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# More than Chance: The Local Labor Market Effects of Tribal Gaming

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**Abstract**

Casino-style gaming is an important economic development strategy for many American Indian tribes throughout the United States. Using confidential U.S. Census Bureau microdata and a database of tribal government-owned casinos, I examine the local labor market effects of tribal gaming on different markets, over different time horizons, and for different subgroups. I find that tribal gaming is responsible for sustained improvements in employment and wages on reservations and that American Indians benefit the most. I also find that tribal gaming increases the average rental price of housing but by an amount smaller than the average wage increase, suggesting net local benefits.

JEL codes: R23, R58, J40, J15, L83

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## 1 Introduction

Local economic conditions on federally recognized American Indian reservations have consistently lagged behind the rest of the United States.[1] Although many reservations are located in remote areas, geography alone does not fully explain differences in economic outcomes. Relative to reservations, average wage income in counties bordering reservations was 25 percent higher in 1980 and remained 25 percent higher in 2010.[2] Over those three decades, the employment gap increased from 14 to 19 percent. The persistence of poverty on reservations is due to a complicated combination of institutional, political, and legal factors, many of which are rooted in a history of colonization (Jorgensen, 2007). American Indian economic progress must therefore be achieved within constraints put in place by colonial systems and policies.[3]

Within this context, hundreds of tribal governments across the United States have turned to the casino and gaming industry to foster local economic activity and raise revenue. Tribal gaming is a tribal government innovation predicated on the sovereignty of Native nations. Commercial casino-style gaming is only permitted state-wide in Louisiana and Nevada; otherwise, it is limited to distinct geographic areas such as waterways. In the 1970s and 1980s, several Native nations asserted their sovereign right to conduct gaming operations on their tribal lands–a right that was codified with the 1988 passage of the Indian Gaming Regulatory Act (IGRA). Since then, tribal gaming has become the most important economic development strategy for federally recognized tribes across the United States (Akee et al., 2015). In 2019, 522 tribal gaming facilities employed approximately 200,000 people and generated almost $35 billion in annual gross revenue (National Indian Gaming Commission, 2020b).[4] Casino patrons typically come from outside the community, often outside the state (Dense and Barrow, 2003), so casinos represent the net entry of funds into tribal economies. Annual revenues generated by tribal government-owned gaming facilities now exceed combined annual revenues from commercial gaming facilities across the United States. The tribal gaming industry has accomplished this economic feat despite being legally confined to federally recognized tribal trust lands, comprising only 2 percent of the total land area of the United States.[5]

[1] There are different designations for Native lands in the United States. Federally recognized reservations are lands designated for tribes with federal recognition. According to the Bureau of Indian Affairs, there were 326 land areas in the United States administered as federal Indian reservations as of 2017.

[2] Calculations based on author's tabulations from confidential decennial Census and American Community Survey data. See Appendix Figure A.10.

[3] I use the term American Indian rather than more inclusive terms such as Indigenous or American Indian and Alaska Native (AIAN) because this paper focuses on economic activities pursued by American Indian tribes in the contiguous United States and not by other Indigenous communities.

[4] Note that not all 522 gaming facilities are included in my analysis for reasons discussed throughout the paper.

[5] Calculations are based on 2018 public statistics provided by the U.S. Census Bureau and land tenure data provided to the author

In this paper, I use confidential demographic Census data and data on tribal government-owned casinos to examine the economic effects of tribal gaming. I leverage the level of detail in the Census microdata to study the effects of tribal gaming separately for American Indian (AI) residents of reservations and white residents of reservations. I include a range of measures of labor and housing on reservations and in the surrounding counties to study the effects of tribal gaming on different markets. I use data from 1980–2014 to study the effects of tribal gaming over time. I estimate all of these effects using a conditional difference-in-differences approach that accounts for selection into gaming via a semi-parametric weighting mechanism. This method uses inverse probability weights based on observable characteristics to match reservations with casinos to reservations without casinos.

I find that tribal gaming increases employment and wages by 2.4 percentage points and 5.6 percent, respectively, on reservations.[6] These effects persist for many decades after casinos open. Separate analyses suggest that labor market improvements are likely driven by American Indian workers and are concentrated on reservations rather than the broader counties. In addition, I find that tribal gaming alters the housing markets on reservations. Tribal gaming increases the probability of renting by 3.8 percentage points and increases the rental price of housing by 4 percent.[7] A reduced-form comparison of the nominal wage effect with the rental price effect suggests that tribal gaming has a positive effect on real wages.

Tribal gaming is an example of a place-based economic development strategy. Place-based policies are a class of policies designed to shift economic activity toward economically lagging areas.[8] Pursuant to the IGRA, gaming tribes must locate their facilities on tribal lands and must invest revenues in ways that benefit the tribe. Whether place-based policies confer long-term benefits to the people living in the targeted places is an empirical question.[9] The basic intuition is as follows. The direct effect of a place-based policy that increases the demand for local labor is an increase in wages, which induces migration into the targeted locality.[10] Housing supply then increases to meet new levels of demand for housing. The housing supply

by the Bureau of Indian Affairs.

[6]The 5.6 percent increase in wage income is defined relative to the average wages of employed people living on reservations that never opened a casino during my sample time frame.

[7]The 4 percent increase in the rental price is defined relative to the average rental price for renters living on reservations that never opened a casino during my sample time frame.

[8]Place-based policies typically take the form of spatially targeted investments or tax incentives. Place-based policies can be contrasted with person-based policies, which aim to help economically disadvantaged people, irrespective of where they live. For example, person-based strategies include welfare and working tax credits, like the Earned Income Tax credit. Place-based policies would include Enterprise Zones.

[9]According to standard theory, the entire benefit of spatially-targeted programs accrues to the owners of non-traded capital (Rosen, 1979; Roback, 1982). Standard spatial equilibrium theory assumes a world where workers are perfectly mobile and the housing supply is completely elastic.

[10]Migration onto reservations may be constrained by land use regulations and infrastructure weaknesses. But migration onto

response is delayed and incomplete, leading to an increase in housing prices. In equilibrium, real wages remain unchanged. This equilibrium suggests that it may be difficult to justify place-based policies from a welfare perspective when markets function perfectly.

My results suggest that tribal gaming delivers uniquely concentrated net benefits to the people living in the places where the policy is implemented. This result adds to our understanding of when and under what conditions place-based policies may be most effective. This question is often difficult to address because place-based policies tend to be implemented in a small number of regions and with a great deal of variation in the bundle of investments and incentives offered in different regions. In contrast, tribal gaming is implemented across a large number of localities. Although gaming facilities may vary in size, the federal regulations governing tribal gaming operations are applied uniformly across nations.[11] My research suggests that place-based policies may be most effective when local governments have autonomy over the application of the policy, when the locality is characterized by high baseline unemployment, and when workers hold a strong preference for place.[12]

This research also contributes to our knowledge of how tribal gaming affects the long-run well-being of American Indian reservations and the people living on them. Tribal gaming has been linked to increased economic activity either on reservations or in the wider geographies where reservations are located (Simeonova et al., 2021; Anderson, 2013; Conner and Taggart, 2013; Reagan and Gitter, 2007; Evans and Kim, 2006; Evans and Topoleski, 2002). Gaming revenues have enabled tribal governments to invest in their economies, societies, and institutions (Akee et al., 2015). Although gambling invokes negative connotations for many people, the research on the social costs of tribal gaming has produced weak or mixed evidence on associations with crime, health, education, and problem gambling.[13] There is still much we don't know about the impact of the tribal gaming industry on local communities more broadly, especially in light of the predictions about the general equilibrium effects of place-based policies.

This paper complements the literature by contextualizing the effects of tribal gaming within a local labor

reservations is possible, in most cases even for people who are not members of the tribal community.

[11] Tribal casinos are subject to tribal-state compacts, however, which are unique within tribe-state pairs. This is discussed in more detail in Section 2.

[12] See Section 3.

[13] Some research has shown that tribal gaming is associated with short-run increases in bankruptcy, violent crime, and auto theft in the county where the casino opens (Evans and Topoleski, 2002). Although data are limited and sample sizes are small, studies of First Nations gaming in Canada find little evidence of increases in post-casino crime or problem and pathological gambling rates (Belanger, 2014; Williams et al., 2011). Tribal gaming is correlated with health improvements, such as a decrease in smoking, heavy drinking, and obesity (Wolfe et al., 2012). The evidence on the effects on education is mixed. Evans and Kim (2006) find that casinos increase high school dropout rates and reduce college enrollment, but Akee et al. (2018) find that distributing casino revenues to tribal citizens improves child educational attainment.

market framework and examining the effects of tribal gaming over different time horizons, on different markets, and for different subgroups.[14] Past research largely focuses on a narrow post-adoption window of time. In my research, I use 26 years of post-IGRA data and perform event study analyses to examine the persistence of casino shocks over time. My results suggest that the average labor market effects are close to constant over time. But ten years after the casino opens, employment effects begin to increase for white people living on reservations while they begin to decrease for American Indians. Past studies do not estimate the effects of tribal gaming on non-labor outcomes. In my study, I incorporate measures of housing and find that tribal gaming increases the probability of renting versus owning a home and, consequently, increases the rental price of housing. These results indicate that the effects of tribal gaming extend beyond the labor market, suggesting the need for a richer array of outcome measures in our studies. In addition, due to data limitations, most papers have been unable to distinguish between the effects of tribal gaming on and off reservations. My paper separately identifies the effects of tribal gaming on reservations and on off-reservation county complements. My results suggest that the long-run effects of tribal gaming are largely contained to the reservations themselves. All in all, my paper adds support and further nuance to the growing body of research pointing to the success of gaming as a tribal government economic development strategy.

The rest of the paper is organized as follows. Section 2 describes the institutional context and the history of tribal gaming. Section 3 introduces a framework for studying the local labor market effects of tribal gaming. Section 4 describes my empirical approach to analysis, including my data and the approach I take to dealing with non-random selection into gaming. In Section 5, I present the results from the labor market analysis (Section 5.1), the housing market analysis (Section 5.2), and additional analyses (Section 5.3). Section 6 gives my concluding remarks, including a discussion of the implications of tribal gaming for individual well-being.

## 2 Institutional Context

Many Native communities throughout North America have a rich tradition of gambling that predates colonization. Traditional games were often practiced at intertribal gatherings, serving as a means of "cultural transmission and knowledge exchange" (Yanicki, 2021). But in the 1970s and 1980s, tribes began to open small-scale gaming facilities, namely bingo halls, for profit. The pivotal moment for tribal gaming as an

[14] I consider reservations to be local labor markets or geographically distinct localities where labor market activity is a function of policies and institutions.

economic industry was in 1987 when *California v. Cabazon Band of Mission Indians* came before the U.S. Supreme Court.[15] Through the lawsuit, the State of California sought to shut down the card room facilities of the Morongo and Cabazon Bands. The Supreme Court ultimately ruled against California, clarifying that state authority was civil or regulatory rather than criminal or prohibitory and therefore did not apply to tribal gaming operations taking place on reservations in states where those activities are already permitted in some form.[16] This ruling led to the passage of the 1988 Indian Gaming Regulatory Act (IGRA).

The IGRA created the National Indian Gaming Commission as the industry regulator and established a three-class system of regulation with different levels of state involvement. My research focuses on Class III gaming, or casino-style gaming.[17] Class III games were perceived to be the biggest competitive threat to the commercial gaming industry. Thus, before a tribe can operate a Class III facility, it must negotiate a compact with the state where the facility will be located. According to the IGRA, both states and tribes must enter into the negotiations in good faith, and states are not permitted to request a share of the casino revenues as a condition of compact approval, although, in practice, the majority of tribal-state compacts do have revenue-sharing provisions with varying payment structures (The United States Government Accountability Office, 2015).[18] Compacts may put limits on the size of tribal casinos or may include provisions to offset anticipated negative effects of gaming, such as investments in gambling addiction programs.

The IGRA puts conditions on gaming that are designed to generate uniquely concentrated benefits for host communities. First, the IGRA is spatially targeted. It stipulates that tribal casinos must be located on land that was held in tribal trust at the time of the passage of the IGRA.[19] Second, the IGRA requires that tribal governments have the sole proprietary interest in gaming operations. Third, Section 11 of the IGRA requires that net revenues from tribal gaming must be used in ways that improve tribal welfare.[20] District

[15] *California v. Cabazon Band of Mission Indians* was not the first challenge to tribal gambling operations. Throughout the 1970s and 1980s, local and state authorities began making arrests and issuing lawsuits. One high-profile example was the challenge to the Seminole Tribe of Florida's high-stakes bingo facility. The Supreme Court declined to hear *Seminole Tribe of Florida v. Butterworth* on the basis that the State of Florida's jurisdiction did not extend to the Seminole reservation, affirming the Seminole Tribe's sovereignty-based rights (Cattelino, 2005).

[16] Technically, the provision that states must not expressly prohibit gaming is not strictly interpreted. For example, the Foxwoods Resort Casino, one of the largest casinos in the country, is located in Connecticut, which permits nonprofits to host casino events for fundraising.

[17] Class I gaming is traditional tribal card games. Class II gaming is bingo and related games, which is regulated by the tribal government and the National Indian Gaming Commission. The state has no regulatory power over Class I or II gaming. Class III gaming includes all other games like Las Vegas-style casino games.

[18] The terms of tribal-state compacts are sometimes disputed. For example, the Seneca Nation recently took the State of New York to court in a dispute over the legality of provisions that required the Nation to continue to share revenue with the State. Future research could explore how the design of gaming compacts mediates the economic impact of casinos.

[19] Section 20 of the IGRA does provide a process for getting gaming facilities approved on lands acquired after 1988, but only eight tribes had received approval to do so by 2013.

[20] Specifically, the IGRA stipulates that revenues must not be used for purposes other than the following: i) to fund tribal

and Supreme Courts have consistently demonstrated a preference for economic activities that take place on the reservation and reflect a long-term commitment to economic development.[21] Qualitatively, we know that tribal gaming revenues tend to be invested in anti-poverty programs and tribal services (Akee et al., 2019). One of the most common investments has been in education. For example, the Osage Nation has funded college scholarships with their gaming revenues, and the Cherokee Nation has instituted language revitalization programs (Akee et al., 2015). Due to the conditions imposed by the IGRA, tribal gaming can be viewed as a place-based economic development strategy. Unlike many other types of place-based policies, however, tribal casinos are endogenous. As Cattelino (2008) points out, entrance into the tribal gaming industry is not a passive action or something that acts upon tribal communities. Rather, it is an action taken by tribal governments based on economic, political, and cultural incentives.

