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ABSTRACT

Small Business Economics of the Lakota Fund on the Native American Indian Reservation*

Poverty rates on Native American Indian reservations are triple the US average. Small business incubation programs, available elsewhere in the US, are sparse on the reservations. Small businesses are potent drivers of US economic growth. Some 25.5 million entrepreneurs generate more than 50% of the GDP, are 26% of the exporters, and create 80% of the total net new job formation. The Small Business Administration (SBA), an independent agency of the federal government created in 1953, maintains and strengthens the nation's economy by aiding, counseling, assisting, and protecting the interests of small businesses and by assisting families and businesses to recover from national disasters. SBA services hardly exist on the Native American Indian Reservations (NAIRs), however. Studies have linked micro entrepreneurial activities to economic growth and poverty reduction. Our study tests the effects of the Lakota Fund (LF), a small business development initiative, on the NAIRs to determine whether SBA-like programs (loans, training, and consulting) can improve economic conditions on the NAIRs. The LF, a private micro loan and business training initiative on the Pine Ridge Reservation in South Dakota, is tested for its effectiveness in generating income. The 1980-2006 annual county-level data (Shannon Co. is 'treatment', Todd Co. is 'control') are a natural experiment; the counties are similar otherwise. Using the real per capita income (RPCI) dependent variable, and controlling for other factors, our regression results indicate that the LF initiative and its duration (intensity) raised RPCI significantly − suggesting the success of a privately funded small business incubation initiative targeted at isolated impoverished groups within the highly developed US economy. Suggestions for future research and program replication ideas are explored.

JEL Classification: L26, M21, O16

Keywords: poverty rates, Small Business Administration, Lakota Fund, life expectancy, public sector

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1. Introduction

Many would consider the economic state of one of America's most impoverished people groups deplorable. The Native American Indian Reservations (NAIRs) are the poorest enclaves within the U.S. (*Carlson*, 1997); they house large pockets of the country's most impoverished residents. The average household income on NAIRs is less than three-fourths the US average, a statistic that places most of the reservation inhabitants below or at the fringe of the federal poverty line. Subsequent poverty rates on the reservations average thirty-six percent, which is three times higher than the national average (*U.S. Bureau of the Census*, 2005). NAIR unemployment rates often reach as high as eighty percent, compared with less than six percent in most other US regions. Compounding these challenges is the remote geographical placement of most NAIRs from major economic hub: a real disadvantage with far-reaching adverse social, economic, and political consequences. Currently, there are 2.1 million Native American Indians and more than 20 percent reside permanently on some 55.7 million acres of reservations (mostly in the arid west and unsuitable for farming) land managed by the US Department of the Interior's Bureau of Indian Affairs. The 310 reservations housing 550 plus Indian tribes are US federal territories scattered throughout the national landscape. Consequently, myriads of public policies and private sector initiatives aimed at reducing or alleviating the endemic and long standing plight of this destitute group of Americans using standard economic development and growth policies or strategies would be a major feat in magnitude and sustainability.

Small business is often the driving force of the economic growth in the larger, non-NAIR, areas of the United States, — contributing over 50% of GDP and accounting for over 80% of new job formation (*FirstGov*, 2000). Regarding income generation, more than 53 percent of low-income micro-entrepreneurs earned profitable revenues through small business activities to lift their households out of poverty thus reducing dependence on public assistance by, in many cases, up to 61 percent (*Center for Policy Alternatives*, 2004). Recognizing the potency of such endeavors, the US Small Business Administration (SBA) was created in 1953 as an independent agency of the federal government and is specifically dedicated to maintaining and strengthening the nation's economy by aiding, counseling, assisting, and protecting the interests of small businesses and by helping families and businesses recover from national disasters. The SBA mission is to provide training, counseling, education, disaster relief, and financial aid (primarily through microfinance-type loans); assisting businesses

through Small Business Investment Centers (SBIC) and Small Business Development Centers (SBDCs)—the primary providers of startup resources, training, and consulting services in most areas. SBA-aided enterprises provide thousands of jobs world-wide and hundreds of millions of dollars in tax revenue; these more than justify the costs of providing capital toward the birth of these businesses.

Despite the SBA success in the broader US, few of her initiatives are found on the NAIRs. The microfinance revolution, begun with independent initiatives, simultaneously in Latin America, Africa and South Asia starting in the 1970s, has so far allowed 65 million poor people around the world to receive small loans without collateral, build up assets, and buy insurance (*Armendariz and Morduch*, 2007). Since microfinance theory often links micro entrepreneurial activities with economic growth and poverty reduction, the purpose of this paper is to construct and empirically estimate econometric models for assessing the efficacy of a private sector small business development initiative on the US NAIRs. This study can shed some light on whether programs akin to the SBA (loans, training, consulting) can raise the economic welfare on the NAIRs. Specifically, our effort focuses on the Lakota Fund (hereafter, LF or The Fund), a private micro-loan and business training initiative located on the Pine Ridge Reservation (in South Dakota, a US state) is investigated for its effectiveness in generating sustainable multi-period income for the NAIR citizens. The Fund operates a non-profit economic development center which provides many of the services the SBA offers, but that are also specifically tailored to the culture of Native Americans in the surrounding Lakota Fund service area (Shannon and part Jackson counties). Since its 1987 inception, the number and diversity of business enterprises on the targeted NAIR has risen from two to over three-hundred. The Fund's work is further credited with creating more than seven-hundred fifty reservation-based jobs, propelling Shannon County, SD (home to over eighty-five percent of reservation citizens within the US) from the poorest county in the country to the fifty-sixth (*Lakota Fund*, nd). Although casual observations may confirm the enormous success of the Lakota Fund, other confounding economic factors may have also strongly impacted on development and income growth over the past 21 years of the LF operation. Thus, this study isolates the effects of these other potentially influencing factors to obtain a robust estimate of the real economic impact of the fund.

