries such as manufacturing do not benefit from natural amenities. This contributes to Hawai'i's specialization in the tourism industry, discussed in Section 3 above, since businesses that make use of Hawai'i's endowment of natural resources will have higher productivity than businesses that do not. As a result, greater natural amenities in Hawai'i may limit the ability for other industries to become established in Hawai'i if they have increasing returns to scale, because that scale is only attainable in the industry that can take advantage of Hawai'i's natural amenities—tourism.

Given the healthcare industry doesn't necessarily make use of Hawai'i's scenery and climate as a factor of production, it could be considered at a disadvantage compared to the tourism industry. Essentially the healthcare industry has to pay the same costs for building space and other factors of production as the tourism industry without benefiting from public amenities. For example, it means that land for a hospital is more expensive in Hawaii than it is in other states. But there are potentially healthcare services that would benefit from Hawai'i's tropical climate such as for post-treatment rehabilitation, rest and recovery. Healthcare providers may find opportunities for growth that take advantage of Hawai'i's natural amenities and hospitality capabilities (Bond-Smith and Ilamkar, 2023).

Lastly, the public good nature of Hawai'i's natural amenities will also tend to incentivise overuse. This issue is known as a tragedy of the commons: a kind of market failure that is resolved by management of those resources via mechanisms such as access charges to privatize aspects of these resources, though it is only required as the externalities of additional use become unsustainable such that locations reach beyond their sustainable carrying capacity limits.

4.4 Summary of implications for the healthcare industry

Natural amenities in Hawai'i translate into both a higher cost of living—especially housing—and a more compressed wage distribution. While this allows some industries to pay lower wages in Hawai'i, this may not apply to the same extent in non-tradable industries such as healthcare in which the industry's scale is determined by the size of the local population. To the extent that wages are set based on benchmarks with tradable industries, this may contribute to worker shortages that are most acute in the most remote parts of the state where the disamenity of isolation for transplanted residents is highest. These issues can be addressed by increasing pay to attract and retain employees, though doing so

may require changes to benchmarking methodologies that determine Medicare and insurance reimbursements. In the longer-term, supporting healthcare industry training for locals, especially from the more isolated communities, will help to reduce these shortages.

5. LOCAL GEOGRAPHY

Urban and regional economists usually attempt to find generalizable explanations that can be applied to almost anywhere to explain the location and spatial distribution of economic phenomena by calibrating such explanations to local regions. This allows economists to measure causal patterns that occur in many places while controlling for unique characteristics that cannot be explained by generalizable theories. On the other hand, economic geographers pay much more attention to these context-specific factors to create unique, nuanced, *local* explanations for economic phenomena. In Hawai'i, both of these approaches involve understanding how the landscape, logistics between the islands, and Hawai'i's isolation create unique challenges that are not necessarily faced in other places and are therefore difficult to study with econometric methods that identify recurring causal patterns (Storper, 2010).

5.1 Mountains, rivers, and sea

Hawai'i has very limited flat land available for building space. Islands, by definition, are surrounded by sea. And the mountainous landscape of Hawai'i also precludes building on much of the interior of each island. As a result, there is more limited developable land available for communities to expand in Hawai'i compared to elsewhere in the United States. For example, only 8% of the area within a 50-kilometer radius of downtown Honolulu is developable (See Figure below),

