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AGGREGATING INEQUALITIES:

THE EQUALIZING IMPACT OF THE EARNINGS

OF MARRIED WOMEN IN METROPOLITAN BRAZIL

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AGGREGATING INEQUALITIES: THE EQUALIZING IMPACT OF THE EARNINGS OF MARRIED WOMEN IN METROPOLITAN BRAZIL

ABSTRACT

The Brazilian family underwent profound transformations during the past decade with potentially important implications for the evolution of income inequality. In this study we analyze the impact on inequality of one of these transformations: the rise in wives' labor-force participation rates.

We show that necessary conditions for wives' earnings to have impact on income inequality are: (1) a correlation among spouses' earnings different from one, and/or (2) a different level of income inequality among wives than among husbands. Moreover, it is also shown that if inequality in earnings among wives is smaller than among husbands, then the inclusion of wives' earnings will always have an equalizing impact on the distribution of income among families.

We demonstrate that the correlation among spouses' earnings is around 0.4 and that the level of earnings inequality is more than 50% higher among wives than among husbands. The result of these two forces which operate in opposite directions is that even though the average contribution of wives to the family budget is around 15%, the inclusion of their earnings has an insignificant effect on income inequality. We also show that the inclusion of wives' earnings would necessarily lead to an increase in the Gini coefficient by 7% if the correlation among spouses' earnings were perfect, while a reduction of this correlation from one to the value empirically observed, would lead to a reduction in the Gini coefficient of 8%. Therefore, the equalizing impact of the labor force participation of married women seems to be bounded to be lower than 10%.

1-INTRODUCTION

Brazilian family underwent profound transformations during the past decades. Important examples are a significant rise in women's labor-force participation and a large decrease in family size (see Goldani(1989), Pastore et al.(1983), and Silva (1982))[1]. These transformations led to a reduction in the dependency ratio and an increase in the number of earners per family and consequently have decisively altered the evolution of income inequality in Brazil[2]. Given the great concern about inequality in Brazil, it is surprising that no study has appeared to assess how these transformations in the family may have affected the overall evolution of inequality in Brazil.

The objective of this paper is to consider theoretically and empirically the extent to which the labor-force participation of married women, and so increases in the number of earners per family, contributes to reduce inequality in family earnings[3].

In income distribution studies it is always difficult to consider simultaneously families with distinct sizes and structures. Therefore in this paper we opt to restrict our universe of analysis to NUCLEAR families, i.e.,

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[1]Goldani(1989,pp.51) showed that from 1970 to 1980 the Brazilian population living in private households increased by 28% while the number of private households increased by 45%. This led to a ten percent decrease in average household size.
Silva(1982,Tables 2.4 and 2.5) and Médici(1982) showed that from 1970 to 1977 the average family size decreased from 5.0 to 4.5 and the female labor-force participation rate increased from 18.2% to 34.7%.

[2]The clearest evidence is the following important empirical observation by Hoffmann and Kageyama(1986, pp 10 and Tables 3 and 6): They noticed that, in Brazil from 1970 to 1980, inequality in <u>personal</u> income among economically active individuals <u>increased</u> whereas inequality in <u>family</u> income were <u>reduced</u> during the same period.

[3]The impact of the labor force participation of married women on the distribution of well-being among individuals is in principle quite distinct from the impact on the distribution of monetary income among families. Welfare considerations would require us to study the women's contributions both at home and at the market place. These welfare considerations are beyond the scope of this paper which concentrates on pure <u>measurement</u> questions.

husband-wife families with or without children[4]. Within this universe[5], we compare the inequality associated with the distribution of families according to husbands' earnings with the inequality associated with the distribution of families according to the sum of the spouses' earnings[6]. In other words, we estimate the marginal impact of including wives' earnings on the inequality among nuclear families.

Similar studies were done by Mincer(1974), Smith(1979), Danziger(1980), Lehrer and Nerlove(1981,1984), and Blau(1984) for the United States; Layard and Zabalza(1979) for the United Kingdom, Gronau(1982) for Israel; Schirm(1988) for Quebec in Canada; and Duraisamy and Levy-Garboua(1989) for France. See Winegarden(1987) for a cross-national study. Surveys of this literature can be found in Michael(1985) and Treas(1987).

The marginal contribution of wives' earnings to the inequality among families is a typical problem in aggregation of inequalities (see Shorrocks(1978,1982,1983) and Satchel(1987)). Whenever two income sources are added the aggregated inequality, and hence the marginal contribution of each source, will depend on three factors: (1) their relative size; (2) the sign and magnitude of the association between them; and (3) their relative inequality. Although these three factors have been universally recognized as the determinants of the aggregated inequality, there are at least two important questions which remain relatively unexplored in past literature: (1) How do these three factors interact with each other in determining the marginal impact of each income source on the aggregated inequality? (2) To

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[4]Actually, we only consider families whose children are less than 14 years old.

[5]This universe accounts for approximately 1/3 of the Brazilian families.

[6]Actually, we only consider labor earnings.

what extent is it possible to isolate the individual contribution of each of these three factors? These two questions are going to be referred to as the Interaction and Decomposition questions, respectively.

Answers to these questions will, for instance, enhance our ability of predicting how the inequality among families would evolve under alternative scenarios for the labor force participation of women.

This paper is organized into five sections. Section 2 theoretically discuss the Interaction question. In Section 3 we estimate the marginal impact of including wives' earnings on the inequality in family earnings for the nine largest Brazilian metropolitan areas using the 1985 Brazilian Annual Household Survey-PNAD. In addition, we estimate (1) wives' labor-force participation rate and the average contribution of wives' earnings to the total family budget; (2) the correlation between spouses' earnings; and (3) the inequality in husbands' and wives' earnings. Section 4 considers theoretically and empirically the Decomposition question. This section develops and applies a new method, using the Gini coefficient, for decomposing wives' marginal impact on inequality in family earnings into two components: one generated exclusively by differences in earnings inequality between spouses and another generated exclusively by less than perfect assortive mating on spouses' earnings. Finally, Section 5 summarizes our main findings.

2-Theoretical Aspects

Let $\mathbb{R}^N_{++}=\{\mathbf{x}=(x_1,\dots,x_N):x_i>0, i=1,\dots,N\}$. Let $\mathcal{R}^1=(r^1_1,\dots,r^1_N)\in\mathbb{R}^N_{++}$ denote husbands' earnings, $\mathcal{R}^2=(r^2_1,\dots,r^2_N)\in\mathbb{R}^N_{++}$ denote wives' earnings, and $\mathcal{R}^+=(r^+_1,\dots,r^+_N)\in\mathbb{R}^N_{++}$ denote husbands' plus wives' earnings (i.e., family earnings). Therefore, $\mathcal{R}^+=\mathcal{R}^1+\mathcal{R}^2$ and $\mathcal{R}=(\mathcal{R}^1,\mathcal{R}^2)\in\mathbb{R}^N_{++}\times\mathbb{R}^N_{++}$ denote the couples' earnings.

Let $I:\mathbb{R}^N_{++}\to\mathbb{R}_+$ be an inequality measure, i.e., a Schur-convex function which is homogeneous of degree zero and satisfies $I(1,\ldots,1)=0$. Let $I^1=I(\mathcal{R}^1)$, $I^2=I(\mathcal{R}^2)$, and $I^+=I(\mathcal{R}^+)$. Define $\Delta_I(\mathcal{R})=(I^+-I^1)/I^1$. Thus, $\Delta_I(\mathcal{R})$ measures the marginal impact of including wives' earnings on the earnings inequality among families when I is the inequality measure being used[7].

Given $\mathcal{R}$ and a choice of I, $\Delta_I(\mathcal{R})$ is uniquely determined, i.e., Δ is solely a function of $\mathcal{R}$ and I. The objective of this section is to examine some general properties of this function.