The passage of the IGRA precipitated a wave of casino openings across the country. Figure 1 shows a map of the federal reservations that had ever opened a Class III casino during my sample time frame. In the early years, tribal gaming was often characterized as an economic development panacea.[22] Three decades later, tribal gaming has not proved to be an economic panacea, and it certainly has not been an economic panacea for all tribal communities. Revenue data published by the National Indian Gaming Commission reveal a highly skewed distribution of gaming revenues, with 8 percent of all tribal gaming facilities responsible for more than 50 percent of total revenue in fiscal year 2021 (National Indian Gaming Commission, 2022). Nevertheless, tribal gaming has been the most important economic development strategy for tribal governments across the United States since the 1980s (Akee et al., 2015). Annual gross revenues from more than 500 tribal gaming facilities now surpass revenues from all commercial gaming facilities in the United States.[23] Tribally owned casinos generated almost twice as much revenue as the 25 largest Las Vegas Strip casinos combined in 2019 (National Indian Gaming Commission, 2020a; Nevada Gaming Control Board, 2020). Despite the size and importance of tribal gaming, a thorough understanding of the industry's impact is still developing.

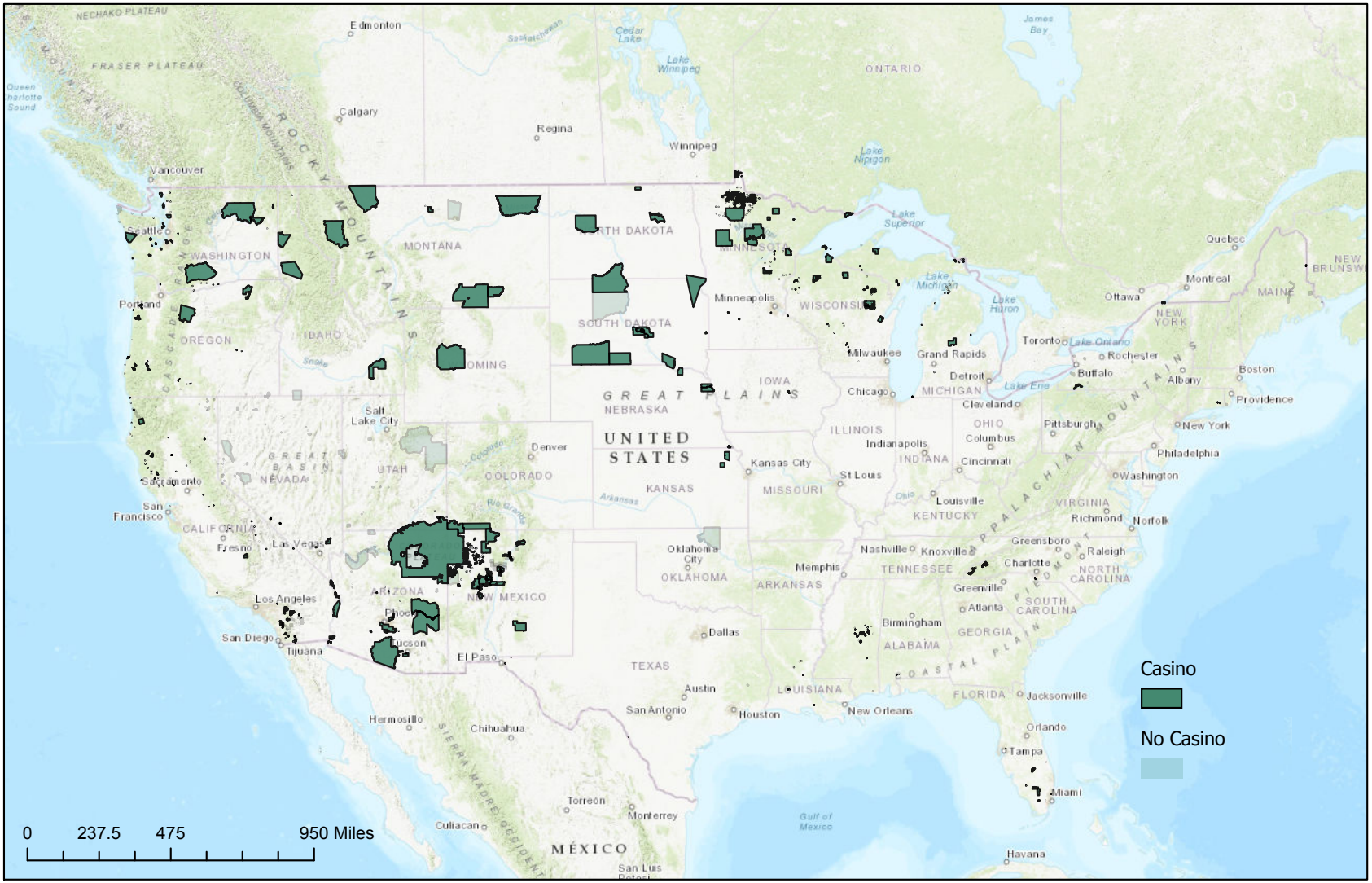
government operations, (ii) to provide for the general welfare of the Indian tribe and its members, (iii) to promote tribal economic development, (iv) to donate to charitable organizations, and (v) to help fund operations of local government agencies.

[21] In *Washington v. Confederated Tribes of the Colville Indian Reservation*, Judge McKay wrote that "tribes do have an interest in raising revenues for essential governmental programs, [and] that interest is strongest when the revenues are derived from value generated on the reservation by activities involving the tribes and when the taxpayer is the recipient of tribal services."

[22] In fact, it was commonly referred to as "the new buffalo," alluding to the historical importance of the North American bison to many Native communities throughout the Plains, the Northwest, and the Rocky Mountains. The comparison between tribal gaming and the North American bison highlights the importance of the gaming industry to the prosperity of Native communities.

[23] According to the American Gaming Association, 466 commercial casinos generated $30 billion in gross revenue in 2020 (American Gaming Association, 2023). By comparison, 515 tribal casinos generated $39 billion in gross revenue in fiscal year 2021.

Figure 1: Casinos on Federal Reservations




*Note:* Reservations that had opened a casino at some point by 2013 are shaded in dark green. Reservations that had not are shown with reduced opacity.

## 3 Framework for Studying the Effects of Tribal Gaming

In this paper, I exploit the opening of casinos to examine the impact of place-based policies on reservations. Due to the conditions of the IGRA, tribal gaming is a place-based economic activity that must be pursued on reservations.[24] I define federal reservations to be relatively clearly delineated local labor markets (Kline and Moretti, 2014; Moretti, 2011; Glaeser and Gottlieb, 2009). They are politically distinct localities characterized by specific industries, institutions, and local policies, resulting in regional differences in labor market activity (Redbird, 2021). I treat tribal casinos as place-based policies that generate a permanent shock to local labor demand, and I rely on the insights of general spatial equilibrium models to develop hypotheses about how local economic outcomes respond to these casino shocks.[25] In particular, I hypothesize that casino shocks may affect the labor market, the housing market, and the movement of people in the local labor market.

According to the standard spatial equilibrium framework, the direct effect of a local labor demand shock is an increase in nominal wages by an amount equal to the productivity increase (Rosen, 1979; Roback, 1982).[26] Higher wages in the locality induce the migration of perfectly mobile workers from other localities. The local labor supply response is determined by a number of factors, including wages, cost of living, and amenities. Higher wages increase the budget of the residents of the locality, raising demand for non-traded goods like housing. Higher demand for housing, paired with an inelastic housing supply, leads to higher housing prices. Standard spatial equilibrium models predict that real wages remain unchanged in equilibrium, and the entire benefit of the positive shock accrues to the owners of non-traded capital, or the landlords.[27] Appendix B provides a slightly more formal treatment of the general equilibrium effects of tribal gaming.

The standard Rosen-Roback model is instructive because it urges us to consider the general equilibrium response to local labor demand shocks. However, there are many ways in which the assumptions of the

[24] This statement is true with some exceptions. Some tribal casinos are located on off-reservation tribal trust land, generally due to its advantageous proximity to a metropolitan area. In addition, tribes may own commercial casinos in areas with no tribal lands. For instance, the Poarch Band of Creek Indians owns gaming facilities in Aruba and Curaçao through its Wind Creek brand. These instances are rare and excluded from my analysis.

[25] In practice, casino shocks are not permanent nor constant. Some tribal casinos have permanently closed. In my data, this has only happened to less than 5 percent of the casinos that opened. Also, many casinos temporarily close for renovations at some point in their lifetimes and can subsequently expand in size significantly. Given these caveats, we could consider the estimated effects to underestimate the true effects of tribal gaming. Future analysis would benefit from more detailed data on casino openings, closings, and renovations.

[26] This assumes homogeneous labor, perfectly competitive labor markets, and no unemployment.

[27] This prediction also assumes that local labor is not used for housing production.

standard model diverge from reality in the context of Indian country.[28] First, standard models assume that workers are perfectly mobile: they have no moving costs and they have nearly identical preferences. In other words, workers have no preference for place. In practice, land, community, or place is central to Indigenous identity as well as to economic development. Reservations are cultural centers for tribal members and are otherwise not equivalent to another locality, with amenities being held constant; therefore, workers on reservations would be considered inframarginal to place. Furthermore, property institutions on reservations may increase the cost of in-migration. Federal reservations are characterized by a patchwork pattern of land ownership, with a varying degree of land held in federal trust. Migration costs may affect workers asymmetrically because many of the amenities associated with living on trust land—i.e., tax benefits and tribal services—often require tribal membership. In addition, tribal gaming operations may adopt preferential hiring practices that favor American Indian workers, imposing a higher cost of migration on workers who do not identify as American Indian.

Second, the Rosen-Roback model assumes that markets are complete. In practice, there are labor market frictions on most reservations. Baseline unemployment is approximately 50 percent in my sample, depending on the survey wave. In addition, reservations have missing insurance and credit markets. Trust land is associated with credit constraints and transaction costs.[29] Lack of access to credit on trust land increases the cost of in-migration (Malamud and Wozniak, 2012; Wozniak, 2010; Bound and Holzer, 2000). Adaptations of the standard Rosen-Roback model describe how place-based policies may be efficient in light of pre-existing market distortions (Kline and Moretti, 2014). In addition, to the extent that some unemployment is involuntary, demand-side interventions may engender real benefits for workers (Austin et al., 2018; Bartik, 2014; Attanasio et al., 2011).

Although standard spatial equilibrium models may not reflect the complex realities of Indian country, they supply a key insight that place-based policies may provide only limited benefits to local residents in the long run. More generally, spatially-targeted interventions designed to foster growth in economically lagging places may precipitate a series of unintended changes. Labor market analyses of casinos tend to abstract from the possible general equilibrium effects of gaming. Humphreys and Marchand (2013) study the local labor market effects of commercial casinos in Canada and argue that casino shocks are not capable of

[28] Indian country is the legal term defined by U.S. law 18 USC §1151 to refer to all lands within the limits of any Indian reservation under the jurisdiction of the U.S. government, all dependent Indian communities within the borders of the United States, and all Indian allotments.

[29] Trust land cannot be used as collateral, which presents obstacles to accessing credit. Here, the term "transaction cost" refers to the reality that leasing or buying structures on trust land is a slow and encumbered process mediated by the federal government.

producing general equilibrium effects. They posit that wage changes are likely to be concentrated within the industry and that productivity spillovers are limited because casinos tend to hire unskilled workers. However, the authors acknowledge that this argument may not hold in rural places where casinos are often the largest employer, as is the case for the majority of reservations. Few papers directly examine the unintended effects of casinos on the housing market. Wenz (2007), the notable exception, uses Census-provided measures of housing value to estimate the implicit welfare effect of tribal and commercial casinos combined. This hedonic analysis is based on the premise that if casinos confer net benefits, people should be willing to pay higher housing prices; otherwise, they would move elsewhere. But there are issues with applying this method to Indian country, namely because housing value is hard to interpret when houses are built on trust land, the title to which is held by the federal government.

Several analyses indicate that tribal casinos are associated with economic gains in the short run (see Table 1), but we have little empirical evidence on the long-run effects of tribal gaming. All but one of the papers summarized in Table 1 stop at or before 2000, even though 40 percent of tribal casinos at that time had been open for five years or less. In addition, none of the papers in Table 1 estimates the effects of tribal gaming on the housing market. In fact, data limitations preclude most studies from treating the reservation as a local labor market and differentiating gaming effects on versus off reservation. I rely on 35 years of confidential Census microdata to help fill this gap in our understanding of the long-run local labor market effects of tribal gaming.

Table 1: Summary of Relevant Tribal Gaming Literature

| Source | Data | Sample | Time frame | Relevant findings | Main limitations |
|---|---|---|---|---|---|
| Simeonova et al. (2021) | Panel of Restricted Census and annual Internal Revenue Service (IRS) data | All primary and secondary tax filers who reside on reservations | 1989-2017 | Casinos increase family income rank 0.44 points (scale: 0-100) for all. Increase is larger for non-Indian families. | Analysis is focused on one outcome: income rank. Casino effects are not causally identified. |
| Anderson (2013) | U.S. Census Summary Files for tribal lands per Taylor and Kalt (2005) | Reservations: Single-race American Indian (AI) only | 1990 & 2000 | Casinos increase AI per capita income 7.4%. Effects are not detected for smaller casinos. | Analysis focuses on the short run and is limited to single-race AI on reservations. No housing measures included. Data are reservation level and contain only one pre-treatment period. |
| Conner and Taggart (2013) | U.S. Census Summary Files for tribal lands per Taylor and Kalt (2005) | Reservations: AI only and all races | 1990 & 2000 | Class II & III gaming increases per capita income (appx $3k) and median income ($3.5-5.7k). Effects of Class III gaming are greatest on AI only. | Analysis focuses on the short run and is limited to reservations. No housing measures included. Data are reservation level and contain only one pre-treatment period. |
| Reagan and Gitter (2007) | U.S. Census of Population, Public Use Microdata Samples (PUMS) | Public Use Microdata Areas (PUMAs) with reservations: Tribal members only | 1990 & 2000 | Gaming facilities increase per capita income by 20% in MSAs and by 13% in non-MSAs. Employment increase is only detected outside MSAs (14 percentage points). | Analysis focuses on the short run. No housing measures included. Data do not identify reservations and only include only one pre-treatment period. |
| Evans and Kim (2006) | Restricted decennial long-form Census data | People who reside on reservations | 1990 & 2000 | Casinos increase labor force participation for AI women (3.4-6%) but not for men. Employment increases (2-6%) are larger for AI than non-AI and greatest in hospitality industry. | Analysis focuses on the short run. Effects on housing market are not estimated. Data contain only one pre-treatment period. |
| Evans and Topoleski (2002) | Bureau of Indian Affairs (data on tribes) & Bureau of Economic Analysis (data on counties) | Aggregated tribal groups, or counties that include reservations | 1983, 89, 91, 93, 95, 97, & 99 | For tribes: casinos increase tribal population 12%, increase employment 26%, and decrease fraction of working but poor 5.5 percentage points. For counties: Tribal casinos increase jobs/adult. Effects increase with time from opening. | Analysis focuses on the short run. No housing measures included. Data do not allow reservation geography and/or race to be identified. |

*Note:* This table summarizes the relevant literature that empirically examines the impact of tribal gaming on labor market outcomes. Limitations are outlined with a view toward highlighting the contributions of my research. Relevant evaluations of commercial gaming include Humphreys and Marchand (2013), Walker and Jackson (2007), and Grinols (2004). Empirical examinations of tribal gaming involving other types of outcomes include Akee et al. (2019), Akee et al. (2018), and Wolfe et al. (2012).

