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CAN NON-AGRICULTURAL EMPLOYMENT REDUCE RURAL POVERTY? EVIDENCE FROM MEXICO*

CARIDAD ARAUJO**
The World Bank and Georgetown University

This paper explores the role of the local context on the effectiveness of policy interventions in reducing poverty through non-agricultural rural employment (NARE). NARE is negatively associated to poverty in Mexico. Manufacturing employment is more poverty-reducing than services in semi urban municipalities. In turn, services employment matters more in rural than in semi urban areas. Factors associated to pro-poor NARE are low income inequality, dynamic agriculture, and government expenditures. Policy interventions in education and roads are poverty-reducing through manufacturing employment in semi urban municipalities and through services employment in all municipalities.

JEL: R12, R23, O54, O18
Keywords: Rural Employment, Poverty, Off-farm, Mexico

1. INTRODUCTION

Several recent studies have addressed the importance of off-farm incomes in rural areas of the developing world. Evidence from El Salvador, Ecuador, and Mexico suggests they constitute between 40 to 50% of total rural households' income, 30-50% in Sub Saharan Africa, and up to 80% in South Africa (The World Bank, 1998 and 2003). Similarly, data from India in the early 90s shows that off-farm incomes represent 34% of total households' income. Moreover, the Indian data shows that the importance of off-farm incomes over total income does not vary dramatically across income quintiles (Lanjouw and Shariff, 2002).

The range of activities classified as non-agricultural jobs is broad. For example, in Northeastern Brazil (where 22% of the rural working population

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**e-mail: caraujo@worldbank.org, mca27 @georgetown.edu

participates in non-agricultural activities as their primary occupation), of those in non-agricultural jobs, one third is in the manufacturing sector, 17% in commerce, 13% are self-employed, and 18% in education and government (Ferreira and Lanjouw, 2001). The heterogeneity in the types of occupations suggests that the non-agricultural sector encompasses wide variation in terms of wages, working conditions, stability, and contracts. Along these dimensions, there can be differences in the access of the poor to non-agricultural jobs. For example, the India study found that casual employment was more prevalent among the lower income quintiles, while permanent employment was more common among the higher quintiles.

Despite the increasing importance of off-farm incomes in rural areas, it has been difficult to address empirically what is the impact of non-agricultural rural employment (NARE) on poverty reduction. In the policy world, many have pointed towards the potential of off-farm employment to reduce rural poverty. However, there are reasons to believe the poor may indeed not be the first ones to benefit from NARE. For instance, several studies that look at the individual probability of participation in the sector find that it is usually the more educated young individuals, with better social networks and access to roads, who are more likely to participate in this sector (Araujo, de Janvry and Sadoulet, 2004b; de Janvry and Sadoulet, 2001; Ferreira and Lanjouw, 2001; Lanjouw and Shariff, 2002). This suggests that access to off-farm jobs may be limited for the poor. Similarly, in contexts where land and other assets are concentrated, spillovers from linkages between agriculture and the non-farm sector may not reach the poorest. Previous work has documented that inequality can affect not only growth, but its poverty reduction potential (Ravallion and Datt, 2002) and as the prospects of fast growth of agriculture in the developing world on the near future are small, the poverty reduction potential and distributional implications of NARE deserve a closer look[1].

This paper focuses on two questions. The first question relates to the impact of NARE on poverty. The second one explores in which environments can policy interventions in education and roads be more effective in reducing poverty through NARE.

These questions are addressed empirically using Mexican municipal data for the 1990s and through the estimation of employment, poverty, and population equations. Results show a negative effect of manufacturing and services employment on poverty. The effect of manufacturing employment is larger than the one of services in semi urban municipalities. In turn, services employment has a larger effect on poverty in rural than in semi urban municipalities.

When exploring the effectiveness of policy interventions in reducing poverty through NARE, the data suggests that interventions to improve roads and secondary education reduce poverty through services employment in rural and semi urban municipalities and through manufacturing employment only in

[1]In fact, Reardon, Berdegué and Escobar (2001) show that non-farm employment in Latin America grew faster than agricultural employment for the past three decades.

semi urban municipalities. While these interventions are only poverty-reducing through manufacturing employment in semi urban municipalities, they are more poverty-reducing through services employment in rural than in semi urban municipalities.

