PLACE-BASED ECONOMIC DEVELOPMENT AND
LONG-RUN FIRM EMPLOYMENT AND SALES:
EVIDENCE FROM AMERICAN INDIAN RESERVATIONS

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NBER Working Paper No. 32555
June 2024
JEL No. H55,O12,O18,R11

## ABSTRACT

We examine how one of the largest U.S. place-based economic development programs, the
Indian Gaming Regulatory Act (IGRA) of 1988, with annual revenues in excess of \$40 billion,
affects local firm total employment and sales through direct channels and through IGRA's effects
on adjacent non-gaming industry firms. Our analysis focuses on the effect of this national (across
29 U.S. states) place-based economic development program over several decades. We create a
novel data set linking a firm-level panel dataset of business outcomes and tribal casino operations
by geographic location over several decades. We find that after the start of tribal casino
operations, there is a substantial average increase in employment and sales for local firms. We
also show that casino operations drive initial increases in employment and sales; however, pre-
existing firms also realize gains in employment and sales in the subsequent 2-5 years after the
start of casino operations. These effects also spill over to firms in non-related industries; in our
analysis, we exclude the Arts, Entertainment, Recreation, Accommodation and Food Services
industries and we continue to observe higher employment for firms located on tribal reservations
with casino operations. We provide the first evidence on the impact of place-based economic
development on long-run business outcomes in some of the most underdeveloped regions in the
U.S.

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A data appendix is available at http://www.nber.org/data-appendix/w32555

# 1 Introduction

Place-based economic development programs have a long history in the United States to help impoverished communities (Bartik, 2020; Garin and Rothbaum, 2024). Current efforts to improve economic activity in the U.S. after the start of the COVID-19 pandemic have been increasingly focused on place-based economic programs aimed at revitalizing regional economic centers through the American Rescue Plan, Infrastructure Investment and Jobs Act, the CHIPS and Science Act as well as the Inflation Reduction Act (Lynch and Wootson, 2024). Various aspects of these laws provide direct funding at regional levels for the development of new, or revitalized, industries in rural and less developed regions of the county. Evaluating the effect of these laws will be the subject of considerable research in the future. However, there are existing place-based economic development programs that have received very little evaluation or research focus.

The Indian Gaming Regulatory Act (IGRA) was signed into law in 1988 and was intended to create economic development activities for American Indian tribal governments (Akee et al., 2015). IGRA created a formal path for federally recognized American Indian tribal governments to start their own casino operations on their reservation lands. At the time, there were few casino operations outside of a few geographic locations such as Las Vegas, Nevada, and Atlantic City, New Jersey. The IGRA is an example of a place-based economic development initiative on a relatively large scale across numerous states. It is also the single largest policy intended to spur development in Native American Communities, which have been historically marginalized. The National Indian Gaming Association reported that the industry as a whole had revenues of approximately $41 billion in 2022 (Harris, 2023).

The opening of tribal casinos are local tribal government decisions, thus there is considerable variation in the timing of casino operations across reservations. There are hundreds of tribal casinos located across the continental United States. The IGRA cleared legal and political obstacles and created a pathway for tribal governments to move forward in expanding upon existing economic activities and provided a short-term advantage for tribal nations to pursue casino operations in regions without existing such operations. At the very least, the passage of IGRA provided tribal governments with an advantage over commercial casino interests until state-level legislation authorized commercial gaming enterprises.[1]

The introduction of IGRA has been little studied, in part, due to the lack of appropriate data at the tribal and individual levels across tribal nations and over time [2]. The IGRA program, however, is one of the largest place-based economic development programs ever introduced in the U.S. and is worthy of study in context but also in light of the broader topic of place-based economic development. The few studies that do exist have examined the effect of tribal gaming activities on outcomes at the tribal nation or county levels using either repeated cross-section household data(Evans and Topoleski, 2002; Wolfe et al., 2012) or with panel data on a single population (Akee et al., 2018, 2010). The first set of papers suggest that casino operations improved health and employment outcomes while the second body of research, focusing on the effect of cash transfers derived from casino revenues, has found mostly beneficial outcomes for American Indian children treated to exogenously increased household incomes. One exception that uses panel data is Simeonova et al. (2021) which examines the effect of tribal casinos and cash transfers on adult income rankings using confidential-use panel data for individual income and earnings. No studies, that we are aware of, have used business data to examine the effect of tribal casinos on business employment, expansion, and sales revenues or the distribution of such effects across different industries. This is due to a lack of business microdata that are geocoded for reservation location or business data that can be aggregated to the reservation level Akee et al. (2019)

Our analysis examines the effect of casino operations on several firm outcomes, using longitudinal data on individual firms located on and off of American Indian reservation lands over the period 1990 to 2019 (National

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[1] Two states in the U.S. continue to prohibit casino gaming - Hawaii and Utah.

[2] Business data from the Census Bureau, arguably the most important source of data on US businesses, are not geocoded for location in a reservation. This makes it impossible to publish public business data at the reservation level. Such data are available for counties, metro areas, etc, and are widely used to study local economic conditions and programs Akee et al. (2019)

Establishment Time Series - NETS). We examine the effect of casino openings on average employment and sales for all reservation firms. We then examine the extent to which the newly formed casinos have spillover effects on other firms by estimating effects for existing firms (regardless of industry) separately and by estimating models that exclude gambling establishments and establishments in the hospitality and tourism industry more broadly. We find that there are large and statistically significant average increases in employment and sales for all firms on reservations that open a new casino. There are positive, but smaller impacts on both sales and employment for existing firms, and these tend to be concentrated on adjacent industries. For non-adjacent industries, the employment effect is about half the size of adjacent, and for sales, the effect is small and not statistically significant.

These results are consistent with place-based economic development activities that generate new customer flows into areas that previously had lower activities. In particular, the advent of casino operations was aimed at drawing new customers to tribal reservation locations for the express purpose of high stakes casino operations; this new economic activity brought new customers to these somewhat remote locations. We show that new casino operations cause large gains in sales and employment economywide, but they also resulted in a large and sustained increase in sales and employment for existing firms. We find strong results for all firms and we also document that these results spillover to firms that were in existence prior to the start of tribal casino operations.

