# Ghost Towns and Big Cities: Historical Mining and Economic Activity in the American West*

Jason Dunn[1] and James Siodla[2]

[1]Federal Reserve Bank of St. Louis
[2]Department of Economics, Colby College

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**Abstract**

Gold and silver rushes increased the level of mining activity and settlement in the American West during the nineteenth century. This paper aims to identify the short- and long-run impacts of this activity on population growth and density. We find that, in response to gold and silver site discoveries, areas nearby grew more in population than areas farther away. Many of these newly formed towns eventually died, however, as the mining industry declined. These ghost towns were initially smaller, more isolated from markets, and more dependent on mining than their surviving counterparts. We find that, even though the mining industry had declined considerably by the early twentieth century, today's western population is still more populous and dense around historical mining sites compared to other areas. Early mining activity thus encouraged growth, decline, and path dependence in the urban system of the western US.

Keywords: American West, gold rush, mining, path dependence, population density, urban system

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# 1 Introduction

Urban systems often persist through time. Cities that arise and grow due to natural advantages, sunk investments, or self-reinforcing agglomeration economies tend to remain. In the American West, many towns formed and grew in response to the influx of migrants attracted by gold and silver discoveries beginning in 1848 with the California gold rush. Across the region in 1850, 60 percent of the workforce was employed in the mining industry and 40 percent of the population lived within five miles of a mining site. By 1940, however, these shares had both declined to less than five percent. Once-thriving towns had faded or disappeared altogether with the fall of the industry. On the other hand, nearby settlements such as Denver and Sacramento that grew in conjunction with mining activity established themselves as important commercial centers. The processes at work in the settlement of the American West led to distinctly different urban systems in the nineteenth and twentieth centuries, as the core of economic activity began to shift away from mining sites just a few decades after migrants arrived. How did the growth and decline in mining activity influence the evolution of the urban system in the American West?

We answer this question using a variety of data sources to estimate the impact of the gold and silver rushes on the urban system of the American West. We rely on the digitized locations of historical mining sites in twelve western states produced by the USGS (U.S. Geological Survey, 2005). These sites attracted thousands of migrants during the nineteenth century. Included in this dataset is a variable measuring a site's year of discovery, which allows us to explore the role of mining-related activity in generating town growth. We also combine the mining site locations with two different datasets: population data at the census place—i.e., city, town, or village—level from 1850–1940 (Berkes et al., 2023) and population at the census place, tract, and block levels for the year 2010. Using both historical and modern data we study how the urban system of the American West evolved in relation to mining activity during the frontier's settlement.

We use dynamic difference-in-differences (DID) methods to compare areas near newly discovered mining sites with those farther away. We show that the boom in gold and silver mining during the nineteenth century led to the establishment and growth of towns near such activity. As sites were discovered, migrants flooded in and formed settlements. Areas located within five miles of a newly discovered mining site grew most relative to other areas, resulting in a smooth negative relationship between distance to a mining site and population size. But relative population growth began to subside within a few decades. The populations of most mining towns declined as the national economy transitioned to urban-centered production around the turn of the twentieth century. Towns that eventually died were initially smaller, more isolated from markets, and more dependent on mining than their surviving counterparts. Those that survived exhibited greater potential for powerful agglomeration economies to form as the mining industry declined relative to other sectors. We show that towns near mining sites, which were once cores of economic activity, had either died or become part of the periphery around 1920.

Big cities arose in the American West on the heels of mining town decline. While not located directly adjacent to historical mining sites, today's biggest western cities are nevertheless nearby. Population density is also significantly higher today in nearby areas compared to areas farther away. These areas are denser today than other areas due to either housing oversupply or better amenities, depending on their location relative to historical mining sites. Our main results show that mining activity greatly influenced the early distribution of population in the American West and the region today still reflects this pattern, even as the core of economic activity has slowly shifted over time. Thus growth, decline, and path dependence all contribute to the evolution and formation of the western urban system of the US.

Our study relates to the literature on the impact of resource booms on local economic activity. The allure of striking it rich through gold and silver discoveries served as a significant pull factor for miners and merchants alike. For instance, Clay and Jones (2008) find that California miners generally received extremely small—or even zero or negative—economic profits, while non-miners such as merchants or other service providers often experienced positive economic outcomes. This underscores the follow-on commercial growth that arose from increases in mining activity.[1] Jacobsen and Parker (2016) find that the oil boom-and-bust-cycle of the 1970s and 1980s in western US states had positive then negative effects on county-level income and employment. Similarly, coal mining in US counties between 1870 and 1970 led to initial increases in population and manufacturing activity—especially in eastern states—but the effects became negative after the first decade of activity (Matheis, 2016). Over the long run, cities near historical coal mining experienced lower rates of entrepreneurship and employment growth (Glaeser et al., 2015). Recent oil and gas booms, on the other hand, have increased wages and manufacturing productivity in US counties, thus showing no evidence of a resource curse (Allcott and Keniston, 2018). In southern US

[1] Many studies have engaged with gold and mining more generally. For instance, Aragón and Rud (2013) find that the expansion of a mine in Peru had a positive impact on local household income, driven by the mine's demand for local factors of production. Brodeur and Haddad (2021) study the positive relationship between former gold rush counties in the US and the prevalence of present-day LGBT populations.

counties over the twentieth century, oil extraction raised per capita income and population density in oil abundant counties relative to nearby counties, thus contributing to regional convergence (Michaels, 2011). Overall, the results are mixed regarding the role of natural resource booms on the long-run viability of nearby areas and may depend on initial conditions and historical context.[2]

The literature on path dependence in urban systems often focuses on identifying the impact of large shocks on the spatial distribution of population. Spatial persistence in the location of economic activity can come through several channels, including geography, agglomeration economies, and sunk investments (Lin, 2015). Evidence from several studies suggests that wartime bombings have only temporary effects on city populations and the location of economic activity (Brakman et al., 2004; Davis and Weinstein, 2002; Miguel and Roland, 2011), which implies that fundamental elements such as geography determine city locations. Studies that do not explicitly utilize shocks have also shown that geography matters. Natural attributes, for instance, have a substantial influence on the concentration of industry (Ellison and Glaeser, 1999), housing supply (Saiz, 2010), the population concentration of the coastal US (Rappaport and Sachs, 2003), and the distribution of cities in Europe (Bosker and Buringh, 2017).

In other contexts, large shocks have had permanent effects on urban population sizes and density. In these cases, persistence comes through the formation of self-reinforcing agglomeration economies. Portage sites, once a nuisance for the transportation industry but no longer relevant, became areas for commerce and the establishment of agglomeration economies that persist to the present day (Bleakley and Lin, 2012). During the US Civil War, British cities reliant on cotton textile manufacturing shrank in population relative to other cities, an effect that lasted at least until the end of the nineteenth century (Hanlon, 2017). The movement of millions of German expellees into resettled areas following World War II led to persistence in agglomeration patterns at least through 1970 (Schumann, 2014). In the modern Americas, areas with high pre-colonial density are denser today even after the trauma of colonization inflicted upon native populations (Maloney and Caicedo, 2016). These

[2]Sachs and Warner (1999) find that resource booms have done little—if anything—to generate economic growth in seven Latin American countries in the era of globalization. A synthesizing work attributes ambiguity in the effects of natural resource endowments to the volatility of countries (van der Ploeg, 2011). Natural resource booms can typically lead to exchange rate appreciations, deindustrialization, and unsteady growth. Countries must have strong laws, robust financial systems, and low corruption rates to benefit from these endowments, and exhaustible resources need to be converted into productive assets for longer-term growth. As McLean (2007) suggests in the case of nineteenth-century Australia, natural resources alone are not sufficient for driving growth, but require strong institutions in order for countries to benefit from their abundance.

studies reveal the importance of historical events for explaining modern-day agglomeration patterns. Our study adds to this literature by studying the impact of one of the largest migratory movements in US history.

Also influential in town formation, development, and persistence is infrastructure investment. Most research in this area has found that railroad investment encouraged urbanization and settlement in many contexts—from the US and Sweden to India and Kenya (Atack et al., 2010; Berger and Enflo, 2017; Donaldson, 2018; Jedwab et al., 2017).[3] Closely related to our study is work by Hodgson (2018), who finds that being near new expansions of the railroad network increased the lifetime and survival of post offices—which act as proxies for town locations—in seven western US states. Whereas Hodgson (2018) focuses on the expected lifetime and survival of already existing post offices, our study analyzes the impact of mining activity that preceded the establishment of towns and post offices in the West. Post office establishments, railroad investments, and other forms of human coordination followed on the heels of the discovery of mineral resources.

Lastly, we contribute to a vast literature on the role of mining in the settlement of the American West. The region was largely undeveloped by European settlers at the time, yet property rights to resources emerged as competition for the use of land, and the right to mine it, increased. The rushes in California and near the Nevada Comstock Lode, for instance, increased land competition that resulted in the formation of mining districts and structured property rights in response to rising mineral output levels (Libecap, 1978; Umbeck, 1977). Population growth followed after these institutional changes. Scholars have debated the impact of these migratory movements, not only on economic development but also on the decimation of indigenous peoples.[4] While not without controversy, from the single perspective of US settlers, this large-scale western migration fostered growth in economic activity across the region. In urban systems, the interaction of agglomeration economies, institutions, and cultural traits—each of which influenced the development of the American West—influence the ways in which people organize themselves across space and thus

[3]Centralized and authoritarian decisions can also kickstart agglomeration economies: towns in Sweden established by a king's decree hundreds of years ago, while getting off to inauspicious starts in suboptimal locations, are nevertheless thriving today due to sunk investments (Cermeño and Enflo, 2019).