This section is in four parts. The first sub-section establishes some basic facts and notation about the Lorenz curve and rank correlation. In the subsequent two sub-sections we investigate how $\Delta_I(\mathcal{R})$ depends on $\mathcal{R}$ for generic inequality measures. First, we examine a theoretically important extreme case in which $\Delta_I(\mathcal{R})=0$. Specifically, we consider the case in which the relative contribution of wives's earnings to the family budget is the same in all families. The analysis of this case will provide us with necessary conditions on $\mathcal{R}$ for $\Delta_I(\mathcal{R})\neq 0$.

Secondly, we show that in certain cases it is possible to determine whether $\Delta_I(\mathcal{R})\leq 0$ independently of the nature of the correlation between $\mathcal{R}_1$ and $\mathcal{R}_2$. These results are also used to formalize the notion that aggregation of income from different sources always tends to reduce inequality.

Finally, in the fourth sub-section we completely characterize how $\Delta_I(\mathcal{R})$ depends on $\mathcal{R}$ when I is chosen to be the coefficient of variation.

The following additional notation will be used. Let ρ be the correlation coefficient between $\mathcal{R}^1$ and $\mathcal{R}^2$. Let m^1, m^2 and m^+ be the means and

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C^1, C^2, and C^+ the coefficients of variation of $\mathcal{R}^1$, $\mathcal{R}^2$, and $\mathcal{R}^+$, respectively. Define $\eta = C^2/C^1$, and $\alpha = m^2/m^+$. Finally, let L^1, L^2 and L^+ be the Lorenz curves associated with $\mathcal{R}^1$, $\mathcal{R}^2$ and $\mathcal{R}^+$.

2.1-Preliminaries: The Lorenz Curve and Rank Correlation.

Let $\mathbb{P}$ be the set of all permutations $p=(p(1),\ldots,p(N))$ of $(1,\ldots,N)$. For all $\mathbf{x}\in\mathbb{R}^N_{++}$, let

$$A^x = \{p\in\mathbb{P}\text{: for all pair } (i,k),\ 1\le i\le k\le n,\ x_{p(i)}\le x_{p(k)}\},$$

i.e., A^x is the set of all orderings of $\mathbf{x}$ in ascending order. Further, for all $\mathbf{x}\in\mathbb{R}^N_{++}$ and $p\in A^x$, let $S^x_0=0$ and

$$S^x_k = \sum_{i=1}^{k} x_{p(i)} \qquad\qquad k=1,\ldots,N.$$

Note that $\{S^x_k\text{: } k=0,\ldots,N\}$ is independent of the particular permutation $p\in A^x$ we choose to define it. Based on $\{S^x_k\text{: } k=0,\ldots,N\}$ the level of the Lorenz curve for $\mathbf{x}$ at $s\in[0,1]$ can be expressed as

$$L^x(s) = (b\cdot S^x_{k-1}+(1-b)\cdot S^x_k)/S^x_N$$

where k is chosen such that $N\cdot s\le k\le N\cdot s+1$ and $b=k-N\cdot s$, so that $b\in[0,1]$. In other words, the Lorenz curve is the piecewise linear interpolation of the points $(0,0)$, $(1/N, S^x_1/S^x_N)$, ..., $(1-1/N, S^x_{N-1}/S^x_N)$, $(1,1)$. As a consequence,

Remark 1: The Lorenz curves for $\mathbf{x}$ and $\mathbf{y}$ are identical if and only if $S^x_k/S^x_N = S^y_k/S^y_N$ for all $k=1,\ldots,N-1$.

To simplify notation let $A^1=A^x$ for $\mathbf{x}=\mathcal{R}^1$ and let A^2 and A^+ be defined similarly. We say that $\mathcal{R}^1$ and $\mathcal{R}^2$ are perfectly rank-correlated ($\rho_R=1$) when $A^1\cap A^2\neq\emptyset$, i.e., when there exist at least one permutation that put simultaneously the husbands' and the wives' earnings in ascending order. Note that any permutation that could put simultaneously the husbands' and the wives' earnings in ascending order would also put family earnings in ascending order, hence

Remark 2: $A^1\cap A^2=A^1\cap A^2\cap A^+$;

Remark 3: If $f\in A^x$, $g\in A^y$, and $\mathbf{z}_i=\mathbf{x}_{f(i)}+\mathbf{y}_{g(i)}$ then $L^z=(1-b)\cdot L^x+b\cdot L^y$ where $b=S_N^y/S_N^z$. More generally, it can be proved that the space of Lorenz curves is convex.

2.2-Fixed Participation of Wives in Family Income

Assume the relative contribution of wives' earnings to the family budget is the same in all families. In other words, assume $\mathcal{R}^2=a\cdot\mathcal{R}^+$. It then follows immediately that $\mathcal{R}^+=\mathcal{R}^1/(1-a)$. Therefore, since I is homogeneous of degree zero, $I^+=I^1$. Consequently, $\Delta_I(\mathcal{R})=0$ independent of a (the relative contribution of wives' earnings to the family budget).

The interpretation of this result is important and immediate: If each wife contributes with a fixed proportion to her family budget then the inclusion of her earnings will only multiply the income of every family by a constant factor, $(1-a)^{-1}$. As a result, it will not alter the prevailing level of inequality. This extreme case, $\mathcal{R}^2=a\cdot\mathcal{R}^+$, has two illuminating alternative characterizations:

Theorem 1: (i) $\mathcal{R}^2=a\cdot\mathcal{R}^+$ if and only if $\rho_R=1$ and $L^1=L^2$

(ii) $\mathcal{R}^2=a\cdot\mathcal{R}^+$ if and only if $\rho=1$ and $\eta=1$

Proof: ((i)⇒) If $\mathcal{R}^2=a\cdot\mathcal{R}^+$, $\mathcal{R}^2=\mathcal{R}^1\cdot a/(1-a)$. Hence, $A^1=A^2$ implying that $\rho_R=1$. Moreover, $\mathcal{R}^2=\mathcal{R}^1\cdot a/(1-a)$ implies that $S_k^2=S_k^1\cdot a/(1-a)$ for all k=1,...,N. Hence, $S_k^2/S_N^2=S_k^1/S_N^1$ for all k=1,...,N, implying by Remark 1 that $L^1=L^2$.

((i)⇐) Next, assume that $\rho_R=1$ and $L^1=L^2$. By definition if $\rho_R=1$ there exist a permutation $f\in A^1\cap A^2$. Moreover, if $L^1=L^2$, by Remark 1, $S_k^1/S_N^1=S_k^2/S_N^2$ for all k=1,...,N. Hence,

$$\sum_{i=1}^{k} r^1_{f(i)} = S_k^1 = \frac{S_N^1}{S_N^2} S_k^2 = \frac{S_N^1}{S_N^2} \sum_{i=1}^{k} r^2_{f(i)} \qquad k=1,\dots,N.$$

Therefore,

$$r_i^1 = \frac{S_N^1}{S_N^2} r_i^2 \qquad i=1,\dots,N.$$

or equivalently,

$$\mathcal{R}^1 = \frac{S_N^1}{S_N^2} \mathcal{R}^2$$

Since $S_N^1=m^1\cdot N=(1-a)\cdot m^+\cdot N$ and $S_N^2=m^2\cdot N=a\cdot m^+\cdot N$, we obtain $\mathcal{R}^1=((1-a)/a)\cdot\mathcal{R}^2$ which is equivalent to $\mathcal{R}^2=a\cdot\mathcal{R}^+$.

((ii)⇒) If $\mathcal{R}^2=a\cdot\mathcal{R}^+$, $\mathcal{R}^2=\mathcal{R}^1\cdot a/(1-a)$. Therefore, $C^2=C^1$ and $\rho=1$.

((ii)⇐) If $\rho=1$, there exist $\mathfrak{a}$ and $\mathfrak{b}>0$ such that $\mathcal{R}^2=\mathfrak{a}+\mathfrak{b}\cdot\mathcal{R}^1$. In this case, $C^2=\mathfrak{b}\cdot C^1\cdot m^1/(\mathfrak{a}+\mathfrak{b}\cdot m^1)$. So, if in addition $\eta=C^2/C^1=1$ then $\mathfrak{a}=0$ and $\mathcal{R}^2=\mathfrak{b}\cdot\mathcal{R}^1$ that implies $\mathcal{R}^2=a\cdot\mathcal{R}^+$.