## 4 Empirical Strategy

### 4.1 Data

Demographic data used in this paper are provided by confidential microdata from the 1980–2000 Decennial Census long-form samples as well as confidential microdata from the 2005–2014 American Community Survey (ACS) samples.[30] These data include key measures of socio-economic conditions on reservations. The person files include data on income, employment, race, education, age, sex, marital status, and migration history. The household files include data on the dwelling type, the number of rooms, housing characteristics such as plumbing and kitchen facilities, and rent or mortgage paid for the housing unit.

There are public-use versions of the long-form data sets at various levels of aggregation, but the restricted-use versions have two main advantages. First, the restricted-use Census data contain microdata on people and households, allowing me to perform subgroup analysis for populations of interest. The Summary File (SF) data system publishes aggregate data for reservations, but it does not report all variables and does not report data for all subgroups of interest. Populations on reservations are not homogeneous, with some demographic groups experiencing better labor market conditions than others.

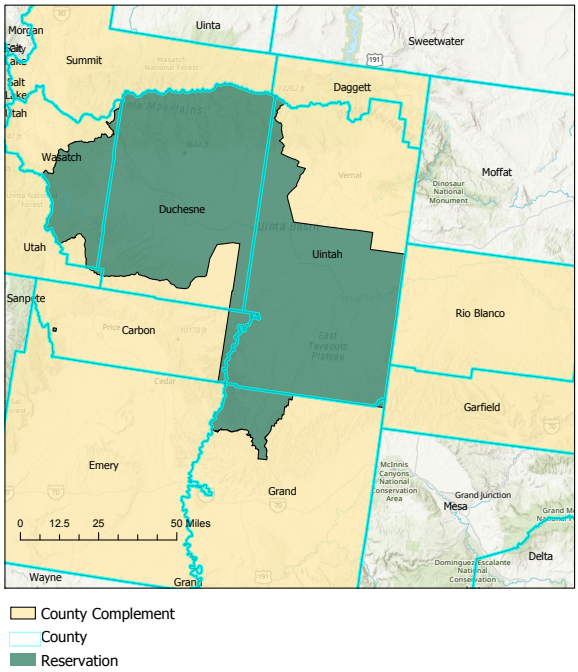
Second, the restricted-use Census data contain geographic information at a much finer level of granularity than the public-use Census data. The Public Use Micro Samples (PUMS) contain individual-level data but the smallest geographic level is the Public Use Microdata Area (PUMA), which is an aggregate of 100,000 people.[31] PUMAs do not delineate reservation boundaries and are not sufficient for identifying whether an individual resides on a reservation; furthermore, the homeland variable that indicates whether a PUMA contains a reservation is not available dating back to 1980. The geography files in the restricted-use Census data not only identify the census block, tract, county, and state, but they also contain a variable that indicates whether a person resides in an American Indian, Alaska Native, or Native Hawaiian Area (AIANNHA). This variable allows me to compare economic outcomes on reservations with economic outcomes in surrounding areas.[32]

[30] The Census long-form survey instrument is administered to one-sixth of the U.S. population, eliciting information about the housing unit and the social, demographic, and economic characteristics of each member of the household. The ACS is administered annually to 1 percent of the population. Due to small sample sizes on reservations and to mitigate disclosure risk, I have pooled ACS data into two five-year increments: 2005–2009 and 2010–2014.

[31] Counties with more than 100,000 people are separated into distinct PUMAs, and counties with fewer than 100,000 PUMAs are combined.

[32] The AIANNHA variable distinguishes between different types of homelands: federal Indian reservations, state reservations, off-reservation trust lands, Hawaiian Home Lands, Oklahoma tribal statistical areas, and Alaska Native villages. Pursuant to the IGRA, tribal gaming can only be conducted on federal Indian reservations.

Figure 2: Example of a County Complement




*Note:* This figure shows (in yellow) the land areas that would be included in the county complement to the Uintah and Ouray Reservation (in dark green) in northeastern Utah. The teal outlines show where the county borders are drawn. Counties are labeled.

I restrict my sample to people older than 16 years of age who live on or near a federal reservation in the lower 48 states between 1980–2014. Reservations recognized by state governments but not federal governments are not afforded the same rights to operate gaming facilities and are excluded from analysis. The sample used in my main analysis contains approximately 575,000 observations from approximately 250 reservations. To comport with the Census Bureau's data confidentiality rules, I dropped observations that were missing from any data source. I discuss sample creation in Appendix C.1, and I provide a comparison of the reservations included and excluded from the analysis.

I construct an additional sample comprising people who live in a county that contains one of the federal reservations from the main sample but do not live on the reservation itself. I follow the naming convention of Akee et al. (2017) and refer to the part of the county that does not contain the reservation as the "county complement." The county complement sample contains approximately 11,130,000 observations. Figure 2 provides a visual depiction of how the county complement would be defined in the context of the Uintah and Ouray Reservation in Utah.

Table 2 presents summary statistics for the reservation sample and the county complement sample used in the analysis. These tabulations indicate that the average resident of a federal reservation in my sample is

approximately equally likely to be American Indian or white. More than 80 percent of the people living in the counties surrounding the reservations are white. High school graduation rates, the proportion employed, and mean wages on reservations increased between 1980 and 2014 (columns 1 and 2) but remained low compared with the off-reservation county complement (columns 3 and 4).

Table 2: Sample Characteristics

| | (1) | (2) | (3) | (4) |
|---|---|---|---|---|
| | Reservation Sample | | County Complement Sample | |
| | 1980 | 2010-2014 | 1980 | 2010-2014 |
| American Indian | 0.46 | 0.5 | 0.01 | 0.01 |
| White | 0.5 | 0.43 | 0.89 | 0.8 |
| Female | 0.54 | 0.51 | 0.55 | 0.51 |
| Mean age | 40.64 | 44.88 | 43.33 | 45.55 |
| High school education | 0.51 | 0.76 | 0.66 | 0.83 |
| Employed | 0.37 | 0.48 | 0.42 | 0.57 |
| Homeowner | 0.74 | 0.71 | 0.73 | 0.65 |
| Have mortgage | 0.16 | 0.29 | 0.37 | 0.47 |
| Mean mortgage payment | 125.2 | 227.5 | 263.2 | 516.3 |
| Renter | 0.19 | 0.24 | 0.25 | 0.33 |
| Mean rent | 51.1 | 99.7 | 122.7 | 263.6 |
| Mean wage | 9,097 | 13,160 | 12,350 | 19,340 |
| Conditional mean wage | 20,290 | 26,010 | 25,410 | 32,470 |
| Observations by year | 66,000 | 147,000 | 1,738,000 | 2,015,000 |

*Notes:* Author's tabulations from confidential decennial Census data from 1980 and ACS data pooled from 2010–2014. Table shows summary statistics for the sample of people living on approximately 250 federal reservations (columns 1 and 2) and the sample of people living on county complements (columns 3 and 4) for the first and last waves of data included in analysis. The samples are restricted to people over the age of 16. Race is based on self-reported single race. Mortgage and rent payments are monthly payments in 2000 dollars and are not conditional on having a mortgage or paying rent. Wage is in 2000 dollars, and conditional wage is conditional on being employed.

I combine the confidential Census data with a dataset on casino gaming operations originally sourced through public sites, namely CasinoCity.com and the websites of the casinos.[33] My casino dataset includes all Class III gaming facilities opened on federal reservations between 1988 and 2013. It includes the name of the casino, the year it opened, the geographic coordinates, and two measures of size: the number of slot machines and square footage. These data are used to estimate the effect of casino adoption on economic outcomes on reservations.

Approximately 70 percent of the reservations in the sample used in the analysis opened a Class III

[33] A list of casinos and measures of casino size for 1988–2005 came from Wolfe et al. (2012). A similar list for 2005–2013 was provided by Michael Mathes. I appended the two datasets, resulting in a list that spans 1988–2013. I later validated and supplemented the dataset with a list covering that entire time period from Brad Humphreys. Casino City also collects more detailed, proprietary data (see CasinoCityPress.com), but my dataset contains only data that can be accessed through the Casino City website.

gaming facility at some point between 1988 and 2013. Table 3 presents summary statistics comparing reservations with casinos and without casinos based on land and population characteristics. On average, reservations with casinos are smaller in terms of land area but larger in terms of overall population size.[34] The share of the population identifying as American Indian is smaller on reservations with casinos. Although the same reservations supply the sample for Tables 2 and 3, the individual-level averages are lower than the reservation-level averages because smaller reservations tend to have a higher share of people who identify as American Indian. The differences in land area and population size and composition are statistically significant at the 5 percent level. Reservations with casinos have a smaller share of land held in federal trust on average, although the difference between adopters and non-adopters is not statistically significant.

Table 3: Reservation Characteristics by Casino Adoption

| | Casino | No casino |
|---|---|---|
| Population | 2,739 | 1,664 |
| Indigenous population share | 0.58 | 0.68 |
| Land area in acres | 240,000 | 320,000 |
| Share of land in trust | 0.71 | 0.79 |
| Number of reservations | 150 | 80 |

*Notes:* Author's tabulations from a variety of public data sources and from the confidential decennial Censuses and American Community Surveys. Reservations are classified as having a casino if they opened a casino at any point between 1988 and 2013 and are classified as not having a casino otherwise. The Indigenous population share is the share of the population that reports being Indigenous as their single-race identity. Both population measures are averages across 1980–2014 and are likely endogenous to casino adoption. The number of observations is rounded based on Census confidentiality rules.

### 4.2 Empirical Specification and Identification

I identify the effect of tribal gaming through a two-way fixed effects difference-in-differences (DD) regression framework, exploiting cross-reservation variation in casino adoption. This approach allows me to estimate a model that includes both reservation and time fixed effects. The economic relationship being estimated is given by Equation 1:

$$Y_{ihrt} = \beta \cdot Casino_{rt} + \alpha_r + \alpha_t + \mathbf{X}'_{ihrt} \cdot \gamma + \epsilon_{ihrt} \tag{1}$$

where $i$ indexes individuals, $h$ indexes households, $r$ indexes reservations, and $t$ indexes years. $Casino_{rt}$ is a time-varying indicator of whether a casino had opened on a reservation by year t. $\hat{\beta}$ is the coefficient of

[34] Population size was constructed using sample weights. Population counts are likely underestimates of the true population and, in particular, the true American Indian population (Ong et al., 2020). Note that the population measure shown in Table 3 should not be considered the baseline, or pre-treatment, size of the population. It is the average across all survey waves.

interest, representing the DD estimate of the casino effect. In various specifications, $Y$ captures three sets of dependent variables, including labor market measures ($Y_{ihrt}$): wage income, total income, employment, labor force participation, and hours worked; housing market measures ($Y_{hrt}$): homeowner, renter, mortgage payment, rent payment; and population measures: population size and American Indian population share ($Y_{rt}$), and recent move ($Y_{ihrt}$). $\mathbf{X}'$ is a vector comprising individual- or household-level controls (see Appendix C.2.5), and $\alpha_r$ and $\alpha_t$ are reservation and year fixed effects, respectively. I estimate the model separately for American Indian people and white people living on reservations as well as separately for people living on reservations and people living in off-reservation county complements. Unless otherwise specified, standard errors are clustered at the reservation level.[35]

The standard difference-in-differences model accounts for time-invariant systematic differences between reservations that opened casinos and reservations that did not open casinos, such as differences in tribal gaming traditions (Jorgensen, 2000) or in the presence of plausibly exogenous institutions (Cookson, 2010).[36] One factor that is highly predictive of casino adoption is proximity to markets. The average distance from the reservation to the nearest urban area is 23.58 kilometers for reservations that opened a casino between 1988 and 2013 and 32.61 km for reservations that did not.[37]

The variable $\beta$ identifies the average effect of casino adoption for reservations with casinos under the identifying assumption known as the parallel trends assumption. Intuitively, mean time trends in the outcome variables of interest must be the same for casino adopters and non-adopters in the absence of treatment. One possible concern with the standard DD model is that reservations with casinos may have been on a different growth trajectory before casino adoption and would have exhibited labor market differences even in the absence of casinos. Past research has indicated that the opening of tribal casinos may be related to time-varying measures like population size and composition (Wenz, 2008). Figure A.11 in the Appendix plots the raw data for two outcomes of interest—employment and wages—by year of the casino opening. These data show parallel pre-trends for the 69 percent of reservations that opened casinos in the middle of my sample time frame but not for the earlier or later adopters in my sample.

The potential violation of the parallel trends assumption suggests that there may be selection into casino

[35] Standard errors from county complement regressions cluster the standard errors at the county complement level.

[36] Cookson (2010) finds that the application of Public Law 280 (PL-280), which supplants tribal jurisdiction with state jurisdiction, is associated with casino adoption. Anderson and Parker (2008) argue that PL-280 is plausibly exogenous, although Dimitrova-Grajzl et al. (2014) find evidence to suggest otherwise. Either way, the implication that political institutions may predict casino adoption and also affect economic outcomes remains worth consideration.

[37] Calculated using all reservations that appear in my casino database. Distances are kilometers between the reservation centroid and the centroid of the nearest urbanized area or urban cluster.

adoption based on differential time trends. I conduct a two-step approach to correct for selection via a weighting mechanism. First, I employ lasso analysis to identify a set of pre-treatment measures that predict casino adoption. Lasso (least absolute shrinkage and selection operator) is a supervised machine learning method that uses non-parametric regression analysis to identify the explanatory variable(s) with the highest predictive value for the given dependent variable. This technique relies on an algorithm to run through all linear combinations of all proposed pre-treatment measures and select the subset of measures that minimizes the prediction error.[38] Lasso analysis selected pre-treatment measures of employment, education, population composition, and local in-migration. Next, following Abadie (2005), I use the selected set of explanatory variables to calculate a treatment propensity that absorbs control-treatment differences into a single scalar. I use this propensity score to address control-treatment imbalances by assigning inverse probability weights to reservations. This matching estimator allows me to recover the average treatment effect on the treated under the less restrictive *conditional* parallel trends assumption.[39]

A second concern arises due to the staggered adoption of casinos across reservations over time. Recent advancements in the DD literature point out that the two-way fixed effects DD estimate is biased in the presence of differential treatment timing if there are time-varying treatment effects (Callaway and Sant'Anna, 2021; Goodman-Bacon, 2021; De Chaisemartin and d'Haultfoeuille, 2020). Although the legislation that paved the way for tribal gaming was implemented in a single year, casinos opened in a staggered fashion across reservations. Figure 3 shows that most tribal casinos opened before the 2000s, but new casinos continued to open during the entire sample time frame. Figure 4 presents a series of maps showing the geographic evolution of casinos across the United States.

