A Robust Poverty Profile for Brazil Using Multiple Data Sources*

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This paper presents a poverty profile for Brazil, based on three different sources of household data for 1996. We use PPV consumption data to estimate poverty and indigence lines. "Contagem" data is used to allow for an unprecedented refinement of the country's poverty map. Poverty measures and shares are also presented for a wide range of population subgroups, based on the PNAD 1996, with new adjustments for imputed rents and spatial differences in cost of living. Robustness of the profile is verified with respect to different poverty lines, spatial price deflators, and equivalence scales. Overall poverty incidence ranges from 23% with respect to an indigence line to 45% with respect to a more generous poverty line. More importantly, however, poverty is found to vary significantly across regions and city sizes, with rural areas, small and medium towns and the metropolitan peripheries of the North and Northeast regions being poorest.

Este artigo apresenta um perfil de pobreza para o Brasil, com base em três diferentes pesquisas domiciliares de 1996. Nós usamos a PPV para estimar as linhas de pobreza e indigência. A Contagem Populacional é usada para permitir um refinamento inédito do mapa da pobreza do país. As medidas de pobreza também são

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apresentadas para um amplo conjunto de sub-grupos, com base na PNAD de 1996, com novos ajustamentos por aluguéis imputados e por diferenças espaciais de custo de vida. A robustez do perfil é verificada em relação a diferentes linhas de pobreza, deflatores espaciais de preço e escalas de equivalência. A incidência total da pobreza varia de 23% considerando a linha de indigência a 45% considerando uma linha de pobreza mais generosa. Mais importante, porém, é que a pobreza varia significativamente entre regiões e tamanhos de cidades, sendo mais pobres as áreas rurais, cidades pequenas e médias e as periferias metropolitanas das regiões Norte e Nordeste.

1. Introduction

If economic stability is sustained and macroeconomic conditions permit a gradual resumption of growth within the bounds of fiscal discipline, Brazil now faces a real opportunity to improve the living conditions of its poorest people. While economic growth will have to play an important part in that process, both international experience and the country's very high levels of inequality suggest the need for improving the effectiveness of public policy, and ensuring that services and transfers reach those in greatest need. This, in turn, requires that one knows who the poor are, where they live, and what their social and economic profile is.

Although distributional analysis of Brazil has generally been of a high standard, there are four reasons why we believe that the construction of this poverty profile is important. First, price stability since 1994; trade liberalization; and technical change in a number of sectors in the last few years are all likely to have had some impact on the distribution of income. Second, various expenditure surveys, notably the *Pesquisa sobre Padrões de Vida* (PPV) of 1996, suggest that price variations across this continent-sized nation are substantial.[1] Previous profiles have generally not accounted for these spatial price differences at all.[2]

[1]Brazil's latest decadal detailed expenditure survey of metropolitan areas, the POF 1996, broadly confirms the importance of these differences, even though, by construction, it can not measure cost-of-living disparities between metropolitan areas and the rest of the country.

[2]There are exceptions. For instance, Rocha (1993) used regional price deflators in describing the evolution of aggregate poverty measures. Her deflators were constructed quite differently from the ones we will use, as discussed below.

Third, previous analyses of the annual *Pesquisa Nacional por Amostra de Domicílios* (PNAD), Brazil's main rural-and-urban household survey instrument, failed to incorporate any values for imputed rent as part of the incomes of owner-occupiers, thereby introducing a substantial distortion into the measurement of their real living standards. While the PNAD is still short of best international practice in not including questions that permit such an imputation, we were able to 'predict' values as best we could, by means of an augmented hedonic price regression, as discussed below. Finally, we were also able to partition the set of non-metropolitan urban areas in Brazil by size more finely than has hitherto been the case. Whereas before large (non-metropolitan) cities like Campinas (SP) or Campos (RJ) were lumped in the same category as small towns of less than 20,000 inhabitants, we matched urban population data from the 1996 Semi-Census ('Contagem') to the PNAD, generating a finer partition which sheds considerable light on the structure of urban poverty in the country.

The remainder of the paper is organized as follows. The next section briefly describes our basic concepts and methodology and how the available data sets are used. In section 3, we present the detailed (cross-tabulation) poverty profile for Brazil, based on the nationally representative PNAD 1996 survey.[3] The analysis is carried out for the whole country, but focuses on urban areas, both metropolitan and non-metropolitan. The profiles of poverty are presented both across and within macro geographical regions, both in terms of subgroup-specific poverty measures and in terms of their contribution to total poverty. Section 4 presents the results of the partial profile analysis, based on probit regressions run on PPV 1996 data, which investigates the marginal effect of a number of household and personal characteristics on the probability of being poor. The probit regressions are also used for testing the robustness of the profile with respect to different income concepts and regional price deflation procedures. Section 5 then discusses some data-related concerns, which have become apparent when comparing results from the different surveys we have used. One important finding here is that, because of income measurement errors, traditional poverty statistics derived from PNAD data may be overestimates, particularly in rural areas. Section 6 summarizes and concludes.

[3]Although annual PNAD data is now available until 1999, use of the 1996 data enables us to benefit straight-forwardly from the PPV and the 'Contagem' data-sets, both of which also date from 1996. Poverty profiles, unlike scalar indices, do not generally change dramatically from one year to the next.

2. Data and Methodology

The basic welfare indicator used for constructing the poverty profile in section 3 is a transformation of the total household income (Y_i)[4] reported in the PNAD 1996. It is given by, $y_{ij} = \frac{Y_{ij}}{I_j n_i^{\theta}}$where household i lives in spatial area j, n_i is the number of members of household $i, \theta \in (0, 1)$ is the Buhmann et al. (1988) equivalence scale parameter, and I_j is the price deflator for spatial area j. The recipient unit is the individual, which is to say that the distribution analyzed is a vector of y, where y_i is entered n_i times.

Y_{ij} incorporates one important addition to the total household income variable reported in the original PNAD data set, namely a measure of imputed rent. This imputation, which is standard practice in household welfare analysis (See e.g. Deaton (1997) is meant to evaluate the monthly flow of rental services that house-owners derive from their housing stock. It is imputed only to households that report owning their houses (whether or not they own the land). Imputed values were derived by means of a two-step procedure: first a hedonic rental price model was estimated by means of a set of regressions of rents actually paid, on characteristics of both the rented dwelling and the renting household. These regressions were run on the PNAD subsample of households which reported the rent they paid for the dwellings in which they lived. Secondly, the parameters of these estimated models were applied to the characteristics of each individual house-owning household in the PNAD 1996, and used to predict its imputed rent, which was added at the household level, and henceforth formed part of its total income.[5]

The equivalence scale parameter is straightforward, and its usefulness to check the sensitivity of poverty or inequality estimates to different assumptions about economies of scale is well established (see Coulter et al. (1992); Ferreira and Litchfield (1996); and Lanjouw and Ravallion (1995). Much more problematic, in the case of Brazil, is the choice of a suitable spatial price deflator. Ideally, a spatial price deflator, like its temporal counterpart, seeks to approximate a true cost of living index, $\Gamma_j = \frac{E(p_j, \bar{u})}{E(p_R, \bar{u})}$, where $E(.)$ is the expenditure function, p_j is the vector of prices ruling in area j, $\bar{u}$ is a given level of utility and R is some reference area.

[4]Total household income Y_i is the sum of all labor and non-labor incomes, whether in cash or kind, across all members of household i, except for lodgers ("pensionistas"), domestic servants or their relatives. These individuals are also excluded from the denominator n_i. As discussed below, Y_i also includes imputed rent for the appropriate households.

[5]Imputed rent implied in an increase of average per capita income of 18.2% and a fall of FGT indexes P0, P1 and P2 of 16.1%, 21.9% and 26.3%, respectively (using the intermediary poverty line discussed below).

Any deflator used in practice is bound to be an imperfect approximation to Γ_j. Ravallion and Bidani (1994) argue for using a Laspeyres price index, constructed by fixing the vector of quantities for some reference area (in their case, a country average), and allowing the price vector to vary across all areas in the domain of the index. Others have pointed out that this method has a tendency to underestimate real incomes, by failing to account for the substitution effects of changes in relative prices over space.

In addition, the issue is complicated in Brazil by the availability of three separate expenditure surveys, each of which generates different quantity and (implicit) price vectors, and each of which has its own advantages and disadvantages. The ENDEF was carried out in 1974. Its main advantage is that it was the last truly comprehensive expenditure survey carried out in Brazil, including urban and rural areas all across the country. Its main disadvantage is obvious: prices and consumption patterns have changed substantially in the last 25 years. The *Pesquisa de Orçamentos Familiares* (POF) is the ENDEF's main successor. It is carried out in ten-year intervals, but only for eleven metropolitan areas. The last wave dates from 1996. Its main advantage is that the consumption questionnaire is highly disaggregated (approximately 1300 foodstuff items per household).[6] Its main disadvantage, for a national analysis, is its limited geographical coverage.