■

This theorem establishes that the relative contribution of wives' earnings to the family budget is the same in all families if and only if (1) spouses' earnings are positively and perfectly correlated with each other and (2) the inequality of earnings among husbands equals the inequality among wives. Notice that $L^1=L^2$ implies that $\kappa=1$ while $\rho=1$ implies that $\rho_R=1$. The condition $L^1=L^2$ imposes further restrictions on how similar husbands' and wives' earnings inequality must be, whereas the condition $\rho=1$ imposes stronger restrictions on the association between spouses' earnings. As a consequence of this theorem, a necessary condition for $\Delta_I(\mathcal{R})\neq0$ is that at least one of the conditions above must be violated[8], i.e.,

Corollary 1: (i) If $\Delta_I(\mathcal{R})\neq0$ then $\rho_R\neq1$ or $L^1\neq L^2$,

(ii) If $\Delta_I(\mathcal{R})\neq0$ then $\rho\neq1$ or $\kappa\neq1$.

In addition to their direct interest, these alternative characterizations are extremely important as a starting point for the analysis that follows, and in particular, to the decomposition procedure to be discussed later in section 4.

2.3-The Weighted Sub-Additivety of Inequality Measures

There exists a sense in which the aggregation of income from different sources always leads to reductions in inequality. This notion can be best formalized using the following weighted super-additivity property of Lorenz curves due to Satchell (1987, Theorem 1b):

Theorem 2: $L^+ \geq (1-\alpha)\cdot L^1 + \alpha\cdot L^2$

Remember that higher Lorenz curves imply smaller inequality levels. Thus, one may appropriately refer to $L^+-\{(1-\alpha)\cdot L^1+ \alpha\cdot L^2\}$ as the <u>equality</u> gain from

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[8] This statement is in conflict with Corollary 3b in Satchell(1987). The fact is that Satchell's corollary is incorrect.

aggregation. Next, we want to show that this gain is zero if and only if $\rho_R=1$.

Theorem 3: $L^+ = (1-\alpha)\cdot L^1 + \alpha\cdot L^2$ if and only if $\rho_R=1$.

Proof: By Remarks 1 and 3, $L^+=(1-\alpha)\cdot L^1 + \alpha\cdot L^2$ if and only if

$$S_k^+/S_N^+ = (1-\alpha)\cdot S_k^1/S_N^1 + \alpha\cdot S_k^2/S_N^2 \qquad k=1,\dots,N \qquad (1)$$

Since $\alpha=m^2/m^+$, $1-\alpha=m^1/m^+$, $N\cdot m^+=S_N^+$, $N\cdot m^1=S_N^1$, and $N\cdot m^2=S_N^2$. Expression (1) is equivalent to

$$S_k^+ = S_k^1 + S_k^2 \qquad k=1,\dots,N$$

This is equivalent to the existence of permutations $f\in A^+$, $h\in A^1$, and $w\in A^2$ such that

$$\sum_{i=1}^{k} r^+_{f(i)} = \sum_{i=1}^{k} r^1_{h(i)} + \sum_{i=1}^{k} r^2_{w(i)}. \qquad k=1,\dots,N \qquad (2)$$

Since

$$\sum_{i=1}^{k} r^+_{f(i)} = \sum_{i=1}^{k} r^1_{f(i)} + \sum_{i=1}^{k} r^2_{f(i)}, \qquad k=1,\dots,N$$

$$\sum_{i=1}^{k} r^1_{f(i)} \geq \sum_{i=1}^{k} r^1_{h(i)}, \qquad k=1,\dots,N$$

because $h\in A^1$, and

$$\sum_{i=1}^{k} r^2_{f(i)} \geq \sum_{i=1}^{k} r^2_{w(i)} \qquad k=1,\dots,N$$

because $w\in A^2$, expression (2) is equivalent to

$$\sum_{i=1}^{k} r^1_{f(i)} = \sum_{i=1}^{k} r^1_{h(i)} \qquad k=1,\dots,N$$

and

$$\sum_{i=1}^{k} r^2_{f(i)} = \sum_{i=1}^{k} r^2_{w(i)}. \qquad k=1,\dots,N$$

In turn, these two expressions are equivalent to

$$r^1_{f(i)} = r^1_{h(i)} \qquad i=1,\dots,N \qquad (3a)$$

and

$$r^2_{f(i)} = r^2_{w(i)} \qquad i=1,\dots,N. \qquad (3b)$$

Finally, (3) holds if and only if there exist a permutation $f \in A^1 \cap A^2 \cap A^+$. It follows then by the Remark 2 that (3) holds if and only if $A^1 \cap A^2 \neq \emptyset$, i.e., if and only if $\mathcal{R}^1$ and $\mathcal{R}^2$ are perfectly rank-correlated.

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Theorem 2 has several useful direct consequences:

Corollary 2: $L^+ \geq \text{MIN}\{L^1, L^2\}$.

Corollary 3: $L^+ \geq L^1$ if $L^1 \leq L^2$.

Corollary 3 is particularly important. It establishes that if inequality in wives' earnings were smaller than in husbands' earnings then the inclusion of wives' earnings would always reduce inequality, independent of the correlation between spouses' earnings. As it is well known (Dasgupta, Sen, and Starrett(1973)), if $L^+ \geq L^1$ then $I^+ \leq I^1$. Hence, it also follows from Corollary 3 that

Corollary 4: If $L^1 \leq L^2$ then $I^+ \leq I^1$ and consequently $\Delta_I(\mathcal{R}) \leq 0$, independent of the correlation between spouses' earnings.

For $\Delta_I(\mathcal{R}) \leq 0$, the hypothesis $L^1 \leq L^2$ is stronger than necessary. To show it is stronger, we obtain results similar to Corollary 4 under weaker assumptions. The idea is to find analogs to Theorem 2 which are phrased in terms of inequality measures instead of Lorenz curves. As a matter of fact, there exists a variety of such analogs to Theorem 2. For instance, as appropriately observed by Satchell(1987,theorem 2), for all inequality measures which, like the Gini coefficient (G), are decreasing <u>linear</u>

functions of the Lorenz curve[9], the weighted super-additivity property of Lorenz curves transforms into a weighted sub-additivity property for inequality measures.

Corollary 5: If I can be expressed as a decreasing linear function of L then $I^{+} \le (1-a)\cdot I^{1} + a\cdot I^{2}$ with equality holding if and only if I is strictly decreasing and $\rho_R=1$.

Proof:

The practical usefulness of Corollary 5 is limited by the fact that most inequality measures commonly used are not linear functions of L. Nonetheless, in several cases this weighted sub-additivity property still holds. The study of weighted sub-additive inequality measures started with Kolm(1976, section IX). Shorrocks(1978, Theorem 1) showed that *constant-sum convexity*[10] is a sufficient condition for an inequality measure to have the weighted sub-additivity property. More specifically,

Theorem 4: (i) If the inequality measure I is a constant-sum convex function then $I^{+} \le (1-a)\cdot I^{1} + a\cdot I^{2}$.