This novel study distinguishes itself in at least two ways, upon the arduous construction of a unique dataset. First, the nature of the area surrounding the Lakota Fund

affords the opportunity to realistically examine a microfinance initiative at the aggregate (or county) level. Past analyses of aggregate program effects rely on inferences from individual panel data models over narrow time horizons (*Khandker*, 2005). Given the size of the two counties, the economic isolation of the Reservations, and long duration of the Lakota Fund, we are able to measure both the tangible impact of the economic injection ('micro-loan' values) and the intangible effects of the program's existence and intensity as its services and client base grow over time. Secondly, no previous study has attempted an econometric investigation of the impact of microfinance programs on impoverished pockets within the US, an otherwise highly developed economy. The plight of the American Indians and the abject poverty endemic on practically all Indian Reservations are often overshadowed by other policy issues on the national scale. Our study is a timely and robust investigation of a potentially effective small business economic development micro-finance program in highly impoverished counties on native Indian Reservations located in the Western US. Furthermore, assessing the effectiveness of the Lakota micro-financing loan program takes on added significance because more than 75 percent of America's 557 Indian tribes do not own casinos, and just 48 tribes earn more than $10 million a year on gaming. Prairie Wind gambling hall, the only casino on the Pine Ridge Indian Reservation, comprises only three trailers sited far away from any urban center and it earns less than $1 million a year for the Oglala Sioux Indians. Therefore, the lack of any meaningful Indian casinos or tourist attractions as engines of entrepreneurial growth raises the importance of the Lakota fund.

The rest of this paper proceeds as follows. Section 2 discusses the economies of Shannon (treatment) and Todd (control) counties, and the NAIRs in S. Dakota. Section 3 reviews pertinent literature and section 4 focuses on the theory, data, and specifies of the empirical model for assessing the fund's success. Section 5 presents results and discusses the findings. Section 6 is summary conclusions with implications for future research.

2. The socio-economic health of Shannon and Todd counties (NAIRs) in S. Dakota[1]

Shannon County, S. Dakota, is poor, rural and located in southwestern part of S. Dakota in the US. Completely encapsulated in the Pine Ridge Indian Reservation (about 2 million acres of the Northern Great Plains grasslands), its residents are ninety-four percent Native American (Oglala Lakota Nation). The Pine Ridge is the second largest Indian

[1] Please refer to the map of South Dakota (Figure 1) which identifies both these counties.

Reservation in the country and it spans Shannon and Jackson counties. According to Indian Services Medical Records and the US Census Bureau [*various years*], the Pine Ridge NAIR population is about 50,000, annual median income is about $2,600, infant mortality is roughly three times the US average, half of the population is under 18 years old, 70 percent of the children are poor, some 40 percent of the population is diabetic, the suicide rate is more than 72 percent higher than the US average, and the life expectancy is 55 years for male and 60 years for females. Although great strides have been made in alleviating its abject poverty status, by most standards in any developed country Shannon County is still highly impoverished. More specifically, its unemployment rate is seventeen percent with a poverty rate of over fifty-two percent. Shannon County economy is based on two industries: Education, Health, and Social Services; and Public Administration, which combined employ over sixty percent of the entire population. Data for this study covering the 1980 – 2006 period also included the seven years (1980 – 1986) before the LF inception. The fund operating only in Shannon County makes it the 'treatment' area from the year 1987 to date. The LF is unique, being the only non-profit U.S. Section 501(C) (3) of the IRS Code operating as an economic development entity in this reservation.

As a control for comparing the effects of the Lakota Fund in Shannon County, another Indian reservation county in S. Dakota to be studied, quite similar in practically all aspects to Shannon except the absence of the Fund, is Todd county. Located in south-central South Dakota and completely within the Rosebud Indian reservation, Todd County is an ideal reservation county as a control location in this study. Todd's unemployment and poverty rates, being ten and forty-eight percent respectively, before infusion of the LF in Shannon County, fared much better. Generally, the economies, cultural values and social traditions across NAIRs are heterogeneous (*Vinje*, 1977); however, Shannon and Todd Counties are similar in these attributes with Health, Education, and Social Service, as their main economic pillar (although the percent of Todd's Public Administration is half that of Shannon County (*US Census Bureau,* 2007). The complete absence of the LF program in Todd County naturally makes it the 'control' area for the entire 1980 – 2006 study period.