Our findings speak to two separate strands of the economics literature. The first strand focuses on the emerging economic literature on the determinants of American Indian economic development. The research has primarily focused on tribal government structures (Cornell and Kalt, 1998, 2000) and less on specific industries or investments (although Trosper (1978) provides an exception). As noted earlier, there is some emerging analysis on tribal casino effects; however, this study is the first to use longitudinal data for firms over a considerable period of time that covers the establishment of many new casinos and to examine the effect of tribal casinos on revenues and employment on other firms in adjacent industries. Our finding of the positive spillover effects is an important contribution to this literature and also provides the first estimate of the regional benefits of the tribal gaming industry as a whole using a longitudinal dataset of business establishments for tribal reservation lands.

The second strand is the literature focusing on place-based economic development. One of the most common types of place-based economic policy in the United States is enterprise zones, which exist at both the state and federal levels. They provide tax incentives and sometimes exemptions from regulation, with the intent of spurring business investment and growth. Evidence on the effectiveness of enterprise zones in improving employment opportunities is mixed, and there remains uncertainty about what policies work, how they work, and for whom they work (Ham et al., 2011; Neumark and Kolko, 2010; Neumark and Simpson, 2015). Evidence on the effectiveness of place-based programs involving infrastructure expenditure and investments in higher education and research is somewhat more promising. Kline and Moretti (2014) find positive long-run effects of the Tennessee Valley Authority, an ambitious regional development plan, on manufacturing employment and income in the targeted region. Tribal casino operations are most similar to place-based economic development under enterprise zones; these types of programs typically do not require large amounts of public investment but either a reduction in tax burdens or regulation. Our results show that, in contrast to prior results, there is considerable evidence for their effectiveness in varied geographic locations and conditions.

## 2 Place Based Programs Literature

Place-based economic development plans are often targeted to regions that have experienced a steep decline in one or two dominant industries. This often happens when new technology replaces obsolete ones or the opening of trade displaces certain industries to either other locations domestically or internationally. The purpose of place-based economic development is thus to provide new opportunities for individuals residing in these locations. In particular, place-based policies are intended to remedy unemployment in these regions where certain industries may be in decline. Autor et al. (2013) show that job loss (and unemployment) does little to encourage out-migration. Chinese trade shocks resulted in very little out-migration and thus there is a need to develop new

industries in these regions.

It is estimated that the U.S. Federal government spends approximately $ 60 billion per year on place-based economic development programs (Bartik, 2020). In recent years, the Bipartisan Infrastructure Plan has committed billions of dollars to regional and local economic development projects ranging from electrical vehicle charging stations to expanding passenger rail and rebuilding roads and bridges. Additionally, the Inflation Reduction Act also contains billions of dollars to revitalize the U.S. manufacturing base with clean energy tax credits and for domestic manufacturing of batteries, wind and solar components, and carbon sequestration or capture systems. These investments have been shown to provide a local multiplier effect on both the supplier and demand side; estimates find that the average local multipliers range from 1.3 to 1.7 (Bartik and Sotherland, 2019).

One of the most famous place-based economic development programs, the Tennessee Valley Authority (TVA), invested approximately $30 billion over several decades (Kline and Moretti, 2014). The investment consisted of road, dam, and canal construction which was meant to lift the region out of poverty and encourage manufacturing and agricultural production. Research has found that the benefits of the program accrued primarily in manufacturing and less so in agriculture (Kline and Moretti, 2014); the researchers concluded that the benefits came at the cost of potential manufacturing production from other parts of the country. Thus, this program diverted economic activity into a different region of the country.

Other successful place-based economic development includes efforts by the Economic Development Administration (EDA) to seed development in regional clusters, with notable successes including Milwaukee's water cluster and agricultural technology initiatives in St. Louis (Donahue et al., 2018). An expansion of these efforts is included in the 2021 American Rescue Plan, which created EDA's Build Back Better Regional Challenge, funding 21 emerging regional industry clusters. The recently enacted CHIPS and Science Act also has an explicitly place-based approach to boosting innovation and commercial activity and is hosting a competition that will provide selected regions with funding to establish regional innovation hubs.

The American Indian gaming industry provides approximately $ 20-30 billion in revenues annually (Akee et al., 2015) surpassing $40 billion in the past year Harris (2023). Therefore, this is one of the largest place-based economic development projects in the U.S. Contrasted with the total amount invested by the U.S. federal government the country as a whole of $60 billion annually (Bartik, 2020), this program is unprecedented in both place-based and American Indian economic development programs. Our analysis examines one potential outcome of this long-run investment: business establishment revenues and employment in various industries located on the reservation lands.

## 2.1 American Indian Economic Development History

American Indian economic development has been affected by the forced removal of tribal nations, the confiscation of tribal lands, and the forced cultural and language assimilation (Cornell and Kalt, 2000; Lomawaima, 1995; Newton et al., 2019). For example, by the early 1930s, almost 86 million acres of reservation land had been transferred out of Indian ownership via sale, foreclosure, or fraud (Wilkinson, 1987). This reduced tribal reservation land (wealth) holdings by over 60% of the previous land base. Meriam et al. (1928) reported that the loss of land was not accompanied by an increase in living standards or other outcomes; in fact, conditions quickly deteriorated. As a result, American Indians, Alaska Natives, and other Indigenous Peoples within the U.S. have faced some of the worst economic conditions.

While many tribal governments have treaties with the U.S. Federal government that guarantee certain resources, transfers and general support, many of these have been underfunded for centuries. Analysis by Berry and Reynoso (2003) found that federal government resources for Indigenous Peoples are woefully underfunded. Therefore, there have been relatively few economic development projects that have had the financial resources over a sustained period. As a result, economic development programs have proceeded in a piecemeal fashion across different locations with varying levels of success.

Therefore, Indian Gaming was viewed as a potentially viable option for creating economic activities on reservation lands that would improve economic conditions for tribal governments, its tribal citizens, and neighboring communities as well. Essentially, IGRA 1988 provided tribal governments with a monopoly right to open and operate tribal casinos where few other high-stakes casinos operated. Some existing descriptive research has shown that there have been remarkable changes since the advent of casino operations. Akee and Taylor (2014) find that between 1990 and 2010, using public-use US Census and American Community Survey Data, the family poverty rate fell from 44% to around 31% in that time; this is one of the largest drops in poverty observed. Nevertheless, the poverty rate and per capita income levels have still not reached parity with the average levels in the U.S.; this speaks to the unevenness of the benefits of tribal casino operations.

# 3 Data Description and Geographic Linkages

We compile data on Tribal casino openings through a manual search of public use documents. The data contains information about the opening date of tribal casinos for federally-recognized American Indian nations. There are a few instances where tribal casino operations and/or bingo hall operations occurred before the 1988 Indian Gaming Regulatory Act was signed into law; however, the vast majority of existing tribal casino operations began in the 1990s and early 2000s, providing sufficient variation over time and location to identify the effects of tribal casino operations on employment and sales revenues of nearby establishments within reservation boundaries.