(ii) If I is a strictly constant-sum convex function then

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[9] See Mehran(1976) for the characterization of an important sub-class of such measures. In particular, the Gini coefficient is given by

$$G = 1 - 2\cdot\int_0^1 L(s)ds.$$

[10] A function $I:\mathbb{R}^N_{++}\to\mathbb{R}_+$ is *constant-sum convex* when for all $\mathbf{x}\in\mathbb{R}^N_{++}$, $\mathbf{y}\in\mathbb{R}^N_{++}$, and $b\in[0,1]$

$$I\left[b\cdot\frac{\mathbf{x}}{m^x} + (1-b)\cdot\frac{\mathbf{y}}{m^y}\right] \le b\cdot I\left[\frac{\mathbf{x}}{m^x}\right] + (1-b)\cdot I\left[\frac{\mathbf{y}}{m^y}\right].$$

where m^x and m^y are the mean of **x** and **y**, respectively. Moreover, I is said to be strictly constant-sum convex when strictly inequality holds in the expression above whenever $\mathbf{x}\neq\mathbf{y}$ and $b\in(0,1)$.

$$I^{+}=(1-a)\cdot I^{1}+a\cdot I^{2} \text{ if and only if } \mathcal{R}^{2}=a\cdot\mathcal{R}^{+}$$

The class of convex inequality measures encompasses a wide variety of measures in common use. It contains all members of the Atkinson(1970) family and Generalized Entropy family (Shorrocks(1980)). The Generalized Entropy family includes the square of the coefficient of variation and the two inequality measures proposed by Theil(1967,pp.126-7)[11]. Interestingly, constant-sum convexity is not only a necessary condition for weighted sub-additivity but it is also a sufficient condition.

Theorem 5: A inequality measure I is weighted sub-additive if and only if it is constant-sum convex.

Proof: If I is constant-sum convex then by Theorem 4 it is weighted sub-additive. Next suppose I is weighted sub-additive then

$$I\left[b\cdot\frac{\mathbf{x}}{m_x} + (1-b)\cdot\frac{\mathbf{y}}{m_y}\right] \le b\cdot I\left[b\cdot\frac{\mathbf{x}}{m_x}\right] + (1-b)\cdot I\left[(1-b)\cdot\frac{\mathbf{y}}{m_y}\right] =$$

$$= b\cdot I\left[\frac{\mathbf{x}}{m_x}\right] + (1-b)\cdot I\left[\frac{\mathbf{y}}{m_y}\right]$$

where the last equality follows from the fact that I is homogeneous of degree zero.

■

Theorems 4 and 5 are the analog to Theorems 2 and 3 we were looking for. It follows from them that

Corollary 6: If an inequality measure I is a constant-sum convex function then

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[11] The square-root of the coefficient of variation is a example of a inequality measure which is not constant-sum convex, see Shorrocks(1978, footnote 10) for another example.

(i) $I^{+} \leq MAX(I^{1}, I^{2})$ and (ii) $\Delta_{I}(\mathcal{R}) \leq 0$ if $I^{2} \leq I^{1}$ independent of the correlation between the spouses' earnings.

Moreover,

Corollary 7: (i) If $I^{2}=I^{1}$ and I is a strictly constant-sum convex function then $\Delta_{I}(\mathcal{R})=0$ if and only if $\mathcal{R}^{2}=\alpha \cdot \mathcal{R}^{+}$;

(ii) If $I^{2}=I^{1}$ and I can be expressed as a strictly decreasing linear function of the Lorenz curve then $\Delta_{I}(\mathcal{R})=0$ if and only if $\rho_{R}=1$;

(iii) If I is the coefficient of variation then $\Delta_{I}(\mathcal{R})=0$ if and only if $\rho=1$[12].

In summary, these theorems and corollaries establish that the inequality associated to a sum of two income sources is always less than the weighted average of the inequality of each income source. In other words, the aggregated inequality is always no greater than the inequality associated with the most inequatable of the sources, independently of the nature of the correlation between them. It follows from these results that if the inequality in earnings among wives were smaller than among husbands, then the inclusion of wives' earnings would necessarily reduce inequality independently of the association between spouses' earnings. For wives earnings to increase inequality, there must exist a higher earnings inequality among wives than among their husbands.

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[12] This implies that the coefficient of variation is not a constant-sum convex function as claim by Kolm(1976, Section IX.c.2).

2.3-Coefficient of Variation

As Gronau (1982) pointed out, the use of the coefficient of variation as a measure of inequality considerably simplifies the characterization of the functional relationship between $\Delta_I(\mathcal{R})$ and $\mathcal{R}$. Indeed, when I is the coefficient of variation

$$\Delta_I(\mathcal{R}) = [(1-a)^2 + a^2 \cdot r^2 + 2a\cdot(1-a)\cdot\rho\cdot r]^{1/2}-1.$$

$\Delta_I(\mathcal{R})$ depends on $\mathcal{R}$ only through the parameters a, ρ, and r[13]. The parameter a is an indicator of the contribution of wives' earnings to the total family budget; ρ is a measure of association between spouses' earnings; and finally, r measures the inequality of earnings among wives relative to the inequality among husbands.

Next, we consider the sensitivity of $\Delta_I(\mathcal{R})$ to each of these parameters. See Figures 1 to 3. To begin with we analyze how $\Delta_I(\mathcal{R})$ varies with a holding ρ and r constant[14]. If $\rho=1$ then $\Delta_I(\mathcal{R}) = a\cdot(r-1)$ and the inclusion of wives' earnings will reduce or increase inequality depending solely on whether the inequality among wives is smaller ($r<1$) or larger ($r>1$) than the inequality among husbands. In this case, of perfect and positive correlation, the impact will be monotonic and proportional to a. If the correlation is not one but positive and sufficiently large then $\Delta_I(\mathcal{R})$ will not be proportional to a but will still vary monotonically with a.

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[13] Naturally, the parameterization (a,ρ,r) is not the unique option. In fact, Gronau(1982) and Schirm(1988) have chosen different parameterizations. Gronau considers our parameterization in a appendix to his paper [Gronau(1982,p.134)].

[14] Needless to say, this type of analysis may be very sensitive to the parameterization used. Since the parameterization implicitly dictates what is held constant in each exercise. As mentioned before, Gronau(1982) and Schirm(1988) use different parameterizations, so their results are not strictly comparable with ours.

Specifically, if $r \geq 1$ and $\rho \geq 1/r$ then $\Delta_I(\mathcal{R})$ will be monotonically increasing with a; conversely if $r \leq 1$ and $\rho \geq r$ then $\Delta_I(\mathcal{R})$ will be monotonically decreasing with a. Otherwise, ($\rho < \mathrm{Min}\{r, 1/r\}$)the relationship between $\Delta_I(\mathcal{R})$ and a will be U-shaped with a trough at

$$\underline{a} = \frac{1 - \rho r}{1 + r^2 - 2\rho r}$$

In particular, the trough relationship will always be U-shaped when $\rho \leq 0$. Therefore, as long as the contribution of wives'earnings to their family budget is small and spouses' *earnings are negative correlated, the inclusion* of wives' earnings will always reduce inequality. Finally, notice that when $a=1$, $\Delta_I(\mathcal{R}) = r-1$. Therefore, if the inequality among wives is higher than among husbands then, inevitably, for high values of a, $\Delta_I(\mathcal{R})>0$.

The relationship between $\Delta_I(\mathcal{R})$ and ρ holding a and r constant is, as one would expect, always monotonically increasing. Therefore, whenever the inclusion of wives' earnings does have a equalizing impact, an increase in the correlation between spouses' earnings reduces this equalizing impact. When the inclusion of wives'earnings generates more inequality an increase in the correlation between spouses' earnings would reinforce this concentration impact.

Finally, the relationship between $\Delta_I(\mathcal{R})$ and r holding a and ρ constant has some counter-intuitive features. One would expect that the larger the earnings inequality among wives the higher the propensity of including wives' earnings to increase income inequality among families. In other words, one would expect $\Delta_I(\mathcal{R})$ to be increasing with r. That is actually the case when $\rho>0$. However, if $\rho<0$, $\Delta_I(\mathcal{R})$ will be decreasing with respect to r for small values of r, more specifically, for all $r<-(1-a)\cdot\rho/a$.

Hence if spouses' earnings are negatively correlated then more inequality among wives reduces inequality among families as long as the inequality among wives is still small.