3. Literature review

Private entrepreneurial systems, compared with managed economies, are generally known to spur economic success including unemployment reduction (*Thurik,* 2003). Perhaps

the most famous of all micro-finance programs is that of Grameen Bank in Bangladesh, begun in 1976 by Muhammad Yunus. The Bank's five-fold purpose is to:

"Extend banking facilities to poor men and women; eliminate the exploitation of the poor by money lenders; create opportunities for self-employment for the vast multitude of unemployed people in rural Bangladesh; bring the disadvantaged, mostly the women from the poorest households, within the fold of an organizational format which they can understand and manage by themselves; and reverse the age-old vicious circle of "low income, low saving & low investment", into virtuous circle of "low income, injection of credit, investment, more income, more savings, more investment, more income". (*Grameen Bank*; see also *Armendariz and Morduch*, 2007).

In gauging the success of the Grameen Bank heavy emphasis has been placed on the micro-credit model's financial sustainability and the program's effects on household or personal consumption, that is, comparison of borrowers to non-borrowers. With much emphasis placed on how micro-finance programs affect the economic and social status of individuals, there is scant evidence (if any) on how a micro-finance initiative affects the broader economy. In other words, almost all studies attempt to determine differences in social status of borrowers *versus* non-borrowers. Such a focus however overlooks the quantitative effects of resource injection into small area economies and the corresponding implications on per capita income, unemployment, or other measures of real economic outcomes. These effects would not be limited to the borrower but, in the course of creating his (or in microfinance's case more likely her) business enterprise circulates resources provided from previously established businesses. The increased economic resources must be spent on other businesses; thus, regardless of who actually receives the loan, the whole community economy eventually benefits. "No man is his own island," likewise no business operates in a vacuum. This is the heart of the multiplier effect in basic macroeconomic theory.

While the effects on borrowers are important to microfinance programs, their main attraction to outside donors is their claim of a self-sustaining, poverty reduction model. For all their rhetoric, when balance sheets of microfinance programs are audited, the reality is not as bright. For example, although the Grameen Bank has posted profits during most of the intervening period from 1985 to 1996, using western accounting standard audit practices indicate that most of those profits became losses (*Morduch*, p. 1590). Moreover, much to the chagrin of microfinance proponents, it appears that the only programs that attain the self-

sufficiency status (e.g., BancoSol or Bank Rakyat Indonesia's Unit Desa system) either charge high interest rates or cater towards upper-lower class clients (*Morduch*, p. 1576).

Sustainability is one mode for assessing the success of a microfinance program, another method in particular, societal cost *v/s* individual benefit, may tell a different story. With respect to Grameen Bank to achieve a one dollar rise in household consumption it would cost the society only ninety-one cents (*Morduch*, p. 1593). Thus, while Grameen bank is losing money and is being subsidized, the society continues to benefit from the rise in total new wealth creation through its programs. This would indicate a possible positive externality that would justify its continued existence.

Vinje (1977) constructed a multiple regression model of the determinants of per-capita income on the 24 largest per-capita income NAIRs, using 1970 cross-sectional data of the sampled NAIRs. The empirical model included three broad groups of independent variables: the percent of the reservation's labor force in manufacturing, government, and agriculture; geographic attributes (capturing the effect of size and population dispersion as possible infrastructural constraints on per capita income); and unemployment rate (absence of job opportunities). The per-capita income regression model turned out to be insignificant. Granted that labor force participation and per-capita income are positively correlated, Vinje then proposed a labor force participation model. He theorized that variations in native Indian values among the NAIRs might be a determinant. He regressed labor force participation on three proxies of cultural traditionalism across the 24 sampled NAIRs: median school years of education completed (proxies willingness to depart from traditional values, spurred by the federal government's Indian educational initiatives) is expected to be positively related to labor-force participation rate; number of relatives 18 years and older living in the household (proxy for extended family system which strengthens attachment to core traditional values) is expected to be negatively related to labor-force participation rate: and population percent in the 45-65 age rage (the older population segment is less attached to the market wage economy) is expected to be negatively correlated with labor-force participation rate. Only the first two independent variables were statistically significant and correctly signed and the model explained 61.34 percent of the variation in the labor-force participation rate. In particular, education (that weakens cultural ties) alone explained about 48 percent of the model.

In a follow-up work some 20 years later, Vinje (1996) used data over 30 years (the 1970, 1980 and 1990 US Census data set) of the 23 most populous NAIRs to evaluate the potency of gambling activities as an engine of economic progress. Rather than per-capita income or labor-force participation rate, family poverty rate is the dependent variable. In the simple regression equation for each of the annual 1970 (1980) [1990] cross-sections, education alone, defined as population percent 25 years and older completing high school, explained ≈48 (≈50) [≈52] percent of the variations in NAIR poverty rate. The addition of labor force percent in manufacturing raised the model's explanatory power to about 82 percent, an indication that educational attainment (a basic need that is correlated not only with incomes but good health and improved overall well-being) and employment in manufacturing together can capably raise NAIR households from poverty.

Past work on the determinants of economic well-being (variously measured) on the NAIRs reviewed are instructive; however, they are: (a) at this point in time too dated for crafting future economic development plans, policies and strategies, (b) cross-sectional in design and incapable of capturing the trajectory of economic progress in continuous time, and are devoid of the growing current interest in private sector economic development initiatives such as the Lakota Fund (a micro-finance loan program investigated here).

