

How Wyoming's Exodus of Young Adults Holds Back Economic Diversification

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Pathways to Prosperity Project



Growth Lab Working Paper Series
No. 233

**October
2024**

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This paper may be referenced as follows: Protzer, E., Bui, T., Freeman, T., Hausmann, R., Henn, S., Kaddah, F., Lamby, L., O'Brien, T., Rueda-Sanz, A., Villasmil, R. (2024). "How Wyoming's Exodus of Young Adults Holds Back Economic Diversification." Growth Lab Working Paper, Harvard University Kennedy School of Government.

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Executive Summary

Wyoming is a rural Mountain West state with a high Gross State Product (GSP) per capita, foremostly driven by its fossil fuel sector. The state's longstanding strengths in resource extraction provide much of its livelihood, including both its private earnings and public finances. Its other industries are comparatively much smaller, but Wyoming would benefit from their expansion in order to smooth out resource-related shocks going forward. Importantly, Wyoming should think on a big scale when considering such opportunities. Middling, business-as-usual growth in its non-resource sectors will not fundamentally do much to insulate Wyoming's economy against resource busts.

One category of diversification opportunities to consider are those in industries tied to the natural endowments of the land. Wyoming generally does well in these sectors, but prospects of further expansion are either highly uncertain or limited in scale. Some of the most promising opportunities are in new energy and critical minerals, but these carry significant technological uncertainty and/or modest income potential. Transformative growth in agriculture is likely to be difficult because Wyoming faces hard constraints on its water consumption, and its tourism income per capita is already among the very highest of any US states. Adding value to raw materials is a commonly-discussed strategy that, in practice, does not work well in the modern economy because raw materials are often easily traded over long distances.

While it is therefore vital for Wyoming to pursue economic activities related to its natural endowments, it must also look to its advanced services and manufacturing sectors. Wyoming is a severe laggard in these industries versus other states, and serious action is needed to generate the large pools of skilled labor that they need to succeed. There is widespread recognition that Wyoming is behind on this matter, and the state has made critical investments in education to bridge this gap. The missing ingredient, however, is keeping young people and families in the state. By the time people born in Wyoming reach their thirties, nearly two thirds have left – one of the highest rates in the country. Without access to this workforce, it is exceedingly difficult for the Wyoming economy to diversify.

Empirically, young Wyomingites and families overwhelmingly leave the state in favor of larger cities. University of Wyoming graduates especially are attracted to large cities a few hours' drive away from Laramie, Wyoming (where the University of Wyoming is located). These destinations include Fort Collins and Denver. Even if it wanted to, Wyoming could not wave a magic wand to create a large urban metropolis overnight, and it is therefore necessary to understand what specifically attracts young adults and families to these big cities instead of Wyoming towns so that the latter can compete better.

The evidence shows that housing is a surprisingly important factor related to migration decisions on which Wyoming underperforms. Young adults fresh out of university often prefer to live in centrally-located apartments, so that they are close to jobs, restaurants, and friends. Wyoming towns, however, lack dense multi-family housing in their downtown cores as compared to other US towns with very similar overall population. This lack of dense downtown housing suitable for young people contributes to an overall housing supply deficiency, thereby driving up housing prices across the board. It also entails depressed foot traffic in downtowns, leading to fewer customers for local businesses and ultimately fewer urban amenities like restaurants versus Colorado communities – a key result given that surveyed University of Wyoming students report that restaurants are their top desired urban amenity.

The main reason there is not denser housing in Wyoming downtowns is because strict regulations have illegalized them. A plethora of restrictions exist around issues like minimum lot sizes, maximum building heights, minimum parking space requirements, maximum dwellings per unit of area, and more. Studies show that Wyoming is more overregulated than other communities when it comes to restrictions on housing density. Other places successfully leave these decisions to the free market rather than government, and Wyoming could remove these restrictions to increase its supply of housing for young people at no cost. There is additionally a lack of funding for arterial infrastructure in Wyoming, such as water and sewage lines, which drives up development costs.

A general lack of funding for community assets arguably also affects young peoples' and families' migration decisions. There is evidence that community demand for investment outstrips supply in water and transport infrastructure, and that many counties use allotted sales tax expansions ("Penny Taxes") very frequently. One way Wyoming could direct more funding to its local communities is via an expanded grants management system; Wyoming gets less federal grant funding per person than other rural US states, and based on interviews this is tied to a lack of dedicated staff who can navigate the significant overhead associated with following and applying for grants.

Overall, while Wyoming is currently a laggard on advanced service and manufacturing industries there are concrete steps it could take to compete better by retaining more of its young people. Wyoming's Pathways to Prosperity economic development project has already enacted a number of changes to support that outcome, but more can be done. With denser downtowns and more funding for community assets, Wyoming would bolster both its economic and cultural vitality by keeping its young people and leveraging them to obtain growth in new industries.

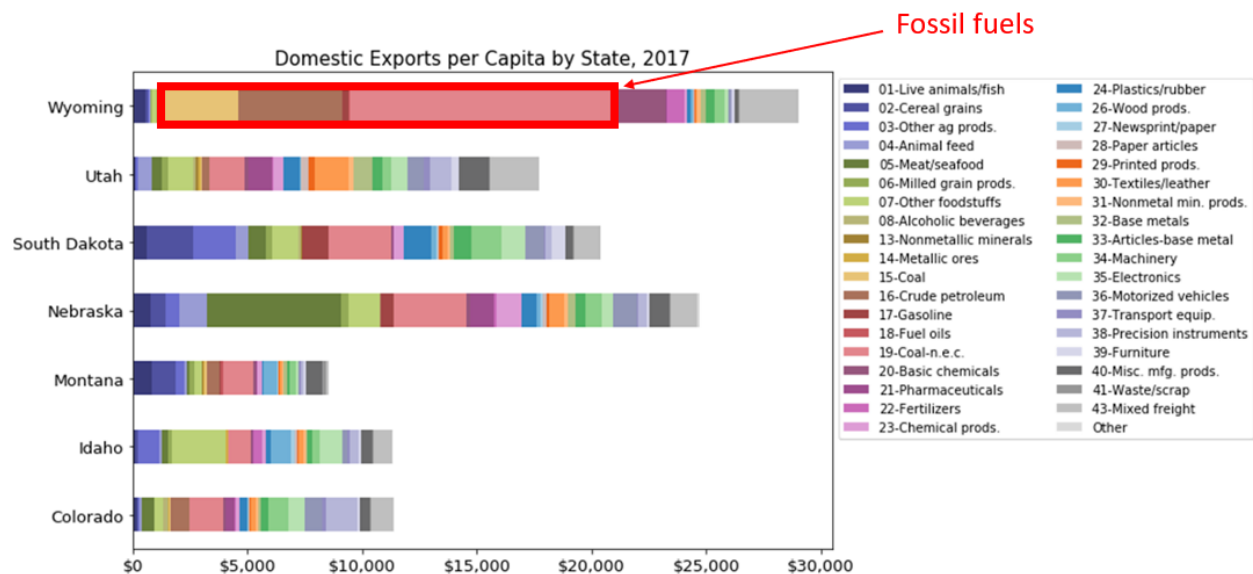
Introduction: Wyoming's Economic Diversification Challenge

Wyoming is a rural Mountain West state in the US with a very high standard of living. In 2022 Wyoming's Gross State Product per capita was approximately \$62,500¹, which was above the US average and ranked as the 14th highest in the country. As of October 2023 its unemployment rate was tied for the 15th lowest of any US state², and many Wyoming communities rank highly in the US in terms of social mobility³. This prosperity transpires among a population of just 580,000 who live in very dispersed settings; the largest city, Cheyenne, has a core population of 65,000 and a metro population of 100,000.

Population centers in Wyoming tend to be small, and are also far from each other, with the result that Wyoming is more akin to a collection of disconnected local economies rather than a unified state economy. As discussed in the Growth Lab's Growth Perspective on Wyoming⁴, some counties are extremely intensive in resource extraction; some depend on tourism; and some with larger population centers feature nascent service and manufacturing sectors.

Under the status quo Wyoming's economy is evidently highly successful. However, its economy is also highly undiversified. Figure 1 shows its tradable income is enormously dominated by fossil fuels, while neighboring states' domestic exports per capita in agricultural and manufactured goods are higher.

Figure 1. Domestic Goods Exports per Capita by State, 2017



Source: US Commodity Flow Survey

¹ <https://www.statista.com/statistics/248063/per-capita-us-real-gross-domestic-product-gdp-by-state/>

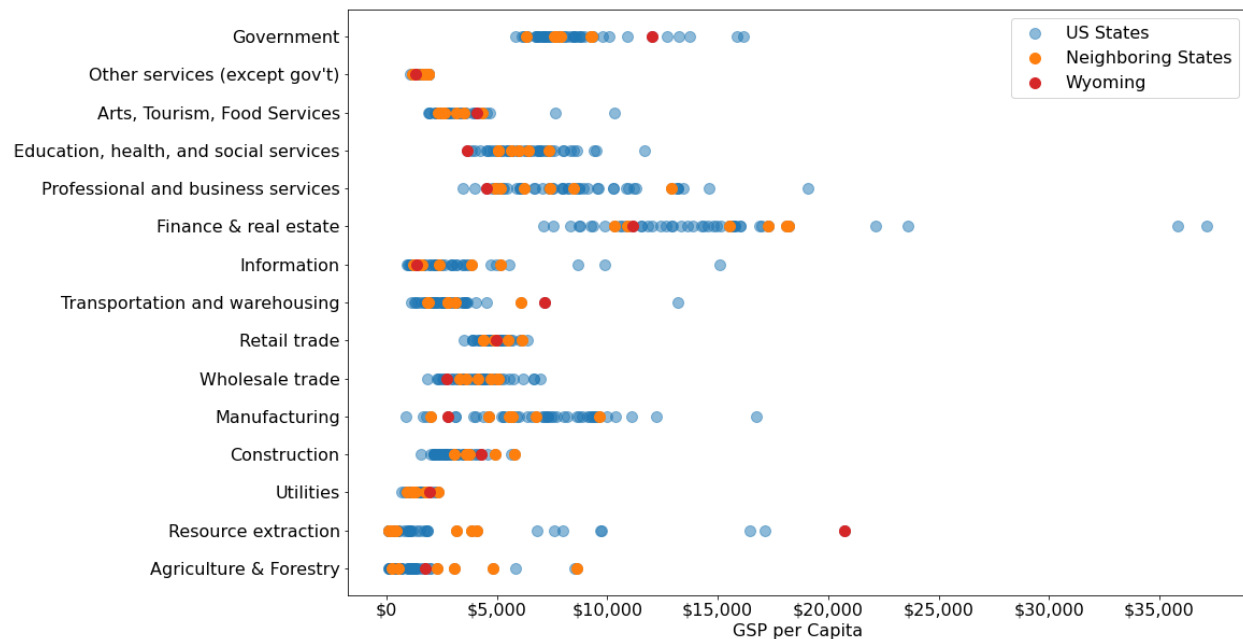
² <https://www.bls.gov/web/laus/laumstrk.htm>

³ <http://www.equality-of-opportunity.org/neighborhoods/>

⁴ <https://growthlab.hks.harvard.edu/sites/projects.iq.harvard.edu/files/growthlab/files/2023-03-cid-wp-432-wyoming-growth-perspective.pdf>

Figure 2 decomposes Wyoming's Gross State Product per capita by sector in comparison to other US states. Unsurprisingly, Resource Extraction is an extremely strong driver of Wyoming's income per person, far above most other states. It also performs well on other sectors that are related to its natural endowments, namely Arts, Tourism, and Food Services; Transportation and Warehousing; and Agriculture and Forestry. However, Wyoming is very far behind on tradable sectors that typically require large pools of skilled workers, including Education, Health, and Social Services; Professional and Business Services; Finance and Real Estate; Information; and Manufacturing.

Figure 2. Gross State Product per Capita by State and Sector, 2022



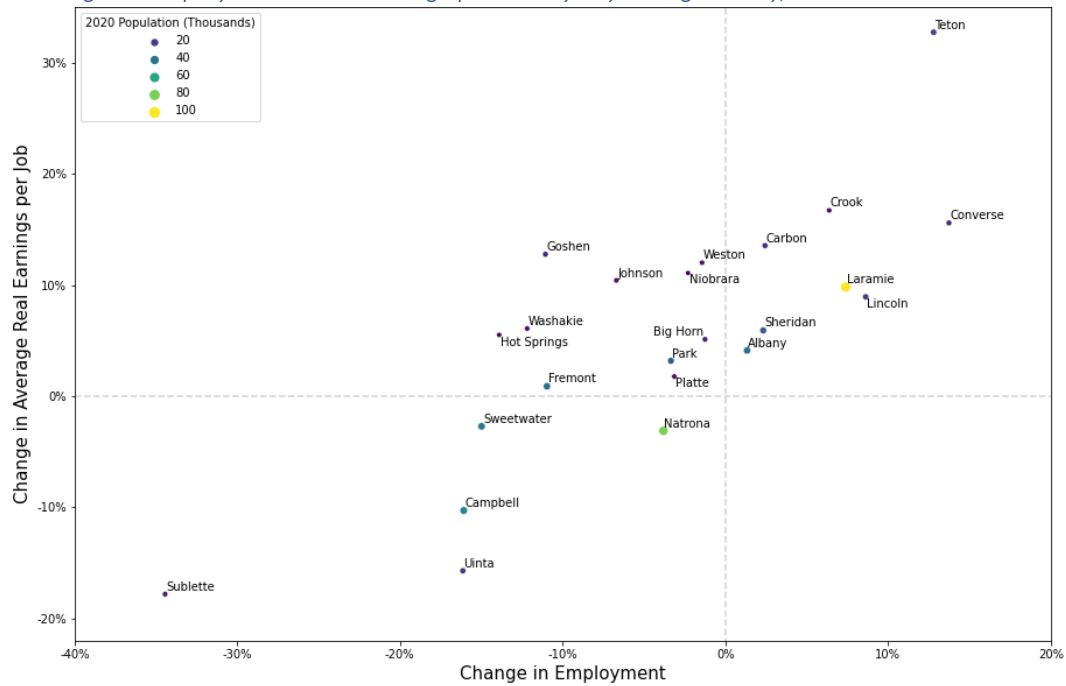
Note: in the standard classification system Petroleum Refineries are categorized as manufacturing. In the above graph they have been reallocated to Resource Extraction, to more accurately capture resource extraction activities versus true industrial manufacturing activities.

Source: US Bureau of Economic Analysis

Wyoming's economic strengths related to the natural endowments of the land are an enormous asset. However, its lack of activity in other sectors of the economy means that Wyoming is highly exposed to economic shocks. Historically Wyoming has experienced numerous booms and busts related to its fossil fuel industry, and going forward there is even the possibility that weakening global demand for fossil fuels could significantly diminish the size of its resource industry outright. If Wyoming had additional activity in other sectors of the economy – as complements to, not replacements for its fossil fuel industry – its economy would be far better poised to weather shocks over the long term. Swings in resource activity would be softened by strong activity in other areas of the economy.

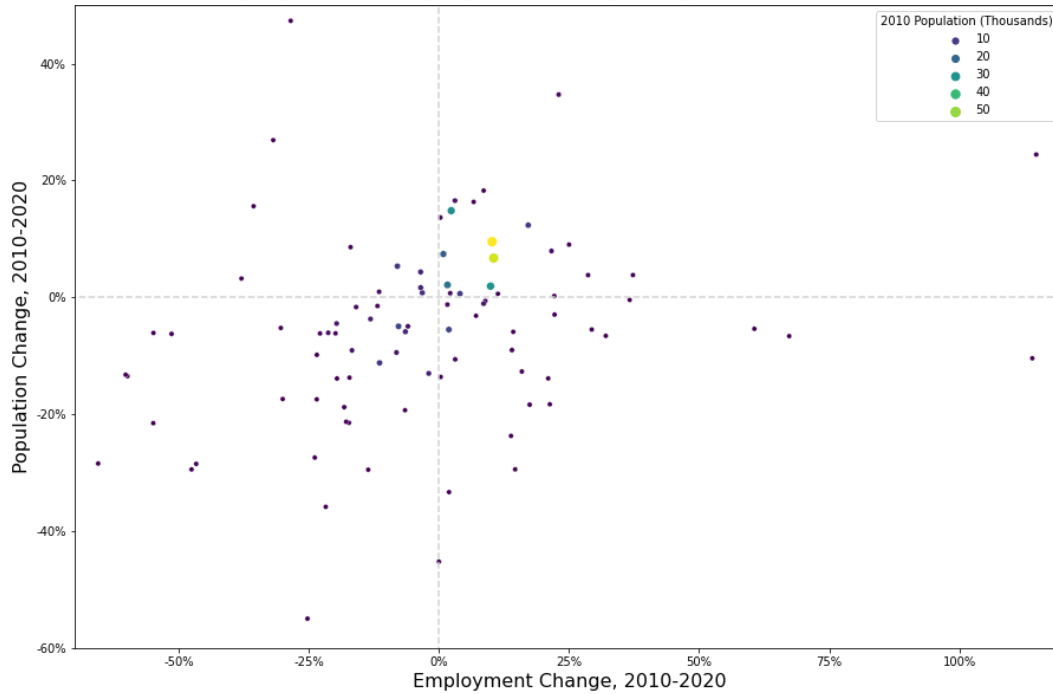
Economic outcomes in the years following the 2014 bust in global energy markets demonstrate how severe these shocks can be. Figure 3 shows how many Wyoming communities lost jobs and experienced worsening average earnings per job from 2010 – 2020. Figure 4 shows that especially for smaller communities, this translated to population losses as well.

