Changes in Brazilian Rural Poverty and Inequality From 1991 to 2000: The Role of Migration

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Resumo: Este trabalho pesquisa mudanças na pobreza e desigualdade rural no Brasil na década de noventa. Usamos dados dos Censos Demográficos de 1991 e 2000 para caracterizar tendências na pobreza e na desigualdade nas cinco macroregiões do pais. Regressões ao nível municipal mostram a) o papel fundamental do crescimento da renda domiciliar per capita na redução da pobreza rural, b) um efeito importante do aumento no Gini na pobreza rural, e c) diferenças regionais significativas na importância relativa desses efeitos. Descobrimos que entre maior a migração maior foi a redução na incidência da pobreza rural, devido ao maior crescimento na renda per capita e menor crescimento na desigualdade da renda. Porém, o impacto da migração na incidência da pobreza foi pequena. A migração teve um impacto muito maior no número absoluto de pessoas pobres rurais. Uma pergunta fundamental para pesquisas futuras é verificar se os migrantes conseguiram escapar da pobreza.

Palavras-chave: pobreza rural, desigualdade, migração.

1. Introduction and Summary of Findings

Rural poverty is extremely high in Brazil. In 1991, 72% of the rural population lived in poverty (households with less than ½ of a minimum wage per capita), and 45% lived in extreme poverty (households with less than ¼ of a minimum wage per capita). The good news is that there was a significant decline in rural poverty in the 1990s. By the year 2000, poverty in rural areas had declined by 16% and extreme poverty by 19%. Poverty reduction in urban areas was of a similar magnitude in this period.

Rural poverty--and rural poverty reduction--was quite heterogeneous across macro-regions. For example, extreme poverty in rural areas was still above 40% in the North and Northeast regions of the country in the year 2000, while it was below 20% in the three regions of the Center-South (Southeast, South, and Center-West). Perhaps even more troublesome was that the process of adjustment to the policy reforms of the 1990s was much more successful where poverty was already lower. Rural poverty fell between 25% and 37% in the Center-South. Rural poverty fell by only 10% in the Northeast, and it rose slightly in the North. Increasingly, the rural poor were concentrated in these latter two regions.

Income growth was the main cause of poverty reduction in the 1990s. Household income per capita rose by 32% in rural Brazil between 1991 and 2000. Unfortunately, as in many episodes of growth in Brazilian history, this was accompanied by an increase in income inequality. The Gini index of rural income inequality rose from 0.58 to 0.62. A closer examination of changes in income by deciles revealed that income levels rose by 35% to 40% in each of the top five deciles of the income distribution. The level of income collapsed by over 90% in the bottom decile, contracted by 24% in the second decile, and grew only modestly in the next three deciles. Thus, at least for the bottom 20% of the income distribution, the depth of poverty is likely to have increased. A lack of employment in rural areas appears to be at the heart of the problem for the bottom two deciles.

Poverty reduction was most dramatic in those regions that succeeded in growing rapidly with little or no associated increase in inequality (the South and Southeast). In the Center-West, where it is not uncommon to find farms with over 10,000 hectares of land, rapid growth was accompanied by a sharp increase in inequality. Poverty reduction still occurred in the Center-West, but at a slower pace than in the South and Southeast. In the North and Northeast, income growth was moderate or negative, and inequality rose. Growth in social

security payments to rural areas in the 1990s was an important part of the explanation for rising household income in this period (Beltrão et al., 2005).

The rural population declined by 11% between 1991 and 2000. We suspect that had this not occurred, poverty reduction might have been much less pronounced. If the migrants were disproportionately poor, migration could have contributed to rural poverty reduction. Similarly, if there were surplus labor, then output would have fallen little or not at all as the lowest productivity workers exited from the sector. In such a scenario, income per capita would have risen for the remaining rural residents. We explore the relationship between poverty reduction and migration at a municipal level and find that where the population declined faster, the rate of poverty fell more. Although statistically significant, the magnitude of the relationship was quite small. We conclude that out-migration had a much larger impact on the number of poor in rural areas rather than on the rate of rural poverty.

Section 2 describes the data, construction of the variables, and methodology. In Section 3 we analyze changes in income, poverty, and inequality at the national and macro-regional levels. Section 4 takes a closer look at the relationship between migration and rural poverty. Section 5 provides conclusions.

2. Data and Methodology

The data used to construct the measures of income, poverty, and inequality come from the long form of the Demographic Censuses of 1991 and 2000. Approximately 10% of the Brazilian population used this questionnaire in both years. A detailed description of the procedures used to construct the variables can be found in an appendix that is available from the authors. We describe the main variables briefly here.

Income is measured as domicile income per capita. As is common in studies of poverty in Brazil, we exclude a) collective domiciles (such as prisons and hospitals), b) domestic employees and their family members (to avoid double counting their income), and c) people who pay rent to the domicile head to live in the domicile. Income includes earnings from all sources, government transfers, and other forms of unearned income. One of the most important limitations of the definition of income in the Demographic Censuses is that it does not include non-marketed production for own-consumption. For small farmers who consume a significant portion of what they produce, this is likely to lead to a significant underestimation of their true incomes. If own-consumption is relatively constant over time, then it should not have a large impact on the measured *change* in income between 1991 and 2000.[1]

Poverty and *extreme poverty* are measured in relation to uniform national poverty lines. While it would be preferable to use poverty lines that take account of differences across regions and rural/urban areas in the cost of living, existing poverty lines that incorporate these difference are based on out-dated data from the 1980s (and in some cases the 1970s). Thus, we have adopted the same poverty lines as the recently released *Atlas of Human Development* (2003). The poverty and extreme poverty lines were set at 1/2 and 1/4 of an August 2000 minimum wage per person. With a minimum wage of 151 reais, this

[1] The National Household Surveys (PNAD) also exclude own-consumption from their measure of income. Additional research is necessary to investigate the magnitude of own-consumption, its stability over time, and to develop an approach for estimating *total income* in rural Brazil. There is no doubt that the exclusion of own-consumption biases estimates of poverty upward. In one study that sought to correct for this problem based on the 1996 Living Standards Measurement Survey in Brazil (PPV), the authors found that a PNAD income-based measure of poverty overestimated extreme poverty by roughly twenty percentage points in the Northeast, and ten percentage points in the Southeast (Ferreira and Lanjouw, 2001). In terms of the distribution of income, however, there are off-setting forces and the net impact is unclear. Hoffman (2000), for example, cites the under-reporting of incomes at the upper end of the income distribution as an important limitation of the Census and PNAD data.

translated into a poverty line of approximately US$1.33 per person per day in that month. While a uniform national poverty line is likely to overstate poverty in some areas, such as in the rural Northeast, the changes in poverty between 1991 and 2000 are much less sensitive to this problem.