2. BACKGROUND

Some of the related literature on the linkages between NARE and poverty. In understanding this relationship, many have focused in the differences across the off-farm jobs of the poor and those of the non-poor. For example, in their study of Northeastern Brazil, Ferreira and Lanjouw (2001) find that rural areas near urban municipalities account for a much larger share of non-farm employment than isolated areas. This evidence is consistent with the importance of access to markets and infrastructure for the expansion NARE. Interestingly, when looking at the importance of income from NARE over total income, they find that its share is homogeneous across income quintiles. The differences lie across other dimensions of off-farm occupations. For example, while cultivation income is more important for those in higher income quintiles, agricultural labor plays a larger role for the lower quintiles. They also find that non-farm enterprise income is more important for those with larger incomes. On the contrary, incomes from low return off-farm activities are only important for the landless. These patterns, and the large prevalence of occupations in sectors such as construction and domestic services among the off-farm jobs to which the poor have access, suggest that some of NARE consists of residual occupations to which people who do not have other options are driven.

Along this line, when trying to disentangle the link between economic growth and poverty, Lanjouw and Shariff (2002) characterize the off-farm sector as one where two types of occupations are prevalent: some that are productive (such as manufacturing and services) and other that have low productivity. The latter contribute to the incomes of the poor, but do not allow for social or economic mobility. The authors suggest that because of the presence of these two types of occupations, it is not clear in which direction the importance of off-farm income evolves with economic growth. However, they suggest there may exist an indirect impact of the off-farm sector on poverty through wages, as the expansion of the non-agricultural sector can push agricultural wages up.

There are many parallels that can be found between the literature that looks at the poverty reduction potential of NARE and the studies on pro-poor economic growth. Among the cross-country work in this area, Timmer (1997) explores the "elasticity of connection" between economic growth and growth in per capita income. He finds that elasticities are not equal to one and that they rise with income. This suggests that economic growth can worsen the distribution of income. Timmer finds that in countries where the income gap between the rich and the poor is small, labor productivity in agriculture is more important in generating incomes for all quintiles. Also, agricultural productivity results in higher elasticities of

connection for the lower quintiles than for the higher ones. Finally, where the income gap is small, he finds that growth of the non-agricultural sector reaches the poor.

Ravallion and Datt (1998, 2002) argue that while cross-country evidence shows poverty falls with economic growth, there is variation in the poverty-reduction potential of a given rate of growth. Using Indian data, they explain whether differences in poverty reduction are due to heterogeneity in rates or sectorial patterns of growth or in the poverty reduction potential of growth. They find that farm yields, government expenditures, and non-farm output are associated to reductions in poverty, and that inflation is poverty-increasing. Their results suggest that NARE growth is more pro-poor in places with higher farm yields and female literacy, and with lower infant mortality, urban-rural disparities in consumption, and landlessness. In their study of India, Ravallion and Datt (2002) conclude that the sectorial composition of growth matters to the aggregate rate of poverty reduction. While initial conditions in rural development and human capital account for much of the differences in rural poverty reduction, they enter in an additively fashion.

The previous discussion of the literature on the relationship between poverty and NARE points towards several elements that can influence its effectiveness in reducing rural poverty, such as the sectorial composition of NARE, local inequality along various dimensions (e.g. income, land, or education), labor productivity in agriculture, agricultural potential, and government expenditures. The analysis which follows incorporates all of them.

3. MODEL

The proposed framework explores the relationship between NARE and poverty, and the role of the local context on the effectiveness of policy interventions to reduce poverty through the expansion of NARE. It starts with an analytical model that relates employment and poverty reduction. The model consists of three key components: an equation of employment, one of population changes, and a third one of poverty.

Let Pov_i denote poverty in municipality i. Pov_i is a function of municipal income Y_i, population Pop_i, as well as of other municipal characteristics that affect income poverty Z_i^{pov}:

$$(1) \qquad Pov_i = P(Y_i, Pop_i, Z_i^{pov})$$

As non-agricultural jobs are more likely to pay the highest wages, the income of rural and semi urban municipalities is an increasing function of the number of workers employed in this sector, L_i, and of other municipal characteristics that affect income Z_i^{y}:

(2) $Y_i = Y(L_i, Z_i^y)$

Replacing equation 2 in 1:

(3) $Pov_i = P(L_i, Pop_i, Z_i^y, Z_i^{pov})$

On the other hand, population changes both as a result of migration M_i, and of natural growth, of which past population levels, $Pop_{i,-1}$ is used as proxy:

(4) $Pop_i = Pop(Pop_{i,-1}, M_i)$

In addition, the municipal level of migration depends on the local employment opportunities, especially in the non-agricultural sector, as well as on other municipal attributes, Z_i^M, related to the costs of migrating and to people's preferences:

(5) $M_i = M(L_i, Z_i^M)$

Substituting equation 5 in 4, there is a reduced-form expression for population:

(6) $Pop_i = Pop(Pop_{i,-1}, L_i, Z_i^M)$

NARE is modeled separately for the manufacturing and services sectors $(L_i = \sum_s L_{is})$ such that:

(7) $L_{is} = L(L_{is,-1}, h_{i,-1})$

where $L_{is,-1}$ is the lagged municipal level of employment in the sector, and $h_{i,-1}$ represents lagged values of other local attributes that affect employment. A system of equations that consists of 3, 6, and 7 is estimated recursively in three steps.