Figure 3. Change in Employment and Earnings per Job by Wyoming County, 2010 - 2020



Source: US Census Bureau

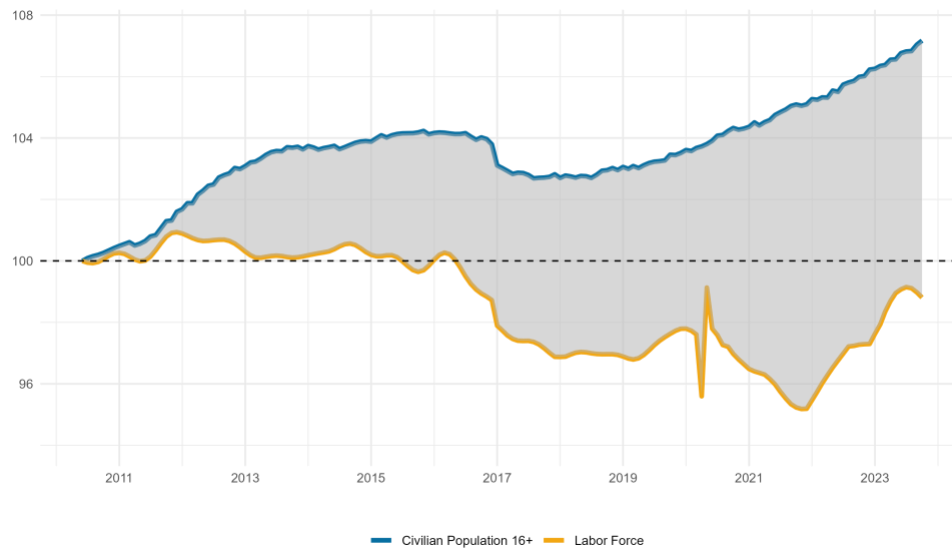
Figure 4. Population and Employment Change by Town in Wyoming, 2010 - 2020



Source: US Census Bureau

Figure 5 shows that in the aggregate for the state, this trend has amounted to a loss of workforce since approximately 2016 even as the overall adult population has grown. This directly results in an increasing dependency ratio, where there are more non-employed adults that state finances must support for every worker in Wyoming.

Figure 5. Relative Growth of Adult Population and Labor Force since 2010.



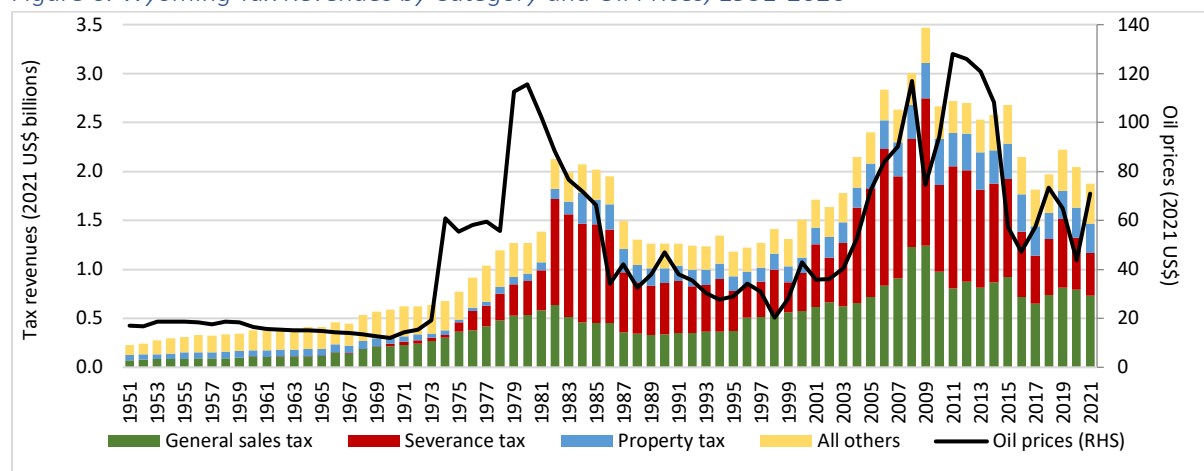
Source: US Census Bureau

The Wyoming government's funding (which ultimately goes toward essential community services like education, healthcare, and policing) also depends strongly on fossil fuel income, and fluctuates accordingly in a downturn. Figure 6 shows a decomposition of Wyoming's tax revenues over time. A large share of revenues come directly from Wyoming's severance tax (a royalty on mineral extraction in the state). What's more, oil, gas, and coal are the top direct contributors to property taxes and are also important contributors to sales and use taxes. Overall, Wyoming's tax revenues closely track oil prices, which emphasizes the close connection between the fossil fuel economy and Wyoming's fiscal health.

To soften the blow from these kinds of shocks in the future it would therefore be extremely advantageous for Wyoming to diversify its economy. Critically, to achieve that goal Wyoming must attain large, transformative economic growth in sectors of its economy that are not already related to fossil fuel activity. Middling, business-as-usual growth on the order of a few hundred dollars of income per capita will not change the basic picture of Wyoming's economy. It is necessary to think big, in terms of gains in thousands of dollars per person in different industries.

The composition of Wyoming's economy denoted in Figure 2 suggests two main economic diversification strategies to investigate. First, this report will examine whether Wyoming can diversify by building on its strengths in natural resources. It will specifically examine opportunities in energy and resource extraction, agriculture, tourism, and adding value to raw materials. Second, it will examine how Wyoming could catch up on the advanced services and manufacturing industries it underperforms on.

Figure 6. Wyoming Tax Revenues by Category and Oil Prices, 1951-2020



Note: severance tax assessment changed from being assessed on prior year production to being assessed on current year production in 1981.

Sources: US Census Bureau; BP Statistical Review of World Energy

A key result this analysis will present is that Wyoming's extremely high emigration rate of young adults prevents it from participating more substantively in advanced service and manufacturing industries. The report will then investigate the drivers of young Wyomingites' migration decisions, and what Wyoming can do to retain more of its young people. A number of supportive changes have already been enacted through the Pathways to Prosperity economic development project, but there is still more to be done.

Does Wyoming have transformational growth opportunities based in its natural endowments?

Resource Extraction and Energy

Although global demand for fossil fuels is steadily eroding, there are exciting prospects for future energy and natural resource industries that could grow instead. These opportunities would arguably fit well with Wyoming's expertise as an energy resource state. Nevertheless, there is a significant amount of uncertainty associated with these opportunities.

In one category are resource opportunities, namely critical minerals. These carry economic uncertainty because their viability depends on innate geology, which may or may not turn out to be favorable in different cases. The Wyoming State Geological Survey states that "In Wyoming, several of the critical minerals on the current list are considered to have moderate to high potential for economic development, including the rare earth elements, platinum group elements, and vanadium... Many other elements on the list are also known to occur in at least trace quantities across the state, but not in sufficient quantities to mine."⁵ Several news releases over the past year tout the viability of new critical

⁵ <https://www.wsgs.wyo.gov/minerals/critical-minerals.aspx>

mineral discoveries^{6,7,8}, but commercial extraction of critical minerals in Wyoming has to date mostly been limited to uranium – on a far smaller economic scale than fossil fuel extraction.

What's more, it is important to be realistic about the market size that critical mineral discoveries in Wyoming could represent. Arguably the most promising deposit discovered in Wyoming to date is at Halleck Creek, which is estimated to contain 7.48 million tons of rare earth oxides (after extraction and processing into metal form)⁹. The global market size for rare earth oxides in 2024 is valued at approximately \$6.7 billion¹⁰; if Wyoming hypothetically captured the entire global market this would bring in just over \$11,500 of revenue per person in the state. Realistically, of course, Wyoming cannot capture or match the entire global market, so revenues per person would be smaller. Depending on annual production this site could hypothetically bring in substantial earnings, but for comparison this would still likely be much smaller than the size of its existing fossil fuel industry.

The other category, opportunities in new energy and transformation thereof, includes a wide variety of nascent technologies¹¹, such as:

- Small Modular Nuclear Reactors
- Carbon Capture & Sequestration
- Hydrogen Energy
- Large-Scale Energy Storage (e.g. Batteries, Compressed Air, Pumped Hydroelectric)
- New Coal Products (e.g. Coal Bricks, Coal-Derived Asphalt)

These energy opportunities carry uncertainty because their technologies are not yet mature. There is considerable debate among experts about the viability of each such technology^{12,13,14} and the ultimate global market size they may represent. It is also unclear how much of the market share Wyoming could realistically capture in each such opportunity. For example, some interviewed experts believe that the future will be dominated by solar, wind, and battery storage. Others see an important role for hydrogen, and yet others emphasize the role of nuclear energy. The implications for Wyoming's potential earnings are very different in all these scenarios.

Wind energy is somewhat unique, in that it is a considerably more mature technology – and Wyoming is well-known to have some of the best wind resources in the country. However, it is important to be realistic about the economic magnitude of the opportunity. The University of Wyoming estimates that an

⁶ <https://www.wsj.com/articles/wyoming-hits-the-rare-earth-mother-lode-natural-resources-policy-china-mining-8e559cec>

⁷ https://www.thesheridanpress.com/news/regional-news/wyoming-mine-could-soon-be-ranked-number-one-for-critical-minerals/article_3ae671fe-a02e-11ee-9531-93772cfd0142.html

⁸ <https://www.wyomingpublicmedia.org/open-spaces/2023-05-26/massive-rare-earth-discoveries-could-mean-a-new-mining-rush-in-the-mountain-west>

⁹ <https://www.mining.com/american-rare-earths-boosts-tonnage-at-halleck-creek-project-in-wyoming/>

¹⁰ <https://www.globenewswire.com/news-release/2024/02/15/2829539/0/en/Rare-Earth-Oxides-Market-Powering-Sustainable-Technologies-and-Green-Initiatives-with-market-Size-Share-to-Exceed-USD-25-1-Billion-by-2034-at-CAGR-of-15-60-By-PMI.html>

¹¹ <https://wyoenergy.org/portfolio/next-generation-energy/>

¹² <https://thedriven.io/2023/04/03/hydrogen-for-long-distance-trucking-makes-no-sense-says-expert/>

¹³ <https://www.technologyreview.com/2023/02/23/1069086/when-hydrogen-will-help-climate-change-and-when-it-wont/>

¹⁴ <https://www.cnn.com/2023/05/11/world/carbon-capture-removal-pollution-climate-intl/index.html>

aggressive expansion of wind energy in the state would bring in approximately \$89 million per year in tax revenues and create approximately 1,500 long-term operations and maintenance jobs¹⁵. This would be a positive economic impact, to be sure, but for comparison Wyoming's employment total in resource extraction in 2019 was almost 25,000¹⁶.

Collectively these resource and energy opportunities are exciting, and it is important that Wyoming dedicates resources to pursue them. However, the significant uncertainty and market size limitations associated with these opportunities means that Wyoming cannot credibly ignore other diversification paths. The worst-case scenario – that few of these opportunities work out for Wyoming on a large scale – could, unfortunately, very well happen.

Agriculture

Fundamentally, there are two ways a place can expand its agricultural output: by either increasing the area of land that is cultivated, or by increasing productivity so that the same land area yields more output. Unfortunately, neither of these pathways look sufficiently strong in Wyoming to provide transformative growth.

Of Wyoming's 62.1 million acres of land, 25.1 million acres constitute privately owned agricultural land (40% of the total). Considering that just under half of Wyoming's land is owned by the federal government, this means that a very high share of Wyoming's available private land is used for agriculture – around 80%. What's more, large amounts of federal land are also used for grazing¹⁷. There is thus not much room to expand the amount of land used for agriculture in Wyoming.

Large productivity gains, on the other hand, are possible in theory but not in practice. Figure 7 shows gross earnings per acre for Wyoming's major agricultural commodities, as calculated from the 2022 Wyoming Agricultural Statistics¹⁸. Crop agriculture, unsurprisingly, earns far more per acre of land than livestock (the latter of which is dominated by ranching). The true difference may in fact be understated in this graph, as the underlying data does not include public grazing lands. Given that livestock accounts for more than 90% of agricultural land usage in Wyoming, increasing the scale of crop agriculture would, in theory, allow Wyoming to dramatically increase its agricultural output.

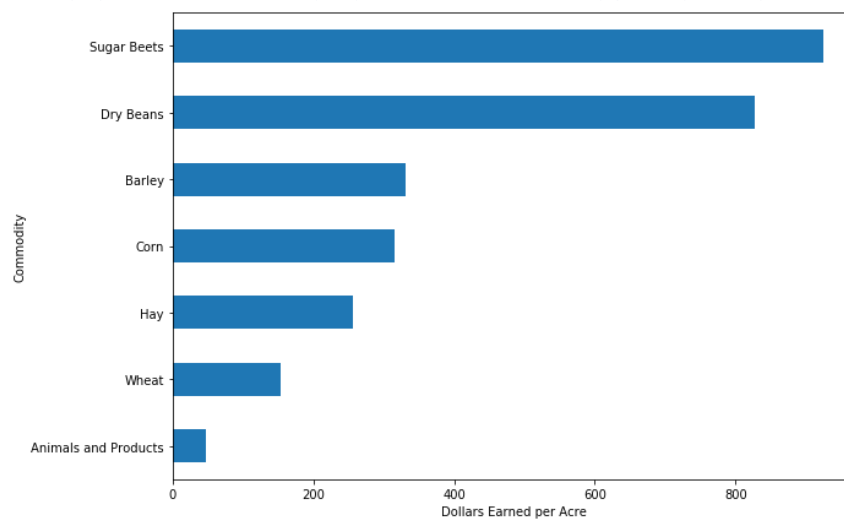
¹⁵ https://www.uwyo.edu/ser/research/centers-of-excellence/energy-regulation-policy/_files/wind-energy-report.pdf

¹⁶ http://eativ.state.wy.us/i&e/wyemp01_21.htm

¹⁷ <https://www.blm.gov/programs/natural-resources/rangeland-and-grazing/rangeland-health/wyoming>

¹⁸ https://www.nass.usda.gov/Statistics_by_State/Wyoming/Publications/Annual_Statistical_Bulletin/WY-2022-Bulletin.pdf

Figure 7. Gross Earnings per Acre Farmed by Agricultural Commodity for Wyoming, 2021.



Sources: Wyoming Census of Agriculture, State Agriculture Overview

In practice Wyoming's water scarcity places sharp constraints on the extent to which more crop agriculture is possible. Wyoming presently uses about half of the water to which it is entitled¹⁹, and more than 95% of that water usage is consumed by irrigation for crops²⁰. Wyoming could thus theoretically double its production of crops before running out of water, raising its gross agricultural earnings by 25% (assuming gross earnings from crops, based on the year 2021, would also approximately double) or \$736 per person. This is, of course, small compared to the more than \$20,000 of revenue per person that Wyoming's resource extraction industries create, and it would also be unwise for Wyoming to exhaust its water resources.

Official statistics on dairy production are unfortunately less detailed, and do not allow a systematic analysis of land and water usage. Interviews with experts indicate, however, that dairy would (like crop production) earn significantly more per area of land used, at the cost of enormously higher water consumption. In light of Wyoming's water constraints, a large expansion of dairy production in Wyoming thus also does not seem viable.

Given that Wyoming has very limited scope to increase its use of land and water as inputs to agriculture, there is not a plausible path to transformative growth for Wyoming's agricultural sector. Wyoming should instead expect more regular, moderate growth in its agricultural sector driven by technological progress.

Tourism & Recreation

Wyoming features a strong tourism sector centered around outdoor recreation, and especially Yellowstone National Park. The top 10 states in terms of GSP per capita in Arts, Tourism, Recreation, and Food Services are as follows:

¹⁹ <https://leg.mt.gov/content/Committees/Interim/2021-2022/Water-Policy/Jan2022/Wyo-WDO-2020Rept.pdf>

²⁰ <https://www.usgs.gov/centers/wyoming-montana-water-science-center/science/water-use-wyoming>

Box 1. GSP per Capita in Tourism in 2022, Top 10 States

State	GSP per Capita from Arts, Tourism, Recreation, and Food Services, 2022
Nevada	\$10,324
Hawaii	\$7,643
Vermont	\$4,671
New York	\$4,523
Colorado	\$4,329
Tennessee	\$4,322
Wyoming	\$4,086
California	\$4,076
New Hampshire	\$4,051
Massachusetts	\$4,007

Source: US Bureau of Economic Analysis

Tourism is a well-established sector and Wyoming is endowed with incredible natural beauty. There may be some realistic prospects for growth of the tourism sector in Wyoming with the right investments in advertising, infrastructure, etc. It is important to be sober, however, about the amount of growth this could credibly represent. Wyoming is already among the best-performing states in this sector, and perhaps it could plausibly move up a few hundred dollars per person in income. The states in the very highest ranks, however – Nevada and Hawaii – have some of the most highly-demanded amenities in the world (respectively, Las Vegas and Hawaiian beaches).

A related element of income for Wyoming is the manufacture of goods used for outdoor recreation. This income should arguably be understood as part of the manufacturing sector (which is addressed in a subsequent section of this report), however, because like other forms of manufacturing it depends on human skills and not directly on the natural endowment of the land in the same way that other tourism (like that associated with demand for skiing or hiking) does.

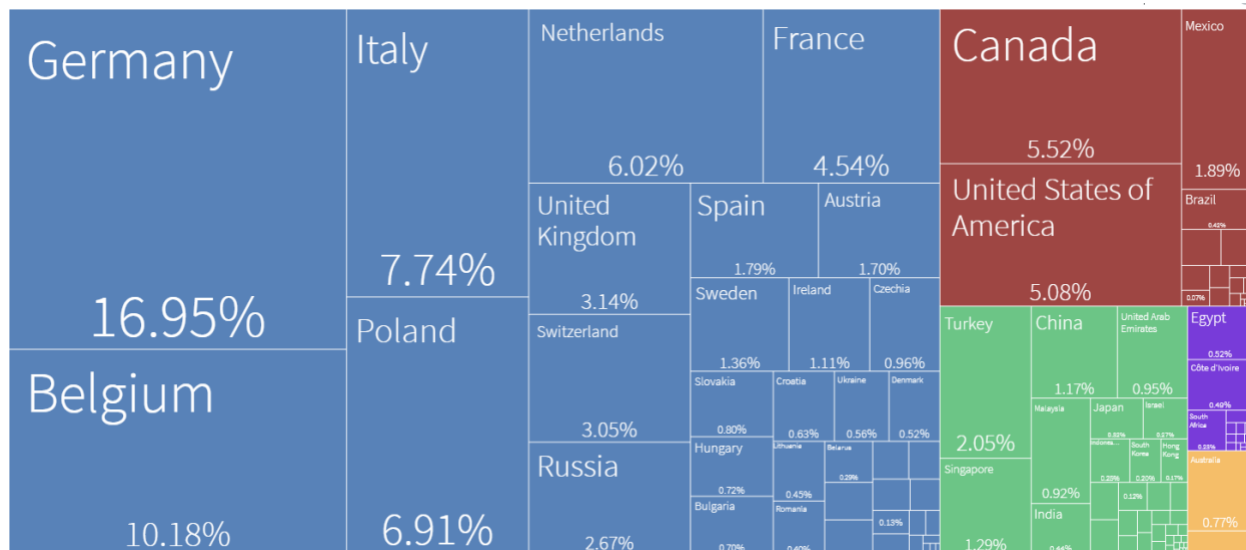
Adding Value to Raw Materials

A commonly-discussed economic strategy for Wyoming is to add value to the raw materials it extracts, for example by manufacturing trona into glass or soda ash. The key argument behind this idea is that performing value-added manufacturing in Wyoming would save the costs of transporting the raw material in question to a factory somewhere else.