The *Gini Coefficient* is estimated from a piecewise linear Lorenz curve. The Gini is a measure of inequality that lies between zero and one, with larger numbers indicating greater inequality. The Gini measures inequality of *total* domicile income per capita, i.e., income from all sources. In other work, we have also used *Concentration Ratios to* examine the contribution of specific income sources--such as agricultural or wage income--to overall inequality (Helfand and Levine, forthcoming). We summarize those results briefly below.

3. Changes in Income, Poverty, and Inequality at the National and Macro-Regional Levels

Table 1 provides information on domicile income per capita, inequality, poverty, and extreme poverty for Brazil and the five macro-regions. For all of Brazil, income rose by 29% between 1991 and 2000. Growth, however, took place in the context of a modest increase in inequality. The Gini coefficient rose from 0.63 to 0.65. Nevertheless, poverty and extreme poverty both fell by more than 20%. In the year 2000, 32% of the population had incomes below the poverty line, and 15% lived in extreme poverty.

Rural income in Brazil rose faster than urban income in this period (32% versus 23%), but this was off-set by a larger increase in inequality in rural areas. The Gini rose by 7% in rural areas and by only 3% in urban areas. The fact that overall inequality rose by less than either urban or rural inequality can be explained in several ways. First, income inequality between rural and urban areas declined because incomes rose faster in rural areas. Second, the urban population grew by 24% while the rural population fell by 11%. This means that more people were shifting from low income rural jobs to higher income urban jobs, and that less weight was attached to the larger increase in rural inequality in the 1990s.

The combination of rural areas increasing both income and inequality at a faster rate than urban areas produced a situation in which poverty fell by about the same percentage in urban and rural areas of Brazil (around 16%). The headcount ratio fell to 0.25 in urban areas and to 0.61 in rural areas. It is notable that the reduction in urban poverty took place in the context of a 24% increase in the urban population. Similarly, the decline in rural poverty was most likely aided by the migration out of rural areas. We return to the relationship between migration and poverty in Section 4 of this paper. Growth had a larger impact on extreme poverty in rural areas, with the headcount ratio falling by 19% in rural areas versus 14% in urban areas. The contrast is even more striking in terms of absolute changes in the Gini ratio: in rural areas the Gini fell by nine points, and in urban areas by only one point. At the end of the period, 11% of the urban population and 36% of the rural population was estimated to be living in extreme poverty.

The lower portion of Table 1 presents data on rural areas in the five macro-regions. The following observations stand out. First, rural incomes in 2000 were two to three times as high in the Center-South (Southeast, South, and Center-West) relative to the North and Northeast. Second, lower incomes in the North and Northeast translated into much higher poverty rates. In 2000, over 70% of the rural population of these two regions lived in poverty, and more than 44% lived in extreme poverty. In the Center-South, in contrast, poverty and extreme poverty rates were below 43% and 19% respectively. Third, faster income growth in the rural Center-South--the region where the level of income was already substantially higher--contributed to an increase in rural income inequality across regions. This is one reason why the national level rural Gini rose. Within regions, rural income inequality rose by less than the national change of 7% in the Southeast (2%) and South (0%),

and by more in the North (11%) and Center-West (10%). Fourth, within the Center-South, the South was the region that performed best. Domicile income per capita grew by 57% with no associated increase in inequality. As a result, poverty and extreme poverty fell the most in this region (by 37% and 47% respectively). Income growth in the Southeast was about 10 percentage points below that of the South. Thus, poverty and extreme poverty fell by only 30% and 40% respectively. In the Center-West, income grew at the same rate as in the Southeast, but it was accompanied by a 10% increase in the Gini. Consequently, poverty and extreme poverty fell by even less. Finally, there were also differences between the North and Northeast. Inequality rose considerably in both regions, but in the North it was accompanied by a decline in income whereas in the Northeast income grew by a modest 13%. As a result, poverty and extreme poverty fell gradually in the Northeast (by 10% and 14% respectively), whereas extreme poverty actually rose by 10% in the North.

Tables 2 and 3 provide information on income shares and income growth by deciles at the level of macro-regions and the nation. The objective of these Tables is to shed additional light on the changes in inequality and income in rural areas in this period. The first three columns of Table 2 show income shares by deciles for rural Brazil. Three conclusions can be drawn. First, the income shares of the bottom five deciles all declined, while the shares of the top five deciles all rose. Thus, the pattern of growth in the 1990s contributed to a deterioration in the distribution of income. Second, there was a monotonic pattern of change in the income distribution: the bottom decile lost the most (one percentage point) and the top decile gained the most (1.6 percentage points). As we move from the bottom to the top deciles, the losses become smaller and the gains become larger. Finally, because the losses and gains were larger at the extremes, the ratio of the mean income of the top 20% to the mean income of the bottom 20% changed by much more than the ratio of the top 10% to the bottom 40%. The last two rows of Table 2 show that the 20/20 ratio rose by more than 150% (from 20 to 53), while the 10/40 ratio rose by almost 50% (from 20 to 29).

The first three rows of Table 3 show that although the bottom half of the income distribution was losing income share, only the bottom two deciles experienced an absolute decline in income. Average income fell by 96% in the first decile and by 24% in the second. Between 1991 and 2000, income grew by about the same proportion in the top five deciles of the distribution (between 35% and 39%). When the income data is disaggregated by macro-region, it is clear that the severe decline in income of the bottom decile was most dramatic in the North and Northeast, and did not occur in the South. Conversely, rapid income growth for the top decile of the income distribution was confined to the Center-South of the country.