Borrowing the terminology of Goodman-Bacon (2021), in the case of a staggered treatment design, the two-way fixed effects DD estimator identifies the *variance-weighted* average treatment effect on the treated, where the weights are based on group size and time spent in treatment.[40] Time-varying treatment effects

[38]The set of proposed pre-treatment measures was determined by a combination of data availability and insights from the literature.

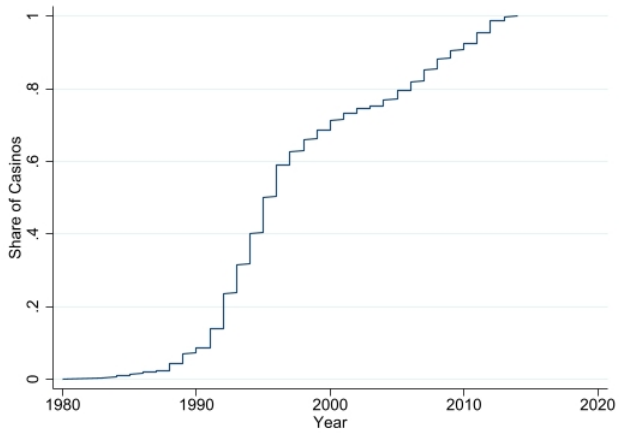
[39]In the notation of Abadie (2005), we can recover the average treatment effect on the treated through a weighted average of temporal differences in outcome measures:

$$ATT = \mathbb{E}\,[\frac{Y(1)-Y(0)}{P(D=1)} \cdot \frac{D-P(D=1|X)}{1-P(D=1|X)}]$$

where $D$ is the treatment indicator and $P(D=1|X)$ is the propensity score. Intuitively, this method is weighting down the outcomes for values of covariates that are over-represented in the control and weighting up the outcomes for values of covariates that are under-represented.

[40]In the case of differential treatment timing, the two-way fixed effects DD estimator is a weighted average of all potential 2X2 DD estimates where the weights are based on both group size and length of time spent in treatment. In the simplest version, there are three groups (early treated, late treated, and never treated) that generate four different 2x2 comparisons: early treated vs. late

Figure 3: Staggered Opening of Casinos

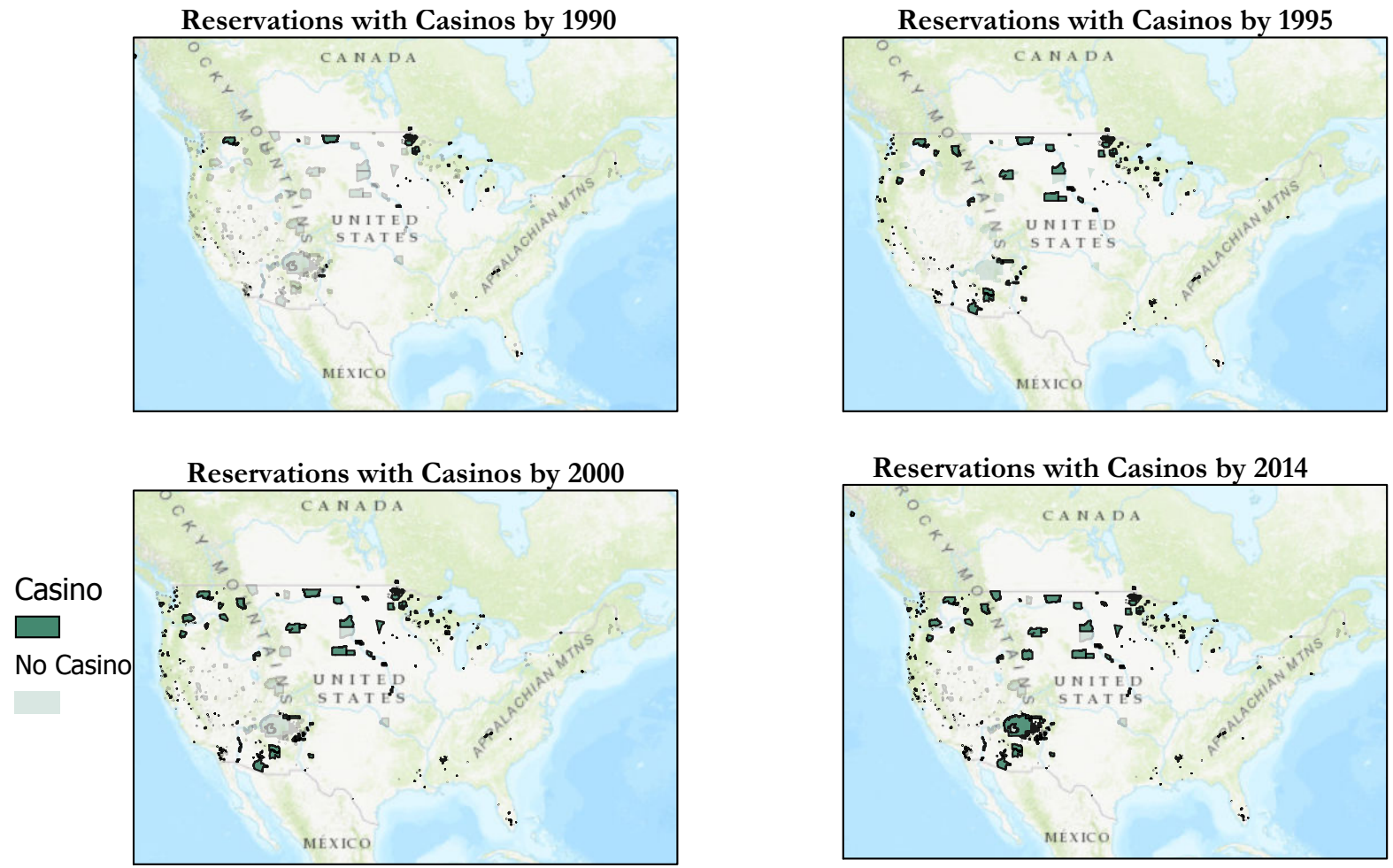



*Note:* This figure shows the share of tribal casinos open by each year between 1980 and 2013. Data are provided by public sources, including CasinoCity.com, and may include casinos that are not included in my main analysis. Each casino is represented as a separate unit, even if it is located on a reservation that already has an existing casino.

generate bias due to cross-group heterogeneity that comes from the different post-treatment windows. To address this concern, I test for temporal treatment heterogeneity using an adaptation of the Bacon decomposition. This exercise indicates that most of the casino effects are driven by the treated versus never-treated group and not by differences between groups treated at different times. Again, approximately 70 percent of the treated observations in my analysis are treated in one early Census wave: 1990–2000. I also find that treatment timing groups are largely balanced on baseline covariates. The lack of balance, if any, comes from the treated versus never treated comparison. This lattice of evidence suggests that bias due to differential treatment timing is likely minimal.

treated, treated vs. never treated, early treated vs. never treated, and late treated vs. never treated. Because the early-treated group spends the most time in treatment, it receives the most weight.

Figure 4: Evolution of Casino Adoption on Federal Reservations



To examine whether there are time-varying treatment effects and to assess the parallel trends assumption, I perform an event study estimation in addition to the conditional DD. The event study version is estimated by:

$$Y_{ihrt} = \sum_{k=-20}^{20} \gamma_k \delta_{k,rt} + \alpha_r + \alpha_t + \mathbf{X}'_{ihrt} \cdot \gamma + \epsilon_{ihrt} \tag{2}$$

In this specification, $\delta_{k,rt}$ is a time-since-implementation dummy. It is equal to 1 if reservation $r$ is $k$ years relative to its casino adoption in year $t$ and 0 otherwise. Years since implementation are grouped in five-year bins. All other variables are defined as in Equation 1. Observations are weighted by the inverse probability of casino adoption, as described above. Subgroup analysis is performed by estimating Equation 2 separately for American Indian people and white people.

## 5 Results

Estimates from my main analysis (Equation 1) indicate that tribal gaming drastically changes the economic landscape of reservations. Casino openings increase income, employment, labor force participation, and the rental price of housing. Additional analysis suggests that these effects are long-lived and are predominantly concentrated on American Indian people living on reservations.

### 5.1 The Labor Market

Table 4 reports the results of the conditional difference-in-differences estimation of Equation 1 for a set of labor market outcomes. The coefficients that appear in columns (1) - (3) indicate that casinos are responsible for a significant and meaningful increase in all three measures of income. Casino adoption has the largest effect on total income, with an average increase of $1,284 annually.[41] The change in total income may actually capture a combination of changes, including both a decrease in public assistance and an increase in household income due to per capita payments, which are cash disbursements of casino revenues made to tribal citizens.[42]

[41] This estimate is in line with Reagan and Gitter (2007), who find that tribal casinos increase the per capita income of tribal members in non-metropolitan areas by $1,500 annually. Their estimate is from a specification that controls for outliers.

[42] Per capita payments are typically small but sizable in some tribal communities. Not all gaming communities receive these transfers. Comprehensive information about per capita payments is not publicly available. As of 2009, more than 100 nations had received approval from the Bureau of Indian Affairs (BIA) to issue per capita payments (Taggart and Conner, 2011). The BIA does not have data on per capita payments beyond 2008 (Simeonova et al., 2021). Using information about per capita payments up to 2008, Conner and Taggart (2013) find that Class III gaming with per capita payments decreases labor force participation.

The results reported in columns (1) and (2) indicate that casinos increase average annual wage income by $731 and increase average annual earnings by $822. Earnings are defined as self-employment income plus wage income, so the larger effect on earnings suggests that casino openings may have a positive effect on self-employment that is additional to the effect on employment in the formal sector. My data suggest that the increase in wage income due to casino adoption represents a 3.8 percent increase, averaging over all post-adoption years.[43] The increase in total income represents a 5.8 percent increase. [44]

Table 4: The Labor Market Effects of a Casino Opening

| | (1) Wage income | (2) Earnings | (3) Total income | (4) Employment | (5) Labor force | (6) Hours |
|---|---|---|---|---|---|---|
| Casino | 731.0 | 821.5 | 1,284 | 0.024 | 0.027 | 0.690 |
| | (385.2) | (368.4) | (475.8) | (0.011) | (0.013) | (0.385) |
| Observations | 575,000 | 575,000 | 575,000 | 575,000 | 575,000 | 575,000 |
| Adjusted R2 | 0.194 | 0.218 | 0.271 | 0.170 | 0.182 | 0.193 |

*Notes:* Coefficients are from regressing labor market outcomes on an indicator of casino opening. All regressions include reservation and year fixed effects and the following covariates: age, education, sex, race, and marital status. Income measures are in 2000 dollars. Wage income is winsorized at the 95th percentile; earnings and total income are winsorized at the 5th and 95th percentiles. Heteroskedasticity-robust standard errors are shown in parentheses, clustered by reservation. Regressions are propensity score re-weighted such that all reservations have the same distribution of observed covariates as casino adopting reservations. Number of observations, model coefficients, and test statistics have been rounded based on Census confidentiality rules.

In addition to increasing average income, I also find that tribal casinos increase employment by 2.4 percentage points (Table 4, column 4) and increase labor force participation by 2.7 percentage points (column 5).[45] Others have documented that many American Indian casino workers are drawn from the pool of previously unemployed workers (Cornell et al., 1998). Despite employment changes, I find only a small increase in the number of hours worked, amounting to less than one hour per week on average (column 6).

The continuous measures that appear in Table 4, including measures of income and hours worked, are coded as zero for non-employed people.[46] The casino effect on wage income, for example, may be due to

[43]This calculation is based on the inflation-adjusted mean wage income on reservations that did not have a casino, which is $19,000.

[44]For comparison, Anderson (2013) uses Census data from 1990 and 2000 and finds a 7.4 percent increase in per capita total income for people who identify as American Indian and live on the reservation. There are many explanations for the discrepancy between my estimate and the estimate from Anderson (2013). For instance, the sample definition differs. Anderson (2013) excludes reservations with fewer than 250 residents, excludes the Navajo Reservation, and also excludes people who identify as multiple races. In addition, Anderson (2013) only estimates the effect of tribal casinos on outcomes measured in the year 2000.

[45]For comparison, Reagan and Gitter (2007) find that tribal casinos increase employment of tribal members by 14 percentage points in non-metropolitan areas only. In metropolitan areas, tribal casinos are not found to have a significant effect on employment. The authors conclude that the employment effects are driven by a reduction in the probability of being out of the labor force. This analysis relies on data from 1990 and 2000 and thus should be interpreted as a shorter-run effect of tribal gaming.

[46]This variable definition is partly to comply with Census confidentiality rules. Different definitions that allow for missing values would create new estimation samples, which would pose a disclosure risk.

a casino effect on the probability of employment or due to a casino effect on the wage income earned by employed people. Put differently, there are two margins on which casinos can impact wages. I decompose the casino effect into these two margins by adapting a decomposition that first appears in Attanasio et al. (2011) and, more recently, in Wheeler et al. (2022). Carrying through the earlier example, the wage effect can be decomposed as follows:

$$\underbrace{\mathbb{E}[Wage|Casino=1]-\mathbb{E}[Wage|Casino=0]}_{\text{ATE for wage}}=$$

$$\underbrace{(\mathbb{E}[Wage|Casino=1,Employ=1]-\mathbb{E}[Wage|Casino=0,Employ=1])}_{\text{ATE for wage|employment}}\cdot\underbrace{Pr[Employ=1|Casino=1]}_{\text{Treated employment probability}}$$

$$+\underbrace{\mathbb{E}[Wage|Casino=0,Employ=1]}_{\text{Control wage|employment}}\cdot\underbrace{(Pr[Employ=1|Casino=1]-Pr[Employ=1|Casino=0])}_{\text{ATE for employment}} \tag{3}$$

I define the extensive margin effect as the casino effect that would occur if treatment were to increase wages only by increasing employment (the last line of Equation 3). I define the intensive margin effect as the treatment effect on wages that would occur if treatment were to change wages but not lead to any additional employment (the second line).[47] The extensive margin effect and the intensive margin effect sum to the average treatment effect for wages. The same process can be followed for the other continuous labor measures that are only observed for the employed.

Table 5 reports the results of the decomposition. For each measure of income and for hours worked, the total casino effect (shown in the first row) is disaggregated into the extensive margin effect (second row) and the intensive margin effect (third row). The conditional casino effect (fourth row) is the implied mean change in income or hours worked per employed worker on a reservation with a casino. The control mean is calculated based on reservations that do not have casinos in a given year.[48]

This exercise indicates that the casino effects on wage income and earnings are driven by the employment effects or the extensive margin (columns (1) and (2)). In contrast, casinos increase total income both

[47]The extensive margin effect is the average treatment effect on employment multiplied by the mean wage for employed people living on reservations without casinos. The intensive margin effect is the difference between the total treatment effect on wage and the extensive margin effect on wage.

