

## INCOME DISTRIBUTION AND ECONOMIC CHANGE IN PARAGUAY, 1972-88

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The author reconstructs the income distribution of families in Paraguay for 1972, 1982, and 1988 by aligning three different urban household surveys with two farm income and two land tenure studies within a national accounts framework. He finds, first, a narrowing disparity between average family incomes in agriculture and non-agriculture in the recent decade, and, second, a steady widening in the agrarian distribution in contrast to a more stable non-agricultural distribution. The "cross-over" of the Paraguayan agricultural distribution from one of greater to lesser equality than the non-agricultural distribution is also found for a number of other recent cases and confirms Kuznets' speculation about the North American data. In the Paraguay experience, the "cross-over" may be due to the deepening cleavage between the commercial *minifundia* and the modernizing *latifundia* in the areas of new settlement. Paraguay's countrywide distributions are also compared to other Latin American economies of similar income level and agricultural shares.

### 1. INTRODUCTION

The hypothesis which links the degree of inequality with economic growth stems from the experience of deepening uneven development between the city and the countryside. The relative decline of the more egalitarian agrarian sector and the increased importance of the less equal urban sector, Kuznets (1955) wrote, would result in a widening overall distribution until the agrarian sector fully modernized and the urban sector itself became more equal, transformed perhaps by worker organization and welfare legislation. Only then, as among the already industrialized countries of our day, could the overall income distribution be expected to narrow. During this process, the developing country would have to endure the stresses and strains to which the sectoral differentials gave rise. This primarily empirical sketch of a two-sector model was also consistent with the mechanics of W. R. Lewis' (1954) labor surplus model. Together, the two models offered a plausible set of hypotheses against which evidence from Third World countries might be examined.

The earliest measurement of consistent time series for a number of developing countries, published by Weisskoff (1970) for Puerto Rico, Argentina, and Mexico, tended to confirm the characteristics of the two sector model and the expectation of a widening of the overall distribution with growth. Such analysis, the author cautioned, should lead to the closer examination of those policies, industries, or crops that might explain the changes in the distributions.

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The few critical studies in the early seventies soon gave way to a virtual explosion of large samples, as the focus of the development field began to give more attention to the distributional questions of the apparent prosperity that was being achieved. (See Fields, 1980, for a review of the decade.) The early cross-sections of the income distributions of many nations consisted of observations which were admittedly as heterogeneous as they were numerous. By the mid-eighties, attempts were being made to place the individual country samples into a more comparable framework. The ILO (see Van Ginneken and Park, 1984) generated consistent, single-year estimates for some 23 countries and the United Nations Statistical Office (1985) gathered distributions for 57 countries. On the basis of these and others' efforts, Campano and Salvatore (1988) were able to test Kuznets' hypothesis by pooling 143 observations drawn from time series and cross-sectional data from 95 countries.

Fields (1989a, b, 1990), in reviewing the more recent literature, quite correctly points out that the original Kuznets' hypothesis refers only to changes in a single country through time. Thus, the large sample cross-sections might not be as appropriate as the single-country time series which are now becoming available. It is also ironic that the study of income distribution, which began as a radical critique of the Western development process, has become instead a part of the established scientific landscape. (See, for example, World Bank, 1990, Table 30).

The income distribution of each nation summarizes a great many social processes in a single measure. As the social scorecard for all of society's material gain, it is the net result of the currents and conflicts, comprehending the impact of inflation, strikes, repression, and social bargaining. Sheahan (1987, chapter 2, 8-11), for example, seeks to connect the quantitative evidence on poverty and income distribution with specific country studies and their resolution of social conflict.

Current research on income distribution has taken two further turns. One may be seen as "introspective" and seeks to decompose changes in the overall distribution into sector, factor, or regional contributions. (See Adelman and Levy, 1984). An alternative, almost polar approach has been to "expand" the distribution and view it as the end result of a more comprehensive social accounting model. (See Weisskoff, 1985, chapter 15, and Robinson, 1989, for reviews). Although both approaches may be valuable, contemporary research demands as well a literate union of empirical accounting coupled with a frank evaluation of the political and social changes that underlie the measurements.

The goal of this paper is to report findings of income distributions for a single country, Paraguay, for the years 1972, 1982 and 1988. These distributions have been constructed by arranging the results of several micro-surveys carried out with a variety of methodologies by different agencies into a consistent framework of national and sectoral accounts. The uniqueness of the present study lies in assembling and aligning these partial studies, which together summarize the results of the closing era of Latin America's most durable authoritarian and personalistic regimes.

The paper consists of four further sections. First, we review briefly the economy of Paraguay and its relative position in Latin America. Second, we examine the shortcomings and advantages of the methodology available to the

contemporary researcher who attempts retrospectively to reconstruct the income distributions of an earlier era. Third, we present the results of the country-wide and sectoral distributions of other countries. In this way, we hope to fit this country study into the general picture of Latin America and other nations of similar income level and experience.

## II. THE ECONOMY OF PARAGUAY

Paraguay, a relatively sparsely populated Latin American country wedged between Bolivia, Argentina and Brazil, has for the past four decades pursued a unique series of economic policies, alternating between outward and inward oriented growth. This era has also been marked by economic stability, expansion, and continual political repression, in contrast with the more periodic inflationary episodes and political turbulence of Paraguay's neighbors. (See P. H. Lewis, 1980; Baer and Breuer, 1986, and U.S. Department of State, 1989.)

The Stroessner era, following Birch (1991), may be divided into three periods. The first period, (1954-74), marks the beginning of Paraguay's transformation from a traditional plantation which exported cattle, wood, yerba and quebracho, into a modern commercial farmland which, in addition, began to export sugarcane, cotton, and vegetable oil. Once an upstream dependency of Buenos Aires, Paraguay and its economy were reoriented into a new alliance with Brazil, the rival regional superpower, by the construction of the eastern highways, a major bridge, and the largest hydro-electric dam in the world, Itaipu, on the Parana River. The dam construction, which began in 1974, ushered in a boom period which lasted until 1981.