4. THE DATA

The data to characterize poverty comes from the Mexican 1990 and 2000 population census. As with most census, the Mexican ones do not collect information on consumption or income. For that reason, three different variables are used to characterize changes of welfare: the percentage of the employed economically active population earning less than two minimum wages, the average number of persons per room in each dwelling, and an index constructed with

these two variables using principal-components.[2] Throughout the rest of the paper, these measures are referred to as poverty or marginality.

Figure 1 presents a smoothing of employment growth on poverty reduction between 1990 and 2000.[3] It depicts separate lines for rural and semi urban municipalities[4], and for services and manufacturing employment growth. Overall, rates of employment growth are larger for services than for manufacture and for semi urban than for rural municipalities. While there is heterogeneity in the poverty reduction outcomes, its correlation to employment growth also exhibits some variability. For example, while there is a positive correlation between manufacturing employment growth and poverty reduction in semi urban municipalities, there is no correlation between them in rural municipalities where manufacturing employment growth was very low. The absence of a systematic relationship between manufacturing employment growth and poverty reduction in rural municipalities where the growth of this type of employment was also very low suggests that there could be a critical level of non-agricultural employment growth that is necessary for it to impact poverty reduction. On the other hand, for services –both in rural and semi urban municipalities– there is a positive correlation between poverty reduction and employment growth.

A second subject of interest are the intersectorial linkages in terms of employment. In the presence of positive employment linkages, one would expect to find that in places where employment in non-agricultural activities grew faster, employment in agriculture also experienced a bigger expansion. Figure 2 explores these correlations through a smoothing of non-agricultural on agricultural employment growth. The first clear pattern is that along the region of negative agricultural employment growth, there is positive non-agricultural employment growth for both manufacturing and services, or substitution between agricultural and non-agricultural employment. In the positive region of agricultural employment

[2]The National Council of Population of the Mexican government (CONAPO) chose these and five other variables from the population census to construct an index of marginality for each of the municipalities of the country. The five additional variables included in the CONAPO index are the percentage of illiterate adults, and the percentage of population living in dwellings without piped water, sewerage, electricity, and with soil floor. We chose to include only a subset of the variables of the CONAPO index that were exclusively related to "private'' components of poverty. While basic services and education provision require of some government intervention, our interest was on the components of welfare that would have changed over the decade due to the direct impact of households' non-agricultural incomes. In addition, we excluded the percentage of population in dwellings with soil floor because it has a much stronger geographic pattern than rest of the components, which suggests that the degree to which floor material is associated to a lack of welfare depends also on other elements such as the local weather, environmental quality, or the urbanization in the region.

[3]Poverty reduction is the first difference between our marginality index. Employment growth is the first difference on number of persons employed in each sector, normalized over municipal population in 1990 and multiplied by 100.

[4]Semi urban municipalities are those where the largest town has between 2,500 and 15,000 persons; rural municipalities have less than 2,500 persons in their largest town.

growth, there are two trends. For all of the curves but manufacture in semi urban municipalities, the same pattern of substitution remains. However, for manufacture in semi urban municipalities, Figure 2 is consistent with the presence of positive externalities from agriculture in terms of NARE generation.

Figure 3 explores the correlation between manufacturing and services employment growth, again by smoothing one on the other. In this case, the patterns are suggestive of positive employment linkages, or complementarity. This positive correlation between manufacturing and services employment growth is larger in magnitude in semi urban than in rural municipalities.

