How Badly Are Native Americans Affected by Economic Recessions?

The Role of Agriculture

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ABSTRACT

We analyze if the share of agricultural employment can contribute to strengthening employment resilience in Indian Country. We define Indian Country as all reservation territories within the contiguous United States. We construct employment data by sector for Indian Country based on Zip Code level data from 1990 to 2015. We analyze employment growth in Indian Country across recessions and recovery periods and find Indian Country generally to be less affected by recessions than the United States as a whole. We operationalize resilience in two ways: lower variability of employment and speed of recovery. We find a larger share of agricultural employment to be associated with lower variability of employment, but also slower recovery.

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1. INTRODUCTION

Employment is both key to economic well-being as well as a threat to financial stability for individuals if their jobs are at risk during economic recessions. This paper analyses how much Native Americans have been affected by the three most recent recessions and which type of economic sector structure has been specifically helpful in fostering resilience. Our specific attention is focused on the agricultural sector, which would lend itself to resilience as people need to eat regardless of economic conditions.

We find Indian Country to be less affected by economic recessions than the United States as a whole, but sometimes slower in recovery. Variability across reservations is substantial, with thriving and suffering reservations coexisting at the same time. We find agricultural employment to reduce employment volatility, but likely for the wrong reasons: while it has little effect in slowing down employment losses, it seems to slow down recoveries and growth overall.

Data from the United States Department of Agriculture indicates that hired farm labor in the United States actually declined by roughly 9% between 1990 and 2012. According to the Bureau of Labor Statistics, agricultural employment is expected to further decline by about 6% between 2014 and 2024. During the Great Recession (officially dated from first quarter 2008 to second quarter 2009), hired farm labor fell by almost 3% as compared to more than 6% across all sectors, but actually recovered and surpassed pre-recession levels by almost three percent, while overall employment was still 3% below prerecession levels. However, farm labor as identified in

these statistics only covers dependent employment, but not self-employed farming. Family farms may still have the desired effect on employment overall, but we are not able to provide insights on this with the data at hand.

Of course, not all recessions identified by the National Bureau of Economic Research are created equal: the global recession in the late 1980s was exacerbated by the savings and loan crisis, leading to the 1990 recession. The 2001 recession followed the bursting of the dot-com bubble and severely affected IT and parts of the financial service sector. The Great Recession was triggered by the bursting of the housing bubble and affected the entire world economy, which left only a few employment sectors largely unaffected (such as education and health care). Despite the varied causes of these recessions and the secular decline in agricultural employment, variability in agricultural employment remained low. Could an increase in agricultural employment contribute to economic security on Indian reservations? Does it make sense to gear policies towards agriculture, despite the predicted decline in agricultural employment in the foreseeable future?

We approach these questions empirically by investigating previous contributions of agriculture to employment in Indian Country. At the core of our empirical analysis are monthly Zip Code level estimates by sector from 1990 to 2015, which we compare and complement with information from the Bureau of Labor Statistics, the United States Department of Agriculture, the National Establishment Time Series (NETS) as well as Info-USA. We document sectoral variation of employment across reservations and compare them to the national average. Next, we employ regression analysis to identify possible contributions of agricultural employment shares to employment growth as well as employment variability.

The paper proceeds as follows: After the review of the literature, we discuss our methodology, and the data sources used. After a discussion of descriptive statistics and visual presentations about employment development by sector in Indian Country, we discuss the results

from our regression analysis. Our conclusion reviews our results and discusses their implication for policy.

2. LITERATURE REVIEW

Since the passage of the Indian Gaming Regulatory Act of in 1988, the gaming industry has developed quite substantially throughout Indian Country. As might be expected, much of the literature on economic development among Native American nations is centered on the impact of gaming. The literature on the subject is quite extensive, as documented in the annotated bibliography compiled by Gardner, Kalt, and Spilde in 2005 (Gardner, Kalt, and Spilde 2005). However, when it comes to labor issues, the scholarly literature on Indian employment is much more limited. There were a few full-length scholarly monographs on Indian labor published during the 1990s. For example, Littlefield and Knack edited a volume on Indian labor from an ethnographic perspective (Littlefield and Knack 1996). Patricia Kasari examined the low prestige jobs common to American Indians (Kasari 1999). Aside from scholarly works, federal agencies have also published work on Indian labor, mainly the Bureau of Indian Affairs. The Bureau of Indian Affairs published information on Indian labor on a biennial basis from 2001 to 2003 (United States Department of Interior 2001). Starting in 2005, the report has been published annually. There has been a recent upsurge in longer publications on the subject. For example, Ronald Baudin edited a volume on the labor market conditions facing veterans living on tribal lands (Baudin 2014). In 2015, James Davis completed his dissertation on space in relation to Indian labor markets for both reservation and urban Indians (Davis 2015). He and his colleagues continued with that analysis in 2016, publishing an article on poverty among current-day Native Americans (Davis, Roscigno, and Wilson 2016). As might be expected, there has been a particular interest in the impact of casinos on Indian labor (Evans and Topoleski 2002; Bangsund and Leistritz 1997). Even Davis focuses on casinos in his examination of the labor market on

Indian reservations. So, little work has been done on other drivers of Indian employment beyond casinos. Longitudinal studies on the topic are sparse as well.

The research on the agricultural industry in Indian Country is equally sparse. Benedict Colombi examined the Nez Perce agricultural economy in relation to large-scale agriculture in the area. He found that government policies have consistently benefitted large-scale farms at the expense of the smaller-scale Nez Perce operations (Colombi 2005). In turn, Klaus Frantz studied the impact of the appropriation of water rights by non-Indian farmers for irrigation in relation to the Salt River and Gila River reservations in Arizona (Frantz 2012). As with the Nez Perce, the policy approaches of the federal government, along with other socioeconomic factors, resulted in large-scale agricultural interests being favored and the decline of the agricultural industry among the Pima and Maricopa nations. Finally, while not a peer-reviewed source, David Bartecchi reports that in South Dakota, 84.57 percent of agricultural income on nine reservations was generated by non-Indians, with the remainder, 15.43 percent, going to Indian people, again illustrating the disparity in the impact of federal policies on Native agriculture (Bartecchi 2014).

When it comes to statistics on Native American agriculture, there is yet again a paucity of data. The United States Department of Agriculture's "2007 Census of Agriculture: American Indian Farmers" indicated there were 34,706 farms for whom American Indians or Alaska Natives were the principal operators, up from 15,494 in 2002, an increase of 124% (United States Department of Agriculture, n.d.). The Department of Agriculture has produced other data on American Indian agriculture, the latest being published in 2014 under the title, *2012 Census of Agriculture: American Indian Reservations* (United States Department of Agriculture 2014). However, it must also be noted that problems exist in attaining accurate data related to Indian agriculture. In 1995, John McKean, Garth Taylor, and Wen Lin Liu argued that inadequate databases exist for American Indian agriculture (McKean, Taylor, and Liu 1995). They compared databases that included the Census of Agriculture, Census of Population, and Bureau of Indian Affairs Natural Resource Information System. They find that statistics on the same

variable across those data sources can differ by factors of three to five. Possible reasons for such variation are self-reporting in racial categories, differing definitions for the same term, and the use of estimates instead of original data collection. Moreover, much of this data, whether collected or estimated, is only available at large time intervals. They conclude databases related to Indian agriculture are "erroneous, inadequate, and inconsistent" (361). No matter the problems in comparing the separate databases on Indian agriculture, the Department of Agriculture census, using consistent methodology, indicates there has been an increase in Indian-owned farms over the years. Yet, given the paucity of the scholarly literature related to Indian agricultural labor and questions surrounding the accuracy of the databases on Indian agriculture, it seems there is a great need for further investigation into Indian agriculture more generally and Indian agricultural labor more specifically. This paper intends to fills some of those gaps as follows. Our estimates are generated by combining publicly available data sources monthly in a consistent way across all Zip Codes and major sectors of the United States. This procedures allows for data comparison across Zip Codes within and outside of Indian Reservations. The frequency of our updates provides policy makers with current and accurate information on Indian Country employment, including agriculture, to ease the design, deployment, and monitoring of developing strategies to promote this particular aspect of the economies on Indian reservations.

3. METHODOLOGY

We are interested to learn whether Native American reservations were more or less vulnerable and more or less resilient to economic shocks than the United States on average. Specifically, did reservations suffer larger or smaller employment losses and how quickly did they recover relative to the United States average? Our approach to learning about vulnerability and resilience of Native American reservations to economic downturns involves three steps: first, we will aggregate across all Indian reservations, henceforth called Indian Country, and compare

Indian Country overall and by sector to the United States. Next, we will repeat this exercise on the disaggregate level. In particular, we will look at the distribution of sector shares and their responsiveness to recessions across reservations. Finally, as our focus is particularly on the role of agriculture, we will investigate whether growth rates and their variability across reservations was influenced by the share of agricultural employment with the help of regression analysis.