[4]For instance, some scholars focus on the increases in immigration and economic development that came with the rushes (Brands, 2010; Hahn, 2016; West, 1999), while others focus on the environmental degradation they caused and their imperialistic impulses (Andrews, 2008; Curtis, 2013; Frymer, 2017; Immerwahr, 2019; Isenberg, 2005; Lecain, 2009; Meinig, 2000; Rohe, 1986). In a study documenting the genocidal actions of early settlers in California, Madley (2016, p. 10) states that as many as 16,094 Indians were killed by non-Indians in the state between 1846 and 1873. The state's indigenous population had fallen by as much as 80 percent over this period.

ultimately drive persistence in the location of economic activity (Nunn, 2014).

Several features of our setting differ from those of previous studies. First, we estimate the short- and long-run impact of a large, temporary resource boom on the urban system of the American West. Early migrants flooded into Western foothills within a relatively narrow window of time. Although they often left behind mere traces of their activity when mines were eventually depleted, through this volatile process migrants of European descent had settled and taken over the region.[5] Second, we study the processes of both population growth and decline over time. For instance, we observe mining settlements that survived and thrived over the long run and ghost towns that ultimately disappeared. Once resources became more costly to extract for the common migrant, and the lure of mining had disappeared, the stage was set for a reorganization of the urban system. Lastly, the Western frontier during the nineteenth century was an open-access setting in which property rights to mineral extraction emerged to meet local needs (Libecap, 2007). These institutional arrangements were adapted from eastern practices as development progressed, so that mining activities in the American West were not guided by a pre-existing institutional framework. Our study thus provides insight into the formation and evolution of an urban system in an economically and institutionally nascent setting.

## 2 Historical background

The American West experienced a flurry of mineral rushes and migration in the mid-to-late nineteenth century. In conjunction with notions of exploring and developing the frontier, gold and silver functioned as catalysts for expanding US ambitions and investment (Curtis, 2013; White, 2012). Before the rushes, the region was populated by mostly nomadic American Indian tribes and self-subsisting Mexican farmers (Belich, 2009; West, 1998). Only a few Europeans penetrated the area before 1845, primarily through military excursions or exploration and hunting expeditions (West, 1998). In 1848, when James Marshall discovered gold in Sutter's Mill, California, news spread quickly, and soon California was receiving emigrants from the Midwest and East and from continents as distant as Australia, Asia, and South America (Mountford and Tuffnell, 2018).

While the California gold rush looms large in the historical narrative of the West, the discovery of gold and silver in other states also attracted a large influx of people. These

[5] (Paul, 1974, p. 11) describes the mining West as a "series of frontiers" that opened at different points between 1848 and 1880. In each frontier emerged towns and settlements, some rising to prominence and others declining to dust in later decades.

rushes led to growth in auxiliary markets. Growing areas began to build infrastructure such as railroads, telegraphs, ditches, and houses (Mountford and Tuffnell, 2018). While not every rusher stayed, the establishment of markets and industry outside of mining led to sustained population growth in western states. Areas that were once uninhabited by settlers of European origin were transformed into dense population centers (Curtis, 2013).

The initial migrations were spurred by the opportunities provided through placer mining, or sifting for gold flakes in a flowing river. Large influxes of migrants, typically poor and with limited mining-related skills, were attracted to individual opportunities to profit through the discovery of gold.[6] Placer mining was ideal for this demographic as it required very little prior knowledge or physical capital. As placer deposits waned, however, the majority of remaining minerals were stuck in lodes and veins within the mountains themselves, thus requiring deep-mining techniques to extract them. Extraction of this nature required extensive machinery and knowledge, influencing the centralization and corporatization of the mining industry. The exhaustion of placer deposits gave way to the more sophisticated practice of deep mining over the nineteenth century (Belich, 2009; Curtis, 2013; Isenberg, 2005; Limerick, 2006). The likelihood of striking it rich declined for the individual miner in the late nineteenth century, and with it the allure of mining for a vast group of migrants.

Both placer mining and deep mining techniques required an institutional structure for governing the orderly extraction of minerals. An important institutional development was the establishment of mining districts, which often formed in places where a significant amount of mineral deposits were discovered. These areas established laws governing mining claims and private property rights. Miners often elected their own president, secretary, judge, treasurer, and recorder to carry out various administrative duties. Districts also established stipulations and regulations surrounding common goods such as water and timber. It is the institutional order offered by these districts that likely attracted ever more people. One such example is the Comstock Lode, a premier silver mining region in Nevada. Output in the Comstock Lode rose ten-fold between 1859 and 1861; at the same time the local population rose from 100 to 20,000 (Libecap, 1978, p. 343). In 1859, the Gold Hill District was established to govern extraction; a similar government at Virgina City soon followed (Libecap, 1978). As van der Ploeg (2011) argues, strong institutional legitimacy, through laws and financial institutions, are essential for developing positive outcomes from natural resource endowments. The mining districts functioned as small communities with explicit

[6] Additionally, Eastern financial markets experienced a series of financial panics in the latter half of the nineteenth century, decimating individual wealth and encouraging people to start anew in the promising frontier (West, 1998).

and written codes aimed at governing the extraction of local minerals. The result of such institutional support was an influx of migrants and steady population growth.

As shown in Figure 1, employment in mining in the American West had dominated other forms of employment in the initial years of settlement. But mining was too uncertain and unstable an endeavor to remain the predominant industry of the western economy. Well before the turn of the twentieth century, agriculture and cattle ranching had surpassed mining in economic importance (Belich, 2009; West, 1998; White, 1993). The US federal government also promoted western settlement through a variety of legislative actions, including the Pacific Railway Act, General Mining Act, and Homestead Act. These acts incentivized settlers to build infrastructure, expand industry, and establish frontier settlements (Paul, 1974). Over time more and more settlers had become retail merchants, service providers, and manufacturing workers. While mining activity had declined in the American West by the late nineteenth century, the industry had staked a sizable claim on the region's long-run development.

# 3 Data

Our analysis focuses on identifying both the short- and long-run impacts of gold and silver mining that occurred in the American West between 1850 and 1940. We focus on mining sites in the following twelve states: Arizona, California, Colorado, Idaho, Montana, New Mexico, Nevada, Oregon, South Dakota, Utah, Washington, and Wyoming. We include the western half of South Dakota in our analysis—specifically, areas west of –101 degree longitude—in order to capture economic activity near the Black Hills, which was an important mining location during this time. Locations in eastern South Dakota mined very little, if any, gold or silver. We combine information from several sources to create longitudinal and cross-sectional datasets linking historical towns and modern census tracts and blocks to the location of the nearest historical mining site.

## 3.1 Mining site locations

Our primary variable of interest is proximity to historical mining sites, the locations of which are gathered from the USGS Mineral Resources Database (U.S. Geological Survey, 2005). This database contains the geographic coordinates of all past and present mining sites and camps in the US; there are nearly 166,000 such sites in our sample region. Of these sites, 3,824 mined gold or silver, either exclusively or with other minerals, and were discovered before 1941. Each location is represented as a point using geographic coordinates; it is unclear whether these coordinates represent the center of a particular mining site or some other point. Nevertheless they provide a fairly precise measure of the locations of historical mining sites.

Figure 2 shows the locations of the mining sites in our sample. Historical gold and silver sites were located in all twelve states. Relatively few sites existed in the Pacific Northwest and Wyoming, while many more were near the Rocky Mountain and Sierra Nevada mountain ranges in Colorado, California, and Nevada. The figure shows a large degree of spatial variation in the presence of old mining sites, with clustering occurring in some areas and wide dispersion in others. This variation is useful for identifying the impact of mining activity on western urban development.

Another useful feature for our study is variation in the timing of mining site discoveries. Figure 3 shows the distribution of discovery years for the mining locations in the full sample of 3,824 historical gold or silver sites. We collapse discoveries by decade (1851–1860, 1861–1870, and so on) to align with the timing of the census population data. While mining sites were formed in all decades up to 1940, the mid-to-late nineteenth century represents the boom years in discovery. Nearly half of the gold and silver mining sites in our sample were discovered between 1861 and 1890 alone. The distribution of discovery years is consistent with the historical narrative of gold and silver seekers rushing west and discovering sites when the idea of striking it rich was most promising. The timing of discovery across various decades also suggests the presence of several different frontiers as argued by Paul (1974).

## 3.2 Town populations and variables, 1850–1940

To construct town-level population sizes, we use full count census data from IPUMS (Ruggles et al., 2021) and census places as defined by the Census Place Project (Berkes et al., 2023). Using the Census Place Project (CPP) crosswalks, we create a panel of town-level variables for 7,626 cities and towns observed each decade from 1850 through 1940, except for 1890 due to the destruction of population schedules for that year. The variables we consider include population, demographic, and economic characteristics. We create these variables by linking publicly released individual and household level census data to their sub-county place of residence. Each census place has geographic coordinates that we use to identify its distance to the nearest historical mining site. These census places include both small towns and big cities, which are temporally consistent using a clustering method that accounts for annexations and border changes over time.[7] We are thus able to follow the populations of cities and towns as they grow and decline while accounting for changes in their spatial boundaries. This temporal consistency also means that our dataset includes only the most isolated ghost towns, not those that are likely to be annexed by adjacent cities over time. Thus, the changes in these towns are more accurate representations of the population dynamics taking place from 1850–1940.