[48]The "control" includes reservations that never opened casinos as well as reservations that eventually opened casinos in their pre-treatment period.

Table 5: Decomposition of Labor Market Effects into Extensive and Intensive Margins

| | (1) Wage income | (2) Earnings | (3) Total income | (4) Hours |
|---|---|---|---|---|
| Total casino effect | 731.0 | 821.5 | 1,284 | 0.690 |
| | (385.2) | (368.4) | (475.8) | (0.385) |
| Extensive margin | 464.0 | 512.8 | 537.2 | 0.905 |
| | (204.0) | (225.5) | (236.2) | (0.398) |
| Intensive margin | 267.1 | 308.7 | 746.5 | -0.215 |
| | (251.5) | (211.1) | (318.5) | (0.240) |
| Conditional casino effect | 503.9 | 582.0 | 1,408 | -0.406 |
| | (474.5) | (398.2) | (600.7) | (0.453) |
| Control mean | 19,000 | 21,000 | 22,000 | 37.08 |
| Observations | 575,000 | 575,000 | 575,000 | 575,000 |

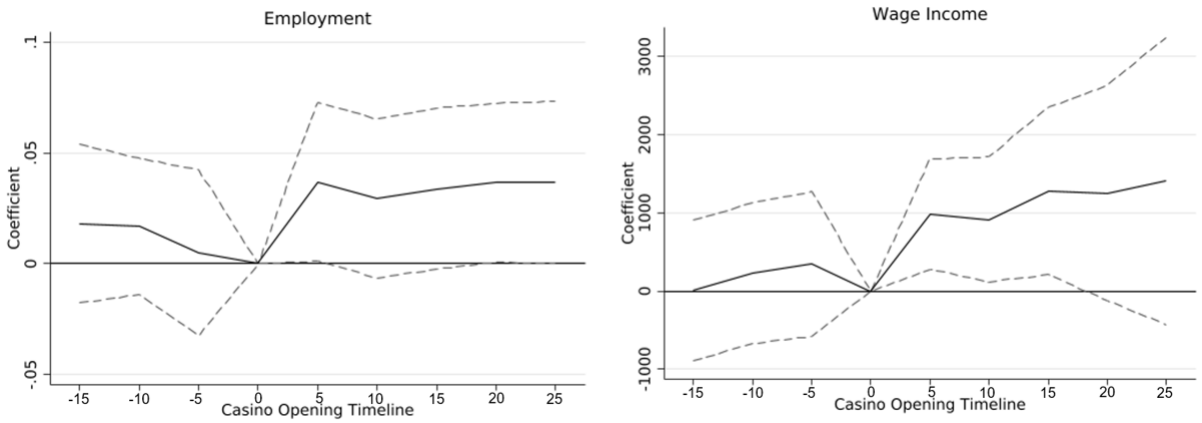
*Notes:* This table reports decompositions of casino effects on labor market outcomes into extensive and intensive margins. The extensive margins are the casino effects on outcomes due to the casino effect on employment, evaluated at the control mean. The control mean is the mean value for employed people on reservations without casinos. The intensive margins are the residual casino effects. The conditional casino effects are the implied mean changes for employed people on reservations with casinos. All regressions include reservation and year fixed effects and the following covariates: age, education, sex, race, and marital status. Income measures are in 2000 dollars. Wage income is winsorized at the 95th percentile; earnings and total income are winsorized at the 5th and 95th percentiles. Weekly hours are winsorized at the 95th percentile. Heteroskedasticity-robust standard errors are shown in parentheses, clustered by reservation and constructed using the Delta method. Regressions are propensity score re-weighted such that all reservations have the same distribution of observed covariates as casino adopting reservations. Number of observations, model coefficients, and test statistics have been rounded based on Census confidentiality rules.

through the extensive and intensive margins (column (3)). I find that annual total income increases by $1,408 among workers who are employed. Finally, the decomposition reveals that the small increase in hours worked may actually be the result of two opposing effects: an increase in hours worked through an increase in employment and a decrease in hours worked among workers who are already employed. The negative intensive margin effect on hours worked is not statistically significant, but it is suggestive that the household income effects associated with casino openings could have a negative effect on labor supply.

The coefficients reported in Tables 4 and 5 are estimates of the casino effects, averaging over all post-casino adoption time periods. But the local labor market effects of opening a casino need not be constant over time. Labor market changes may be largest initially, as labor is in high demand to construct the casino as well as staff the casino and related facilities. On the other hand, employment gains may continue to accrue over time if casinos have a job multiplier effect on the local economy or if they increase in size through expansions.[49] To examine the effects of opening a casino over time, I perform the event study

[49]Evans and Topoleski (2002) find that the effects of tribal casinos are larger 4–10 years after opening than in the first four years. The authors rely on a model that allows casino effects to change over time, but their data do not allow for the detection of anticipatory casino effects.

Figure 5: Event Study Employment and Wage Effects




*Note:* These figures plot coefficients and 95 percent confidence intervals from an event study specification that estimates the dynamic employment (left) and wage (right) effects of the casino opening. Coefficients are from regressions that are propensity score re-weighted such that all reservations have the same distribution of observed covariates as casino-adopting reservations. The x-axis represents years relative to the casino opening in year 0. Years -15+ are grouped with -15 and years 25+ are grouped with 25.

estimation described in Equation 2.

Figure 5 shows employment and wage effects over time. In the first five years after opening, the casino has the immediate effect of increasing employment and wage income. These effects persist, remaining relatively constant over time.[50] The second column of Figure 5 suggests that the wage effects may increase slightly over time, although I cannot detect heterogeneous effects with statistical precision. There are various explanations for possible increases in the wage effect. For example, wage increases may be due to productivity spillovers. Cozzetto (1995) describes how tribes' external executives of casinos are replaced by community members as they gain knowledge about the industry.

To shed light on which workers experience the labor market benefits associated with tribal gaming, I perform the same event study analysis for American Indian people and white people separately.[51] Throughout my analysis, I classify people as American Indian based on their self-reported single-race identity, which I impute using a multiple-race bridging method developed by Liebler and Halpern-Manners (2008), described in Appendix C.1. In most cases, workers need not be tribal members to take advantage of casino jobs. In my sample, the average resident of a reservation is approximately equally likely to be white or American Indian, and workers could be supplied by surrounding communities as well. There are, however, several reasons why there may be heterogeneous casino effects by race. First, some casinos institute preferential hiring

[50] The lack of heterogeneous treatment effects over time provides further support for the two-way fixed effects DD approach.
[51] Only about 5 percent of people living on federal reservations in my sample are neither American Indian nor white.

practices that derive from a legal exemption to Title VII of the Civil Rights Act known as the Indian Preference Exemption. Some tribal casinos such as the Mohegan Sun advertise a preference for hiring American Indian applicants in order to target labor market benefits toward members of the community.[52] Second, past research has shown that the benefits of policies targeted at Native communities may in some cases unintentionally accrue to people who are not members of the community (e.g., Pendakur and Pendakur, 2021; Aragon and Kessler, 2020).

Figure 6 shows the results of my subgroup analysis. The confidence intervals are large, but the figure suggests that, at least initially, the employment and wage effects on reservations are concentrated on American Indian workers. The patterns presented in the second column of Figure 6 suggest that casino adoption has no effect on the wage income of white people on reservations at any point in the post-adoption period. In contrast, the patterns presented in the first column suggest that employment effects for American Indian people may decline after the first five years, whereas employment effects for white people may increase. These findings suggest that Figure 5 masks important heterogeneity in casino effects over the post-adoption years.[53]

### 5.2 The Housing Market

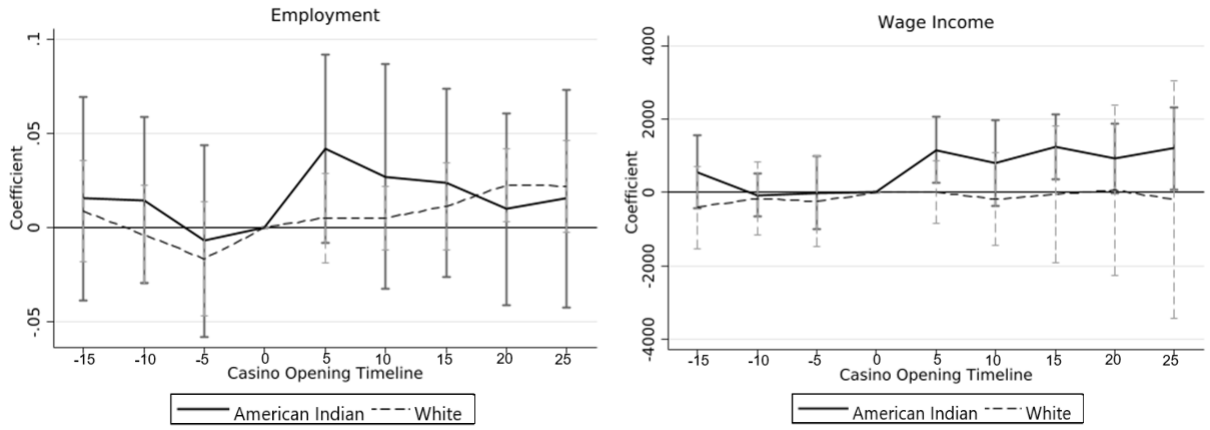
In line with the predictions of the standard spatial equilibrium models, I find evidence that tribal casinos affect the housing markets on the reservations where the casinos open. Table 6 reports the results of the conditional difference-in-differences estimation of Equation 1 for a set of housing market outcomes. This analysis is conducted at the level of the housing unit. Columns (1) - (3) indicate that casinos change the housing composition on reservations. I find that casino openings decrease the probability of homeownership by 5.3 percentage points. This effect is offset by the 3.8 and 1.5 percentage point increases in the respective probabilities of renting and occupying housing without payment.[54] One possible explanation for these results involves owner-occupied housing being converted to rental properties.

[52] Although I do not have detailed data on the hiring decisions of casinos, there is suggestive evidence that preferential hiring practices are adopted in some cases. For example, Akee and Taylor (2014) document that the proportion of American Indian people employed on reservations has increased substantially in the past 20 years and that there has been no commensurate increase in employment for others on reservations. Nevertheless, the mean wage and employment rate for white people on reservations in my sample are $16,230 and 55 percent, whereas the mean wage and employment rate for American Indian people are $9,115 and 39 percent.

[53] Heterogeneous casino effects are consistent with some past research. Evans and Kim (2006) find that tribal casinos have uniformly larger effects on the labor force participation, employment, and hourly wage of American Indian people than on others. Using detailed panel data, Simeonova et al. (2021) document that improvements in family income rank post-casino adoption are larger for white families, although per capita payments to American Indian families appear to overcome much of the difference.

[54] In the Census data, housing units are coded as being either owned outright, owned with a mortgage, rented, or occupied without payment. In this case, the homeownership variable includes ownership with and without a mortgage.

Figure 6: Event Study Employment and Wage Effects by Race




*Note:* These figures plot coefficients and 95 percent confidence intervals from an event study specification that estimates the dynamic employment (left) and wage (right) effects separately for American Indian people and white people living on reservations. Coefficients are from regressions that are propensity score re-weighted such that all reservations have the same distribution of observed covariates as casino-adopting reservations. The x-axis represents years relative to the casino opening in year 0. Years -15+ are grouped with -15 and years 25+ are grouped with 25.

These results are also consistent with an explanation involving an inelastic housing supply response to the in-migration of new workers following the opening of the casino. The per capita quantity of housing on federal reservations is lower than it is in the rest of the country. Based on the housing statistics from the 2006–2010 ACS, 11 percent of American Indian people living on reservations met the Housing and Urban Development definition for overcrowding (Pettit et al., 2016). Despite the availability of land, much of the land on reservations may be unsuitable for development. In addition, construction costs are higher on reservations than off reservations, and the average reservation continues to experience a high reliance on mobile homes. Rent-to-own programs like the Mutual Help Program have improved rates of home ownership in recent years but are unable to correct long-standing housing supply issues. In principle, tribal gaming may affect housing supply directly through its effect on housing demand and indirectly through its effect on a tribe's ability to finance home loans.[55] I do not observe housing supply directly, but I find suggestive evidence that casinos may spur new construction (see Table 8).

Column (5) of Table 6 indicates that casino openings have a small effect on average monthly rental payments that is statistically significant at the 10 percent level. Specifically, the opening of a casino is associated with a $10 increase in rent paid per month. The mean monthly rent paid on reservations without casinos is approximately $242 per month, so the $10 increase represents a 4 percent increase in the rental

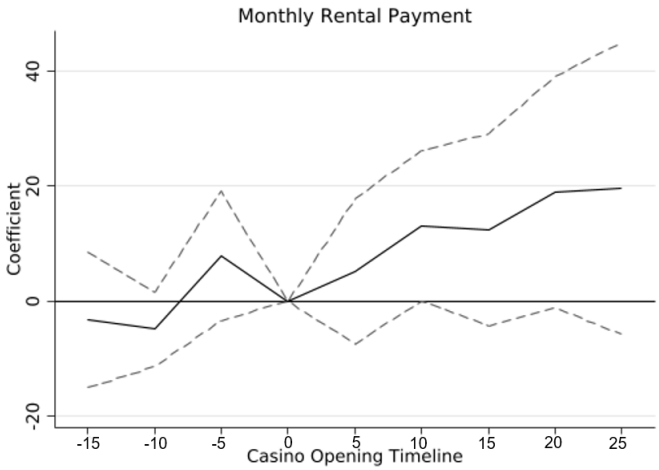
[55]For instance, casino revenues could be used to finance loans issued through the Native American Housing Assistance and Self Determination Act of 1996 (NAHASDA), which provides block grants and financing guarantees to tribes for private market loans to develop affordable housing.

Table 6: The Housing Market Effects of a Casino Opening

| | (1) Homeowner | (2) Renter | (3) Occupy | (4) Mortgage paid | (5) Rent paid |
|---|---|---|---|---|---|
| Casino | -0.053 | 0.038 | 0.015 | 23.83 | 10.05 |
| | (0.026) | (0.020) | (0.007) | (20.15) | (5.61) |
| Observations | 278,000 | 278,000 | 278,000 | 278,000 | 278,000 |
| Adjusted R2 | 0.115 | 0.128 | 0.035 | 0.222 | 0.117 |

*Note:* Coefficients are from regressing housing market outcomes on an indicator of casino opening. All regressions include reservation and year fixed effects and the following covariates: dwelling type, urban, complete plumbing, complete kitchen, and number of cars. Mortgage and rent paid are in 2000 dollars and winsorized at the 95th percentile. Heteroskedasticity-robust standard errors are shown in parentheses, clustered by reservation. Regressions are propensity score re-weighted such that all reservations have the same distribution of observed covariates as casino adopting reservations. Number of observations, model coefficients, and test statistics have been rounded based on Census confidentiality rules.