3.1 Measuring Resilience: Aggregate Measures

As characterized in the literature review, many measures of vulnerability and resilience compared to losses during recovery exist. Our focus here is on employment, so we follow the general notion of the literature and look at percentage of job losses during recessions and the gains thereafter in Indian Country during the three recessions in our data set and compare them to the job losses and gains during the same periods in the United States as a whole.

3.2 Measuring Resilience: Disaggregate Measures

To see what resilience may look like, we first graph employment percentiles by sector across reservations over the entire sample period. We so as shares of total employment as well as growth over time. In order to do so, we normalize 1990 as "100" and track job development in the United States versus reservations overall as well as by sector for the entire 25 years of our data. We also provide employment growth percentiles across reservations for all recession and recovery periods.

3.3 Measuring Resilience: Regression-Based Measures

While the visual analysis of developments over time provides substantial insight into the data, it cannot establish the connection between agriculture and economic vulnerability as well as resilience. We therefore employ a series of regression models to measure the contribution agriculture may have. Frist, we would like to see whether reservations that have a larger share of

agricultural employment also had faster job growth[1]. We include three other variables that measure the degree of concentration of sectoral diversification as suggested by the new economic geography literature. One core question of this literature is whether economic clusters, that is high concentrations of a single industry, or well diversified sector portfolios lead to faster growth. We capture the essence of this question by including the employment share of the largest sector as a cluster proxy. We also include the effective number of sectors as measures of diversification. This provides us with the following specification.

$$d(emp)_{it+12} = \alpha + \beta_1\, sec11_{it} + \beta_2\, ENS_{it} + \beta_3\, S1_{it} + D_i + D_t + \varepsilon_{it},$$

where *t* is time in month and *i* is the *i*-th reservation. *d(emp)* is the annual percentage change in employment, α is a constant, *sec11* is the share of agriculture in reservation *i* at time *t*, *ENS* is the effective number of sectors, *S1* is the share of the largest of 14 sectors in the reservation, D_i is a dummy variable (fixed effect) that absorbs all factors assumed constant during the period of investigation, D_t is a dummy variable that absorbs all time specific macro-factors (such as economic policies, interest rates) influencing all reservations in the same way and ε is an error term. This expression specifies our baseline fixed effects panel equation. As we are interested in how current sector portfolios and the current share of agricultural employment influences growth, we chose to use the 12 months ahead change in employment as our left hand side variable. This specification also avoids potential endogeneity problems, as substantial growth could lead to a larger share of agriculture or increase in the relative size of the dominant sector. In our specification, our right hand side variables are predetermined and as such endogeneity issues have been avoided. We use reservation fixed effects to control for factors not expected to

[1] Aside from macro-economic policies, many factors that explain employment growth differences across geographies within the United States are either location or location-time specific, such as a location's average cost of living, effective income tax rates, and conditions for small business development. See Cebula et. al. (2015) for a discussion. We attempt to control for these factors by reservation- and reservation-time period fixed effects.

change over time in each one of our regression equations. As we are interested in employment risk mitigation on the reservation level, we control for sectoral composition through the effective number of sectors, which is the inverse of the Herfindahl index[2] as well as the share of the largest sector in each reservation.

A simple way of viewing vulnerability and resilience is the variability of the economic variable of interest. Thus, less vulnerable reservations should exhibit lower variability of employment than more vulnerable ones. We investigate this hypothesis with two measures of variability, the standard deviation of employment growth and the median deviation from the median. We regress these measures on the same right hand side variables as before:

$$SD(emp)_i = \alpha + \beta_1 \overline{sec11}_i + \beta_2 \overline{ENS}_i + \beta_3 \overline{S1}_i + \varepsilon_i,$$

where *SD(emp)* is the standard deviation of employment growth, which we replace with the median deviation from the median for robustness checks. Note that we measure the standard deviation of employment growth over the entire period, thus, we can only obtain results across reservations, and the shares are replaced with the long-run averages.

To study upswings and downswings, we split the panel into recession and recovery periods.[3] We use our first equation again, however, only limiting the years to the given recession and the first three years after the given recession, which we call recovery years, respectively.

[2] We describe how to calculate the Herfindahl index and the effective number of sectors in the appendix.

[3] The dates used in the estimation for the recessions follow the NBER definitions. Recovery periods are the first three years after each recession. Detailed dates are provided in the appendix.

4. DATA

Data comes from various sources. Aggregate and sectoral employment data comes from the Bureau of Labor Statistics, obtained through the Federal Reserve of Saint Louis. The Bureau of Labor Statistics does not directly provide data on agricultural employment at the aggregate level. Agricultural employment was therefore obtained from the Department of Agriculture, where the quarterly survey measures of hired agricultural labor were used for the graphs below. Zip Code level data was obtained from the Institute for Spatial Economic Analysis (ISEA), which estimates Zip Code level employment by sector on a monthly basis. Various other data, such as food price indices were also obtained through the Federal Reserve of Saint Louis. Supplementary data came from the *Census of Agriculture: American Indian Reservations*, and establishment level data was obtained from Info USA through ESRI as well as NETS through Walls and Associates.

4.1 Discussion of Data Sources

The ISEA Zip Code level data includes employment estimates on 14 unique sectors derived from the BLS supersectors. ISEA uses publicly available data sources and combines them with their proprietary algorithms to arrive at estimates at the Zip Code level that reflect seasonally unadjusted employment patterns across almost all US Zip Codes over time. It regularly adjusts for changes in Zip Code structure to reflect those patterns as accurately as possible. Due to the nature of the data sources they combine, their estimates carry error terms that need to be taken into account in the estimation procedures. Reservation boundaries do not coincide with Zip Code boundaries. Therefore, establishment level data is necessary to split Zip Codes into reservation employment and outside of reservation employment within the same Zip Code. The current gold standard (and equally expensive) source of that data is the NETS data set (National Establishment Survey), which has been successfully used by, for example, the University of Wisconsin to address similar issues. However, due to its costliness, we can only obtain a small subsample of the NETS data for quality control purposes. Specifically, we

obtained a sample of 100,000 establishments of active establishments in 2014 across all sectors in Zip Codes that intersected with land based reservations. We use both the 2014 NETS data and the 2015 Info USA establishment level data to estimate the share of labor inside and outside of reservations within Zip Codes. To see how well both data sources would reflect ISEA estimates, we calculated correlation coefficients between NETS, InfoUSA, and ISEA data for the years 2014 and 2015, respectively. The correlation coefficient of the NETS data with ISEA zip code employment data is 0.84, the correlation coefficient for InfoUSA with ISEA data is 0.94. For shares of Zip Codes inside and outside of reservations, please see the Appendix for additional details. For agriculture, we unfortunately cannot correlate our employment numbers for the reservations with measures of agricultural activity from the *Census of Agriculture: American Indian Reservations* as this census data does not include information on employment.

4.1 Data Preparation

From our primary data sources, we generated data sets for three different definitions of Indian Country: a wide definition, which includes all Zip Codes that are in a reservation, are touched by a reservation, or include a reservation; a narrow definition, which only includes those Zip Codes that are in a reservation in their entirety; and an imputed definition, which uses the establishment level data previously described to impute employment in those Zip Codes that only have a share of employment in reservations. The following map illustrates the construction of the data:

