Small Bus Econ (2011) 36:157–168
DOI 10.1007/s11187-009-9191-9

Economic impact of a private sector micro-financing scheme in South Dakota

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Accepted: 26 February 2009 / Published online: 7 April 2009

Abstract While poverty rates on Native American Indian reservations are triple the US average. Small business incubation programs, available elsewhere in the US, scarcely exist on the Native American Indian Reservations (NAIRs). Our unique study tests the effects of the Lakota Fund (LF), a private sector small business development initiative on the Pine Ridge Reservation in South Dakota, on the economic development of the NAIRs. Our objective is to determine whether the SBA-like programs (loans, training, and consulting) can improve economic conditions. The 1980–2006 annual county-level (Shannon Co. is 'treatment,'and Todd Co. is 'control') data are a natural experiment. Results indicate that the LF inception and duration significantly raised real per capita income (RPCI)—suggesting not only the success of the LF, but support for the broader notion that privately funded small business initiatives can be used to support economic development of isolated impoverished groups within the US economy.

Keywords Economic development · Lakota fund · Micro-financing · Native American Indian reservations · Small business incubation

JEL Classifications L26 · M21 · O16

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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 US (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 36%, which is three times the national average (US Census Bureau 2006). NAIR unemployment rates often reach as high as 80%, compared with less than 6% in most other US regions. Compounding these challenges is the remote geographical placement of most NAIRs from major economic hubs, which is 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% 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 US—contributing over 50% of the GDP and accounting for over 80% of new job formation (First Gov 2000). Regarding income generation, more than 53% 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% (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 (SBA 2007). The SBA mission is to provide training, counseling, education, disaster relief, and financial aid (primarily through microfinance-type loans), and to assist 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 worldwide and hundreds of millions of dollars in tax revenue; these more than justify the costs of providing capital toward the birth of these businesses (SBA 2004).

Despite the SBA success in the broader US, few of its 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, to build up assets, and to 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), which is investigated for its effectiveness in generating sustainable multi-period income for the NAIR citizens. The Fund operates a non-profit economic development center that 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 of Jackson county). Since its 1987 inception, the number and diversity of business enterprises on the targeted NAIR have risen from 200 to over 300. The Fund's work is further credited with creating more than 750 reservation-based jobs, propelling Shannon County, SD (home to over 85% of reservation citizens within the US), from the poorest county in the country to the 56th (Lakota Fund 2007). 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 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 were 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 study of a potentially effective small business economic development micro-financing program in highly impoverished counties on the native Indian reservations in South Dakota. Furthermore, assessing the effectiveness of the Lakota micro-financing loan program takes on added significance because more than 75% 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 South Dakota. Section 3 reviews pertinent literature, and Sect. 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 provides summary conclusions with implications for future research.

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

Shannon County, S. Dakota, is poor, rural, and located in the southwestern part of South 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 94% Native American (Oglala Lakota Nation). Pine Ridge is the second largest Indian Reservation in the country, and it spans Shannon and Jackson counties. According to Indian Services Medical Records and the US Census Bureau (2006), 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% of the children are poor, some 40% of the population is diabetic, the suicide rate is more than 72% 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 17% with a poverty rate of over 52%. Shannon County's economy is based on two industries: Education, health, and social services and public administration, which combined employ over 60% of the entire population. Data for this study covering the 1980–2006 period also included the 7 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 US 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 South 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 10% and 48%, respectively,