4. The empirical model and data construction

Although many studies exist on microfinance programs, their effects at the small area macroeconomic level have not been investigated. The current study performs a cross-Reservation data analysis at the county-level to elicit the propensity of The Lakota Fund to generate income and thus reduce poverty. Two Indian Reservations counties are studied for their similarities in cultural, political, geographic, economic characteristics, and location, and size (e.g., small and isolated) to control for the program's impact. Data were gathered for the years 1980-2006 on per capita income, industry mix, school attendance, and public sector size for both Shannon County (treatment), home to over 85% of the Pine Ridge Indian Reservation and base of the Lakota Fund, and Todd County (control), which encapsulates much of the Rosebud Indian Reservation. The core difference between the two areas is the existence of the Lakota Fund in one (Shannon County) and its absence in the other (Todd County).

Past research and received theories justify specifying a model of variations in per-capita income as dependent on industry (industry mix), public sector size, and education. We innovate with the inclusion of a microfinance injection determinant as a catalyst for income production; its dual dimensional effects are captured using an indicator (existence or not) or dummy variable and duration (tenure). Additional innovations of our study include experimenting with three alternative measures (shapes) of the 'Lakota Fund program duration or intensity' and using high school 'attendance rate' (inverse of truancy) as possible measure of 'work ethic' or the 'opportunity cost of employment' on the NAIR.

Consequently, we motivate three econometric models in this context, using 1980 – 2006 annual data of each county. In each model real per capita income (*dependent variable*) is regressed separately against each county's industry mix (variations in industry mix are known to generate variances in per capita income), public sector size (the larger the less efficient), and school attendance rate (a reasonable proxy for 'workforce ethic' and 'foreword perspective'). For Shannon Co., a dummy indicator of the program's existence (0 before 1987, 1 otherwise) as well as a measure of the program's intensity (alternatively measured, see below) is used to capture the Fund's ability to influence positive changes in income, and thus poverty reduction, at the county level. Since there is no *a priori* reason to impose a functional form on the shape of the program intensity measure, we test three among the possible shapes: curve linear, exponential, and a geometric-variant measure that explicitly incorporates the average loan values[2, 3.] This third alternative construct of the program intensity effect is uniquely interesting for its economic content.

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[2] The exponential intensity measure was divided by 10,000 to normalize the data and provide more accurate coefficients. Because the geometric intensity measure is, in essence, an interaction between logged loan values and the exponential intensity measure, it, too, was divided by 10,000 prior to the logarithmic transformation.

[3] It assumes the geometric series form $\sum_{n=i}^{k} a_n \delta^n$ where a_n represents the average loan in year *n* and within which δ^n interacts the impact of the programs intensity on the loan size progressively with time. We choose *e* for the δ^n base and allow the exponent to assume increasing integer values with year *n*. Assuming a geometric form can yield certain advantages. One may derive under certain assumptions, for example, a mathematical relationship between the income over time (or perhaps income autocorrelation), loan values, and the program's intensity measure. Assume that changes in average loan values can be absorbed by growth in the economy (e.g. more money finds a home on the reservation), and that the income response to a change in loan value is governed by a certain coefficient α, that the period of response is undefined, and that there exists some degree of time-related correlation for income. For the above series, then, the sum as time period *n* approaches infinity is given simply by $\frac{a_n}{1-\delta}$, where a_n represents an average loan injection, and the impact of that summed effect

Using stacked data to conserve the degrees of freedom, we estimated a Fixed Effects (FE) model at the county/year cohort level to control for possible cross-county heterogeneity and endogeneity (namely selection and variable omission) bias. The contribution of this study is not to be underestimated. Long resting at the bottom of the economic barrel of the United States, the extension of the SBA or similar (Lakota Fund) programs could work to reverse the vicious cycle of poverty endemic to the Native American Indian Reservations. Programs similar to the Lakota Fund could be extended not only to more Reservations, but also to other isolated pockets of impoverished areas within the US and other developed countries across the world. Macroeconomic policy implications of this research are rich and multi-dimensional.

As one would expect, effective evaluation of microfinance programs is highly contingent upon available data and data quality. Small business development programs may, for example, prefer to target one specific impoverished area compared with another for a host of reasons: infusing most available micro-credit data with, among other issues, selectivity bias. As Montgomery (2005) notes, even detailed panel data can be plagued by such concerns, limiting an economist's ability to elicit clean measures of a program's propensity to fight poverty and generate growth. For this reason, applicable literature (Pitt and Khandker, 1998, for example) implemented fixed effects to control for endogeneity (selection or program placement) bias and unobserved heterogeneity across groups (*Coleman*, 1999) that may prejudice the coefficients of the program as a result of omitted variables. We offer two models to address this concern.