The collapse in the income of the bottom decile, and the significant drop in the income of the second decile are extremely troubling in terms of the depth of poverty and extreme poverty in rural areas. However, because 72% of the rural population was counted as poor in 1991, what mattered for the number of people below the poverty line was income growth in the 6^{th} and 7^{th} deciles of the distribution. Income growth for these deciles was impressive in the 1990s. Similarly, with 45% of the rural population below the extreme poverty line in 1991, what mattered for the reduction of extreme poverty in the 1990s was income growth in the 4^{th} and 5^{th} deciles

In order to gain further insight into what might explain the income decline for the bottom decile, we examined the composition of the households in the bottom two deciles in the year 2000. We disaggregated them into children under ten years of age, people who were not employed, and for those who were employed we examined the position in their principal occupation. Unfortunately, the 1991 questionnaire did not permit this type of disaggregation. Thus, we were not able to track changes over time. We found the following differences between the bottom two deciles: 1) 45% of the individuals in the bottom decile lived in households with zero per capita income. In the second decile, there were no individuals

living in households with zero income. 2) Only 18% of individuals in the bottom decile were employed. In the second decile this share rose to 25%. Clearly, a lack of employment in rural areas is an important part of the explanation for low incomes. It is not clear, however, if there was significantly less employment in 2000 than in 1991. The type of employment also matters, as illustrated below. 3) In the bottom decile, the employed individuals were distributed as follows: self-employed (5%), subsistence (5%), unpaid family members (3%), informal employees (4%), and domestic servants (1%). The distribution in the second decile was: self-employed (7%), subsistence (2%), unpaid family members (3%), informal employees (8%), formal sector employees (4%), and domestic servants (2%). Thus, 14% of individuals had wage employment in the second decile (informal, formal, and domestic), versus only 5% in the first decile. This is an important difference, but also raises the question about the degree to which income data in the Census are distorted by excluding agricultural production that is not marketed. It is possible that measured income fell in the bottom decile due to a shift away from market oriented production in favor of subsistence production. This hypothesis should be explored in future research.

Tables 2 and 3 also provide income distribution data for the five macro-regions in Brazil. In the North, Table 2 shows that the pattern of changes in income shares was also monotonic. The bottom decile lost the most and the top decile gained the most. However, the share of income going to the top decile in the North rose by 3 percentage points, or nearly twice the increase at the national level. Table 3 shows that changes in the income distribution in the North were not due to rapid income growth of the rich. Mean incomes fell in the bottom seven deciles, and only rose by 4% for the top decile. Thus, stagnation and decline of incomes was a general phenomenon in rural areas of the North.

The Gini rose by nearly as much in the Northeast (8%) as in the North (11%). Tables 2 and 3 show that the bottom two deciles in both regions exhibited similar patterns of decline both in terms of income levels and shares. One of the main differences is that deciles five through nine outperformed the top decile in the Northeast, and this decile actually lost income share in this region. The 8^{th} and 9^{th} deciles gained the most.

The Gini did not change in the South and only rose by 2% in the Southeast. Thus, it is not surprising that there were no major changes in income shares by deciles in these two regions. Income growth in the South was robust for all deciles other than the first. Income growth in deciles three through eight was somewhat faster than in the top two deciles and, as a result, the top 20% actually lost income share. In the Southeast, income growth was also respectable in all deciles but the first. Income grew the fastest in deciles four through seven.

The Gini rose by 10% in the Center-West, which was similar to the increases in the North and Northeast. The pattern of change in the income distribution, however, was quite different. Income shares fell in the bottom nine deciles in this region. The top decile increased its share of income by 5.8 percentage points. Thus, there is no doubt about the model of agricultural growth that was being pursued in this region of the country. In spite of its concentrating nature, income did grow by a reasonable proportion in all other deciles except for the bottom two. Average income in deciles three through nine grew between 29% and 36%.

We are currently in the process of conducting research on the contribution of specific incomes sources to changes in inequality and total income. We briefly report some key results here. Weak and negative income growth, in the Northeast and North, respectively, resulted from stagnation and decline in agricultural and non-agricultural earnings, and slower growth in social security earnings than in the rest of the country. These regions also experienced larger than average increases in inequality. In the North, this was due primarily to increasing concentration of agricultural earnings. In the case of the Northeast, a shift in the shares of income from less to more concentrated sources also played a role in increasing the

Gini. The South and Southeast, in contrast, experienced rapid income growth with little to no increase in inequality. The reason for the stable levels of inequality was that increased concentration of agricultural earnings was off-set by a reduction in the concentration of non-agricultural and "other" income. In the Center-West, income grew enough to substantially reduce rural poverty, despite rising inequality that was due almost exclusively to the increased concentration of agricultural earnings. While the sources of income growth differed across the three regions of the Center-South, they all relied on some combination of growth in agricultural earnings, non-agricultural earnings, and social security income. In the South and Center-West, for example, impressive growth in agricultural earnings played a decisive role. Non-agricultural earnings grew throughout the Center-South, but were most important in the more industrialized Southeast. Thus, while the sharpest contrast is between the poor performance of the northern regions and the much better performance of the Center-South, the three regions of the Center-South illustrate different pathways to rural poverty reduction.

4. Migration and Rural Poverty Reduction

Migration out of rural areas may affect the number of poor, and incidence of poverty, in a number of different ways. We focus on the incidence here, and briefly return to the relationship between migration and the number of poor at the end of this section. On one hand, those who are relatively better off to begin with may have had more opportunities to accumulate human capital and therefore more to gain by migrating to seek urban employment. Under such a "brain drain" scenario, it is possible to imagine out-migration being associated with a decline in the average level of income in a municipality's rural areas, and an increase in the incidence of poverty.[2] On the other hand, families and individuals who are more income-distressed may be more likely to migrate. In this case, pure composition effects, possibly combined with a flow of remittances to poorer families and other factors discussed in more detail below, could increase income per capita and reduce poverty.

In order to test whether the association of out-migration with rural poverty reduction was positive or negative between 1991 and 2000, we first constructed a municipal-level database. The database contains the headcount poverty ratio, mean income per capita, Gini ratio, and population, for rural areas within each municipality, in 1991 and 2000.[3] We then performed regression analyses of the determinants of variation across municipalities in the change in poverty, income and inequality.