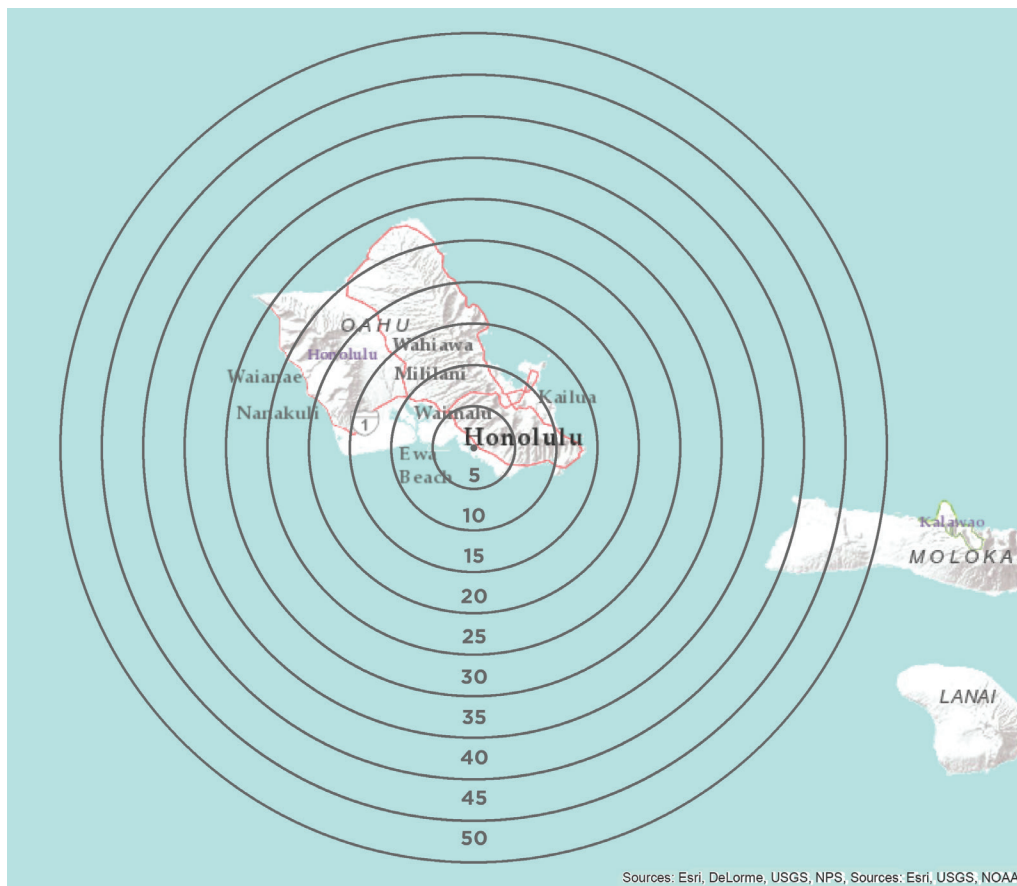


Figure: Map of O'ahu: Land Availability within 50-Mile Radius of Downtown.

Source: La Croix, S. (2016) "New perspectives on land and housing markets in Hawai'i: Implications for industrial and commercial land leasing", University of Hawai'i Economic Research Organization (UHERO), January.

making it the most land-constrained city in the USA (La Croix, 2016). For reference, this area is far less than even the USA's second-most land constrained city, Ventura, California, in which 20% of the area within 50 kilometers is developable. The limited availability of developable land and sometimes capacity constraints on the water supply naturally restricts the supply of housing in Hawai'i, pushing up prices.

But there are also flow-on effects from this constraint on developable land. The "Home voter" effect is that people who own houses in locations with higher housing costs are more likely to vote in governments and support policies that restrict housing, in order to protect their investments (Saiz, 2010) and further increasing housing costs. The Wharton Residential Land Use Regulatory Index (Gyourko et. al., 2008) compiled survey responses regarding the stringency of local regulation on housing production. While the most recent iteration of the index excluded Hawaii (Gyourko et. al., 2021), UHERO conducted a study to fill this gap (Inafuku et. al., 2022). Both the original index and its latest iteration shows that Hawai'i is the most regulated state in the US by some margin, which further exacerbates the cost of housing in Hawai'i (See Figure below).

5.2 Isolated islands

Hawai'i is the only island state in the US and separated from the continental states by about 2,500 miles of Pacific Ocean. The nature of its island geography and its isolation has unique effects on Hawai'i's economy that may also affect the healthcare industry. Overall, our island geography creates several interesting challenges that all contribute to difficulties doing business in Hawai'i and the cost of living.

Firstly, as already noted in Section 3 above, small scale, distance, and an open economy mean that Hawai'i specialized in tourism in order to benefit from increasing returns to scale (Bond-Smith, 2024), but this specialization means that many other goods have to be imported. Transportation costs combined with production costs elsewhere are lower than local production costs, because local production cannot benefit from larger scale by exporting (since it cannot compete with locations that have closer proximity to more customers) contributing to Hawai'i's specialization.

As a result, business in Hawai'i requires more challenging logistics than other places, both for transportation from the mainland and between islands—goods are not transported by simply loading them on the back of a truck. It either requires shipping, which is less frequent, or air transportation, which is more costly. Distributors face a trade-off between larger shipments and higher storage requirements or more frequent air transport with less storage costs. For goods with a short shelf-life distributors also need to factor in the timeliness of shipments. These all generate additional logistical costs to distribute goods to and between the islands. For healthcare providers, this means that the costs of shipping medical supplies will be higher in Hawai'i than it is for providers on the mainland.

Hawai'i's island geography might limit the ability to use a central hub to distribute goods to a wide market. Just as healthcare will typically require a centralized location on each island for its provision, discussed in Section 3, so too will logistics and distribution. Distribution has a significant degree of economies of scale, because a distributor can only distribute to its network. But the accessible network for a distribution center on an island is limited to the size of the island. There may be some degree of centralisation in Honolulu, as there is for healthcare services, but there are still higher costs in the challenging inter-island logistical environment. This also means that distribution may have limited competition in Hawai'i due to the small market size of each island.

While Hawai'i can import many goods and services, it must find sufficient clean water locally and generate sufficient electricity locally. These types of non-tradable goods require careful local planning and management. For water, it is not priced by a market mechanism the same as other goods. Instead, local water boards have to manage the size of the resource available in an equitable and efficient manner. Ultimately, islands reach the capacity of their existing water infrastructures and have to plan several years in advance to expand the water supply. Events such as the contamination of the water supply at Red Hill make this even more challenging because it takes away the excess capacity that is needed to manage the period between investment in new infrastructure. As a result, some developments may ultimately be delayed by the availability of water. If this happened, the constraint on supply of housing and other developments would also push up house prices and the cost of living. Similarly, O'ahu will eventually reach the capacity of potential groundwater and one day require a desalination plant to provide for sufficient water. The expense of desalination will add to the cost of living in

Hawai'i whether it is paid for by a price on water or by taxes. These pressures on the cost of living exacerbate wage and recruitment issues for healthcare workers and employers.