Finally, the PPV was conducted for the first time in 1996, covering urban and rural areas in the Northeast and Southeast regions only. Its main advantage is that it is the most recent expenditure survey available which covers the country's non-metropolitan areas. It also has the most detailed questionnaire on issues of incidence of government programs.[7] Its main disadvantages are its restricted regional coverage, and the relatively aggregated nature of its consumption questionnaire.

Based on each of these surveys, or on combinations of them, a multitude of different price deflators could be constructed, each yielding potentially different distributions of real income for the country. Additionally, the various different data sources could be used to construct true price indices (as in Ravallion and Bidani, 1994) or, alternatively, cost of living indices where quantities are allowed to vary, in order to capture the substitution effects implicit in each region's actual

[6]See Lanjouw and Lanjouw (1996) for a discussion of the effects of changes in the degree of aggregation in expenditure surveys, on poverty measurement.

[7]See World Bank (1998) for a detailed analysis of public expenditures and their incidence in the Brazilian Northeast, based on PPV data.

expenditure patterns (as in Rocha (1993)). In order to overcome the possible ambiguity resulting from these different approaches, we tested the sensitivity of the poverty profile with respect to variations in the spatial price deflator.

To do so, we generated a parametric class of deflators, based on PPV expenditure and implicit price data. The class of indices is given by : $I_{\alpha j} = \sigma I_+ + (1-\sigma) I_-$ where $I_+ = \sigma_F \frac{q_+ p_j}{q_+ p_+} + \sigma_H \frac{\pi_j}{\pi_+}$ and $I_- = \sigma_F \frac{q_- p_j}{q_- p_-} + \sigma_H \frac{\pi_j}{\pi_-}$ and α can take any arbitrary value in $[0, 1]$. σ_F is the food share in housing and food expenditure, and σ_H is the corresponding housing expenditure share. p and q are food price and quantity vectors in the regions they are indexed by. The quantities are averages of the consumption quantities for each commodity reported by deciles $2-5$ in each region, and the prices are the implicit prices (or unit values) for those deciles.[8] π is a housing cost analogue for the same deciles in each region. All of these are taken from the PPV data set. In order to make the parametric class of deflators I_α a suitable instrument to test for the robustness of the profile with respect to different reference consumption bundles, the reference regions indexed by - and + are chosen so as to maximize the differences in relative prices between them.

They are chosen so that (p_-, p_+) solve the following algorithm: $\min \rho(p_i, p_j)$ over $S = \{p_k\}, \forall k$. Rho is the Pearson correlation coefficient. This program simply entails choosing the two areas, within the ten areas surveyed by the PPV, which display the least correlated price vectors. In addition, we also examined the profile based on nominal incomes, i.e. the controlling case of no regional deflation: with $I_j = 1, \forall j$.

The ten areas surveyed by the PPV are: (1) Metropolitan Fortaleza; (2) Metropolitan Recife; (3) Metropolitan Salvador; (4) other urban areas in the Northeast; (5) rural areas in the Northeast; (6) Metropolitan Belo Horizonte; (7) Metropolitan Rio de Janeiro; (8) Metropolitan São Paulo; (9) other urban areas in the Southeast; and (10) rural areas in the Southeast. The correlation coefficients between price vectors for each pairwise combination of these ten regions are given in table 1 below.

[8] In line with current practice (see Deaton, 1997), we use actual consumption data rather than the solution to a cost-minimizing linear program, both to weigh prices and to construct the poverty line. These weights can better reflect the constrained choices made by consumers. The consumption basket from the poorest tenth of the population is excluded because it represents consumption patterns observed under extreme hardship. The next four deciles are used so as to provide the consumption pattern of the (less extreme) poor.

Table 1
Correlation Coefficients across region-specific price vectors, from the PPV (1996) survey

	Fortaleza	Recife	Salvador	NE urb	NE rur	RM B.H.	RM Rio	S. Paulo	SE urb	SE rur
Fortaleza	1.000									
Recife	0.8581	1.000								
Salvador	0.9302	0.7321	1.000							
NE urban	0.9594	0.8805	0.9229	1.000						
NE rural	0.9593	0.8814	0.9143	0.9846	1.000					
RM B.H.	0.9050	0.6761	0.8559	0.8656	0.8513	1.000				
RM Rio	0.8468	0.8153	0.7772	0.8694	0.8268	0.8654	1.000			
S. Paulo	0.8969	**0.6239**	0.8580	0.8526	0.8453	0.9318	0.7985	1.000		
SE urban	0.9324	0.7992	0.8542	0.9240	0.8956	0.9591	0.9234	0.9205	1.000	
SE rural	0.9063	0.8360	0.8258	0.9163	0.8832	0.9326	0.9371	0.8582	0.9849	1.000

As table 1 indicates, p_- turns out to be the price vector for the metropolitan area of Recife, and p_+ is the price vector for the metropolitan area of São Paulo.[9] In general, once one such index is computed (for a given α) for each of the ten regions, we have deflators for all households located in the NE and SE regions in the PNAD. Unfortunately, as noted above, the PPV does not survey the other three regions of the country. We deflate household incomes in those regions by mapping I_j s as follows:

1. Average for the three metropolitan areas in the NE → Each metropolitan area in the North.
2. Other urban areas in the NE → Other urban areas in the North.[10]
3. Average for the three metropolitan areas in the SE → Each metropolitan area in the South.
4. Other urban areas in the SE → Other urban areas in the South.
5. Rural areas in the SE → Rural areas in the South.
6. Average for all metropolitan areas in the NE and SE → Each metropolitan area in the Center-West.
7. Average of other urban areas across the NE and SE → Other urban areas in the Center-West.
8. Average of rural areas across the NE and SE → Rural areas in the Center-West.[11]

[9] Note that the correlation coefficient is insensitive to price *levels* by construction, so that the two metropolitan areas have the most different *relative* prices, not *absolute* price levels.

[10] The PNAD does not survey rural households in the North region, for cost-related reasons. We therefore do not need a spatial price deflator for that area.

[11] These are unweighted averages.

This would give us a complete set of price deflators (for any given α), with which to adjust the entire PNAD household income distribution to take spatial price differences into account. Furthermore, by varying α in the interval $[0, 1]$, thereby constructing convex combinations of the two price indices based on the reference regions with the least correlated price vectors, we could test the robustness of the poverty profile — or indeed of any poverty or inequality measure — with respect to changes in the choice of price deflator.

In the event, this procedure turns out to be unnecessary for the case of Brazil. I_- and I_+ themselves, given in table 2 below, turn out to be very closely correlated. In particular, the ranking of the 10 PPV areas by poverty headcount with respect to the lower bound poverty line (see below) is identical for both of them. In this light, and in order to avoid the presentation of an unmanageable number of profile tables, the analysis presented below is based exclusively on the São Paulo-based regional price index (I_+). Clearly, given the information in table 2, the matrix $I_{\alpha j}$ can be constructed for $J = \{j\}$ and for any values of $\alpha \in [0, 1]$.

Table 2
Regional Price Indices based on the Recife and São Paulo baskets.

PPV 'Region'	I_-: The Recife-based index	I_+: The São Paulo-based index
RM Fortaleza	1.004451	1.014087
RM Recife	1.000000	1.072469
RM Salvador	1.234505	1.179934
Northeast Urban	1.085385	1.032056
Northeast Rural	0.931643	0.953879
RM Belo Horizonte	1.043125	0.958839
RM Rio de Janeiro	1.094239	1.002163
RM São Paulo	1.120113	1.000000
Southeast Urban	0.995397	0.904720
Southeast Rural	0.985787	0.889700

Once one of these price indices (and a value for θ) is chosen, a vector of regionally deflated, equivalised household incomes is defined and ready for distributional analysis. Inequality measures can be immediately computed. For poverty analysis, however, a poverty threshold needs to be defined, so as to identify the poor. Following standard practice, we adopt a set of three poverty lines, to check the robustness of the profile to variations in the specific line chosen. Since we have deflated the incomes by a spatial price index, and taken household economies of scale into account, we do not need region — or household type-specific lines. All three lines are expressed in 1996 reference region (metropolitan São Paulo) prices. These are:

- An indigence line, equal to the cost of the 'minimum food basket' in the reference region: $\varsigma = p_R q_R^*$, where q_R^* is the same vector q_R of average consumption bundles for deciles 2–5 in reference region R, scaled up to yield a caloric intake equal to the FAO minimum intake of 2,288 calories per day.[12] This line is equal to R$ 65.07.

- A lower-bound poverty line, which scales up the cost of the minimum food basket to take into account the non-food expenditures of those people whose total incomes would just allow them to purchase that minimum food basket. I.e. $z^- = \frac{\varsigma}{\epsilon_L}$, where ϵ_L is the Engel coefficient for households whose total income is equal to the indigence line. This line is worth R$ 131.97 and we treat it as our main, 'headline' poverty threshold.