We then link the tribal casino opening data by geographic identifiers to the National Establishment Time Series (NETS) data. This data set is available for use with a site license from a private firm. The data contains establishment-level longitudinal information for a large share of US business establishments. The data is often used by other firms for marketing purposes and assigning credit scores. We use each establishment's physical address and Census data on Reservation Boundaries to determine which establishments are located within each tribal reservation. We then add data on the start of casino operations by reservation location and year. Therefore, we create a novel panel data set that includes annual measures of establishment employment and sales that are linked to information on whether a tribal casino has opened in a particular year.

In Table 1 we provide the means and standard deviations for the business establishment outcome measures used in our analysis and show them at the start of our panel and the end in the years 1990 and 2019, respectively. The average sales in dollars in 1990 was approximately $800,000 (in 2019 $) and it was $ 1.3 million in 2019 on average. We also see that the average number of employees appears to have increased by at least two people on average from 9 to 11 employees. Finally, the average age of the establishment decreased from 31 years in 1990 to 16 years in 2019 reflecting the opening of a significant number of new establishments over time.

We restrict our analysis to firms located on federally-recognized American Indian reservation locations. These tribal lands are self-governing and differ from other non-federally recognized American Indian lands; only federally-recognized tribal nations are allowed to operate tribal gaming operations under the Indian Gaming Regulatory Act of 1988 (Akee et al., 2015). This implies that we exclude data from Alaska, Hawaii, and Oklahoma as these states do not have federally-recognized tribal reservation lands.[3] We also exclude the Navajo Nation as that tribe is an extreme outlier in terms of geographic and population size; the Navajo Nation is an order of magnitude larger than the next largest tribal reservation population at approximately 157,000 (Sanchez-Rivera et al., 2023).[4]

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[3]While there are tribal gaming operations within the state of Oklahoma, until recently (see U.S. Supreme Court Oklahoma v. McGirt, 2020) there was only one tribal reservation in the entire state - the Osage Nation. Therefore, due to the complications associated with this particular state, we omit it from the analysis.

[4]We also exclude ten smaller tribal nations due to incomplete data; those tribal nations that are excluded are Hopi Reservation, Lac Vieux Desert Reservation, Little Traverse Bay Reservation and Off-Reservation Trust Land, Match-e-be-nash-she-wish Band of Pottawatomi Reservation, Nisqually Reservation, Shingle Springs Rancheria, Tunica-Biloxi Reservation and Off-Reservation Trust Land, Tuolumne Rancheria, Twenty-Nine Palms Reservation, and the Yavapai-Apache Nation Reservation. The inclusion of these ten tribal nations would increase the size of some standard error estimates but produce substantively similar results.

**Table 1:** Table of Means for Reservation-Based Business Establishment Measures in 1990 and 2019

| | 1990 | | 2019 | |
| Variable | Mean | Std. Dev. | Mean | Std. Dev. |
| --- | --- | --- | --- | --- |
| Annual Sales in Dollars | 805,079 | 5,780,000 | 1,303,508 | 13,032,09 |
| Employees | 9.35 | 41.62 | 10.94 | 66.30 |
| Age of Establishment | 31.37 | 23.11 | 16.51 | 17.79 |

# 4  Empirical Methodology

We employ a difference-in-differences (DiD) methodology to assess the effect of tribal casino operations on business establishment sales and employment. Our analysis relies on the premise that the initiation of tribal casino operations is determined at the tribal government level and is expected to be independent of individual-level firm characteristics or outcomes. We initially include the tribal casino business in our analysis, but we show additional results where we omit newly established businesses or businesses in the casino and related industries. A base DiD model would be specified as follows:

$$Y_{it} = \alpha_0 + \gamma \times Casino_{rt} + \theta_t + \mu_r + \epsilon_{it} \tag{1}$$

The dependent variable measures the level of employment or sales for establishment $i$ in year $t$. The treatment variable is $Casino$, which has a value of 1 if a casino is operational on a tribal reservation $r$ in year $t$ and 0 otherwise; $\theta_t$ denotes a year fixed-effect, while $\mu_r$ represents a reservation fixed effect. All standard errors are clustered at the reservation level.

However, there exists significant literature evaluating the suitability of the two-way fixed effects estimator (TWFE), particularly in the context of interventions with staggered and heterogeneous treatment effects (Borusyak and Jaravel, 2018; De Chaisemartin and d'Haultfoeuille, 2020, 2023; Goodman-Bacon, 2021).

Our data exploits temporal variation in the start of casino operations on American Indian reservations since 1988; we thus adopt a strategy that accommodates a binary staggered treatment as an absorbing state, accounting for heterogeneous and dynamic treatment effects. Reviews by De Chaisemartin and d'Haultfoeuille (2023) and Roth et al. (2023) discuss several approaches to address similar challenges, including the methods proposed by Callaway and Sant'Anna (2021), Sun and Abraham (2021), and Borusyak et al. (2021). When utilizing the never-treated group as controls, estimates by Callaway and Sant'Anna (2021) and Sun and Abraham (2021) are identical. Borusyak et al. (2021) efficiency may surpass the others under parallel trends and Gauss-Markov theorem assumptions, yet potential correlations in outcomes over time might diminish this advantage. Borusyak et al. (2021) estimates could be more or less biased depending on deviations from perfectly parallel trends, unlike Callaway and Sant'Anna (2021) and Sun and Abraham (2021), whose assumptions rely solely on parallel trends between the last pre-treatment with the post-treatment periods within each cohort, rather than across all groups and periods as in Borusyak et al. (2021) approach.

We conduct our analysis of the dynamic and heterogeneous treatment effects using Callaway and Sant'Anna (2021) difference-in-difference (CSDID) method with multiple time periods. Callaway and Sant'Anna (2021) propose a heterogeneity-robust estimate that adjusts the traditional TWFE for the case of binary treatment with multiple treatment time periods, limiting observations used as counterfactuals to exclude those already treated and focusing only on never-treated and not-yet-treated units. This estimate allows for aggregating different groups of units into cohorts that receive treatment simultaneously, obtaining an average outcome across groups belonging to each corresponding cohort. Additionally, their estimator allows for aggregation at different levels such as by cohorts, event time, calendar time, and across all groups and all periods.