Table 4 provides descriptive statistics for the municipal level variables used in the regression analysis. Consistent with the picture at the national level, the median municipality saw a decline in the incidence of rural poverty, substantial growth in income per capita, an increase in the Gini, and a decline in the rural population. However, there is also substantial variation across municipalities in each of these variables. We can exploit this variation to assess the importance of differences in each of these municipal-level variables for reducing (and in some cases increasing) rural poverty.

Given our observations above that the paths to poverty reduction varied considerably across regions, we estimated regression models that included interactions between each of the

[2] This would occur if people with incomes that are both above-average and above the poverty line disproportionately leave the rural population, and this effect is not fully offset by a reverse flow of remittances.

[3] We use "smallest comparable areas" ("AMCs" for their Portuguese name) in order to be able to compare the same geographic unit over time. For simplicity, we refer to these as "municipalities," even though in reality they are composed of one or more municipalities aggregated together. The 5,507 municipalities existing nationwide in 2000 were aggregated into 4267 AMCs, of which 4210 were retained in the dataset used for this analysis. We excluded the four AMCs in the state of Roraima, because of data problems in that state, and excluded the AMC representing the capital city of Brasilia. In order to study *changes* in the variables of interest, we also excluded those AMCs that contained no rural areas in one or both of 1991 and 2000.

main variables and dummies for 4 of the 5 macro-regions, and tested whether the region interaction coefficients were different from zero. While formal tests rejected the hypothesis that all of the interaction terms were zero in the principal models, the partial effects of the explanatory variables rarely differed in sign across regions, and the rare sign-change across regions was generally not statistically significant. Thus, we also estimated the same models without the region interaction terms. These are the results we present here. The results of the more general model are available from the authors upon request.

Table 5 gives the estimates of 5 models for the determinants of changes in the headcount ratio of rural poverty. All models include 25 state level fixed-effects which are not reported in the tables. The first 3 models estimate individually the relationships between change in poverty and each of (a) per capita income growth, (b) change in the Gini ratio and (c) population growth. The coefficient on income growth in the model indicates, as expected, that faster per capita income growth is associated with greater poverty reduction. Also as expected, the coefficient on the Gini in the second model shows that greater increases in municipal-level inequality are associated with greater poverty increase. The effects of both income growth and change in the Gini are even larger in Models 4 and 5. This is because faster income growth is associated with larger increases in inequality, which partially counteracts the effect of faster income growth on poverty reduction. Thus, without controlling for the effect of changes in inequality, the estimated effect of income growth on poverty reduction is smaller (in absolute value) in Model 1 than in Models 4 and 5, and the coefficient on the change in the Gini is similarly smaller in Model 2 which does not control for the effect of greater income growth.

The positive coefficient on population growth in Model 3 confirms that in municipalities where the rural population declined faster, rural poverty reduction tended to be greater. On average, where the rate of population decline was 1 standard deviation (58 percentage points) greater than that of the mean municipality, poverty fell an additional 1.4 percentage points.[4] This fact is consistent with any of a combination of the following: (1) a pure composition effect – proportionately greater migration of poor (rather than non-poor) people from rural to urban areas, so that average income increased and measured inequality declined without the income of any individual remaining in rural areas necessarily changing at all; (2) the presence of large amounts of "surplus labor" in rural areas, so that out-migration did not significantly reduce total income in rural areas, but reduced the number of people among whom it was distributed; (3) proportionately greater migration of non-working age individuals, thus contributing to an improvement in the dependency ratio among poor households; and (4) some of those who migrated to urban areas were able to earn sufficiently high incomes to remit some of their earnings back to their families who remained in rural areas. Future research should seek to devise a strategy for testing the relative importance of these alternative explanations.

It is important to note that the effect of population growth becomes smaller in Model 4, and statistically insignificant in Model 5. This is because population change affects poverty via its effects on the level and distribution of income. Thus, controlling for income growth and change in the Gini reduces the effect of population change on poverty. The reason the positive association does not disappear entirely, when these controls are added in Model 4, probably relates to the fact that the Gini is a single number that incompletely summarizes the entire income distribution. However the statistically insignificant, positive coefficient on population growth in Model 5 suggests that the change in the Gini does,

[4] Figure 1 summarizes the comparative static exercises discussed in the text here. The change just mentioned is the "unconditional effect" (i.e. not controlling for other variables) of a standard deviation variation in the rate of population decline on poverty reduction. None of the rates mentioned here are annualized. In other words, they give the proportional change in the underlying variable between 1991 and 2000.

indeed, capture most of what is important for poverty reduction about changes in income distribution associated with population decline.

In order to further assess the impact of population decline on income and inequality, Table 6 shows the results of regressions of (1) the change in the Gini and (2) growth in per capita income, on population growth. Both equations control for initial levels of all 3 variables (income, Gini and population). The Gini change regression (Model 1) controls for per capita income growth, and the growth equation (Model 2) controls for change in the Gini.[5] The coefficients on population growth are statistically significant and show that out-migration is associated with both falling rural inequality and rising average rural incomes. This result suggests a rejection of the stark "brain drain" scenario, according to which out-migration comes disproportionately from more well-off individuals and families who have enjoyed greater opportunities to acquire human capital. Yet, as discussed above, at this stage in our research we are not able to identify which of four causal mechanisms account for the observed association of population growth with income growth and inequality change. Pure composition effects of out-migration could account for both faster income growth and greater inequality reductions. However, so could the removal of surplus labor, improvement in the dependency ratio or the flow of remittances from migrants, so long as the out-migration is disproportionately from the lower end of the income distribution.