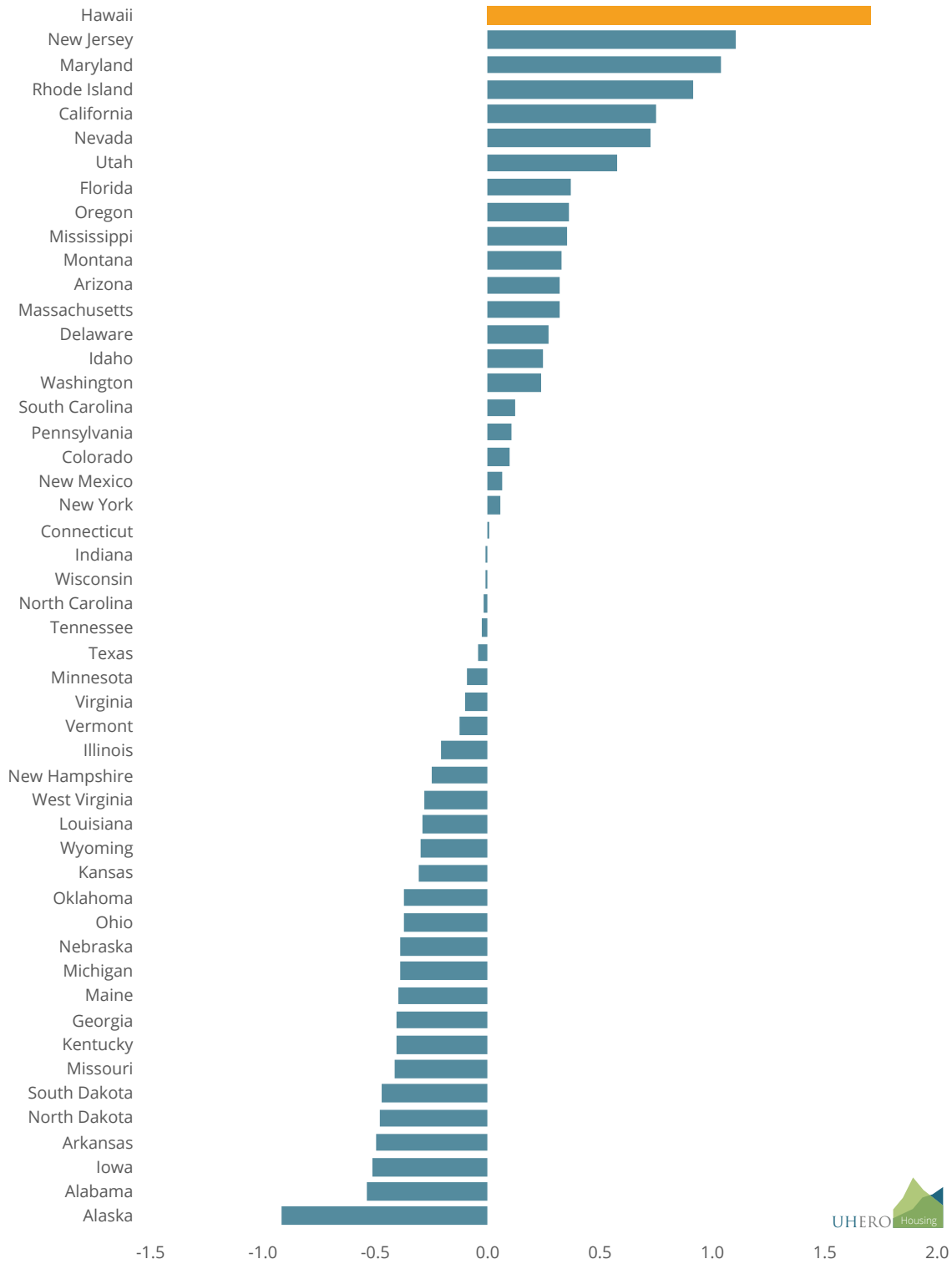


Figure: Average Wharton Index by state

Source: Inafuku, R., Tyndall, J., and Bonham, C. (2022) "Measuring the burden of housing regulation in Hawai'i", *UHERO Brief*, University of Hawai'i Economic Research Organization (UHERO), April 14. Note: The figure shows the Wharton Index of each state, calculated by taking the average of all reporting jurisdictions within that state.

5.3 Competition and regulation

Increasing returns to scale (discussed in Section 3), combined with the small size of the Hawai'i market, may limit the number of firms in an industry that can profitably operate in Hawai'i. As a result, small markets like Hawai'i may be more prone to limited competition in many sectors. This especially applies to industries like telecommunications, cable TV, electricity, and airports—often referred to as natural monopolies—but could also apply to other sectors with economies of scale, such as food distribution and the parts of the healthcare industry. A lack of competition creates incentives for higher prices and discourages investment in innovation to improve productivity (Bond-Smith, 2022). This may be one factor contributing to higher healthcare costs in Hawai'i than elsewhere. There are a few different ways that competition issues can be addressed. Governments can monitor sectors of concern, which provides an incentive for firms to 'self-regulate' in order to avoid a stricter and more costly regulatory regime. Or governments can choose to intervene in such sectors in various ways. While many of these industrial-competition regulations are designed for other industries, it may be necessary to adapt these approaches to further industries such as healthcare, in a small market like Hawai'i.

In some industries, services can be “unbundled”, to create a ladder of investment for entry (Cave, 2006) in which entrants use components of services from competitors until such time as they are large enough to invest in their own capacity for these services. In healthcare, a similar service unbundling may already occur, even in absence of regulation. For example, surgeons operating their own clinics are sometimes able to use operating theaters in a large hospital. This mechanism for competition in healthcare services may be particularly important in the islands, when some islands may be too small to host more than one hospital. But, when there are only one or a few providers of unregulated, unbundled services in the islands, it is possible that the lack of competition would still drive up the price of accessing those unbundled services.