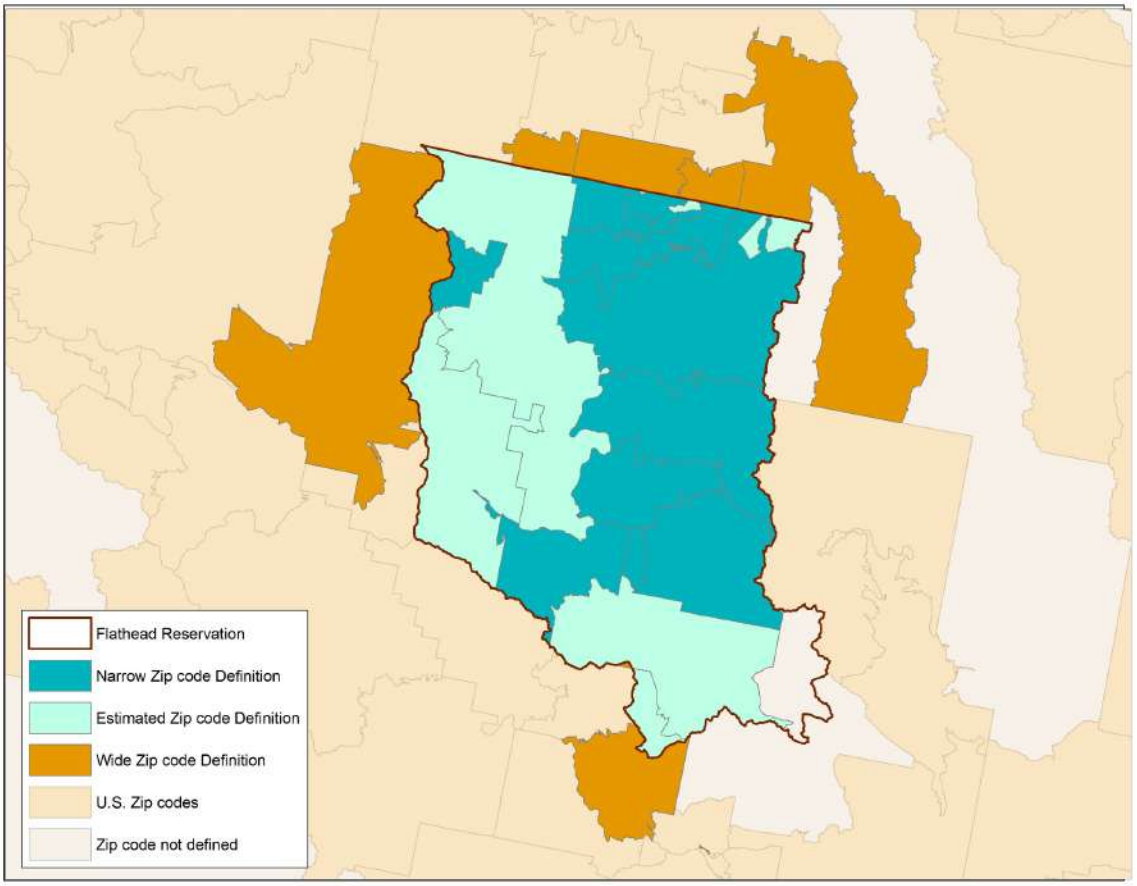


Figure 1: Flathead reservation with Zip Code boundaries

The map shows the Flathead Reservation in Western Montana. Zip Codes that fall entirely inside the reservation boundaries (outlined with a thick black line) are shown in dark teal color. When reservation boundaries cut through a Zip Code, the area interior to the reservation is shown in light teal, the area outside the reservation in brown. Zip Codes that fall entirely outside are shown in beige and areas with no properly designated Zip Codes are shown in light beige. The Narrow Zip Code definition we use for our analysis is the dark teal area in the map. The imputed, or split, version includes all dark and light teal areas in the map. The wide definition includes all dark and light teal areas as well as the brown zip code areas.

This raises the question of a proper definition of Indian Country for the purposes of economic analysis. The following map, which displays Native American population shares in the United States informs us about the depth of the problem:

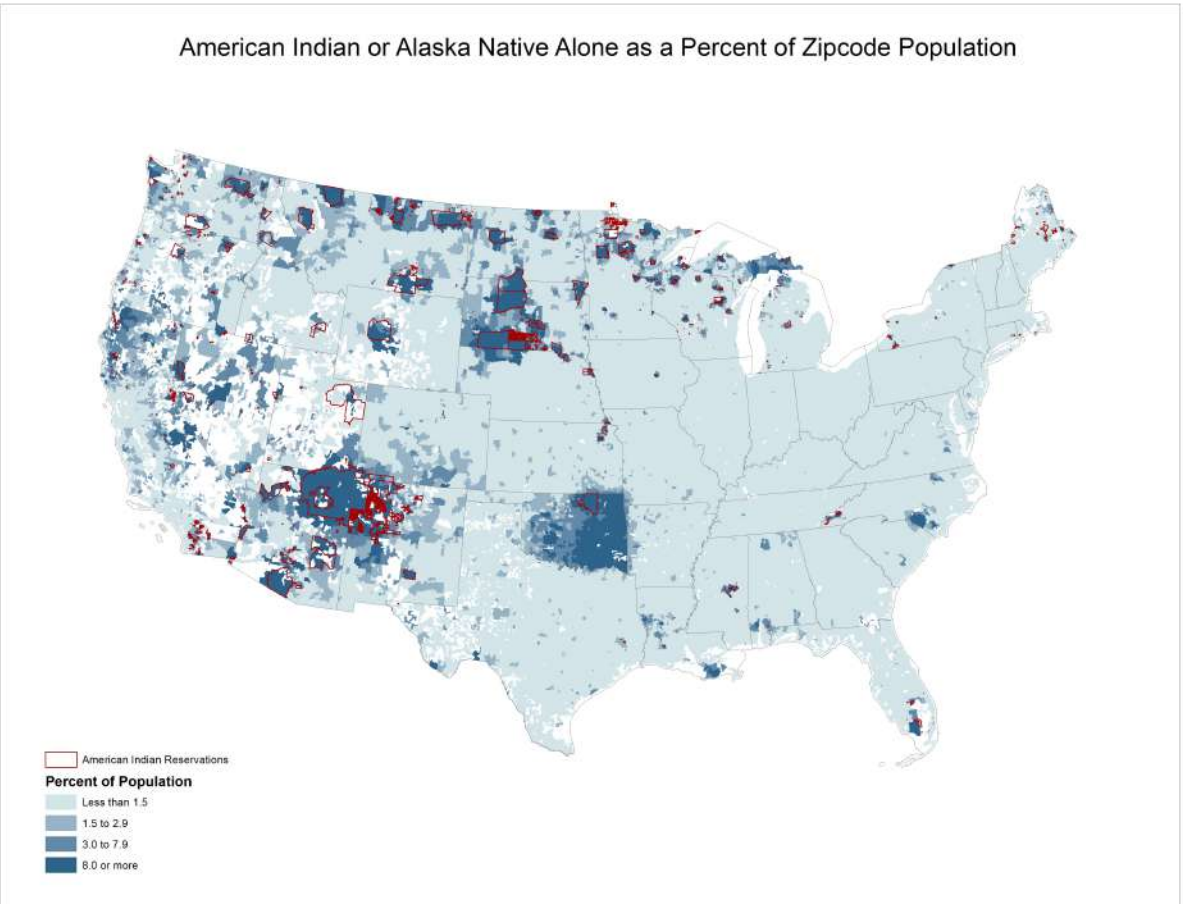


Figure 2: Native American Population as a percent of Zip Code population. Data Source: Census

Inspection of the map shows that many reservations have a high density of Native American population. However, the Native American population shares even within reservations are low, often within the single digit percentages. Moreover, frequently large shares of Native American populations live in the proximity, but outside of reservation territories. Two possible solutions emerge from the map: either focus on areas with the highest percentage shares of Native Americans (choosing an arbitrary cut-off) or solely focusing on land-based reservation territories. Since the latter is precisely defined, we decided to move forward with the land-based reservation territories, acknowledging that other definitions both have their merit and are equally interesting and defendable. Moreover, we notice that for many reservations, substantial shares of Native Americans live outside, but in proximity of reservation territories. We therefore adopt our

wide definition of reservations as our baseline and discuss results obtained from the split and narrow definitions in our robustness checks.

5. STYLIZED FACTS ABOUT LABOR ON INDIAN RESERVATIONS

Before we can investigate the effect of agriculture on vulnerability and resilience in Indian Country, we need to learn about the structure of employment on Indian reservations. We do so in three steps: We first investigate how employment in Indian Country developed over the last 25 years. Next, we take a closer look specifically at agricultural employment as compared to the US overall. Finally, we investigate the sectoral composition of Indian Country as compared to the United States, where we answer questions like: What are the largest sectors and what is the employment share of these sectors?