To provide a sense of the size of these coefficients, we can compute as follows (see Figure 1): Controlling for the rate of per capita income growth and initial levels of all three variables, municipalities with a rate of population decline one standard deviation (58 percentage points!) larger than the mean saw their Gini index increase by 1 point less than the mean municipality.[6] Municipalities with a rate of population decline one standard deviation above the mean also experienced 4.9 percentage points additional per capita income growth. Given the estimated coefficients from Model 5 in Table 5, these differences in the change in the Gini and the per capita income growth rate are associated with an additional 1.1 percentage points of poverty reduction. As noted above, the "direct" effect of population growth on poverty change (apart from its effect via income growth and change in the Gini) is too small to be statistically different from zero with 90 percent confidence in Model 5 of Table 5. However, if we include it in the computation for the sake of completeness, the "direct effect" of an additional standard deviation of population decline is an additional 0.3 percentage point of poverty reduction. Thus, the "total effect" of an additional standard deviation in the rate of population decline accounts for an additional 1.4 percentage points of poverty reduction.

To get a sense of the relative importance of out-migration in explaining municipal level variation in poverty reduction, we might first compare this 1.4 percentage points with the standard deviation of poverty change: 12.9 percentage points. Viewed this way, the role of out-migration appears modest, though not negligible.[7] To make the point more directly, consider what the above comparative static exercise is saying: An additional 58 percentage point decline in rural population is required in order to reduce the incidence of rural poverty an additional 1.4 percentage points. A much smaller decline in rural population—say five percent, the mean—would account for a mere tenth of a percentage point in poverty

[5] Of course, as the table makes clear, the two dependent variables are correlated, and it may be that causation goes in both directions. Although we would ideally find adequate exogenous instruments for each one in order to properly identify and estimate the whole system, our focus here is on the partial correlation between each of these and population growth.

[6] Gini index = 100 x Gini ratio. The Gini index has a range of 0 to 100.

[7] This is not surprising, given that out-migration only accounts for a modest part of the variation in income growth and inequality change. One additional standard deviation in population decline accounts for only 1 point of change in the Gini index (vs. a standard deviation of 11 points for the change in the Gini index) and 4.9 percentage points of income growth (vs. a standard deviation of 66 percentage points).

reduction. Thus, the extremely large variation in rates of rural population growth would appear to explain only a modest part of rural poverty reduction. This evidence suggests that even large-scale, continued out-migration is not likely to produce large reductions in the percent of rural residents living in poverty, absent some substantial change in migration patterns or opportunities for much more productive urban employment of currently poor rural residents that could lead to dramatically increased remittance flows in the future.

One potential concern with the above analysis is that the extremely large variation in population growth may indicate the presence of outliers significantly biasing downward the estimated effect of rural population decline on poverty reduction. To test this possibility, we removed two observations with uniquely large values for the growth in rural population, as well as three other observations that had unusually large or unusually negative residuals in Model 3 from Table 6. We then re-estimated the models in Tables 6 and 7 and recomputed the comparative statics in Figure 1. Removing these five observations reduced the standard deviation of population growth to 0.34 (from 0.58 previously) and reduced the range of the variable dramatically.[8] This result confirms that a couple of extreme values were responsible for a large amount of the measured variation in that variable. On the other hand, there was no qualitative change in the regression results. Out-migration continued to account for only a modest part of the reduction in rural headcount poverty ratios in Brazil over the 1990s.

It should be emphasized that none of the analysis here addresses the extent to which out-migration improves the welfare of the migrants themselves. Out-migration may still be an important pathway out of poverty for the migrants, even if not for those who remain behind. Moreover, the analysis above addresses the incidence of rural poverty (the percent of rural residents living below the poverty line), not the absolute number of rural poor, nor the ratio of rural to urban poor. de Janvry and Sadoulet (2000) have shown that rural out-migration accounts for most of the reduction in the ratio of rural to urban poor during three growth episodes in Latin America between 1970 and 1997. In light of this finding, we briefly analyze the impact of migration on the *absolute number of rural poor* in the 1990s.

The estimated number of people below the poverty line in rural areas declined by 6.5 million, from 25.9 million in 1991 to 19.4 million in 2000. We decompose this change into a) a reduction in the incidence of poverty, and b) a migration effect, in two ways. The first approach use the following equation: $\Delta poor = \Delta P_o Pop^{91} + \Delta Pop\ P_o^{91} + \Delta P_o \Delta Pop$. The first term captures the effect of a decline in the incidence of rural poverty by allowing the rural poverty rate (P_o) to change while holding the population constant at its 1991 level (Pop^{91}). The second term captures the effect of migration by allowing the population to change while holding the poverty rate constant at its 1991 level. And the third term captures the interaction between changes in the poverty rate and the population. According to this approach, the decline in the poverty rate accounted for 63% of the decline in the number of rural poor, the population decline represented 44%, and the magnitude of the interaction term was -7%. This result is substantially different from that found by de Janvry and Sadoulet (2000). It suggests that the reduction in the incidence of rural poverty played a major role in reducing the number of poor people in the rural areas of Brazil in the 1990s.

One problem with the above decomposition is that it does not properly control for population growth. Due to population growth resulting from a birth rate that exceeded the death rate, many more than 4 million people had to leave rural areas in order for the observed rural population to decline from 35.8 to 31.8 million people between 1991 and 2000. Thus, we calculated a counterfactual number of rural poor in the year 2000 assuming a) no

[8] Two of the removed observations had rural population growth of 13.62 and 27.14, respectively. Removing these two observations reduced the maximum value of this variable from 27.14 to 4.36.

migration, b) no change in the poverty rate, and c) population growth equal to the national average (15.6% between 1991 and 2000). Under this scenario, the number of rural poor would have risen to 30 million in 2000. We then decomposed the difference between the counterfactual number of poor in the year 2000 (30 million), and the observed number of poor (19.4 million), into a poverty reduction effect and a migration effect using the same methodology as above. With this approach, the decline in the poverty rate accounted for 45% of the decline in the number of rural poor, migration accounted for 65%, and the magnitude of the interaction term was -10%. Thus, while somewhat diminished, the qualitative result found above remained unchanged: the reduction in the rural poverty headcount ratio accounted for a substantial share of the decline in the number of poor people in rural areas.

5. Conclusions

In this paper we first described the pattern of changes in income, poverty, and inequality in rural areas of Brazil in the 1990s. We showed that the incidence of rural poverty fell considerably in this period, and that this was largely attributable to income growth. We also demonstrated substantial regional heterogeneity in the experiences, and explanations, of poverty reduction.