As mentioned before, the treatment in this study is whether a casino started operating at any point from 1988 onward until the last time period in our panel on American Indian reservations. Therefore, the treated group, encompassing approximately 50% of reservations, would be the reservations that have an operating casino

at some point in the panel, and hence, the counterfactuals are reservations that never had an operating casino. The analysis is also conducted on the total of all business establishments and subsequently restricted to two different sub-samples: a sample of pre-existing firms that opened prior to the start of casino operations; and a sample of all vintages of business establishments with the exclusion of those in NAIC industries 71 (arts, entertainment and recreation) and 72 (accommodations and food services). The latter is done with the objective of identifying 'spillover' effects on other industries within the same reservations compared to sales and employment in the same industries in not-treated reservations.

The estimator is the Doubly Robust DiD estimator, where the outcome model is the weighted least squares, and the treatment model is inverse probability tilting (Sant'Anna and Zhao, 2020). Standard errors may be estimated using asymptotic theory clustering at reservation level or wild bootstrap implementing Mammen (1993) approach and following MacKinnon and Webb (2018) and Kline and Santos (2012) (Rios-Avila et al., 2023).

Moreover, Rambachan and Roth (2023), Roth et al. (2023), and Roth (2022) discuss how practitioners led by intuition use estimated pre-treatment trends as a test of the plausibility of the parallel trends assumptions. However, not finding significant pre-treatment coefficients does not certify that parallel trends generally hold. Roth (2022) finds that these tests usually have low power and argues that conditioning the analysis of the results on these pre-trends may even introduce statistical distortions from a selection effect known as pre-test bias. Nevertheless, understanding the effect of interest remains crucial even if different trends are identified. Having this in consideration, our specifications employ the formal approach proposed by Rambachan and Roth (2023), building on the earlier work by Manski and Pepper (2018), to test for robust inferences when parallel trends may not hold. This process allows us to restrict the magnitude of the post-treatment breaking of parallel trends to a constant $\bar{M}$, implying that the violation of post-treatment parallel trends may not be a constant $\bar{M}$-times larger than the pre-treatment violation.

## 5    Results

### 5.1    Impact of Casino Openings on Sales and Employment

In order to account for the staggered nature of the start of tribal gaming operations over both time and space, we provide the staggered difference in differences analysis using the Callaway and Sant'Anna (2021) approach in Table 2.[5] The first two columns provide overall estimates of the impact of casinos on log of sales and employment. We find that there is no pre-trend average differences when using either a wild bootstrap or asymptotic theory method for estimated standard errors (both standard errors are provided below the estimated coefficients). However, we do find that there are positive and statistically significant effects on log sales and log employment after the start of tribal casino operations. The size of the coefficients are 0.385 and 0.404 log points respectively, indicating an increase of around 40% in sales and employment. Note that this analysis includes all business establishments of all vintages.

The next two columns in Table 2 restrict our analysis to pre-existing firms that were in business prior to the opening of the tribal casino. This analysis provides insight into the potential spill-over effects that the new tribal casino has on other businesses. This sample explicitly excludes the tribal casino operations. We find no pre-trend average differences in the log of sales or employment in columns 3 and 4. However, we do observe a positive and statistically significant effect of casino operations on log sales and log employment by 0.154 and 0.232 log points, respectively, for pre-existing business establishments.

Finally, the last two columns include business establishments of all vintages but exclude those from NAICS categories 71 and 72; these include arts, entertainment, recreation, and food and lodging service industries. This sample, therefore, also excludes the tribal casino operations. This analysis focuses on the effect of tribal casino operations on other non-casino affiliated establishments in adjacent industries. We find that there is a positive

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[5]Note that in Appendix Table A1 we provide the estimated coefficients aggregated by each event time.

**Table 2:** Staggered Difference in Difference Regression Analysis for the Effects of Casino Openings on Reservation Level Sales and Employment

|  | (1) Log(Sales) | (2) Log(Emp) | (3) Log(Sales) | (4) Log(Emp) | (5) Log(Sales) | (6) Log(Emp) |
|---|---|---|---|---|---|---|
| **Pre-Treatment Average** | | | | | | |
| Casino Effect | 0.0013 | 0.0065 | -0.0026 | 0.0032 | -0.0026 | -0.0051 |
| Wild Bootstrap | (0.0151) | (0.0142) | (0.0145) | (0.0136) | (0.0124) | (0.0098) |
| AT | (0.1412) | (0.0132) | (0.0139) | (0.0132) | (0.0118) | (0.0098) |
|  | | | | | | |
| **Post-Treatment Average** | | | | | | |
| Casino Effect | 0.385 | 0.4041 | 0.1539 | 0.2321 | 0.0852 | 0.1227 |
| Wild Bootstrap | (0.0878)*** | (0.0784)*** | (0.0544)* | (0.0495)*** | (0.0602) | (0.0505) |
| AT | (0.0896)*** | (0.0812)*** | (0.0572)*** | (0.0492)*** | (0.0585) | (0.0481)** |
|  | | | | | | |
| Sample | CS | CS | Pre-Existing | Pre-Existing | Excluding | Excluding |
| Reservations | 281 | 281 | 268 | 268 | 279 | 279 |
| Observations | 7,818 | 7,818 | 7,507 | 7,507 | 7,631 | 7,631 |
| WB T-value 0.05 | 2.71 | 2.70 | 2.83 | 2.77 | 2.67 | 2.79 |
| WB $\bar{M}$ 0.05 | 2.75 | 2.11 | NA | 0.56 | NA | NA |

Notes: Columns 1 to 6 are estimated using CS Difference-in-Difference with Multiple Time Periods. Averages in columns 3 and 4 include only existing firms prior to the opening of casinos. Averages in columns 5 and 6 include all firms from all vintages but exclude those from NAIC industries 71 and 72. Dynamic effects using CS Difference-in-Difference with Multiple Time Periods. Control group: never treated. Outcome model: weighted least squares. Treatment model: inverse probability tilting. Asymptotic Theory (AT) and Wildbootstrap (WB) standard errors in parenthesis (mammen approach). WB T-value 0.05 is the corresponding bootstrapped t-critical value for a significance level of 5%. WB $\bar{M}$ 0.05 is the corresponding breakdown value in the sensitivity analysis to test for robust inference when parallel trends may not hold, so that the confidence interval contains 0, with a significance level of 5%. * $p \leq 0.10$, ** $p \leq 0.05$, *** $p \leq 0.01$

effect on log sales, but the magnitude is small and not statistically significant. There is a positive effect on log average employment by 0.123 log points that attains statistical significance for the asymptotic theory method of standard error estimation.