One shortcoming of the data is that the CPP algorithm is unable to match every census record to its town location. In some census years, for instance, it was impossible to identify the exact location of a particular person or household. This means that we may observe missing data for a particular town–decade observation either because of a failure to match people to their town, or due to complete population decline in that town. If the matching problem is more likely in rural areas, where old mining towns may be disproportionately located, it could impact the results of our study. It is a smaller concern, however, if these "missing" individuals are randomly distributed across towns in our sample. Nevertheless, the extent of missing matches is minimal overall. Across the states in our sample, between 71 and 99 percent of the population is linked to its town or city location, depending on the decade. Match rates are lowest between 1850 and 1900, averaging 85 percent; between 1900 and 1940, match rates are 96 percent on average. Our dataset thus includes the vast majority of people located in the American West during this time. We address concerns with the population data using post office openings and closures—a robustness check described later—to proxy for town growth and decline.

We also include a variety of demographic and economic variables from the census to complement our analysis of town population growth. We describe these variables in Section 4. Town-level data are also linked to the following geographic and regional variables: elevation (Nagi, 2014), latitude, longitude, physiographic province (U.S. Geological Survey, 2011), state, distance to the West Coast, and distance to the nearest river (U.S. Department of Transportation, 2022). Physiographic provinces represent distinct regions, each with their own geological features, which could influence both the location of minerals and economic development. There are 12 such provinces located in our sample region.

[7] We use the clustering method and parameters recommended by Berkes et al. (2023). This method combines many large cities with their expanding suburbs to consistently define places over time, but also maintains the geographic distinctness of smaller towns nearby.

### 3.3 Census variables, 2010

The second half of our analysis focuses on the impact of historical mining settlement on modern population levels and density. We use data from the 2010 US Census at the census place, tract, and block levels (Manson et al., 2020). We analyze town- and city-level population size and tract- and block-level population density, which we define as the number of people per square mile of land area. We consider a number of other variables at the census tract level, including variables on the housing stock and infrastructure (Esri GIS, 2019; Wayland, 2020), which we describe in Section 4.4. We combine our tract- and block-level variables with the following: elevation range (Nagi, 2014), latitude, longitude, physiographic province (U.S. Geological Survey, 2011), state, distance to the West Coast, and distance to the nearest river (U.S. Department of Transportation, 2022).

## 4 Methods and results

Migrants moved to areas near gold and silver mining sites and created small towns in the process. Some of these towns survived and grew over time, while others disappeared as the mining industry declined. We turn now to exploring this process of growth and decline, further estimating its long-run implications for the urban system of the American West. Our analysis focuses on two time periods. We begin with a dynamic analysis of the role of mining activity on town growth from 1850–1940, after which we focus on the reasons why some towns died while others survived in the shadow of mining's heyday. The second half of our analysis estimates the impact of historical mining activity on today's population distribution and an exploration of the mechanisms underlying it.

### 4.1 Population growth and proximity to gold and silver sites

The spirit of our approach can be motivated by a simple picture. Figure 4 shows the relationship between population size (in natural logs) and distance (in miles) to the nearest mining site for census places that existed at any point between 1850 and 1940.[8] The figure shows this relationship for different decades in the nineteenth and twentieth centuries. Notably, the largest towns were located within just a few miles of mining sites during the nineteenth century; town populations during this time declined as distance to the nearest

[8] Population size is transformed as ln(population + 1) to account for places with no recorded population in a given decade.

mining site increased. This relationship changes in the early twentieth century, when towns farther away began to grow in population. By 1940 a clear shift had occurred: the largest towns on average were located about 35 miles away from mining sites.

We focus on proximity to newly discovered mining sites as a measure of exposure to mining activity and thus treatment. Figure 4 suggests that, early in the gold and silver rushes, towns within five miles of a site grew most. Towns located just outside this radius were likely otherwise similar except for their distance from mining activity. We thus define treated towns as those that were located within five miles of—i.e., exposed to—a newly discovered site at some point between 1851 and 1940. Control towns are those that were always located more than five miles from a mining site during this same period, which ensures that the composition of our control group remains unchanged over time. Towns that were already within five miles of a site in 1850 are excluded from the analysis. Thus, our approach compares towns that were exposed to nearby mining activity at some point between 1851 and 1940 to those that never were. While this time period is longer than the boom period of gold and silver mining, it coincides with the available census place data on populations. Including all gold and silver mining site discoveries up to and including 1940 also puts the rushes of the nineteenth century in a broader historical perspective.

Since we are interested in understanding the long-run effects of even temporary exposure to mining, we allow all towns once treated to remain so throughout our study period, even if nearby mining sites stopped production at some point before 1940. Doing so allows us to examine the evolution of town growth based on historical exposure to mining. It also ensures most mining sites stay in the sample since most of them lack information about actual production years.

We begin by estimating the impact of exposure to nearby mining activity on town growth using the following two-way fixed effects (TWFE) model:

$$\ln(Population_{ipst}) = \alpha_i + \delta_t + \beta NearSite_{it} + (\sigma_p + \lambda_s) \times Decade_t + \epsilon_{ipst}, \tag{1}$$

where $Population_{ipst}$ is population of town $i$ located in physiographic province $p$ and state $s$ in decade $t$, $\alpha_i$ is a town fixed effect, $\delta_t$ is a decade fixed effect, $NearSite_{it}$ is an indicator for whether town $i$ was located within five miles of a mining site in a particular decade (1851–1860, 1861–1870, and so on), $\sigma_p$ are physiographic region fixed effects, $\lambda_s$ are state fixed effects, $Decade_t$ is a continuous measure of census decades, and $\epsilon_{ipst}$ is an error term.[9] The interaction of physiographic province ($\sigma_p$) and state fixed effects ($\lambda_s$) with the decade

[9]Since 1890 is missing in the census data, we collapse exposure from 1881-1900.

measure accounts for different growth trends across regions of the West. To account for towns with no population in a particular decade, we we add 1 to our population variable. The parameter of interest is $\beta$. Standard errors are clustered at the level of the nearest mining site.

Table 1 shows the results of estimating equation (1). Column (1) shows a basic pooled specification, where the effect of being exposed to a nearby site is positive, large, and statistically significant at the 1 percent level. However, adding census place and decade fixed effects, as shown in column (2), reverses the sign of the treatment coefficient and renders it statistically insignificant. Including physiographic province and state time trends yields a positive and statistically significant effect of roughly 30 percent (column (3)). These outcomes together imply that a number of location- and time-specific variables are correlated with exposure to mining sites, and further suggests that the timing of site discoveries and regional factors related to frontier settlement are key determinants of population growth in the American West.

The evolving nature of frontier settlement suggested by Figure 4, the results shown in Table 1, and the timing of mining site discoveries all suggest that an event study approach is appropriate in our setting. Such an approach allows for estimation of heterogeneous treatment effects over time once an area is exposed to local mining activity. And since site discoveries are staggered over time, treatment is too. Furthermore, we would expect different effects based on whether areas were exposed to mining in its heyday or later in the twentieth century. For instance, the years between 1848 and 1880 were a boom period for gold and silver mining in the American West as new sites were discovered and mined (Paul, 1974). As minerals were depleted over time, the effect of exposure to mining sites likely dissipated. Additionally, as the region developed into the twentieth century, fewer and fewer resources were devoted to mining as new migrants worked in different industries (see Figure 1). Because it does not provide insight into the composition of an estimated treatment effect, estimation of the TWFE model leaves information on the table. Perhaps more importantly, the approach suffers from negative weighting on treatment effect parameters and thus can lead to inconsistent coefficient estimates.[10]

To address these concerns and relax the assumption of homogeneous treatment effects,

[10]The Bacon decomposition provides some insight into the extent of these various contributions to the estimated treatment effect (Goodman-Bacon, 2021). In a parsimonious model with no covariates, the timing of mining site exposure determines the size of the estimated effect for comparisons of towns exposed at different times throughout the sample period. Furthermore, nearly 96 percent of the estimated treatment effect is determined by comparing towns that were exposed at some point between 1851 and 1940 to those that never were.

we estimate a dynamic version of equation (1) based on methods proposed by Callaway and Sant'Anna (2021). In this event framework, the treatment effect is measured relative to the treatment period. Because first exposure is observed from 1851–1860 and last exposure from 1931–1940, these periods range from −80 years (pre-treatment) to 80 years (post-treatment). We present our main results graphically and report 95 percent confidence intervals using standard errors clustered at the level of the nearest mining site. Our main results report average treatment effects on the treated (ATT) before and after exposure, as well as effects by decade and treatment cohort.

Identification of the treatment effect in this setting requires that: (1) parallel trends in population growth among treatment and control groups would exist in the absence of treatment, and (2) towns and cities did not anticipate the discovery of mining sites. To make the first condition more plausible, we follow Callaway and Sant'Anna (2021) to determine a propensity score for $NearSite_{it}$ that is used to match treatment towns to control towns. Towns are matched based on the following time-invariant geographic variables: elevation, (ln) distance to the West Coast, (ln) distance to the nearest river, latitude, longitude, and their interaction. This method helps ensure pair-wise comparisons between otherwise geographically similar treatment and control towns, and thus relaxes the unconditional parallel trends assumption that must hold for all cities in a standard TWFE model. We show graphical evidence that the second condition is met.

Table 2 provides summary statistics for the geographic variables separately for treated and control towns based on our treatment assignment, further stratified by decade of exposure. The majority of treatment occurs up to 1880, which corresponds with the gold and silver rush period. Most treated towns were within five miles of a mining site by this time, even as more sites were being discovered (see Figure 3). On average, treated towns were located at higher elevations—where mining sites existed—than control towns. This difference is a large source of variation across groups in our sample. Treatment and control towns are otherwise similarly situated across the western region and relative to water sources. Over 6,700 towns were never exposed to mining by our definition while more than 800 were. The large number of control towns provides a good sample for matching to treated towns using the methods of Callaway and Sant'Anna (2021).