By the eighties, Paraguay's frontier had shifted eastward, her crops and commerce redirected toward Brazilian rather than Argentine ports. The new highways had successfully opened the north-central and eastern provinces. Reacting to the Carter administration's reduction in aid due to his human rights record, Stroessner launched a wheat-growing program to the benefit of the large and technologically-sophisticated planter and reduced Paraguay's dependency on imported grain. Other grants of state lands have favored Brazilian and Japanese immigrants and multi-national agro-developers, while the severe pressure on peasant organizations has suppressed the real income of the small grower in spite of buoyant world prices for their agricultural exports. In short, the country's geographical and diplomatic isolation and its desire to earn foreign exchange following the collapse of the Itaipu boom in 1981 have resulted in the growth of a dual, almost neo-feudal "modernization" of agriculture. (See Weisskoff, 1991b, 1992 for a detailed analysis.)

Unique in Latin America, Paraguay has thus remained a rural and agricultural country. The emphasis on food exports and the relative tardiness to industrialize have slowed the growth of cities and has kept the people on the land. Major investments—the giant dam construction, the bridge and road networks, and the integrated rural development schemes—have been located far from the capital. Only a modest infrastructure in public utilities, education, and health services distinguishes Asunción from the provincial towns, constraining her growth as the principal port and administrative center.

The economic and social profile of Paraguay underscores the anomalous position of the country relative to the other nations of South America (See Table 1). With 2.3 percent of the continent's land area and 1.4 percent of the population, Paraguay ranks behind Uruguay in size and ahead of Bolivia, Ecuador and Colombia in per capita income (lines 1-3). From 1965 to 1980, Paraguay's per capita GNP grew more than twice as fast as the regional average but 1.6 times slower than the regional average in the 1980s (line 4).

TABLE 1  
PARAGUAY IN LATIN AMERICA ECONOMIC & SOCIAL CHARACTERISTICS

	Years A/B	Paraguay		Ratio: Paraguay to All S. America		Rank <sup>1</sup> B	Source and Table
		A	B	A	B		
1. Land area (mill. hect.)			40		2.3	9	A 1
2. Population			4,042		1.4	9	B 1
3. GNP per capita (US\$)	72/88	300	1,180	43.9	72.6	8*	C 1
4. Average annual growth rate GNP/cap.	65-80/80-8	3.6	-2.1	221.4	-161.5	8	D 1
5. Population: average annual growth rate	65-80/80-8	2.8	3.2	119.7	148.0	1	D 26
6. Agricultural share in GDP	65/88	37.0	30.0	187.8	194.8	1	D 3
7. Daily calorie supply	65/86	2,627	2,853	108.2	114.4	2	D 28
8. Urban population: share of total	65/88	36	46	63.5	67.5	10	D 31
9. Value added in mfg: (mill. current \$)	70/87	99	735	3.7	5.1	9	D 6
10. Exports of goods and services as share of GDP	65/88	15	26	97.4	132.7	3	D 10
11. Growth of exports	65-80/80-8	7.9	15.7	170.0	395.5	1	D 14
12. Annual inflation rate	65-80/80-8	9.4	22.1	24.6	14.3	8	D 1
13. Long-term debt service as share of exports	70/88	11.8	24.6	52.7	82.8	6	D 23
14. Percent of age cohort in Primary School	65/87	102	102	104.7	94.5	9	D 29
Secondary School		13	30	24.0	54.2	10	D 29
15. Maternal mortality rate	-/80	—	469	—	232.2	1	D 32
16. Under-5 mortality rate	60/87	134	63	87.8	83.9	5	E 1

Sources: A: UNDP, 1990. B: World Bank (Atlas) 1989a. C: World Bank (Tables) 1989b. D: World Bank (Indicators) 1990. E: UNICEF, 1989.

<sup>1</sup>From high to low of 10 countries. Asterisk indicates shared rank with another country.

Paraguay's population growth rate is the highest in the region. The agricultural share in GDP, while declining during the past 20 years, also remains the highest in Latin America (lines 5-6). Paraguay's share of urban population is the lowest, and its manufacturing sector second smallest (lines 8-9). Paraguay has

thus remained the single Latin American nation with a majority of rural inhabitants. The participation of Paraguay's exports in GDP is third largest in Latin America, but the growth rate of these exports is the highest (lines 10-11). The inflation rate and the relative level of indebtedness have remained below the regional average (lines 12-13).

Neglect of educational and health investment is reflected in Paraguay's lowest ranking in primary and secondary schooling and the highest rate of maternal mortality in the region (lines 14-15). The mortality rate of children under five years of age has remained relatively modest in the region due probably to Paraguay's favorable daily calorie supply (lines 16 and 7).

The beginning of 1989 marked the opening of a new era in Paraguay with the fall of General Stroessner and the assumption of power by an administration apparently determined to guide the country to a more democratic process. The granting of freedom of the press, free assembly, and open debate may now permit the economy to move in new directions as peasants and urban workers form new organizations which may eventually result in higher real wages. Land give-aways have ceased, and the national companies, once the private domain of the ruling family and its associates, have become subject to public examination. Open conflict over the shares of income and wealth now begins. It is at this point of the opening of the political process that we seek to measure the trends in income distribution that have characterized the last 16 years of the Paraguayan economy.

### III. METHODOLOGY

#### A. *Background and Procedures*

Techniques developed for measuring income distribution in several time periods fall into two general categories. In the first, a single agency repetitively administers a standard survey, guaranteeing continuity of concepts, methods, and results, as in the annual CPS for the U.S. and PNAD studies for Brazil. An alternative approach may be called the component-cell method in which a nationwide distribution is synthetically constructed from cell distributions, such as farm surveys and income tax returns, and aligned with published control totals. The BEA distributions for the United States were constructed in this way until 1962. The current method used by the BEA is to combine and match several micro data files to arrive at a total distribution. (See Budd, Radner, and Hinrichs, 1973.)