3-Empirical Evidence

Based on the 1985 Brazilian Annual Household Survey (**PNAD**), this section and the next empirically investigate the sign and magnitude of the impact of including wives' earnings on the income inequality among nuclear families. We restrict our analysis to nuclear families which satisfy the following additional requirements: a) reside in one of the nine largest Brazilian metropolitan areas; b) are the only family in the dwelling they reside; c) the husband is between 25 and 50 years old and does participate in the labor-force; and d) all children in the family are less than 14 years old. The final sample size varies from 900 to 3000 depending on the metropolitan area we consider. The sample screening and sample size are describe in Tables A and B in the Appendix.

This universe was chosen with the explicit intention of including only families whose budget is primarily comprised of labor earnings by husband and wife only. As a result, in this universe, spouses' labor earnings represent over 90% of total (labor and non-labor) family income while children's earnings represent, on average, less than 1%.

Using two alternative inequality measures, Table 1 compares the inequality in husbands' earnings with the inequality in family earnings (husbands' plus wives' earnings). Table 1 reveals that, except for Porto Alegre, the inclusion of wives' earnings increases inequality by 1% to 2% when measured by the Gini coefficient. However, if inequality is measured using the coefficient of variation, the inclusion of wives' earnings can reduce the level of inequality in up to 4%. In any case the impact of including wives' earnings on the inequality among families is surprisingly small.

A possible explanation for such a small impact could be a corresponding small contribution of wives' earnings to total family budget. A such negligible contribution could be due in part to a restricted female labor force participation rate. The evidence in Tables 2, 3, and 4 clearly refutes this possibility. The average contribution of wives' earnings to their family budget is always larger than 12% (see Table 2) while wives' labor force participation and employment rates are equally significant. They are always greater than 35% (see Tables 3 and 4). Hence, it is not possible to explain the small impact of including wives' earnings on the inequality among families, reported in Table 1, by a corresponding small contribution of wives' earnings to their family budget.

An alternative explanation for this small impact observed in Table 1 could be a very assortive mating on spouses' earnings, i.e., a high and positive correlation between spouses' earnings. The results reported in Table 5 show that even though the correlation is positive it is far from one. It actually ranges from 0.3 to 0.5. It is high however from an international perspective.

The correlation between spouses' earnings has two proximate determinants: (1) the correlation between spouses' earnings among those couples in which the wife works; and (2) the strength and direction of the relationship between wives' labor force participation and husbands' earnings. Table 6 present estimates for the correlation between spouses' earnings among couples in which the wife works which are positive and higher than the corresponding estimates for the correlation between spouses' earnings among all couples. This correlation conditional on the wife being in the labor force varies from 0.4 to 0.6. On the other hand, husbands' earnings seem to be weakly but positively related to wives' labor force participation. In fact, Table 7 indicates that husbands with economically active wives have earnings which are on average slightly higher than the earnings of those whose wives are not economically active[15]. In summary, the correlation between spouses' earnings is positive and this fact is mostly due to a relatively strong correlation between spouses' earnings among those couples in which the wife does work.

An important situation in which wives can contribute significantly to the family budget, and at the same time reduce income inequality, is when they participate in the labor market at the moment that their husbands are unemployed. This phenomenon can be clearly observed in Table 8. This table shows that unemployed husbands have wives with labor-force participation rates which are from 5% to 40% higher than the labor force participation rates of wives with employed husbands.

In summary, we have shown that wives' labor-force participation rates are significant, and that the contribution of their earnings to the total family budget is not negligible at all. Furthermore, even though the correlation between spouses' earnings is positive it is far from one. Thus, the small impact of including wives' earnings on the income inequality among families observed in Table 1 can only be explained by a level of inequality in earnings among wives which is much higher than among husbands. This prediction is confirmed by Table 9. The table shows that Gini coefficients among wives are about 50% higher than corresponding values for husbands.

[15] For São Paulo e Porto Alegre these differences are not statistically significant.

Coefficients of variation are about 70% higher among wives than among husbands.

4-Decomposing the Impact of Wives' Earnings on Income Inequality

As shown in the previous section, even though the average contribution of wives' earnings to the family budget is between 10% and 20%, their impact on inequality is very small. To better understand this result one should note two facts. On the one hand, a non-perfect assortive mating on spouses' earnings causes the inclusion of wives' earnings to <u>reduce</u> inequality among families. On the other hand, a higher level of earnings inequality among wives than among husbands causes the inclusion of wives' earnings to <u>increase</u> inequality among families. In summary, the small impact reported in Table 1 is the result of two forces operating in opposite directions. In this section we intend to estimate the magnitude of these two components by decomposing the impact of wives' earnings on family inequality, Δ_I, when the Gini coefficient is used to measure inequality. Our decomposition procedure relies heavily on Theorems 1(i) and 5(i) and the fact that the Gini coefficient can be expressed as a linear function of the Lorenz curve.

4.1-Defining and Finding the Decomposition

By Corollary 1(i) $\Delta_I \neq 0$ only if (1) the inequality among wives is different from the inequality among husbands, $L_2 \neq L_1$, and/or (2) there is not a perfect assortive mating based on spouses' earnings, $\rho_R \neq 1$. Our objective in this section is to decompose Δ_I into two components, Δ_L and Δ_ρ, such that (i) $\Delta_I = \Delta_L + \Delta_\rho$, (ii) $\Delta_L = 0$ if and only if $I_2 = I_1$, and (iii) $\Delta_\rho = 0$ if and only if $\rho_R = 1$. In addition, we would like to ensure that $sign(\Delta_L) = sign(I_2 - I_1)$ and that $\Delta_\rho \leq 0$.

When all those conditions are met, it becomes natural to use Δ_L as a measure of the contribution of the differences in inequality between husbands' and wives' earnings, and Δ_ρ as a measure of the reduction in inequality due to a non-perfect assortive mating on spouses' earnings.

To obtain this decomposition we consider a counterfactual joint distribution for spouses' earnings $\mathcal{R}_*=(\mathcal{R}^1_*,\mathcal{R}^2_*)$ which is obtained from $\mathcal{R}=(\mathcal{R}^1,\mathcal{R}^2)$ as follows: $\mathcal{R}^1_*=\mathcal{R}^1$ and $\mathcal{R}^2_*=(r^*_1,\dots,r^*_N)$ where $r^*_i=r^2_{f(i)}$ for all $i=1,\dots,N$ and some permutation f in A^1. In other words, $\mathcal{R}_*$ is obtained from $\mathcal{R}$ by rearranging couples in order to obtain a perfect assortive mating on spouses' earnings. By construction, (i) $L^1=L^1_*$ and $L^2=L^2_*$ and (ii) $m^1=m^1_*$ and $m^2=m^2_*$, where L^1_* and L^2_* are the lorenz curves and m^1_* and m^2_* are the average earnings associated to $\mathcal{R}^1_*$ and $\mathcal{R}^2_*$, respectively. In summary, the transformation from $\mathcal{R}$ to $\mathcal{R}_*$ preserves the size and inequality of each income source creating, though, a perfect rank-correlation between them.

Note that Δ_L would be the observed impact on inequality of including wives' earnings in the event of a perfectly assortive mating on spouses' earnings. Therefore, Δ_L appropriately isolates the contribution of higher levels of earnings inequality among wives. On the other hand, Δ_ρ measures the increase in Δ_I we would observe in the case spouses are rearranged to guarantee a perfectly assortive mating. Hence, Δ_ρ isolates the contribution of a non-perfect assortive mating.

Let $\mathcal{R}^+_*=\mathcal{R}^1_*+\mathcal{R}^2_*$ and I^+_* be the inequality associated to $\mathcal{R}^+_*$. Define $\Delta_L=\Delta_I(\mathcal{R}_*)$ and $\Delta_\rho=\Delta_I(\mathcal{R})-\Delta_I(\mathcal{R}_*)$. That (Δ_L,Δ_ρ) is the decomposition with the properties we prescribe above is proved next

Theorem 6: If $\Delta_L=\Delta_I(\mathcal{R}_*)$ and $\Delta_\rho=\Delta_I(\mathcal{R})-\Delta_I(\mathcal{R}_*)$ then (i) $\Delta_L=(I^+_*-I^1)/I^1$, $\Delta_\rho=(I^+-I^+_*)/I^1$, and $\Delta_I=\Delta_L+\Delta_\rho$, (ii) $\Delta_L=0$ if $L_2=L_1$ with $sign(\Delta_L)=sign(L_2-L_1)$

when I can be expressed as a linear function of the Lorenz curve, and (iii) $\Delta_\rho \le 0$ with $\Delta_\rho = 0$ if and only if $\rho_R = 1$ when is strictly Schur-convex.