Unfortunately, this strategy is not credible. In the modern global economy raw materials are easily traded over long distances, whereas the location of a factory is more seriously constrained by factors that cannot easily be moved across borders – such as access to large pools of skilled labor and proximity to industrial supply chains connections.

A compelling example of this logic comes from the global distribution of chocolate production. Figure 8 shows which countries had what shares of global chocolate exports in 2021:

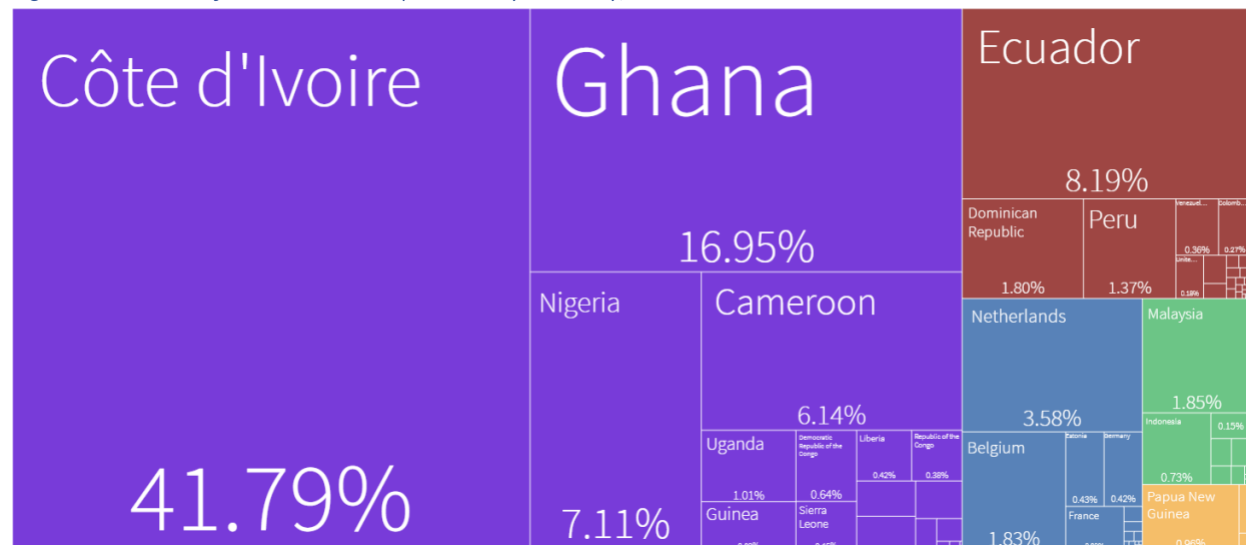
Figure 8. Shares of Global Chocolate Exports by Country, 2021.



Source: Atlas of Economic Complexity

Evidently, the global leaders in chocolate production tend to be wealthy industrialized countries – and importantly, those with temperate climates where raw cocoa does not grow. The treemap below shows instead which countries had what shares of global cocoa bean exports in 2021:

Figure 9. Shares of Cocoa Bean Exports in by Country, 2021.



Source: Atlas of Economic Complexity

In contrast to the previous treemap, this one is clearly dominated by developing tropical countries whose climates are well-suited to grow cocoa (although some European countries feature less prominently as re-exporters of cocoa beans).

These treemaps demonstrate that localized access to the raw material in question – cocoa beans – is not the key determinant factor that decides which countries produce the value-added product, chocolate. Cocoa beans, like any raw material, are transportable, and global chocolate producers ship cocoa beans

to advanced industrialized countries where they are manufactured into chocolate. These advanced countries may not be able to grow their own cocoa beans, but they have skilled workforces and long histories of artisanship creating high-quality chocolate. That workforce, of course, is not transported nearly as easily as raw cocoa beans.

Wyoming needs to look beyond its natural resources

Wyoming's natural endowments offer ideas for further diversification opportunities that are either highly uncertain (in natural resources & energy), modest in size (in agriculture and tourism), or outright unworkable (adding value to raw materials). These sectors do not provide a secure path to large diversification opportunities.

That is not to say that Wyoming should not pursue diversification opportunities related to natural resources. On the contrary, modest and/or uncertain growth opportunities related to natural endowments can contribute to an overall solution and may have particular regional importance in some cases. But other sectors must also be seriously pursued; it is critical to examine why the state underperforms on many service and manufacturing industries, and determine what can be done to alleviate that underperformance.

Does Wyoming have transformational growth opportunities in manufacturing and services?

The sectors Wyoming is deficient in, manufacturing and sophisticated services, strongly depend on human skills and labor to succeed. This stands in contrast to natural resource sectors that depend on the endowments of the land. These kinds of skill-driven activities lend themselves well to the Growth Lab's economic complexity framework²¹. Economic complexity operates under the idea that some skills are shared across different economic activities, and thus that the presence of one particular industry can predict which other industries may be suitable for a community to pursue.

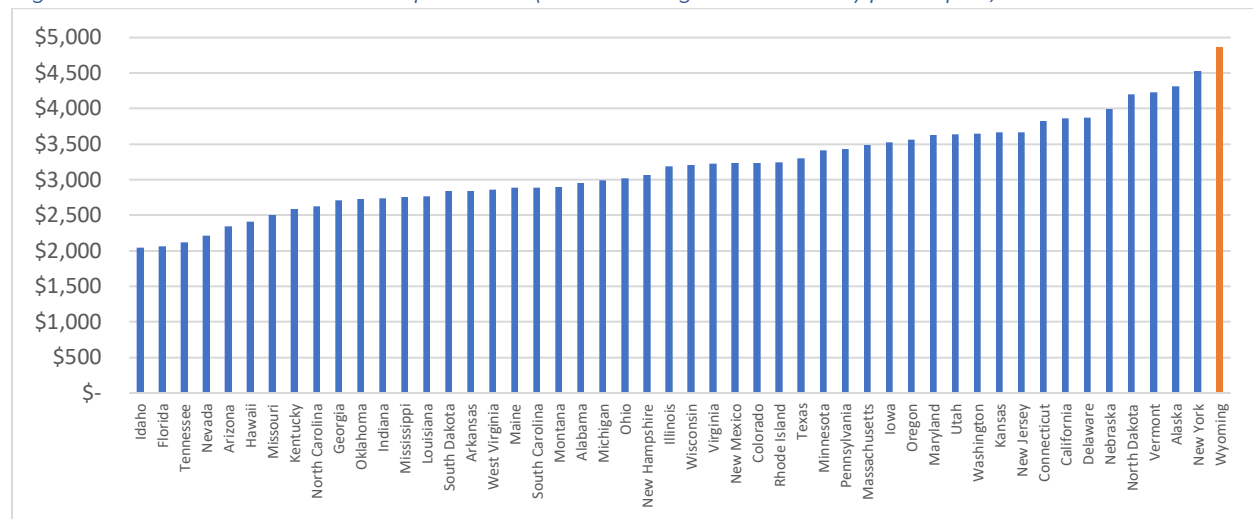
We use this methodology to empirically predict whether Wyoming has nearby, easy-to-reach economic diversification opportunities in manufacturing and services, as documented in Appendix A.1. Unfortunately, the immediate answer is "no." Wyoming's current economic structure predicts little expansion into these areas, which is why it has not diversified into them to date. However, this conclusion presents another question: *why* is it currently implausible for Wyoming to expand into manufacturing and service industries? If deeper constraints can be solved, it may be possible to unlock a path for Wyoming to participate in these advanced sectors.

²¹ <https://direct.mit.edu/books/oa-monograph/3014/The-Atlas-of-Economic-ComplexityMapping-Paths-to>

How the Emigration of Wyomingites Holds Back Economic Diversification

As detailed in Appendix A.2., advanced manufacturing and service industries critically depend on access to large pools of skilled workers to succeed. This poses a major challenge for Wyoming given that it is a small rural state. That necessity is nevertheless well-recognized, and is arguably a key reason²² the state spends so much on education (Figure 10) – there is an impetus to maximize the potential of the labor force Wyoming does have access to.

Figure 10. Total State Education Expenditure (K-12 and Higher Education) per Capita, 2021.



Source: US Census Bureau, Compiled by Urban-Brookings Tax Policy Center

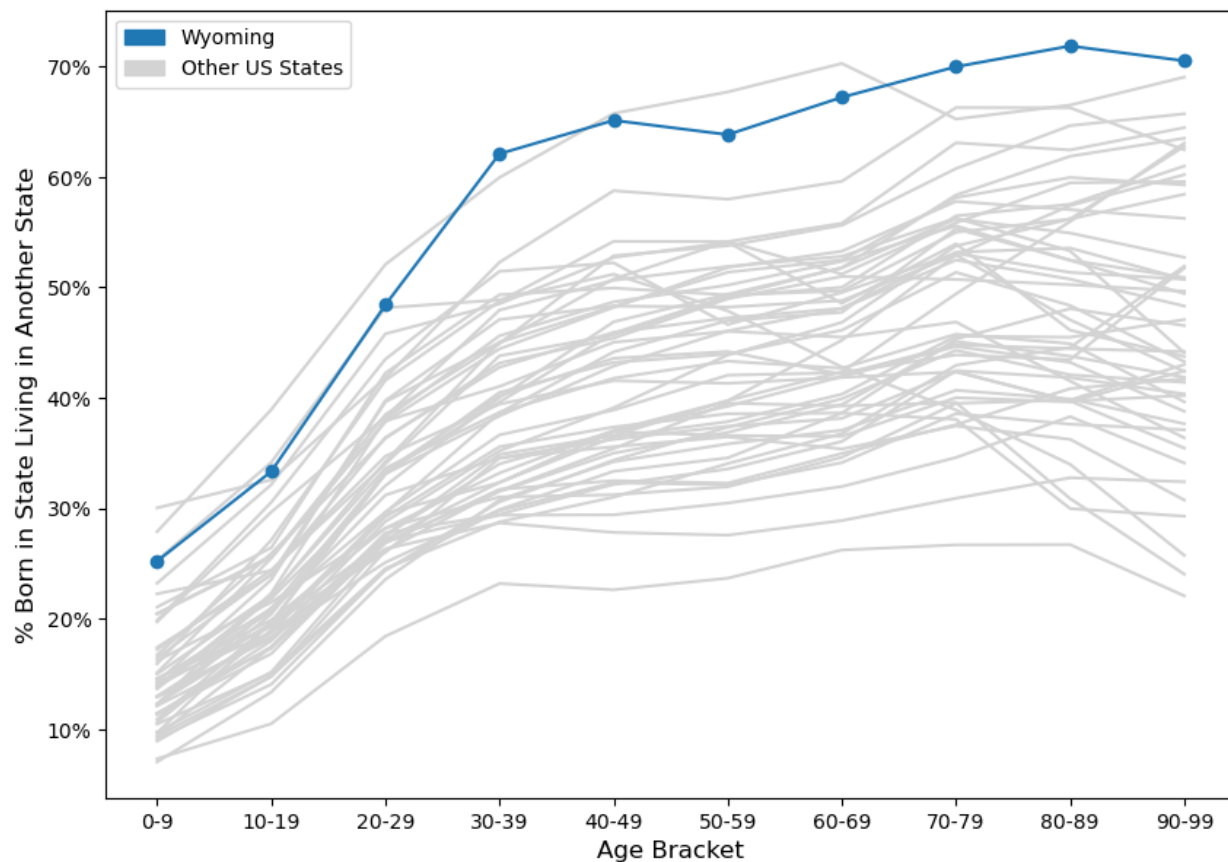
This investment in education is essential for Wyoming to build up a homegrown skilled labor force. The missing ingredient, however, is the state's ability to retain young people. People born in Wyoming leave the state at one of the highest rates in the country (Figure 11), and even more specifically some 70% of University of Wyoming graduates leave Wyoming²³. While much-touted in popular discussion in Wyoming, the "boomerang" effect of people returning to the state as they age is evidently quite weak and does not substantially offset these losses. Indeed, Figure 11 shows that the share of people born in Wyoming living outside the state does not significantly decrease after a certain age (as one would have expected from a boomerang effect), but remains very high.

²² Wyoming's push into Computer Science education is one salient example, see:

<https://www.forbes.com/sites/jennaarnold/2018/02/13/wyomings-next-frontier-computer-science/>

²³ <https://impact307.org/2023/04/25/uw-working-to-keep-grads-in-wyoming/>

Figure 11. Share of People Born in State Living in Another State, 2022.



Source: American Community Survey

The exodus of young, educated Wyomingites places obvious limitations on the state's diversification potential, because the requisite workforce leaves rather than stays.

Wyoming already has half the solution to its economic diversification challenge: it provides outstanding education. For example, in 2022 its National Assessment of Education Progress scores were the 6th highest of any state²⁴. It urgently needs to fix the remaining major factor, its exodus of young adults and families. If it succeeds in this regard, Wyoming will move to a new equilibrium where its economy can readily access a significant pool of homegrown talent.

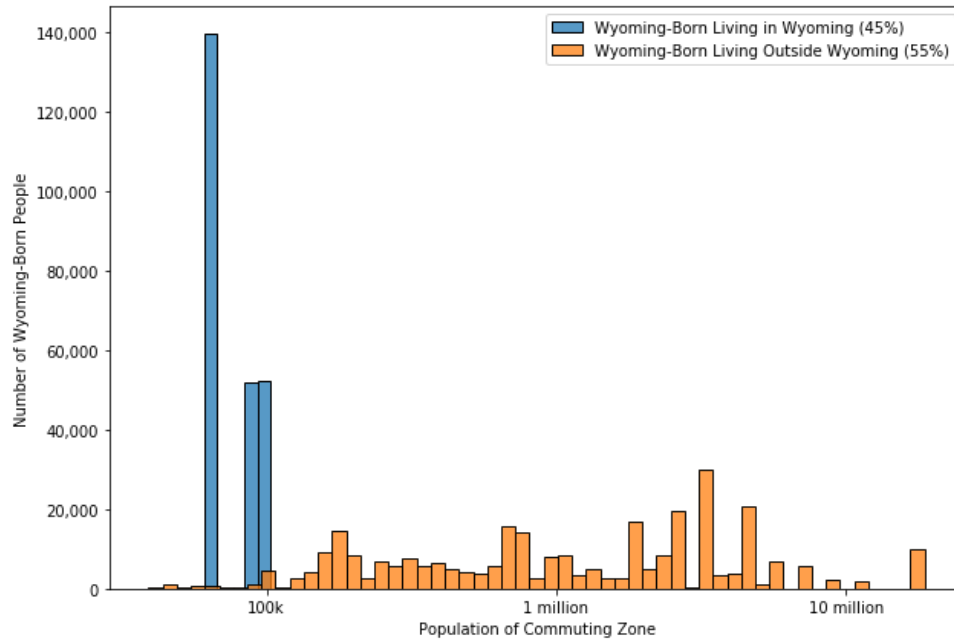
Why do Young Adults and Families Leave Wyoming?

The key first-order reason why people leave Wyoming is to live in bigger cities. Figure 12 shows the distribution of where people born in Wyoming live in terms of the population size of the Commuting Zone they inhabit. Wyoming-born people who live outside the state overwhelmingly live in larger communities than their counterparts who have remained in Wyoming.

²⁴ <https://ignitewy.org/wp-content/uploads/2023/01/Wyomings-National-Rank-Quality-Counts-and-NAEP.pdf>

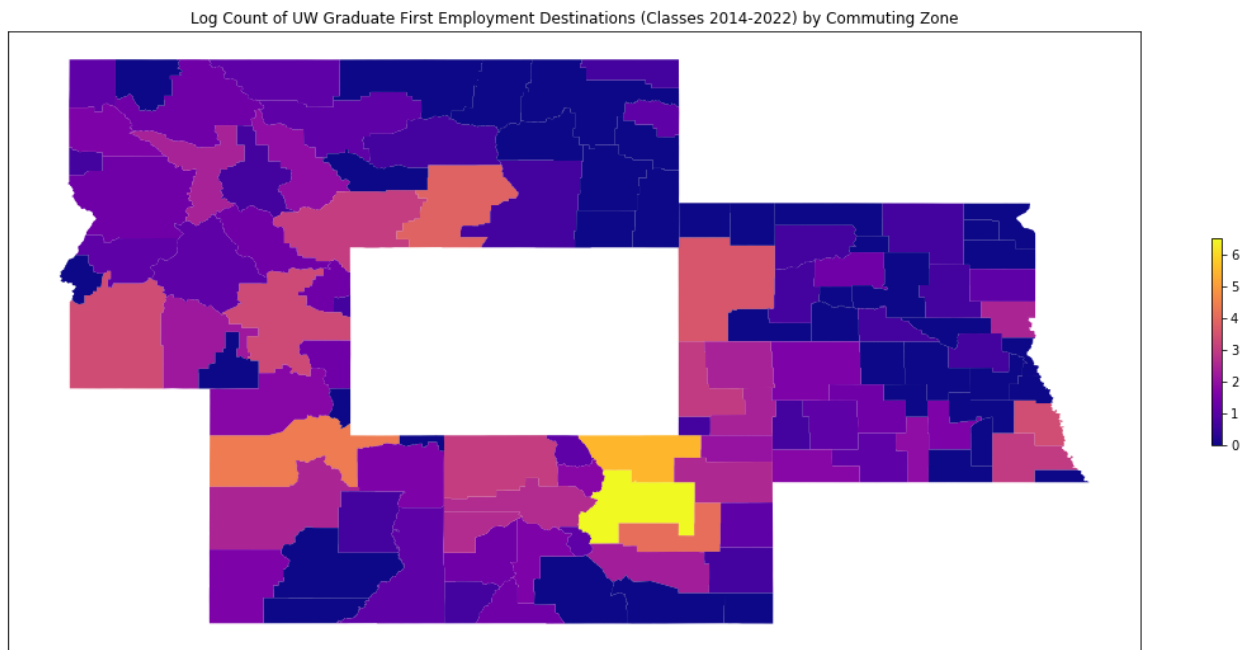
Figures 13-14 use exit survey data to analyze the first destinations of University of Wyoming graduates from the classes 2014 – 2022; the figures specifically look at how many graduates went to each Commuting Zone in the states that neighbor Wyoming. Graduates in the region are strongly attracted to large cities that are nearby Laramie, where the University of Wyoming is situated.