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

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 (U.S. Census Bureau 2006)]. 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 more prosperous, including in job creation and growth (Thurik 2003). Perhaps the most famous of all micro-finance programs is that of Grameen Bank in Bangladesh, begun in 1976 by Nobel Laureate 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, and low investment" into a virtuous circle of "low income, injection of credit, investment, more income, more savings, more investment, more income." (Grameen Communications 2002; Armendariz & 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 indicates that most of those profits became losses (Morduch 1999, 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 vs. individual benefit, may tell a different story. With respect to Grameen Bank, to achieve a 1 dollar rise in household consumption, it would cost the society only 91 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 the 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 the labor-force participation rate; population percent in the 45–65 age range (the older population is less attached to the market wage economy) is expected to be negatively correlated with the labor-force participation rate. Only the first two independent variables were statistically significant and correctly signed, and the model explained 61.34% of the variation in the labor-force participation rate. In particular, education (which weakens cultural ties) alone explained about 48% 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, and 1990 cross-sections, education alone, defined as population percent 25 years and older completing high school, explained about 50% of the variations in NAIR poverty rate. The addition of labor force percent in manufacturing raised the model's explanatory power to about 82%, 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: (1) at this point in time too dated for crafting future economic development plans, policies, and strategies, (2) cross-sectional in design and incapable of capturing the trajectory of economic progress in continuous time, and (3) 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 crossrReservation data analysis at the county-level to elicit the propensity of The Lakota Fund to generate income and thus reduce poverty. Two Indian reservation counties are studied for their similarities in cultural, political, geographic, and economic characteristics, as well as 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 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 County, 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.

Pooling the 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 US, 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. The 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 the most available micro-credit data with, among other issues, selectivity bias. As Montgomey (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

[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 with 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 some degree of time-related correlation for income exists. 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 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

Footnote 3 continued
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

$$\delta = 1 - \frac{\alpha a_n}{y_{t+1} - y_t}.$$

prejudice the coefficients of the program as a result of omitted variables.

Khandker (2005) circumvented the issues of endogeneity and heterogeneity across families and villages in Bangladesh by utilizing a fixed effects (FE) model at the household level (smaller cohorts than previous literature) across time. Using an analogous assumption, we utilize FE (by pooling the 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:

$$Y_{it} = \beta + X_{it}\alpha_i + \lambda_j + e_{it}, \quad (1)$$

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 (public sector size (PUBSECTSZ), school attendance rate (ATRTE), industry mix (INDMIX), real per capita loan rate (RAVLOAN), the Lakota fund program presence dummy (PGMDUM), and three alternative variants of the program intensity (respectively, PGMINT and PGMINTSQ, PGMINT_EXP, PGMINT_GEO) over county j for period t, and λ_j is the fixed effects by county.[4] This modeling approach has two advantages. First, it allows the number of observations to increase while still controlling for co-linearity that might result from the absence of the program in Todd County. Second, in line with the concerns of Montgomey (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; the 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 is not surprising, 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. While the mean real per capita income for Shannon County appears lower than for Todd County (Fig. 1), the value for Shannon County is driven downward by the strikingly low RPCI prior to 1986. The mean RPCI in Shannon County from 1990 onward has actually been higher than in Todd County.

Micro-entrepreneurial activities emanating 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 specifications of the program intensity factor appear in columns 3 (exponential) and 4 (geometric).

The empirical regression model results (Table 2, columns 2 through 4) are significant, as indicated by each model's summary fit measures (F tests and R^2s). 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

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

Table 1 Descriptive statistics of the data[a]

Variable label and definition	Shannon County $n_1 = 27$ (1980–2006)		Todd County $n_2 = 27$ (1980–2006)		Pooled data $n_1 + n_2 = 54$	
	Mean	SE	Mean	SE	Mean	SE
Dependent						
RPCI: *Real per capita income*	6,201.74*	1,545.82	6,549.94	992.80	6,375.87	1,298.71
Control						
PUBSECTSZ: *Public sector size*	28.89	5.08	19.95	6.72	24.42	7.43
ATRTE: *School attendance rate*	89.92	1.22	89.82	1.64	89.87	1.43
INDMIX: *Industry mix*	7.93	3.04	13.96	5.91	10.95	5.56
Program						
RAVLOAN: *Real average loan rate*	2,867.12	2,837.81	–	–	1,433.56	2,458.55
PGMDUM: *Program dummy*	0.74	0.45	–	–	0.37	0.49
PGMINT: *Program intensity*	7.78	6.90	–	–	3.89	6.22
PGMINTSQ: $PGMINT^2$	106.30	126.73	–	–	53.15	103.72
PGMINT_EXP: *Exponential form of PGMINT*	2,842.67	9,813.83	–	–	1,421.33	7,021.78
PGMINT_GEO: *Geometric form of PGMINT*	6.88	6.84	–	–	3.44	5.91

[a] Data sources and definitions are detailed in the Data Appendix

* 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.