In such cases, governments can choose to regulate prices, either for the unbundled service or the final product, or choose to provide the service themselves. Regulated prices are based on estimates of the costs and risks and are intended to provide sufficient profit to reflect a competitive market when competition is too weak to sufficiently constrain prices. One problem with regulated prices is that it still provides very little incentive for regulated businesses to reduce the cost of providing those price-regulated products and services. One approach to address this problem is to set a maximum allowable revenue for each regulated business, rather than regulating prices. This incentivises productivity improvements by allowing businesses who reduce costs to keep the difference between costs and revenue, at least in the short term until the next revenue reset cycle every few years. If there are particular concerns about a lack of local investment in innovation and productivity growth due to the small scale of Hawai'i's healthcare market, this factor can also be taken into account in how healthcare would be regulated by requiring and incentivising regulated businesses to implement innovation investment strategies to lower costs or improve productivity. These incentives would also allow regulated firms to keep some of the gains from improvements, and reduce allowable revenues in future periods in order to share the cost savings of improvement with consumers.

The final option of note is for governments to invest in these services themselves. For example, airports in Hawai'i are owned by the State, rather than privately owned. This approach may be necessary in healthcare in some smaller communities that are not sufficiently large to finance a business case for their own hospitals and healthcare facilities but are also too remote to easily make use of a more centralized facility.

Different jurisdictions will take different approaches to regulating industries of concern, but it is likely that there are more industries of concern in small isolated economies like Hawai'i. If there is concern about competition and access for healthcare in Hawai'i, then regulatory or government investment options could be considered.

5.4 Housing in Hawai'i

These forces of economic geography combined with restrictive housing regulation has left Hawai'i residents facing the highest housing costs in the nation (Tyndall et. al., 2023). This also has circular effects for economic geography. Economic geographers and urban economists have paid a lot of attention to expensive housing markets. In particular Gyourko et. al. (2013) focused on “super-star” cities, where the *increase* in house prices over multiple decades was much higher than average. The divergence between super-star cities and other places is explained by an inelastic (or restricted) housing

supply, an increasing number of high-income households nationally, and spatial sorting of lower-income residents into more elastic housing markets.

Hawai'i does not host one of these so-called 'super-star' cities,² but the explanation of inelastic supply and the dynamics of spatial sorting still explain Hawai'i's high housing costs. Inelastic supply sustains higher house prices. Spatial sorting implies that lower-income Hawai'i residents then leave the state—in search of more affordable housing in places with more elastic supply—while higher-wealth outsiders, who value Hawai'i's natural amenities, are moving or buying vacation homes here. This is contributing to discontent as Native Hawaiians and kama'āina feel unable to remain living in their ancestral homeland. But it also affects the healthcare workforce such that there are greater shares of healthcare workers born in Hawai'i and living on the mainland in lower-pay occupations (Department of Business, Economic Development & Tourism, 2023).

The free movement of people between Hawai'i and the US mainland means that the wealthiest people across the US are able to buy vacation homes in Hawai'i that may often sit vacant. Similarly, non-resident investors can own transient vacation rental rentals that provide accommodation to tourists rather than residents. These factors both use up a much larger share of housing supply in Hawai'i than in other places and possibly tilt the supply of housing towards types of homes that may be less suitable for residents.

Hawai'i's small scale and the potential for limited competition may also contribute to the cost of construction in Hawai'i. Small scale means that competition may be limited to the small number of large developers who can operate in Hawai'i. Furthermore, the lack of population growth (in part due to a lack of new housing), combined with small scale, means that in any one year there is typically only a relatively small change in the housing stock. This limits the economies of scale available to land developers compared to much larger cities where even low levels of population growth can sustain large developments of standardized housing designs. As a result, only a few developers may ultimately be responsible for determining the supply of new housing to Hawai'i.

All of these factors of economic geography, spatial sorting, limited competition, and small scale add to a higher cost of housing. A range of housing impacts can be found in the UHERO Hawai'i housing factbook (Tyndall et. al., 2023).

5.5 Cost of living

These effects combine to generate a significantly higher cost of living in Hawai'i compared to other places. The Bureau of Economic Analysis publishes a regional price parities index.³ The index shows that in 2021 Hawai'i was 13% more expensive on average than elsewhere in the US. Price differences are even higher in metropolitan areas, which in Hawai'i only includes Honolulu. The cost of living is slightly lower in the neighbor islands (non-metropolitan Hawai'i), although much of this difference can probably be attributed to lower housing costs around Hilo on the Big Island. Despite lower costs, the cost of living in non-metropolitan Hawai'i is comparable to some of the most expensive metropolitan areas across the US. Much of this cost of living impact has already been discussed above in the sections on amenities and housing, but this isn't the only effect.

The high cost of living means that when employment opportunities present themselves elsewhere, or when Hawai'i residents are made unemployed, they are more likely to leave Hawai'i, more likely to take part time work, or more likely to accept a job that is a poorly quality match for their skills, compared to residents in other places. Indeed, the stronger economic recovery from the COVID-19 pandemic in the continental states is likely to have contributed to a population drop in Hawai'i of 1% between 2020 and 2022 with Honolulu's population falling below 1 million (US Census Bureau, 2023).

² Honolulu is not considered a superstar because Honolulu has always been expensive and the superstar status refers to excessive price growth.