Figure 12. What Sized Communities do Wyoming-Born People Live In?



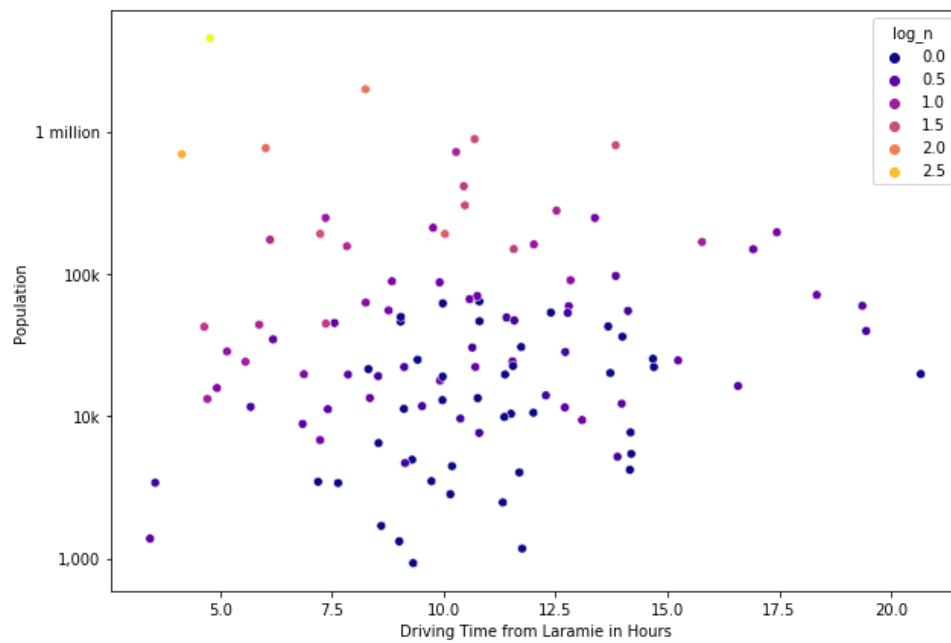
Source: 2019 5-Year American Community Survey

Figure 13. Log Count of UW Graduates' First Employment Destinations (Classes 2014-2022) by Commuting Zone in States that Neighbor Wyoming, Mapped



Source: University of Wyoming Exit Survey

Figure 14. Log Count of UW Graduates' First Employment Destinations (Classes 2014-2022) by Commuting Zone in States that Neighbor Wyoming, Scatter Plot



Sources: University of Wyoming Exit Survey, OpenStreetMaps, US Census Bureau

Ex-Wyomingites are evidently voting with their feet, leaving the state in favor of bigger cities. This presents a significant challenge for the state of Wyoming to solve. Even if it wanted to, Wyoming cannot wave a magic wand to simply create a city from thin air of the kind that ex-Wyomingites seem to prefer. Instead it is necessary to understand the specific push and pull factors that drive ex-Wyomingites to prefer these cities instead of Wyoming communities, and take action to improve on these factors where possible.

In a seminal paper, Glaeser and Gottlieb (2009) provide a helpful framework to think about the general reasons behind peoples' migration decisions. There are three broad categories of such push-pull factors, all of which are important:

1. House prices. These constitute the single largest location-specific living expense, and determine how costly it is for an individual to live in any given location.
2. Job availability. This determines an individual's economic payoff from living in a specific location, in terms of salary.
3. Amenities. These can be understood as factors that make a location inherently attractive to live in, such as its natural beauty, the availability of entertainment (e.g. at restaurants or concerts), and even livability issues such as access to healthcare or low crime rates. Peoples' preferences for amenities can be highly personal, but there are also some kinds of amenities that almost everyone values (such as the safety of a city or having good transportation infrastructure).

When people make migration decisions they take all of these issues into account together, and weigh the tradeoffs between them. Implicitly, people ask themselves, what will I get (in terms of economic payoff and enjoyment of amenities) for what I pay (the cost of housing)? The key takeaway for Wyoming is that it should strive to understand factors in this decision process where 1) it underperforms and 2) it can readily make policy changes to ameliorate that deficiency. By improving how it fares in this overall calculation, Wyoming can compete better against places like Denver, Fort Collins, and Salt Lake City and thus retain more of its young people.

Does housing drive emigration?

Housing, it turns out, is a surprisingly important weakness in the factors that lead young people to leave Wyoming, and one where there are clear policy actions that can fix the problem.²⁵ Wyoming has an overall deficiency of housing supply, and in particular an undersupply of housing that is attractive to young adults.

Consider the different types of housing a person typically uses at different stages of their life:

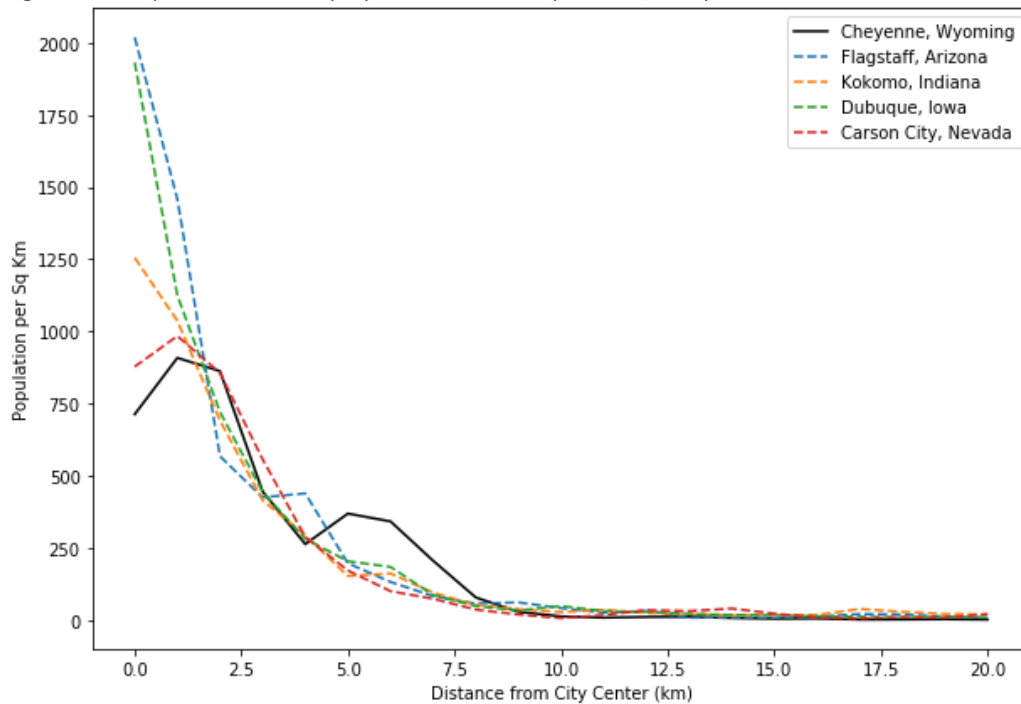
- Fresh college graduates typically prefer centrally-located apartments. These are not only affordable, but also very close to jobs, restaurants, and friends. Many young Wyomingites who move to Denver and Fort Collins anecdotally prefer and pursue this kind of lifestyle; for example, one company interviewed in Cheyenne opened a Fort Collins office simply to be able to hire all the young people who prefer to live there.

²⁵ See the Growth Lab's note on housing in Wyoming for additional detail:
<https://growthlab.hks.harvard.edu/sites/projects.iq.harvard.edu/files/growthlab/files/2023-04-cid-wp-435-wyoming-housing-note.pdf>

- Young families typically prefer starter homes that are modest in size and may have small yards. These have more space that is appropriate for a growing family, and are reasonably affordable for couples with a few years of career experience. These may be detached homes or townhouses.
- Established adults with mature careers typically prefer large detached homes. These are the most expensive housing option, but offer plenty of space to enjoy family activities.

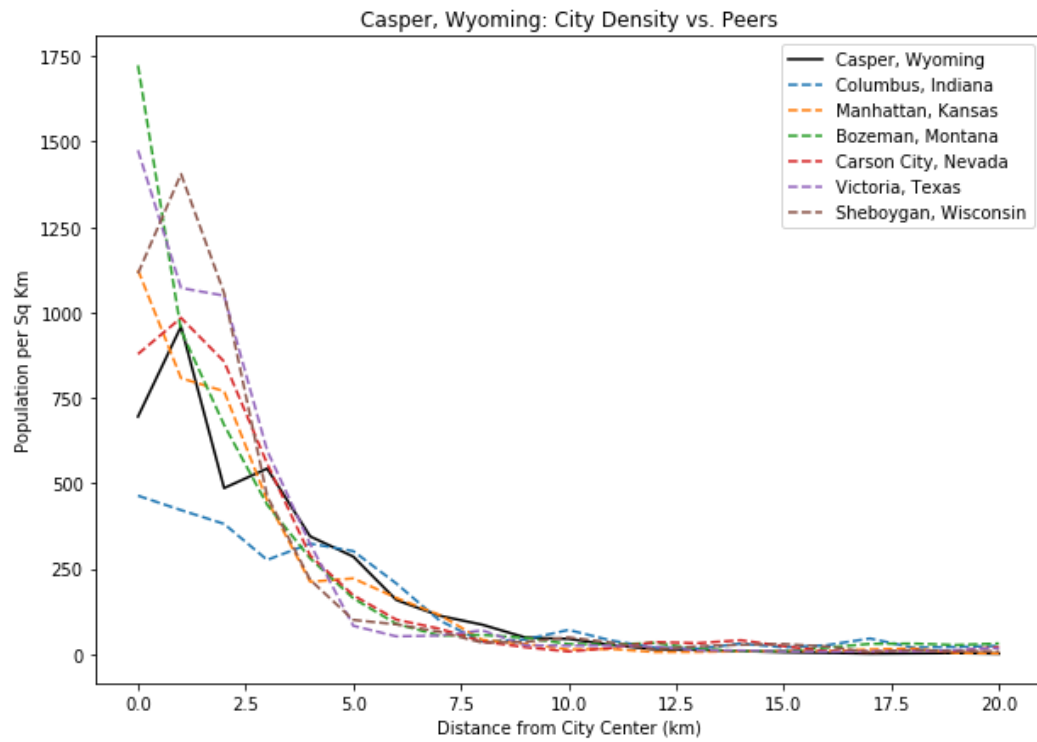
In general, Wyoming builds the highest number of large detached homes appropriate for adults with mature careers; some but not many starter homes that are appropriate for young recently married couples; and extremely few multi-family apartment buildings that the young adults who flock to Denver and Fort Collins pursue. This deficiency is directly evident in the urban geography of Wyoming cities. Figures 15 and 16 show that as compared to other US towns with very similar overall population, Cheyenne and Casper lack population density close to city center, which is reflective of a lack of dense, multi-family apartment buildings. In Figure 17 we are even able to obtain data on building heights for Laramie versus peer cities, and show that Laramie lacks tall buildings close to city center compared to peers.

Figure 15. Population Density by Distance to City Center, Cheyenne vs. Peers.



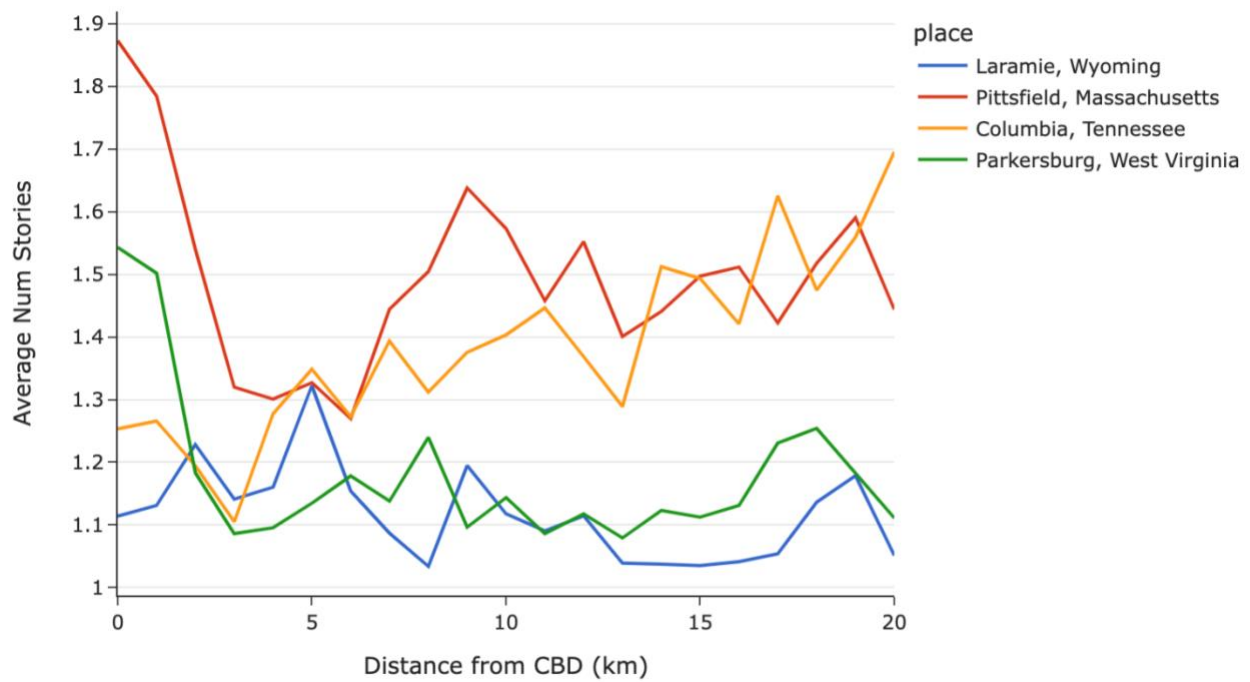
Sources: own calculations based on Meta High Resolution Population Density Maps, Dun & Bradstreet

Figure 16. Population Density by Distance to City Center, Casper vs. Peers.



Sources: own calculations based on Meta High Resolution Population Density Maps, Dun & Bradstreet

Figure 17. Average Number of Building Stories by Distance to City Center, Laramie vs. Peers.

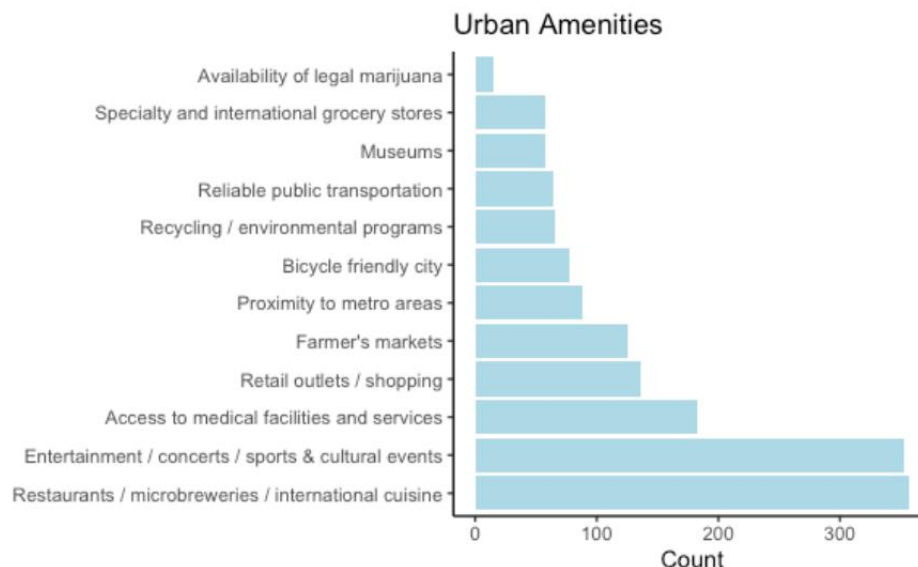


Sources: own calculations based on Regrid, Dun & Bradstreet

Not only does this lack of density near city center reflect an undersupply of the kind of housing young people pursue, but it directly leads to a deficiency of the urban amenities they are attracted to. Figure 18 reports results from a survey of University of Wyoming graduates, and shows that their top preferred urban amenity is restaurants. Numerous research papers show that denser housing causes a city to have more restaurants, plausibly due to increased local foot traffic (for example Liang and Adris 2021, Li 2022, Blanco and Neri 2023). Given the lack of downtown density in Wyoming communities it is thus unsurprising that, as reported in Figure 19, most Wyoming Commuting Zones have fewer restaurants than Colorado Commuting Zones with a similar population size. For example, the largest Wyoming Commuting Zone – that centered around Laramie County (i.e. Cheyenne) – has a population of just over 100,000, and it has 86 non-chain restaurants. In contrast the Commuting Zone centered around Montrose County in Colorado has only 87,000 people, yet in the data it has 206 non-chain restaurants.