- An upper-bound poverty line, which scales up the cost of the minimum food basket to take into account the non-food expenditures of those people whose actual food expenditures equal the cost of the minimum food basket. I.e. $z^+ = \frac{\varsigma}{\epsilon_U}$, where ϵ_U is the Engel coefficient for households whose total food expenditure is equal to the indigence line. This line is equal to R$ 204.05. While profiles were computed with respect to this line as well, it yields very high headcounts (62% for Brazil as a whole) and is thus less useful for profiling. To save space, detailed profiles are not presented for this poverty line, although results are available from the authors on request.

Since our identification methodology relies on comparing a vector of spatially deflated incomes with a single poverty line, it is crucial that the poverty line be expressed in the same 'currency unit' as the income vector — i.e. in the 1996 prices ruling in the reference region (metropolitan São Paulo). If the price deflator changed, the poverty lines should change in tandem, by adopting the new reference region's price vector, and scaling up its quantities vector to yield the desired caloric intake.

3. The 1996 Poverty Profile: Cross-Tabulations

Table 3 below summarizes the results of the poverty profile cross-tabulations constructed from the adjusted PNAD data set discussed in section 2, for Brazil as a whole. As stated above, the Table is based on household income vectors spatially deflated by the São Paulo-based price index ($I+$), and for $\theta = 1.0$. Table

[12] This figure is the exact caloric recommendation for metropolitan São Paulo, according to IBGE/IPEA, 1998, table 1.

3 measures poverty with respect to the main (lower-bound) poverty line ($z-$ = R$ 131.97). Table A.1 in the Appendix does so with respect to the indigence line (ζ = R$ 65.07). Identical profiles were constructed for the upper-bound poverty line (z^+), and these can be obtained from the authors on request. Since poverty in Brazil, when measured with respect to that line, is too high to be of much use in identifying the neediest, as well as due to space constraints, it is not included here.

In each table, for each population subgroup defined by columns 1 and 2, columns 3–8 contain, respectively, its population share f_k; its mean income $\mu(y)_k$; its headcount poverty index $P0_k(FGT(0))$; its normalized poverty deficit $P1_k$ $(FGT(1))$; its progressively weighted poverty deficit $P2_k(FGT(2))$; and its contribution to (or share in) total poverty s_k.[13]

Table 3
Poverty Profile 1996: Brazil , $z = z^-$ (R$ 131.97/month), $I = I_+$,$\theta = 1.0$

Household Characteristics	Subgroups	f_k	y_k	P_{0k}	P_{1k}	P_{2k}	s_k
	Total	100.00	283.86	45.29	22.30	14.08	100.00
Region	North	4.84	191.96	60.35	29.44	18.20	6.45
	North-East	29.59	135.37	74.86	43.16	29.50	48.91
	Center-West	6.81	282.75	44.66	18.81	10.57	6.72
	South-East	43.59	380.40	27.70	10.86	5.91	26.67
	South	15.17	325.91	33.60	13.76	7.71	11.25
Location	Metropolitan Core	17.63	498.29	23.20	8.90	4.72	9.03
	Metropolitan Periphery	12.14	300.41	32.14	12.21	6.48	8.62
	Large Urban	18.89	365.02	30.08	11.80	6.26	12.55
	Medium Urban	15.69	271.24	41.71	18.50	10.72	14.45
	Small Urban	15.02	173.80	59.45	29.86	18.76	19.72
	Rural	20.63	106.38	78.21	46.68	32.83	35.64
Dependency Ratio*	1	9.99	630.69	7.81	1.44	0.49	1.72
	$1 < d \leq 1.5$	14.60	410.76	19.95	5.60	2.23	6.43
	$1.5 < d \leq 2$	22.40	326.78	33.06	11.52	5.41	16.35
	$2 < d \leq 3$	21.85	211.86	52.72	23.42	13.10	25.44
	$3 < d \leq 4$	13.61	184.66	60.37	30.67	19.04	18.14
	$d > 4$	15.31	100.81	80.51	50.77	36.50	27.22
	Other	2.25	37.83	94.67	75.37	64.50	4.70
	Not Specified						
Housing Status	Own House, Paid, with Own Land	63.76	288.74	45.08	22.12	13.95	63.47
	Own House, Paid without Own Land	5.60	148.08	67.86	38.61	26.64	8.38

[13]The three poverty measures used in this paper are discussed in Foster et al. (1984).

	Own House, Still Paying	6.06	440.54	20.94	7.34	3.53	2.80
	Rent	12.23	366.34	30.16	12.06	6.55	8.14
	Ceded	11.70	160.54	63.28	33.60	21.94	16.35
	Other	0.50	172.71	58.38	26.64	15.79	0.65
	Not Specified	0.15	216.01	58.68	31.34	20.76	0.20
Water	Piped	81.59	332.35	35.44	14.67	8.15	63.86
	Not Piped	18.26	67.83	89.14	56.33	40.51	35.94
	Other	0.15	207.79	59.83	31.77	20.97	0.20
	Not Specified						
Sanitation	Sewerage System	37.84	442.21	21.62	7.46	3.64	18.06
	Concrete Cesspit 1	10.19	388.72	24.25	8.30	4.12	5.46
	Concrete Cesspit 2	12.84	235.26	46.19	19.55	10.90	13.10
	Rudimental Cesspit	22.67	145.50	65.87	33.05	20.59	32.98
	Drain	1.98	112.58	72.38	38.38	25.12	3.17
	River or Lake	2.75	164.73	57.20	25.63	14.81	3.47
	Other	0.19	141.04	70.49	36.59	23.03	0.30
	Not Specified	11.52	57.68	92.21	61.52	45.67	23.46
Electricity	Yes	91.93	303.66	41.21	18.84	11.26	83.65
	No	7.91	55.10	92.45	62.31	46.71	16.14
	Other	0.16	212.15	57.64	30.49	19.99	0.21
	Not Specified						
Waste Disposal	Collected Directly	63.26	373.41	28.73	10.88	5.70	40.13
	Collected Indirectly	7.36	257.20	47.98	21.86	12.75	7.80
	Burned	14.35	112.50	75.95	42.51	28.52	24.06
	Unused Plot of Land	13.23	79.32	85.33	52.33	37.14	24.93
	Other	1.80	115.39	77.23	43.48	29.26	3.07
	Not Specified						

Characteristics of the Head	Subgroups	f_k	$\mu(y)_k$	P_{0k}	P_{1k}	P_{2k}	s_k
Gender	Male	82.26	282.64	45.62	22.79	14.53	82.86
	Female	17.74	289.52	43.75	20.04	11.98	17.14
Race	Indigenous	0.17	168.69	66.69	41.66	30.89	0.25
	White	54.27	384.04	31.08	13.50	7.96	37.24
	Black	45.07	159.79	62.59	32.97	21.48	62.30
	Asian	0.46	671.79	15.64	6.23	3.29	0.16
	Not Specified	0.02	89.60	85.41	50.34	35.15	0.04
Age	0–24	3.97	188.88	55.75	27.02	16.68	4.89
	25 to 44 Years	48.40	268.02	47.09	23.85	15.40	50.33
	45 to 64 Years	36.43	305.75	43.04	21.36	13.50	34.63
	>65 Years	11.20	314.79	41.06	16.98	9.28	10.15

Education	0 – 1 Years	21.86	104.48	75.00	42.29	28.63	36.20
	1 to 4 Years	20.03	150.86	61.51	31.75	20.51	27.21
	4 to 8 Years	30.10	230.49	41.04	17.31	9.84	27.28
	8 to 12 Years	20.56	394.59	19.82	7.03	3.56	9.00
	> 12 Years	7.45	1077.98	1.91	0.56	0.24	0.31
Immigration Status	Not Immigrant	40.56	258.16	52.56	28.35	18.89	47.08
	0 to 5 Years	7.51	270.34	46.60	21.95	13.35	7.72
	6 to 9 Years	4.25	262.61	47.43	21.42	12.65	4.45
	More Than 10 Years	28.87	295.57	40.90	18.54	11.06	26.08
	Other Not Specified	18.81	331.48	35.32	15.36	8.95	14.67
Labor Status	Inactive	17.70	279.16	43.39	19.70	11.75	16.96
	Unemployed	2.77	131.51	71.27	41.48	28.85	4.36
	Formal Employees	23.31	292.55	34.62	13.18	6.81	17.82
	Informal Employees	13.30	162.34	64.72	34.15	21.96	19.01
	Self-Employed	27.00	235.64	52.76	28.62	19.21	31.45
	Employer	4.76	781.14	13.64	5.58	3.27	1.43
	Public Servant	8.73	422.27	26.99	11.32	6.27	5.20
	Unpaid	2.39	139.04	70.00	43.75	32.69	3.70
	Other Not Specified	0.04	124.31	70.91	53.32	43.19	0.07
Employment Tenure	0 Years	20.47	259.16	47.16	22.65	14.07	21.32
	1 Years or More	13.04	215.60	51.76	24.74	15.19	14.90
	1 to 3 Years	14.65	260.42	44.79	20.42	12.12	14.49
	3 to 5 Years	8.23	301.52	41.10	18.80	11.21	7.47
	> 5 Years	43.19	322.23	43.16	22.53	14.82	41.17
	Other Not Specified	0.42	134.50	70.08	39.99	27.80	0.66
Sector of Occupation	Agriculture#	19.61	117.00	77.39	46.75	33.00	33.51
	Manufacturing	12.15	310.39	35.50	16.00	9.50	9.52
	Construction	8.04	200.47	48.94	20.74	11.56	8.69
	Services	31.50	373.11	31.98	12.74	6.88	22.24
	Public Sector	8.23	443.76	25.89	10.57	5.75	4.70
	Other Not Specified	20.47	259.15	47.17	22.65	14.07	21.33