³ Other cost of living indexes measure the cost differences between places with a fixed basket of goods that does not allow for substitution between products. For example, since housing is significantly more expensive in Hawai'i than elsewhere such indexes do not account for the reduction in house size that people make and the increase in consumption of other goods and services where price differences are smaller. As a result, these indexes massively overestimate cost of living differences between places. The BEA's RPP index is the suitable comparison for comparing cost of living differences between places.

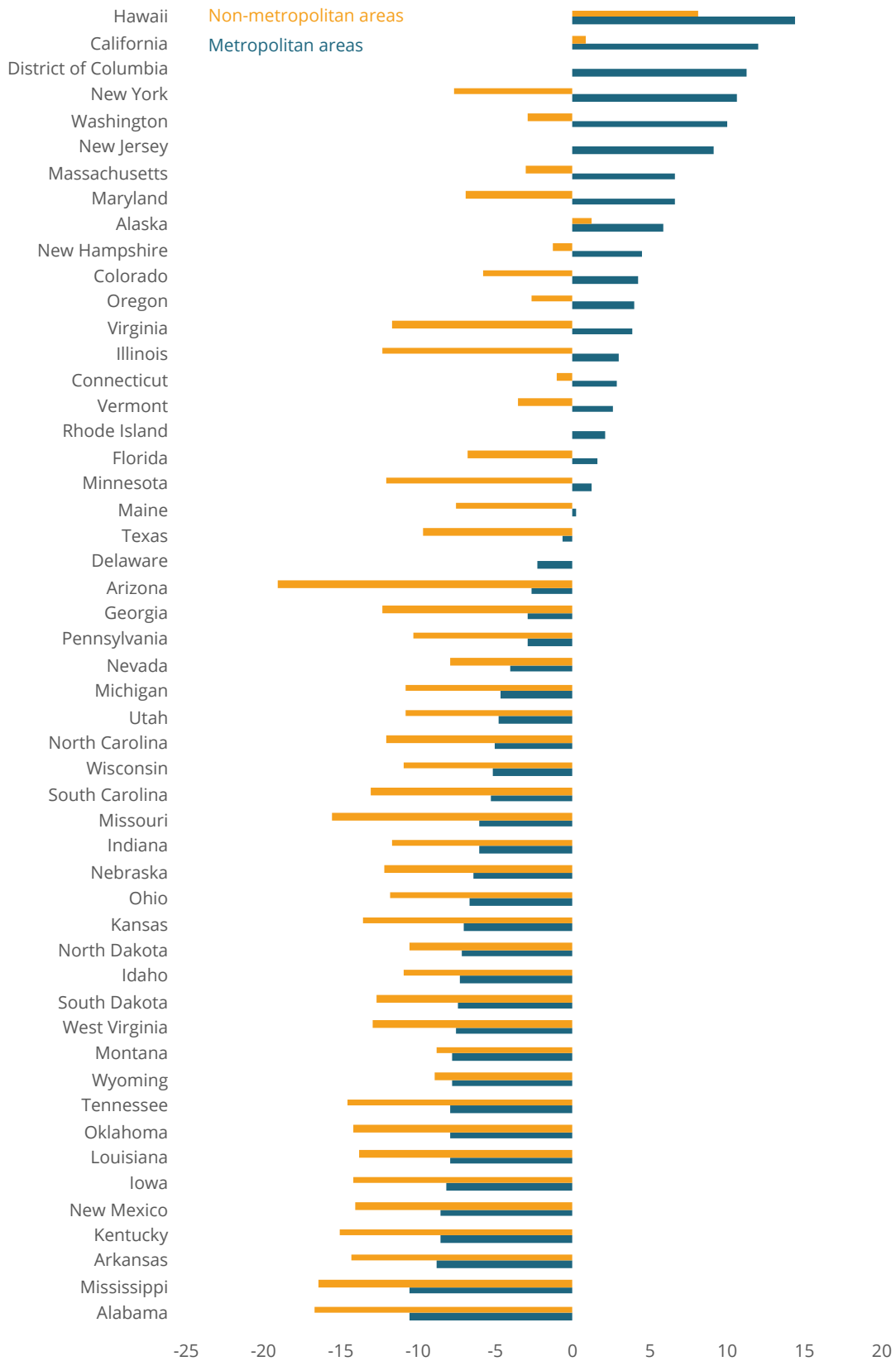


Figure: Regional Price Differences by State 2021
 Source: Authors calculations from Bureau of Economic Analysis, "PARPP Regional price parities by portion".
 Note: there are no "non-metropolitan areas" for Delaware, New Jersey, Rhode Island or the District of Columbia.

It also changed the spatial distribution of population within Hawai'i, with falls on O'ahu, which has been slower to recover international visitors, but gains on Kaua'i and the Big Island where US visitors recovered strongly.

This may be an explanation for why Hawai'i typically has a lower unemployment rate than elsewhere in the US. Similarly, the specialization in tourism might also mean that people can find work in temporary or part time service industry positions, meaning that underemployment, where people are employed but seeking more hours, is a better reflection of labor market tightness in Hawai'i. Overall, the usual measures of labor market performance appear to be distorted in Hawai'i by its higher cost of living and specialization in the tourism industry (Bond-Smith and Johnson, 2023). For example, the unemployment rate may not reflect tightness in the labor market in a comparable way to other states if many of those searching for work in Hawai'i choose to stay on the mainland during periods of unemployment.