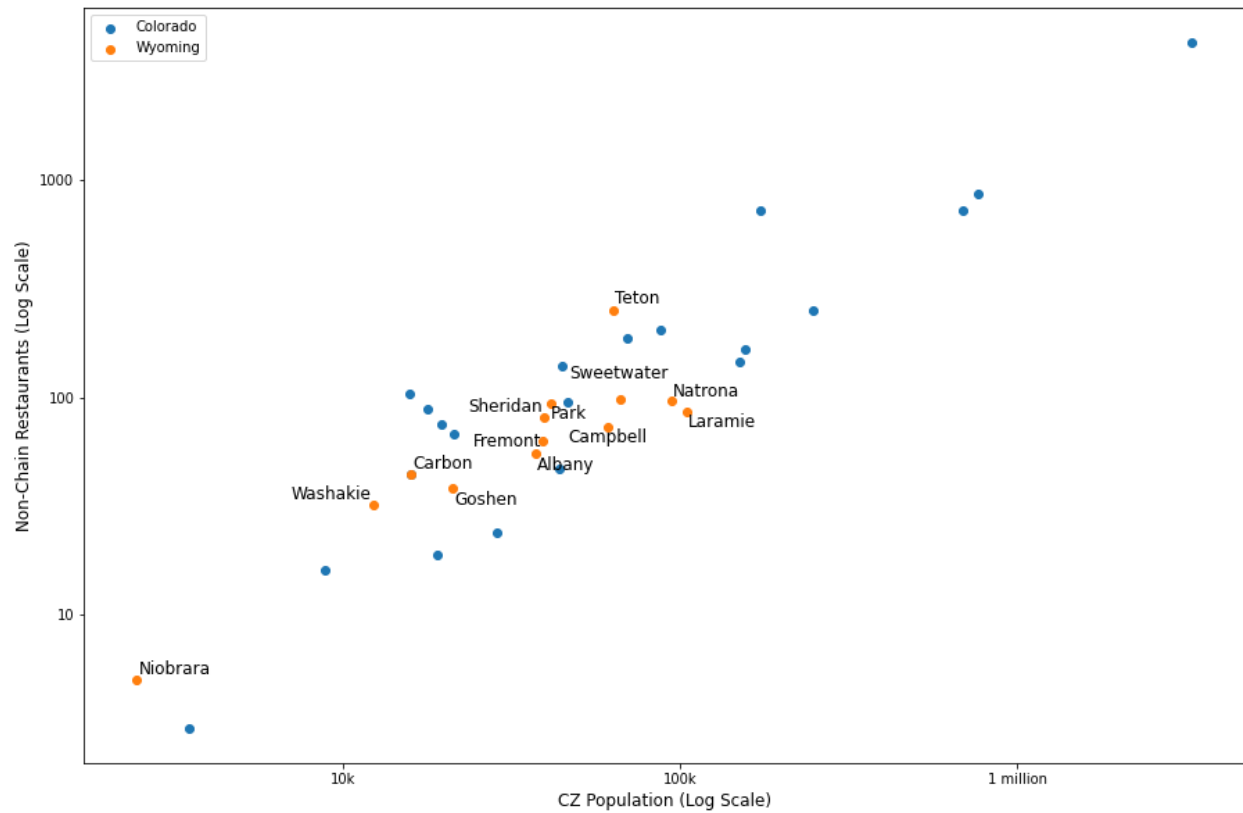
This undersupply of housing appropriate for young adults also fits into a broader picture of an undersupply of housing in Wyoming generally, which sends house prices up and thus creates yet another mechanism to drive away young people. Figure 20 shows computed elasticities of new housing supply to housing prices, and demonstrates that the vast majority of Wyoming counties' housing supply is less responsive to demand than the average US county. Sublette and Campbell County are possible exceptions, but this responsiveness may also reflect the construction of temporary housing to service their large mineral extraction industries.

Figure 18. Top Urban Amenities Desired by University of Wyoming Graduates, By Number of Respondents who Put Amenity in Top Three Choices



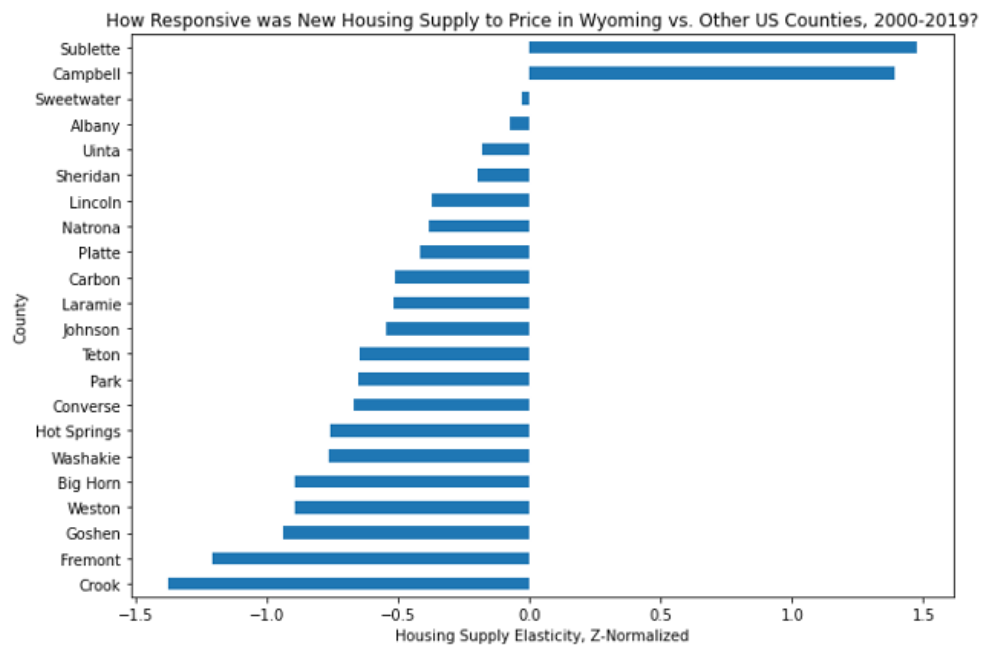
Source: University of Wyoming Survey

Figure 19. Population vs. Number of Non-Chain Restaurants among Colorado and Wyoming Commuting Zones



Source: Liang and Andris (2021)

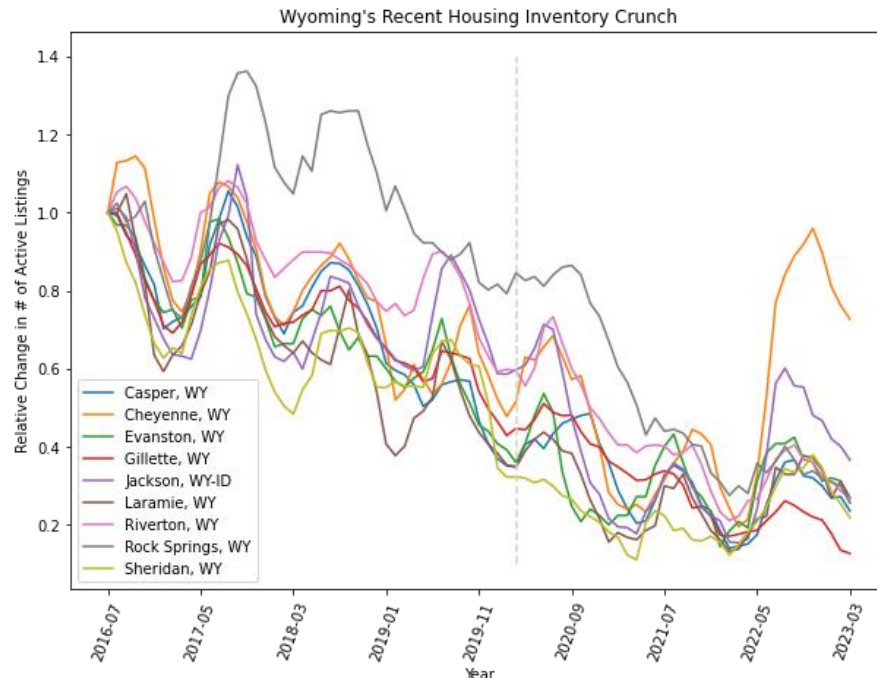
Figure 20. Elasticities of New Housing Supply to Price in Wyoming Counties vs US Average



Sources: own calculations based on US Census Bureau, Zillow

Perhaps unsurprisingly, the housing inventory on the market has also been falling in Wyoming towns in absolute terms since the earliest available datapoint in 2016 (Figure 21), although Cheyenne has made a laudable recent partial recovery.

Figure 21. *Fall of Wyoming's Housing Stock on the Market versus Summer 2016*

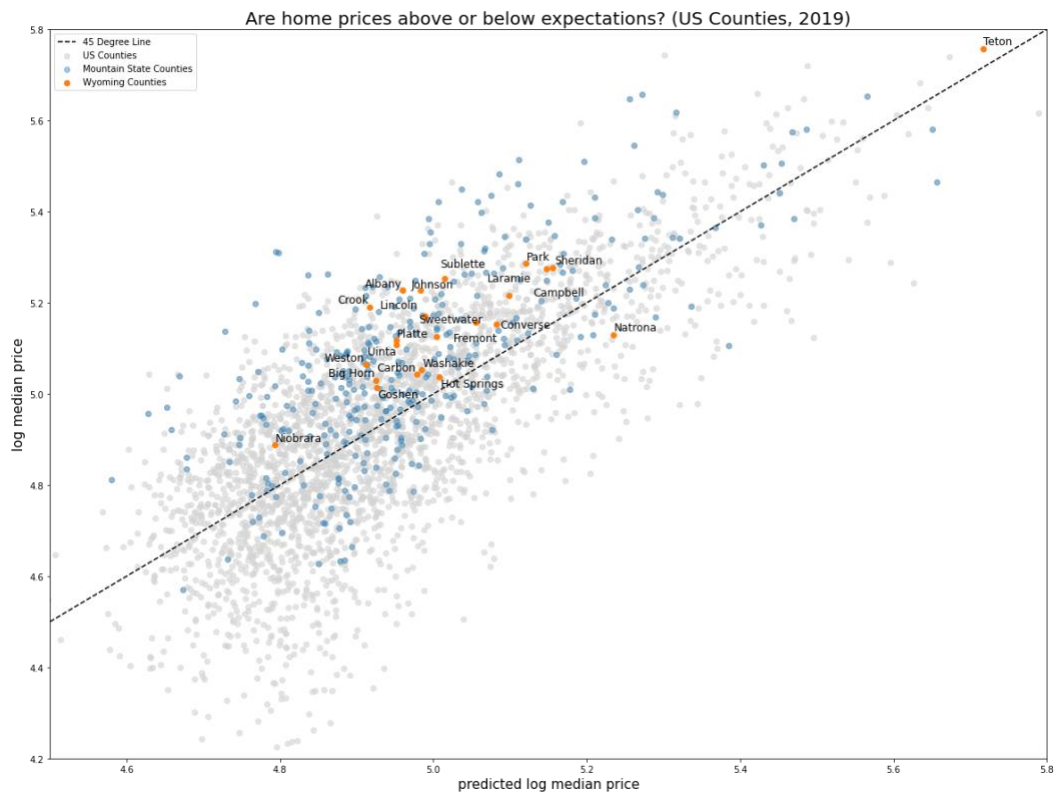


Source: *realtor.com*

Figure 22 shows that relative to economic fundamentals (i.e. controlling for factors such as income per capita, population, population density, and remoteness) housing prices in almost every Wyoming county were above expectations in 2019 – even before the COVID-19 pandemic sent house prices exploding across the globe. These elevated prices are a direct consequence of Wyoming's durable lack of housing supply. Despite much misinformed popular skepticism, research has demonstrated there is a convincing causal relationship between increasing the housing supply in a town and prices moderating²⁶. Critically, expanding market-rate housing not only works to improve affordability but is overall the most important factor to address housing prices in supply-constrained contexts. The Financial Times documents a series of examples of the relationship between housing supply and prices in different places around the developed world, as shown in Figures 23 – 26.

²⁶ See here for a literature review: <https://www.london.gov.uk/media/102314/download> and here for a readable summary thereof: <https://www.ft.com/content/86836af4-6b52-49e8-a8f0-8aec6181dbc5>

Figure 22. Actual vs. Predicted Home Prices by US County, 2019



Sources: own calculations based on Zillow, US Census Bureau, Bureau of Economic Analysis, OpenStreetMaps

Figure 23. Housing Supply and Prices in Texas vs. California.

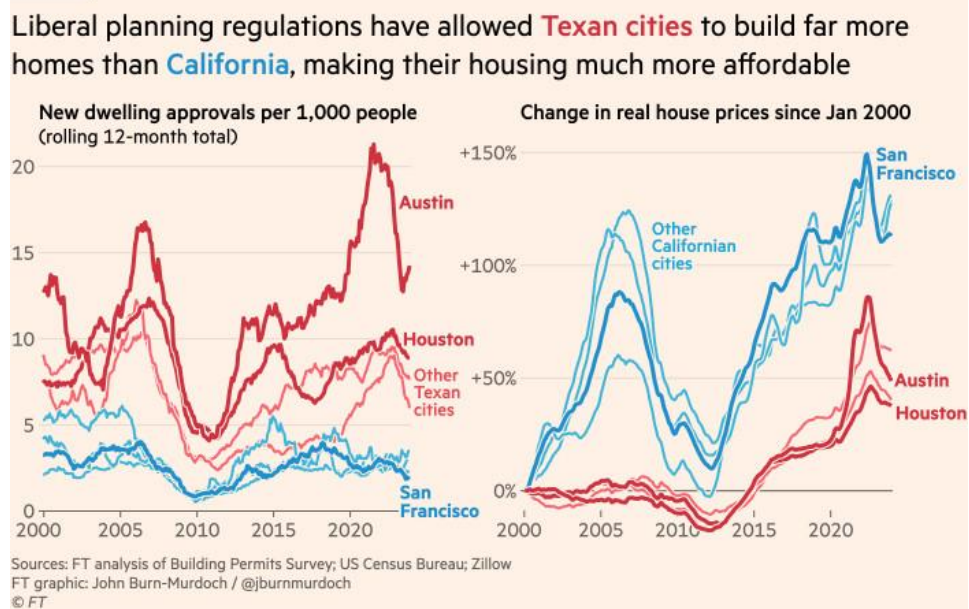


Figure 24. Housing Supply and Prices in Croydon vs. Other Boroughs of London, UK.

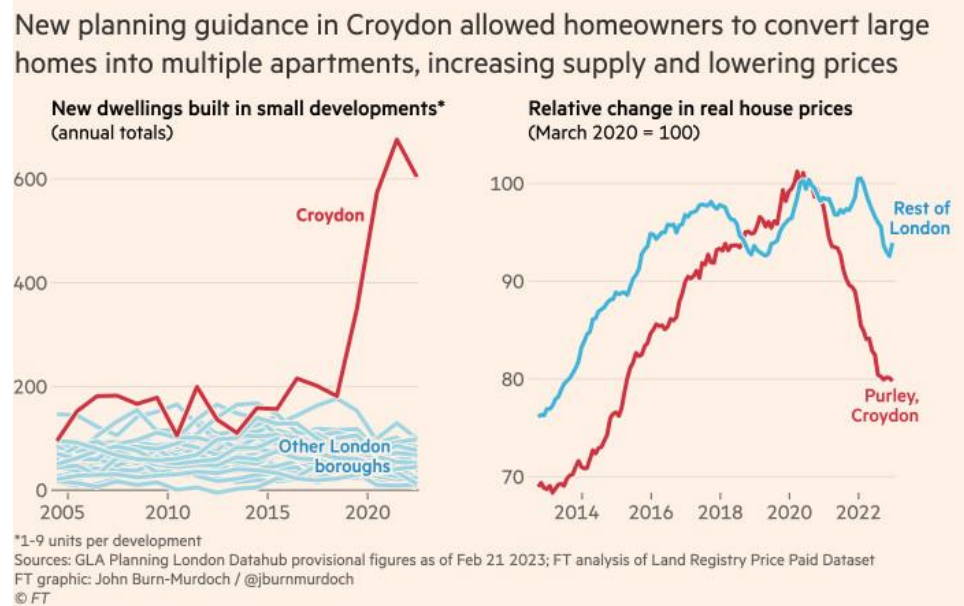


Figure 25. Housing Supply and Prices in Auckland vs. Wellington, New Zealand.

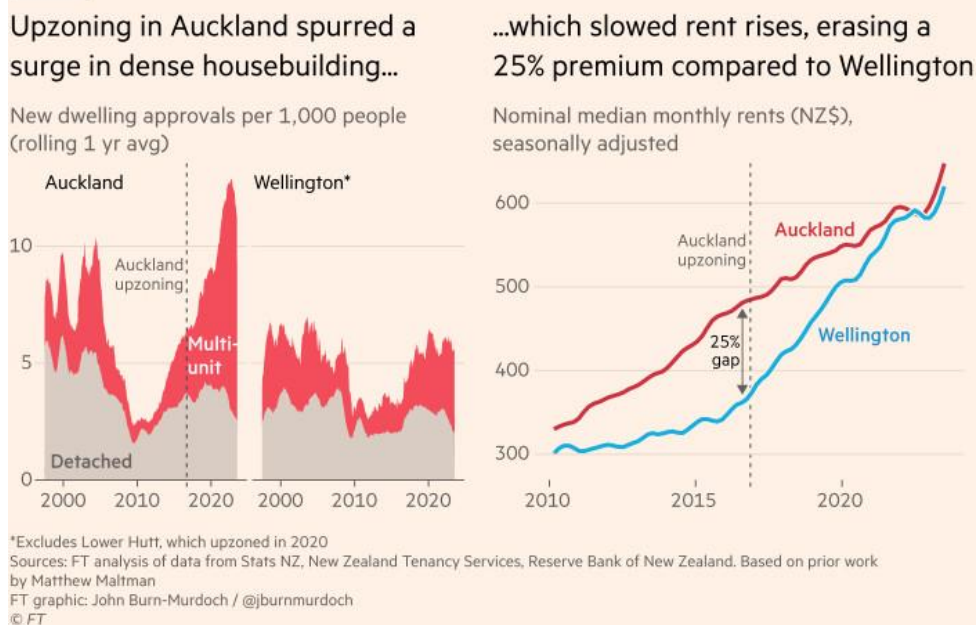
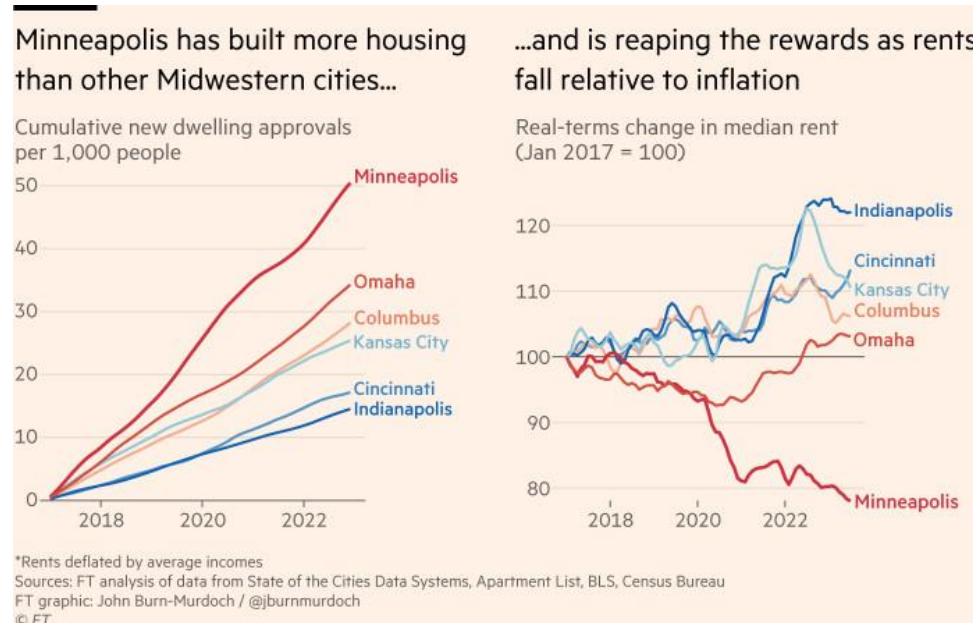