A variant on the first method is to begin with a single, comprehensive sample survey but to assign the short-fall of reported income to various groups according to the assumptions made by the investigator. Bergsman (1980) reviews three studies of the Mexican distributions by Navarette, Felix, and Altimir, all of which apply this method. He then offers his own estimate based on a yet different "elasticity of adjustment." Altimir (1987), in reviewing many Latin American studies, proposes some standard procedures for adjustment.

For Paraguay, each of the early studies of income distribution have taken a different approach. Flecha (1975) distributed total personal income from the national accounts across 6 income classes for 1973, although the sources of his

cell distributions are not cited. Miranda (1982) sampled 3,000 families in 1981 and then constructed income distribution for the urban and rural areas. Flecha found a rather narrow distribution ( $K = 72.9$ ) of country-wide income relative to Miranda ( $K = 136.0$ ), but the later study failed to account for 22 percent of total personal income.

A wealth of micro-analytic sector studies have also been carried out in Paraguay despite the government's discouragement of controversial social science research. Some of these surveys have been executed by public agencies, for example, the Census Bureau (DGEC), the Ministry of Agriculture (MAG), and the Central Bank (BCP). The micro-farm studies of the early 1970s were sponsored by the U.S. foreign aid agency as preconditions for loans, and, as a side result, trained a generation of Paraguayan researchers in rural survey techniques. Other quantitative surveys, such as Miranda (1982), have been sponsored by foreign research foundations. Partial studies have been so numerous that to date three bibliographies of economic data have been published: See Rivarola (1982, 389-439) for rural studies, Fletschner, *et al.* (1984, II, 589-840) for general economy, and Schwartzman (1989, 271-387) for a socio-economic inventory.

The procedure followed in the present study is to align the sectoral studies for a sequence of years, distributing the control totals of sectoral income across the cells, and then aggregating the parts into a whole. By this hybrid approach, we aim to prepare a set of comparable distributions for the Census years 1972 and 1982 and for 1988.

A retrospective study of this nature is also facilitated at this time by the release of previously unpublished data by the Central Bank, as the recent change in the Paraguayan administration has resulted in encouraging a more frank and empirically-based evaluation of the existing social and economic situation. Indeed, the measured distribution itself is but one index of the social tension being generated by the conflict between the extreme concentration of economic power, on the one hand, and the equality inherent in the electoral process on the other.<sup>1</sup>

In this study, we distribute the sector control totals for agriculture and non-agriculture across the sampled micro-studies. (The procedures and sources are outlined in Appendix Tables 1-3.) The agricultural distributions are based on two independent land-holding surveys and two farm income surveys. The non-agricultural distributions are based on three independent urban surveys administered by different agencies. The population estimates are based on studies of the two National Censuses.

The assumptions underlying this methodology are indeed heroic and suffer from the deficiencies inherent both in the national accounts and in the microdata. The national accounts control totals may be underestimated due to the vastness of the home sector in both agriculture and the informal urban sector. (See, for example, Enriquez-Gamon and Campos, 1988.) Changes in the agricultural

<sup>1</sup>The methodology employed here, as Kuznets (1955, 12) has observed about such exercises, is "more in the nature of synthetic estimates, in which the ingenuity of the investigator overcomes gaps and deficiencies of the original data . . . [T]hese must combine detailed information on the flow of income from the productive system . . . with additional and scarce data on the individual and family units who receive this income. It may not be an exaggeration to say that we deal here not with data on the distribution of income by size, but with estimates by courageous and ingenious scholars relating to size distribution of income in the country of their concern."

distributions themselves may be traced to changes in their two measured components, namely the distribution of land holdings and the farm incomes estimated for each size class. Since the latest agricultural census was taken in 1982, changes in the farm income distributions for 1988 could be attributed solely to changes in farm incomes based on the Campos (1986) survey. Ideally, the comprehensive methodology developed there ought to be applied to other representative regions as well.

The Metropolitan Asunción samples for 1972 and 1988 were applied to the entire non-agricultural sector on the basis of the finding that the distribution of the 1978-79 Asunción sample proved to be similar to the distribution for the other seven sampled cities. (Miranda, 1982, T. 9.2, also finds similarity in the distributions of Asunción and the other cities.) Distortions are also introduced to the extent that land holders reside in the cities and that non-agricultural activities are carried out by farmers.

The urban surveys may underestimate the number of the very poorest residents if homes in the periodically flooded zones do not appear in the Census base. (See the critique by Morínigo, *et al*, 1984.) The income of the top classes may also be under-reported due to the importance of unregistered trade (contraband) in both imported manufactures and exported agricultural goods. Income of the rural lower classes is probably most completely captured in the two farm studies used here.

#### B. *The Prototype Estimates*

Due to the variety of forms in which the sectoral data were available, we developed a series of flexible procedures which may be summarized as three prototypical transformations.

The first and simplest was the expansion of the distribution of income shares received by decile groups of a sample to cover the universe population and income (i.e. expanding the frequency distribution). This results in a higher per family income per ordinal group—a rightward and upward shift in the density function—but maintains a constant Lorenz curve. (Non-agriculture, 1972.)

In the second prototype, we applied the sample frequency distribution to a numerically larger population, maintaining the same income levels of all but the top-most class. The residual sector income was then attributed to the open-ended class. This procedure resulted in an upward shift of the density function, the augmentation of its upper tail, and a rightward shift of the Lorenz curve. (Non-agriculture, 1982 and 1988.)