5.1 Employment Growth on Indian Reservations

By how much did employment in Indian Country grow every year, and how does that compare to the United States overall? Employment in our wide definition of Indian Country is, as of December 2015, about 50.7% higher than in January 1990. This equates to a compound annual growth rate of 1.59%. According to the Bureau of Labor Statistics (##), US employment overall only grew by 34.0% during the same time period, or 1.13% annualized. This development is roughly consistent with the also larger increase of Native American population as compared to the United States overall. As the following graph illustrates, this development, however, was by no means uniform:

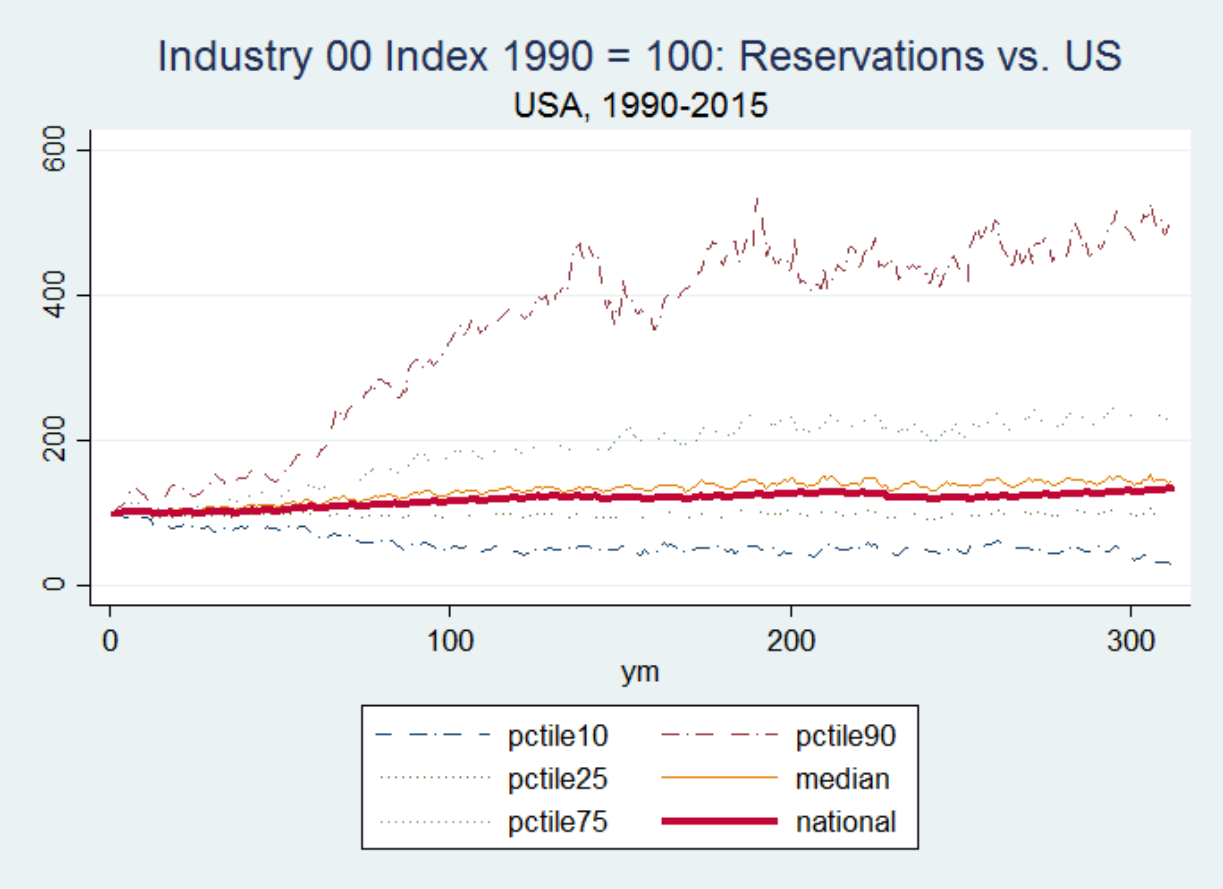


Figure 3: Private sector employment (BLS Supersector code 00) on Indian reservations (wide definition) as compared to the United States as a whole

The graph shows the development of the growth percentiles from the 10% slowest growing (in fact shrinking) to the 90% fastest growing reservations. Employment growth of the median reservation was only slightly above the United States, while the fastest growing reservations outpaced employment growth 7-fold, and employment in the slowest growing reservations dropped to about one fifth of its original size. However, there are clearly more reservations that grew larger than average, and many of those outpaced national growth substantially, which explains the substantial differences explained in the aggregate numbers at the beginning of this section. Interestingly, the most substantial changes in the extremely fast growing or shrinking reservations happened before the turn of the millennium.

5.2 Agricultural Labor in Indian Country

Our specific interest is in the contribution of agriculture in possibly balancing the effect of economic recessions. As the following graph shows, many reservations do not have any agricultural employment at all:

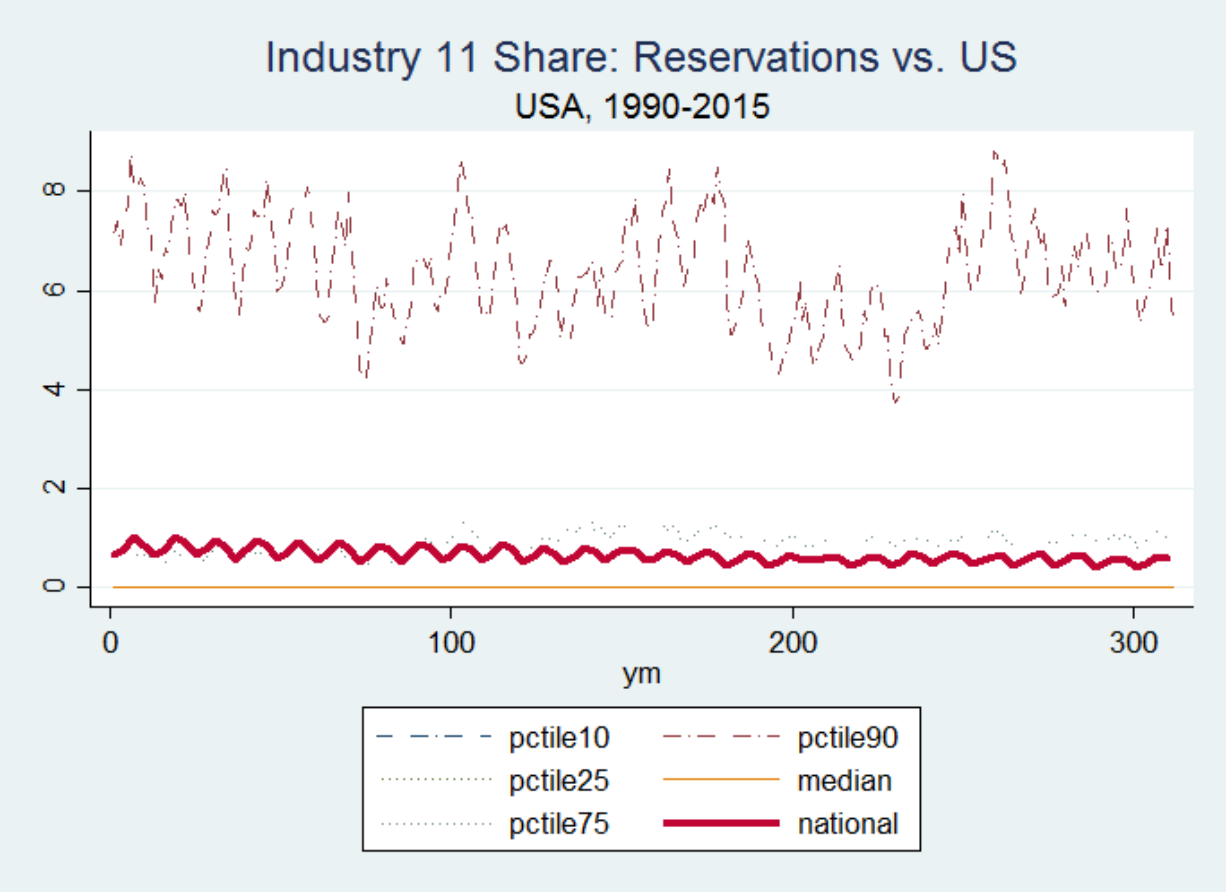


Figure 4: Agricultural employment (BLS Supersector code 11) on Indian reservations (wide definition) as a share of total employment as compared to the United States as a whole

The graph shows that only about 25% of reservations have employment shares that are on par or higher than the US average, but with a growing tendency. The top 10% agricultural reservations have agricultural employment shares roughly 5 times or more than the United States as a whole. More interesting is to see the development over time:

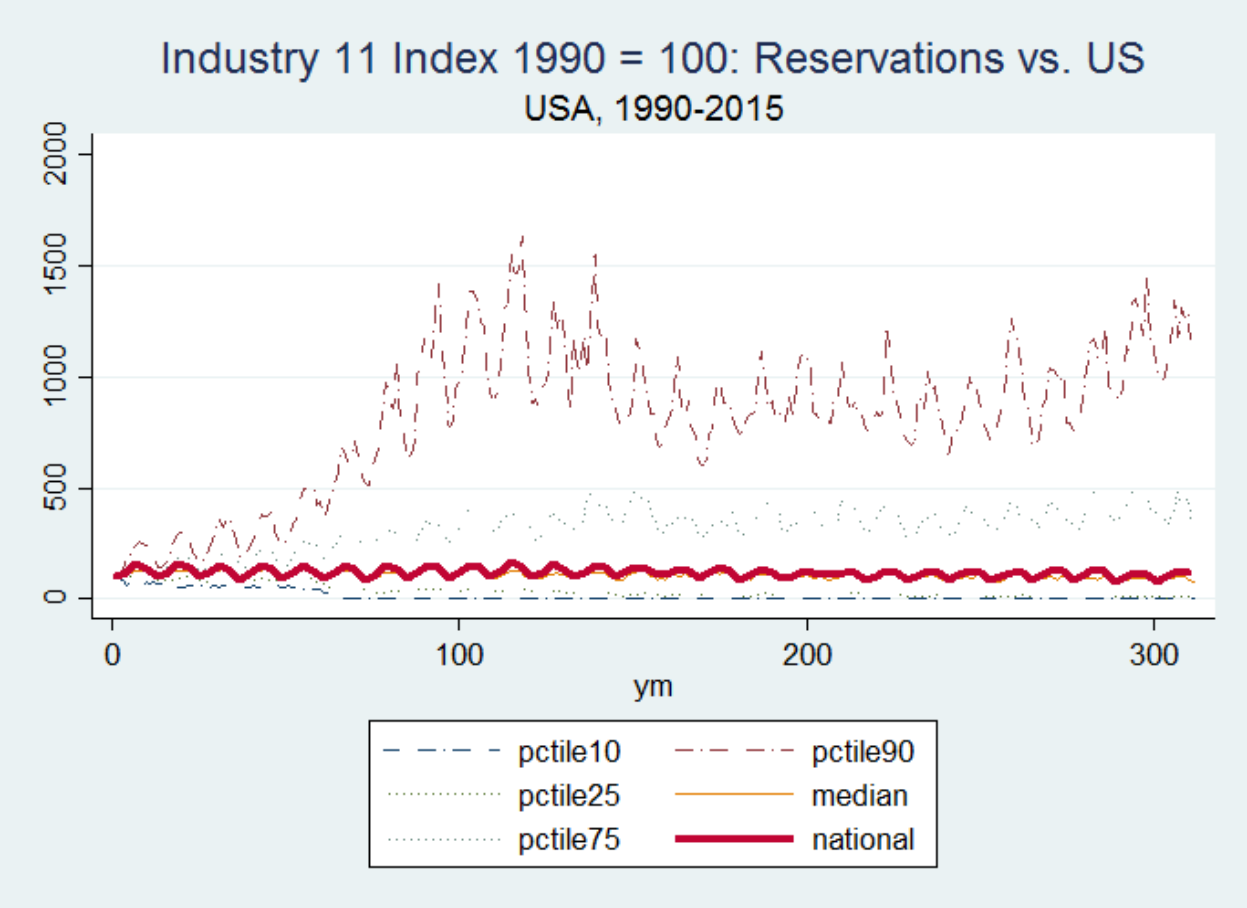


Figure 5: Agricultural employment (BLS Supersector code 11) on Indian reservations (wide definition) as compared to the United States as a whole

The graphs shows the development over time as an index number relative to January 1990 = 100. While the median reservation in terms of agricultural employment roughly kept pace with the United States overall, the top 25 % reservation increased agricultural employment by about 400%, while other reservations lost all their agricultural employment over time.

5.3 Sectoral Composition of Indian Country

We investigate sector employment shares and sectoral employment developments for all other sectors in the same way as we investigated agricultural labor: We first present the shares

for each sector as percentiles across reservations compared to the United States and then look at the development of employment over time.

10 Mining and Logging

Figure 6: Mining and Logging employment (BLS Supersector code 10) on Indian reservations (wide definition) as a share of total employment (left panel) and employment growth over time (indexed, right panel) as compared to the United States as a whole

Mining and logging employment plays a minor role in all but the top 20% of reservations. The 75 percentile line of Indian reservations, which marks the share of Indian reservations that have an equal or small share of mining and logging than indicated by the line, still lies below the national employment share for mining and logging for the entire period. The indexed development over time indicates substantial heterogeneity, an observation repeated over and over again for all sectors, but already observed in the case of agriculture. National employment growth in mining and logging generally outpaced employment growth in Indian reservations in this sector.

20 Construction

Figure 7: Construction employment (BLS Supersector code 20) on Indian reservations (wide definition) as a share of total employment (left panel) and employment growth over time (indexed, right panel) as compared to the United States as a whole

Construction has become an increasingly important sector for Indian reservations. While the median reservation had a less than three percent employment share in 1990, this increased to almost five percent before the housing crash in 2007, then declined in similar ways as in the United States as a whole. It recovered to more than four percent towards 2015. One can clearly see the seasonal pattern as well as the stronger growth of construction employment in the majority of the reservations before the housing bubble.

31 Durable Goods

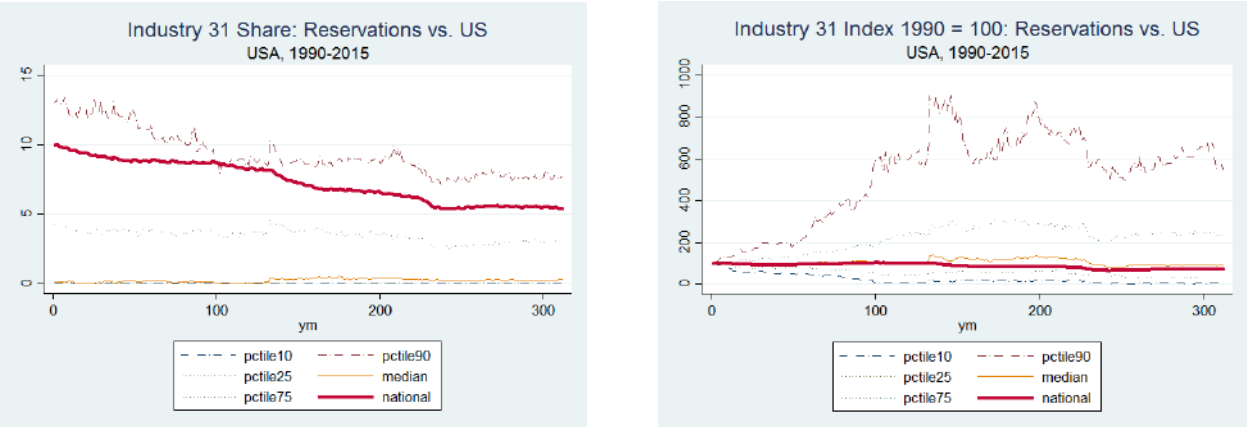


Figure 8: Durable Goods Manufacturing employment (BLS Supersector code 31) on Indian reservations (wide definition) as a share of total employment (left panel) and employment growth over time (indexed, right panel) as compared to the United States as a whole

Manufacturing employment as a share in total employment has been in the decline in the United States, and Indian reservations are no exception. Both durable and non-durable goods manufacturing plays a miniscule role on Indian reservations. The more surprising it is, then, that some reservations, though mostly ones with very small manufacturing employment in 1990, were able to increase manufacturing employment substantially during the last 25 years.