As with geographic practice cost indexes, benchmarking and reimbursement rates may not account for cost-of-living differences. Market clearing requires that prices and wages are sufficient for supply to equal demand such that if costs are not adequately covered, shortages will arise.

For the healthcare industry, the higher cost of living may make it more difficult to recruit people in Hawai'i, since hiring is more likely to involve relocating. This may require the healthcare industry to offer higher wages and relocation incentives than other places to address its workforce shortage. However, as noted above, doing so may require changes to benchmarking and reimbursement methodologies that account for Hawai'i's unique differences such as the cost of living.

6. SUMMARY AND CONCLUSIONS

These economic geography and spatial economics perspectives provide insights about where economic activity takes place and how local geography creates locally unique challenges in different places. This perspective suggests that Hawai'i's healthcare sector might look quite different from healthcare sectors in other places.

Most notably, Hawai'i's small size and isolation affect where and how healthcare services are offered. Economies of scale, economies of scope, and external increasing returns to scale, combined with spatial transaction costs and transportation costs, all push healthcare services to be in more central locations. This pattern is likely to appear at a state level—with services centralized in Honolulu—but will also appear on an island or county level—with services centralized in the local center in each county, and probably to a greater degree than would be the case in regional centers in other states due to Hawai'i's island geography. Yet Hawai'i's small scale, and the even smaller scale on each of the neighbor islands, means that many healthcare service providers are also likely to face higher costs or lower productivity than in other places.

Hawai'i's distance and isolation, combined with external increasing returns to scale in tourism, have generated a specialization in tourism (Bond-Smith, 2024) that exposes its economy to periodic fluctuations when external shocks generate falls in tourist numbers (Bond-Smith and Fuleky, 2022). External increasing returns to scale generates a coordination problem for establishing new industries, reinforcing Hawai'i's specialization in tourism. This presents challenges for productivity, and productivity growth and would mostly affect industries other than tourism with internal and external economies of scale, including healthcare. The state's small scale may also contribute to limited competition in many sectors, including healthcare, hampering innovation and growth.

This also means that many tradeable industries like manufacturing are limited or absent in Hawai'i, shaping the state's industrial landscape. Conversely, non-tradable sectors such as healthcare remain in Hawai'i due to the necessity of providing services locally, but face higher costs or lower productivity. This also affects the range of job types and the composition of Hawai'i's workforce, such as a lower share of scientists and engineers compared to other parts of the United States, which may affect the types of activities that the healthcare industry can host in Hawai'i, and imply a greater level of recruitment from out of state than in other places.

Hawai'i's natural amenities and constrained housing supply add to elevated housing costs, which in turn also increase the cost of doing business. Yet the desirability of these natural amenities means that some higher-income workers may be willing to forgo higher wages elsewhere in order to locate in Hawai'i. On the other hand, cost-of-living effects increase wages at the lower end of the wage distribution as workers seek comparable real wages. This generates a more compressed wage distribution in Hawai'i, though its effect could be expected to be smaller in non-tradable industries such as healthcare in which the scale of the industry is determined by the size of the local population. This means that benchmarking and reimbursement methodologies (such as geographic practice cost indexes) based on costs and wages in tradable industries may underestimate the market clearing rates required and generate shortages in the healthcare industry in Hawai'i. This hypothesis could be tested in future research.

The higher cost of living also implies a tighter labor market, as residents face higher opportunity costs to remain in Hawai'i, exacerbating recruitment difficulties. This is compounded because the ability to recruit from out-of-state may be more difficult in Hawai'i due to its isolation. The combination of limited land availability and greater planning regulations further increases housing costs. Spatial sorting implies that lower-income residents leave and higher-income migrants move in.

The most crucial take-away from this report is that Hawai'i's economic geography, internal and external scale economies, tourism specialization, and housing dynamics collectively raise the cost of living and impede workforce recruitment and retention. These pressures are likely to be particularly pronounced in the healthcare sector and especially in rural and isolated communities, due to the specialized skilled workforce that healthcare requires and the nature of Medicare rebate estimation methodologies.

The perspectives developed in this report generate a range of testable hypotheses about the economics of healthcare provision in Hawai'i. Where these hypotheses match with anecdotal evidence from healthcare providers, the report offers explanations from economic geography and spatial economics for why their experience in Hawai'i might differ from other places in the US. But it also suggests new avenues for research to fully understand other dimensions of the challenges facing the healthcare sector.

The differences between Hawai'i and other places—and the causes of these differences—need to be confirmed by empirical evidence. Given the nature of the data required, much of this work may have to be internal, within healthcare businesses themselves, such as large hospitals and insurance companies. But doing so would also help those businesses to strategically address more of the challenges that they face in Hawai'i, especially regarding the workforce shortage and recruitment challenges.

Yet many of these challenges are too great for individual businesses, reflecting various types of failures such as coordination problems, regulatory issues, and characteristics of the spatial equilibrium that are unacceptable to the public. Addressing such issues requires cross-industry research and policy initiatives. Governments, or industry-wide organizations can support training and recruitment of local residents to contribute to addressing these challenges in the longer term. Governments may have to address healthcare workforce shortages more directly in isolated regions of Hawai'i.

Overall, sound explanations from spatial economic theory with a solid micro-foundation and insights from the place-specific contexts analyzed in economic geography only provides a starting point for understanding the local nuances of the healthcare industry in Hawai'i. The combination of theoretically-sound hypotheses and empirical evidence can yield strong evidence-based strategies and policy designs to better address the unique challenges facing the healthcare industry in Hawai'i.