FIGURE 1
POVERTY REDUCTION AND EMPLOYMENT GROWTH IN RURAL AND SEMI URBAN MUNICIPALITIES

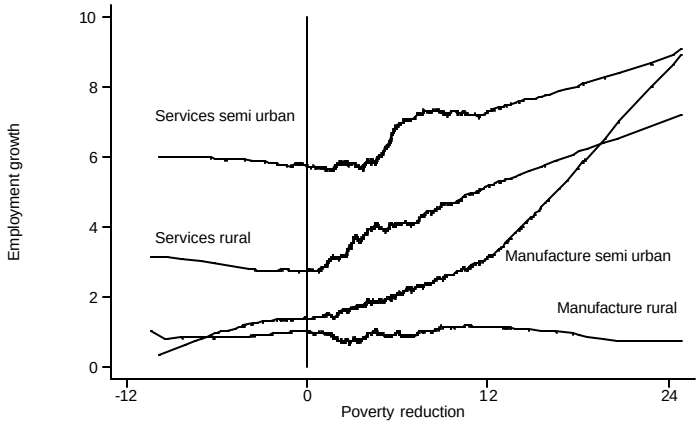


FIGURE 2
AGRICULTURAL AND NON-AGRICULTURAL EMPLOYMENT GROWTH

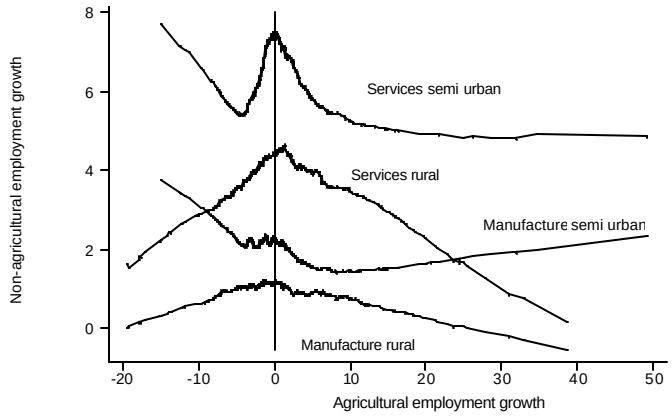
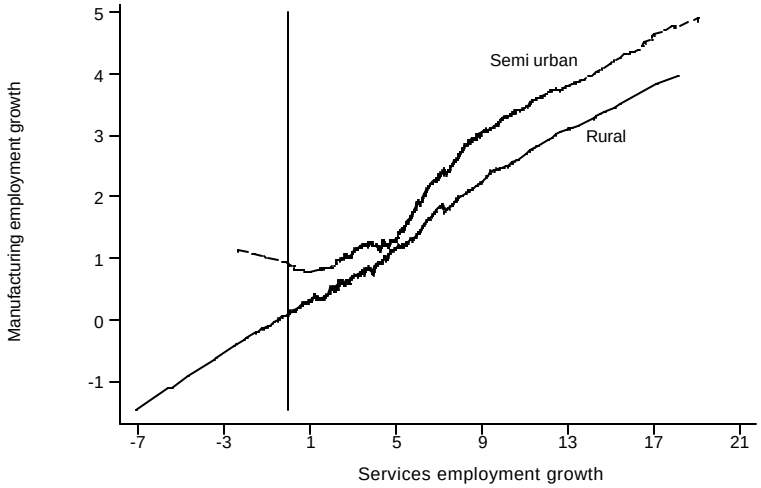


FIGURE 3
MANUFACTURING AND SERVICES EMPLOYMENT GROWTH



5. ESTIMATIONS

Table 1 has summary statistics for the variables that enter in the estimations. By all three measures, poverty is higher in rural than in semi urban municipalities, while the level of employment in manufacturing and services is larger in the latter. Population between 1980 and 2000 grew at a much faster pace in semi urban than it did in rural municipalities. While income inequality seems larger in rural than in semi urban municipalities, there are few differences across them in terms of the two agricultural variables. However, the per capita municipal expenditure was larger in rural than in semi urban municipalities.

TABLE 1
SUMMARY STATISTICS

	Variable	Semi urban		Rural	
		Mean	Std. dev.	Mean	Std. dev.
Poverty index	Pov_i	40.8	7.57	45.5	6.66
% of population under two minimum wages	Pov_i	72.6	13.4	80.9	11.70
Average number of occupants per room in dwelling	Pov_i	2.06	0.56	2.25	0.74
2000 Per capita manufacturing employment * 1000	$L_{i,\,manuf}$	42.3	33.9	27.4	30.3
2000 Per capita services employment * 1000	$L_{i,\,serv}$	121.6	47.4	83.1	42.9
1990 Per capita manufacturing employment * 1000	$L_{i,\,manuf,\,-1}$	28.4	26.3	19.4	27.6
1990 Per capita services employment * 1000	$L_{i,\,serv,\,-1}$	71.9	34.7	45.1	28.7
2000 Population * 10^{-3}	Pop_i	19.2	15.2	6.01	5.75
1980 Population * 10^{-3}	$Pop_{i,\,-1}$	14.8	11.4	5.26	4.62
Income inequality[a]	Z_i^{pov}	7.09	2.19	9.31	3.00
Value of per-hectare agricultural output[b]	Z_i^{pov}	0.001	0.0003	0.001	0.0003
Labor productivity of agriculture[c]	Z_i^{pov}	4.72	20.2	4.63	11.25
Municipal government expenditures*10^{-3}[d]	Z_i^{pov}	0.72	0.49	1.07	0.98
Northern border dummy	Z_i^{pov}	0.01	0.11	0.01	0.07
St.dev. of altitude in meters	Z_i^{pov}	150	133	190	152
% adults with 9th grade or more	Z_i^{pov}	4.29	2.78	1.92	1.83
% who speak indigenous language	Z_i^{pov}	16.5	28.8	29.7	37.9
1/Distance to closest center	Z_i^{pov}	0.02	0.02	0.01	0.01
% of population served by state road	Z_i^{pov}	53.19	39.50	29.06	38.25
Coast dummy	Z_i^{M}	0.08	0.27	0.04	0.20
Altiplano dummy	Z_i^{M}	0.44	0.50	0.50	0.50
1 if higher minimum wage group	$h_{i,\,-1}$	0.02	0.16	0.01	0.11
Average municipal wage in manufacturing	$h_{i,\,-1}$	0.03	0.10	0.04	0.13
Average municipal wage in services	$h_{i,\,-1}$	0.10	0.19	0.03	0.11
Observations		931		532	