Khandker (2005) circumvented the issues of endogeneity and heterogeneity across families and villages in Bangladesh by utilizing fixed effects (FE) at the household level

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on income over an undefined time period is $\alpha\left(\frac{a_n}{1-\delta}\right)$. In this form, δ becomes the ratio or rate at which the loan value a_n converges to its full effect. If one wishes to elicit the impact this ratio (or of the loan value given a certain base ratio) to income over time, one could equate income to the convergent sum and income of the previous period, *ceteris paribus*. This, then, takes the form $y_{t+1} = \alpha\left(\frac{a_n}{1-\delta}\right) + y_t$. Moving y_t to the left side of the equation grants a regressive autocorrelation equation into which one could place a desired income level and thus derive criteria applicable for examining loan values and response rates. Solving separately for the loan value and for the convergence ratio provides equations for determining loan benchmarks necessary to achieve a targeted income over time and the required impulse response of the local economy to a given loan amount to achieve a desired income level, respectively: $a_n = \frac{\alpha}{(y_{t+1} - y_t)(1-\delta)}$ and $\delta = 1 - \frac{\alpha a_n}{y_{t+1} - y_t}$.

(smaller cohorts than previous literature) across time. Using an analogous assumption, we utilize FE (by stacking data, made cross-sectional by county and time) to control for unobserved or unexpected differences (cultural, etc.) across the two Reservations. The proposed empirical specification thus takes the form:

$$Y_{it} = \beta + X_{it}\alpha_i + \lambda_j + e_{it},$$

where Y_{it} represents the dependent variable [Real Per Capita Income (*RPCI*)] of county *j* for period *t*, X_{it} is a vector of independent variables [consisting of: Public Sector Size (*Pub. Sect. Size*), Attendance Rate (*Att. Rate*), Industry Mix (*Ind. Mix*), Real Per Capita Loan (*Real Ave. Loan*), including program measures: Program Dummy (*PGM*), and three variations of Program Intensity [*PGMINT & PGMINT Squared*, *PGMINT_EXP*, *PGMINT_GEO*] over county *j* for period *t*, and λ_j is the fixed effects by county.[4] This approach has two advantages. First, it allows the number of observations to increases while still controlling for co-linearity that might result from the absence of the program in Todd Co. Second, in line with the concerns of Montgomery (2005), it provides cleaner estimates of the Lakota Fund's effects on income, even for cross-sectional time-variant data.

5. **Empirical results and discussion**

Table 1 contains the descriptive statistics of basic variables in the model, separately for each county and for the pooled data. Figure 2 indicates that, during the 1980-1986 pre-Lakota Fund era, real per capita income in Todd county ($5,622) exceeded that in Shannon county ($4,317). Furthermore, Table 1 indicates that Shannon county had a larger public sector and a smaller agricultural sector in its industrial mix. During the 1987-2006 LF years, real per capita income in Shannon county grew to almost equal that of Todd county, public sector has grown in both counties, and Shannon county has become less agricultural in its industrial mix. That the treatment county has become less agrarian does not surprise, as the fund has successfully financed home-based entrepreneurial activities such as quilting, indigenous fine art, and folk art, and supported arts and craft marketing programs and a fine art gallery containing a retail gift shop in the Lakota Trade Center.

→ ***Insert*** Table 1 and Figure 2 about here

[4] Please refer to the Data Appendix for a complete description of the variables and respective sources. Also refer to footnote 3 for the specifics regarding '*PGMINT_GEO*' variable derivation.

Micro entrepreneurial activities resulting from a micro-finance initiative can be viewed strictly as redistributive, suggesting that the ability of the program to reduce aggregate poverty is limited. Our results, however, suggest that small business incubation programs of the Lakota Fund design are quite suited for spurring entrepreneurial activities that raise real income, even for a small isolated geo-economic area. The regression results in Table 2 include the curve-linear variant of the 'program intensity' variable. Results using alternative considerations of the program intensity factor appear in Tables 3 (exponential) and 4 (geometric).

→ ***Insert*** Table 2 about here

The empirical regression results (Table 2, cols. 2 through 4) are significant, as indicated by each model's summary fit measures (F ratio and R^2). Specifically across the specifications, the size of the public sector is negative and statistically significant. This result is perhaps observing the supposed poverty trap in many islands of economic destitution in well off societies. Some argue that the NAIRs develop a cycle of dependency on federal handouts that are not economically stimulating in the long term; essentially, public sector resource use tends to be relatively an inefficient

The NAIR's relatively large agrarian sector, as *a priori* expected, significantly retards long run income progression on the NAIR. One may readily attribute the negative affect of greater agricultural activity to the income deficiencies of certain farm-based (small scale) activities or occupations. Income may fall as the farm sector rises relative to non-farm activity due to low wage returns (and absence of operational scale and scope economies) to farm employment. However, this variable may also be capturing certain aspects of the economy's entrepreneurial spirit. Because of the tradition nature of such vocations for Shannon and Todd Co., farm employment may literally be interpreted as an income path that sheds some, though not all, of the risks associated with greater income generating activities. This would explain the insignificance of the attendance rate variable, which we intend as a proxy for the labor force's work ethic over time. Unfortunately for the cause of poverty reduction, an aggregate unwillingness to venture into growth spawning activity does not appear to positively advance income for all residents.

The simple existence of the Lakota Fund has a positive effect on income generation in Shannon County. The OLS estimates (not reported here and available upon request) also confirm that the Lakota Fund's intensity over time is significantly related to per-capita

income production but does experience diminishing returns at the margin. When controlling for selection bias and possible heterogeneity through FE (see Table 2), these effects become even more pronounced and are highly significant. The choice of program intensity measures does not appear to significantly alter the measured effects of the program's positive impact on per-capita income for across the three FE models.