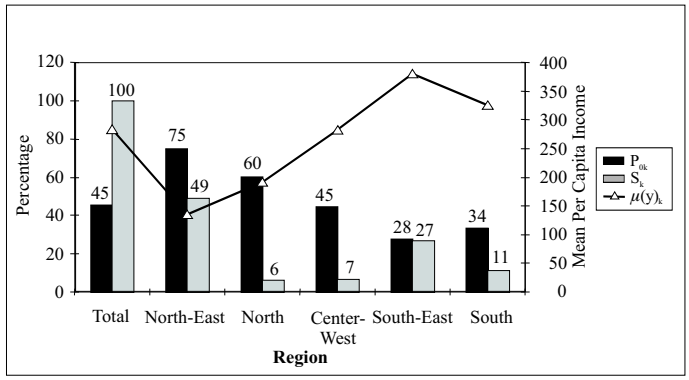
Notes: $S_k = \frac{f_k P_{0k}}{P_0}$. Dependency ratio is defined as the number of household members over the number of earners in the household. # Agriculture includes other Primary Sector occupations.

Table 3 contains a substantial amount of descriptive information. We discuss it under three main headings: the spatial profile; characteristics of the head; and housing and access to services.

The Spatial Profile

Poverty in Brazil still varies rather dramatically by region. In terms of all three FGT indices, the Northeast is the poorest region, followed by the North, the Center-West, the South and the Southeast, in that order. Given the large differences in overall population shares, the composition of poverty is biased towards the more populous Southeast. Still, the Brazilian Northeast, with some 30% of the country's population, accounts for nearly half of the poor and, as table 8 shows, for an even greater proportion (62%) of the indigent. Figure 1 summarizes the regional headcounts and their contribution to total poverty. The right hand scale measures mean incomes in each region, as given by the triangles.

Figure 1

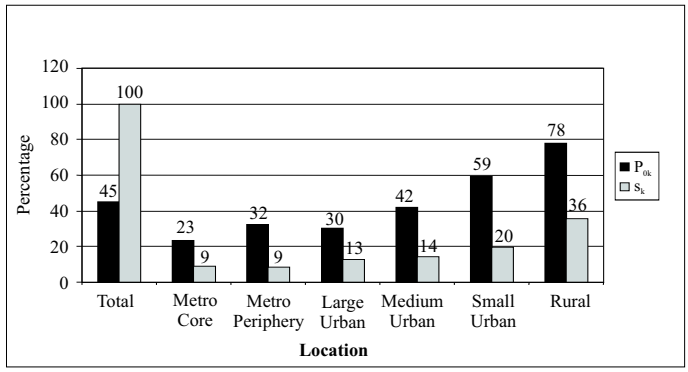


While these regional results simply confirm the persistence of a well-known pattern, more novel results were found about how poverty varies from rural to urban areas and across urban areas, when the latter are disaggregated by size, and metropolitan areas are divided into core and peripheric areas.[14] The findings

[14]To our knowledge, it had not previously been possible to partition urban areas in this way, since PNAD's own classification is coarser. We classified metropolitan households as 'core' if they lived in the main municipality of the metropolitan area (that which gives it its name); and 'periphery' if they lived in any urban segment of any other municipality in the metropolitan

confirm that rural areas are the poorest in the country (with a headcount of 78%).[15] But they also reveal substantial variation across urban areas by size, with all poverty measures decreasing monotonically with city size, except for metropolitan peripheries, which are both always poorer than their cores, and generally roughly as poor as other large urban areas. In terms of the composition of total poverty, rural areas still account for some 36% of all poor people (and 52% of the indigent). Small urban areas account for roughly a fifth, while the combined metropolitan areas cover some 18%. Medium and large towns have the lowest share of poor people. Figure 2 below brings this out sharply.

Figure 2



The policy implications of this disaggregation of urban poverty are not insubstantial. In the first place, poverty incidence is far higher in small and medium towns than in the metropolitan regions, and policies to combat urban poverty should be targeted accordingly. The common view of placid country-side towns as idyllic when compared to the peripheries of large cities appears to be wide of the mark, and any comprehensive strategy for poverty reduction must focus both on rural areas and on small and medium-sized towns. Second, poverty incidence

area. For other urban areas, 'small' are those with less than 20,000 inhabitants; 'medium' have a population between 20,000 and 100,000; and 'large' are greater than 100,000, but not classified as metropolitan.

[15] Readers are referred to section 5, where we highlight important caveats about rural income data, and suggest that our rural poverty figures are likely to be overestimates. Does this mean that rural poverty is actually lower than reported on all the tables in this paper? Probably. Does it then mean that it is likely to be lower than urban poverty? Probably not, but we can't be sure. Does it mean that Brazil needs better rural living standards data? Yes.

within metropolitan areas is higher outside the central municipality. Not only is poverty in metropolitan areas less severe than in smaller towns, but it must be combated beginning from their outlying peripheries.

Characteristics of the Household Head

Turning now to population partitions based on characteristics of the household head, we find first that male- and female-headed households do not really differ in the extent to which they are likely to be poor. This is not as surprising as might appear, and confirms previous findings for Brazil and other developing countries.[16] It should not, however, be taken to mean that the 'average welfare' of men and women in Brazil is roughly the same. This comparison relies on the (narrow) concept of household headship, and says nothing about gender wage gaps in the labor market, or indeed about the intra-household distribution of resources. On both of these important areas, there is evidence to suggest that women may fare less well than men.[17]

Race seems to matter a great deal more. The mean income in black-headed households is 42% of that in white-headed households, and only 24% of that for Asian-headed households. The ratios are very similar for indigenous-headed households. As a result, the headcount for black-headed households, at 63%, is roughly double that for whites, and four times that for Asians. Despite being a (large) minority, black-headed households account for 62% of all poor people in Brazil (ranging from 24% in the South, to 78% in the North). This leaves no room for doubt that the small Asian minority and the white majority are, on average, at a considerably smaller risk of poverty than their black or indigenous counterparts in Brazil. However, the probit analysis discussed in the next section reveals that the marginal effect of race is statistically insignificant when one controls for other relevant variables, such as years of schooling, region, family size and composition. The conclusion must be that, while there is no doubt about the (descriptive) average association between race and poverty, further work is needed to establish the mechanisms through which race affects household welfare outcomes. It is quite likely that some of it operates through educational attainment or demographic

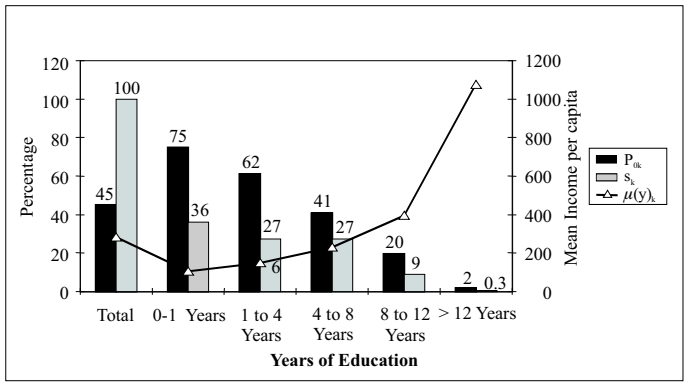
[16] See Ferreira and Litchfield (2001) and Neri and Camargo (2002) on inequality decompositions for Brazil, and Quisumbing et al. (1995) on welfare comparisons across male- and female-headed households for a sample of developing countries.

[17] See Deaton (1989) on a pathbreaking investigation of intra-household resource allocation, and Amadeo et al. (1994) on the level of and changes in the gender gap in the Brazilian labor market.

choices, but labor market and other forms of discrimination can certainly not be ruled out.