Prototype III is a variant of prototype II in that an observed sample distribution of land-holdings is applied to a larger total number of families, shifting the density function of land upward. This land distribution is then transformed into income on the basis of the empirical relationship between income per hectare (or cultivated hectare) and the number of hectares (or cultivated hectares) held. The income of the open-ended class is then estimated as a residual. Thus, the degree to which the farm income distribution changes depends on both the changes in land-holdings and changes in the range of farm incomes associated with the different farm sizes. (Agriculture, 1972, 1982, 1988.)

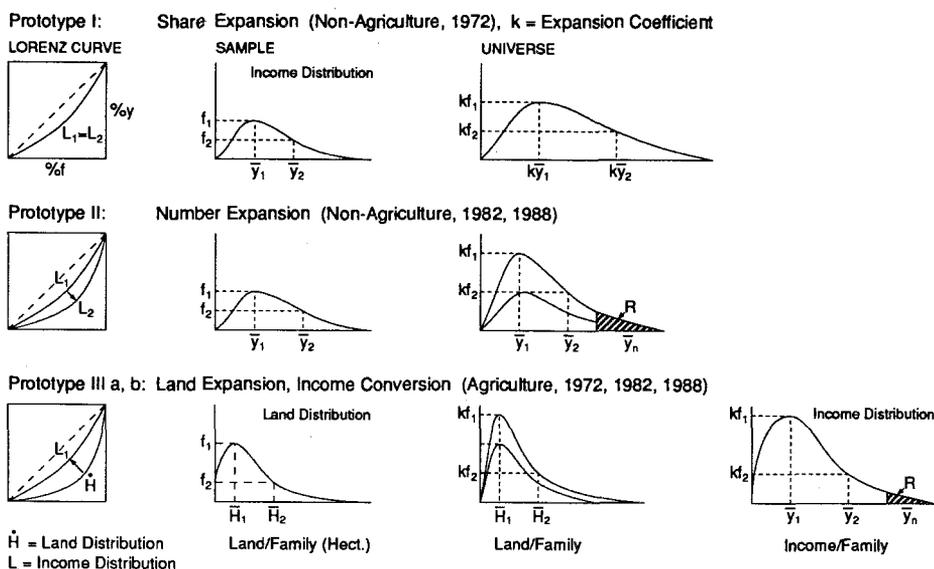


Figure 1. The Three Prototypes

Lacking independent information on the number of families at the very bottom and top tails of the distribution, we have distributed the entire sectoral population proportionately over the range of all sample classes. Presuming that the agricultural censuses have captured the landless and that the urban surveys have included the marginal homes, we have therefore attributed under-reported income to the top class. These assumptions lead to *conservative* estimates of the distributions, as increases in the number of urban and rural poor would further skew the density function and shift the Lorenz curve away from the line of perfect equality.

#### IV. RESULTS

##### A. Country-wide

Paraguay's per capita income grew from \$1,230 in 1972 to \$2,016 in 1982, declined in the early eighties, and then surpassed its earlier level by 1988 (Table 2, column 1). Over the entire period, per capita income grew by 64 percent and population by 60 percent. The country-wide distributions show a consistent widening all during the period, as indicated by the increasing ratio of the income shares of top 20 to the bottom 60 percent of families and by the rise in the Kuznets' index from 90.4 to 101.3 (columns 10-11).

Within this overall widening, however, two patterns of change may be observed (columns 3-9). From 1972 to 1982, the income shares received by the lowest 90 percent of families declined, while the income share to the top 10 percent of families increased. In the period from 1982-88, only the shares of the bottom 60 percent continued to fall, and the share of the middle 61-90 percentiles improved. Over the entire period, therefore, the income share of the bottom 80 percent declined, while the share of the top 20 percent increased.

TABLE 2  
INCOME DISTRIBUTION FOR PARAGUAY, 1972-88

Panel A: Country-Wide

Year	GDP/Cap* (1980 ppp) \$ (1)	Population (mil.) (2)	Percentage of Income to Percentiles of Families						Top 10% (9)	Ratio Top 20 Low 60 (10)	Kuznets Index** (11)	Ratio $\frac{K(A)}{K(N)}$
			0-20 (3)	21-40 (4)	41-60 (5)	Low 60% (6)	61-80 (7)	81-90 (8)				
1. 1972	1,230	2.5	3.6	5.6	10.4	19.6	15.2	14.1	51.1	3.3	90.4	—
2. 1982	2,016	3.4	2.3	5.5	9.6	17.5	14.1	13.4	55.1	3.9	97.0	—
3. 1988	2,019	4.0	1.3	4.5	8.9	14.7	14.6	14.7	56.0	4.8	101.3	—

Panel B: Sectoral

	% No.	% Income	Rel. Av. Income	Low 40%								
4. 1972												
a. Agriculture	50.4	34.5	100	10.5	12.3	22.8	17.1	9.7	50.4	2.6	80.8	1.00
b. All Other	49.6	65.5	193	9.0	10.4	19.4	18.6	15.6	46.3	3.2	83.9	0.96
5. 1982												
a. Agriculture	43.8	25.9	100	8.4	9.0	17.4	11.7	8.3	62.6	4.1	105.2	1.00
b. All Other	56.2	74.1	223	11.9	10.7	22.5	15.9	12.9	48.7	2.7	83.2	1.26
6. 1988												
a. Agriculture	42.1	27.3	100	3.8	5.7	9.5	8.2	6.6	75.7	8.7	131.4	1.00
b. All Other	57.9	72.7	194	12.6	10.3	22.9	17.2	22.0	37.9	2.6	79.8	1.65

Notes:

\*Column 1 From Summers and Heston (1988). Estimate for 1988 converted to PPP using Guarani/PPP exchange rate. GDP, population chained deflators from IMF (1986, 1989).

\*\*Column 11 is the sum of absolute differences of income and recipient percentiles.