The first FE model (overall F=120.67, Prob.>F=0.0000) result in col. 2 of Table 2 captures the program's intensity using simple linear numerical progression (1 for year 1987, 2 for 1988, …, and 20 for 2006) and its square (to investigate possible nonlinearity). The total effect of the program intensity dimension, increasing at a decreasing rate as expected, is computed as ∂log RPCI/∂PGMINT=.0375 +2 (-.0008)PGMINT. This expression, evaluated at the mean data value of 3.89 for PGMINT, yields 0.0375 +2(-.0008)(3.89) or 0.031276, which is statistically significant given that each of the component coefficient estimate is also highly significant. The FE model results in col. 3 of (Table 2) that is based on the exponential shape of the program intensity variable (overall F=52.3, Prob.>F=0.0000) indicates per-capita income to rise with exponential program intensity, which is also a theoretically consistent result. This not withstanding, the more interesting variant of the shape of the program intensity variable is the geometric form (overall F=139.38, Prob.> F=0.0000) in that it capably builds in the average value of the LF microfinance program each year. Compared with the previous two variants (curvilinear and exponential), the geometric form results in col. 4 (Table 2) has a built-in real economic content with policy implications. The average loan amount progression cumulatively raises per-capita income consistently, perhaps due to the compounded multiplier effect. The coefficient size of the program intensity variable across the various hypothesized shapes (curvilinear, exponential, and geometric) are not directly comparable; however, there tends to be a solid economic argument for selecting the geometric form for its economic content (it successfully embeds the per-capita loan amount variable) in relation to the real per-capita income dependent variable.

An important extension, the geometric-variant measure maintains the program's importance after the infusion of the economic-value added loan values. The Lakota Fund's ability to reduce poverty in the local area is not limited to the effect of its existence or growing reception in the community. Rather, the results dictate that the fund tangibly impact on the aggregate growth rates beyond symbolic signals of faith in the Reservation's entrepreneurial sector. Interestingly, successful microfinance development programs in

Indonesia are, for example, recently lauded for their capacity to assist poor households to self-insure their consumption against health shocks (*Gertler, Levine and Moretti*, 2008). This finding is important since families in developing areas encounter significant financial risks from (self-insured) illness cost of care and lost earnings from atrophied work productivity due to health shocks. We suspect that the Lakota fund may confer similar beneficial spillover effects (beyond the direct entrepreneurial benefits) on families in the impoverished NAIRs.

6. Summary conclusion and implications

This paper is the first to perform a quantitative economic assessment of the SBA-like entrepreneurial loan program, The Lakota Fund, begun 1987 on the Pine Ridge NAIR in S. Dakota, an island of historical abject poverty within the US. The Fund continues to provide loans of $1,000 or less (without collateral) for micro enterprises, small business loans ranging from $1,000 to $20,000, technical assistance (through the Business Success Coaches of WBI), individual development accounts (through the Lakota Tiwahe project) low income housing (through Wanbli Otipi housing project), and business incubator (through the Lakota Fund Trade Center). Results of our regression estimates suggest that the Lakota Fund has succeeded in raising real per capita income of Shannon county residents consistently and significantly throughout the 1987 – 2006 study period. The real per capita income of Shannon County (*treatment unit*) now (1987 – 2006) rivals that of Todd County (*control unit*), whereas Todd County's per capita real income exceeded that of Shannon before inception (1980-1996) of the Fund programs in Shannon County.

Due to data paucity, it was infeasible to assess individual components (array of services listed above) comprising the Lakota Fund. Therefore, future efforts could innovate further by conducting a disaggregated analysis conditional on data availability (highly doubtful given data difficulties). Other areas of abject poverty (e.g., core inner city areas in urban and isolated rural U.S.) might experiment with the implementation of culturally appropriate micro-finance programs similar to or better than the Lakota Fund in terms of coverage (e.g., beyond the basic arts and crafts industry) and component program design. Small businesses are the foundation for future corporate giants that compete in the global economy. As a result, a well designed and highly successful micro-enterprise financing structure can confer large and significant private and social benefits (positive externalities) in that the sustained growth in real incomes (poverty reduction) builds net wealth and enhances

further personal, household, and community successes in socio-economic, health (increased life expectancy, better health status), educational (human capital investment) and other dimensions of progressive quality living.

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DATA APPENDIX : Data Description and Sources

Real Per Capita Income (RPCI) is per capita personal income that has been adjusted for inflation based on the 82-84 base year Regional CPI for the South Dakota area.

Source: Bureau of Economic Analysis, Regional Economic Accounts CA1-3 Per capita personal income http://www.bea.gov/regional/reis/

Public Sector Size (Pub. Sect. Size) – This variable expresses (for the sake of isolating) the size of government involvement in economic activity and income. It is derived by subtracting Earnings by Place of Residence (a measure of income that excludes government social insurance programs) from Earnings by Place of Work (a proxy for total earnings, including government programs) and expressing the result as a percentage of entire earnings (Earnings by place of work).