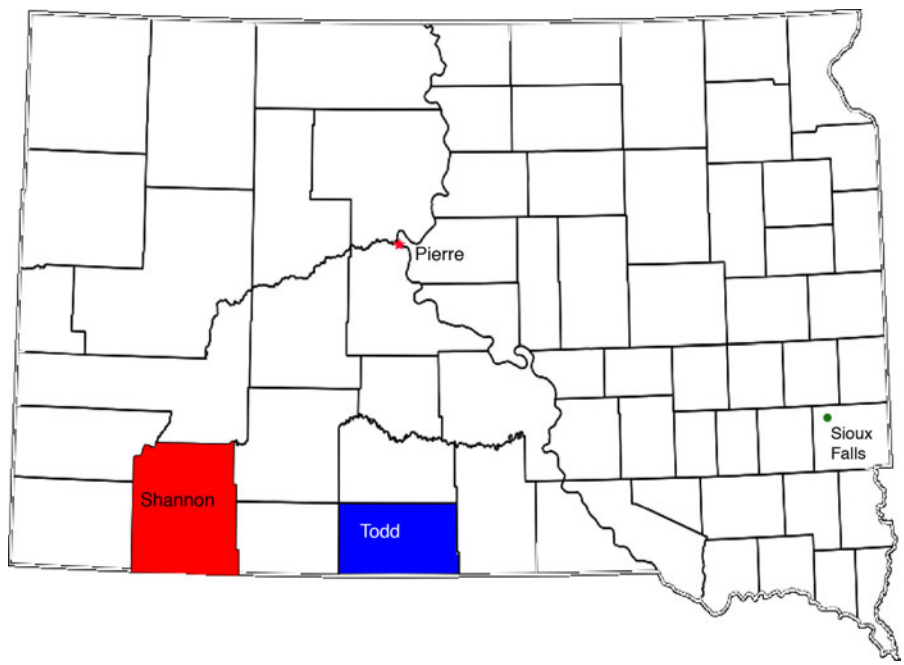

Fig. 1 South Dakota—Shannon and Todd Counties

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 County, farm employment may literally be interpreted as an income path that sheds some, though not all, of the

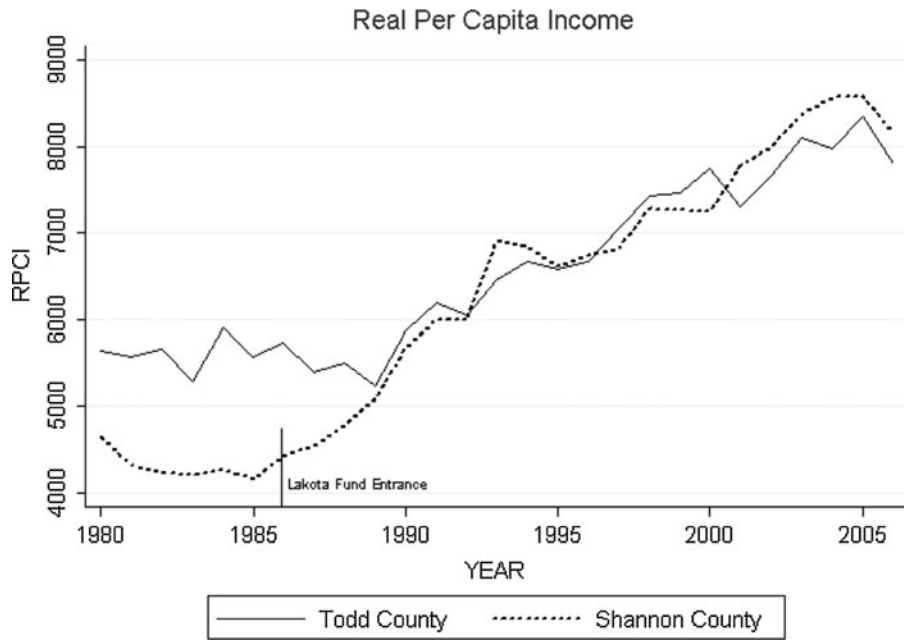

Fig. 2 RPCI over time: Shannon (experimental) versus Todd (control) Counties

Table 2 Pooled data fixed effects regression results (using the alternative specifications of the program intensity variable)[a]