Notes:
a: % of total income earned by those who earn more than 10 minimum wages / % of total income-earners who earn more than 10 minimum wages in 1990.
b: Weighted sum of 1991-2000 rates of growth of national value of yield for 8 crops, where weights are the % of land in each crop in the municipality.
c: Pesos of municipal agricultural output per person employed in agriculture in 1991.
d: Per capita total expenditures of the municipal government in 1999.

TABLE 2
FIRST STEP: EMPLOYMENT ESTIMATIONS

Endogenous variable: 2000 Per capita employment * 1000	Manufacturing						Services					
	Semiurban			Rural			Semiurban			Rural		
	Coef.	P-value	Sign.	Coef.	P-value	Sign.	Coef.	P-value	Sign.	Coef.	P-value	Sign.
1990 Per capita manufacturing employment * 1000	1.02	0.00	***	0.73	0.00	***	-0.06	0.03	**	-0.02	0.56	
1990 Per capita services employment * 1000	0.08	0.00	***	0.10	0.05	**	1.12	0.00	***	0.74	0.00	***
Income inequality	1.17	0.03	**	-0.22	0.69		-0.67	0.20		-1.11	0.06	**
Value of agricultural output	7895	0.00	***	12998	0.00	***	2157	0.31		13746	0.00	***
Labor productivity of agriculture	0.13	0.20		-0.10	0.44		-0.28	0.01	***	-0.11	0.43	
Municipal government expenditures	-3.24	0.02	**	-1.82	0.11		-1.74	0.22		4.30	0.00	***
% adults with 9th grade or more	0.10	0.76		0.01	0.99		1.39	0.00	***	5.28	0.00	***
* Income inequality	0.39	0.00	***	-0.09	0.77		0.14	0.31		-0.04	0.90	
* Value of agricultural output	2113	0.01	***	-2143	0.26		-1367	0.09	*	-1628	0.42	
* Labor productivity of agriculture	-0.05	0.31		0.00	0.94		0.04	0.40		0.06	0.32	
* Municipal government expenditures	0.40	0.40		-0.14	0.80		-0.98	0.04	**	-1.36	0.02	**
% of population served by state road	0.08	0.00	***	0.03	0.43		0.03	0.05	**	0.10	0.01	***
* Income inequality	0.01	0.14		-0.01	0.43		0.02	0.00	***	0.03	0.02	**
* Value of agricultural output	-1.73	0.97		-21.1	0.82		74.4	0.15		120	0.23	
* Labor productivity of agriculture	0.004	0.23		0.0002	0.94		-0.01	0.00	***	-0.0003	0.94	
* Municipal government expenditures	-0.03	0.35		-0.03	0.29		0.004	0.91		0.02	0.63	
Average municipal wage in sector	-19.0	0.00	***	-0.25	0.97		4.89	0.14		5.65	0.51	
1 if higher minimum wage group	4.45	0.34		9.99	0.26		-10.8	0.02	**	-2.01	0.83	
Constant	1.72	0.02	**	-0.38	0.75		0.85	0.23		1.74	0.17	
Observations	931			532			931			532		
F-stat	105.1			27.00			239.1			62.80		

Coefficient is significantly different from zero at: 90% *, 95% **, 99% ***.
Estimations included Z_i^{pov} , Z_i^M variables.

The geographic variables show that more semi urban than rural municipalities are in the coast, and more rural than semi urban municipalities are located in the high-plateau of central Mexico (the Altiplano) and in areas where the terrain is more irregular. Similarly, rural municipalities have a larger indigenous population and are more isolated from an urban center than semi urban ones are.

Finally, the other municipal variables show there are important differences in terms of schooling, as semi urban municipalities have, on average, a percentage of adults with some secondary education that is twice as high as that of rural municipalities. Semi urban municipalities are also better served by state roads and are more likely to be among the municipalities for which the law mandates high minimum wages. While there is little difference in terms of the average wage in manufacturing across semi urban and rural municipalities, wages in services are much higher in the former than they are in the latter.

