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A NOTE ON MEASURING UNEMPLOYMENT

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ABSTRACT

This paper proposes a new measure of the unemployment rate. This measure takes into account not only people who are unemployed, but also those earning below the subsistence level of income in the labor market. The proposed methodology is applied to Brazil's unit record household surveys covering the period between 1995 and 2004.

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1 INTRODUCTION

An important feature of developing countries is that a large proportion of the labor force is employed in the informal sector, which is characterized by providing low incomes for its workers. Incomes in the informal sector can be so low that workers are unable to provide the basic necessities of life for their families. Since workers in a developing country are unlikely to get any monetary support from the government when unemployed, they cannot afford to stay idle. Instead, they do some work to survive, but often report themselves as employed, and consequently, the conventional measure of unemployment estimated from labor force surveys tends to underestimate the true extent of unemployment in society. Thus, many developing countries have low open unemployment rates, but still suffer from acute poverty because of the low earnings of a large segment of their employed work force.[1]

In this paper we propose a modification of the standard unemployment rate so that it includes not only people who are unemployed, but also those earning below a subsistence income from work. In the development of a new measure, people whose earnings are less than the minimum (subsistence) wage are regarded as underemployed.

The issue of poverty is different from the issue related to those not earning a decent wage. When the labor market is weak, and thus, people cannot find a job with a decent wage, they tend to substitute unemployment with underemployment (i.e. they accept jobs with low pay instead of remaining unemployed with no income). Thus, underemployment defined in terms of low earnings reflects a lack of demand in the labor market. The issue of poverty is much broader in the sense that it encompasses many complex factors such as intra-household allocation of resources, non-labor income, and various household characteristics. Although underemployment as defined in this study may influence poverty, the two phenomena are not the same.

Underemployment is generally defined in terms of working fewer hours. If a person is working fewer hours voluntarily, it is not an issue of the weakness of the labor market. It is, in fact, an issue of personal choice. For instance, a person who works only one hour per week and still gets above the subsistence wage cannot be classified as underemployed. Instead, we would classify him/her as fully employed. However, suppose a person is willing to work more hours, but unable to find a job, then he/she may be called underemployed, provided that he/she does not earn the subsistence wage. This situation can occur because of a weak labor market.

Unemployment and underemployment (defined in terms of earnings lower than a predetermined subsistence level) are related issues in the sense that people substitute one for the other depending on labor market conditions. This paper combines these two aspects of labor markets and arrives at a new index of unemployment, which satisfies certain desirable properties. The methodology developed is applied to Brazil's unit record household surveys covering the period from 1995 to 2004.

2 A NEW MEASURE OF THE UNEMPLOYMENT RATE

Suppose there are n persons in the labor force. The unemployment status of the ith person can be described by r_i as:

$r_i = 1$ if the ith person is unemployed

   $= 0$ if the ith person is employed

Then the standard measure of the unemployment rate is given by

$$U = \frac{1}{n}\sum_{i=1}^{n} r_i \tag{1}$$

which is the proportion of persons in the labor force who are unemployed (i.e. those seeking a job but unable to find one). The standard measure of the employment rate is given by (1-U), which is the proportion of persons in the labor force who are employed (i.e. those having a job). Among those who are employed, some have earnings below the minimum wage, while others have earnings above it.

Suppose that the ith person earns x_i from working in the labor market and that the government has set a minimum wage of w. From this, we define a variable $\delta_{i\alpha}$ as:

$\delta_{i\alpha} = 1$ if $x_i > w$

$\quad = \dfrac{(x_i / w)^{\alpha}}{}$ if $x_i \leq w$

We define the ith person as fully employed if $\delta_{i\alpha} = 1$, when he/she earns more than the minimum wage. Similarly, he/she is defined as underemployed if $\delta_i < 1$, when his/her earnings are less than the minimum wage. The degree of his/her employment is measured by $(x_i / w)^{\alpha}$, which will be less than 1 if $\alpha > 0$.