Proof: (i) Follows immediately from the definitions of Δ_I, Δ_L, and Δ_ρ.

(ii) Since $\mathcal{R}^1_*$ and $\mathcal{R}^2_*$ are perfectly rank-correlated, by Theorem 3 $L^+_* = (1-\alpha)\cdot L^1_* + \alpha\cdot L^2_*$ but $L^1 = L^1_*$ and $L^2 = L^2_*$. Hence, $L^+_* = (1-\alpha)\cdot L^1 + \alpha\cdot L^2$. If $L^2 = L^1$ then $L^+_* = L_* = L^1_*$ and consequently $\Delta_L = 0$.

(iii) Since $L^+_* = (1-\alpha)\cdot L^1 + \alpha\cdot L^2$ and by Theorem 3 $L^+ = (1-\alpha)\cdot L^1 + \alpha\cdot L^2$ if and only if $\rho_R = 1$, it follows from Theorems 2 and 3 that $L^+_*(s) \le L^+(s)$ for all $s \in [0,1]$ with equality holding for all s if and only if $\rho_R = 1$. Hence, if I is strictly Schur-convex $I^+_* \ge I^+$ with equality holding if and only if $\rho_R = 1$. Therefore $\Delta_\rho \le 0$ with $\Delta_\rho = 0$ if and only if $\rho_R = 1$.

■

Since the Gini coefficient is both strictly Schur convex and a linear function of the Lorenz curve we obtain the following corollary

Corollary 8: If I is the Gini coefficient, $\Delta_L = \Delta_I(\mathcal{R}_*)$, and $\Delta_\rho = \Delta_I(\mathcal{R}) - \Delta_I(\mathcal{R}_*)$ then (i) $\Delta_L = (I^+_* - I^1)/I^1$, $\Delta_\rho = (I^+ - I^+_*)/I^1$, and $\Delta_I = \Delta_L + \Delta_\rho$, (ii) $sign(\Delta_L) = sign(L_2 - L_1)$, and (iii) $\Delta_\rho \le 0$ with $\Delta_\rho = 0$ if and only if $\rho_R = 1$.

4.2-Estimation

To estimate Δ_L and Δ_ρ it suffices to estimate $\Delta_I(\mathcal{R})$ and $\Delta_I(\mathcal{R}_*)$. Estimates for $\Delta_I(\mathcal{R})$ were obtained in the previous section, Table 1. Estimates for $\Delta_I(\mathcal{R}_*)$ must be obtained, in principle, by simulations which starting from $\mathcal{R}$ appropriately rearrange spouses to ensure perfect rank correlation between spouses' earnings. However, in the case I is the Gini coefficient, $\Delta_I(\mathcal{R}_*)$, and therefore Δ_L and Δ_ρ, can be obtained directly from estimates of I^1, I^2, and a using the following result:

Theorem 7: If I is the Gini coefficient, then:

$$\Delta_L \equiv \Delta_I(\mathcal{R}_*) = a.(I^2/I^1 - 1)$$

and

$$\Delta_\rho \equiv \Delta_I(\mathcal{R}) - \Delta_I(\mathcal{R}_*) = [I^+ - (1-a)\cdot I^1 - a\cdot I^2]/I^1$$

Table 10 reports estimates for Δ_L and Δ_ρ when the inequality measure used is the Gini coefficient. According to these estimates, the absolute values of Δ_L and Δ_ρ are all between 7% and 10%. More specifically, since the Gini coefficients for wives are higher than that for husbands (see Tables 9 or 10) the inclusion of wives' earnings would increase inequality from 7% to 10% if the rank correlation among spouses' earnings were perfect. The fact that the rank correlations are actually well below one (see Table 5) offsets this tendency leading to a final result which is close to zero.

5-CONCLUSIONS

The Brazilian family underwent profound transformations during the past decade with potentially important implications for the evolution of income inequality. In this study we analyzed the impact on the income inequality among nuclear families of one of these transformations: the rise in wives' labor-force participation rates.

We showed that necessary conditions for wives' earnings to have some impact on the income inequality among families are: (1) a correlation among spouses' earnings different from one, and/or (2) a different level of income inequality among wives than among husbands. Moreover, it was also shown that if inequality in earnings among wives is smaller than among husbands then the inclusion of wives' earnings will always have a equalizingimpact on the distribution of income among families.

We have also demonstrated empirically that the correlation among spouses' earnings is around 0.4 and that the level of earnings inequality is more than 50% higher among wives than among husbands. The result of these two forces which operate in opposite directions is that even though the average contribution of wives to the family budget is around 15%, the inclusion of their earnings has an insignificant effect on the income inequality among families.

In order to predict the behavior of the income inequality among families, it is important to isolate the contribution of a less than perfect correlation among spouses' earnings from the contribution of a higher inequality level among wives than among husbands. In the last section, we discussed this issue. We showed that an inclusion of wives' earnings would necessarily lead to an increase in the Gini coefficient by 7% if the correlation among spouses' earnings were perfect, while a reduction of this correlation from one to the value empirically observed, would lead to a reduction in the Gini coefficient of 8%. Therefore, one should expect that as the wives increase their labor force participation, the inequality of earnings among them would be reduced thereby enabling the earnings of married women to play a more important equalizingrole. However, the equalizing impact of the labor force participation of married women seems to be bounded to be lower than 10%.

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FIGURE 1
IMPACT OF INCLUDING WIVES' EARNINGS ON THE INCOME INEQUALITY AMONG FAMILIES:
SENSITIVITY TO THE WIVE'S CONTRIBUTION TO FAMILY BUDGET