Tables 2, 3, and 4 present the results of the estimations. Separate models were computed for rural and semi urban municipalities and for employment in services and in manufacturing. In all of the estimations, the explanatory variables were demeaned so the parameter in front of an interacted variable can be interpreted as the total marginal effect of the interaction.

The first step of the estimation in Table 2 consists of the employment equations. In these estimations, the dependent variables are the per capita level of employment in services and in manufacture in the municipality. In terms of the municipal characteristics that affect employment, the estimations in Table 2 show that the total effect of secondary education on employment in services is positive and significant. Road availability has a positive and significant effect on services employment on both rural and semi urban municipalities and on manufacturing employment in semi urban municipalities. The effect of income inequality on employment is positive for manufacturing employment in semi urban municipalities and negative for services in rural municipalities. In addition, the value of agricultural output is positively associated to employment in manufacturing in rural and semi urban municipalities and to employment in services in rural municipalities only. Labor productivity of agriculture is negatively related to employment in services in semi urban municipalities. Finally, municipal government expenditures are negatively affecting employment in manufacturing in semi urban municipalities and positively related to employment in services in rural municipalities.[5]

The second step of the estimation in Table 3 consists of the population equation. It includes the predicted values for employment in services and manufacture. Sargan tests do not reject the validity of the instruments. Population is larger in semi urban municipalities with higher per capita services employment. In rural and semi urban municipalities, population is positively associated to its past level. Also, population of semi urban municipalities is positively associated to location on the coast and in the Altiplano.

[5]For an analysis of the spatial patterns of expansion of non-agricultural rural employment in Mexico see Araujo, de Janvry and Sadoulet (2004a).

TABLE 3
SECOND STEP: POPULATION ESTIMATIONS

Endogenous variable:	Semiurban			Rural		
Population in 2000 * 10^{-3}	Coef.	P-value	Sign.	Coef.	P-value	Sign.
Instrumented						
2000 Per capita manufacturing employment * 1000	0.01	0.22		0.000	0.92	
2000 Per capita services employment * 1000	0.03	0.00	***	-0.002	0.74	
Population in 1980 * 10^{-3}	1.22	0.00	***	1.11	0.00	***
Coast	1.89	0.02	**	0.42	0.37	
Altiplano dummy	2.01	0.00	***	-0.06	0.78	
Constant	0.00	1.00		0.00	1.00	
Observations	931			532		
F-stat	307.25			235.39		
Overidentification test of all instruments						
Sargan statistic	1.66			4.28		
Chi-sq(11) P-val	0.999			0.961		

Coefficient is significantly different from zero at: 90% *, 95% **, 99% ***.
Estimations included Zi^{pov} variables.

The third step of the estimation in Table 4 incorporates the predicted values of per capita manufacturing and services employment and of population to estimate poverty in 2000. T-tests compare these coefficients across rural and semi urban municipalities in the last column of Table 4. Sargan tests do not reject the validity of the instruments although for semi urban municipalities only at the 5% level. The first two rows of the table refer to the total effects of per capita manufacturing and services employment on poverty. There is a negative association between poverty and NARE in all cases, except manufacturing in rural municipalities, where the coefficient is not significant. This pattern is consistent with the one suggested by Figure 1. In semi urban municipalities, the negative effect of manufacturing employment on poverty is larger than the one of services employment. Also, while manufacturing employment is poverty-reducing only in semi urban municipalities, the poverty-reducing effect of services employment is larger in rural than in semi urban municipalities.

Table 4 suggests that poverty is positively and significantly associated to income inequality in rural and semi urban municipalities and that the poverty-increasing effect of inequality is larger in the latter than in the former. The effect of government expenditures on poverty is negative and larger in semi urban than in rural municipalities. Finally, higher values of agricultural output are negatively related to poverty, and this effect is larger for rural then it is for semi urban municipalities.[6]

[6]Estimations were repeated using each of the components of the poverty index separately. In terms of the signs of the coefficients and their significance, the results are robust to the choice of welfare measure.

TABLE 4
THIRD STEP: POVERTY ESTIMATIONS
(Using index)