The age of the household head displays a small but perceptible (unconditional) correlation with poverty incidence. The latter declines monotonically with age, according to the partition in Table 3. Perhaps the most interesting part of this association, which is otherwise in line with conventional wisdom on labor market returns to experience (often proxied by age), is that it persists for household heads older than 65. These households have the highest mean income of any age group. Since this profile is based on current incomes, this seems to contradict the permanent income hypothesis implication that these older households should be earning less and dissaving into their retirement years. This may reflect a higher life expectancy among richer people; or indeed an excessively generous (and regressive) pension system in operation.[18]

Figure 3



As usual, the most significant (inverse) correlate of poverty is the education of the household head. As Table 3 and Figure 3 below indicate, household income rises monotonically and in a convex fashion with the years of schooling of the household head. Per capita income in a household headed by someone who entered (never mind finished) university is on average ten times larger than that in a household headed by someone with 0-1 year of schooling. Consequently, while the latter household has a 75% probability of finding itself below the poverty line, the former has a 2% probability. Given Brazil's poor record of educational attainment,

[18]See Neri, M. et all. (1999), Neri (2001), Hoffman (2001) and Bourguignon et al. (2002) on the incidence of Brazilian retirement pensions.

some 42% of the population (and some 63% of the poor) live in households whose heads have 4 or fewer years of education.

For Brazil as a whole, a household head's immigrant status is not a particularly strong correlate to their probability of being poor, although those who have not immigrated do seem to be a little likelier to be poor, on average. This picture changes considerably across regions however: in the Northeast, where immigration is often an important survival choice, the headcount of those who have never migrated is 81%, versus 68% for those who migrated more than 10 years ago. Across all regions, one does observe the pattern that those who migrated 10 years ago or more are least likely to be poor. In some, the 'natives' (those who never migrated) are poorer than those who migrated between 1 and 9 years ago (like the Northeast), and in others they are richer (like in the South).

As regards labor status, the unemployed and the informal employees ('sem carteira') have the highest headcounts, followed by the self-employed. Formal employees ('com carteira') are roughly half as likely to be poor (35%) as their informal counterparts (65%). Although poverty among the unemployed records the highest values for all three poverty measures, the labor category contributing the largest share of overall poverty is that of the self-employed, since they are ten times as numerous in Brazil as the unemployed (in 1996). This poverty incidence and severity profile by labor status confirms that recent increases in unemployment are a serious cause for concern about poverty and welfare among the households of those affected. However, the numerical predominance of self-employed workers, allied to the fact that they too are likely to suffer from reductions in aggregate demand, should serve as a reminder that they should not be neglected in the design of safety nets and other remedial policies.

The figures for sector of occupation reveal, once again, the prevalence of poverty among agricultural workers.[19] Among predominantly urban sectors, construction has poorer workers than both manufacturing and services. Public sector workers and employers are, on average, least likely to see their households in poverty.

Housing Characteristics and Access to Services

This part of the profile is clearly even less amenable to any causal interpretation. It is intended merely to describe some of the living conditions of the poor, as compared to the non-poor. Housing status, for instance, provides an

[19] Although, once again, the reader is reminded that poverty rates for agricultural workers are likely to be overestimated due to faulty data collection. See section 3.

interesting insight into the Brazilian housing market. Unlike in many developed countries, where poorer households rent, and the richest ones own houses outright, the highest mean incomes in Brazil are amongst those who rent and those who pay mortgages. The lowest mean incomes are those for households living in 'ceded' housing[20] (some 12% of the population), and those who own their houses, but not the land they are built on. The headcounts in these two categories is between 60% and 70%.

However, given their population share, the vast majority of those counted as poor in table 7 (63% of them) own both their houses and the land on which they stand. This confirms the anecdotal evidence of middle-class households renting flats in the fashionable Jardins neighborhood in São Paulo, or in Rio's 'Zona Sul', while their domestic servants may own a house in a distant part of the metropolitan periphery. The latter may often have been built through a community effort ('mutirão'), using second-rate materials, and with facilities which are considerably less comfortable. But they and the plot of land they are in are owned by the residents. Whether this reflects different preferences, or capital and land market failures, which prevent the poor from accessing either the mortgage or the mainstream rental markets, must remain a matter for further study.

As for access to services, 18% of the Brazilian population (36% of the poor) do not have access to piped water. Only 18% of the poor (versus 38% overall) dispose of their sewage through the main sewerage system. The remaining 82% use alternative means, such as cesspits, drains or direct dumping on river or lakes. 16% of poor households have no access to electricity, as compared to 8% of the total population. And a full 49% of the poor dispose of their garbage by either burning it or dumping it in an unused plot of land. The policy implications from this paragraph dispense with detailed spelling out.

A profile which is exactly analogous to the one just presented, but computed with respect to the indigence line (ς) of R$ 65.07 per person per month, is presented in table A.1 in the Appendix. The broad patterns of the profile (though clearly not the values of the poverty measures) do not change much across the two poverty lines. The main features of table A.1 have already been incorporated into the above discussion.

[20] 'Ceded' housing is an arrangement predominant in some types of agricultural contracts and among domestic servants.

4. The 1996 Poverty Profile: An Analysis of Marginal Effects

While the cross-tabulations presented in the previous section are informative, they have two shortcomings. First, the simple associations between personal characteristics and different measures of poverty are essentially bivariate, and do not control for the effects of other variables. Second, the long tables are not wieldy to test the robustness of the profile with respect to changes in spatial price deflation or in the assumptions about scale economies within households, which was one of the advantages of the methodology proposed in section 2. We therefore conduct the robustness tests in a 'marginal effect' version of the profile, given by simple transformations of a probit model, regressing the probability of being poor on the relevant household characteristics which were used in the cross-tabulations.[21] In this exercise, poverty statistics are computed from income data in the PPV sample, and all covariates come from the same source.

These profile probit regressions are intended to be merely descriptive, and no inference of causation whatsoever is made. The transformed coefficients should be seen only as estimates of partial correlation coefficients with the probability of being poor. The vector of independent variables X includes the following household variables: regional location; some housing characteristics, access to water, electricity and telephones, and the following attributes of the household head: gender, age, race, years of schooling and labor status. The coefficients β are then transformed into marginal effects of a change in the relevant element of X on the probability of being poor, dF/dx. These are tested for statistical significance using standard errors which are adjusted for the clustering process inherent in the sampling procedure. The marginal effects and their p-values for the preferred regression (with the São Paulo price index, and $\theta = 1$) are reported in table 4.

Table 4 contains a number of interesting results. First, controlling for the other variables included, household size has a significant positive and concave effect on poverty. Large households do appear likely to be poorer, controlling for other attributes, although the relationship is concave in family size. Similarly, the proportion of children is positively correlated with poverty, and more strongly so for younger children. No such significant correlation is found for the proportion of over-65s in the household. These results are robust not only to different price deflation procedures but also, more interestingly, to changing the house-

[21] As θ varies, we scale the poverty line up by a factor equal to $\bar{n}^{1-\theta}$, where $\bar{n}$ is the average household size, so as to keep the overall poverty incidence rate constant for households with the average household size. This allows us to compensate for the pure size effect of the adjustment to the income effect, while preserving the re-rankings which are an important part of the exercise.

hold equivalence scale parameter θ to 0.75. In that regression, household size remained positive, concave and significant, and the results for children and the elderly were unchanged. Only when the probit was run for an income vector adjusted by $\theta = 0.50$, did we observe a reversal in the sign of the marginal effect of household size, which then became insignificant. This suggests that, unless there are reasons to suppose that economies of scale within Brazilian households are greater than those implied by a theta in the (0.7, 1.0) range, the stylized fact that larger households are poorer, controlling for other attributes, survives scrutiny. Our findings also suggest that a larger number of children is correlated with a greater probability of being poor, while the same is not true of a larger number of older people.

Table 4
Probit Analysis Results, $z = z^{-}$ =R$131.97, $I = I_{+}, \theta = 1.0$

Variable	dF/dx	$P > \|z\|$	Variable	dF/dx	$P > \|z\|$
Demographic variables					
Household size	0.0838	0.000	Proportion of HH aged 5–15	0.4635	0.000
Household size^2	−0.0035	0.002	Proportion of HH aged > 65	0.0050	0.949
Proportion of HH aged < 5	0.7788	0.000			
Characteristics of Household Head					
Age	0.0050	0.204	Mulato dummy	0.0157	0.490
Age^2	−0.0001	0.176	Indigenous dummy	0.1870	0.183
Years of schooling	−0.0229	0.000	Self-employed dummy	0.0970	0.153
Female dummy	−0.0038	0.882	Unemployed / Unpaid	0.0688	0.300
Black dummy	−0.0304	0.445	Employee	−0.0530	0.368
Housing Characteristics and Access to Services					
Dirt floor in house	0.1226	0.011	Piped Water	−0.1129	0.001
# Bedrooms	−0.0676	0.000	Electricity	−0.1374	0.008
Dirt Road outside	0.0178	0.494	Phone	−0.2281	0.000
Favela dummy	0.0648	0.114			
Regional Dummies					
RM Fortaleza	0.3603	0.000	RM B. Horizonte	0.1249	0.002
RM Recife	0.5325	0.000	RM Rio	0.1973	0.000
RM Salvador	0.4889	0.000	SE – Other Urban	0.0909	0.025
NE – Other Urban	0.5367	0.000	SE – Rural	0.1940	0.001
NE – Rural	0.3549	0.000			

Turning then, to the marginal effects of characteristics of household heads, we find some surprising results. The unsurprising one, of course, is that education is significantly negatively correlated with the probability of being poor (although, even here, the effect is quantitatively much smaller than that of living in a richer

area). But apart from education; age, gender, ethnicity and the occupational status of the household head, all turn out to be insignificant correlates of poverty. For age and gender, this is in line with previous findings from decompositions of Generalized Entropy inequality measures (see Ferreira and Litchfield (2001)). It is also confirmed by the tabulation profiles presented in the previous section.