Source: Bureau of Economic Analysis, Regional Economic Accounts CA04 - Personal income and employment summary http://www.bea.gov/regional/reis/

Attendance Rate (Att. Rate) – This data provides an attendance measure of all school age children and young adults. It is calculated using ADA (Average Daily Attendance) and ADM (Average Daily Membership) data for the specific county's school district. The above data is the ratio of ADA over ADM, expressed as a percentage to provide picture of school attendance (and absence) in the county.

Source: 1980-2000 Data – "South Dakota Educational Statistical Digests" Department of Education and Cultural Affairs, Division of Elementary and Secondary Education. Various years. SRI Reference Database, Lexus Nexus Microfiche.
2001-2004 Data – "Education in South Dakota: District and Statewide Profiles" South Dakota Department of Education. *http://doe.sd.gov/ofm/statdigest/*

Industry Mix (Ind. Mix) – Mix variable represents the economy's production mix concerning its agrarian and industrial nature. It is the ratio of farm employment over non-farm employment when expressed as a percentage.

Source: Bureau of Economic Analysis, Regional Economic Accounts
1980-2000: CA25 SIC
2001-2004: CA25N NAICS
http://www.bea.gov/regional/reis/

Real Per Capita Loan (Real Ave. Loan) – Real Per capita loan values adjusted for inflation based upon the 82-84 regional CPI base year for the South Dakota area. The base (unadjusted) data is the average yearly loan amount, in dollars, provided by the Lakota Fund.

Source: Annual data provided by Dowell Caselli-Smith, Executive Director of the Lakota Fund. Phone: 1(605) 455-2500

Program (PGM) – Dummy variable for the Lakota Fund program existence (1 for years 1987 – 2006 for Shannon county, 0 otherwise)

Program Intensity (PGMINT) – Program intensity variable (1 at program inception for year 1987; 2 for 1978; ….; and 20 for 2006)

Program Intensity Squared (PGMINT Squared) – *Square* of PGMINT

Program Intensity Exponential (PGMINT_EXP) – *Exponential* form of the PGMINT variable

Program Intensity Geometric (PGMINT_GEO) – *Geometric* form of the PGMINT variable. Refer to footnote 3 for the specifics regarding this variable.

Figure 1: South Dakota – Shannon and Todd Counties

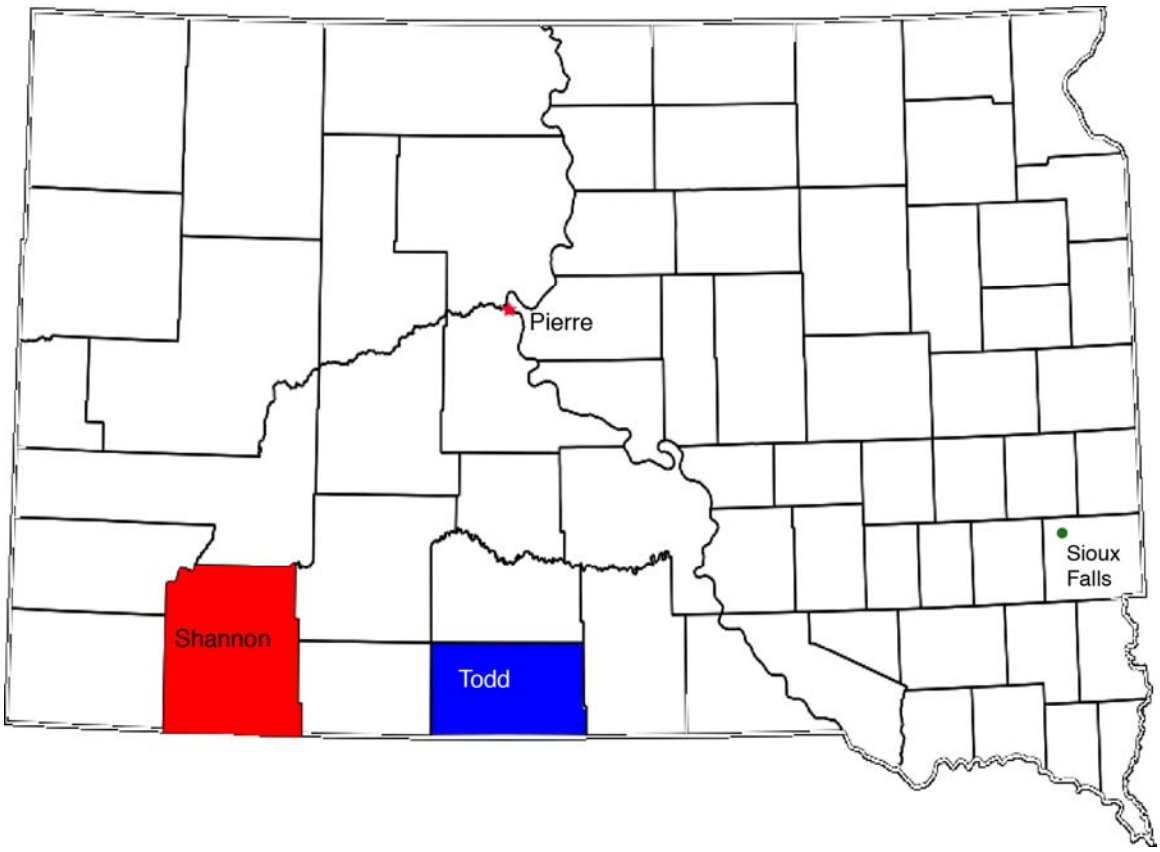

Figure 2: RPCI over time: Shannon (experimental) *versus* Todd (control) counties