The proposed new unemployment rate is given by

$$U_{\alpha}^{*} = 1 - \frac{1}{n}\sum_{i=1}^{n} \delta_{i\alpha}(1 - r_i) \tag{2}$$

where α varies from 0 to ∞. This measure takes into account the predicament of both the unemployed (who have no jobs) and the underemployed (who have jobs with inadequate earnings to meet their basic needs).

3 PROPERTIES OF THE NEW UNEMPLOYMENT RATE

Property I: If $r_i = 1$ for all i, then $U_{\alpha}^{*} = 1$

When all persons in the labor force are unemployed, then there is a 100 percent unemployment rate in society.

Property II: If $r_i = 0$ and $\delta_{i\alpha} = 1$ for all i, then $U_{\alpha}^{*} = 0$

When all persons in the labor force are employed with earnings greater than the minimum wage, then the unemployment rate takes the minimum value of zero.

Property III: If $\alpha = 0$, then $U_{\alpha}^{*} = \dfrac{1}{n}\sum\limits_{i=1}^{n} r_i$

When $\alpha = 0$, then the proposed measure of the unemployment rate is equal to the standard measure of the unemployment rate. In this case, all underemployed persons are regarded as fully employed.

Property IV: $\dfrac{\partial U_{\alpha}^{*}}{\partial \alpha} > 0$

The proposed unemployment rate increases monotonically with α and, therefore, takes a minimum value when $\alpha = 0$. Thus, the standard unemployment rate is the lower boundary of the proposed unemployment measure.

Property V: If $\alpha = \infty$, U_{α}^{*} is equal to the proportion of unemployed plus

underemployed persons in the labor force.

In this case, all underemployed persons are regarded as unemployed. This is the upper boundary of the proposed unemployment rate.

Property VI: $\dfrac{\partial U_{\alpha}^{*}}{\partial x_j} = -\dfrac{\alpha}{n}(x_j / w)^{\alpha-1}$ if $x_j < w$

which is negative when $\alpha > 0$. This property implies that if the earnings of any underemployed person (say *j*th person) increase (or decrease), then the proposed unemployment measure decreases (or increases). This property is valid when $\alpha > 0$. The standard measure of the unemployment rate for which $\alpha = 0$ is completely insensitive to any increase in the earnings of an underemployed person.

Property VII: $\dfrac{\partial^2 U_{\alpha}^{*}}{\partial x_j^2} = \dfrac{\alpha(1-\alpha)}{n}(x_j / w)^{\alpha-2}$ (3)

which is strictly positive when α lies between 0 and 1. Property VI implied that if the earnings of any underemployed person were increased, the proposed unemployment measure should decrease. Property VII implies that the magnitude of reduction in the unemployment rate would be even larger if the earnings of poorer underemployed persons were increased, provided that α lies between 0 and 1. When $\alpha = 1$, the magnitude of unemployment reduction will be the same when we increase the earnings of any underemployed person. In this case, the unemployment measure gives equal weight to all incomes.

If our concern is with equity in earnings, then the unemployment measure should give the largest weight to the poorest underemployed person and this weight should decline monotonically as income increases. To satisfy this requirement, we should choose the unemployment rate for which α lies between 0 and 1.

We have narrowed down the value of α to lie in the range between 0 and 1. Can we further narrow down its value to a single number? The distribution of weight given to different individuals depends on the value of α we choose. If we have a strong preference for equity, then we should choose α where the weight given to the poorest person among the underemployed is maximum. The weight given to the *j*th person is given by the second derivative of the proposed unemployment rate, as shown in (3). Thus, we choose α so that the weight given in (3) is maximized. As can be seen from Figure 1, the weight increases until it reaches maximum value, and then, it declines. We found that the most common value of α was 0.4 when earnings were in the neighborhood of 50 percent of the minimum wage. This is the value we will choose in order to analyze the unemployment situation in Brazil.