In summary, our estimated results indicate little evidence of differential pre-treatment average effects for businesses located on tribal reservations that would eventually start a casino. Moreover, to provide further robustness to our findings, we conducted a sensitivity analysis following the approach outlined by Rambachan and Roth (2023). Results indicate that for the first two columns on log sales and log employment in Table 2, the breakdown values of $\bar{M}$ are 2.75 and 2.11, respectively. For column 4, focusing on the log employment of pre-existing firms, the $\bar{M}$ value is 0.56. However, columns 3, 5, and 6 do not apply to this analysis since they are already insignificant at a 5% level using the wild bootstrap approach.

The sensitivity analysis conducted in this study offers a valuable tool for assessing the robustness of our findings regarding the impact of tribal casino openings on sales and employment when parallel trends may not hold. For instance, we report in column 1 that the conclusion of a positive treatment effect is robust up to the value $\bar{M}$=2.75. This indicates that our results are resilient, and a positive effect of casino openings on sales remains valid unless we allow for a post-treatment violation of parallel trends 2.75 times larger than the largest pre-treatment violation. On the other hand, there is significant evidence that post-treatment effects of casino openings are positive concerning sales and employment in our full sample. It is also strong for pre-existing business establishments in both sales and employment increases, and there is some evidence for positive spillover effects in industries excluding arts, entertainment, recreation (NAICS Code 71), accommodations, and food services (NAICS Code 72).

## 5.2    Effect of Tribal Casino Openings on Sales over Time

This section shows the results from Table 2 above aggregated over time in the event-analysis figures. We provide the estimated coefficients for these figures in Appendix Table A1.

Figure 1 shows the effect on average sales by reservation after the start of new casino operations for all firms in Panel A and for firms that were in business prior to the start of casino operations in Panel B. These figures show the event-time aggregated results from columns 1 and 3 in Table 2. In both panels, there is little difference in sales in the period before the start of casino operations. However, there is a pronounced increase in the log of sales after casino operations begin. In Panel A, we show that after the first year of casino operations, there is a large jump of almost 0.4 log points in average sales across all firms. These observed results are largely due to the increase in sales that are driven by the start of tribal casino operations; this analysis explicitly includes the tribal casino operations data and subsequent analysis will omit it. This increase is sustained for the next nine years in the data. In the bottom panel, for pre-existing businesses, there is a non-significant but consistent increase in sales over time, however, the confidence intervals remain quite large. Nevertheless, there also appears to be a considerable increase in average sales for this group of businesses. These results suggest that the start of casino operations increases total business sales in general; with a large proportion attributable to the casino operations itself. Yet, there is a steady upward trend in sales for pre-existing businesses over the next decade as well.

## 5.3    Effect of Tribal Casino Openings on Employment over Time

In this section, we show in Figure 2 the effect of the staggered opening of tribal casinos on average firm employment by reservation. The top and bottom panels of this figure are the aggregated results over event-time from columns 2 and 4 of Table 2. We find little evidence of differences in employment prior to the start of casino operations in either Panel A or Panel B in this figure; before the start of casino operations, the estimated effects are consistently centered around zero. After the start of casino operations, Panel A shows an increase in the average number of employees for all firms immediately after the start of casino operations. The increase is large and statistically significant. In the bottom panel, we provide the same analysis for firms that were in business prior to the start of casino operations. The results indicate that there is a steady and significant upward trend in employment for these business establishments after the start of casino operations.