The event-study framework yields insight into the nature of frontier development in the American West. Figure 5 shows the impact of exposure to a new mining site over time, which suggests that populations grew after exposure to a mining site and thus towns did not grow in anticipation of site discoveries. Upon exposure, population nearly doubled in the first decade of treatment compared to control towns, with the effect subsiding over time. Roughly fifty years after exposure, towns near mining districts experienced similar growth in population—relative to the treatment period—to towns located farther away. These results are consistent with the median lifespan of a gold or silver mining site in our sample, which is 60 years among the sites for which we have production information. Towns located nearest to mining sites grew when first exposed to the industry's activity but slowed in relative terms as mines closed and areas farther away began to grow.

Table 3 shows the ATT by decade and treatment cohort. The results are consistent with the western frontier experiencing a resource boom in its early days. The decades between 1870 and 1910 represent the most active growth period for towns exposed to gold or silver mining; compared to far-off places, towns within five miles of a mining district experienced at least 65 percent greater population growth in each of these decades. Many mining sites discovered in the 1860s and 1870s were still active in the early twentieth century, and thus a large effect is still present in 1910. By 1920, population growth had slowed considerably and a relative difference was not apparent by 1930.

There is also considerable variation in the ATT by treatment cohort. A treatment cohort represents the decade in which town locations were exposed to a newly discovered mining site. The results show that, compared to areas farther away, areas exposed to nearby mining activity in the 1860s (1870) 1870s (1880), and 1900s (1910) experienced significantly more growth than in other decades. These results suggest that the decade of exposure mattered, so that mining contributed greatly to growth in its early days but less so in later years. Consistent with the boom period (1848–1880) suggested by Paul (1974), exposure to mining in the decades up to 1880 encouraged town growth.

The decade and cohort results together suggest that the large influx of mining migrants to the western frontier encouraged local growth early on but less so as the twentieth century approached. Early mining activity had a greater impact on population growth than later mining activity, which suggests that undeveloped areas in the West benefited most from increases in local economic activity. Over time, as the frontier continued to populate with settlers and industry shifted away from mining, this initial boon to development had waned.

Thus far we have relied on population data generated by the CPP methods that identify each individual's census place of residence (Berkes et al., 2023). As previously mentioned, one concern with this approach is that individuals are not always linked to their census place in every decade, which influences our measure of town-level population. In a case of classical measurement error in the dependent variable, any bias is subsumed in the error term and estimation will be less efficient. Even so, our results strongly align with the hypothesis that mining activity led to local population growth during settlement of the American frontier. Nevertheless, to address the concern about measurement error in the population data, we use post office openings and closures (Blevins and Helbock, 2021) to proxy for the existence of towns, as in Hodgson (2018). The years that post offices existed were well-recorded and thus measurement error is of relatively small concern. If post offices opened and closed with the boom and bust of local populations, then we should see results similar to—and likely more efficient than—those using the population data.

We measure the presence of a post office in a particular decade as an indicator equal to one if a post office exists at any point in a given decade and zero otherwise.[11] Figure 6 shows the impact of exposure to mining activity on post office openings and closures. Areas that were exposed to a mining site were more likely to open a post office upon exposure compared to areas farther away. Beginning four decades after exposure, post offices within five miles of a mining site were more likely to close than post offices farther away. These results largely align with the boom-and-bust pattern for census places. Furthermore, the specification using post office data leads to tighter confidence intervals.

Overall, our results show that cities and towns exposed to mining activity in the nineteenth century grew significantly more initially than other areas in the American West. Furthermore, this effect was strongest among areas that were exposed to mining activity early on. However, over time, areas farther away began to grow: the largest cities and towns were located roughly 35 miles away from a mining site by 1940 compared to just a few miles away in 1860 (see Figure 4). These outcomes imply that many mining towns declined in relative terms or disappeared altogether as the frontier continued to develop. Does the decline in the mining industry solely explain this reversal, or do other factors play a role? We turn now to exploring the reasons behind the death of many western mining towns.

## 4.2 The death of ghost towns

The results thus far suggest that the boom in mining had a large, positive impact on town population growth in the American West. On average, this effect was relatively short-lived, lasting about four decades. Mining was an important focal point for economic activity throughout the region, yet agglomeration took root only in particular areas. For instance, the mining town of Bannack, Montana reached its peak population of 1,375 people in 1880,

[11] We focus on decadal rather than annual changes to align with our population data. For example, a post office in existence from 1861–1906 would be recorded as having opened in 1870 and closed beginning in 1910.

but had completely disappeared by the middle of the twentieth century. Population in the silver towns of Virginia City, Nevada and Leadville, Colorado, on the other hand, peaked in the nineteenth century and still exist today.

Why did some towns die while others survived? The answer provides additional insight into US settlement patterns and the country's spatial distribution of economic activity. We consider many explanations for ultimate town demise, including geographic and economic isolation, specialization in mining, and vapid agglomeration economies. Working within the longitudinal constraints of the census place data, we define ghost towns as those with a population size greater than zero at some point before 1940 and which had lost their entire population by 1940. Such a definition likely captures the majority of ghost towns that had formed during the nineteenth century. We consider all other towns to be surviving towns, whether they declined or grew leading up to 1940. Consider the following model relating ghost town status to a variety of characteristics:

$$GhostTown_{ips} = \alpha + \beta NearSite_i + \mathbf{X}_i\gamma + \sigma_p + \lambda_s + \epsilon_{ips}, \tag{2}$$

where $GhostTown_{ips}$ indicates whether town $i$ located in physiographic province $p$ and state $s$ is a ghost town, $\mathbf{X}_i$ is a vector of controls, $\sigma_p$ are physiographic province fixed effects, $\lambda_s$ are state fixed effects, and $\epsilon_{ips}$ is an error term. $NearSite_i$ is measured as in equation (1), except that it represents whether a town was within five miles of a mining site as of 1940. It thus measures exposure regardless of period of treatment. Included in $\mathbf{X}_i$ are many variables that may influence ghost town status, as described below. All variables except $NearSite_i$ are measured as of the first decade in which population is observed in the CPP data, and thus represent initial characteristics. Standard errors are clustered at the level of the nearest mining site.

Our ghost town determinants fall into several categories representing geographic, demographic, and economic factors. Demographic variables include (ln) population and median age of the population. Geographic variables include elevation, latitude, longitude, and their interaction. We also include distance to the West Coast and distance to the nearest river, both in natural log form. Economic factors include the share of workers employed in mining and (ln) distance to rail. To account for the age of a town or city, we also include indicators for the first decade in which a population was observed in the CPP data.

Table 4 shows the results for a variety of specifications and subsamples. Column (1) shows the results for a basic specification in which we include no controls. Our coefficient of interest suggests that towns near mining sites in their initial decade of settlement were about

20 percentage points more likely to be ghost towns by 1940. This result attenuates and loses statistical significance, however, when we include our full set of geographic controls plus our standard controls (column (2)). Thus natural factors are correlated with both ghost town status and proximity to mining activity. Towns at higher elevations, in particular, are more likely to have disappeared by 1940. Towns located in the mountains were more difficult to access and build over the long term, an isolation that hindered the likelihood of surviving to the middle of the twentieth century. Being farther from the ocean and local rivers was less important for survival.

An economic factor influencing the potential for town survival is railroad access. In a specification that adds distance to the railroad (column (3)) better initial rail access improved the chances that a town survived to 1940. This access is also important in our full specification shown in column (4), which includes a suite of demographic variables. The lack of market access via railroad was a key contributor to decline.

Column (4) shows a specification that considers the demographic and economic structure of local areas. Cities and towns with smaller initial populations and greater shares of workers employed in mining were more likely to become ghost towns. These results suggest that agglomeration economies were more likely to form in places that were initially larger and less specialized in mining. Small populations and specialization in a declining industry hampered long-term success.

Since the CPP data do not include all observed individuals in the census, we again use post office data in a robustness check and show the results in Table 5. We proxy for town decline with the closure of post offices, where our outcome variable is an indicator equal to one if a post office established before 1940 had closed by 1940, and zero otherwise. The downside to using these data is that we cannot account for demographic variables.

Column (1) shows the results for our basic specification with no controls. Post offices initially nearer to mining sites were more likely to close by 1940, which coincides with the result in column (1) of Table 4. Adding controls, as shown in columns (2) and (3), attenuates this coefficient by more than half, although it remains statistically significant at the 1 percent level. Post offices at higher elevations and farther from rail were more likely to close by 1940, similar to our ghost town results. Overall, the results for post offices are largely consistent with those using the CPP data.

While unfavorable geography such as inaccessible locations portended ghost town status, other factors correlated with decline were demographic and economic in nature. Relative to surviving towns, ghost towns initially had smaller populations, larger shares of workers in mining, and less access to rail. These results suggest that early potential for agglomeration economies to form—via larger, more industrially diverse populations—and better market access encouraged the long-run survival and growth of cities and towns in the American West.

### 4.3 Population today and proximity to historical mining sites

Mining sites acted as focal points that attracted migrants and merchants in the settlement of the American West. Eventually this force weakened as towns and cities located farther from mining activity took the reins of growth. What does today's population distribution look like? Does historical mining activity cast a shadow over the settlement patterns of the western region?