FIGURE 1

Weight given to the underemployed for different values of α

Values of α
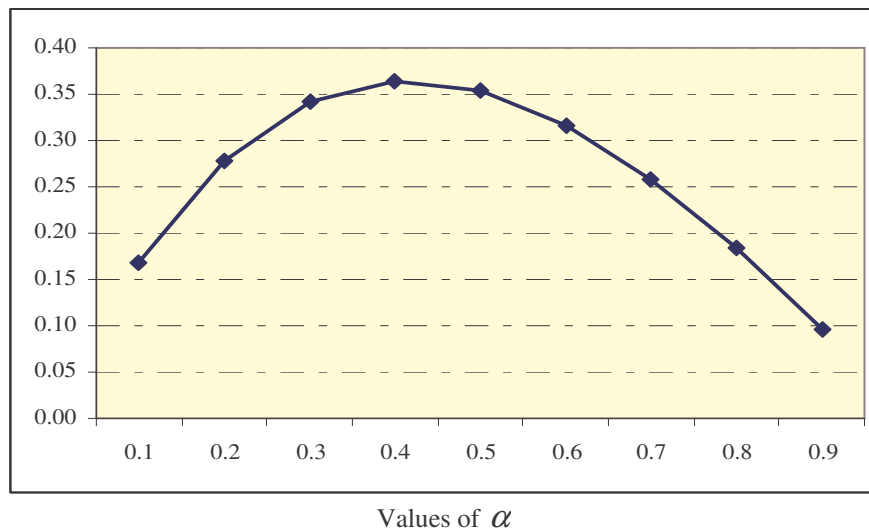
4 EMPIRICAL ILLUSTRATION

We use the unit record data from the *Pesquisa Nacional por Amostra de Domicilios* (PNAD, the Brazilian Annual National Household Survey) covering the period from 1995 to 2004. To calculate the new measure of the unemployment rate, we used Neri's poverty line, which may be deemed as a good proxy for the minimum subsistence level income in Brazil (Rocha 1993, Ferreira et al. 2003).[2]

Table 1 compares the open unemployment rate with the proposed new measure of the unemployment rate over the period 1995-2004.[3] The large gap between the open unemployment rate and the new measure of the unemployment rate points to the problem of underemployment in the Brazilian labor market. However, the declining trend in the gap between the two measures suggests that the Brazilian economy has been increasingly formalized in recent years.

The open unemployment rate and the new measure of unemployment

Period	Open unemployment rate	New measure of unemployment rate
1995	8.36	14.28
1996	9.33	15.59
1997	10.56	15.77
1998	12.16	17.15
1999	13.18	17.89
2001	12.54	16.82
2002	12.37	16.85
2003	13.12	17.51
2004	12.20	16.20
Trend 1995-2004	**3.97**	**1.30**
Trend 1995-2001	**7.48**	**2.98**
Trend 2001-2004	**-0.24**	**-0.75**

Figure 2 presents the unemployment rates for three areas in Brazil: metropolitan, non-metropolitan, and rural. We note that the new measure of unemployment is the highest in rural areas, but the open unemployment rate is the highest in metropolitan areas. The open unemployment rate in rural areas was merely 3.7% in 2004, whereas the new unemployment rate was 21.5%. This difference indicates the existence of large underemployment in the rural sector. The gap in the unemployment rate between metropolitan and non-metropolitan areas has widened over the period. This is true for both measures of unemployment.
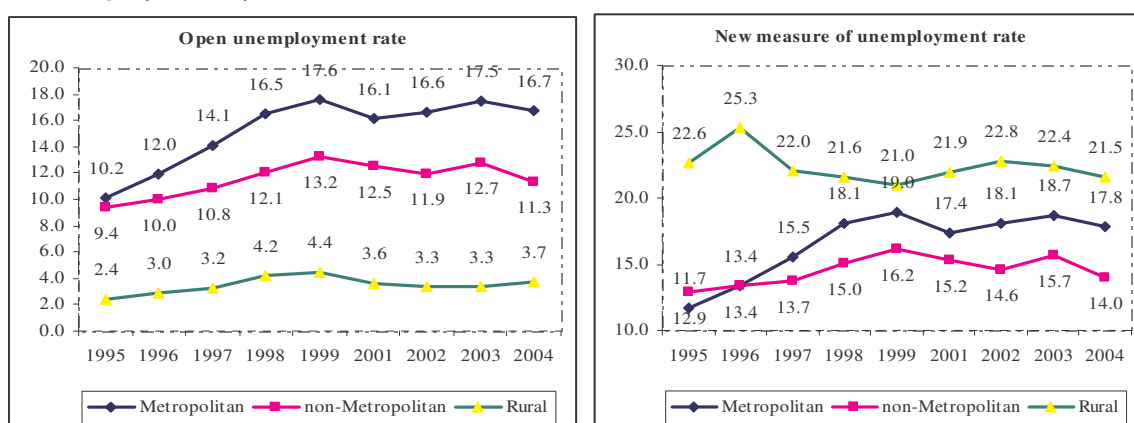
FIGURE 2