32 Non-Durable Goods

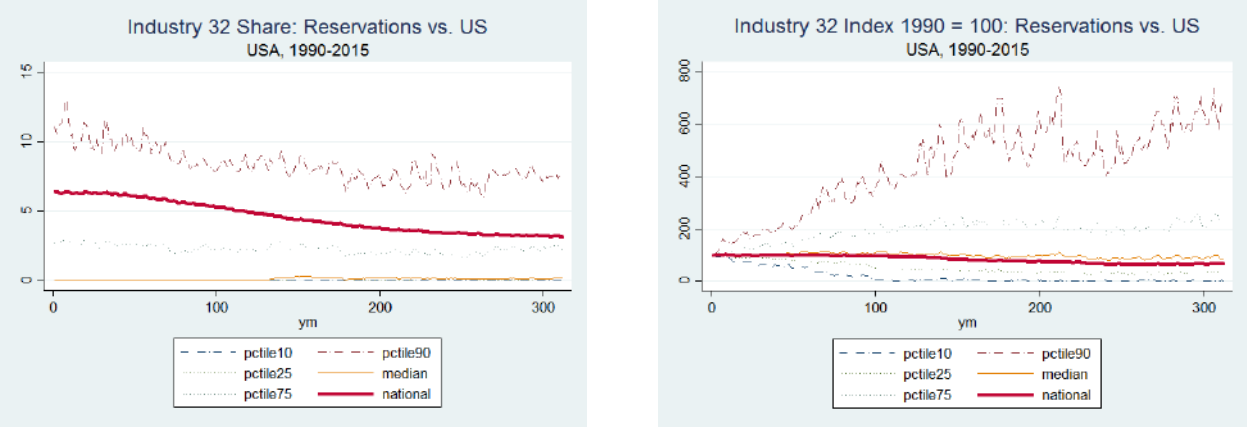
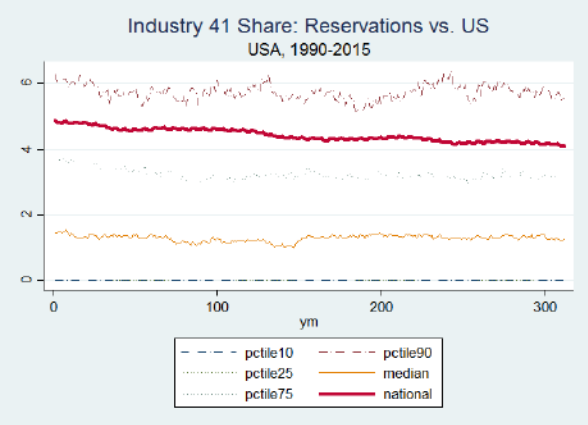


Figure 9: Nondurable Goods Manufacturing employment (BLS Supersector code 32) on Indian reservations (wide definition) as a share of total employment (left panel) and employment growth over time (indexed, right panel) as compared to the United States as a whole

In the context of both durable and non-durable goods manufacturing, it is noteworthy that manufacturing employment in Indian reservations in the majority of reservations showed higher growth rates than in the United States as a whole.

41 Wholesale Trade



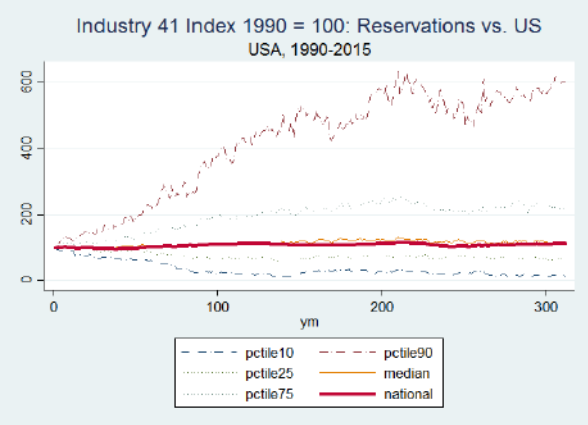
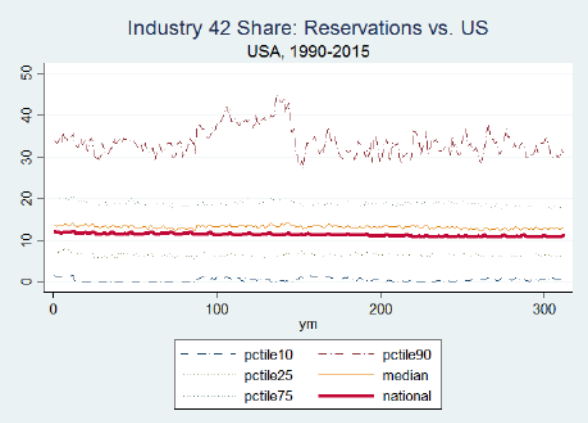


Figure 10: Wholesale Trade employment (BLS Supersector code 41) on Indian reservations (wide definition) as a share of total employment (left panel) and employment growth over time (indexed, right panel) as compared to the United States as a whole

In terms of employment, wholesale trade for the median reservation is only about half as important as for the US as a whole. Employment development in Indian reservations has generally been on par with the US, but again saw great variability across reservations.

42 Retail Trade



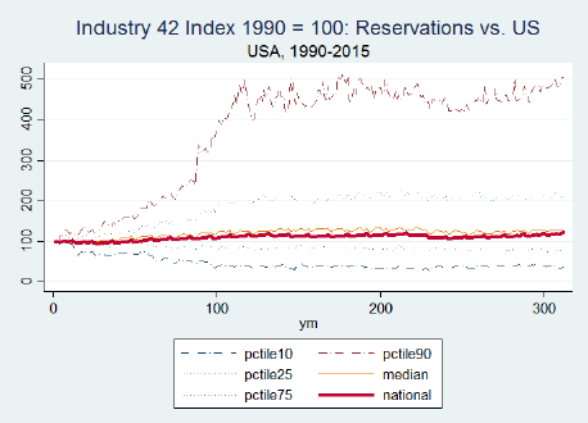


Figure 11: Retail Trade employment (BLS Supersector code 42) on Indian reservations (wide definition) as a share of total employment (left panel) and employment growth over time (indexed, right panel) as compared to the United States as a whole

As one might expect retail trade is more important in Indian reservations than in the US on average – more than half of Indian reservations have employment shares in retail that are higher than the US. Employment development in retail on reservation territories also slightly outpaced the US.

43 Transportation and Utilities

Figure 12: Transportation and Utilities employment (BLS Supersector code 43) on Indian reservations (wide definition) as a share of total employment (left panel) and employment growth over time (indexed, right panel) as compared to the United States as a whole

Transportation and utilities, while in relative importance below the United States, saw increasing importance around the turn of the millennium, with more reservations approaching or surpassing the US employment share in this sector. Job growth in the majority of reservations also outpaced the United States.

50 Information

Figure 13: Information Sector employment (BLS Supersector code 50) on Indian reservations (wide definition) as a share of total employment (left panel) and employment growth over time (indexed, right panel) as compared to the United States as a whole

The information sector in Indian reservations shows some paradoxical behavior: right at the time when the dot-com bubble burst and the share of employment in the information sector started to decline, the employment share in the median reservation increased in this sector and has stayed at this level since. While exceeding the scope of this paper, this finding suggests this phenomenon is in need of further exploration.

55 Financial Activities

Figure 14: Financial Activities employment (BLS Supersector code 55) on Indian reservations (wide definition) as a share of total employment (left panel) and employment growth over time (indexed, right panel) as compared to the United States as a whole

Similar to the information sector, employment in the financial services industry became more important in Indian reservations after the bursting of the dot-com bubble. Employment growth in the majority of the reservations again surpasses that of the United States in this sector

60 Professional and Business Services

Figure 15: Professional and Business Services employment (BLS Supersector code 60) on Indian reservations (wide definition) as a share of total employment (left panel) and employment growth over time (indexed, right panel) as compared to the United States as a whole

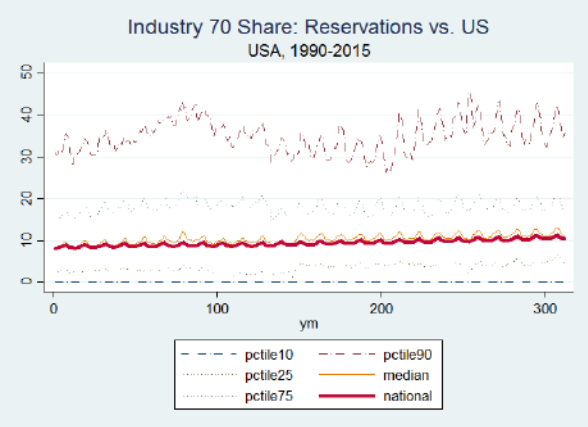
One of the sectors that saw rapid growth in the United States over the last 25 years is the Professional and Business Services sector. While only about 10% of the reservations have a share of employment in this sector that is as high or higher than the United States on average, the majority of the reservations have seen employment growth in this sector substantially outpace employment growth in the United States as a whole. Closer inspection reveals that the national employment share and growth in this sector got dented after recessions, while this does not seem to have been the case on Indian reservations.

65 Education and Health Services

Figure 16: Education and Health Services employment (BLS Supersector code 65) on Indian reservations (wide definition) as a share of total employment (left panel) and employment growth over time (indexed, right panel) as compared to the United States as a whole

It is encouraging to see that the median education and health services employment share on reservations has caught up with the United States average, which means that about half of the reservation even have higher employment shares in this sector than in the US as a whole. However, almost 25% of reservations have no employment in this sector at all. Employment growth in this sector was generally on par with the development in the United States, although about 25% of all reservations saw a figurative explosive employment growth in this sector.