REFERENCES

- Albouy, D. (2016) "What Are Cities Worth? Land Rents, Local Productivity, And The Total Value Of Amenities", *The Review of Economics and Statistics*, 98(3), 477–487.
- Bond-Smith, S. (2022) "Discretely innovating: The effect of limited market contestability on innovation and growth", *Scottish Journal of Political Economy*, 69, 301–327. DOI: 10.1111/sjpe.12306.
- Bond-Smith, S. (2024) "Diversifying Hawai'i's Specialized Economy: A Spatial Economic Perspective", *Economic Development Quarterly*, 38(1), 40–59. DOI: 10.1177/08912424231183941.
- Bond-Smith, S. and Fuleky, P. (2022) "The effects of the pandemic on the economy of Hawaii", *Current Issues in Tourism*, DOI: 10.1080/13683500.2022.2151875.
- Bond-Smith, S. and Johnson, M. (2023) "Are regional unemployment rates fair measures of distressed regions?", study in progress.
- Bond-Smith S., McCann P. (2022) "The work-from-home revolution and the performance of cities", *TPI Working Paper*, No. 026, The Productivity Institute, www.productivity.ac.uk/research/the-work-from-home-revolution-and-the-performance-of-cities/.
- Bond-Smith and Ilamkar (2023) "Potential opportunities to diversify and grow the economy of Hawai'i", *UHERO Report*, study in progress.
- Bonham, C. S., Gangnes, B., Bond-Smith, S., Fuleky, P., Tyndall, J., Inafuku, R., Miller, L., and Rahman, A. (2023) "Promise and peril for the Hawai'i economy", *UHERO Forecast for the State of Hawai'i*, University of Hawai'i Economic Research Organization (UHERO), May 8.
- Boto-García, D., & Leoni, V. (2023). The Economic Value of Coastal Amenities: Evidence from Beach Capitalization Effects in Peer-to-Peer Markets. *Environmental & resource economics*, 84(2), 529–557. DOI: 10.1007/s10640-022-00735-5.
- Cave, M. (2006) "Encouraging infrastructure competition via the ladder of investment", *Telecommunications Policy*, 30, 223–237.
- Department of Business, Economic Development & Tourism (2023) "The healthcare industry in Hawaii", Research & Economic Analysis Division, Department of Business, Economic Development & Tourism, State of Hawaii, April.
- Dijkstra, L., Poelman, H., and Rodríguez-Pose, A. (2020) "The geography of EU discontent", *Regional Studies*, 54:6, 737–753.
- Fischel, W. A. (2001) "The Homevoter Hypothesis" Cambridge: *Harvard University Press*.
- Graves P. E. (1976) "A Reexamination of Migration, Economic Opportunity, and the Quality of Life", *Journal of Regional Science*, 16 (1): 107–12.
- Graves P. E. (1980) "Migration and Climate." *Journal of Regional Science*, 20 (2): 227–37.
- Graves P. E., Linneman P. D. (1979) "Household Migration: Theoretical and Empirical Results", *Journal of Urban Economics*, 6 (3): 383–404.
- Gyourko, J., Hartley, J. S., & Krimmel, J. (2021) "The local residential land use regulatory environment across US housing markets: Evidence from a new Wharton index", *Journal of Urban Economics*, 124, 103337.

- Gyourko, J, Saiz, A. and Summers, A. (2008). “A new measure of the local regulatory environment for housing markets: The Wharton Residential Land Use Regulatory Index”, *Urban Studies*, 45(3): 693-729.
- Gyourko, J., Mayer, C., and Sinai, T. (2013) “Superstar Cities”, *American Economic Journal: Economic Policy*, 5 (4): 167-99.
- Handbury, J. and D. E. Weinstein (2014) “Goods prices and availability in cities”, *The Review of Economic Studies*, 82(1), 258-296.
- Henderson J. V. (1982) “Evaluating Consumer Amenities and Interregional Welfare Differences”, *Journal of Urban Economics*, 11 (1): 32-59.
- Healthcare Association of Hawai'i (2022) “Hawai'i healthcare workforce initiative: 2022 Report”, *Healthcare Association of Hawai'i*.
- Institute of Medicine (2012) *Geographic Adjustment in Medicare Payment: Phase I: Improving Accuracy*. Washington, DC: The National Academies Press.
- Inafuku, R., Tyndall, J., and Bonham, C. (2022) “Measuring the burden of housing regulation in Hawai'i”, *UHERO Research Brief*, University of Hawai'i Economic Research Organization (UHERO), April 14.
- Kersell, K., Caldwell, C., and Islam, M. (2022) “Final Report for the CY 2023 Medicare PFS Update to the GPCIs and MP RVUs. Medicare Physical Fee Schedule (PFS): Geographic Practice Cost Indices (BPCI) and Malpractice Relative Value Units (MP RVUs)”, Actuarial Research Corporation, October 20.
- Krugman, P. (1991) “Increasing returns and economic geography”, *Journal of Political Economy*, 99:3, 483-499.
- Matsuyama K. (1991) “Increasing returns, industrialization, and indeterminacy of equilibrium”, *Quarterly Journal of Economics*, 106(2), 617-650. DOI: 10.2307/2937949.
- Rosenstein-Rodan P. N. (1943) “Problems of industrialisation of Eastern and South-Eastern Europe”, *The Economic Journal*, 53(210/211), 202-211. DOI: 10.2307/2226317.
- Morck R., Nakamura M. (2007) “Business groups and the big push: Meiji Japan's mass privatization and subsequent growth”, *Enterprise & Society*, 8(3), 543-601. DOI: 10.1093/es/khm076.
- Murphy K. M., Shleifer A., Vishny R. W. (1989) “Industrialization and the big push”, *Journal of Political Economy*, 97(5), 1003-1026. DOI: 10.1086/261641.
- Rosen S. 1979. “Wage-based Indexes of Urban Quality of Life,” In Mieszkowski P., Straszheim M., (ed.), *Current Issues in Urban Economics*, 74-104, Baltimore, MD: Johns Hopkins University Press for Resources for the Future.
- Pacific Resource Partnership (2019) “Hawai'i perspectives: Understanding the mindset of Hawai'i residents”, *Spring 2019 Report*, An Initiative of Pacific Resource Partnership.
- Rodrik D. (1996) “Coordination failures and government policy: A model with applications to East Asia and Eastern Europe”, *Journal of International Economics*, 40(1-2): 1-22. DOI: 10.1016/0022-1996(95)01386-5.
- Rodrik D. (2004) “Industrial policy for the twenty-first century”, Discussion Paper No. DP4767, *Centre for Economic Policy Research*, London. <https://cepr.org/publications/dp4767>.
- Rodrik D. (2008) “Normalizing industrial policy”, Working Paper No. 3, *Commission on Growth and Development*, International Bank for Reconstruction and Development and the World Bank. <http://documents.worldbank.org/curated/en/524281468326684286/Normalizing-industrial-policy>.