Unemployment by areas

Figure 3 shows that the new measure of unemployment is much higher among females compared to males. Compared to men, females suffer greater open unemployment, but the gap between the two is even higher in underemployment. This is due to the fact that a larger proportion of females are employed in informal sectors.

FIGURE 3
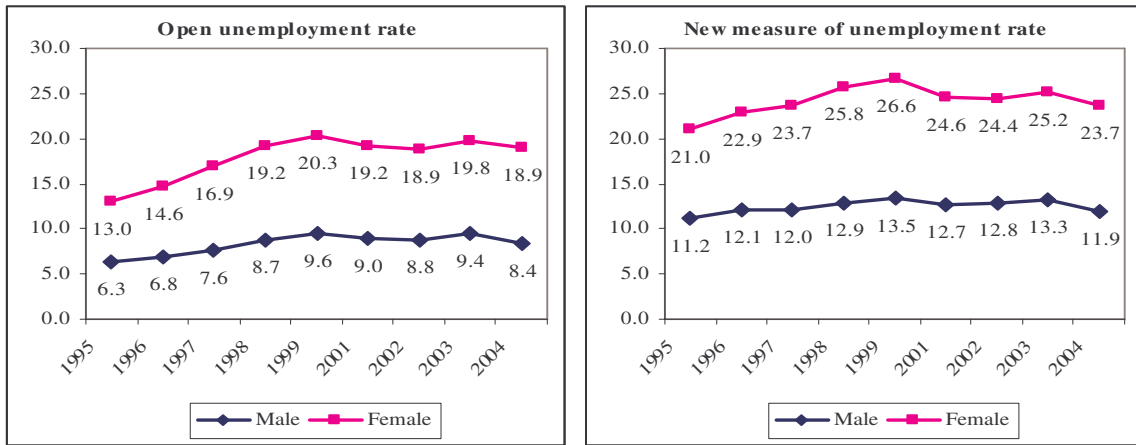
Unemployment by gender

Figure 4 depicts unemployment rates for the 27 Brazilian states. The states are arranged in ascending order of their headcount ratio in 2004. The gap between the two measures of unemployment rates increases with the incidence of poverty in the states. This indicates that poorer states have a prevalence of higher underemployment.