70 Leisure and Hospitality



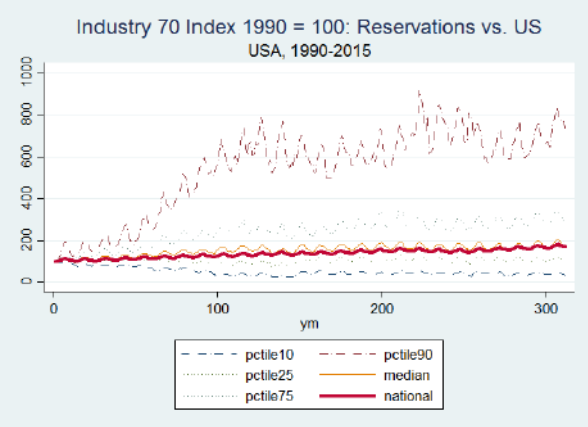
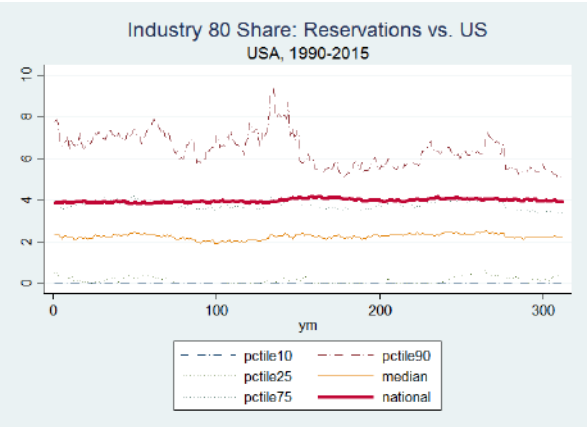


Figure 17: Leisure and Hospitality employment (BLS Supersector code 70) on Indian reservations (wide definition) as a share of total employment (left panel) and employment growth over time (indexed, right panel) as compared to the United States as a whole

Leisure and Hospitality provides roughly 10% of all jobs in the United States. About half of the reservations have a higher share of employment in this sector, reaching more than 30% in the top 10% of reservations, possibly due to gaming operations on those reservations. Growth has been on par with the United States, with phenomenal growth in the 10% fastest growing reservations now employing more than six times as many workers in this sector as compared to 1990.

80 Other Services



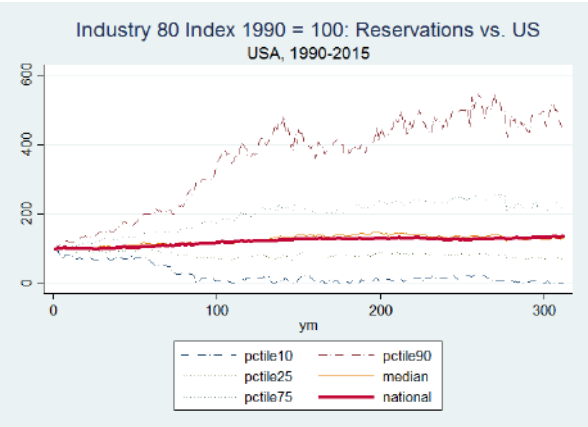


Figure 18: Other Services employment (BLS Supersector code 80) on Indian reservations (wide definition) as a share of total employment (left panel) and employment growth over time (indexed, right panel) as compared to the United States as a whole

On average, about 4% of employees work in establishments that provide other services. On the median reservation, this share is about half and has been constant over time. The "Other Services" covers a collection of services not elsewhere already classified, such as laundry, dry cleaning, personal or pet services, repairs, advocacy, and so on.

In summary, Retail, Education and Health Services, and Leisure and Hospitality are the largest sectors across Indian reservations. All three sectors show low variability over time. We will next investigate whether those sectors have enough weight to instill resilience in Indian Country.

6. RESILIENCE RESULTS

6.1 Aggregate Measures by Recession

In order to understand how vulnerable or resilient Indian country is, we need to first gauge how reservations were affected by past recessions and how fast they recovered. We compare these numbers then to the United States aggregate numbers. For this exercise, we aggregate employment across all reservations and then calculate year-over-year growth rates. We then calculate averages for each recession and recovery period.

			Recessions		
		No Recession	1991 Recession	Dot-Com Bubble	Great Recession
After Recovery	National	2.35	-0.99	-0.35	-2.14
	Indian Country	2.28	1.14	1.11	-1.41

1992 Recovery	National Indian Country	0.66 1.91			
Dot-Com Recovery	National Indian Country	-0.34 1.11			
Great Recession Recovery	National Indian Country	-0.16 -0.43			

Table 1: Average growth of employment during recessions and recovery in Indian Country as compared to the national level

Surprisingly, according to this data, Indian Country was less affected by the last three recessions than the United States as a whole. Recovery also was faster in the first two recessions, but slower after the great recession when Indian Country still saw substantial year-over-year employment losses. In between recessions and outside of recovery periods, Indian Country roughly grew on par with the aggregate United States.

6.2 Disaggregate Measures by Recession

Next, we repeat this exercise by investigating employment growth rates across reservations. In order to do so, we calculate percentiles of growth rates across reservations by past recessions and recovery periods.

			Recessions		
		No Recession	1991 Recession	Dot-Com Bubble	Great Recession
After	10^{th} Pctile	-25.0	-23.5	-44.2	-28.6

Recovery	25th Pctile	-5.7	-7.1	-13.6	-9.4
	Median	1.6	0.0	0.2	-0.8
	75th Pctile	11.0	5.9	16.2	7.0
	90th Pctile	39.2	17.4	77.8	33.3
1992 Recovery	10th Pctile	-13.1			
	25th Pctile	-3.2			
	Median	2.0			
	75th Pctile	8.6			
	90th Pctile	22.4			
Dot-Com Recovery	10th Pctile	-37.0			
	25th Pctile	-11.3			
	Median	1.0			
	75th Pctile	13.2			
	90th Pctile	54.5			
Great Recession Recovery	10th Pctile	-25.1			
	25th Pctile	-8.0			
	Median	0.0			
	75th Pctile	8.0			
	90th Pctile	38.9			

Table 2: Distribution of employment growth across reservations during recessions and recovery

The degree of variability of employment growth across reservations is truly astounding – while, for example, some reservations lost almost all their employment during the Great Recession, others boomed. The Dot-Com bubble saw the largest differences between growing and declining reservations, and the same is true for the recovery years thereafter. While outside the scope of this paper, these findings deserve attention in the future.

6.3 Regression Results

At the core of our interest is the effect of agricultural employment on the development of employment over time on Indian reservations during recessions and recovery. We collect evidence in four steps: (1) What is the role of agriculture in employment growth? The well documented increase in farms on reservations suggests that the two might be positively correlated. (2) Does the share of agricultural labor influence the variability of employment growth? (3) Do reservations with a larger share of agriculture show a lower decline in jobs during recessions? (4) If agriculture slows the decline in job growth, do we see slower or faster recovery on reservations with higher shares of agriculture?

We address all of these questions with the regression equations discussed in the methods section. We use robust standard errors throughout to account for heterogeneity in the error terms. Given the graphs about economic development, both overall and by sector, we are most concerned about influential observations in our regression analysis. Given the large amount of observations and the rather complicated way of creating the desired data, we decided to remove 5% on the top and bottom of the distribution *of each variable* across all estimations. As this reduces the size of our dataset considerably, we then run all regressions both including and excluding possibly influential observations. We generally obtain the same results for both techniques, but estimates specifically on many of the control variables are no longer significant, and, when insignificant sometimes even change signs. We prefer to present the results without influential observations throughout this section of the paper.