Endogenous variable:	Semi urban			Rural			Difference
Poverty in 2000	Coef.	P-value	Sign.	Coef.	P-value	Sign.	
Instrumented							
2000 Per capita manufacturing employment * 1000	-0.050	0.00	***	0.003	0.75		^^^
2000 Per capita services employment * 1000	-0.030	0.00	**	-0.037	0.00	***	^^^
2000 Population * 10^{-3}	-0.013	0.22		-0.047	0.21		^^^
Income inequality	1.385	0.00	***	0.955	0.00	***	^^^
Value of per-hectare agricultural output	-860.8	0.06	*	-2083	0.00	***	^^^
Labor productivity of agriculture	-0.0002	0.97		0.011	0.46		^^^
Municipal government expenditures	-3.939	0.00	***	-1.221	0.00	***	^^^
% adults with 9th grade or more	-0.305	0.00	***	-0.186	0.22		^^^
% of population served by state road	0.013	0.00	***	-0.005	0.37		^^^
St.dev. of altitude in meters	-0.006	0.00	***	-0.004	0.01	***	^^^
% who speak indigenous language	0.020	0.00	***	0.017	0.00	***	^^^
1/Distance to closest center	16.68	0.10		63.26	0.01	***	^^^
Northern border	-4.130	0.00	***	-5.934	0.01	***	^^^
Constant	40.84	0.00	***	45.48	0.00	***	
Observations	931			532			
F-stat	172.17			83.04			
Overidentification test of all instruments							
Sargan statistic	22.5			4.72			
Chi-sq(15) P-val	0.095			0.994			

Coefficient is significantly different from zero at: 90% *, 95% **, 99% ***.
Rural is significantly different than semi urban at 99%: ^^^

5.1. Effectiveness of Policy Interventions

This section explores how effective are policy interventions that increase secondary education and road availability in reducing poverty through non-agricultural employment generation. For a given policy x, the value of $\partial Pov/\partial L * \partial I/\partial x$ is recovered from the estimated model. Table 5 presents the estimates of $\partial Pov/\partial L * \partial I/\partial x$ and compares them across rural and semi urban municipalities.

The results suggest that an increase in the percentage of adults with nine grades of education effectively reduces poverty through manufacturing employment in semi urban municipalities only. The positive sign for rural municipalities is consistent with the previous finding that manufacturing employment had no significant effect on poverty in these municipalities and could be explored further. The role of education on poverty through services employment is poverty-reducing in semi urban and in rural municipalities. Interestingly, the effectiveness of education in reducing poverty through services employment is larger in rural than it is in semi urban municipalities.

On the other hand, the effect of interventions in roads is poverty-reducing through both manufacturing and services employment in semi urban municipalities and through services employment in semi urban municipalities only. Just like with interventions in education, the effectiveness of roads in reducing poverty through services employment is also larger in rural than in semi urban municipalities.

TABLE 5
EFFECTIVENESS OF POLICIES IN REDUCING POVERTY THROUGH NON-AGRICULTURAL EMPLOYMENT GROWTH $\partial Pov/\partial L * \partial L/\partial x$

	Semi urban		Rural		Difference
	Coef.	Std.Err.	Coef.	Std.Err.	
x = % of adults with 9th grade or more					
Per capita manufacturing empl.*1000	-0.005	0.017	0.00003	0.010	***
Per capita services empl.*1000	-0.042	0.014	-0.197	0.077	***
x = % served by state roads					
Per capita manufacturing empl.*1000	-0.004	0.001	0.0001	0.000	***
Per capita services empl.*1000	-0.001	0.001	-0.004	0.002	***

Bootstrapped standard errors reported.
Semi urban is significantly different from rural at: *** 99%, ** 95%, * 90%.

From a policy perspective, it is interesting to explore whether heterogeneity along different dimensions may result in differences in the effectiveness of these policies in reducing poverty through employment in manufacturing and services. Table 6 compares $\partial Pov/\partial L * \partial L/\partial x$ across municipalities of different characteristics in terms of income inequality, value of agricultural output, labor productivity in agriculture, and municipal government expenditures. Estimations were repeated across these partitions of municipalities. For simplification, the table aggregates the total effect of policy interventions through services and manufacturing employment.

The first two columns of Table 6 show that in semi urban municipalities of all contexts, poverty is responsive to policy interventions that increase the percentage of adults with secondary education to promote NARE. However, these interventions are more effective in municipalities where income inequality and the value of agricultural output are high than in those where they are low. Also, interventions in education are more effective in reducing poverty in semi urban municipalities where the labor productivity of agriculture and the municipal government expenditures are low than in places where these are high.

The effectiveness of roads in reducing poverty in semi urban municipalities through the promotion of NARE suggests the opposite pattern. Here, interventions are more effective in places where income inequality and the value of agricultural output are low. Also, roads are more effective in reducing poverty through NARE in semi urban municipalities where the labor productivity of agriculture and municipal government expenditures are high than in those where they are low.

This exercise is more insightful among rural municipalities, where it was found that the total effect of policy interventions on poverty through manufacturing employment was not poverty-reducing. Table 6 allows us to distinguish contexts in which it is. For instance, the total effect of interventions in secondary education is always poverty-reducing. Moreover, its effectiveness in reducing poverty through NARE is larger in rural municipalities with high value of agricultural output than in those with low. This is also true in municipalities where income inequality, labor productivity of agriculture, and government expenditures are low.