To answer these questions, we estimate the long-run impact of proximity to historical mining sites on today's distribution of economic activity. We make use of modern data by considering both population size, at the census place level, and population density, at the census tract and block levels, as functions of distance to historical mining sites. Panel (A) of Figure 7 shows that in 2010 the largest cities and towns were no longer those most adjacent to historical mining sites, as they were in 1860, but instead are located about 35 miles away. The distance gradient exhibits a gentle positive slope out to roughly 35 miles, after which it begins to decline, much as it had beginning in 1920 (see Figure 4). Furthermore, as panel (B) shows, population density exhibits a similar relationship at the census tract level.

The relationships depicted in Figure 7 do not account for a number of geographic and location-specific characteristics that may influence population size and density. To do so, we estimate the following model:

$$\ln(y_{ips}) = \alpha + \beta Proximity_i + \mathbf{X}_i\gamma + \sigma_p + \lambda_s + \epsilon_{ips}, \tag{3}$$

where $y_{ips}$ refers to population size (density) in census place (tract/block) $i$ located in physiographic province $p$ and state $s$, $Proximity_i$ represents a variety of measures of distance to the nearest mining site (described below), $\mathbf{X}_i$ is a vector of geographic controls, $\sigma_p$ are physiographic province fixed effects, $\lambda_s$ are state fixed effects, and $\epsilon_{ips}$ is an error term. Relying on the relationship depicted in Figure 7, we define two different proximity measures as of their 1940 status: (ln) distance to the nearest mining site and a group of distance bands representing areas less than 5 miles from a mining site, 5–15 miles from a site, and 15–35 miles from a site. In the case of census tracts and blocks, we measure the distance between its geometric centroid and the nearest mining site. Areas more than 35 miles from a historical mining site make up the omitted category. Included in $\mathbf{X}_i$ are (ln) elevation (for census places), (ln) elevation range (for census tracts and blocks), (ln) distance to the West Coast, (ln) distance to the nearest river, latitude, longitude, and their interaction. Standard errors are clustered at the level of the nearest 1940 mining site.

We aim to mitigate omitted variable bias by including controls that account for measures correlated with both mining activity and population size and density today. We view our geographical variables as capturing the important factors relevant to development of the American West. For instance, a census place's elevation accounts for hard-to-reach places in the mountains (Burchfield et al., 2006). While mining activity was prevalent in these areas, high elevations make an area less suitable for housing and real estate development (Saiz, 2010). Since we know the area and shape of each census tract and block, we use elevation range rather than elevation in analysis using tracts and blocks.

Panel A of Table 6 shows the results of estimating equation (3) using (ln) distance to the nearest mining site as our main explanatory variable. Column (1) shows a basic specification with no controls. The coefficient is positive but not statistically significant. The specification in column (2) includes our geographic controls, physiographic province fixed effects, and state fixed effects. In this case a negative distance gradient is present: a 10 percent increase in distance from a mining site is associated with a 1.4 percent decrease in population size. Large cities today are located near historical mining sites. The change in the distance coefficient's sign also suggests that geographical and regional variables are correlated with mining site proximity.

The results in panel A, columns (1) and (2), of Table 6 are generally consistent with the relationship depicted in panel (A) of Figure 7. Nevertheless, the figure suggests a nonlinear relationship exists between population and mining site proximity. Panel B of Table 6 shows the results of estimating a relationship using distance bands rather than a continuous measure of distance. The basic specification in column (1) shows that, compared to cities located more than 35 miles from a mining site, those located 15–35 miles away are more populated on average while towns less than five miles from a site are less populated. However, once we condition on geographic and regional factors (column (2)), cities and towns in each of the distance bands are similarly populated compared to those farther away.

The results thus far suggest that cities and towns near old mining sites are more populated than their geography and location would predict. Does population density exhibit a similar pattern? To answer this question, we use census tracts (columns (3) and (4)) and blocks (columns (5) and (6)) as our units of analysis where the dependent variable is (ln) people per square mile. While the basic specification shows no statistically significant relationship, the full specification shows that tracts near a mining site are significantly more dense than those farther away (see column (4)). Furthermore, areas nearest to mining sites are the most dense: there is a steady decrease in the magnitude of the distance band coefficients as distance to the nearest site increases. Overall, tracts within 35 miles of an old mining site are roughly 60–120 percent more dense than tracts farther away. The results for census blocks are very similar, although of slightly smaller magnitudes.

Areas near historical mining activity are larger and denser today than those farther away. The evidence in this section points to mining activity as a primary historical focal point in explaining this outcome. The settlement of the American West occurred through a dynamic process of change, whereby old cores of activity gave way to new and more distant centers of population. While the relationship between population and distance to mining activity has changed over time as some towns declined and others grew, the western US population is still clustered around old mining sites.

## 4.4 Channels of persistence

We now turn to an exploration of the potential channels that explain higher population density in census tracts today that are located near historical mining sites. As before, we consider census tracts less than five miles from an old site as well as those 5–15 and 15–35 miles away. We suspect that people may cluster in these areas for different reasons. We have shown that market access and investment in infrastructure were important determinants of town survival in the early twentieth century. Are areas near historical mining sites disproportionately endowed with infrastructure and other capital investments? If so, such factors could explain population density today. Otherwise, agglomeration economies are likely responsible.

We follow Bleakley and Lin (2012) by estimating equation (3) using the following fixed factors as outcome variables: housing units per square mile, median rent, median house value, percentage of housing built before 1939, the length of major roads per square mile, and rail length per square mile.[12] Each of these variables is measured at the census tract level and expressed in natural logs, except the proportion of pre-1939 housing.

Table 7 shows the results of the modern factor analysis. Panel A reports the simple mean differences between tracts near old mining sites and those farther away. The results in

[12]Major roads includes all roads, highways, and interstates.

column (1) suggest that areas near historical mining sites have more housing units per square mile. However, once we control for population density (shown in Panel B), the density of the housing stock is greater only in the nearest distance bands, which suggests that more housing space per person exists in these areas. Tracts located 15–35 miles from a site have similar housing density to those farther away.

Columns (2) and (3) explore the differences in median housing rent and value across areas. There is a statistically significant difference in housing rent for the 5–15 and 15–35 mile bands in panel A, but this relationship disappears when conditioning on population density. Housing values are relatively high in all distance bands. However, controlling for the fact that housing can be more expensive in denser areas, housing values are higher only in areas 15–35 miles from a mining site. Since the housing stock is not undersupplied in the 15–35 mile range relative to other areas (see column (1)), higher median values likely reflect better amenities due to agglomeration economies and thus greater demand to live in these locations.

In column (4), we show that housing built before 1939 is oversupplied in tracts near mining sites compared to those farther away. This result comports with our previous findings that mining-adjacent areas were developed early in the West's settlement. A large proportion of old housing can contribute to path dependence in location by slowing down population adjustments.

Column (5) shows the results for major roads. Areas near mining sites contain similar levels of road infrastructure when we account for population density, although a marginally significant negative result is apparent in the 5–15 mile range. Similarly, as shown in column (6), census tracts within 35 miles of a mining site are not oversupplied with rail infrastructure relative to their population density. These results on road and rail infrastructure suggest that agglomeration in areas near old mining sites is not due to excess transport investments. If anything, the evidence suggests that some of these locations may be less endowed with transport infrastructure.

Overall, we find evidence that census tracts near historical mining sites, even conditional on population density, differ in housing and amenities from those farther away. In areas within 15 miles of a mining site, housing is more abundant; in areas 15–35 miles from a site, housing is more valuable. Thus, an abundance of housing may explain path dependence in areas most intensely exposed to mining in its heyday, while better amenities may explain persistence in areas less exposed, but nonetheless still proximate, to mining activity. This result is consistent with historical narratives that, as the rush fever subsided over time, migrants settled in mining-adjacent areas rather than mining camps themselves. The evidence suggests that, in these adjacent areas, agglomeration economies are a likely source of path dependence over the long run. As we show, larger initial populations and access to rail encouraged long-run town survival, and thus early infrastructure investment and settlement helped spur the agglomeration economies that eventually took root in the American West.

# 5 Conclusion

The findings of this study confirm the importance of the growth and decline of mining activity in the urban development of the American West. Towns emerged and grew due to their proximity to mining sites and camps. This boost to population lasted only a few decades, on average, as sites were exhausted and towns that depended on them declined. Some of these declining sites became ghost towns, and we find that they were more specialized in the mining sector and more geographically and economically isolated than other towns. They were thus less able to adapt to changes in the structure of the American economy.

Even as mining activity declined in importance over time, today's population distribution in the West is still influenced by the locations of historical gold and silver mines. Conditional on a number of geographic and regional factors, population density today is greater in areas near mining sites than it is in areas farther away. Mining sites thus served as important focal points for development in the region, even if the initial activity that immediately surrounded these locations declined over time.

The gold and silver rushes of the nineteenth century can be viewed as a stimulus to investment and economic development. The allure of rare minerals attracted large populations and follow-on infrastructure that would not have otherwise come so quickly. This does not necessarily imply that these migratory patterns and investments were imprudent, but rather that gold and silver rushes helped merchants and miners realize the far-ranging economic potential of the western frontier. Individuals came largely for the prospect of finding gold or silver, but many others saw potential elsewhere, from farming and cattle ranching to merchandising and manufacturing. Gold and silver acted as catalysts for development and helped determine the locations of economic activity that are present in the western US today, even as many towns that once dotted the landscape have vanished over time.