## B. Sectoral Distributions

Beneath the widening country-wide distributions lies a more complicated scenario of changes affecting agriculture (*A*) and the other sectors (*non-A*). The share of the number of agricultural families declined from 50 percent in 1972 to 42 percent by 1988, while the corresponding share of income fell from a third to a quarter in the first decade and then rose to 27 percent in 1988. As a result, the ratio of average incomes between the sectors widened from 1972 to 1982 and then fell back to their original levels by 1988. (See Table 2, Panel B, columns 1-3).

Changes in the income shares to families within each sector follow three classic patterns. The distribution of the *A*-sector shares consistently widened throughout both periods, as the income shares received by the lowest 90 percent of families declined and the share received by the top 10 percent rose (columns 4-9, lines 4a, 5a, 6a).

The distribution of income shares in the *non-A* sector shows greater stability between 1972 and 1982 and a narrowing by 1988. In the first decade, the income shares to the lowest 60 percent and top 10 percent of families increased and the shares to the middle 61-90 percent of families declined. By 1988, however, the shares received by the middle 61-90 percent rose, the shares to the bottom 60 percent stabilized, and the shares to the top 10 percent fell, resulting in a decline in the index of inequality (column 11).

The rise of the index of inequality in the *A*-sector reflects the promotion of the large agri-business enterprise, the mass conversion of virgin forest into "productive" grazing lands, and the growth of the cotton minifundia. The stable and declining concentration of *non-A* incomes, by contrast, may be related to the modest investments in urban infrastructure, services, and manufacturing, and to the redistribution of agricultural earnings to the *non-A* sector through the so-called prebendary state. While agriculture has declined only moderately in terms of the number of families, its participation in national income has increased, and the deflection of Paraguayan migration to Argentina rather than to its own cities may have temporarily postponed the urban explosion. The poor, in short, have stayed on the land, moving to the frontier colonizations or to other continental metropolises. (See Miranda, 1982, p. 118; Zoomers, 1988, p. 147).

The widening of the overall country-wide distributions from 1972 to 1988 can now be seen as the consequence of the great widening of the *A*-sector relative to the slight narrowing of the *non-A* sector. Moreover, the *A*-sector was in 1972 slightly more equal than the *non-A* sector. However, by 1982, the *A*-sector had "crossed-over", its inequality exceeding the inequality of the *non-A* sector, a trend continuing through 1988 (column 12).

The observation that *A* is at first more equal and then becomes less equal than *non-A* contradicts the conventional pattern noted for many developing countries. Kuznets (1963, p. 53) was puzzled by a similar "cross-over" he observed for U.S. farm and non-farm distributions between 1935-36 and 1950-53. He had speculated that the widening *A*-distribution might have been caused by the growing "cleavage between large-scale, capital-intensive farms and the smaller units," and he expected that similar results might be found in other countries with very modern plantations, such as Australia and New Zealand. As we shall

see in the next section, the transplantation of the modern farm into many Third World countries today has resulted in widening the *A*-distribution, especially if the minifundia sector persists, as in Paraguay and elsewhere, as the producer of key export staples. (See De Janvry, 1981, chapter 3, for other Latin American cases).

The diminishing disparity between the average incomes in *A* and non-*A* observed between 1982 and 1988 also contradicts the normal rule. This may be due to the agricultural recovery in those years and the importance that agriculture achieved once the boom and bust cycle associated with the Itaipu Dam construction was played out. It is ironic that similar narrowing between *A* and non-*A* incomes has been associated with the pro-agrarian policies of China and Cuba, states with very different political orientations. (See China, 1985, p. 551, and Zimbalist, 1989, T.7.8 on Cuba.)

Could the changes noted within the component sectors be due to statistical quirks related to the methodology by which they were constructed? The widening distribution of the *A*-sector between 1972 and 1982 was, for example, due almost exclusively to the measured changes in the distribution of land holdings, since the spread of the farm incomes by which land holdings were converted into income was held constant in the absence of more current income data. It is probable that these spreads had increased. Further widening of the *A* distribution from 1982 to 1988, on the other hand, may be traced to the widening spread between farm incomes of the different farm sizes, since no new information on changes in land holdings was available. Extensive land grants, however, were made during this period, so it is likely that the land distribution widened further. Thus, the results estimated here probably *understate* the degree of widening of the distribution of agricultural income in 1982 and 1988.

The stability of the non-*A* distributions is also striking, given the two independent Income and Expenditure surveys used for the 1972 and 1982 estimates. The slight narrowing of the non-*A* distribution in 1988 may be due to the different income concept used in that survey.

## V. INTERNATIONAL COMPARISONS

How do our estimates for Paraguay compare to the rest of Latin America? Its low income per capita (\$1,236) and large agricultural share (50 percent) in 1972 place Paraguay in the income range of Brazil, Jamaica, Colombia, and Costa Rica of a decade earlier, but not far from El Salvador and the Dominican Republic of the middle 1970s. (See Table 3, column 2.) The small income share received by the lowest 60 percent in Paraguay in 1972 is comparable to Jamaica's poorest 60 percent in 1958 and Colombia in 1964, but the income share of Paraguay's top 10 percent is much higher.