TABLE 6
EFFECTIVENESS OF POLICIES IN REDUCING POVERTY THROUGH NON AGRICULTURAL EMPLOYMENT GROWTH IN DIFFERENT CONTEXTS $\partial Pov/\partial L * \partial L/\partial x$

	Semi urban						Rural					
	x = % of adults with 9th grade or more			x = % served by state roads			x = % of adults with 9th grade or more			x = % served by state roads		
	High	Low	Diff.	High	Low	Diff.	High	Low	Diff.	High	Low	Diff.
Income inequality	-0.167	-0.170		-0.001	-0.006		-0.436	-0.723		0.003	0.005	
Per capita manufacturing empl.*1000	-0.020	-0.091	***	-0.001	-0.007	***	0.050	0.018	**	0.003	-0.003	***
Per capita services empl.*1000	-0.146	-0.079	***	0.0001	0.001	***	-0.486	-0.741	***	0.0001	0.008	***
Value of agricultural output	-0.027	-0.452		0.002	-0.017		-0.554	-0.465		0.001	-0.006	
Per capita manufacturing empl.*1000	-0.084	-0.086		0.002	-0.004	***	-0.024	0.088	***	0.0002	0.013	***
Per capita services empl.*1000	0.056	-0.366	***	0.001	-0.013	***	-0.530	-0.553		0.001	-0.019	***
Labor productivity of agriculture	-0.295	-0.640		-0.008	0.017		-0.141	-1.422		-0.002	0.066	
Per capita manufacturing empl.*1000	-0.027	-0.275	***	-0.004	0.010	***	0.026	0.110	**	-0.002	0.014	***
Per capita services empl.*1000	-0.268	-0.365	***	-0.005	0.007	***	-0.167	-1.531	***	0.00002	0.052	***
Municipal government expenditures	-0.079	-0.369		0.000	-0.003		-0.214	-0.729		-0.005	0.010	
Per capita manufacturing empl.*1000	-0.075	-0.113	***	-0.0002	0.0003		0.015	-0.033	***	-0.001	0.006	***
Per capita services empl.*1000	-0.0035	-0.2561	***	-0.0001	-0.004	***	-0.228	-0.696	***	-0.004	0.004	***

Bootstrapped standard errors reported.
Low is significantly different from high at: *** 99%, ** 95%, * 90%.

[5]For an analysis of the spatial patterns of expansion of non-agricultural rural employment in Mexico see Araujo, de Janvry and Sadoulet (2004a).

Some of these patterns reverse for policy interventions that increase the availability of roads. In fact, these are more poverty-reducing in rural municipalities where the value of agricultural output is low, but where labor productivity of agriculture is high. Moreover, no significant differences are found in the poverty-reduction effectiveness of interventions in roads across municipalities with high or low income inequality and government expenditures.

6. CONCLUSIONS

This paper answers two questions. First, it assesses the impact of non-agricultural rural employment on poverty. And second, it explores in which environments can policy interventions in education and roads be more effective in reducing poverty through NARE. In understanding the poverty-reduction potential of NARE, it explores the role of other municipal attributes such as the sectorial composition of NARE, local income inequality, labor productivity in agriculture, agricultural potential, and government expenditures.

The findings suggest that there is a negative effect of manufacturing and services employment on poverty in semi urban municipalities and a negative effect of services employment on poverty in rural municipalities. The effect of manufacturing employment on poverty in rural municipalities is not significantly different from zero. This poverty-reducing effect is larger for manufacturing than for services employment in semi urban municipalities. Also, the negative effect of services employment is larger in rural than in semi urban municipalities. Our findings suggest that poverty is higher in municipalities with higher income inequality, and with lower government expenditures. These two effects are stronger in semi urban than in rural municipalities. Also, higher values of agricultural output are negatively related to poverty and this effect is larger in rural than in semi urban municipalities.

The last part of the paper compares the effectiveness of interventions that increase the availability of secondary education and of roads in reducing poverty through the expansion of NARE. Interventions in secondary education are more effective in reducing poverty through NARE in places with low labor productivity of agriculture and low per-capita government expenditures and in places with high value of agricultural output. However, the effectiveness of secondary education in reducing poverty through NARE differs across rural and semi urban municipalities in terms of inequality. While these interventions are more poverty-reducing in rural municipalities with low income inequality, the opposite is true for semi urban municipalities.

Finally, interventions in roads are more effective in reducing poverty through NARE in semi urban and rural municipalities with low value of agricultural output, but high labor productivity of agriculture. The effectiveness of these interventions does not differ for rural municipalities along dimensions such as inequality and municipal government expenditures. However, for semi urban municipalities, interventions in roads are more effective where income inequality is low and government expenditures high.

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