Race, however, had appeared to account for a significant share of inequality in those static inequality decompositions, and the tabulation profiles show substantial differences between the poverty incidences across households headed by blacks (including 'mulatos'), and whites. Clearly, the insignificance of the race dummy in the probits is a result of controlling for the other attributes included in the regression. While on average, black and indigenous households are substantially more likely to be poor, this seems to be because of other differences between them and white-headed households, such as education or regional location. This is not to say that there are no grounds for poverty reducing policies which take race into account. Neither can it be interpreted as a verdict on the old sociological debate about whether Brazil's racism is more 'economic' than 'social'. All it does say is that if households headed by non-whites are likelier to be poor, then this is due to their differential access to education, or to their locational choices, or to some other factor, rather than simply because they are non-white.

In terms of housing characteristics and access to services, the direction of causation is almost certainly from poverty to these attributes, rather than the reverse. Our caveat about interpreting these 'marginal effects' merely as descriptive estimates of partial correlation coefficients is particularly pertinent here. The main result is that the poor are indeed significantly less likely to have access to piped water, electricity or, even more markedly, a telephone line. They are also less likely to have many bedrooms, or covered housing floors. The correlations with the nature of the road or street outside, as well as to whether the household is located in a slum ('favela'), turned out to be insignificant, once other factors are taken into account.

Finally, the effect of regional location on the probability of being poor can only be described as dramatic. The reference region (missing dummy) is the metropolitan area of São Paulo. Simply put, the marginal effects reported suggest that living anywhere else is correlated with a greater likelihood of being poor, though the quantitative effects are much larger for the Northeast than within the Southeast. Note that these effects have remained this strongly significant *after* controlling for differences in education, labor status, housing characteristics, etc. The implication is that regional differences in household income, and hence in the vulnerability to poverty, are not only a consequence of different educational

attainment levels, demographic differences across regions, or racial make-up. They must be explained by other factors, which deserve continuing investigation.

In addition to these results, which are interesting in themselves, the probit analysis was used to check the robustness of the profile to changes in two aspects of our adjustments to the data: the regional price deflators, and the Buhmann et. al. equivalence scale parameter q, both of which were discussed in section 2.

When no regional price adjustment is used, the marginal effects of variables other than regional dummies is hardly affected. However, the regional dummies are affected in the manner one would expect. Places where the cost of living is higher than in São Paulo (such as Recife or Salvador) have lower marginal effects (since real incomes there are overestimated in the absence of an adjustment), while areas where the cost of living is lower than in São Paulo (such as the rural Southeast) have higher marginal effects, since real incomes there are underestimated. On the other hand, using different price deflators, such as the São Paulo-based and the Recife-based indices, which were chosen exactly so as to maximize the difference in relative prices between them, turns out to have virtually no effect on either the sign or the significance of any of the right-hand-side variables.

Our conclusions from these robustness checks were twofold. First, dimensions of the profile which are unrelated to household size do not seem to be affected by the choice of theta. Second, it does seem that some price deflation, as opposed to none, makes a difference to the estimated 'marginal effects' of living in different areas on poverty. In other words, not taking spatial cost-of-living differences into account does seem to lead to some re-rankings in poverty across regions. It therefore seemed advisable to adopt one of our spatial price indices, rather than to use nominal incomes. However, it did not seem to matter much, for the profile, which spatial area's basket was used as the base. Tables 5 and 6 below present headcount indices and Gini Coefficients for different combinations of assumptions about values of the Buhmann et. al. equivalence scale and of the regional price deflator.

Table 5
Headcount indices (P_0) for Brazil as a whole, under different assumptions

	$\theta = 0.5$	$\theta = 0.75$	$\theta = 1.0$
I_-	20.48	32.91	47.09
I_+	19.41	31.22	45.29
$I = 1$	20.11	32.13	46.14

Table 6
Gini Coefficients for Brazil as a whole, under different assumptions

	$\theta = 0.5$	$\theta = 0.75$	$\theta = 1.0$
I_-	0.5474	0.5574	0.5700
I_+	0.5525	0.5624	0.5747
$I = 1$	0.5529	0.5627	0.5750

5. Data Issues: Mismeasuring Living Standards Many Times Over

In the course of undertaking the analysis reported in the two preceding sections, which benefited from the coincidence of two important household surveys (the PNAD and the PPV) in 1996, it was natural for us to compare the estimates of household living standards which were generated by the two survey instruments. We found evidence of substantial disparities, which give rise to some concern about the quality of the data that underlies all analysis of poverty and income distribution in Brazil. In this section, we raise some of these concerns and present a brief comparison of indicators from the PNAD and the PPV.

Each of the main household surveys used for welfare analysis in Brazil — namely the PNAD (annual), the POF (decadal), the Pesquisa Mensal de Emprego (PME: monthly), and the PPV (one off) — suffers from its own shortcomings. The last three have highly incomplete geographical coverage: the PME surveys only six metropolitan areas in the country (São Paulo, Rio de Janeiro, Belo Horizonte, Salvador, Recife and Porto Alegre). The POF is also restricted to metropolitan Brazil, and has a ten-year interval in between waves. The PPV covers only two of the five regions of the country (Northeast and Southeast), and has a very small sample size (approximately 5,000 households).

This leaves the PNAD, which has been the main staple of country-wide (as opposed to metropolitan) distributional analysis in Brazil since the mid-1970s. It covers both urban and rural areas (except in the Northern region), and is representative at the state level, as well as for all metropolitan areas. Its sample size, currently of 105,000 dwellings, should be sufficient to produce much narrower confidence intervals for regional poverty or inequality estimates. However, for such

a large survey, and one which is fielded so often, some of the PNAD questionnaire shortcomings are remarkable. The questionnaire has evolved a great deal between the mid-1970s and 1996, generally much for the better. Nevertheless, there is one aspect, crucial for poverty and income distribution analysis, which has remained rather problematic: the income questions for any income source other than wage employment are insufficiently disaggregated and detailed.[22]

In principle, the measurement errors likely to arise from the absence of these more detailed questions could bias income measurement in either direction. Too few questions about in-kind benefits or the values of different types of production for own consumption are likely to lead to an underestimate of welfare, through forgetfulness. On the other hand, the absence of questions about expenditure on inputs is likely to lead to an overestimate of net incomes from home production. In practice, the international evidence suggests that the first effect often predominates, and the absence of such detailed questions can lead to income under-reporting by categories of workers which, as it happens, are quite likely to be poor (see, e.g. Lanjouw and Lanjouw (1996). The evidence which we have uncovered for Brazil, by comparing incomes and poverty incidence estimates from the PPV — which contains (a) a consumption expenditure questionnaire and (b) a more detailed income questionnaire — with the PNAD estimates, suggests that the same is true in this country.

Table 7 below lists estimates of poverty incidence (headcounts) from the PPV and the PNAD, for the ten sub-regions where the PPV is carried out and is representative. It also presents the (sampling design adjusted) 95% Confidence Interval around each of the PPV estimates. The PNAD headcounts come from the adjusted PNAD distribution described in section 2, reflecting imputed rent and regional price deflation adjustments. The PPV estimates are presented for three different welfare indicators which can be constructed from the PPV data: the first is the real per capita household consumption expenditure; the second is real per capita household income, calculated from the more detailed income questions in the PPV questionnaire; the third is real per capita income from PPV questions analogous to those in the PNAD questionnaire.

[22]The data issues addressed in this section are more thoroughly discussed in Ferreira et al. (2000).