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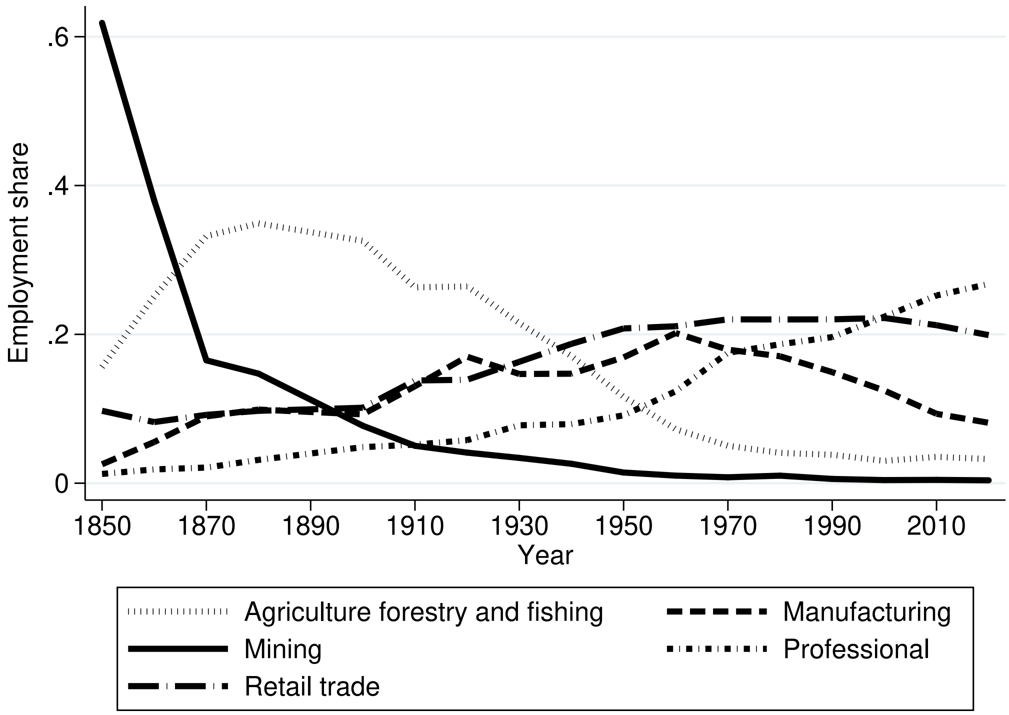
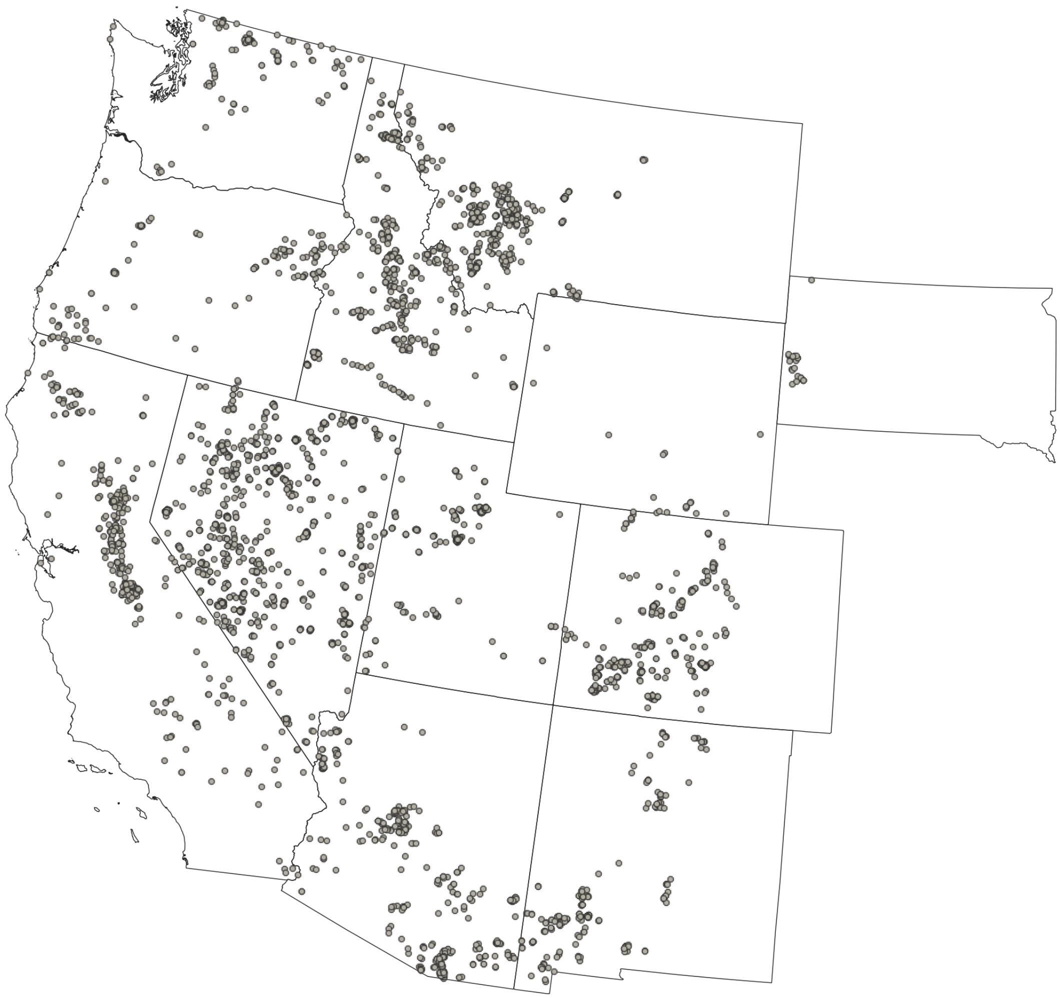
Figure 1: Share of Total Employment in Western States, by Sector



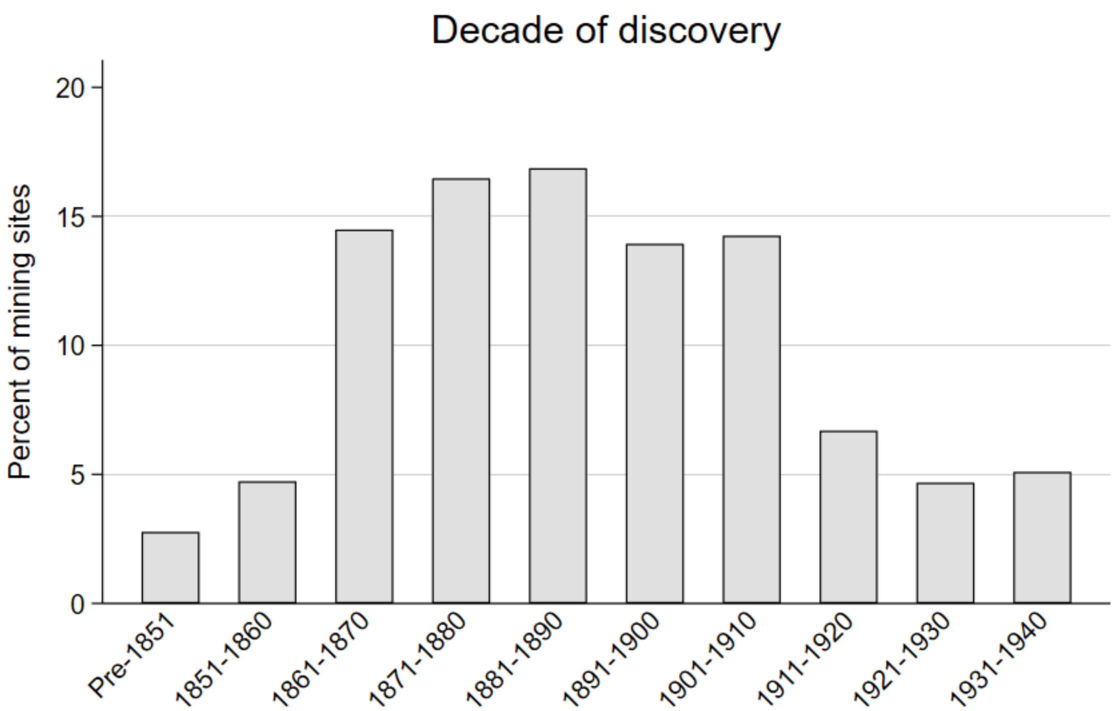

*Notes:* The figure shows employment data for the twelve states in the sample. *Source:* Ruggles et al. (2022).

Figure 2: Historical Mining Sites



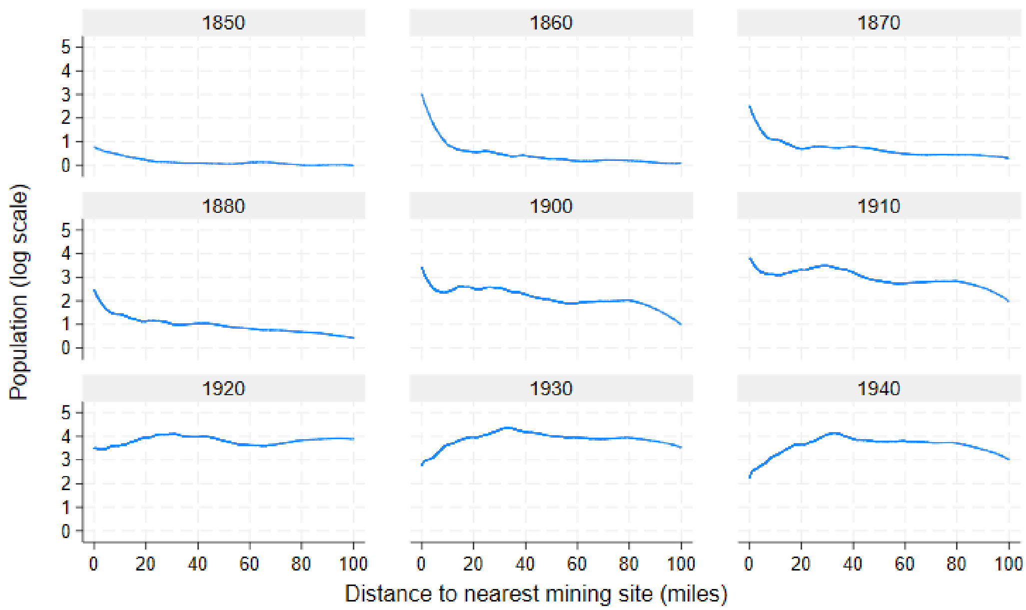
*Notes:* The figure shows the geographic coordinates of mining sites and camps that existed up to and including 1940. *Source:* U.S. Geological Survey (2005).