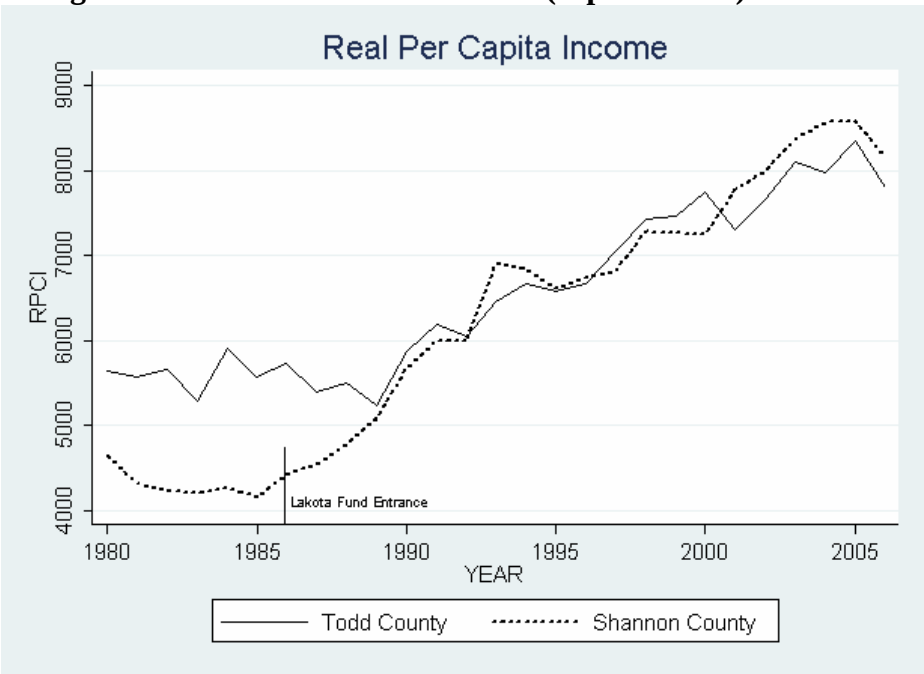

Table 1: Descriptive Statistics

Variable	Shannon County Sample Size = 27		Todd County Sample Size = 27		Stacked Data Sample Size = 54	
	Mean	St. Err.	Mean	St. Err.	Mean	St. Err.
Dependent:						
RPCI	6201.74*	1545.82	6549.94	992.80	6375.87	1298.71
Control:						
Pub. Sect. Size	28.89	5.08	19.95	6.72	24.42	7.43
Att. Rate	89.92	1.22	89.82	1.64	89.87	1.43
Ind. Mix	7.93	3.04	13.96	5.91	10.95	5.56
Program:						
Real Ave. Loan	2867.12	2837.81	--	--	1433.56	2458.55
PGM (Dummy)	0.74	0.45	--	--	0.37	0.49
PGMINT	7.78	6.90	--	--	3.89	6.22
PGMINT Squared	106.30	126.73	--	--	53.15	103.72
PGMINT_EXP	2842.67	9813.83	--	--	1421.33	7021.78
PGMINT_GEO	6.88	6.84	--	--	3.44	5.91

NOTES:

Calculations based on years 1980 to 2006

See Data Appendix for variable definitions and sources.

* While the mean real per capita income value for Shannon Co. appears lower than Todd Co., the figure above is driven downward by the strikingly low RPCI prior to 1986. Mean RPCI in Shannon CO. from 1990 onward is actually higher than Todd Co.

Table 2: Fixed Effects Regression Results (with alternative specifications of the program intensity variable)[a]

Dependent . variable: log *RPCI*	Curvilinear form	Exponential form	Geometric form
Pub. Sect. Size	-.0097*** (.0036) [b]	-.0033 (.0057)	-.0092** (.0037)
Att. Rate	-.0020 (.0090)	-.0245 (.0152)	-.0033 (.0090)
Ind. Mix	-.0321*** (.0050)	-.0248*** (.0081)	-.0315*** (.0050)
PGM (Dummy)	.1146** (.0480)	.3354*** (.0474)	.2106*** (.0339)
PGMINT	.0375*** (.0103991)		
PGMINT Squared	-.0008* (.0005)		
PGMINT_EXP		5.44e-06*** (1.93e-06)	
PGMINT _GEO [c]			.0200*** (.0022)
Goodness of fit summary indicators	R^2 within: .94 R^2 overall: .29 *F*: 120.67 Prob > *F*: 0.0000	R^2 within: .84 R^2 overall: .26 *F*: 52.3 Prob > F: 0.0000	R^2 within : .93 R^2 overall: .29 *F*: 139.38 Prob > *F*: 0.0000

NOTES:

[a] Pooled cross-section time-series data results (sample size = 54 observations).

[b] Standard errors are in parentheses.

[c] Refer to footnote 3 for specifics.

* Denotes 10% significance level

** Denotes 5% significance level

*** Denotes 1% significance level