The Paraguayan distribution, averaged for 1982 and 1988, is more unequal than the distributions of other Latin American countries of similar income levels and agricultural shares. However, the low income share of the poorest 60 percent and the high share of top 10 percent are most similar to the three Peruvian distributions (1961, 1971, 1981) and to Jamaica in 1971. Relative to the sample

TABLE 3  
INTERNATIONAL COMPARISONS OF INCOME DISTRIBUTION IN LATIN AMERICA, 1950s-1980s

Country	Year	GDP/Cap (U.S.\$ PPP)	Ag. Pop. Share	Kuznets Index	Income Shares to:			Concept*
					Low 0-60	Middle 61-90	Top 10%	
Paraguay	1972	1,236	50	96.4	19.6	29.3	51.1	H
Brazil	1960	1,296	54	74.2	24.8	35.8	39.4	H
Jamaica	1958	1,380	39	85.4	19.0	37.5	43.5	H
Colombia	1964	1,463	45	86.2	19.1	33.3	47.6	P
El Salvador	1976/77	1,571	46	60.6	30.2	40.2	29.6	H
Costa Rica	1961	1,663	49	79.4	23.3	31.2	45.5	H
Dom. Repub.	1976	1,705	50	60.0	30.6	36.8	32.6	H
Peru	1961	1,812	50	85.7	17.0	30.6	52.1	P
Paraguay (2)	1982/88	2,017	43	99.2	16.1	28.3	55.6	H
Mexico	1956	2,065	50	83.2	21.9	29.3	48.9	H
Peru	1971/72	2,336	47	85.2	17.4	39.4	43.2	P
Costa Rica	1971/72	2,345	40	64.6	28.4	37.2	34.4	H
Peru	1981	2,494	40	86.0	17.0	36.8	46.2	P
Jamaica	1971	2,630	33	88.0	17.5	32.5	50.0	H
Brazil (4)	1970/78	2,924	33	85.5	19.9	37.3	42.9	H
Sample (15)	1956/88	1,929	45	81.3	21.5	34.4	44.2	
U.S.A.	1935/36	—	25	65.2	27.4	—	—	CU
	1960/62	7,515	10	51.2	34.5	37.4	28.1	CU

Sources: See Weisskoff (1991a) for description of sources and procedures.

\*Concept: (H) Households; (P) Economically active population; (CU) Consumer Units.

average of 15 observations from countries of similar income level and agricultural share, Paraguay's distribution gives smaller income shares to the bottom 90 percent of families and a higher share to the top 10 percent.

We have noted the "cross-over" in the relative intra-sectoral inequality between agriculture and other sectors for the Paraguayan series. Is this unusual for the developing world, or, as Kuznets speculated, would it become more common as modern farming made greater inroads in agriculture?

In surveying sectoral distributions for a wide variety of countries and years, we have found observations that support the hypothesis that the "cross-over" has, in fact, occurred along a changing *continuum* of intrasectoral inequality. Changes in eight countries (see Table 4, panel I), support the conventional view

TABLE 4  
THE CROSS-OVER: CHANGES IN RELATIVE INTRA-SECTORAL INEQUALITIES, 1953-89

I. Pre-Cross-Over (Homogeneous A, Dual N)			
Two Consecutive Surveys ( $K_A < K_N$ for $t'$ , $t''$ )		Single Year ( $K_A < K_N$ for $t$ )	
Country	Year	Country	Year
1. Puerto Rico	53-63	1. Colombia	71
2. Peru	61-71	2. Mexico	65
3. Brazil	60-77-89	3. El Savador	76
4. Costa Rica	71-83	4. Zambia	76
5. U.S.A.	29-35	5. Morocco	70
6. India	58-68	6. Sudan	67
7. Thailand	68-81	7. Sierra Leone	67
8. Egypt	58-64-74-81	8. Spain	80
II. Cross-Over ( $K_A < K_N$ for $t'$ , $K_A > K_N$ for $t''$ )		II. Reverse Cross-Over ( $K_A > K_N$ for $t'$ , $K_A < K_N$ for $t''$ )	
1. U.S.A.	35-50	1. Costa Rica	61-71
2. Paraguay	72-82	2. Philippines	71-83
3. Jamaica	58-75		
4. Taiwan	68-70		
5. Dominican Republic	76-84		
III. Post-Cross-Over (Dual A, Homogeneous N)			
Two consecutive surveys ( $K_A > K_N$ for $t'$ , $t''$ )		Single Year ( $K_A > K_N$ for $t$ )	
1. U.S.A.	50-60	1. Chile	67
2. Paraguay	82-88	2. Panama	70
3. Jamaica	75-84	3. Jordan	80
4. Venezuela	76-82	4. Iraq	76
5. Argentina	53-61	5. Nepal	76
6. Taiwan	70-72	6. Tunisia	75
		7. China	84
		8. U.K.	82
		9. New Zealand	84

Sources: See Weisskoff (1991a) for sources, methods and  $K$ -values.

that income within the *A* sector is more narrowly distributed than in the non-*A* sector. Single observations for eight other countries also confirm this position.

However, distributions from a total of five countries denote a cross-over in the relative inequality between the two sectors—Jamaica, Taiwan, and the Dominican Republic, in addition to the United States and Paraguay. (The dates are also given in panel II of Table 4.) Two countries have also experienced a “reverse cross-over” in which the agricultural sector has changed from a position of lesser to greater equality. Finally, for six countries there is evidence for a stable, post-cross-over period in which the *A*-sector has remained *more unequal* than the non-*A*, due perhaps to the persistence of both modern and traditional farms. In addition, nine other countries—including New Zealand, as Kuznets had speculated—offer single-year observations which support the “post-cross-over” configuration of greater relative rural inequality.

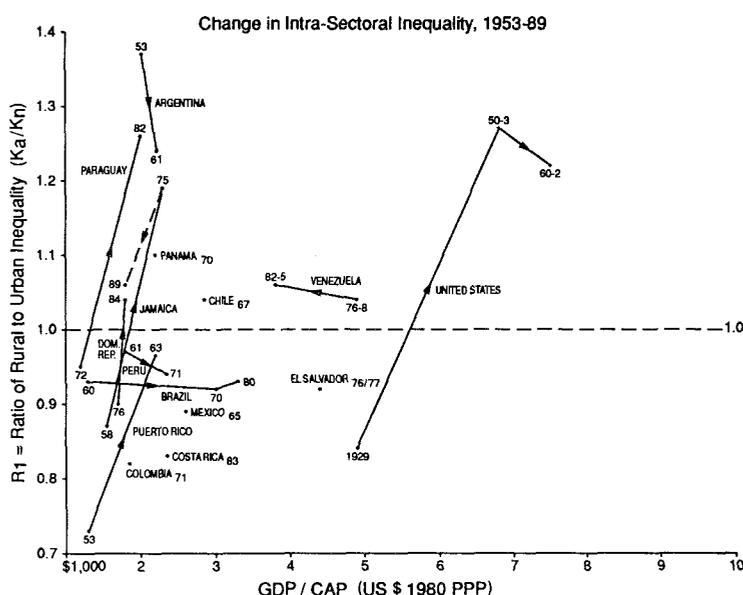


Figure 2. The Cross-Over In Latin America: Change in Intra-Sectoral Inequality, 1953-89