Table 7
Headcount Indices from Different Welfare Concepts and Surveys#

PPV Region	PPV Headcount Estimate	95% C. I. lower bound	95% C. I. upper bound	PNAD Headcount Estimate
PPV Welfare Concept 1: Real Per Capita Consumption Expenditure.				
RM Fortaleza	0.1850	0.0117	0.3582	**0.2626***
RM Recife	0.2212	0.1342	0.3082	**0.2768***
RM Salvador	0.1928	0.1431	0.2424	**0.2697**
NE Urban	0.3756	0.2875	0.4638	**0.4011***
NE Rural	0.4981	0.3820	0.6143	**0.6850**
RM B. Horizonte	0.0791	0.0251	0.1332	**0.0856***
RM Rio	0.0304	0.0186	0.0422	**0.0613**
RM São Paulo	0.0375	0.0027	0.0723	**0.0273***
SE Urban	0.0472	0.0197	0.0748	**0.0743***
SE Rural	0.2603	0.1683	0.3523	**0.3539**
PPV Welfare Concept 2: Real Per Capita Income (Constructed**).				
RM Fortaleza	0.1236	0.0149	0.2323	**0.2626**
RM Recife	0.1970	0.1575	0.2365	**0.2768**
RM Salvador	0.1730	0.1413	0.2048	**0.2697**
NE Urban	0.2896	0.2311	0.3481	**0.4011**
NE Rural	0.2241	0.1480	0.3002	**0.6850**
RM B. Horizonte	0.0557	0.0258	0.0855	**0.0856**
RM Rio	0.0553	0.0198	0.0909	**0.0613***
RM São Paulo	0.0227	0.0123	0.0331	**0.0273***
SE Urban	0.0466	0.0202	0.0731	**0.0743**
SE Rural	0.1019	0.0541	0.1497	**0.3539**
PPV Welfare Concept 3: Real Per Capita Income from questions like those in PNAD***).				
RM Fortaleza	0.1060	−0.0182	0.2302	**0.2626**
RM Recife	0.1547	0.1104	0.1989	**0.2768**
RM Salvador	0.1188	0.0978	0.1398	**0.2697**
NE Urban	0.2340	0.1694	0.2986	**0.4011**
NE Rural	0.3935	0.2991	0.4879	**0.6850**
RM B. Horizonte	0.0205	0.0120	0.0321	**0.0856**
RM Rio	0.0247	0.0011	0.0483	**0.0613**
RM São Paulo	0.0105	0.0028	0.0182	**0.0273**
SE Urban	0.0127	0.0017	0.0237	**0.0743**
SE Rural	0.0973	0.0535	0.1410	**0.3539**

Notes: # based on indigence line ζ of R$ 65.07 per month in all cases.
* denotes PNAD headcount estimates wich fall within the 95% Confidence Interval for the PPV estimate in each welfare concept category.
** This measure of real per capita income is constructed by aggregating for each household the total value of incomes, in cash and kind, reported in response to a large number of separate questions in the PPV questionnaire, and deducting the cost of inputs into household production wherever that is appropriate. The general wisdom is that it provides a more reliable guide to real household income than the single question concept, analogous to that reported in the PNAD.
*** This measure is also derived from the PPV, but is based on single questions about the incomes of farmers and self-employed workers, like those in the PNAD questionnaire. This concept is thus supposed, ex ante, to be the most comparable with PNAD results. Sources: Authors' calculations from the PPV 1996/97 and the adjusted PNAD 1996.

Table 7 reveals an interesting picture about the two data sets. First, PPV welfare concept 3, which is supposedly the most comparable to the PNAD questions, leads to PPV poverty estimates which are substantially lower than those of PNAD. No single PNAD headcount falls within the relevant confidence interval from its PPV analogue. While this might seem to imply that the PNAD really does underestimate incomes substantially, thus overestimating poverty, we must

recall that this PPV concept was selected to mimic the PNAD, and is not the most appropriate.

When we move to PPV Welfare concept 2, its best measure of income, the situation is a little improved. Two PNAD headcounts (those for RM Rio and RM São Paulo) now fall within the relevant PPV confidence intervals. Most other metropolitan and urban headcounts lie just above the upper bound of the PPV confidence interval. The notable exceptions are the two rural areas: while the PPV confidence interval for poverty incidence in rural Southeast is (0.0541, 0.1497), the PNAD point estimate is 0.3539. Perhaps even more strikingly, while the PPV confidence interval for the rural Northeast is (0.1480, 0.3002), the PNAD estimate is 0.6850. An inspection of Panel 2 of table 2 should convince readers that these differences are of an order of magnitude quite different from those in the metropolitan and urban areas.

Since consumption figures tend to be lower than incomes for most poor people (because of savings), the PPV poverty estimates based on expenditure (welfare concept 1) are higher than those based on its income concepts. Consequently, a number of the PNAD poverty estimates do fall within their confidence intervals (in Panel 1). The exceptions are the metropolitan regions of Rio and Salvador and, once again, both rural areas.

What is one to make of all this? Clearly, to commend the PNAD on the grounds that its income-based poverty estimates are generally not statistically significantly different from the consumption-based poverty estimates of the PPV, based on the same, unadjusted poverty line, would seem overly generous. Provided that the poor save, as they seem to do in Brazil, one would expect income-based poverty incidence to be lower than its expenditure-based analogue, for the same population and poverty line. On the other hand, it would seem too harsh to condemn the PNAD on the basis that it does not match the PPV estimates according to a sub-optimal income concept constructed from the PPV.

On balance, the evidence from Panel 2 suggests that the PNAD, because of its short-form income questionnaire, seems to underestimate incomes and overestimate poverty in Brazil. While this effect is serious throughout, it is most serious in rural areas, where point estimates of the headcount are three times as large in the PNAD as in the PPV.

Although its superior geographical coverage still makes the PNAD indispensable to any nation-wide study of poverty in Brazil, it is hard to avoid feeling some concern over quality of the PNAD income data — particularly for rural households. In this paper we have focused on urban areas, and on ordinal comparisons of profiles, rather than on the absolute values of poverty measures. The reader is

nevertheless cautioned that all rural poverty measures discussed above are likely to be substantial overestimates, and that even urban measures are likelier to be above than below the true mark.

In future, two alternative paths can be followed to deal with this situation. In the medium-run, pending a thorough review of Brazil's household survey system, one could use innovative statistical procedures to combine data-sets, seeking to complement their strengths and compensate for their weaknesses. Such techniques, although still in their infancy, usually rely on imputing key variables from small but detailed data sets to larger ones where they are either absent of measured with unacceptable margins of error. See Hentschel et al. (1999) and Elbers et al. (1999). The other alternative is probably first-best, if cost constraints are not binding: that is to redesign the survey system so as to replace various sub-optimal instruments with a single well-designed survey.

6. Conclusions

The first conclusion of this study is that all the other conclusions must be treated with circumspection, since they are based on a data set which seems likely to systematically underestimate non-labor incomes, particularly for self-employed earners and principally in rural areas.

The second main conclusion is that poverty in Brazil, subject to the foregoing caveat, remains substantial. Even after adding imputed rents to the PNAD data, and deflating prices regionally, the national average incidence of indigence in 1996, measured with respect to a food-only poverty line, was 23%. Using a conceptually preferable poverty line, which allows for expenditure on some non-food items (according to the actual consumption patterns of those people whose incomes are equal to the food poverty line), we find a poverty incidence of 45%.

Based on our data, poverty remains more acute in rural areas (headcounts of 52% for the indigence line and 78% for the main poverty line) than in urban areas (headcounts of 15% for the indigence line, and 37% for the main poverty line).[23] However, since only 21% of Brazilians live in rural areas, the urban shares in the composition of poverty are higher: 52% of people living below the indigence line live in urban areas, as do 64% of those with incomes lower than the main poverty line.

Interestingly, urban poverty varies considerably with the type of urban environment. Small cities (population $< 20{,}000$) have a higher poverty incidence than

[23]Overall urban headcounts refer to all non-rural areas, and are computed straight-forwardly from the information in table 7.

medium-sized ones (20,000 – 100,000), and these have a higher incidence than large cities (population > 100,000). The cores of metropolitan areas are least poor, but their peripheries have higher headcounts. Small cities and metropolitan areas have the highest poverty shares among urban environments, each accounting for roughly 18-19% of the national total, but metropolitan areas account for a smaller share of the indigent (13.5%). Greater research on and policy initiatives aimed at reducing poverty in small and medium urban areas would seem to be a priority, along with the continuing need to tackle rural poverty.

Urban poverty, like total poverty, also varies markedly across regions, with the Northeast and the North reporting higher poverty rates than the Southeast or the South, according to all three indices used. However, the higher population share of the Southeast causes it and the Northeast to have the largest numbers of poor people in the country. All this information on spatial variations suggests that there is considerable scope for a finer geographical targeting of government poverty-reduction programs. Poverty and living standards maps have been constructed for Brazil down to the municipality level (see UNDP (1998)), and it would be interesting to compare the allocation of social spending by federal and state governments with those maps.

Our analysis also indicates that families are likelier to be poor if they are larger, and particularly if they have larger numbers of children. Among the characteristics of the household head, the main determinant of a household's vulnerability to poverty is his or her level of education, with (national) poverty rates declining from 75% for those with one year of schooling or less, to 2% for those with more than 12 years. Race and age are also important (unconditional) correlates of poverty, which is higher among households headed by blacks, and lowest among those headed by Asians. Poverty incidence declines monotonically with the age of the head.