**Figure 1: Effect of Casino Operations on Average Sales for All and Existing Business Establishments**
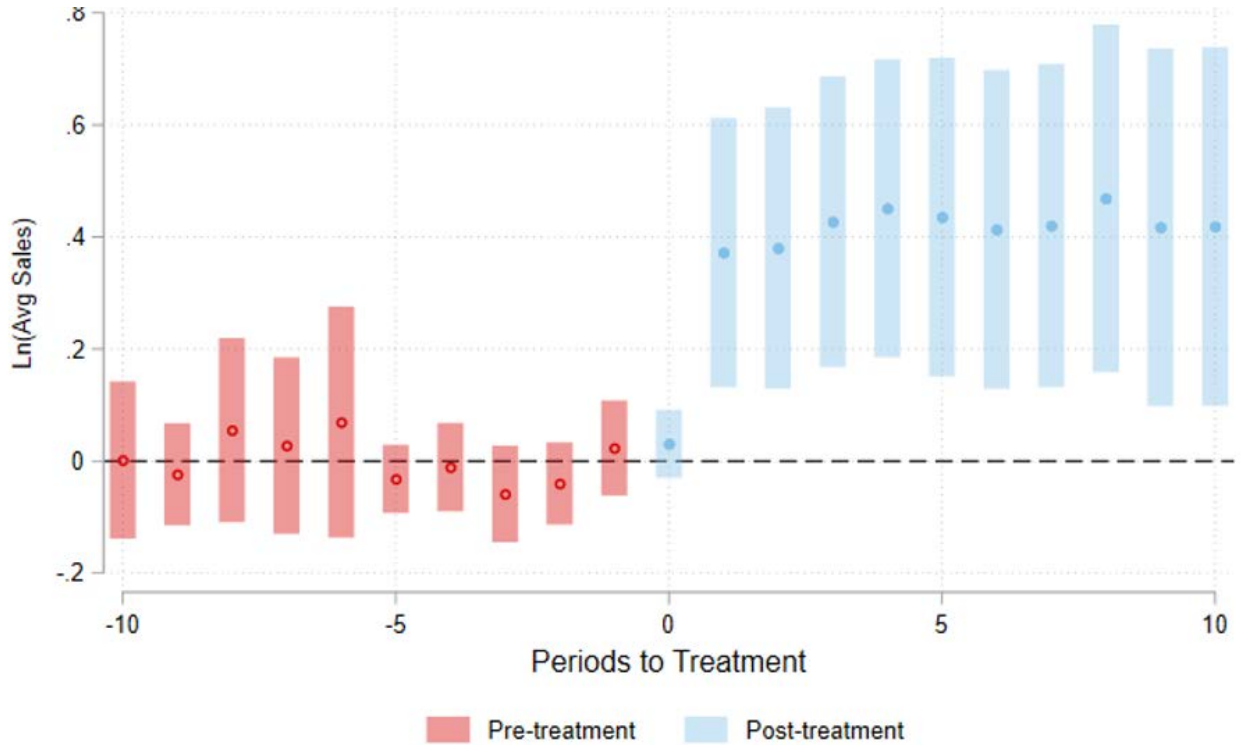
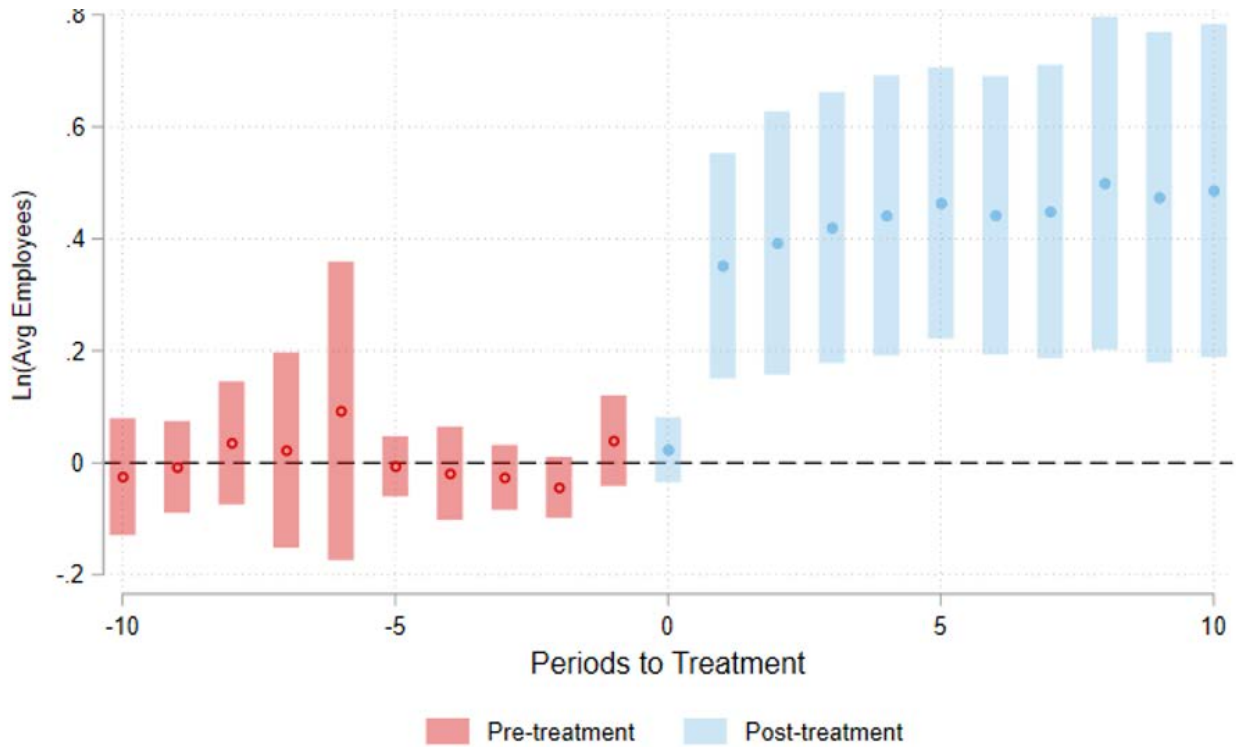**Panel A: All Establishments**



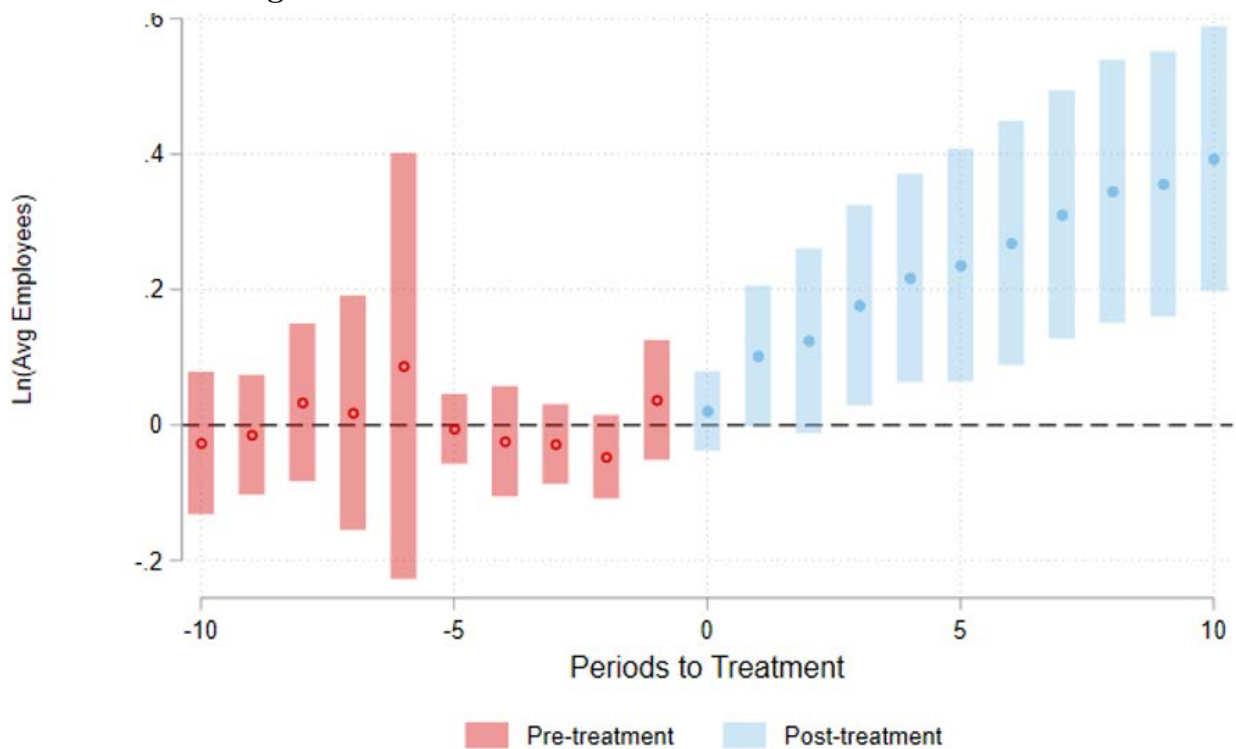**Panel B: Pre-Existing Businesses**
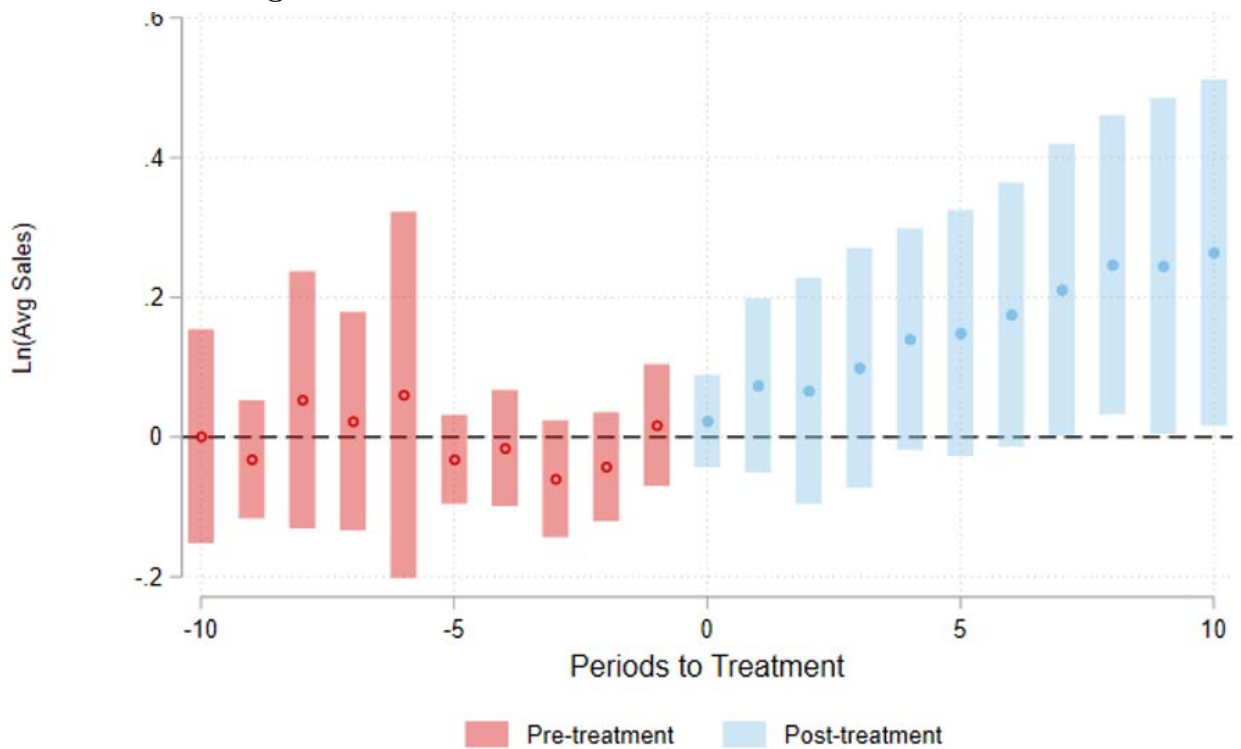