FIGURE 4

Unemployment for 27 states of Brazil in 2004
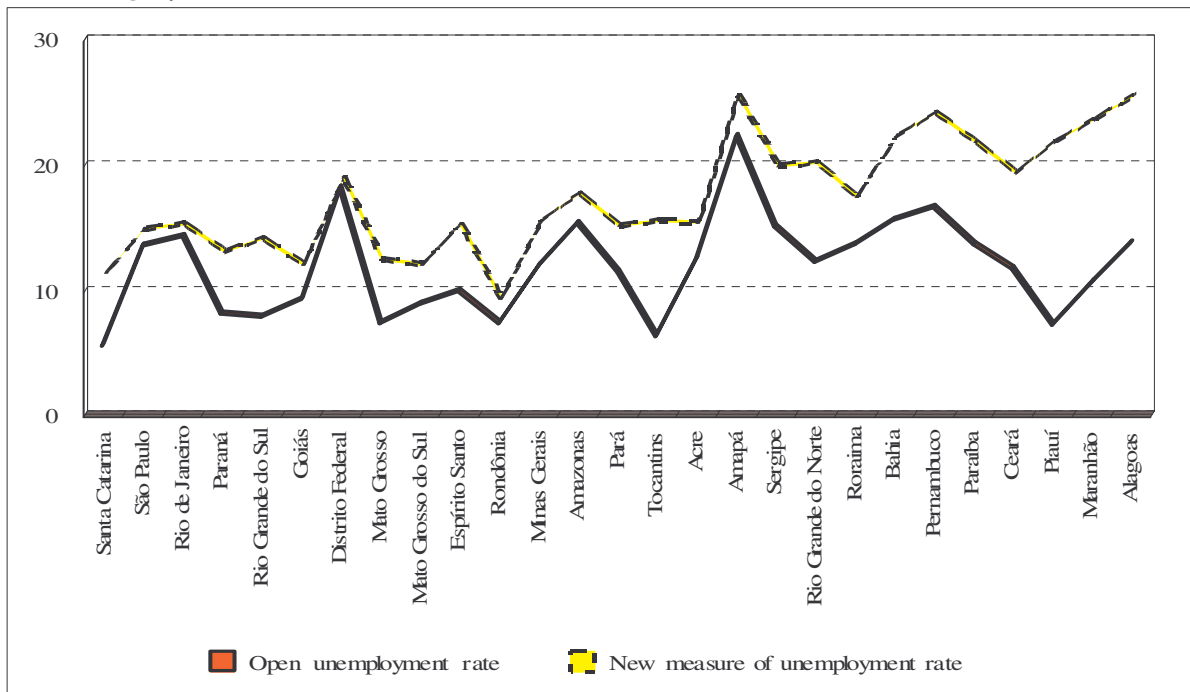
To explore the relationship between unemployment and poverty, we fitted a simple regression of the headcount ratio on the two measures of unemployment across 27 states for each year over the period 1995-2004. Table 2 displays the estimated coefficients along with t-statistics.

TABLE 2

Correlation between poverty and the unemployment rate across 27 states

Period	Poverty & open unemployment rate Estimated coefficient	Poverty & new measure of unemployment rate Estimated coefficient
1995	-1.26 (-1.30)	2.94[*] (3.48)
1996	-1.42 (-1.37)	2.91[*] (3.80)
1997	0.09 (0.07)	3.07[*] (5.36)
1998	-0.25 (-0.25)	2.57[*] (3.54)
1999	0.14 (0.17)	2.76[*] (3.78)
2001	0.31 (0.34)	2.84[*] (4.28)
2002	0.19 (0.26)	1.92[*] (3.22)
2003	0.61 (0.62)	3.30[*] (6.07)
2004	1.28 (1.74)	2.78[*] (7.20)

Note: Figures in brackets are values for the t-ratio. [*] indicates a statistical significance at a 5% level.

The correlation between the headcount ratio and the open unemployment rate is insignificant in all years. The proposed measure of the unemployment rate is found to have a significant and positive correlation with the headcount ratio; as unemployment decreases (increases), poverty also falls (rises). This finding is statistically robust: the estimated coefficients are highly statistically significant at the 5 percent level for the entire 1995-2004 period.

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NOTES

1. The International Labor Organization puts a special emphasis on productive employment. See *Productive Employment for the Poor* (ILO, 1992).

2. Although Brazil has an official minimum wage, we have not utilized it because it is far higher than the minimum subsistence level of income.

3. In PNAD, there is no information on whether an individual is working less hours voluntarily or involuntarily. As such, we have selected (i) unemployed individuals and (ii) employed individuals, but working more than or equivalent to 40 hours per week.