The poor are less likely to rent or pay mortgages on their houses than to own them outright, but their houses are generally of worse quality, and they enjoy disproportionately low rates of access to services like piped water, electricity, garbage collection or phone lines. The implications for future public spending on these types of infrastructure should be obvious: using the information on the geographical location of groups without access to these services, which can be quite detailed, expansions should be targeted to them. Poverty is high among the unemployed and informal sector workers, whether the latter are self-employed or unregistered employees ('sem carteira'). However, a greater share of the poor is in self-employment than in any other labor status category. There is a continuing need to ensure that adequate safety nets are in place, to protect not only formal

employees who lose their jobs and may have access to time-bound unemployment benefits, but also to cushion the effect of falling aggregate demand and demand for labor on informal employees and on the self-employed.

All things considered, there are perhaps two main conclusions from this exercise. The first is that the Brazilian household survey system can be substantially improved at little or no extra cost, so as to provide much more reliable information on living standards across this vast country. The second is that, notwithstanding the above, there is sufficient information in this poverty profile to guide a reallocation of crucial social spending on education, health and social protection, to ensure a more effective use of public resources in helping the poorest people in Brazil.

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Anexo A

Table A.1
Indigence Profile 1996: Brazil ,$z = \varsigma$ (R$ 65.07/month), $I = I_+$,$\theta = 1.0$ [24]

Household Characteristics	Subgroups	f_k	y_k	P_{0k}	P_{1k}	P_{2k}	s_k
	Total	100.00	283.86	22.59	9.60	5.53	100.00
Region	North	4.84	191.96	30.06	11.80	6.58	6.44
	North-East	29.59	135.37	47.89	22.14	13.28	62.72
	Center-West	6.81	282.75	16.63	5.90	3.08	5.01
	South-East	43.59	380.40	9.19	3.22	1.65	17.73
	South	15.17	325.91	12.08	4.45	2.33	8.11
Location	Metropolitan Core	17.63	498.29	7.47	2.41	1.15	5.83
	Metropolitan Periphery	12.14	300.41	10.07	3.33	1.65	5.41
	Large Urban	18.89	365.02	10.22	3.17	1.46	8.55
	Medium Urban	15.69	271.24	17.58	6.43	3.24	12.21
	Small Urban	15.02	173.80	30.82	12.63	7.03	20.49
	Rural	20.63	106.38	52.03	25.54	15.93	47.52
Dependency Ratio*	1	9.99	630.69	0.53	0.10	0.03	0.23
	1<d $\leq$ 1.5	14.60	410.76	2.50	0.55	0.20	1.61
	1.5 <d $\leq$ 2	22.40	326.78	7.60	1.93	0.76	7.54
	2 <d $\leq$ 3	21.85	211.86	23.44	7.03	2.97	22.67
	3 <d $\leq$ 4	13.61	184.66	33.36	12.57	6.21	20.09
	d>4	15.31	100.81	58.28	29.31	17.94	39.49
	Other Not Specified	2.25	37.83	84.12	59.84	48.38	8.37
Housing Status	Own House, Paid, with Own Land	63.76	288.74	22.37	9.51	5.48	63.12
	Own House, Paid without Own Land	5.60	148.08	42.00	20.30	12.60	10.40
	Own House, Still Paying	6.06	440.54	5.26	1.40	0.56	1.41
	Rent	12.23	366.34	10.64	3.50	1.65	5.76
	Ceded	11.70	160.54	35.75	15.55	9.00	18.52
	Other	0.50	172.71	24.75	9.46	5.28	0.55
	Not Specified	0.15	216.01	35.68	14.99	8.65	0.24
Water	Piped	81.59	332.35	13.04	4.53	2.28	47.08
	Not Piped	18.26	67.83	65.19	32.21	20.04	52.68
	Other Not Specified	0.15	207.79	35.46	15.01	8.75	0.24
Sanitation	Sewerage System	37.84	442.21	5.47	1.59	0.69	9.15
	Concrete	10.19	388.72	6.26	1.91	0.90	2.82

[24] One may argue against the use of imputed rent in indigence measures.

	Cesspit 1 Concrete	12.84	235.26	17.93	6.04	2.97	10.19
	Cesspit 2 Rudimental	22.67	145.50	34.19	13.58	7.35	34.31
	Cesspit Drain	1.98	112.58	39.99	17.77	10.52	3.51
	River or Lake	2.75	164.73	23.41	8.69	4.48	2.85
	Other	0.19	141.04	43.05	14.88	7.53	0.37
	Not Specified	11.52	57.68	72.16	37.60	24.16	36.79
Electricity	Yes	91.93	303.66	18.25	7.08	3.82	74.26
	No	7.91	55.10	72.87	38.87	25.35	25.50
	Other	0.16	212.15	33.80	14.20	8.19	0.24
	Not Specified						
Waste Disposal	Collected Directly	63.26	373.41	8.88	2.87	1.35	24.86
	Collected Indirectly	7.36	257.20	21.18	7.60	3.86	6.90
	Burned	14.35	112.50	46.48	20.84	12.31	29.51
	Unused Plot of Land	13.23	79.32	59.44	29.13	18.13	34.81
	Other	1.80	115.39	49.10	21.36	12.50	3.91
	Not Specified						

Characteristics of the Head	Subgroups	f_k	$\mu(y)_k$	P_{0k}	P_{1k}	P_{2k}	s_k
Gender	Male	82.26	282.64	23.30	10.06	5.85	84.85
	Female	17.74	289.52	19.30	7.48	4.04	15.15
Race	Indigenous	0.17	168.69	47.20	25.49	17.47	0.36
	White	54.27	384.04	12.66	4.95	2.76	30.39
	Black	45.07	159.79	34.64	15.21	8.86	69.09
	Asian	0.46	671.79	4.53	1.62	0.88	0.09
	Not Specified	0.02	89.60	59.45	28.95	15.01	0.06
Age	0-24	3.97	188.88	27.45	10.90	5.92	4.83
	25 to 44 Years	48.40	268.02	24.59	10.88	6.43	52.66
	45 to 64 Years	36.43	305.75	21.65	9.22	5.32	34.92
	>65 Years	11.20	314.79	15.33	4.89	2.19	7.60
Education	0 – 1 Years	21.86	104.48	46.22	21.23	12.70	44.71
	1 to 4 Years	20.03	150.86	32.95	14.37	8.41	29.22
	4 to 8 Years	30.10	230.49	15.78	5.73	2.99	21.03
	8 to12 Years	20.56	394.59	5.44	1.72	0.80	4.95
	> 12 Years	7.45	1077.98	0.30	0.08	0.03	0.10
Immigration Status	Not Immigrant	40.56	258.16	30.23	13.81	8.29	54.26
	0 to 5 Years	7.51	270.34	21.37	8.59	4.77	7.10
	6 to 9 Years	4.25	262.61	20.39	7.86	4.14	3.83
	More Than 10 Years	28.87	295.57	17.94	6.92	3.73	22.93
	Other	18.81	331.48	14.27	5.44	2.96	11.88
	Not Specified						

Labour Status	Inactive	17.70	279.16	18.71	7.30	4.03	14.65
	Unemployed	2.77	131.51	45.81	22.04	13.82	5.62
	Formal Employees	23.31	292.55	10.96	3.26	1.38	11.30
	Informal Employees	13.30	162.34	36.60	15.28	8.36	21.55
	Self-Employed	27.00	235.64	30.66	14.23	8.60	36.63
	Employer	4.76	781.14	4.95	2.04	1.22	1.04
	Public Servant	8.73	422.27	10.66	3.49	1.59	4.12
	Unpaid	2.39	139.04	46.89	26.93	19.46	4.97
	Other Not Specified	0.04	124.31	65.55	38.43	28.28	0.13
Employment Tenure	0 Years	20.47	259.16	22.38	9.30	5.36	20.28
	1 Years or More	13.04	215.60	24.23	9.95	5.60	13.98
	1 to 3 Years	14.65	260.42	19.87	7.53	3.96	12.88
	3 to 5 Years	8.23	301.52	18.49	7.06	3.70	6.73
	> 5 Years	43.19	322.23	23.70	10.71	6.39	45.29
	Other Not Specified	0.42	134.50	44.46	21.45	13.65	0.84
Sector of Occupation	Agriculture#	19.61	117.00	52.44	25.77	16.06	45.52
	Manufacturing	12.15	310.39	15.80	5.96	3.09	8.49
	Construction	8.04	200.47	18.48	6.39	3.20	6.58
	Services	31.50	373.11	11.22	3.64	1.69	15.64
	Public Sector	8.23	443.76	9.62	3.15	1.41	3.50
	Other Not Specified	20.47	259.15	22.38	9.30	5.36	20.28

Notes: $s_k = \frac{f_k P_{0k}}{P_0}$. Dependency ratio is defined as the number of household members over the number of earners in the household. # Agriculture includes other Primary Sector occupations.