To answer the first question, we regress overall employment growth by reservation and month on the share of agricultural employment in overall employment 12 months prior, where we control for influences by reservation that are assumed constant over time through reservation fixed effects. The results are shown in the first column of Table 3. While we find significant results, the R^2 informs us that our regression equation, even with the inclusion of large dummy variable sets, does not explain the variation in employment growth rates. This first observation points to an overwhelming importance of idiosyncratic factors in determining growth rates in

Indian Country. Unless there is reason to suspect specification errors such as omitted variable bias, the associations of our variables are nonetheless valid. We see a negative relationship, statistically significant at the 1% level, between the share of agricultural employment and overall employment growth. In column two, we add controls designed to capture economic concepts discussed in the geographical economics literature that influence industry employment or regional employment, such as economic clusters versus diversification of industries. We do so by adding the effective number of sectors, which measures employment diversification, the share of the largest sector, which measures specialization consistent with cluster analysis, and the share of the three largest sectors, which indicates the degree of dominance and competition for spatial resources within a location. We do not find statistically significant results for these controls. We capture influences that vary over time, but are common across reservations in column three through year fixed effects. Most importantly, though, the coefficient of the share of agriculture is consistent with the view that agriculture in Indian Country has had a negative effect on overall employment growth as reservations with larger shares of agriculture saw slower employment growth. We therefore must reject our hypothesis that a large share of agricultural employment increases dependent employment growth in consecutive years. However, this does not mean that small scale self-employed farming may not be able to contribute positively to employment. We simply lack the data to test this hypothesis. Such a test, however, would be straightforward with a sufficiently large sample of the NETS database described earlier in this paper.

We answer our core question, namely whether the share of agricultural labor influences the variability of employment growth by using two measures of employment variability, the standard deviation of employment growth as well as the median deviation from the median job growth across reservations over time. We regress those measures on the average share of agriculture over time as well as averages of our controls. The results are presented in Table 4. Indian reservations with higher shares of agricultural employment see lower variability in job growth (and decline). Consistent with the economic geography literature, a strong lead sector

leads to increased volatility in job growth. Surprisingly, though, there is also some evidence that a larger variety of sectors is related to higher variability in job growth. These findings are consistent, while not always statistically significant, regardless of which definition of Indian Country we employ. While outside of the scope of this paper, this finding deserves more scrutiny.

Do reservations with a larger share of agriculture show a lower decline in jobs during recessions? We address our third question in a similar way as we addressed our first question. Frist, we again regress on year ahead employment growth on the share of agricultural employment as well as our controls, however, only for the months that fall in a recession as indicated by the National Bureau of Economic Research. We find no influence of the share of agricultural employment on job growth or decline during recessions. As recessions differ in length and our regression gives larger weight to longer recessions, we repeated the exercise for all three recessions separately (not included in this paper), with the same result.

Finally, we are interested in seeing whether employment recovers faster in reservations with higher shares of agricultural employment. We repeat the exercise for the previous question for the three years following each recession. The results are documented in Table 6 showing slower employment growth in reservations with higher shares of agriculture.

To solidify our results, we also ran contemporaneous or shorter period ahead regressions as robustness checks. To do so, we replaced the 12 months ahead growth rates with contemporaneous and 6 months ahead growth rates. Inspection of the results lead us to believe that a larger employment growth rate may also lift agricultural dependent employment, but not the other way round.

7. SUMMARY AND CONCLUSION

We set out in the hope to identify agriculture as a potential balancing weight during times of economic downturns in the industry portfolios of Native American reservations. The hypothesis we investigated was in particular whether a larger share of agricultural employment could reduce employment volatility. We indeed find this to be the case, but for all the wrong reasons: the share of agricultural employment has little to no measurable effects during downturns, but reduces employment growth during upswings. This was clearly not what we expected, let alone hoped for. We, however, want to emphasize again that this pertains to dependent agricultural labor, not self-employed small scale farms. We suggest this phenomenon needs to be investigated further. Specifically, given the large automation potential as identified by Frey and Osborne (2017), family farms with high automation support may very well indicate opportunities in this direction.

At this point, large scale farming support in Indian reservations cannot be recommended. Our results rather suggest extending research into cluster formation versus sector variety on Indian reservations. Some of our preliminary results suggest that both offer opportunities for growth, but may induce the risk of larger employment volatility. We intend to pursue this direction further.

One of the surprising findings was that Indian Country appears less vulnerable to recessions than the United States as a whole. This seemingly positive results comes with a caveat: the effect of recessions on employment in Indian Country varies vastly by reservation. While there are many reasons why this may be plausible, it is important to confirm this finding with more detailed datasets, e.g. at the establishment level, as the datasets we used for this study are merely estimates. These establishment level datasets can then be used to analyze in detail why the best performing reservations have done so well while the hardest hit reservations have suffered so much. Together with the results from this paper, we believe findings from such

research can offer significant insights into economic development in Indian Country and guide pathways into future policy design.

8. LITERATURE

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APPENDIX

Recession and Recovery Periods (Source: NBER)

Within our data set, we cover three recessions, according to the NBER:

July 1990 to March 1991

March 2001 to November 2001

December 2007 to June 2009

We arbitrarily assign the three year period after each recession as the recovery period. Consequently, the following dates mark the recovery periods in our data set:

April 1992 till March 1994

December 2001 till November 2004

July 2009 till June 2012

Calculation of Effective Number of Sectors

The effective number of sectors is defined as the inverse of the Herfindahl Index. The Herfindahl index is a concentration measure used to study market power. It is measured as the sum of squares of market shares of all entities in a market:

$$H = \sum_{i=1}^{N} s_i^2$$

H is the Herfindahl index, s_i is the market share of the *i*-th entity, and *N* is the number of all entities. In our case, entities are sectors. A value of *H* close to one indicates high concentration, a value close to 0 low concentration. The effective number of sectors, *ENS*, is the inverse of the Herfindahl index:

$$ENS = {}^{1}/_{H}$$

It indicates how many sectors the economy would be equivalent to if all of them had the same size.

Table 3: Influences on Employment Growth

VARIABLES	(1) 12 Month Ahead Year-Over-Year Employment Growth	(2) 12 Month Ahead Year-Over-Year Employment Growth	(3) 12 Month Ahead Year-Over-Year Employment Growth
Employment Share in Agriculture	-0.21***	-0.19***	-0.19***
	(-3.40)	(-3.16)	(-3.32)
Effective Number of Sectors		0.62	0.94
		(0.96)	(1.42)
Largest Sector Share		-0.085	-0.078
		(-1.12)	(-1.04)
Reservation Dummies	Yes	Yes	Yes
Year Dummies			Yes
Observations	96,228	96,228	96,228
R-squared	0.000	0.001	0.005
Number of Reservations	552	552	552

Robust t-statistics in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 4: Variability of Employment Growth; Standard Deviation (StdDev) and Average Deviation from the Median (ADM)

VARIABLES	(1) Employment Annual Changes, StdDev	(2) Employment Annual Changes, StdDev	(3) Employment Annual Changes, ADM	(4) Employment Annual Changes, ADM
Av. Emp. Share in Agric.	-4.27***	-1.57**	-0.17**	-0.011
	(-3.31)	(-1.98)	(-2.12)	(-0.23)
Av. E. Number of Sectors		63.9***		-0.44
		(2.67)		(-0.86)
Av. Largest Sector Share		12.3***		0.40***
		(3.84)		(6.58)
Constant	128***	-746***	14.6***	-3.10
	(6.65)	(-3.06)	(21.0)	(-0.62)
Observations	428	428	428	428
R-squared	0.008	0.218	0.009	0.632

Robust t-statistics in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 5: The Role of Agriculture in Recessions across Reservations and over Time; Year over Year Changes

VARIABLES	(1) 12 Month Ahead Year-Over-Year Employment Growth	(2) 12 Month Ahead Year-Over-Year Employment Growth	(3) 12 Month Ahead Year-Over-Year Employment Growth
Emp Share in Agriculture	0.086	0.13	0.13
	(0.56)	(0.90)	(0.96)
Effective Number of Sectors		0.81	1.63
		(0.48)	(0.97)
Largest Sector Share		-0.39*	-0.37*
		(-1.87)	(-1.81)
Reservation Dummies	Yes	Yes	Yes
Year Dummies			Yes
Observations	9,694	9,694	9,694
R-squared	0.000	0.007	0.014
Number of Reservations	544	544	544

Robust t-statistics in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 6: The Role of Agriculture in Recoveries across Reservations and over Time; Year over Year Changes

VARIABLES	(1) 12 Month Ahead Year-Over-Year Employment Growth	(2) 12 Month Ahead Year-Over-Year Employment Growth	(3) 12 Month Ahead Year-Over-Year Employment Growth
Emp Share in Agriculture	-0.18***	-0.16***	-0.16***
	(-3.26)	(-2.95)	(-2.96)
Effective Number of Sectors		0.31	0.32
		(0.46)	(0.47)
Largest Sector Share		-0.11	-0.11
		(-1.31)	(-1.35)
Reservation Dummies	Yes	Yes	Yes
Year Dummies			Yes
Observations	37,050	37,050	37,050
R-squared	0.000	0.001	0.003
Number of Reservations	551	551	551

Robust t-statistics in parentheses
*** p<0.01, ** p<0.05, * p<0.1