## VI. CONCLUSIONS

The measurement techniques we have devised to estimate Paraguayan income distributions have utilized three urban household surveys, two land surveys, and two rural income surveys placed within a national accounts framework. The general stability of the non-*A* distributions and the plausibility of the findings for the *A*-sector suggest that the gain in merging these data sets offsets the heterogeneity of the underlying survey techniques. They also suggest that it may be possible to construct similar synthetic estimates of distributions of other countries for which comparable components are available and to place them in an historical context.

Our measurement of Paraguayan income distributions comes at a time when that country begins to emerge from three-and-a-half decades of self-imposed isolation from the world community due to its uncompromising stance on human rights while pursuing its own development path. That path has resulted in the agricultural expansion of small-scale cotton growing, medium-scale soybean farming, and large-scale livestock raising. This tri-polar modernization of agriculture has deepened the divisions within the rural sector and has maintained agriculture's relative income vis-à-vis the other sectors.

As Paraguay rejoins the Latin American community and moves to restore the democratic rights of its citizens, that nation now confronts the situation that we have here recorded, namely, a rapidly widening distribution of income within agriculture and a very unequal country-wide distribution. While this tendency has also been observed elsewhere in Latin America, it highlights in the Paraguayan case the most fundamental conflict that nation faces in its transition to democratic processes.

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APPENDIX TABLE 1a  
COMPUTATION OF THE SECTORAL INCOME DISTRIBUTIONS

A. The General Formula

Given  $\hat{N}_j^t$ ,  $\hat{Y}_j^t$ ,  $D_i^n$ ,  $H_i^t$ ,  $\bar{Y}_{ij}^t$ , from the sources,  
Compute

$$(A.1) \quad D_{ij}^y := [N_{ij}^t \cdot \bar{Y}_{ij}^t] \div \hat{Y}_j^t \quad \text{for all } i, j, t$$

where

$D_i^n$ ,  $D_i^y$  = Percentage distribution (shares) of the number ( $n$ ) of families and their corresponding income ( $y$ ), respectively, for intervals  $i$  in Sector  $i$ , for year  $t$ .

$\hat{N}$ ,  $\hat{Y}$  = Control totals number of families and their income.

$N_{ij}^t$  = Number of families in interval  $i$  in sector  $j$  for year  $t$ .

$\bar{Y}_{ij}^t$  = Average income for interval  $i$  in sector  $j$  for year  $t$ .

For agriculture

$$(A.2.a) \quad \bar{Y}_i^t = \bar{Y}_i^h \cdot \bar{H}_i \quad \text{for 1972, 1982,}$$

or

$$(A.2.b) \quad \bar{Y}_i^t = \bar{Y}_i^c \cdot c_i \cdot \bar{H}_i \quad \text{for 1988.}$$

Where

$\bar{H}_i$  = Midpoint number of hectares held per farm for interval  $i$ .

$\bar{Y}^{h,c}$  = Average income per hectare ( $h$ ) or per cultivated hectare ( $c$ ) for each interval  $i$ .

$c_i$  = Ratio of cultivated to total land held, in hectares per farm, for each interval  $i$ .

APPENDIX TABLE 1b  
THE PROTOTYPES

Prototype I	Application
Given $\hat{N}$ , $\hat{Y}$ , $\hat{D}_i^n$ , $\hat{D}_i^y$	Non-Ag, 1972
Compute	Sample from Asunción, 1970-71, applied to entire non-Ag sector. Distributions from Figueroa and Weisskoff (1974), T.4.2, derived from 568 families.
(B.1) $N_i = \hat{D}_i^n \cdot \hat{N}$	
(B.2) $\bar{Y}_i = [\hat{D}_i^y \cdot \hat{Y}] \cdot [N_i]^{-1}$	
Where $\hat{D}$ = Sample of distributions, $i = 1, \dots, 7$ .	(continued over)