Figure 26. *Housing Supply and Prices in Minneapolis vs. Other Midwestern Cities.*

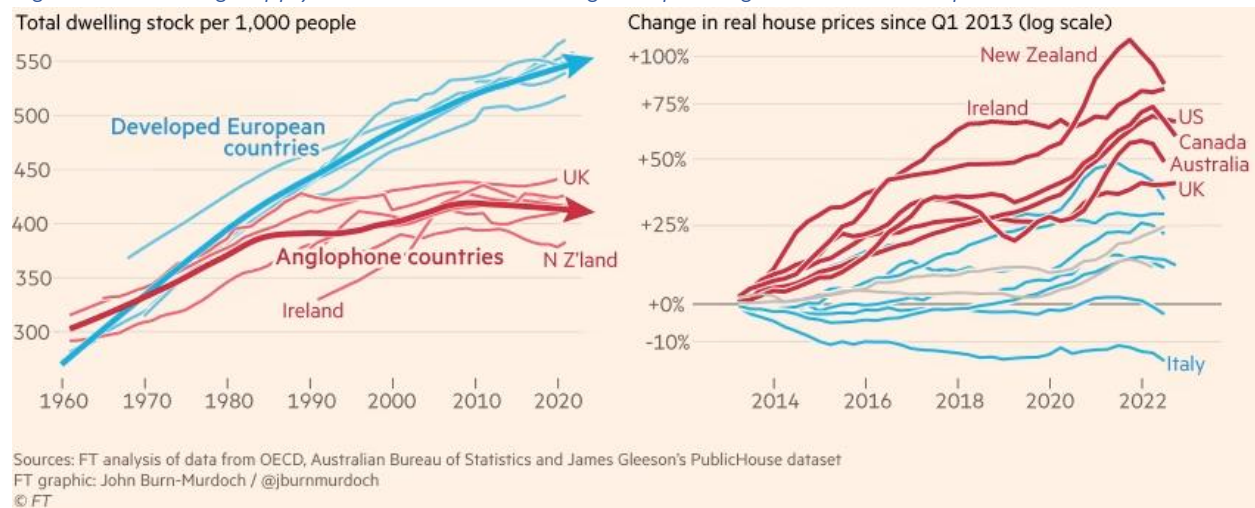


Wyoming's lack of housing for young people thus creates a related set of problems that ultimately drive them away. First, it means there is simply a lack of desirable places to live. There are only so many dense downtown apartment buildings in Wyoming of the kind one might find in Fort Collins and Denver. Second, this lack of downtown density directly leads to a lack of restaurants, which young people highly demand. Third, the overall lack of housing supply sends housing prices in Wyoming to levels above what economic fundamentals would suggest, which makes it more expensive to live in Wyoming than it needs to be.

It is important to ask in turn, why does Wyoming have such serious shortages of housing appropriate for young people (and of housing in general)? As documented by the Financial Times (Figure 27), the English-speaking world in general has suffered from shortages of housing and commensurately high price growth (especially since the late 1980s²⁷). The most plausible unifying factor that leads these English-speaking countries to have so little housing is their use of common-law legal institutions, which is important to understand because it quickly suggests that there are likely legal-regulatory problems responsible for housing shortages.

²⁷ Historically there was a large expansion of suburban road networks and housing in the decades following WWII. In English-speaking countries, however, common-law institutions facilitated the implementation of strict local zoning laws (as part of a backlash against perceived 'excessive' housing construction) that was not possible to the same extent in countries with different institutions. In countries where housing policy is decided nationally, local opposition to further expansion of the housing supply did not have a clear institutional pathway to translate to laws that obstruct housing construction.

Figure 27. Housing Supply and Price Growth in English-Speaking vs. Other Developed Countries.



Wyoming, unfortunately, underperforms in this regard. One study that examines zoning- and land-use-related lawsuits per capita found that Wyoming is in approximately the top third of the most overregulated states on the issue of housing²⁸. Another study used natural language processing, a type of machine learning, to analyze the strictness of housing laws of more than 2,600 US towns and cities²⁹. While not every Wyoming town is included (due to the varying ease of digitally accessing such laws for different towns), many that are in the data do not compare favorably. Table 2 shows how overregulated several Wyoming towns are compared to the rest of the US.

As such, Wyoming is in a situation where the country it is in, the US, underperforms on housing compared to other developed countries. Yet even within the US, Wyoming has more severe supply problems than average, and has higher prices than economic fundamentals would justify – and also has more restrictive regulations on housing density than average.

Table 2. Degree of Housing Overregulation in Wyoming Municipalities.

Municipality	More Restrictive Density Regulations Than This % of US Municipalities
Rawlins	63%
Laramie	83%
Casper	95%
Douglas	95%
Jackson	98%

Practically, these regulations feature in many facets of local- and state-level housing laws. Examples of density restrictions include zoning that forbids multi-family homes, minimum lot sizes, minimum setbacks, maximum building heights, minimum parking space requirements, and maximum housing units

²⁸ <https://www.cato.org/sites/cato.org/files/pubs/pdf/pa-823.pdf>

²⁹ <https://journals.sagepub.com/doi/full/10.1177/00420980231156352>

per area of land. Barriers in the housing approvals process include the use of protest petitions, which allow an extremely small minority of a town's electorate to veto a housing project, and the use of extended multi-round public hearings.

Developers also note that a lack of investment in arterial infrastructure is a significant barrier to construction. One quantitative signal of this constraint is the fact that ARPA funds for water infrastructure in Wyoming were heavily oversubscribed, with more than \$225 million in requested funds from a pot of money of approximately \$60 million. This issue is closely related to the challenges of Wyoming's fiscal system, which has very low tax rates and thus limits the funds available for infrastructure investment. As documented in the Growth Lab's Housing Note³⁰, there is evidence that labor costs, material costs, and the extent of federal land ownership in Wyoming are not binding constraints to housing expansion.

Overall, as such, Wyoming faces a powerful lever to fix its problems with urban design that drive away young adults and families. Both local and state governments can dramatically reduce regulatory restrictions on dense multi-family housing, which will create denser downtown environments that are attractive to young adults. This can be complemented with more funding for arterial infrastructure, so that developers can rapidly expand housing wherever regulatory restrictions are relaxed. Various levels of government in Wyoming have already begun to take laudable strides toward these goals, and there is a strong opportunity to build on this momentum for leaders across the state.

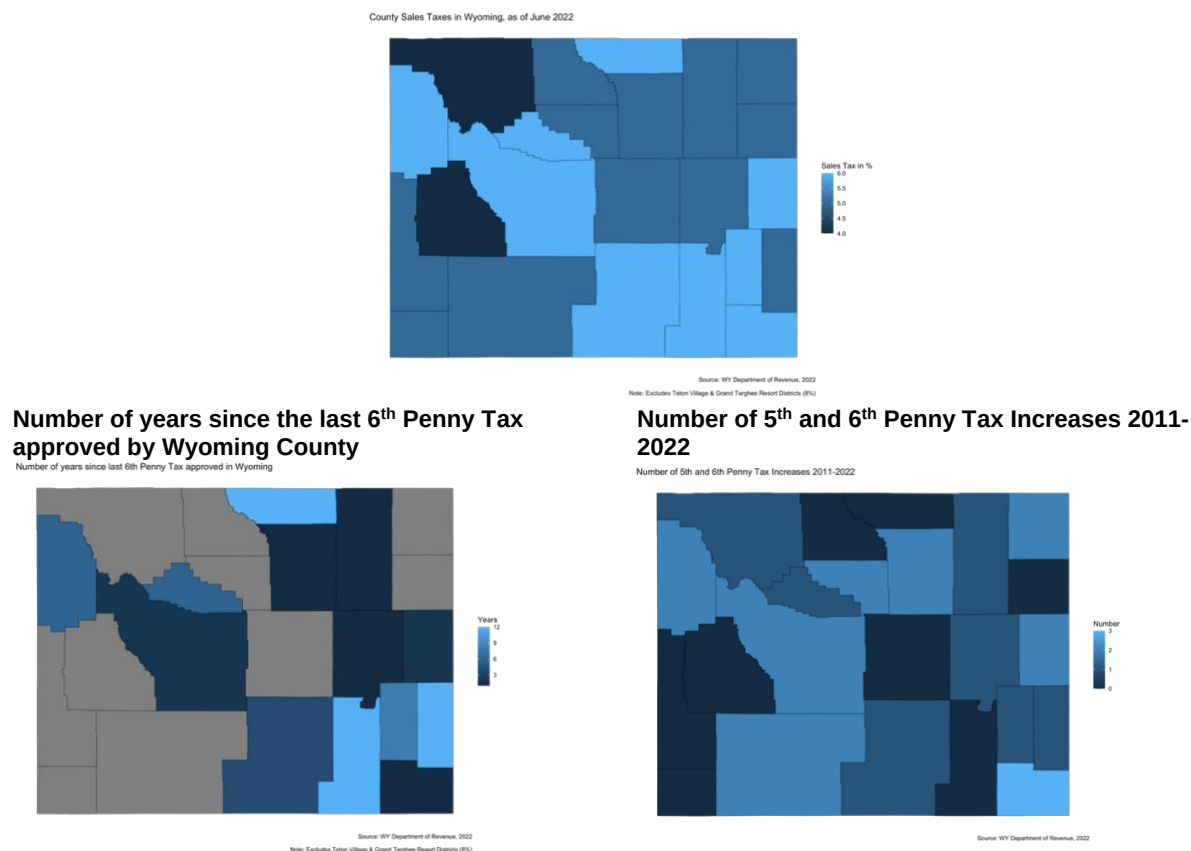
Does a lack of financial investment in community assets drive emigration?

Another determinant of migration decisions is the extent of investment in community assets such as essential infrastructure and publicly-provided amenities. These impact the overall attractiveness of a town as a place to live in, and thus its potential to retain young people who might migrate elsewhere. The available evidence suggests that funds for these investments are undersupplied, and that many Wyoming communities are particularly missing out on federal grants opportunities.

A general indication of the demand for funds for such assets comes from the prevalence of penny taxes in Wyoming. These special-purpose taxes allow counties to raise the sales tax rate beyond the state baseline of 4%, either to 5% or 6% (but no higher), in order to fund voter-approved projects (for example transportation or fire service infrastructure and equipment, community centers, etc.). All Wyoming counties except Park and Sublette currently use the 5% penny tax (and Park used it up until April 2022), and half of Wyoming counties use the 6% penny tax. In many communities these penny taxes have a history of frequent use; Figure 28 shows the current sales tax rate, number of years since last 6th penny tax approval, and the gross number of 5th and 6th penny tax increases since 2011. For example, the 6th penny tax has been used in Laramie county three times since 2011, and Albany and Sheridan counties have applied the 6th penny tax consistently since that year.

³⁰ <https://growthlab.hks.harvard.edu/sites/projects.iq.harvard.edu/files/growthlab/files/2023-04-cid-wp-435-wyoming-housing-note.pdf>

Figure 28. Use of Penny Taxes by Wyoming County.

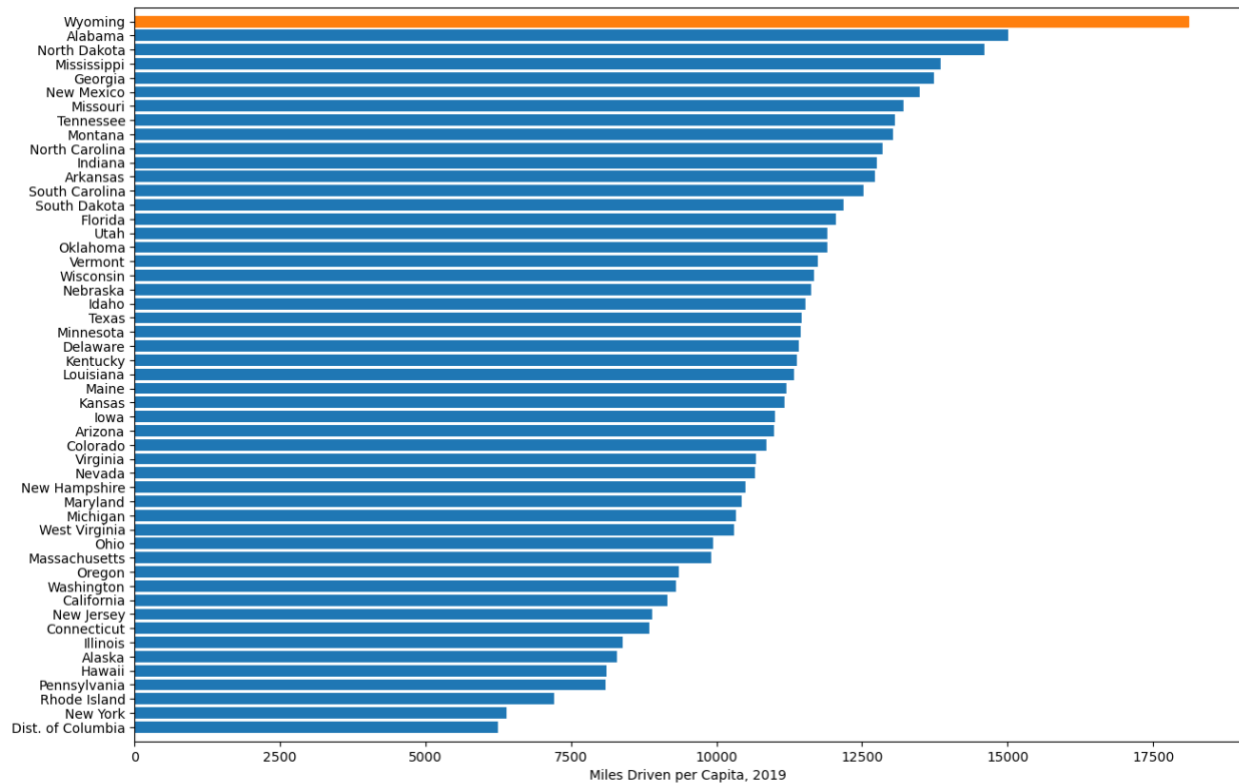


Evidently, in a number of Wyoming communities there is high demand for these kinds of funds. Given that about half of counties are right at the limit of how high they're allowed to push the sales tax, there may be further demand for funds to invest in community assets that is unmet.

Additional evidence can be found about demand for funds in specific policy domains. As mentioned in the previous section on housing, for instance, there is significant unmet demand for funds for water infrastructure in Wyoming. Investment in transport arguably forms another such area. Figure 29 shows that Wyomingites drive the most miles per capita of any US state (by a considerable margin), indicating that there is very high demand for transportation infrastructure (such as highways, bridges, etc.). Yet funding for transportation is also plainly undersupplied: the Wyoming Department of Transportation reports³¹, for example, that while most states' funding for roads and bridges is approximately 70% state and 30% federal, in Wyoming it is 20% state and 80% federal.

³¹ <https://wyoleg.gov/InterimCommittee/2021/08-2021051815-03BudgetHighlights.pdf>

Figure 29. Miles Driven per Capita by State in 2019.



Source: US Department of Transportation

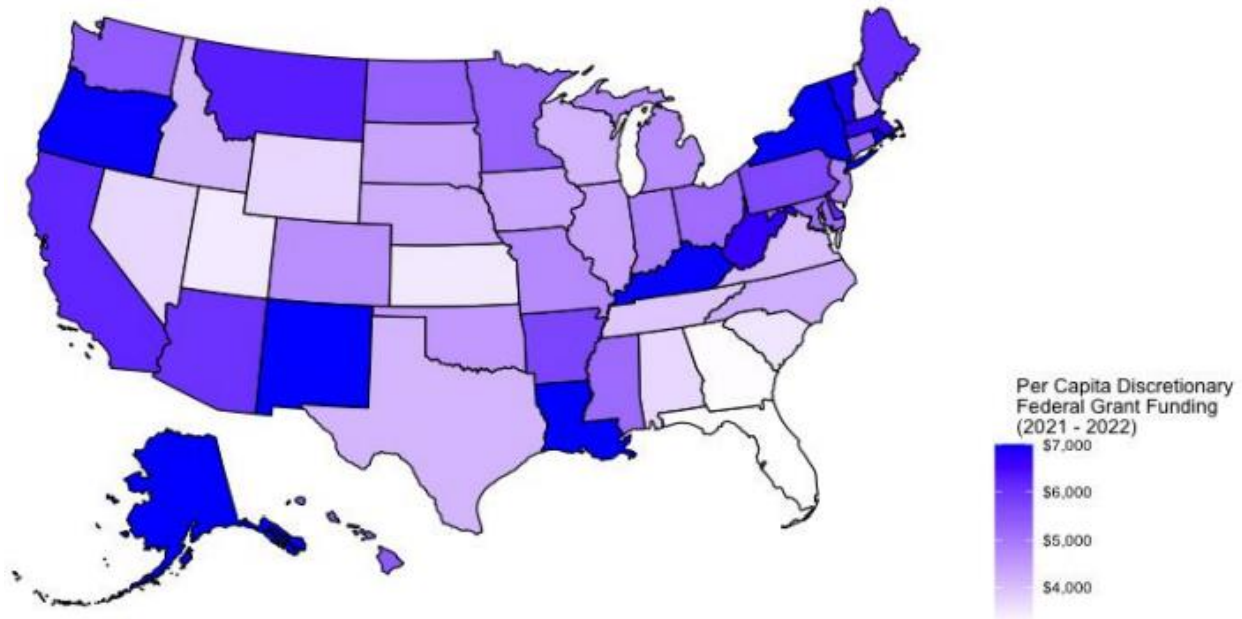
Together these pieces of evidence paint a picture of community amenities that are highly demanded but for which funding is in low supply. The undersupply of these amenities, in turn, may help to drive emigration by limiting the livability of Wyoming communities.

An important avenue through which more funding for community amenities could plausibly be obtained is via state and federal grants. Wyoming communities do not tap into grants funding as successfully as other peers around the US, as described in detail in the Growth Lab's Grants Note³².