Figure 7: Event Study Housing Price Effects




*Note:* These figures plot coefficients and 95 percent confidence intervals from an event study specification that estimates the dynamic housing price effects of the casino opening. Coefficients are from regressions that are propensity score re-weighted such that all reservations have the same distribution of observed covariates as casino-adopting reservations. The x-axis represents years relative to the casino opening in year 0. Years -15+ are grouped with -15 and years 25+ are grouped with 25.

price. I do not find any statistically significant effect of the casino opening on monthly mortgage payments (column (4)); however, the interpretation of the size of mortgage payments is not straightforward. Mortgage payments reflect both housing price *and* borrower attributes. Monthly payments are also a function of the size and the term of the loan. In part for these reasons, the standard spatial equilibrium literature focuses on changes in the rental price of housing and makes the assumption that everyone in the model is a renter. In reality, only approximately 20 percent of people living on reservations in my sample rent their housing units (see Table 2). Using the same method of decomposition introduced in Section 5.1, I show in Table 7 that the rent effects are concentrated at the extensive margin: they are explained by a rise in the propensity to rent, rather than a rise in the rental price of housing conditional on renting.

Table 7: Decomposition of Housing Market Effects into Extensive and Intensive Margins

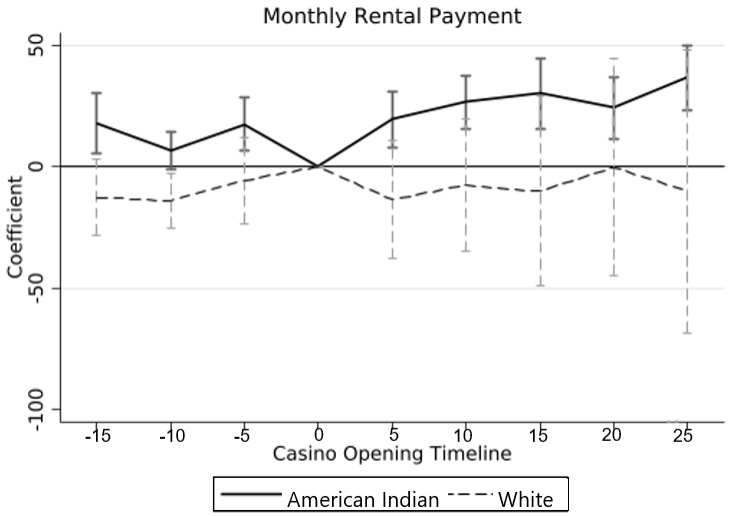
| | (1) Rent paid | (2) Mortgage paid |
|---|---|---|
| Total casino effect | 10.05 | 23.83 |
| | (5.605) | (20.15) |
| Extensive margin | 9.163 | 7.822 |
| | (4.767) | (4.867) |
| Intensive margin | 0.888 | 16.01 |
| | (2.052) | (17.03) |
| Conditional casino effect | 3.582 | 44.95 |
| | (8.273) | (47.85) |
| Control mean | 241.7 | 463.5 |
| Observations | 278,000 | 278,000 |

*Notes:* This table reports decompositions of casino effects on housing market outcomes into extensive and intensive margins. The extensive margins are the casino effects on outcomes due to the casino effect on renting a home (column 1) or having a mortgage (column 2), evaluated at the control mean. The control mean is the mean value for renters or people with mortgages on reservations without casinos. The intensive margins are the residual casino effects. The conditional casino effects are the implied mean changes for people living on reservations conditional on renting (column 1) or conditional on having a mortgage (column 2). All regressions include reservation and year fixed effects and the following covariates: dwelling type, urban, complete plumbing, complete kitchen, and number of cars. Mortgage and rent paid are in 2000 dollars and winsorized at the 95th percentile. Heteroskedasticity-robust standard errors are shown in parentheses, clustered by reservation and constructed using the Delta method. Regressions are propensity score re-weighted such that all reservations have the same distribution of observed covariates as casino adopting reservations. Number of observations, model coefficients, and test statistics have been rounded based on Census confidentiality rules.

Figure 7 shows that the rent effects are experienced not only around the time of the casino opening but also 25 years post-adoption. After opening, the casino continues to increase monthly rent steadily over time. Figure 8 suggests that the rent effects on reservations are predominantly experienced by American Indian people, not by white people. This result is probably not explained by a differential propensity to rent. American Indian people and white people in my sample are approximately equally likely to rent their housing unit, although white people are more likely to own homes and have mortgages on reservations.[56] It is possible that new migrants are both more likely to rent, which would increase the probability of renting and the rental price of housing, and more likely to be American Indian. This explanation is unlikely to be true. My subgroup analysis does not produce any evidence that people who identify as American Indian are more likely to have recently moved; however, my data do not allow me to observe migration directly.

[56]This is likely driven by the restrictions associated with trust land. White people on reservations are unlikely to live on trust land. It is substantially more challenging to get a mortgage on trust land than on fee simple land due to the inability to collateralize land that is held in trust. There are programs that have been enacted to overcome these obstacles, such as the Housing and Urban Development Office of Native American Programs Section 184 Indian Home Loan Guarantee Program (HUD-184). But past research suggests this program has been largely underutilized or ineffective on tribal lands (Laderman and Reid, 2010).

Figure 8: Event Study Housing Price Effects by Race




*Note:* These figures plot coefficients and 95 percent confidence intervals from an event study specification that estimates the dynamic housing price effects separately for American Indian people and white people living on the reservation. Observations in the regression are weighted by the inverse probability of opening a casino. The x-axis represents years relative to the casino opening in year 0. Years -15+ are grouped with -15 and years 25+ are grouped with 25.

### 5.3 Additional Results

In addition to analyzing the effects of tribal casinos on reservation labor markets and housing markets, the results of which I reported in Sections 5.1 and 5.2, I perform three analyses. First, I study the population effects of tribal gaming. Second, I test for heterogeneity by casino size. Third, I study the spillover effects of tribal gaming on adjacent areas.

#### 5.3.1 Population Effects

Standard spatial equilibrium models predict that place-based policies that induce local labor demand shocks will be responsible for changes in the local population. Table 8 reports the results of a conditional difference-in-differences estimation of the effects of casino openings on measures of population.[57] I do not find evidence that casino openings significantly affect the size of the adult population on the reservation (column 1); however, with repeated cross-sectional data, I am unable to interpret this as evidence against migration.[58] In fact, I find that casino openings increase the probability that a person has moved in the past ten years by

[57]Note that I use the same sample of people over the age of 16 for this analysis.

[58]My point estimates, although not statistically significant, are large. For comparison, Evans and Topoleski (2002) find that the tribal population in counties with reservations increases by 12 percent four years after a casino opens, but the authors cannot observe migration decisions and do not have data pertaining to the reservation itself. Akee and Taylor (2014) use ACS data to show that the American Indian population on reservations grew 24 percent between 1990 and 2010. In that same period of time, the American Indian population in Indian areas with gaming increased from 262,000 to 772,000, which represents a 195 percent increase.

Table 8: The Population Effects of a Casino Opening

| | (1) Log population | (2) AI share | (3) Recent move |
|---|---|---|---|
| Casino | 0.439 | -0.023 | 0.073 |
| | (0.342) | (0.051) | (0.037) |
| Observations | 1,000 | 1,000 | 575,000 |
| Adjusted R2 | 0.298 | 0.147 | 0.105 |

*Notes:* Coefficients are from regressing reservation-level measures of population (columns 1 and 2) and an individual-level measure of migration (column 3) on an indicator of casino opening. Columns (1) and (2) include state and year fixed effects. Column (3) includes reservation and year fixed effects and the following covariates: age, education, sex, race, and marital status. Income is in 2000 dollars and winsorized at the 95th percentile. Population is the log of the number of people living on the reservation. AI share is the share of the population that identifies as American Indian. Recent move indicates whether a respondent moved into their house in the past 10 years. Heteroskedasticity-robust standard errors are shown in parentheses, clustered by reservation. Regressions are propensity score re-weighted such that all reservations have the same distribution of observed covariates as casino adopting reservations. Number of observations, model coefficients, and test statistics have been rounded based on Census confidentiality rules.

7.3 percentage points (column 3). Although having recently moved is a crude proxy for migration onto the reservation, the coefficient does indicate that casino openings are responsible for more movement of people. I am also unable to detect evidence that the casino opening changes the share of the reservation population that identifies as American Indian (column 2). That being said, racial self-identification may be endogenous to casino openings, either leading to the dis-enrollment of tribal citizens (Gonzales, 2003) or leading to a higher likelihood of self-identifying as American Indian (Antman and Duncan, 2021).[59]

### 5.3.2 Casino Size Heterogeneity

The effects of casino shocks may be a function of the size of the shock (e.g., Anderson, 2013). To test for heterogeneity in casino effects by casino size, I estimate Equation 1 with an indicator for the opening of a casino and a continuous measure of casino size. Casino size is an aggregate index of the number of positions (slot machines) and square footage at each casino on the reservation in that year. I construct the index using the Anderson (2003) method of weighting variables using the inverse covariance matrix. The size index increases over time with the opening of additional casinos on the reservation. Aggregation over casinos is done by summation. Selected results are presented in Table 9. I find that the casino effects on employment and wage increase with the size of the casino shock (columns 1-2); however, this approach to testing for heterogeneity does not produce evidence of differential impacts on many other measures, including the

[59]Specifically, Antman and Duncan (2021) find that state policy changes that allow for tribal casinos are associated with a higher likelihood that people with Indigenous ancestry will self-identify as Indigenous and a lower likelihood that people with no Indigenous ancestry will self-identify as Indigenous. At the same time, tribes in particular that make per capita payments may tighten their tribal membership requirements due to competition for funds.

Table 9: Heterogeneous Effects by Casino Size

| | (1) Wage income | (2) Employment | (3) Recent move |
|---|---|---|---|
| Casino | 282.8 | 0.012 | 0.073 |
| | (257.0) | (0.007) | (0.036) |
| Casino size | 255.3 | 0.012 | 0.016 |
| | (139.1) | (0.005) | (0.017) |
| Adjusted R2 | 0.054 | 0.057 | 0.088 |
| Observations | 575,000 | 575,000 | 575,000 |

*Notes:* Coefficients are from regressing each outcome measure on an indicator of casino opening. All regressions include reservation and year fixed effects and the following covariates: age, education, sex, race, and marital status. Income is in 2000 dollars and winsorized at the 95th percentile. Recent move indicates whether a respondent has moved in the past 10 years. Casino size is an index that measures the aggregate size of the casino(s) on a reservation based on the number of slots and the number of square feet. Heteroskedasticity-robust standard errors are shown in parentheses, clustered by reservation. Regressions are propensity score re-weighted such that all reservations have the same distribution of observed covariates as casino adopting reservations. Number of observations, model coefficients, and test statistics have been rounded based on Census confidentiality rules.

probability of having recently moved (column 3).

### 5.3.3 Spillover Effects

Finally, the results reported in Table 10 indicate the extent to which the local labor market effects of tribal gaming spill over into the neighboring localities. I estimate Equation 1 for the sample of individuals and households that are located on the county complements to federal reservations. The regressions include county complement and year fixed effects and are weighted by the inverse probability that the bordering reservation opens a casino. I do not find any evidence that tribal gaming has a statistically significant effect on the labor market or housing market of the county complement on average, with the exception of a small ($5.72) increase in the average monthly rent payment.

This null result is inconsistent with the widely-held belief that tribal gaming has economic spillovers for nearby communities (e.g., Akee et al., 2015). But it is important to note that my analysis averages over all post-adoption years and does not differentiate between counties of different sizes. When I restrict my analysis to focus on rural reservations and their county complements only, I do find evidence of spillover effects.[60] The combination of these results is consistent with the argument that casino shocks are not the type of local labor demand shock capable of fundamentally changing the market equilibria of larger localities (Humphreys and Marchand, 2013). My analysis suggests that the effects of tribal casino shocks are, on average, localized to the reservations where the casinos open.

[60]The results of this analysis are not released to avoid Census disclosure risk.

Table 10: The Effects of a Casino Opening on the Surrounding Counties

| Panel A: Labor Market Outcomes | | | | | |
|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) |
| | Wage | Earnings | Employ | Labor | Hours |
| Casino | -479.2 | -530.8 | -0.002 | -0.003 | -0.334 |
| | (435.0) | (470.4) | (0.005) | (0.004) | (0.219) |
| County & year FE | X | X | X | X | X |
| Observations | 11,130,000 | 11,130,000 | 11,130,000 | 11,130,000 | 11,130,000 |
| Adjusted R2 | 0.200 | 0.221 | 0.172 | 0.195 | 0.211 |
| Panel B: Housing Market Outcomes | | | | | |
| | (6) | (7) | (8) | (9) | (10) |
| | Owner | Renter | Occupy | Mortgage | Rent |
| Casino | -0.007 | 0.007 | 0.000 | -20.15 | 5.72 |
| | (0.007) | (0.008) | (0.001) | (20.20) | (2.86) |
| County & year FE | X | X | X | X | X |
| Observations | 5,721,000 | 5,721,000 | 5,721,000 | 5,721,000 | 5,721,000 |
| Adjusted R2 | 0.306 | 0.314 | 0.009 | 0.260 | 0.245 |
| Panel C: Sociodemographic Outcomes | | | | | |
| | (11) | (12) | (13) | | |
| | Pop | AIAN | Move | | |
| Casino | 0.276 | -0.020 | 0.002 | | |
| | (0.195) | (0.013) | (0.014) | | |
| County & year FE | | | X | | |
| State & year FE | X | X | | | |
| Observations | 1,200 | 1,200 | 11,130,000 | | |
| Adjusted R2 | 0.405 | 0.067 | 0.212 | | |

*Notes:* All regressions use observations from the county complement sample. Coefficients are from regressing labor market outcomes (Panel A), housing market outcomes (Panel B), and demographic outcomes (Panel C) on an indicator of the casino opening on the reservation bordering the county complement. Panel A regressions control for a set of individual characteristics and Panel B regressions control for a set of housing characteristics. Population is log county complement population. Heteroskedasticity-robust standard errors are shown in parentheses, clustered by county complement. Regressions are propensity score re-weighted such that all reservations have the same distribution of observed covariates as casino adopting reservations. Number of observations, model coefficients, and test statistics have been rounded based on Census confidentiality rules.