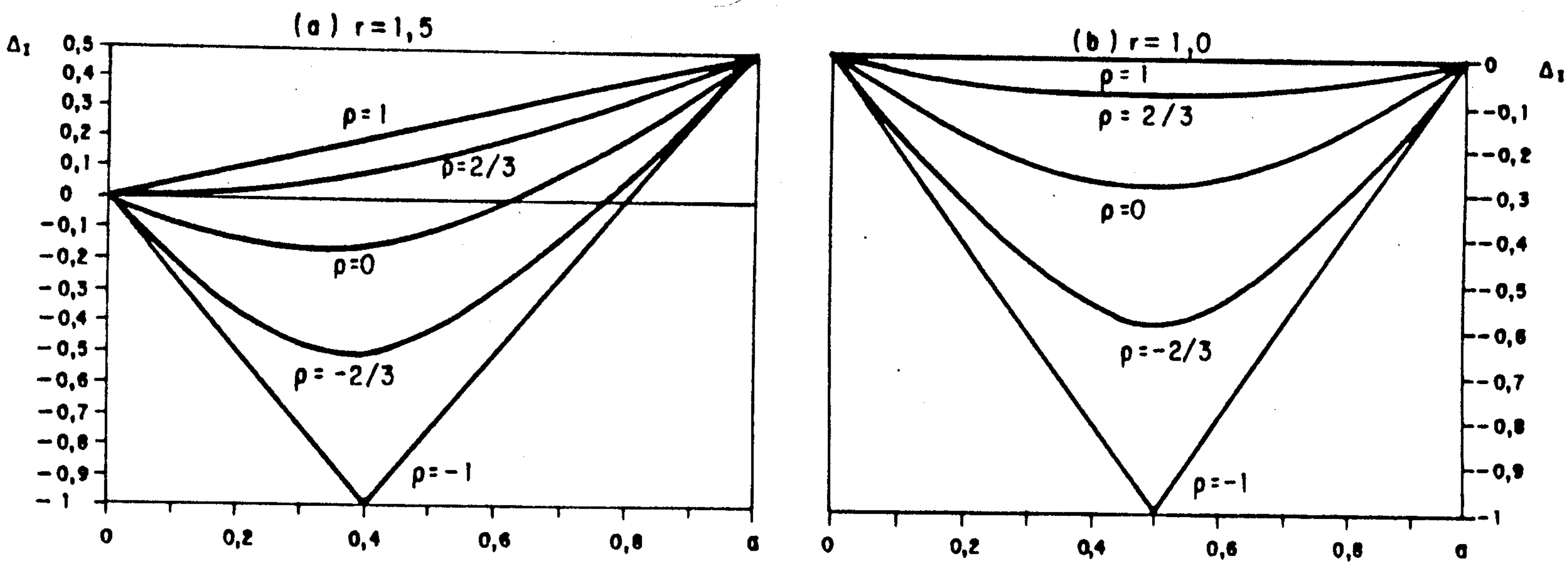

FIGURE 2

IMPACT OF INCLUDING WIVES' EARNINGS ON THE INCOME INEQUALITY AMONG FAMILIES: SENSITIVITY TO THE CORRELATION BETWEEN SPOUSES' EARNINGS

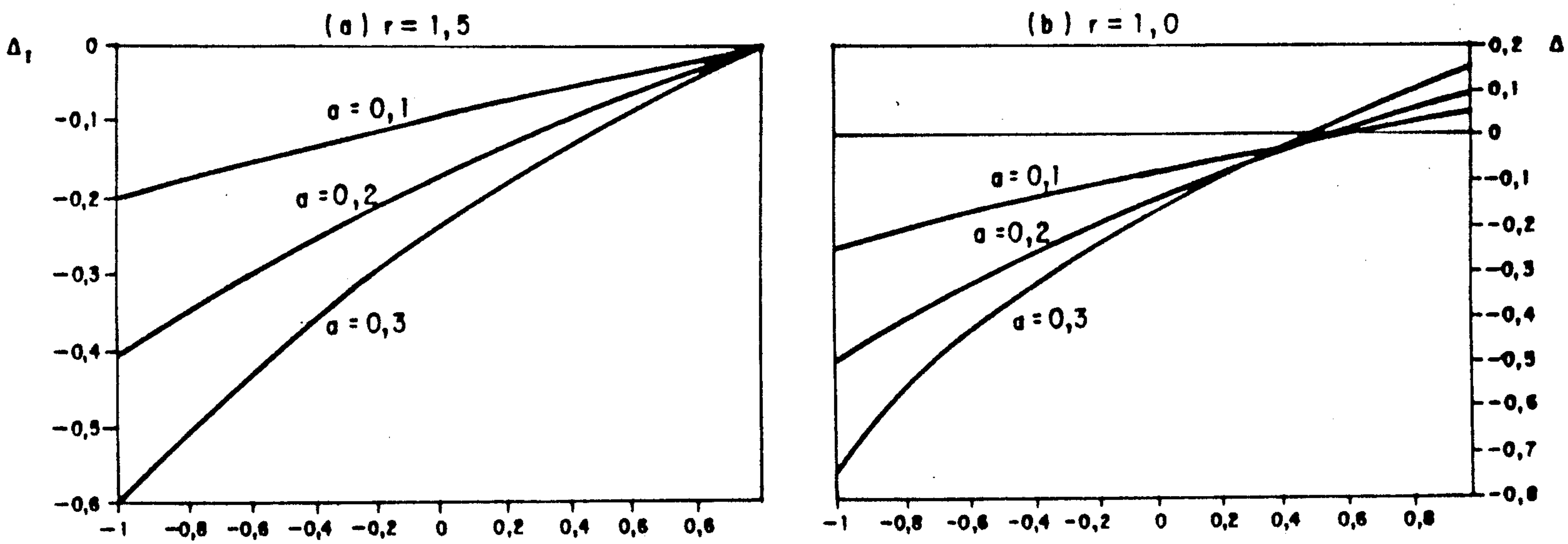

FIGURE 3

IMPACT OF INCLUDING WIVES' EARNINGS ON THE INCOME INEQUALITY AMONG FAMILIES: SENSITIVITY TO THE RELATIVE INEQUALITY BETWEEN WIVES' AND HUSBANDS' EARNINGS.

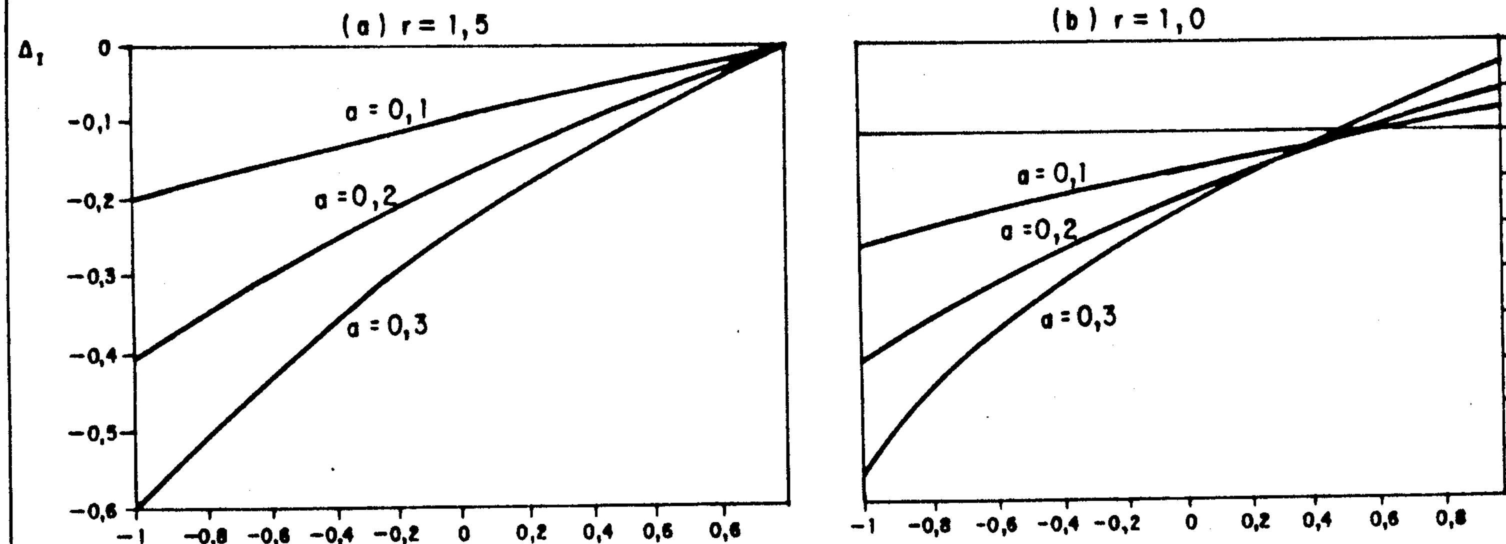

TABLE 1

INEQUALITY MEASURES FOR THE DISTRIBUTIONS OF FAMILIES ACCORDING TO HUSBANDS' EARNINGS AND WIVES' EARNINGS 1985

Metropolitan Area	*Gini Coefficient*	*Coefficient of Variation*
BELÉM		
- Husband	0.556	1.37
- Couple	0.566	1.41
- Variation	+1.8	+2.9
FORTALEZA		
- Husband	0.585	1.53
- Couple	0.595	1.52
- Variation	+1.7	-0.7
RECIFE		
- Husband	0.608	1.67
- Couple	0.618	1.65
- Variation	+1.6	-1.2
SALVADOR		
- Husband	0.563	1.55
- Couple	0.571	1.48
- Variation	+1.4	-4.5
BELO HORIZONTE		
- Husband	0.544	1.27
- Couple	0.550	1.26
- Variation	+1.1	-0.8
RIO DE JANEIRO		
- Husband	0.554	1.65
- Couple	0.566	1.58
- Variation	+2.2	-4.2
SÃO PAULO		
- Husband	0.508	1.24
- Couple	0.513	1.23
- Variation	+1.0	-0.8
CURITIBA		
- Husband	0.504	1.13
- Couple	0.509	1.14
- Variation	+1.0	+0.9
PORTO ALEGRE		
- Husband	0.526	1.32
- Couple	0.518	1.26
- Variation	-1.5	-4.5

SOURCE: PNAD-85 - Authors own tabulations.