Figure 3: Discovery of Mining Sites, by Decade



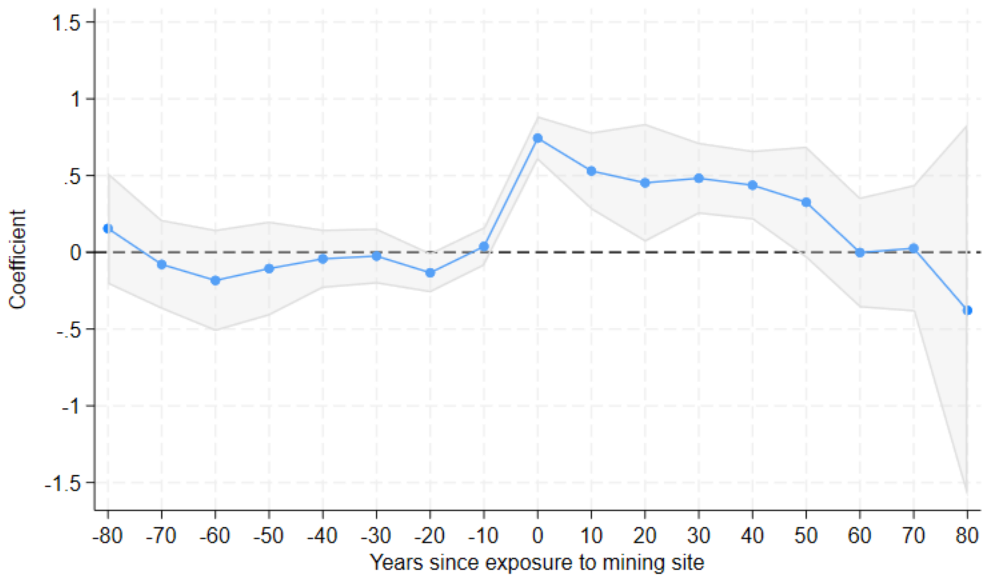

*Notes:* The figure shows the decades of discovery of 3,824 sites that mined gold or silver at some point up to and including 1940. "Pre-1851" sites include all those that existed before 1851, even those mined by Spanish colonists in the seventeenth century. *Source:* U.S. Geological Survey (2005).

Figure 4: Population Size and Distance to Nearest Mining Site, by Decade



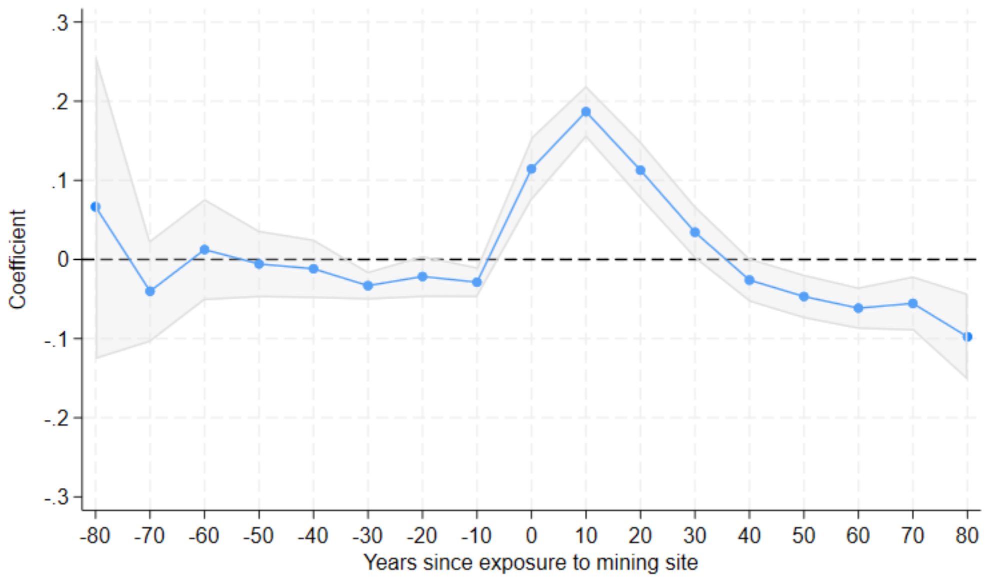

*Notes:* Each panel displays (ln) population size as a function of distance to the nearest gold or silver mining district. The sample consists of all census places located within 100 miles of the nearest mining site. Population size is transformed as ln(population + 1) to account for places with zero population in a particular decade(s). The raw population data are smoothed using Stata's lowess procedure (bandwith=0.2).

Figure 5: The Impact of Exposure to a Newly Discovered Mining Site Among Census Places



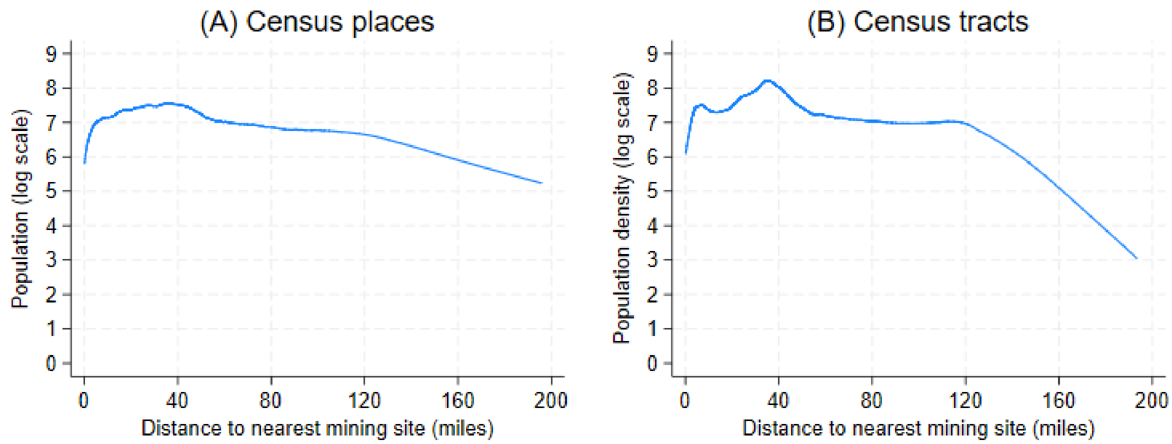

*Notes:* The figure shows the estimated coefficients and 95 percent confidence intervals for the ATT estimated using the method outlined in Callaway and Sant'Anna (2021). Exposure is measured as being within five miles of a newly discovered mining site. The year of exposure (i.e., treatment) occurs sometime between the nine years before zero and zero on the $x$-axis.

Figure 6: The Impact of Exposure to a Newly Discovered Mining Site Among Post Offices




*Notes:* The figure shows the estimated coefficients and 95 percent confidence intervals for the ATT estimated using the method outlined in Callaway and Sant'Anna (2021). Exposure is measured as being within five miles of a newly discovered mining site. The year of exposure (i.e., treatment) occurs sometime between the nine years before zero and zero on the $x$-axis.

Figure 7: Modern Population Size and Density by Distance to Nearest Historical Mining Site




*Notes:* The figure displays population size (panel (A)) and population density (panel (B)) as a function of distance to the nearest gold or silver mining district as of 1940. The sample consists of all census places (panel (A)) and census tracts (panel (B)) located within 200 miles of the nearest mining site. The raw population data are smoothed using Stata's lowess procedure (bandwith=0.2).

Table 1: The Impact of Exposure to a Newly Discovered Mining Site

| | (1) | (2) | (3) |
|---|---|---|---|
| Near site | 0.773*** | –0.136 | 0.297*** |
| | (0.046) | (0.091) | (0.067) |
| Census place FE | | X | X |
| Decade FE | | X | X |
| Physiographic province trends | | | X |
| State trends | | | X |
| No. of observations | 67,887 | 67,887 | 67,887 |
| No. of census places | 7,543 | 7,543 | 7,543 |
| Adjusted $R^2$ | 0.004 | 0.474 | 0.494 |

*Notes:* The table shows the average treatment effect based on estimation of equation (1). Standard errors, which are shown in parentheses, are clustered at the level of the nearest mining site. *** p<0.01, ** p<0.05, * p<0.1.

Table 2: Summary Statistics for Town Sample

| Variable | Treated | Control |
|---|---|---|
| *Decade of exposure to mining site:* | | |
| 1851–1860 | 76 | – |
| 1861–1870 | 229 | – |
| 1871–1880 | 179 | – |
| 1881–1890 | 94 | – |
| 1891–1900 | 104 | – |
| 1901–1910 | 60 | – |
| 1911–1920 | 29 | – |
| 1921–1930 | 18 | – |
| 1931–1940 | 18 | – |
| *Geographic variables:* | | |
| Elevation (feet) | 1,566 | 1,127 |
| Distance to West Coast (miles) | 401 | 473 |
| Distance to nearest river (miles) | 256 | 251 |
| Latitude | 41 | 42 |
| Longitude | –114 | –113 |
| No. of observations | 807 | 6,736 |

*Notes:* Mean values are shown for elevation, distance to West Coast, distance to nearest river, latitude, and longitude. Treated towns are those located within five miles of a newly discovered gold or silver mining site in any year between 1851 and 1940. Control towns are those that were never treated before 1940. Towns within five miles of a mining site before 1851 are excluded.