We constructed a number of regression models to explore the determinants of variation across municipalities in the change in poverty, income and inequality. The results confirm a) the fundamental role that income growth played in reducing rural poverty, b) the important--yet weaker--effect on rural poverty of increases in the Gini, and c) significant regional differences in the relative strength of these effects.

Because of the dramatic out-migration from rural areas in this period, we used the municipal level regression models to investigate the relationship between changes in the rural population and changes in poverty, income and inequality. We found that greater out-migration was associated with greater reductions in rural poverty, due to both greater per-capita income growth and smaller increases in income inequality. This result is suggestive evidence that out-migration occurs disproportionately from poor households, and it rules out the starkest version of a "brain drain" story in which migrants are disproportionately non-poor and from households with above-average per capita incomes.

At this stage in our research, we are unable to identify the precise mechanism whereby out-migration reduces the incidence of rural poverty. It is likely a combination of (1) a simple composition effect of removing poor individuals from the population, (2) the removal of "surplus labor" from the rural population, so that there is no shrinking of the income pie, but a smaller pool of people among whom to share it, (3) disproportionate migration of persons not of working age, and (4) a flow of remittances from migrants to their families who remain in rural areas. Whichever the mechanism, it is clear that greater out-migration was associated with enhanced poverty reduction. Our results, however, suggest that the positive impact of out-migration on the incidence of rural poverty was rather small.

Finally, we showed that migration explained approximately half of the decline in the number of poor people in rural areas in the 1990s. The fact that migration only explains half of the decline is an important finding. It implies that the economic forces that contributed to lowering the incidence of rural poverty also explain about half of the decline in the number of rural poor. A key question for future research is to explore the changes in welfare of the migrants who moved from rural to urban areas. Was migration a successful strategy for escaping poverty, or did it simply shift the poor from rural to urban areas?

6. References

Barros, Ricardo Paes de, Mirela de Carvalho, and Samuel Franco, "Pobreza Rural e Trabalho Agrícola no Brasil ao Longo da Década de Noventa," mimeo, Rio de Janeiro, Jan. 2004.

Beltrão, Kaizô Iwakami, Ana Amélia Camarano, and Juliana Leitão de Mello, "Mudanças nas Condições de Vida dos Idosos Rurais Brasileiros: Resultados Não Esperados dos Avanços da Seguridade Rural, IPEA, Texto para Discussão No. 1066, 2005.

Corseuil, Carlos Henrique and Miguel N. Foguel, "Uma Sugestão de Deflatores para Rendas Obtidas a Partir de Algumas Pesquisas Domiciliares do IBGE," IPEA, Texto para Discussão No. 897, July 2002.

de Janvry, Alain and Elisabeth Sadoulet, "Rural Poverty in Latin America: Determinants and Exit Paths," *Food Policy*, 25(4): 389-409, 2000.

Del Grossi, Mauro Eduardo, and José Graziano da Silva, "O Uso das PNADS para as Áreas Rurais," IPEA, Texto para Discussão No. 874, April 2002.

Ferreira, Francisco H.G., and Peter Lanjouw, "Rural Nonfarm Activities and Poverty in the Brazilian Northeast, *World Development* Vol. 29, No.3, pp. 509-28, 2001.

Helfand, Steven M., and Luis F. Brunstein, "The Changing Structure of the Brazilian Agricultural Sector and the Limitations of the 1995/96 Agricultural Census," *Revista de Economia e Sociologia Rural*, Vol. 39, No. 3, July/Sept. 2001, pp. 179-203.

Helfand, Steven M., and Edward S. Levine, "The Impact of Policy Reforms on Rural Poverty in Brazil: Evidence from Three States in the 1990s," forthcoming in an edited volume of essays in honor of Keith Griffin.

Hoffmann, Rodolfo, "Mensuração da Desigualdade e da Pobreza no Brasil," in Henriques, Ricardo (ed.), *Desigualdade e Pobreza no Brasil*, Rio de Janeiro: IPEA, 2000.

Rocha, Sonia and Roberto Cavalcantini de Albuquerque, "Geografia da Pobreza Extrema e Vulnerabilidade à Fome," Rio de Janeiro: Instituto Nacional de Altos Estudos, Sept. 2003.

United Nations Development Program, Instituto de Pesquisa Econômica Aplicada and Fundação João Pinheiro, *Atlas do Desenvolvimento Humano no Brasil*, www.ipea.gov.br, 2003.

Table 1
Income, Poverty and Inequality: Brazil and Macroregions
1991 and 2000

Region/Type	Income Per Capita			Inequality			Poverty (1/2 MW pc)			Extreme Pov. (1/4 MW pc)		
	1991	2000	% ch	1991	2000	% ch	1991	2000	% ch	1991	2000	% ch
	(R$ of 1/2002)			(Gini)			(Headcount)			(Headcount)		
Brazil												
Total	255	330	29	0.63	0.65	2	0.40	0.32	-21	0.20	0.15	-23
Urban	308	379	23	0.61	0.63	3	0.30	0.25	-17	0.12	0.11	-14
Rural	90	119	32	0.58	0.62	7	0.72	0.61	-16	0.45	0.36	-19
Rural Only												
North	98	95	-3	0.57	0.63	11	0.69	0.70	1	0.40	0.44	10
Northeast	57	64	13	0.53	0.57	8	0.85	0.77	-10	0.60	0.51	-14
Southeast	120	177	47	0.57	0.58	2	0.61	0.42	-30	0.32	0.19	-40
South	127	201	57	0.55	0.55	0	0.56	0.35	-37	0.28	0.15	-47
Center-West	136	200	48	0.58	0.63	10	0.57	0.43	-25	0.27	0.19	-29

Note: Roraima has been excluded from the Northern and national statistics due to data problems.
Source: Authors' calculations based on the micro data from the demographic censuses.