Notes: Casino opening coefficients are estimated based on specifications that include fixed effects by reservation and year, and use the final sample including only firms in reservations recognized at the federal level and without firms in the Navajo Nation Reservation and Off-Reservation Trust Land, Alaska, Hawaii, Oklahoma, and those with incomplete data. Estimation of dynamic effects using CS Difference-in-Difference with Multiple Time Periods. Control group: never treated. Outcome model: weighted least squares. Treatment model: inverse probability tilting. The estimation of the 95% confidence intervals uses the Wildbootstrap standard errors (mammen approach). The top panel includes averages by reservation across all businesses; the bottom panel only includes averages by reservation across businesses that were also in operation prior to the start of the casino operations.

**Figure 2: Effect of Casino Operations on Average Employment for All and Existing Business Establishments**

**Panel A: All Establishments**
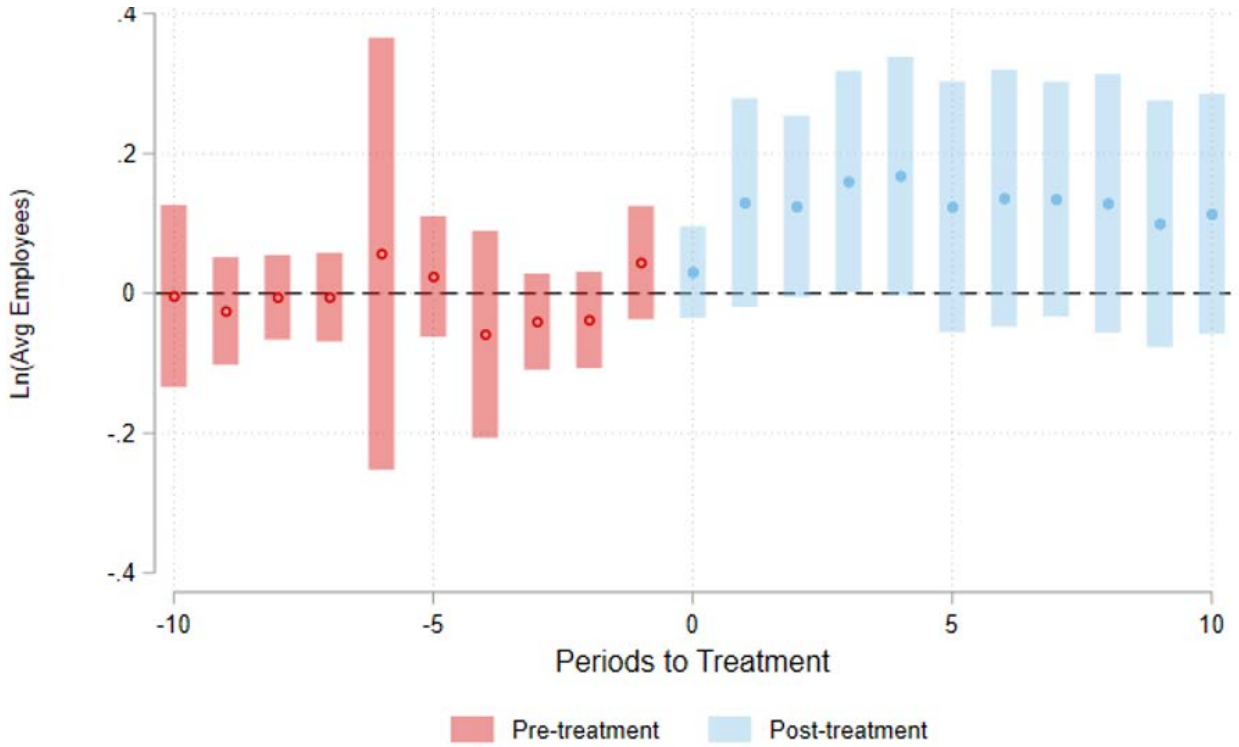


**Panel B: Pre-Existing Businesses**



Notes: Casino opening coefficients are estimated based on specifications that include fixed effects by reservation and year, and use the final sample including only firms in reservations recognized at the federal level and without firms in the Navajo Nation Reservation and Off-Reservation Trust Land, Alaska, Hawaii, Oklahoma, and outliers. Estimation of dynamic effects using CS Difference-in-Difference with Multiple Time Periods. Control group: never treated. Outcome model: weighted least squares. Treatment model: inverse probability tilting. The estimation of the 95% confidence intervals uses the Wildbootstrap standard errors (mammen approach). The top panel includes averages by reservation across all businesses; the bottom panel only includes averages by reservation across businesses that were also in operation prior to the start of the casino operations.