APPENDIX TABLE 1b—continued

<p>Prototype II</p> <p>Given <math>\hat{N}</math>, <math>\hat{Y}</math>, <math>\hat{D}_{kl}^n</math>, <math>Y_{i-1}</math></p> <p>Compute</p> <p>(B.3) <math>D_i^n = \sum_{kl} \hat{D}_{kl}^n</math></p> <p>(B.4) <math>N_i = D_i^n \hat{N}</math></p> <p>(B.5) <math>Y_{i-1} = N_{i-1} \bar{Y}_{i-1}</math></p> <p>(B.6) <math>\bar{Y}_{10} = [\hat{Y} - \sum (Y_{i-1} N_{i-1})] N_{10}^{-1}</math></p> <p>(B.7) <math>D_i^y = [N_i \bar{Y}_i] \hat{Y}^{-1}</math></p> <p>Where <math>k = 1, \dots, 8</math> cities, <math>l = 1, \dots, 19</math> income intervals, <math>i - 1 =</math> all but top interval.</p>	<p>Non-Ag, 1982</p> <p>Newly-released sample of 1,330 families from Asunción and 7 provincial cities for 1978-79 for 19 income intervals were aggregated to a single non-Ag distribution for 10 intervals and applied to the entire sector. Income mid-points were taken for the 9 lower intervals, and income to the top was computed as a residual.</p> <p>Non-Ag, 1988</p> <p>The household employment survey of 1,000 families for 1989 was used due to its more detailed presentation of 9 income intervals, DGEC (1990), Tables 1, 5. The land-income relationship for 6 and applied to the 1988 universe.</p>
<p>Prototype IIIa:</p> <p>Given <math>\hat{N}</math>, <math>\hat{Y}</math>, <math>\hat{D}_m^{nh}</math>, <math>\bar{H}_i</math>, <math>\bar{Y}_i^h</math></p> <p>Compute</p> <p>(B.8) <math>\bar{Y}_{i-1} = \bar{Y}_{i-1}^h \cdot \bar{H}_{i-1}</math></p> <p>(B.9) <math>N_i = \hat{D}_i^{nh} \hat{N}</math></p> <p>Then (B.6-7 above)</p> <p>Where <math>\hat{D}_m^{nh}</math> = sample distribution hect/farm, <math>m = 1, \dots, 4</math>.</p>	<p>Agriculture, 1972</p> <p>Distribution of number of families by holding size for 1972 sample is from Galeano (1982), Table 1, 5. The land-income relationship for 6 non-corresponding categories is given by USAID/CEDES, Table D-4. Net incomes per hect. for 4 categories which correspond to the land-holding categories were interpolated, and then applied to the land-holding mid-points to obtain income per size holding and total income. Income of the top category (farms over 50 hectares) was calculated as a residual.</p>
<p>Prototype IIIb:</p> <p>Given <math>p</math> = price deflator</p> <p>Compute</p> <p>(B.10) <math>\bar{Y}^{ht} = \bar{Y}^h \cdot p</math></p> <p>Then (B.8-9, 6-7)</p>	<p>Agriculture, 1982</p> <p>Distribution of land-holdings in 15 Eastern departments aggregated into 5 classes from MAG (1985), pp. 202-211, 18 original intervals. Actual mid-points for each size class calculated from ECLAC (1984), 509.</p> <p>Price Inflater from <i>World Tables</i>.</p>
<p>Prototype IIIc</p> <p>Given <math>c_i</math>, <math>\bar{Y}_i^c</math></p> <p>Compute</p> <p>(B.11) <math>\bar{Y}_i = \bar{H}_i \cdot c_i \cdot \bar{Y}_i^c \cdot p</math></p> <p>Then (B.8-9, 6-7)</p> <p>Where <math>c_i</math> = cultivated/total land, <math>\bar{Y}_i^c</math> = net farm income per cultivated hect.</p>	<p>Agriculture, 1988</p> <p>Net farm income, including home consumption and livestock, was sampled for 1 region and this was applied to the distribution of cultivated land. Income of top class was calculated as a residual, due to their concentration on livestock. Cultivated land computed for the 4 intervals from Ag Census of 10 major farming departments, MAG (1985), T.18. Net farm income per cultivated hect. from Campos (1986) was computed from sample in Table 22, p. 87, and inflated to 1988 prices.</p>

All sectors: For each year, the sectoral distributions were cumulated and interpolated separately, and the concentration indices computed from the standard interpolated quintile shares to insure comparability of different sectors and years. Country-wide distributions were obtained by ordering the rural and urban intervals for each year, accumulating, and then interpolating to obtain standard quintile shares.

APPENDIX TABLE 2  
SUMMARY OF THE DATA BY CONCEPT

Symbol	1972	1982	1988	Concept
<b>Agriculture</b>				
$i$	5	5	5	No. of Intervals
$D$	1972	1982	1982	Distributions of Families
$H$	Interval Midpoint	actual midpoint		Hectares per Interval
$\bar{Y}^h$	1972-73	1972-73/inflated	1985	Net farm income per hect.
Top $\bar{Y}_i$	Residual	Residual	Residual	Income of open-ended Interval
$C$	—	—	1982	Share cultivated/total hect.
—	1,000	1,000	40	Sample size, income variable
<b>Non-agriculture</b>				
$i$	7	10	9	No. of Intervals
$j$	1	8	1	No. of Cities
$\bar{Y}, D$	1970-71	1978-79	1989	Av. income; Dist. of families
Top $\bar{Y}_i$	Exhaustive	Residual	Residual	Av. income of open interval
—	568	1,330	1,000	Sample size, families

APPENDIX TABLE 3  
SUMMARY OF SOURCES BY CONCEPT

Concept	1972	1982	1988
<b>A. Income</b>			
1. Totals	World Tables	National Accounts	National Accounts
2. A/N Shares	(World Bank, 1989b)	(MAG, 1990)	
3. Deflators	World Tables	World Tables	Ag.: IMF N: Coyuntura Ec, T.3
<b>B. Population</b>			
1. Totals	Nat. Census '72	Nat. Census '82	Projections (DGEC, Oct. 1986)
2. A/N Shares	FAO Production Year-books (USDA, 1990)	FAO	FAO (USDA, 1990)
3. Family Size	Census '72	Census '82	1982 (DGEC, July 1985)
<b>C. Ag. Sector</b>			
1. Land Distr.	Ag. Survey, 1972 (Galeano, 1982)	Ag. Census, 1982 (MAG, 1985)	(1982)
	$i = 5$	$i = 18$	
2. Midpoints	Arithmetic	Actual	Actual
3. Income	1972-73: Sample of 1,000 < 50 hect.	1972 inflated to 1982	Cultivated/total land (MAG, 1985, T.18)
	$i = 6$ , interpolated to 4 (USAID/CEPES, T.D-4)		Net income per cult. hect. (Campos, 1986, T.22).
<b>D. Non-Ag. Sector</b>			
1. Distrib.	Asunción, 1970-71: (Figueroa-Weisskoff, 1974), ECIEL Sample)	Asunción and 7 cities 1978-79 (Central Bank, unpublished worksheets)	Metro. Asunción, 1989: (DGEC, 1990).