*NOTE: Husband (I_1), Couple (I_+), Variation (Δ_I)

$\Delta_I = [(I_+ - I_1) / I_1] .100$

TABLE 2

WIVES' AVERAGE CONTRIBUTION TO FAMILY BUDGET

1985

Metropolitan Area	*Average Contribution (%)*
BELÉM	12.6
FORTALEZA	14.5
RECIFE	12.2
SALVADOR	13.2
BELO HORIZONTE	12.3
RIO DE JANEIRO	14.2
SÃO PAULO	13.2
CURITIBA	13.9
PORTO ALEGRE	17.0

SOURCE: PNAD-85 - Authors own tabulations.

TABLE 3

WIVES' EMPLOYMENT RATE
1985

Metropolitan Area	*Employment Rate (%)*
BELÉM	37.8
FORTALEZA	42.8
RECIFE	35.8
SALVADOR	39.5
BELO HORIZONTE	35.7
RIO DE JANEIRO	38.9
SÃO PAULO	35.1
CURITIBA	39.9
PORTO ALEGRE	47.2

SOURCE: PNAD-85 - Authors own tabulations.

TABLE 4

WIVES' LABOR FORCE PARTICIPATION AND UNEMPLOYMENT RATES

1985

Metropolitan Area	*Participation Rate*	*Unemployment Rate*
BELÉM	39.1	3.5
FORTALEZA	43.7	3.9
RECIFE	38.2	6.3
SALVADOR	41.2	4.3
BELO HORIZONTE	38.0	6.1
RIO DE JANEIRO	40.9	4.8
SÃO PAULO	37.0	5.2
CURITIBA	42.8	6.8
PORTO ALEGRE	50.0	5.6

SOURCE: PNAD-85 - Authors own tabulations.

TABLE 5

CORRELATION COEFFICIENT BETWEEN SPOUSES' EARNINGS

1985

Metropolitan Area	*Correlation Coefficient*
BELÉM	+0.5
FORTALEZA	+0.4
RECIFE	+0.4
SALVADOR	+0.3
BELO HORIZONTE	+0.4
RIO DE JANEIRO	+0.4
SÃO PAULO	+0.3
CURITIBA	+0.4
PORTO ALEGRE	+0.3

SOURCE: PNAD-85 - Authors own tabulations.

TABLE 6

CORRELATION BETWEEN SPOUSES' EARNINGS AMONG COUPLES IN WHICH THE WIFE WORKS

1985

Metropolitan Area	*Correlation Coefficient*
BELÉM	+0.6
FORTALEZA	+0.6
RECIFE	+0.5
SALVADOR	+0.5
BELO HORIZONTE	+0.5
RIO DE JANEIRO	+0.4
SÃO PAULO	+0.6
CURITIBA	+0.6
PORTO ALEGRE	+0.5

SOURCE: PNAD-85 - Authors own tabulations.

TABLE 7

DIFFERENCES BETWEEN THE AVERAGE EARNINGS OF HUSBANDS WHOSE WIVES ARE ECONOMICALLY ACTIVE AND THE AVERAGE EARNINGS OF HUSBANDS WHOSE WIVES ARE NOT ECONOMICALLY ACTIVE

1985

Metropolitan Area	*Difference Between Average Earnings (In Multiples of Minimum Wages)*
BELÉM	2.2 (0.7)*
FORTALEZA	2.0 (0.5)
RECIFE	1.9 (0.6)
SALVADOR	1.2 (0.6)
BELO HORIZONTE	2.1 (0.4)
RIO DE JANEIRO	1.9 (0.5)
SÃO PAULO	0.6 (0.4)
CURITIBA	0.9 (0.4)
PORTO ALEGRE	0.4 (0.4)

SOURCE: PNAD-85 - Authors own tabulations.

* NOTE: Values in parenthesis correspond to estimates in standard errors.

TABLE 8

WIVES' LABOR FORCE PARTICIPATION RATES

BY HUSBANDS' EMPLOYMENT STATUS

1985

Metropolitan Area	*Employed Husbands*	*Unemployed Husbands*
BELÉM	38.7	79.9
FORTALEZA	43.6	57.2
RECIFE	37.9	51.9
SALVADOR	41.2	45.9
BELO HORIZONTE	37.6	58.7
RIO DE JANEIRO	40.4	62.5
SÃO PAULO	36.9	42.1
CURITIBA	42.6	49.9
PORTO ALEGRE	49.7	69.4

SOURCE: PNAD-85 - Authors own tabulations.

TABLE 9

INEQUALITY MEASURES FOR THE DISTRIBUTIONS OF FAMILIES ACCORDING TO HUSBANDS' EARNINGS AND WIVES' EARNINGS

1985

Metropolitan Area	*Gini Coefficient*	*Coefficient of Variation*
BELÉM		
- Husband	0.556	1.37
- Wife	0.849	2.61
FORTALEZA		
- Husband	0.585	1.53
- Wife	0.830	2.52
RECIFE		
- Husband	0.608	1.67
- Wife	0.879	2.87
SALVADOR		
- Husband	0.563	1.55
- Wife	0.840	2.47
BELO HORIZONTE		
- Husband	0.544	1.27
- Wife	0.842	2.46
RIO DE JANEIRO		
- Husband	0.554	1.65
- Wife	0.842	2.52
SÃO PAULO		
- Husband	0.508	1.24
- Wife	0.839	2.49
CURITIBA		
- Husband	0.504	1.13
- Wife	0.817	2.27
PORTO ALEGRE		
- Husband	0.526	1.32
- Wife	0.774	2.16

SOURCE: PNAD-85 - Authors own tabulations.

TABLE 10

DECOMPOSING THE IMPACT OF INCLUDING WIVES' EARNINGS ON THE INCOME INEQUALITY AMONG FAMILIES
USING THE GINI COEFFICIENT
1985

Metropolitan Area	Gini Coefficient						
	Couple (I_+)	Head (I_1)	Wife (I_2)	Δ^*	a^{**} (%)	Δ_1^{***}	Δ_2^{****}
BELÉM	0,566	0,556	0,849	+1,8	16,9	8,8	-7,0
FORTALEZA	0,595	0,585	0,830	+1,7	19,7	8,1	-6,4
RECIFE	0,618	0,608	0,879	+1,6	16,5	7,2	-5,6
SALVADOR	0,571	0,563	0,842	+1,4	17,4	8,5	-7,1
BELO HORIZONTE	0,550	0,544	0,840	+1,1	15,5	8,3	-7,3
RIO DE JANEIRO	0,566	0,554	0,842	+2,2	18,9	9,6	-7,5
SÃO PAULO	0,513	0,508	0,839	+1,0	15,9	10,3	-9,3
CURITIBA	0,509	0,504	0,817	+1,0	16,9	10,4	-9,4
PORTO ALEGRE	0,518	0,526	0,774	-1,5	18,1	8,7	-10,2

SOURCE: PNAD-85 - Authors own tabulations.

NOTE: $^*\Delta = [(I_+ - I_1)/I_1] .100$

$^{**}a$ = ratio between wife's average earnings and couple's average earnings.

$^{***}\Delta_1 = a.[(I_2 - I_1)/I_1] .100$

$^{****}\Delta_2 = [(I_+ - (1-a)I_1 - aI_2)/I_1] .100$