## 6 Concluding Remarks

Investments in tribal gaming exceed investments in any other economic development strategy pursued by tribal governments in the past 30 years. By 2010, more than 90 percent of American Indian people living on reservations were living within a community that had a tribal government-owned gaming facility (Akee and Taylor, 2014).[61] My research contributes to our understanding of the economic implications of this unique

[61] Akee and Taylor (2014) point out that the percentage of American Indian people affected by tribal gaming is likely even higher because gaming nations may transfer some share of gaming revenues to non-gaming nations through inter-tribal gaming-device leasing or philanthropic activities.

industry that dominates the local labor markets of so many tribal communities.

My research quantifies the impact of tribal gaming on the labor and housing markets on reservations. I find that casinos are responsible for large improvements in the labor market, notably increasing average annual wage income and employment. I show that these positive labor market effects persist up to 25 years after the casino opens. Consistent with the predictions of spatial equilibrium models, I also find evidence that casinos have indirect effects on the housing market. In particular, casino openings increase the rental price of housing. Taken together, my results suggest that people living on reservations with casinos experience an increase in both average nominal wages and average housing prices. But a decomposition analysis suggests that the rental price effect is due to an increase in the probability of renting versus owning. In addition, a back-of-the-envelope calculation suggests that changes in real wages are positive, indicating that tribal casinos generate net benefits.[62] Furthermore, my analysis suggests that the net benefits are concentrated on the American Indian people living on reservations where the casinos open.

My results suggest that tribal gaming is a place-based policy that likely improves the well-being of local residents in the long run. This result is not trivial, given that the literature on local labor markets indicates that place-based policies do not necessarily confer benefits to local workers in equilibrium. The case of tribal gaming may therefore contribute to our understanding of where place-based policies are efficient. Tribal gaming may result in uniquely concentrated benefits for the local population because reservations are, on average, economically lagging places that are characterized by pre-existing market distortions (Malamud and Wozniak, 2012). Or, perhaps the benefits of tribal gaming are related to some combination of the conditions associated with the IGRA, which requires tribal gaming to be owned by tribal governments, operated within the confines of the reservation, and used as a source of revenue to invest in tribal services. To a certain extent, the IGRA upholds the autonomy of tribal nations to enter into the gaming industry and decide how to invest their revenues for the benefit of their community members.[63] This may serve as a model for other types of place-based development initiatives, both in Indian country and elsewhere.

Although this is outside of the scope of my research, the implications of tribal gaming extend beyond economics. For instance, tribal gaming relates to important issues like sovereignty. While the sovereignty

[62] This calculation is based on Equation 7 in Appendix Section B and uses estimates of the housing expenditure share ranging from 0.3–0.6. Using the wage income and rental price coefficients from Tables 4 and 6, I estimate that casino openings increase real wages by 3.7-5.2 percent.

[63] Granted, there are limits to this autonomy. These limits are particularly evident when tribal governments set out to open casinos rather than other types of gaming facilities because Class III casinos require the negotiation of a compact with the state where the reservation is located. In recent years, there have been several high-profile disputes over the terms of tribal-state compacts.

of Native nations is inherent, tribal gaming may both affirm and undercut sovereignty (Cattelino, 2010). For many nations, the act of opening a casino is an expression of sovereignty. This is an economic development strategy that cannot be pursued in most other parts of the state, and it is only made possible by tribal sovereignty. At the same time, success in gaming can lead to a movement to dismantle rights. For example, the U.S. government used economic strength to target tribes for Termination Era policies based on the argument that the communities with the strongest economies no longer needed a collective agreement with the government.[64] Concerns over potential competition for tribal casinos have also contributed to litigation between tribes. For instance, the federal recognition of the Cowlitz Indian Tribe was stalled due to opposition by the Quinault Indian Nation. In the context of First Nations gaming in Canada, Manitowabi (2011) argues that gaming simultaneously advances self-determination goals and neoliberal goals for the host nations, materializing as both a tool of decolonization and colonization.

Future research that helps us understand the full impact of tribal gaming could build an important protection against threats to undermine Native sovereignty through legal attacks on the tribal gaming industry.[65] A more comprehensive analysis of the local labor market effects of tribal gaming would include data on firms, revealing the demand-side responses in the local economy in the gaming industry and beyond. In addition, future work could examine the relationship between gaming revenues and access to finance. Casino revenues improve a tribe's credit rating, which reduces the cost of capital. Finally, at present, we have a limited understanding of the implications of the negotiations between states and tribes that pave the way for casino-style gaming on reservations. Future research filling these gaps would help support this tribally led economic development initiative.

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[64] Cattelino (2010) calls this approach "need-based sovereignty," which puts Native communities in the untenable position of being unable to exercise sovereignty without economic power and yet challenged about the legitimacy of their sovereignty given economic power.

[65] A 2022 lawsuit alleges that the agreement between Washington State and Native nations violates the U.S. Constitution's guarantee of equal protection. The lawsuit argues that tribal affiliation is race-based. This argument does not recognize Native Nations as sovereign entities.

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# Appendix

## "More than Chance: The Local Labor Market Effects of Tribal Gaming"

**Laurel Wheeler**

# A Additional Background

## A.1 Institutional and Economic Background on Indian Country

This research takes place within the context of Indian country, which is a non-contiguous geographic area that is legally defined to encompass different types of Native homelands in the United States, including reservations, dependent Indian communities, allotments, and special designations (US law 18 USC §1151).[66]

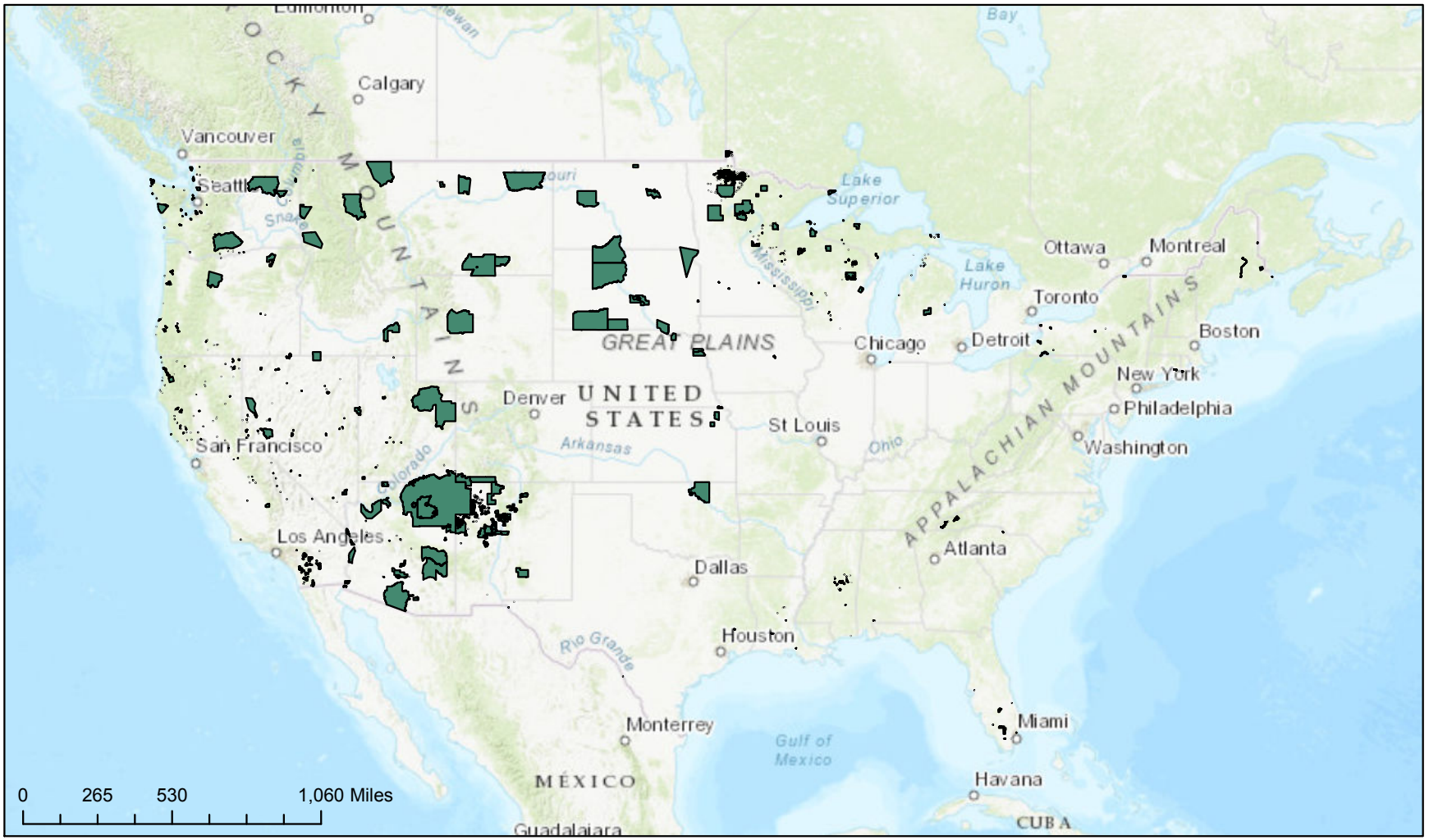
Figure A.9 shows the geographic distribution of federally recognized reservations in 36 states.[67] Most, though not all, reservations are located in the West in rural areas. Reservations range in size from the 16 million-acre Navajo Nation Reservation that stretches across parts of Arizona, New Mexico, and Utah to the 1.32-acre parcel of land in California where the Pit River Tribe's cemetery is located. There is also a great deal of heterogeneity in population size across reservations. At the time of the 2010 census, the Navajo Nation was an outlier with more than 170,000 people living on the reservation. In contrast, at that time, approximately 75 percent of federal reservations had fewer than 2,500 inhabitants (Census, 2011).

Post-contact Native history has been shaped by a series of federal policies that were designed to accommodate Euro-American expansion, resulting in tribal displacement, land loss, and a weakened ability to self-govern (Cornell and Kalt, 1998). The Indian Appropriations Act of 1851 allocated funds to move Native peoples from their traditional homelands to marginal lands in the West, creating the formalized reservation system that exists today (Indian Land Tenure Foundation, 2009). In 1887, the General Allotment Act divided up reservation lands into individually owned parcels. Following the allotment period, federal policy toward Native peoples seemingly vacillated between a desire to lend support to the sovereignty of Native Nations and a desire to disband tribal communities. The 1934 Indian Reorganization Act (IRA) was passed to stop allotment and recognize the sovereignty of Native nations. But federal policy reversed course during the Termination Era in the 1950s, giving some states civil jurisdiction within reservation boundaries through legislation such as Public Law 83-280. Finally, the 1960s and 1970s began the Self-Determination Era, bearing witness to the passage of legislation supporting tribal autonomy. In recent decades, federal policy increasingly recognizes tribal sovereignty in dealing with matters related to crime, employment, natural resources, healthcare, and finances. Tribal gaming has grown out of the Self-Determination Era.

[66] Dependent Indian communities (18 USC §1151(b)) are lands that are federally supervised and set aside for Native peoples. Allotments are lands that were originally part of a reservation before the Allotment Era policies that divided reservations. Allotments are parcels that are still in restricted or trust status. Special designations are congressional designations that are made for jurisdictional purposes.

[67] These are the lands designated as federal reservations during my sample time frame: 1980–2014. At the time of writing, there are 326 federal reservations.

Figure A.9: Federal Reservations

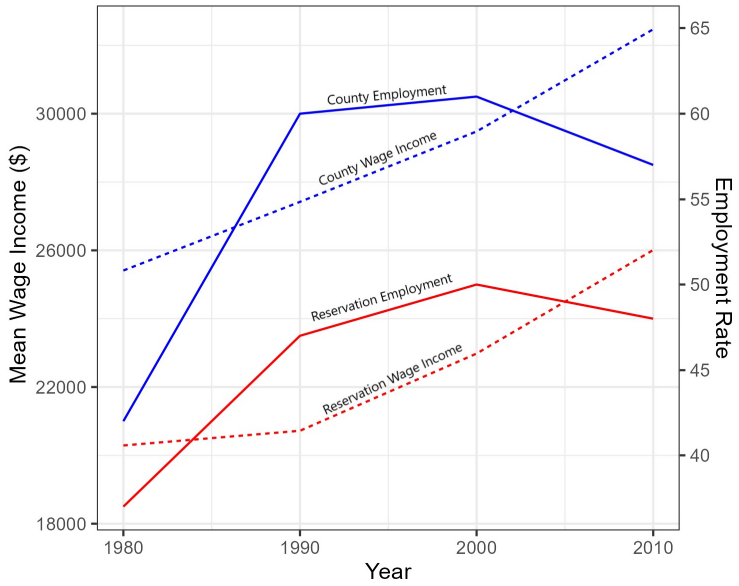



*Note:* Land areas designated as federal reservations in 2014 are shaded in dark green. Since the 2020 *McGirt v. Oklahoma* decision, 40 percent of Oklahoma is Indian country.

## A.2 Employment and Wage Trends

The patterns revealed in Figure A.10 show that employment and income inequality exist between reservations and the counties bordering reservations and have existed for decades.

Figure A.10: Labor Market Conditions on Reservations and Surrounding Counties




*Notes:* Plot shows the author's tabulations from confidential decennial Census data from 1980, 1990, and 2000 and ACS data pooled from 2010–2014. Summary statistics are provided for the sample of people living on federal reservations (in red) and the sample of people living on county complements (in blue). Mean annual wage income is given by the dashed lines, and employment rates are given by the solid lines. Wage income is in 2000 dollars and is conditional on being employed. The samples are restricted to people over the age of 16.