Figure 30 shows, for example, that Wyoming receives less in discretionary federal grant funding per capita than other rural states. Figure 31 shows that within Wyoming these grants are highly concentrated among counties with higher population levels, demonstrating that this is a particular problem for small communities.

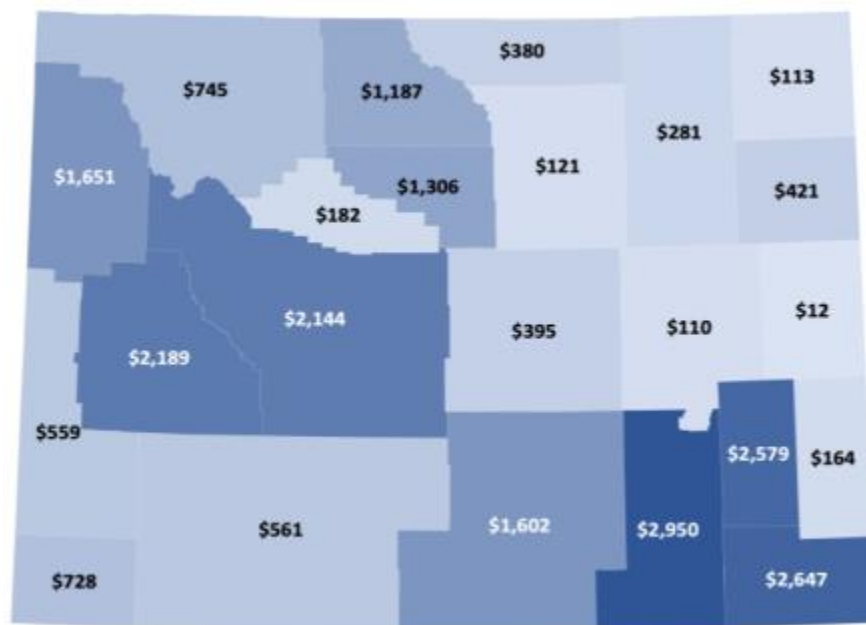
³² <https://growthlab.hks.harvard.edu/sites/projects.iq.harvard.edu/files/growthlab/files/2024-01-cidwp-441-wyoming-p2p-grants-note.pdf>

Figure 30. Federal Discretionary Grants per Capita by US State, 2021-2022.



Source: usaspending.gov

Figure 31. Federal Discretionary Grants per Capita by Wyoming County, 2021-2022.



Source: usaspending.gov

To assess why Wyoming lags behind on access to federal grants, the Growth Lab 1) mapped out possible issues by phase of the federal grant cycle then 2) surveyed and interviewed grant writers across Wyoming to understand which specific areas create the biggest blockages. Figure 32 shows these issues,

with color-coding to highlight the most severe problems. Overall, the biggest problems are in the initial process of identifying and applying to grants, rather than administering them, and often arise from the lack of dedicated professionals who pursue grants for Wyoming full-time rather than as a side-element of their work.

Figure 32. The Federal Grant Lifecycle with Principal Blockages Marked Red.

Pre-NOFO	Proposal Preparation	Award Phase	Closeout
Identify Need and Initial Project Design	Complete Project Design (scope, objectives, activities, and outcomes)	Day-to-Day Project Implementation and Financial Management	Final Reporting
Identify Funding Source (incl. overall orientation to federal grants)	Cost out Various Aspects (incl. risks)	Reporting (administrative, financial, programmatic) including Progress Reports	Final Auditing
Organizational Readiness	Proposal Writing, including Justify Need	Regulatory Adherence (environmental, labor, procurement, etc.)	Unused Funds Hearing
Build Relationship with Funder	Raise Matching Contribution or Co-Investment as Needed	Contract Services as required	
		Responding to changes outside the normal day-to-day (inflation, COVID, etc.)	

A number of especially serious constraints are as follows:

- **Lack of relationships between communities and funders.** Different grants can, naturally, have wildly varying requirements and scopes of application, and consequently present a lot of ambiguity and unfamiliarity. It is thus important for the community recipients to have good relationships with people in the bodies that award grants; this facilitates quick, informal communication to move past these uncertainties. Surveyed and interviewed Wyoming grant writers found that while a good relationship with the grantee is very helpful to push projects forward, few grant writers were confident they know who to contact about a grant when they have questions. This was especially severe among small communities.
- **Inability to follow changing grant opportunities.** The varying nature of grants also means that each new grant presents new challenges and opportunities, and that new grants are regularly created with new criteria and goals. Without dedicated professionals to keep up with the churn of new grant opportunities, communities often do not know about grant opportunities at all until the associated deadlines have passed.
- **Shortage of prioritized community needs and “grant ready” project plans.** Ideally, communities should apply for grants that address pre-identified community needs rather than try to reactively

identify needs to meet the criteria of some particular grant. This helps to ensure the grant is impactful and, if the needs are pre-documented, that the grant application is completed on time. Communities often, however, do not have the bandwidth to create detailed documentation of their most critical needs.

- **Overreliance on “local heroes” – especially for smaller communities.** Instances of Wyoming communities that have successfully obtained grants tend to rely on “local heroes,” or people who are not dedicated grant writing professionals but nevertheless go above and beyond to land grants. These local heroes develop expertise with the grants system in the process, creating valuable knowhow that unfortunately is lost when these heroes move or retire.

Whereas Wyoming lacks meaningful statewide coordination on accessing grants, Alaska, Montana, and Colorado all use some kind of coordination and thereby achieve higher grant awards per capita. The Alaska Municipal League, for example, is a nonprofit organization that helps local municipalities access grants (especially if they lack local capacity), while the Colorado Department of Local Affairs is a state government body that similarly supports local communities to access grants. Having dedicated grants professionals who operate statewide evidently helps to overcome the key barriers that Wyoming communities face, as these full-time professionals cultivate expertise and leverage economies of scale (operating on behalf of many communities) to efficiently pursue grant opportunities.

Several policy solutions are possible to address these constraints. Creating a dedicated state-level body that helps local communities access grants is arguably the first-best solution, as this creates a long-term presence that can cultivate deep expertise and relationships. Hiring external consultants to perform these services, either as the main solution or as a short-term measure before creating a dedicated state-wide grants office, is another possibility, albeit likely a more expensive and less durable one.

The Wyoming Job Market and Its Retention of Young People

On the other two major factors that drive migration decisions – housing and amenities – there are clear policy actions that Wyoming can take to improve matters. Access to good jobs, however, is considerably trickier for Wyoming to make major short-term improvements on. As previously discussed, its current economic composition is not well-placed to expand into new industries, and its ability to change that is heavily constrained by its exodus of young, educated people.

This presents a vicious cycle, where Wyoming cannot easily expand into new industries because it does not have an adequate presence in advanced industries. One way to break out of this cycle is by addressing factors related to housing and amenities in order to retain more young people, who can then help to drive the creation of new businesses and jobs. Another complementary route, however, is related to the idea of a “big push” (see, for example, Kline and Moretti 2014 or Gruber and Johnson 2019). The key idea is that overall economic activity in a town requires a certain minimum scale to induce self-sustaining growth, and that minimum scale can be achieved through unconventional means such as the creation of a major military base or research facility.

These kinds of opportunities are often difficult to come by, but not impossible. The Warren Air Force Base in Cheyenne, for example, employs more than 4,000 people³³ (including more than 3,000 troops). Going forward, Wyoming leaders should actively consider what additional “big push” sources of employment may be available to the state.

Actions so Far through the Pathways to Prosperity Project

Pathways to Prosperity is a state economic development project headquartered with the Wyoming Business Council³⁴, and conducted in collaboration with many leaders and organizations across Wyoming. It is an iterative problem-solving process that identifies constraints to economic growth and development, convenes partners who can address those constraints, builds solutions, and learns from the results.

In the course of the Pathways to Prosperity project, a number of actions have emerged through this collaboration:

- Removal of inter-municipal tradesperson certification barriers. State legislature was passed to make it easier for tradespeople to become certified in one Wyoming town versus another, a process that previously incurred bureaucratic delays. This allows tradespeople to more easily work on housing projects in different parts of Wyoming.
- Reform of several housing regulations in Cheyenne. The Cheyenne city council removed minimum lot sizes; removed luxury material requirements; removed multi-family density barriers; reduced required minimum parking spaces; and increased allowed building heights. These all allow a more free-market environment where housing supply can readily react to meet demand.
- State water infrastructure matching funds. The state legislature allocated \$25 million in matching funds so that Wyoming communities can access federal Infrastructure Investment and Jobs Act funds for water infrastructure without having to supply their own financing. This opens up an additional \$108 million in federal funding for water infrastructure for Wyoming communities.
- Wind River Recompete Award. Following a successful competitive application, Wind River was awarded \$36 million in federal economic development funds to support job creation.
- Rocky Mountain Power Request for Information Policy Update. Previously, in Rocky Mountain Power service areas it was difficult for the company to respond to requests for information about pricing for potential business operations. They have now moved to a model in Wyoming based on how they operate in other states, where this information can be more readily supplied. This allows new businesses to expand in Wyoming more easily.
- Grants strategy updates. Several statewide grants summits were convened and attended, contributing to a realignment of strategy for the Wyoming Grants Assistance Program focused on creating better access to federal funds for Wyoming communities. Some contributions to federal

³³ <https://www.warren.af.mil/About-Us/Fact-Sheets/#:~:text=Warren%20became%20the%20nation's%20first,members%20and%20964%20civilian%20employees.>

³⁴ <https://wyomingbusiness.org/about/approach/>

legislation initiatives were made with Wyoming's federal elected representatives to make federal grants rules more accessible for small, rural communities.

- Creation of childcare "strike teams." Stakeholders were organized to make rules around the private provision of childcare less cumbersome, so that supply can organically respond to meet childcare demand. Access to childcare is arguably an important amenity to keep families in Wyoming.

Conclusion

Although Wyoming presently struggles to participate in advanced service and manufacturing sectors, this gap can plausibly be bridged by making its communities more attractive for young people to stay in. While livability could be increased in some cases through additional financial investment in communities – for example, in water or transportation infrastructure – there are numerous urban issues related to housing that require cost-free deregulation. A freer housing market would increase the supply of homes of the kind that young Wyomingites demand, and by creating denser downtowns also boost the stock of urban amenities they are attracted to.

The necessary reforms to keep young people in Wyoming, and thereby diversify its economy, will require communities to have honest conversations about what they want to be like in the future. Wyoming has a very strong rural cultural identity, and the reality is that towns will have to navigate the tension between preserving that identity and changing to better suit the young people who presently leave in droves. It is not close to realistic to suggest that anywhere in Wyoming could become a large urban metropolis, but denser housing construction in Wyoming downtowns would nevertheless be a modest departure from the status quo. Keeping more young people in Wyoming also means that towns would grow larger, albeit through a population with homegrown Wyoming values.

Pursuing a strategy of keeping young people in Wyoming to diversify the economy would, nevertheless, arguably deliver a major shot in the arm to the Wyoming way of life. Giving people who grew up in Wyoming more reasons to stay and raise another generation in the state is a direct way to preserve Wyoming's cultural livelihood. Expanding jobs and earnings in advanced services and manufacturing would inject further durable vigor into the Wyoming economy, keeping its businesses open and protecting communities' financial viability.

A number of collaborative actions have already emerged through the Pathways to Prosperity project to support economic diversification and the retention of young people. Leaders across Wyoming can build on this momentum to support the further development of the state's economy.

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Appendix A.1: Wyoming's Lack of Easy Economic Diversification Opportunities

In order to calculate Wyoming's current diversification potential in different industries (including manufacturing and services), a dataset was created with the following coverage:

- Geography: all "Commuting Zones" (collections of counties/municipalities that form cohesive labor markets) across all of the US, Canada, and Mexico
- Time: the year 2016
- Industry: all 4-digit tradable industries in the North American Industrial Classification System (NAICS)
- Observed data: number of employees in each industry in each commuting zone

The raw data used for this dataset includes the US County Business Patterns, Canadian Census, and Mexican Economic Census. The year 2016 is used because it is the last year for which Eckert et al. (2020) can successfully impute suppressed values in the US County Business Patterns dataset³⁵. Merging all the data together required harmonizing NAICS industry classifications manually, and creating a machine learning algorithm that predicts commuting patterns to create Canadian commuting zones.

Having created this dataset, it is possible to take contemporary data from Wyoming and use a machine learning algorithm to predict which industries "should" be larger than they are (thus representing untapped growth potential), based on general patterns of how industries co-locate across all of North America. The steps involved are described in Box A.1.1.

³⁵ Publicly available data from the US government on how many people are employed in what industry where comes with a lot of suppressed datapoints. This data suppression is especially severe for small communities, like those seen in Wyoming. It is therefore vital to use a dataset that bypasses this data suppression.

Box A.1.1. Machine Learning Prediction Methodology

The machine learning algorithm was trained on data from outside Wyoming to make a prediction of the following formulation:

For a Commuting Zone c and an industry i , observe the logarithm of c 's employment in each industry other than i . Use this information to predict the logarithm of c 's employment in industry i .

Intuitively, this algorithm relies on the Principle of Relatedness. If a Commuting Zone has lots of employment in many industries that are highly related to some industry i , then there should be a high chance that it also has lots of employment in industry i itself. One can think about how two industries may require similar types of skills, infrastructure, regulatory frameworks, and more. As a hypothetical example, if a certain community has lots of employment in car manufacturing then it could be likely to have lots of employment in other forms of machinery manufacturing, like making air conditioners or jet engines. But knowing that a community has lots of employment in car manufacturing probably wouldn't reveal much information about whether it is good at an industry that requires very different economic inputs, such as financial services. The machine learning algorithm looks at which industries co-occur together in different Commuting Zones to learn how related each industry is to each other one.

Once the algorithm has been trained on all non-Wyoming data, it can be used to make predictions for more contemporary 2022 Wyoming data derived from a combination of the US Quarterly Census of Employment and Wages and, for the purposes of imputing suppressed datapoints, Eckert et al. (2020).

These predictions can be summed for all Wyoming Commuting Zones, to make the point as shown in Table A.1.1 that nearby economic diversification opportunities for Wyoming are extremely limited. There are only a few industries where employment gains beyond a few dozen jobs are predicted, and these industries tend not to be high-tech.

Table A.1.1. Top Industries Where Predicted Size Exceeds Actual Size in Wyoming.

NAICS Code	NAICS Name	# Jobs Predicted Above Current Level
4841	General Freight Trucking	732
5111	Newspaper, Periodical, Book, and Directory Publishers	556
5416	Management, Scientific, and Technical Consulting Services	487
5412	Accounting, Tax Preparation, Bookkeeping, and Payroll Services	442

4245	Farm Product Raw Material Merchant Wholesalers	376
5121	Motion Picture and Video Industries	263
7132	Gambling Industries	97
3273	Cement and Concrete Product Manufacturing	59
3231	Printing and Related Support Activities	57
5191	Other Information Services	51
5612	Facilities Support Services	37
5614	Business Support Services	30
5619	Other Support Services	29
4842	Specialized Freight Trucking	28
3362	Motor Vehicle Body and Trailer Manufacturing	20

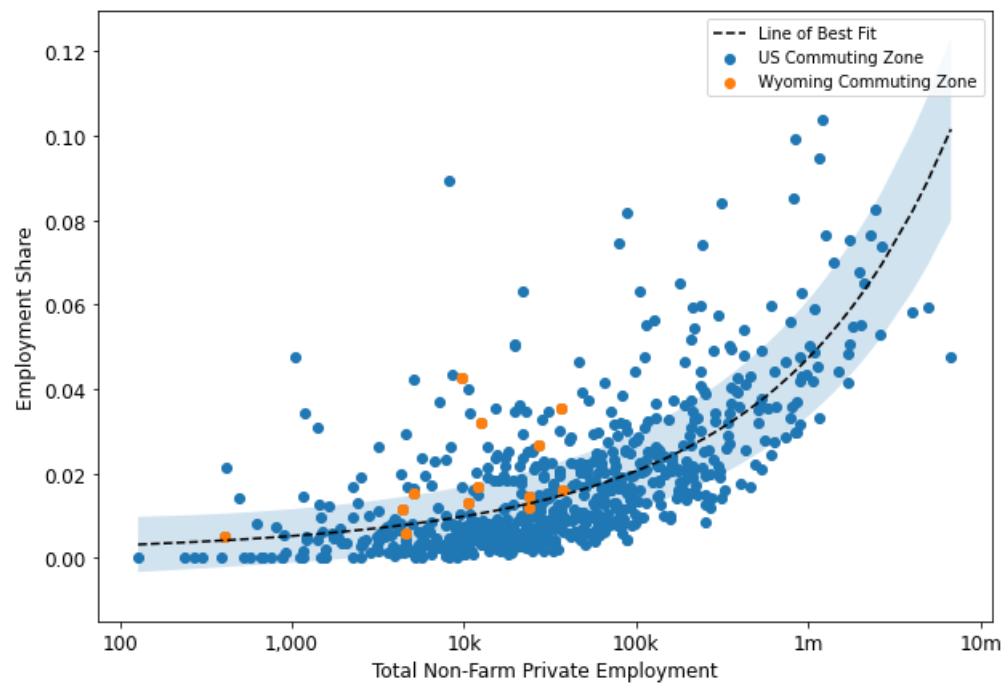
Appendix A.2: Economic Agglomeration and Diversification

Large pools of talented workers are critical for economic diversification in service and manufacturing industries. The following graphs demonstrate this relationship, and show how Wyoming is limited in this regard.

Let us first consider service industries, for which there is a tight empirical relationship between the overall size of a Commuting Zone and its share of employment in each specific sector. Figures A.2.1 – A.2.4 showcase these relationships. Each graph includes a line of best fit³⁶, and a shaded region to delineate one standard deviation of the datapoints away from that line of best fit. Many of Wyoming's Commuting Zones are approximately in line with trends in service sectors, and some even outperform for their size.