Table 2
Income Shares and Ratios in Rural Areas

	Brazil			North			Northeast		
	1991	2000	Change	1991	2000	Change	1991	2000	Change
Income Shares by Decile									
1	0.01	0.00	-0.010	0.01	0.00	-0.011	0.01	0.00	-0.013
2	0.02	0.01	-0.009	0.02	0.01	-0.014	0.03	0.01	-0.016
3	0.03	0.02	-0.006	0.03	0.02	-0.007	0.03	0.03	-0.008
4	0.04	0.03	-0.004	0.04	0.03	-0.005	0.04	0.04	-0.004
5	0.05	0.04	-0.002	0.05	0.04	-0.003	0.05	0.05	0.000
6	0.06	0.06	0.001	0.06	0.06	0.000	0.07	0.07	0.004
7	0.08	0.08	0.003	0.08	0.08	0.001	0.08	0.09	0.009
8	0.10	0.11	0.005	0.10	0.10	0.002	0.10	0.12	0.016
9	0.15	0.15	0.006	0.15	0.15	0.006	0.15	0.17	0.023
10	0.47	0.49	0.016	0.47	0.50	0.030	0.43	0.42	-0.012
Income Ratios									
Top 10 / Bottom 40	20	29		19	32		15	22	
Top 20 / Bottom 20	20	53		19	89		15	58	

Notes: Roraima has been excluded from the Northern and national statistics due to data problems.
Source: Authors' calculations based on the micro data from the demographic censuses.

Table 2 (Cont.)
Income Shares and Ratios in Rural Areas

	Southeast			South			Center-West		
	1991	2000	Change	1991	2000	Change	1991	2000	Change
Income Shares by Decile									
1	0.01	0.00	-0.007	0.01	0.01	-0.004	0.01	0.00	-0.009
2	0.02	0.02	-0.002	0.02	0.02	-0.001	0.02	0.02	-0.005
3	0.03	0.03	0.000	0.03	0.03	0.000	0.03	0.03	-0.004
4	0.04	0.04	0.002	0.04	0.04	0.002	0.04	0.04	-0.003
5	0.05	0.05	0.002	0.05	0.05	0.003	0.05	0.04	-0.004
6	0.06	0.06	0.003	0.06	0.07	0.004	0.06	0.05	-0.005
7	0.08	0.08	0.003	0.08	0.08	0.003	0.07	0.07	-0.006
8	0.10	0.10	0.000	0.11	0.11	0.001	0.10	0.09	-0.009
9	0.15	0.15	-0.004	0.15	0.15	-0.002	0.14	0.13	-0.013
10	0.46	0.46	0.004	0.44	0.43	-0.006	0.48	0.54	0.058
Income Ratios									
Top 10 / Bottom 40	18	20		17	17		19	27	
Top 20 / Bottom 20	19	26		18	21		19	35	

Notes: Roraima has been excluded from the Northern and national statistics due to data problems.
Source: Authors' calculations based on the micro data from the demographic censuses.

Table 3: Growth in Average Income by Decile in Rural Areas

	Deciles									
	1	2	3	4	5	6	7	8	9	10
Brazil										
1991	9	19	26	33	42	53	68	92	134	426
2000	0	14	27	39	54	72	94	127	184	581
% Change	*-96*	*-24*	*6*	*18*	*27*	*35*	*37*	*39*	*37*	*37*
North										
1991	10	21	29	37	47	58	74	99	146	458
2000	0	7	21	32	43	56	74	99	148	475
% Change	*-100*	*-67*	*-27*	*-15*	*-9*	*-3*	*-1*	*0*	*1*	*4*
Northeast										
1991	8	15	20	25	31	38	47	60	84	245
2000	0	7	17	26	35	45	59	78	109	267
% Change	*-100*	*-56*	*-12*	*3*	*13*	*20*	*24*	*30*	*30*	*9*
Southeast										
1991	14	25	35	46	58	73	94	123	180	554
2000	8	34	52	70	89	112	143	181	258	821
% Change	*-43*	*34*	*47*	*53*	*53*	*53*	*52*	*47*	*43*	*48*
South										
1991	14	28	39	51	64	82	104	136	196	561
2000	14	42	62	83	107	136	170	217	305	870
% Change	*-3*	*51*	*60*	*65*	*67*	*67*	*64*	*59*	*55*	*55*
Center-West										
1991	16	30	41	52	65	80	101	131	188	653
2000	5	34	52	70	87	109	137	175	253	1080
% Change	*-70*	*12*	*29*	*36*	*35*	*35*	*36*	*34*	*34*	*65*

Notes: Roraima has been excluded from the Northern and national statistics due to data problems.
Source: Authors' calculations based on the micro data from the demographic censuses.

Table 4
Descriptive Statistics for Municipal-Level Rural Variables in Poverty, Income and Inequality Regressions[1]

Income Component	Mean	St. Dev.	Median	Min	Max
Change in Headcount Poverty Ratio	-0.15	0.13	-0.14	-0.85	0.84
Growth in Per Capita Income	0.50	0.66	0.40	-0.93	11.56
Change in Gini Ratio	0.05	0.11	0.05	-0.62	0.61
Growth in Population	-0.05	0.58	-0.10	-0.98	27.14
Initial (1991) Headcount Poverty Ratio	0.68	0.21	0.72	0.00	1.00
Initial (1991) Gini Ratio	0.48	0.09	0.47	0.00	0.90
Log Initial (1991) Population	8.48	1.01	8.51	3.31	12.97

Notes:
1. Because of changes in the official municipality structure between 1991 and 2000, municipalities are aggregated into "smallest comparable areas" or "AMCs" for the Portuguese initials. For simplicity, we refer to AMCs simply as "municipalities." All statistics are unweighted across municipalities. Means are simple, arithmetic means of county-level variables.
Source: Authors' calculations based on the micro data from the demographic censuses.