## 5.4 Analysis by Industry Type

In Figure 3 we focus our analysis on firms that are exclusively outside of the tribal casino, accommodations and food, arts, and recreation industries. We include business establishments for all vintages in this analysis. Panel A shows the average employment by reservation change after the casino operations started in these other industries. We find that there is a steady increase over time that peaks around year 4 after the start of tribal casino operations; this increase is positive for subsequent years but it does trend downward and starts to lose statistical significance. The second panel provides the effect of casino operations on sales in these same firms. In this graph, the post-treatment estimates (after the start of casino operations) indicate less sustained evidence of the increase in sales for firms outside the gaming and entertainment industries. The analysis shows an increase in average sales in the years following a new casino, however, these effects are estimated less precisely.

**Figure 3: Effects on Employment and Sales For Existing Firms Excluding Arts, Entertainment, Recreation, Accomdations and Food Services Industries**

**Panel A: Employees**



**Panel B: Average Sales**
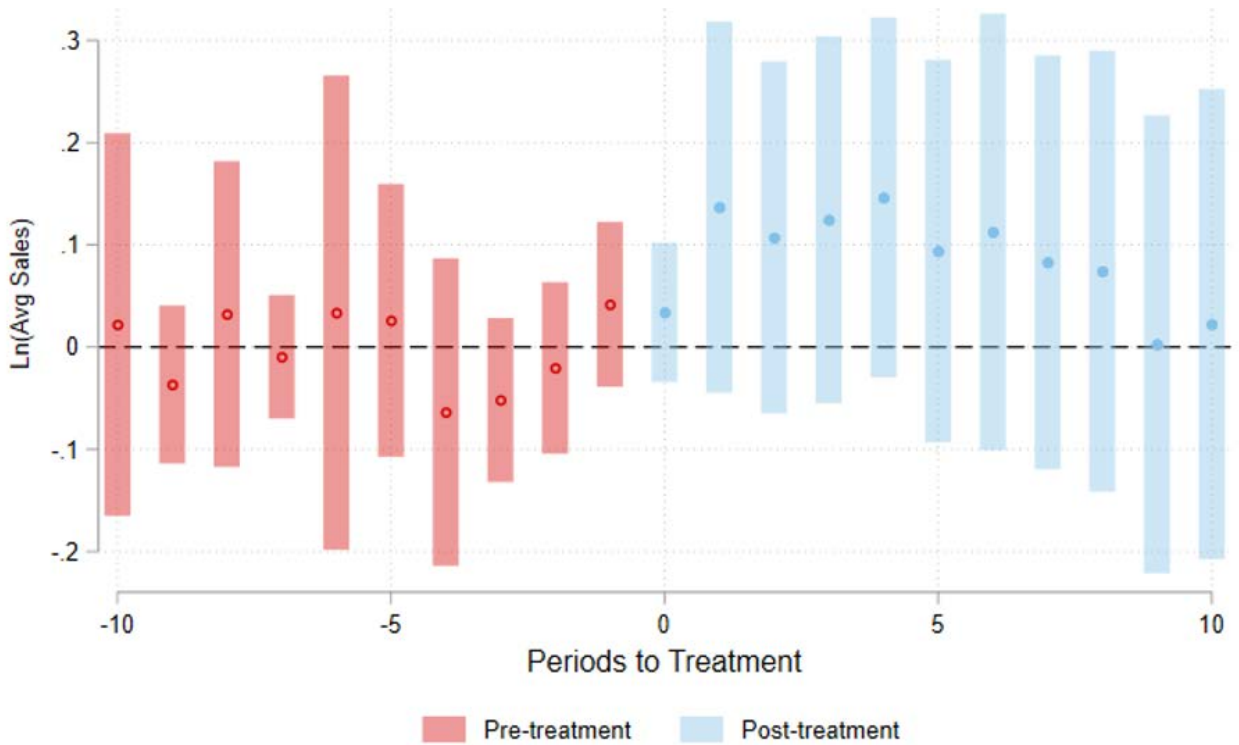


Notes: Casino opening coefficients are estimated based on specifications that include fixed effects by reservation and year. Estimation of dynamic effects using CS Difference-in-Difference with Multiple Time Periods. Control group: never treated. Outcome model: weighted least squares. Treatment model: inverse probability tilting. The estimation of the 95% confidence intervals uses the Wildbootstrap standard errors (mammen approach). We exclude from this analysis any firm in the NAICS categories 71 (arts, entertainment, and recreation) and 72 (accommodations and food services).

# 6 Conclusion

In this analysis, we compile a novel data set that merges the National Establishment Time Series (NETS) data with data on the start of tribal-owned casino gaming operations located on American Indian reservations throughout the United States over three decades. With this novel panel data set, we investigate the effect of a previously understudied place-based economic development program on reservation-based business establishments. Accounting for the staggered nature of tribal casino openings over time and space, we find a large and statistically significant effect on average firm sales and employment by reservation. These increases accrue to pre-existing firms in addition to the newly established firms. We find that these results persist for several years. We also focus on non-gaming and non-recreational industry firms finding that there is evidence that employment increases after the start of tribal casino operations as well, and tentative evidence that sales of firms outside of the hospitality sector increase as well.

Our analysis is the first to directly evaluate the effect of tribal casino operations on local firms. This is one of the most successful place-based economic development programs in the history of the U.S. and it was specifically provided to some of the most disadvantaged communities in the country. Our analysis draws attention to the potential effects that increased traffic flows provide for related and adjacent industry sales and employment. Standard analysis of place-based economic development programs has focused primarily on the specific industry; our results indicate that evaluation should include adjacent industries that may benefit from positive spillover effects.

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