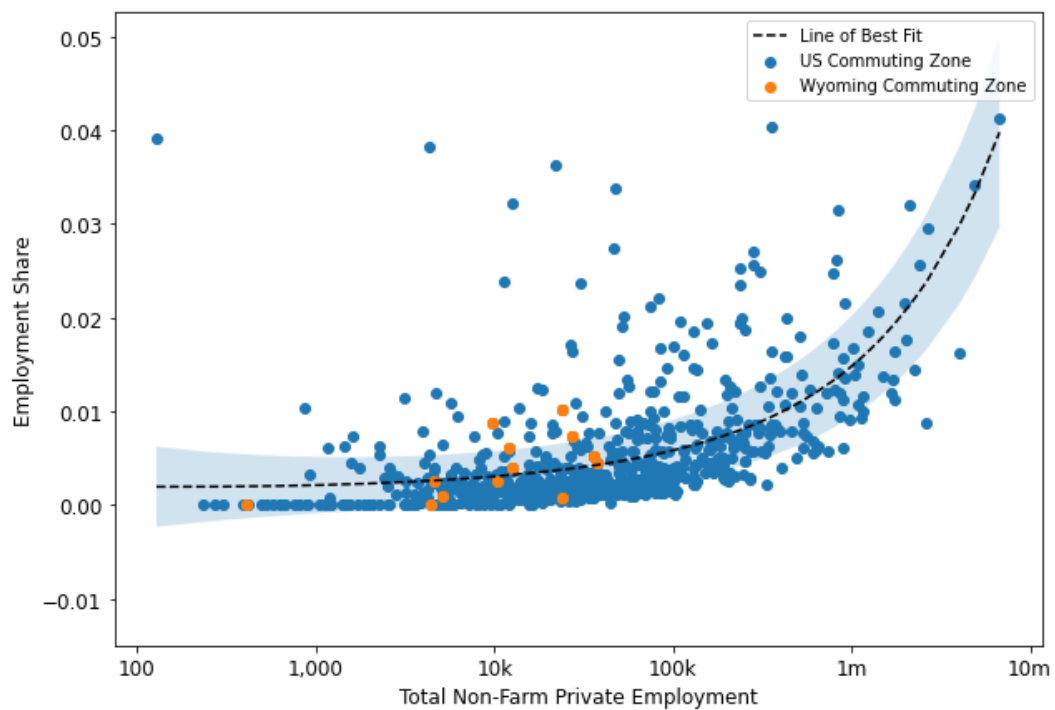
³⁶ Calculated via a Pseudo-Poisson Maximum Likelihood regression.

Figure A.2.1. Size vs. Employment Share in Professional, Scientific, and Technical Services, 2016.



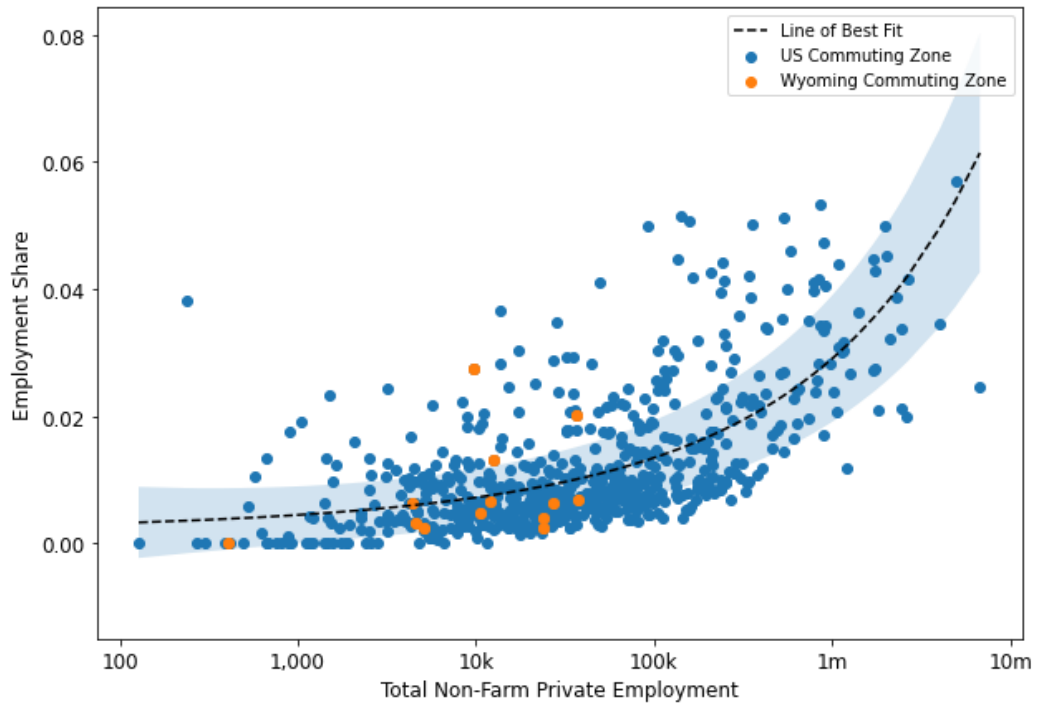
Source: Eckert et al (2020)

Figure A.2.2. Size vs. Employment Share in Information, 2016.



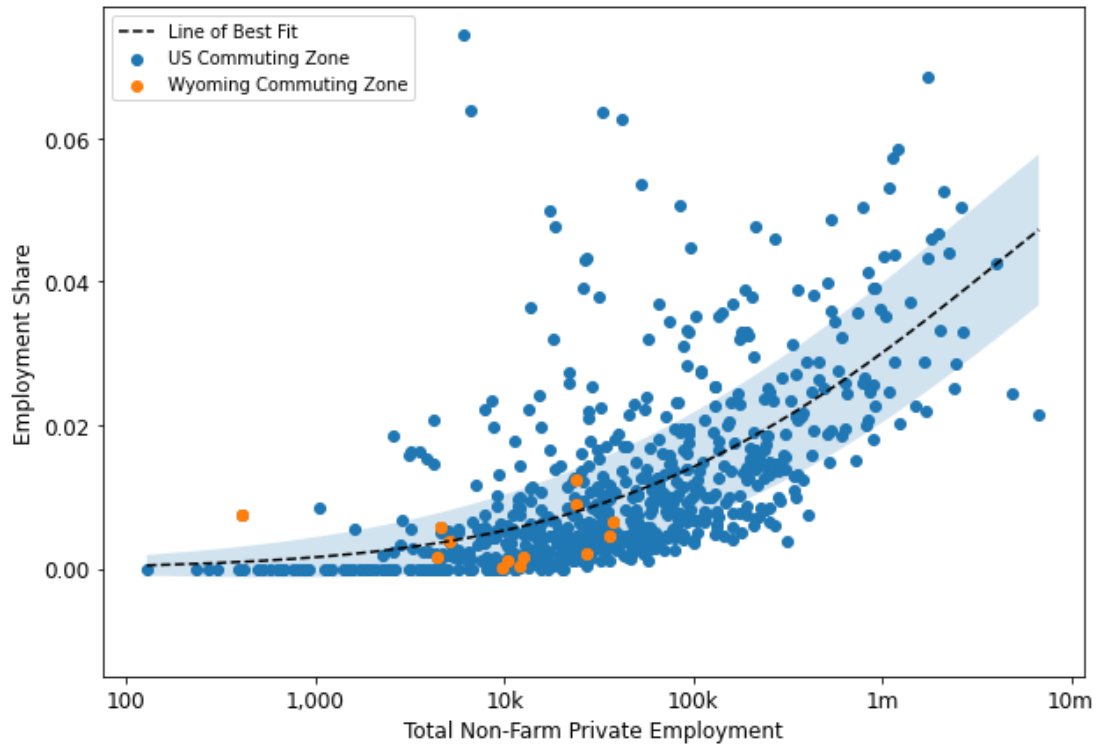
Source: Eckert et al (2020)

Figure A.2.3. Size vs. Employment Share in Finance and Insurance, 2016.



Source: Eckert et al (2020)

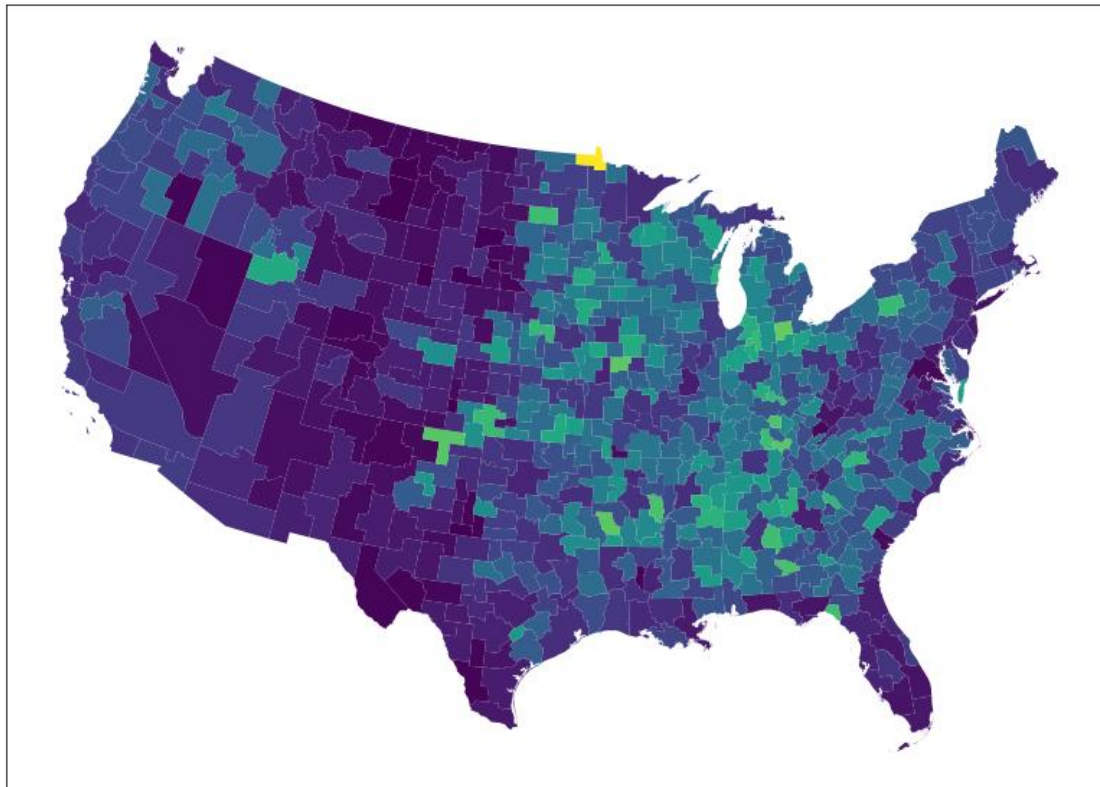
Figure A.2.4. Size vs. Employment Share in Management of Companies and Enterprises, 2016.



Source: Eckert et al (2020)

Manufacturing is more complicated to assess. Whereas the most important input to high-end service industries is skilled people, manufacturing also involves the transportation and processing of physical goods. This means that transportation costs and access to markets (both upstream and downstream) are significant factors of production. Manufacturing is therefore strongly geography-dependent, and there are clear regional differences in the distribution of manufacturing in the lower continental US (Figure A.2.5). Historical settlement patterns have undoubtedly interacted with transportation costs over time, creating large pools of manufacturing knowhow and employment in particular east of the Rocky Mountains.

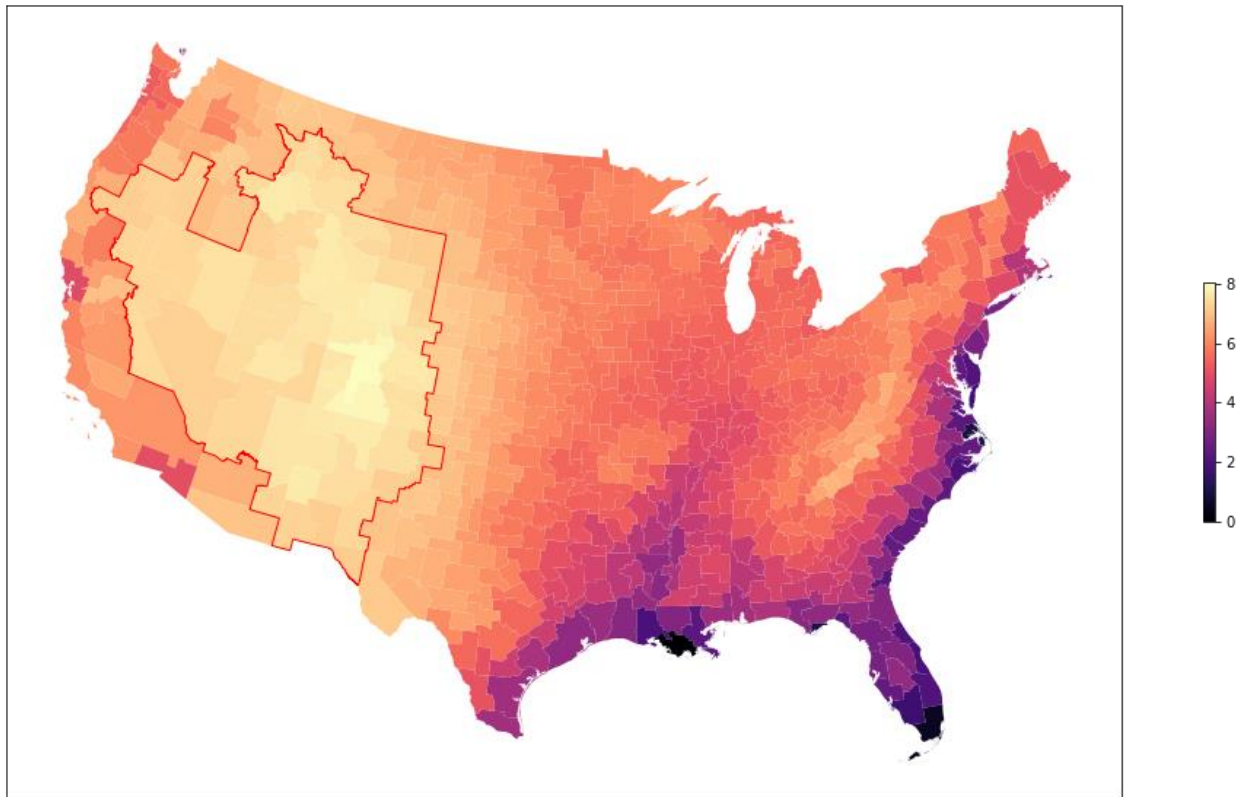
Figure A.2.5. Share of Manufacturing in Employment by Commuting Zone.



Source: Eckert et al (2020)

It is therefore most appropriate to compare Wyoming's performance in manufacturing to areas with similar geographies. We accomplish this by examining elevation, which is arguably the most salient aspect of Wyoming's economic geography because it creates transportation costs (related both to terrain and weather) and, through shaping the climate, has limited long-term population growth. We calculate the median elevation across all US Commuting Zones, and then select the set of Commuting Zones with elevations at least as high as the lowest elevation of any Wyoming Commuting Zone. Figure A.2.6 maps elevation and shows the region of geographic peers (bordered in red).

Figure A.2.6. *Logarithm of Elevation by US Commuting Zone, with Region of Wyoming Geographic Peers Bordered in Red.*

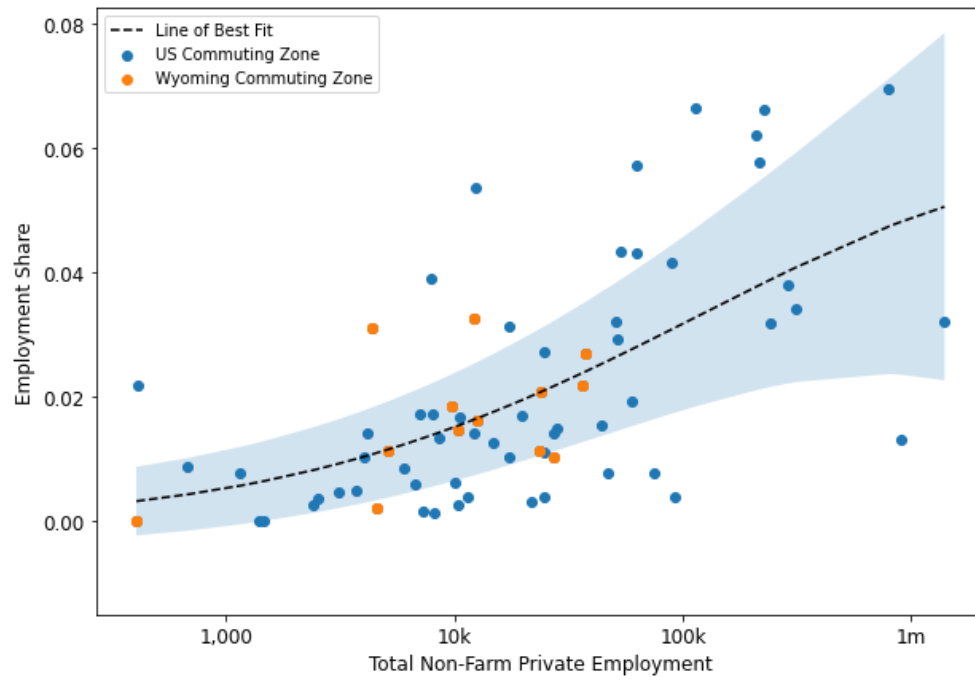


Source: US Geological Survey

Among this set of regional peers, we next look at how population size relates to the presence of industrial and electronics manufacturing³⁷, sectors that are attractive to investigate because they are large, technology-driven, and generally well-paid. Figure A.2.7 demonstrates that there is, similar to what was observed in high-end services, a positive relationship.

³⁷ We accomplish this by taking firm-level data from Dun & Bradstreet that covers which firms participate in multiple NAICS industries. We use this data to build metrics of relatedness between manufacturing industries, and then apply a greedy modularity clustering algorithm to create six cohesive groups of manufacturing industries. We discard two groups (one covering food processing, such as grain milling, and another covering basic processing of raw materials, such as plywood manufacturing), keeping the remaining manufacturing industries that better reflect participation in the creation of manufactured industrial and electronics goods. Finally, among the set of regional peers we drop one outlier Commuting Zone that on paper has a very small population but is immediately adjacent to Salt Lake City, and thus does not accurately reflect the economic composition of independent towns of a comparable size.

Figure A.2.7. Size vs. Employment Share in Industrial and Electronics Manufacturing Among Regional Peers, 2016.



Source: Eckert et al (2020)

Wyoming's lack of sizeable cities means it is especially critical for the state to retain its educated young adults, so they can together form pools of skilled labor that enable diversification into manufacturing and services. As described in the main text of the report, however, young educated Wyomingites leave the state at very high rates.