Dependent variable = log RPCI (*log of real per capita income*)	Curvilinear form	Exponential form	Geometric form
PUBSECTSZ: *Public sector size*	−0.0097***[b]	−0.0033	−0.0092**
	(0.0036)[c]	(0.0057)	(0.0037)
ATRTE: *School attendance rate*	−0.0020	−0.0245	−0.0033
	(0.0090)	(0.0152)	(0.0090)
INDMIX*: Industry mix*	−0.0321***	−0.0248***	−0.0315***
	(0.0050)	(0.0081)	(0.0050)
PGMDUM: *Program dummy*	0.1146**	0.3354***	0.2106***
	(0.0480)	(0.0474)	(0.0339)
PGMINT: *Program intensity*	0.0375***		
	(0.0103991)		
PGMINTSQ: $PGMINT^2$	−0.0008*		
	(0.0005)		
PGMINT_EXP: *Exponential form of PGMINT*		5.44e-06*** (1.93e−06)	
PGMINT_GEO[d]: *Geometric form of PGMINT*			0.0200*** (0.0022)
N	54	54	54
Goodness of fit summary indicators	R^2 overall = .29 [F = 120.67; Prob > F: 0.0000]	[F = 52.3; Prob > F: 0.0000]	R^2 overall = 0.29 [F = 139.38; Prob > F: 0.0000]

[a] Data sources and definitions are detailed in the Data Appendix

[b] *, **, and *** denote statistical significance at the 0.10, 0.05, and 0.01 levels, respectively

[c] Standard errors are in parentheses

[d] Refer to footnote 3 for details on construction of this variable

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 column 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 $\partial \log \text{RPCI}/\partial \text{PGMINT} = 0.0375 + 2\,(-0.0008)\text{PGMINT}$. This expression, evaluated at the mean data value of 3.89 for PGMINT, yields $0.0375 + 2(-0.0008)(3.89)$ or 0.031276, which is statistically significant given that each of the component coefficient estimates is also highly significant. The FE model results in column 3 of (Table 2), which 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 column 4 (Table 2) have 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, for example, recently have been lauded for their capacity to assist poor households to self-insure their consumption against health shocks (Gertler et al. 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 in 1987 on the Pine Ridge NAIR in South 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 the Wanbli Otipi housing project), and a 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 the paucity of data, it was not feasible 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 (this is highly doubtful given data difficulties). Other areas of abject poverty (e.g., core inner city areas in both the urban and isolated rural US) might experiment with the implementation of culturally appropriate micro-financing 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.

Acknowledgements An earlier draft of this paper under the title: "Small Business Economics of the Lakota Fund on the Native American Indian Reservation" was presented at the Western Economic Association International (WEAI) annual conference, CEP Session on "Topics in Political Economy" in Waikiki, HI (July 2008), and also circulated as a IZA Discussion Paper no. 3999. We thank the WEAI session participants for their constructive suggestions, Brenda Ellis for her outstanding editorial comments, Matthew Mone for his assistance in formatting and incorporating the map of South Dakota, and anonymous referees of this journal for their constructive comments. The usual caveats apply.

Data appendix

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. (2004b). Regional Economic Accounts Ca1-3 Per capita personal income http://www.bea.gov/regional/reis/

Public Sector Size (PUBSECTSZ) This variable captures the size of government sector 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. (2004a). Regional Economic Accounts Ca04—Personal income and employment summary http://www.bea.gov/regional/reis/

Attendance Rate (ARTE) These data provide 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 are the ratio of ADA over ADM, expressed as a percentage to provide a picture of school attendance (and absence) in the county.

Sources: 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 (2004). http://doe.sd.gov/ofm/statdigest/

Industry Mix (INDMIX)—The county economy's production mix regarding 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. (2004c, 2004d). Regional Economic Accounts
1980–2000: CA25 SIC
2001–2004: CA25 N NAICS
http://www.bea.gov/regional/reis/

Real Average Loan Rate (RAVLOAN) 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 are 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 Dummy (PGMDUM) 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 (PGMINTSQ) 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 detailed computation of this variable.

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