Table 3: The Impact of Exposure to a Newly Discovered Mining Site, by Decade and Cohort

| | By decade | | By cohort | |
|---|---|---|---|---|
| | Coeff. | Std. err. | Coeff. | Std. err. |
| 1860 | 0.386 | 0.324 | 0.022 | 0.451 |
| 1870 | 0.716*** | 0.220 | 0.520*** | 0.141 |
| 1880 | 0.653*** | 0.181 | 0.674*** | 0.170 |
| 1900 | 0.774*** | 0.157 | 0.194 | 0.146 |
| 1910 | 0.805*** | 0.123 | 0.831*** | 0.301 |
| 1920 | 0.314* | 0.161 | –0.321 | 0.427 |
| 1930 | –0.038 | 0.135 | 0.005 | 0.424 |
| 1940 | 0.028 | 0.145 | –0.585 | 0.664 |

*Notes:* The table shows the ATT by decade and treatment cohort based on the methods outlined in Callaway and Sant'Anna (2021). Standard errors are clustered at the level of the nearest mining site. *** p<0.01, ** p<0.05, * p<0.1.

Table 4: Ghost Towns and Initial Characteristics

| | (1) | (2) | (3) | (4) |
|---|---|---|---|---|
| Near site | 0.189*** | 0.017 | 0.014 | -0.005 |
| | (0.020) | (0.018) | (0.018) | (0.019) |
| Elevation (thousands of feet) | | 0.207*** | 0.196*** | 0.166*** |
| | | (0.019) | (0.019) | (0.018) |
| ln(Distance to West Coast) | | -0.002 | 0.003 | 0.011 |
| | | (0.012) | (0.012) | (0.012) |
| ln(Distance to nearest river) | | 0.000 | -0.003 | -0.008 |
| | | (0.008) | (0.008) | (0.008) |
| ln(Distance to rail) | | | 0.029*** | 0.018*** |
| | | | (0.004) | (0.004) |
| ln(Population) | | | | -0.078*** |
| | | | | (0.005) |
| Median age | | | | -0.001 |
| | | | | (0.001) |
| Mining share of emp. | | | | 0.176*** |
| | | | | (0.051) |
| No. of observations | 7,543 | 7,543 | 7,543 | 7,543 |
| Adjusted $R^2$ | 0.014 | 0.206 | 0.212 | 0.247 |

*Notes:* The results are based on estimation using OLS. The dependent variable is an indicator for whether a previously populated census place had zero population by 1940. All variables are measured as of the first decade of population observed in the census place data. Column (1) shows the results for a basic specification with no controls. Columns (2)–(4) show the results for specifications in which are added the controls shown in the table plus physiographic province fixed effects, state fixed effects, indicators for the decade in which population is first observed, latitude, longitude, and their interaction. For more information on variable definitions, see the main text. Standard errors, which are shown in parentheses, are clustered at the level of the nearest mining site. *** p<0.01, ** p<0.05, * p<0.1.

Table 5: Post Office Closures and Initial Characteristics

| | (1) | (2) | (3) |
|---|---|---|---|
| Near site | 0.132*** | 0.059*** | 0.059*** |
| | (0.014) | (0.014) | (0.014) |
| Elevation (thousands of feet) | | 0.144*** | 0.123*** |
| | | (0.015) | (0.015) |
| ln(Distance to West Coast) | | 0.003 | 0.008 |
| | | (0.006) | (0.006) |
| ln(Distance to nearest river) | | -0.011** | -0.014*** |
| | | (0.005) | (0.005) |
| ln(Distance to rail) | | | 0.020*** |
| | | | (0.002) |
| No. of observations | 11,381 | 11,381 | 11,381 |
| Adjusted $R^2$ | 0.009 | 0.055 | 0.062 |

*Notes:* The results are based on estimation using OLS. The dependent variable is an indicator for whether a city or town's post office—established before 1940—had closed by 1940. Distance to nearest mining site and distance to rail are measured as of the decade the post office was established. Column (1) shows the results for a basic specification with no controls. Columns (2) and (3) show the results for specifications in which are added the controls shown in the table plus physiographic province fixed effects, state fixed effects, indicators for decade of establishment, latitude, longitude, and their interaction. For more information on variable definitions, see the main text. Standard errors, which are shown in parentheses, are clustered at the level of the nearest mining site. *** p<0.01, ** p<0.05, * p<0.1.

Table 6: Today's Population Distribution and Historical Mining Sites

| | Dependent variable: | | | | | |
|---|---|---|---|---|---|---|
| | ln(Population) | | ln(Pop. density) | | ln(Pop. density) | |
| Explanatory variable | (1) | (2) | (3) | (4) | (5) | (6) |
| *Panel A: Distance in miles* | | | | | | |
| ln(Distance to nearest site) | 0.082 | –0.138*** | 0.047 | –0.430*** | –0.110 | –0.319*** |
| | (0.071) | (0.051) | (0.166) | (0.054) | (0.115) | (0.058) |
| *Panel B: Distance bands* | | | | | | |
| <5 miles from site | –0.432* | 0.398** | –0.257 | 1.205*** | 0.056 | 0.808*** |
| | (0.244) | (0.161) | (0.474) | (0.146) | (0.344) | (0.168) |
| 5–15 miles from site | 0.005 | 0.554*** | –0.097 | 0.752*** | 0.261 | 0.622*** |
| | (0.242) | (0.140) | (0.402) | (0.139) | (0.313) | (0.144) |
| 15–35 miles from site | 0.301** | 0.437*** | 0.199 | 0.555*** | 0.315* | 0.424*** |
| | (0.150) | (0.115) | (0.206) | (0.132) | (0.180) | (0.102) |
| Census units | Places | Places | Tracts | Tracts | Blocks | Blocks |
| Controls | | X | | X | | X |
| No. of observations | 5,202 | 5,202 | 15,572 | 15,572 | 1,105,265 | 1,105,265 |

*Notes:* The results are based on estimation of equation (3). Each observation is a census place in columns (1) and (2), a census tract in columns (3) and (4), and a census block in columns (5) and (6). The dependent variable is (ln) population for census places and (ln) population density for census tracts and blocks. Tracts and blocks without population are excluded, although results are very similar when they are assigned a value of one and included in the analysis. Each panel shows results using different measures of proximity, as specified. Control variables include (ln) elevation (column (2) only), (ln) elevation range (columns (4) and (6) only), latitude, longitude, and their interaction, as well as (ln) distance to the West Coast and (ln) distance to the nearest river. Also included are physiographic province fixed effects and state fixed effects. For more information on variable definitions, see the main text. Standard errors, which are shown in parentheses, are clustered at the level of the nearest mining site (as of 1940). *** p<0.01, ** p<0.05, * p<0.1.

Table 7: Modern Factors and Historical Mining Sites

| Explanatory variable | Housing units (1) | Median rent (2) | Median value (3) | Old housing (4) | Major roads (5) | Rail-roads (6) |
|---|---|---|---|---|---|---|
| *Panel A: Mining and modern factors* | | | | | | |
| <5 miles from site | 1.279*** | 0.043 | 0.175** | 0.083*** | –0.434 | –0.931** |
| | (0.140) | (0.047) | (0.075) | (0.029) | (0.422) | (0.445) |
| 5–15 miles from site | 0.824*** | 0.070* | 0.133** | 0.047* | –0.940*** | –0.703* |
| | (0.140) | (0.037) | (0.053) | (0.025) | (0.335) | (0.378) |
| 15–35 miles from site | 0.579*** | 0.053** | 0.141*** | 0.041** | –0.460* | –0.035 |
| | (0.141) | (0.024) | (0.049) | (0.019) | (0.243) | (0.405) |
| *Panel B: Mining and modern factors, conditional on population density* | | | | | | |
| <5 miles from site | 0.090** | –0.027 | 0.070 | 0.083*** | 0.163 | –0.489 |
| | (0.037) | (0.043) | (0.074) | (0.027) | (0.451) | (0.450) |
| 5–15 miles from site | 0.082*** | 0.026 | 0.067 | 0.047** | –0.567* | –0.427 |
| | (0.018) | (0.033) | (0.050) | (0.021) | (0.339) | (0.383) |
| 15–35 miles from site | 0.029 | 0.019 | 0.093** | 0.040** | –0.185 | 0.169 |
| | (0.022) | (0.023) | (0.044) | (0.017) | (0.258) | (0.399) |

*Notes:* The results are based on estimation of equation (3). Each observation is a census tract. Panel A reports simple mean differences; Panel B reports mean differences conditional on (ln) population density. Modern factor data include total housing units per square mile, median rent, median house value, percentage of housing built before 1939, total length in feet of roads, highways, and interstates (per square mile), and total length in feet of railroads (per square mile). All variables are in natural logs except the proportion of pre-1939 housing. Census tracts without transportation infrastructure are given a value of 0.01 feet (before scaling by area and log transforming). Control variables include (ln) elevation range, latitude, longitude, and their interaction, as well as (ln) distance to the West Coast and (ln) distance to the nearest river. Also included are physiographic province fixed effects and state fixed effects. For more information on variable definitions, see the main text. Standard errors, which are shown in parentheses, are clustered at the level of the nearest mining site (as of 1940). *** p<0.01, ** p<0.05, * p<0.1.