Figure A.11 plots the raw data for two outcomes of interest, employment and wages, by year of casino opening for four different groups. The first group comprises reservations that did not open a casino between 1980 and 2013. This group is a stable sample that serves as a comparison to three "treatment" groups:

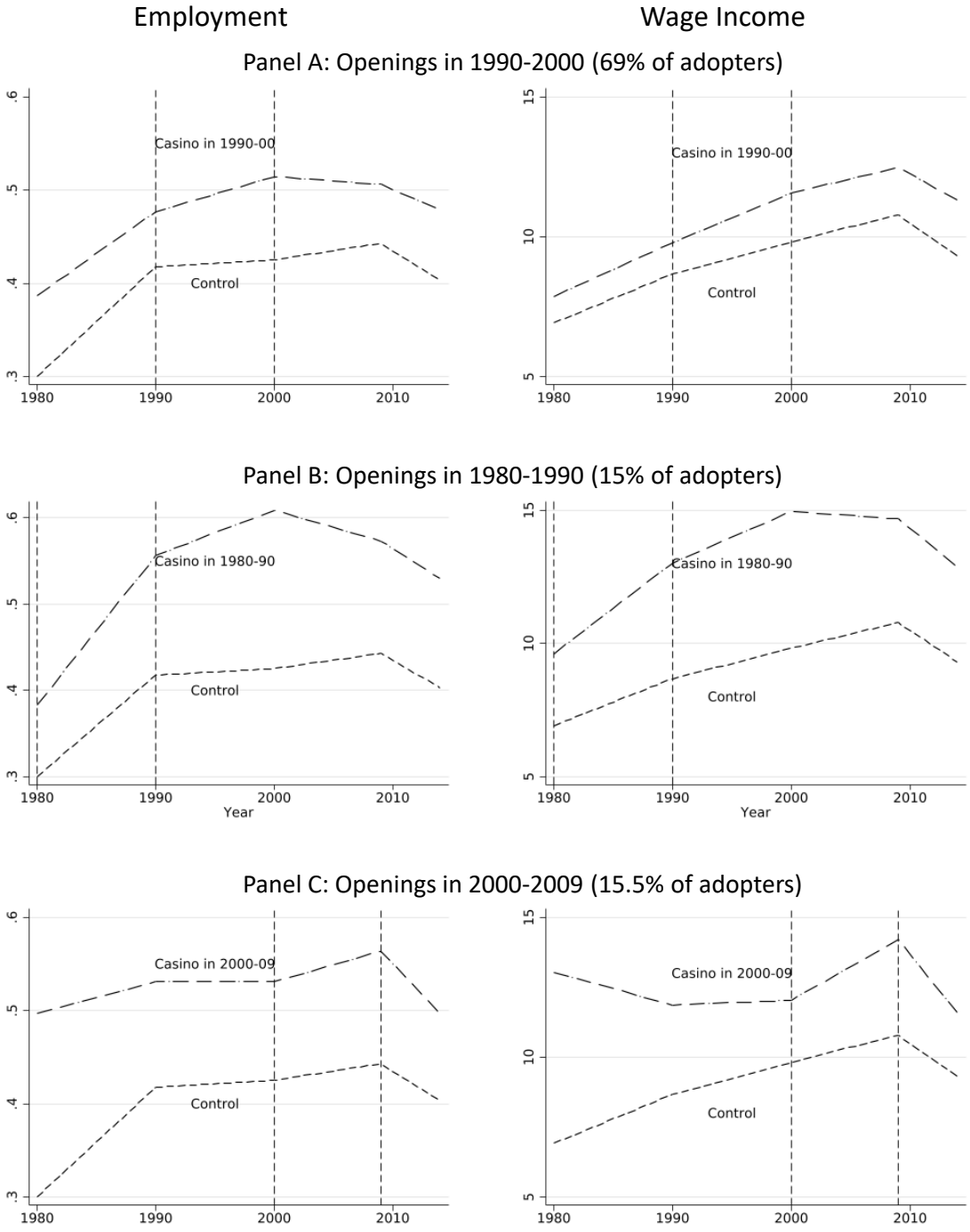
- Reservations that first opened a casino between 1990 and 2000 (panel A)
- Reservations that first opened a casino between 1980 and 1990 (panel B)
- Reservations that first opened a casino between 2000 and 2009 (panel C).

The vast majority (69%) of casino adopters opened a casino between 1990 and 2000. The graphs in panel A of Figure A.11 suggest minimal deviations from parallel trends in employment and wage across "treated" and "control" reservations. For the 15 percent of reservations in my data that opened casinos

before 1990, I only observe one pre-treatment wave of data. Panel C suggests somewhat larger deviations for the 15 percent of "treated" reservations that opened a casino between 2000 and 2009.[68]

[68] Less than 0.5 percent of treated reservations in my sample opened their first casino after 2010.

Figure A.11: Employment and Wage Trends by Year of Casino Opening




*Note:* This figure shows the unweighted employment (column 1) and average wage income (column 2) trends for reservations by year of casino adoption. There are three "treatment" groups: reservations that opened casinos at some point between 1990 and 1999 (panel A), reservations that opened casinos at some point between 1980 and 1989 (panel B), and reservations that opened casinos at some point between 2000 and 2009 (panel C). The two vertical dashed lines in each graph signify that casinos opened at some point between the lines. The "control" group comprises reservations that never opened a casino, and it is stable across all graphs. Wage income is in thousands of dollars, adjusted for inflation, and winsorized at the 95th percentile.

## B The General Equilibrium Effects of Tribal Gaming

The opening of a casino on reservation $r$ permanently shifts labor demand outward. The equilibrium response is defined by changes in wage, rental prices, and population. Following Suarez Serrato and Zidar (2016), assuming full labor force participation and market clearing conditions, tribal gaming has the following effect on wages $(w_r)$, rental prices $(p_r)$, and population $(N_r)$:

$$\frac{\partial w_r}{\partial Casino_r} = \frac{\triangle L_r^D}{\epsilon_r^S - \epsilon_r^D} \tag{4}$$

$$\frac{\partial p_r}{\partial Casino_r} = (\frac{1+\epsilon_r^S}{1+\eta_r})(\frac{\partial w_r}{\partial Casino_r}) \tag{5}$$

$$\frac{\partial N_r}{\partial Casino_r} = \epsilon_r^S(\frac{\partial w_r}{\partial Casino_r}) \tag{6}$$

where the symbol $\triangle$ denotes a percentage change, ${L_r}^D$ is labor demand, $\epsilon_r^S$ and $\epsilon_r^D$ are the elasticities of labor supply and demand, respectively, and $\eta_r$ is the elasticity of housing supply. Equations 4–6 suggest that the level effect of opening a casino is likely an increase in wages, rental prices, and local population. It is not necessarily the case that wages will be higher in equilibrium. For example, if per capita payments due to casino revenues are so large that workers leave the labor force, average wages from employment may stay the same or even decrease. Although per capita payment amounts are not publicized, this scenario seems unlikely, especially given that wage effects average over all reservations, and not every tribe issues per capita payments.

Higher nominal wages alone do not signify welfare improvements. Busso et al. (2013) demonstrate that changes in worker welfare can be calculated from changes in mean utilities in the shocked locality.[69] It follows that the effect of tribal gaming on the welfare of workers on reservation $r$ is given by:

$$U_{ir} = ln(w_r) - \alpha ln(p_r) + A_r + \epsilon_{ir} \tag{7}$$

[69] They show that the partial derivative of the indirect utility function $V$ with respect to the mean utility across agents $v_r$ is equal to the number of workers in the locality: $\frac{\partial V}{\partial v_r} = N_r = \mathbb{E}[\max_r \ v_r + \xi_{ir}]$. Assuming $\xi_{ir}$ are type I extreme value, this is equivalent to $\sigma \log(\exp \frac{v_r}{\sigma})$.

which can be approximated as the percent change in real wages: $ln(w_r) - \alpha ln(p_r)$, where $\alpha$ is the housing expenditure share. Values of $\alpha$ range from 0.3 to 0.6 in the literature (Suarez Serrato and Zidar, 2016; Notowidigdo, 2011; Diamond, 2016). Equation 7 is a reformulation of Roy's Identity and indicates that welfare depends on both nominal wages and rental prices.

# C Data Appendix

In this data appendix, I define the variables used in the analysis, and I describe the process by which I generated the two samples used in analysis.

## C.1 Sample Description

The main sample used in analysis contains people over the age of 16 who reside on federal reservations. To comport with Census confidentiality rules, I drop observations that are missing data for any dependent variable or for my explanatory variable. Whenever possible, I set missing values equal to zero for dependent variables. For example, hours worked equals zero if a person is unemployed. I also drop observations that do not have an inverse probability weight associated with them. This could be due to a lack of pre-treatment data for a given reservation.

The full sample of people living on federal reservations between 1980 and 2014 covers 324 reservations in 36 states. The states without reservations are Arkansas, Delaware, Georgia, Illinois, Kentucky, Maryland, New Hampshire, New Jersey, Ohio, Pennsylvania, Tennessee, Vermont, Virginia, and West Virginia. American Indian areas in Alaska, Hawaii, and Oklahoma are not classified as reservations, with the exceptions of Annette Island in Alaska and Osage in Oklahoma.[70] During my sample time frame, most American Indian people in Oklahoma lived in areas designated as Oklahoma Tribal Statistical Areas, which are broad areas that sometimes overlap.[71] Similarly, Alaska Native villages and Hawaiian Home Lands do not conform to my definition of local labor markets. Observations from these three states are excluded from the analysis. Oklahoma is an exceptional case for reasons related to gaming as well. Until Senate Bill 1252 was enacted in 2004, Class III gaming in Oklahoma was effectively limited to pari-mutuel betting due to the State's early opposition to Class III casinos (Meacham, 2022).

I further restrict my analysis to observations that come from reservation land and not off-reservation trust land. I also exclude observations from reservations that appear in only one wave of data. This may occur because a small number of reservations gained federal recognition in the 2000s. For example, the Mashpee Wampanoag in Massachusetts were federally recognized in 2007.

This process created a data set containing approximately 575,000 people in approximately 278,000 households from approximately 250 reservations. Table C.1 reports sample means for federal reservations

[70] During the sample time frame, these three states did not allow Class III gaming.

[71] The 2020 *McGirt v. Oklahoma* decision reaffirmed the tribal lands of Oklahoma, including the Muscogee, Cherokee, and Quapaw reservations as well as other trust and restricted lands owned by tribes and their citizens across the state.

that are covered in my main sample and those that are not covered.

Table C.1: Sample Means for Reservations Included in and Excluded from Main Sample

| | Included in Sample | Excluded from Sample |
|---|---|---|
| Total population | 3,500 | 1,500 |
| AIAN population share | 0.64 | 0.68 |
| Land area | 250,000 | 130,000 |
| Casino | 0.66 | 0.38 |
| Number of Reservations | 250 | 70 |

*Notes:* Author's tabulations, rounded, from the confidential decennial censuses and American Community Surveys, the author's gaming database, and land data provided by the Bureau of Indian Affairs. Land area is in acres. Casino is the proportion of reservations that had opened a casino between 1980 and 2014. Number of observations rounded due to Census confidentiality rules.

A small body of evidence indicates that tribal gaming may affect growth in neighboring areas (Akee et al., 2015; Evans and Topoleski, 2002). To test whether there are spillovers associated with tribal gaming, I construct a new sample that allows me to compare economic outcomes for people living on reservations to those for people living in the surrounding areas. I refer to the new sample as the "county complement" sample, following the terminology of Akee et al. (2017). The county complement comprises the county less the intersection of the county with the reservation.

If a county contains only one reservation, the casino variable that describes that reservation is associated with the county complement. If one reservation spans two counties, observations from both counties appear in the county complement sample. If the county contains more than one reservation, I assign to the county complement the maximum value associated with the explanatory variable. In regressions that use the county complement sample, I cluster standard errors at the county complement level.

## C.2 Data Dictionary

### C.2.1 Racial Self-identification

Census racial self-identification questions in the Census surveys changed over time, allowing for multiple-race identification after 1990. The share of the U.S. population identifying as having at least some Indigenous heritage increased from .79 percent in 1990 (single race) to 1.46 percent in 2000 (single + multiple race). To avoid conflating changing demographics with changes to the survey instrument, I implement the modified regression bridging method developed by Liebler and Halpern-Manners (2008) to construct single race variables that are consistent over time. The method uses combinations of individuals who identify with multiple races, in addition to information about individual and geographic characteristics, to predict

respondents' preferred single race in the survey data that allow for multiple-race reporting.

### C.2.2 Labor Market Outcomes

- **Wage income:** Continuous measure of income from current wage employment. Adjusted for inflation and converted to year 2000 dollars.[72] Winsorized at the 95th percentile. Wage income for unemployed workers is 0.

- **Earnings:** Continuous measure of total earnings from wage income and self-employment income. Adjusted for inflation and converted to year 2000 dollars. Winsorized at the 5th and 95th percentiles. Earnings for unemployed workers is 0.

- **Total income:** Continuous measure of total income, which is the sum of all sources of income, including wage income, self-employment income, interest income, Social Security income, public assistance, retirement, and other. Adjusted for inflation and converted to year 2000 dollars. Winsorized at the 5th and 95th percentiles. Total income is not restricted to be non-negative and may be non-zero for unemployed workers.

- **Employment:** Binary indicator of whether individual is currently employed. Equal to one if individual is employed and equal to zero if unemployed or not in the labor force. Categories of employment include employed, at work; employed, with a job but not at work; and armed forces, at work.

- **Labor force:** Binary indicator of whether individual is currently in the labor force. Equal to one if individual is in the labor force and equal to zero otherwise. Workers who are employed and unemployed are considered in the labor force.

- **Hours worked:** Continuous measure of typical hours worked per week in the past year. Winsorized at the 95th percentile. Hours worked for individuals who are not working is 0.

### C.2.3 Housing Market Outcomes

- **Homeowner:** Binary indicator of home ownership. Equal to one if the housing unit is either owned outright or with a mortgage and equal to zero otherwise.

[72] I use the national Consumer Price Index (CPI) deflator to adjust for inflation.

- **Renter:** Binary indicator of renting housing. Equal to one if the housing unit is rented and equal to zero otherwise.
- **Occupy:** Binary indicator of occupation of housing. Equal to one if the housing unit is occupied without payment and equal to zero otherwise.
- **Mortgage paid:** Continuous measure of monthly mortgage payments for housing unit. Adjusted for inflation and converted to year 2000 dollars. Winsorized at the 95th percentile. Equal to zero for housing units that do not currently have mortgages, either because they are rented or because they are owned outright.
- **Rent paid:** Continuous measure of monthly rental payments for housing unit. Rental price is given in bins in Census data, so rent paid is calculated as the midpoint of the rental price interval. Adjusted for inflation and converted to year 2000 dollars. Winsorized at the 95th percentile. Equal to zero for housing units that are not currently rented.

#### C.2.4 Population Measures

- **Log population:** Log transformation of the number of people living on the reservation, constructed using the number of observations and sample weights.
- **AI share:** The share of the reservation population that identifies as American Indian (AI), constructed using the number of observations, sample weights, and racial self-identification.
- **Recent move:** Binary indicator of whether the respondent had moved into their current residence in the past ten years.

#### C.2.5 Covariates

Covariates were selected based on a combination of economic theory and the results of lasso analysis. The following variables are used as covariates in labor market regressions:

- **Age:** Continuous measure of age of respondent in number of years.
- **Education:** Binary indicator of whether respondent had completed high school.
- **Race:** Binary indicator of whether respondent identified as AIAN.

- **Sex:** Binary indicator of reported sex.
- **Marital status:** Binary indicator of whether respondent was married at the time of the survey.

The following variables are used as covariates in housing market regressions:

- **Plumbing:** Binary indicator of whether the housing unit has complete plumbing services.
- **Kitchen:** Binary indicator of whether the housing unit has complete kitchen facilities.
- **House:** Binary indicator of whether the housing unit is a single-family house.
- **Urban:** Binary indicator of whether the census block is coded as urban versus rural.
- **Automobiles:** Continuous measure of the number of automobiles, vans, and trucks owned by the household.

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