Table 5

Regression Results for Change in Rural Headcount Poverty Rate: 1991-2000[1]

	(1)	(2)	(3)	(4)	(5)
Changes in the variables[2]					
Income per capita	-0.09			-0.13	-0.11
	(10.42)**			(9.56)**	(9.39)**
Gini		0.12		0.46	0.54
		(5.11)**		(13.09)**	(14.78)**
Population			0.02	0.01	0.01
			(2.66)**	(2.08)*	(1.58)
Initial levels of the variables[3]					
Poverty					-0.33
					(21.05)**
Gini					0.19
					(7.45)**
Population					0.00
					(1.04)
Observations	4210	4210	4210	4210	4210
Adjusted R-squared	0.76	0.68	0.68	0.81	0.86

Notes:

1. All regressions include state dummies (not reported); robust t statistics in parentheses.
   * significant at 5%; ** significant at 1%.
2. Changes in income per capita and population are proportional changes (0.2 is 20% change).
   The change in the Gini is the change in the Gini ratio which ranges from 0 to 1.
3. The rate of poverty is measured by the headcount ratio, which ranges from 0 to 1.
   The natural log of initial population is the measure of initial population level.

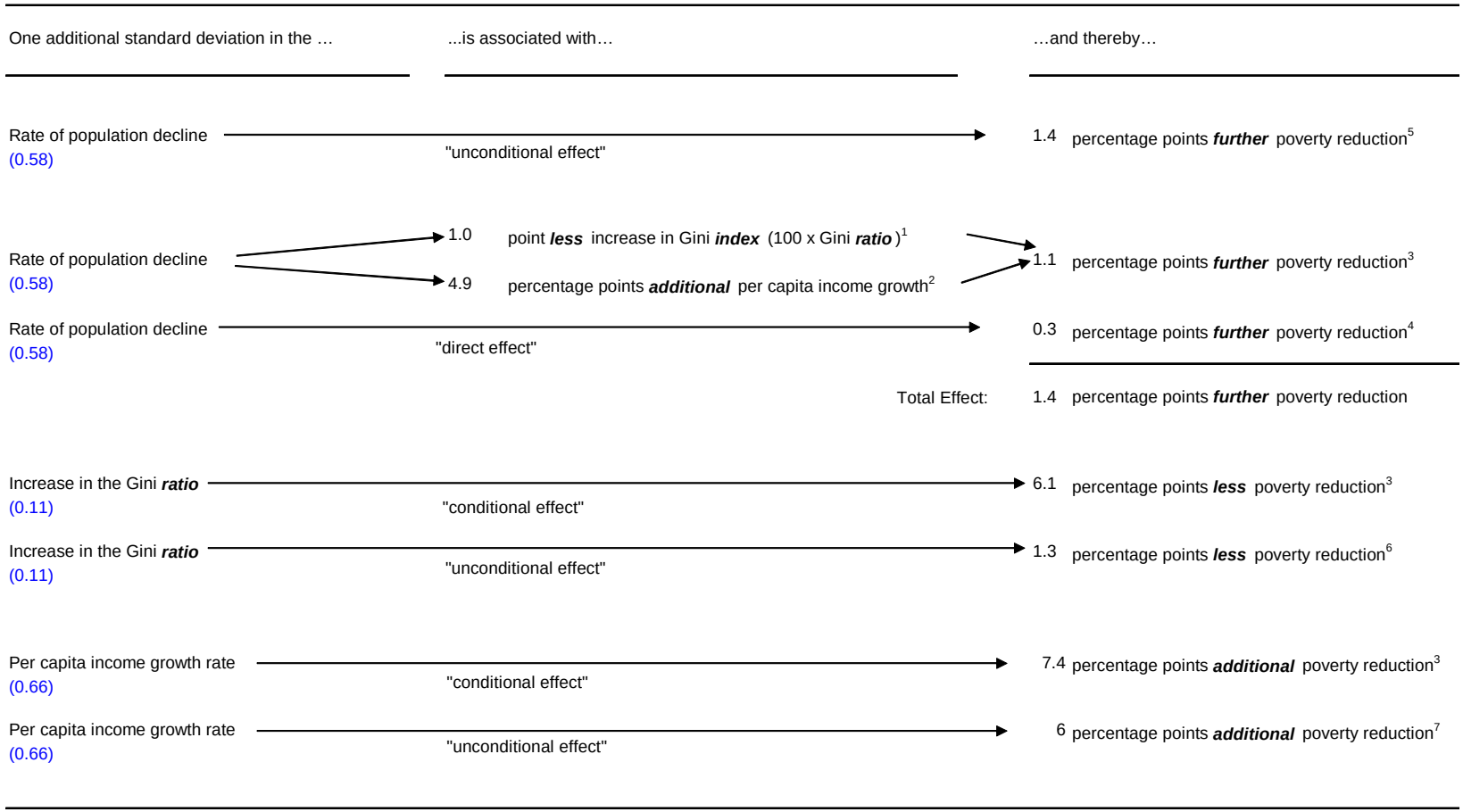
Table 6

Regression Results for Changes in Rural Gini and Rural Per Capita Income: 1991-2000[1]

	Change in Gini	Growth of Income Per Capita
	(1)	(2)
Changes in the Variables[2]		
Population	0.02	-0.08
	(3.22)**	(3.26)**
Income Per Capita	0.06	
	(11.44)**	
Gini		2.93
		(12.29)**
Initial Levels of the Variables[3]		
Population	0.02	-0.11
	(10.79)**	(7.76)**
Income Per Capita	0.00	-0.43
	(0.39)	(8.18)**
Gini	-0.69	1.25
	(35.90)**	(6.76)**
Observations	4210	4210
Adjusted R-squared	0.63	0.59

Notes:
1. All regressions include state dummies (not reported); robust t statistics in parentheses; * significant at 5%; ** significant at 1%.
2. Changes in income per capita and population are proportional changes (e.g. 0.2 is a 20% change). The change in the Gini is the change in the Gini ratio which ranges from 0 to 1.
3. The level of poverty is measured by the headcount ratio, which ranges from 0 to 1. The natural logs of initial population and income per capita are used for initial levels of these variables.

Figure 1
Comparative Statics for *County-Level Variations* Using Regression Coefficients From Tables 5 and 6



Notes:
1. Based on estimated coefficient from Table 6, Model 1.
2. Based on estimated coefficient from Table 6, Model 2.
3. Based on estimated coefficients from Table 5, Model 5.
4. Based on estimated coefficient on population growth in Table 5, Model 5.
5. Based on estimated coefficient from Table 5, Model 3.
6. Based on estimated coefficient from Table 5, Model 2.
7. Based on estimated coefficient from Table 5, Model 1.