-
- Rossi-Hansberg, E. (2005) "A Spatial Theory of Trade", *American Economic Review*, 95 (5): 1464-1491.
- Saiz, Albert (2010) "The geographic determinants of housing supply", *Quarterly Journal of Economics* 125(3): 1253-1296.
- Storper, M. (2011) "Why do regions develop and change? The challenge for geography and economics", *Journal of Economic Geography*, 11(2): 333-346. <https://doi.org/10.1093/jeg/lbq033>.
- Tyndall, J., Bond-Smith, D., Inafuku R. (2023) "The Hawai'i housing factbook", *UHERO Report*, University of Hawai'i Economic Research Organization (UHERO), June 28.
- US Census Bureau (2023) "Growth in U.S. Population Shows Early Indication of Recovery Amid COVID-19 Pandemic", *Press Release*, Number CB22-214. <https://www.census.gov/newsroom/press-releases/2022/2022-population-estimates.html>.
- Waltert, F. and Schlöpfer, F. (2010) "Landscape amenities and local development: A review of migration, regional economic and hedonic pricing studies," *Ecological Economics*, 70(2): 141-152.

UHERO

THE ECONOMIC RESEARCH ORGANIZATION
AT THE UNIVERSITY OF HAWAII

UHERO THANKS THE FOLLOWING SUPPORTERS:

KA WĒKIU - THE TOPMOST SUMMIT

Bank of Hawaii
DGM Group
First Hawaiian Bank
Hawaii Business Roundtable
Hawaii Community Foundation
HMSA
Kamehameha Schools
Queen's Health Systems

KILOHANA - A LOOKOUT, HIGH POINT

American Savings Bank
Benjamin Godsey
Castle Foundation
Central Pacific Bank
D.R. Horton
First Insurance Company of Hawaii, Ltd.
Hawaii Pacific Health
Hawaiian Airlines
Hawaiian Electric Industries
Matson
Tradewind Group

KUAHIWI - A HIGH HILL, MOUNTAIN

Alexander & Baldwin
Better Homes and Gardens Real Estate Advantage Realty
Castle & Cooke Hawaii
Chamber of Commerce

Halekulani Corporation
Hawaii Gas
Hawaii Hotel Alliance
Hawaii State AFL-CIO
Hawaiian Dredging Construction Company
HGEA
Honolulu Board of Water Supply
The Howard Hughes Corporation
HPM Building Supply
Kaiser Permanente Hawaii
Nordic PCL Construction
Servco Pacific, Inc.
Stanford Carr Development
United Public Workers

ADDITIONAL SUPPORTERS

Architects Hawaii, Ltd.
Charles Wathen Company (Pier Investments)
Chartwell Financial Advisory
Finance Factors
Foodland Super Market, Ltd.
The Hawaii Laborers & Employers Cooperation
and Education Trust Fund
Hawaii National Bank
Hawaii Tourism Authority
HC&D, LLC
Honolulu Board of Realtors
The Natural Energy Laboratory of Hawaii Authority
Pacific Cost Engineering
The Pacific Resource Partnership
Trinity Investments

Kulia I Ka Nuu (literally "Strive for the summit") is the value of achievement, those who pursue personal excellence. This was the motto of Hawaii's Queen Kapiolani. Supporters help UHERO to continually reach for excellence as the premier organization dedicated to rigorous, independent economic and policy research on issues that are both central to Hawai'i and globally relevant.

Over its more than twenty year history, UHERO research has informed decision making on some of the most important issues facing our community, including the ever-changing economic outlook, challenges to our environment, and policies affecting water, housing, energy, and many other areas.

Contributions from generous supporters like you make it possible for UHERO to fulfill this mission. Your financial commitment also allows us to distribute UHERO forecast reports to all Hawaii stakeholders.