Incentive Effects of Risk Pooling, Redistributive and Savings Arrangements in Unemployment Benefit Systems: Evidence from a Structural Model for Brazil

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Eduardo Zylberstajn (Fundacao Getulio Vargas, Brazil)

Extended Abstract

We develop and estimate a structural (behavioral) model of job search. Unemployed workers receive job offers or discover employment opportunities in the formal and informal sectors. Jobs in the formal sector come with unemployment and pension benefits; those in the informal sector do not. However, flexibility and access to leisure in the later are higher, there are no income taxes, and unemployment benefits (if available) can continue to be received – since informal work is difficult to monitor. Workers have to decide whether to take the job offer (and thus exit unemployment) or to wait for the next one. To this end they compare the “utility” of taking the job with the expected utility of waiting one more period. Utility depends on the monetary value of the job (that is the expected value of earnings and social security benefits), as well as leisure. Given the rules of the social security (unemployment and pensions), the dynamics of the model depend on: (i) the unobservable probability of receiving a job offer or finding an employment opportunity; (ii) the observable probabilities of separation from formal and informal jobs; (iii) the distribution of the log of wages in the formal and informal sectors; (iv) preferences for consumption over leisure; and (v) the level of risk aversion (see simplified description below).

We estimate the model using panel labor force data for Brazil and find that it does a reasonable job in predicting observed transitions (see description of estimation strategy below). We then use the model to simulate the effects that changes in the design of the unemployment benefit system has on the relative size of the formal and informal sectors, the unemployment rate, the share of unemployed individuals receiving no unemployment benefits, and the fiscal cost of the system. We do this by projecting forward labor market transitions for those individuals in the data set. We focus on four types of design: (a) standard unemployment insurance (risk pooling with systematic implicit redistribution); (b) pure savings accounts (no redistribution); (c) savings accounts with ex-post explicit redistribution; and (d) saving accounts with ex-ante explicit redistribution. Preliminary results show that option (b) generates the lowest unemployment rates and shares of informal work – at zero cost – but the highest share of unemployed individuals who are not receiving benefits. Option (a) generates the highest unemployment rate and the largest share of informal work, at the highest fiscal cost, albeit the share of unemployed workers receiving benefits is higher. Option (c) is dominated by option (d) that generates better labor market outcomes and has a larger coverage of unemployed workers, at lower fiscal costs.
The Model

At each time $t$, unemployed individuals can be offered a formal or informal sector job and need to decide whether to take it or wait for another offer. To solve this problem individuals start by calculating the monetary value of the job offer. We assume that individuals are quasi-myopic. They do not solve the full recursive problem but look ahead and project expected revenues based on forecasts of wage growth, a discount factor, and the risk of separation from the job. Depending on whether the job is formal ($F$) or informal ($I$) the expected monetary value is give by:

$$
V(j) = w_j \left( \sum_{t=0}^{T} \left( \frac{(1+g)^t}{(1+r)^t} \right)^{t-1} S_j + \frac{(1+g)^T}{(1+r)^T} \left( 1 - \mu_j \right)^{T-1} d_j b_j \mu_j + c \right),
$$

(1)

where $\log(w_j) \sim N(W_j, \sigma_j)$ is the realization of the wage in sector $j$ (formal or informal), $g$ is the growth rate of wages, $r$ is a discount rate, $\mu_j$ is the probability of separation from the job in sector $j$, $S_j$ are the accumulations of acquired rights in pensions and unemployment savings accounts, $d_j$ is the number of months individuals can receive unemployment benefits, $b$ is the replacement rate, and $c$ the number of salaries in the form of unemployment benefits that the worker can carry over if working. Presumably in the informal sector $b=d=0$ and $c>0$ (since it is more difficult to enforce not working in the informal sector while receiving unemployment benefits), while in the informal sector we have $b>0$, $d>0$ and $c=0$.

Simplifying, we have:

$$
V(j) = w_j A_j,
$$

(2)

where $A_j = \left( \frac{\theta_j - \theta_j^{T+1}}{1-\theta_j} \right) \left( 1 + d_j b_j \frac{\mu_j}{1-\mu_j} \right) + c, \theta_j = \left( \frac{(1+g)(1-\mu_j)}{1+r} \right)$, and $T$ is the planning horizon.

Individuals also calculate the monetary value of the decision to “wait” for another job offer. It is given by:

$$
E[V(0)] = \frac{b_t w_j}{1+r} + \frac{v_F E[V(F)] + v_I E[V(I)] + (1-v_F-v_I)b_{t+1}w_j}{(1+r)^2},
$$

(3)

where $b_t$ is the replacement rate that the individual receives at time $t$ (for long-term unemployed $b_t$ is likely to be zero) and $v_F$ and $v_I$ are the probabilities of being offered a formal or informal sector job at time $t+1$.\(^1\) The expectations operator $E$ is introduced because at time $t+1$ the realization of the wage for the offered job is not known.

Assuming that individuals also value the level of leisure (flexibility) $L_j$ associated with each job (or unemployment), a job offer ($j=F$ or $j=I$) will be taken as long as:

$$
U(V(j), L_j | \alpha, \lambda) > U(V(0), L_0 | \alpha, \lambda),
$$

(4)

\(^1\) These probabilities depend on the duration of the unemployment spell. To simplify the notation we ignore this point here.
where $U(.)$ is a utility function that depends on individuals preferences relative to risk ($\lambda$ ) and the consumption/leisure tradeoff ($\alpha$).

**Estimation Strategy**

The estimation has three stages:

1. For each individual in the data set we estimate $W_j$ and $\sigma_j$ (that is the distribution of earnings if working in the formal and informal sector). This distribution depends on individual characteristics such as education, age, gender, and others. We control for unobserved heterogeneity.
2. For each individual in the data set we estimate the probability of separation from a formal or informal sector job ($\mu_j$).
3. For each individual in the data set, given a vector of parameters $v_j, \mu_j, \alpha$ and $\lambda$ we calculate the probability of observing one of three outcomes: staying unemployed, taking an informal sector job, or taking a formal sector job. Given these probabilities we calculate the log-likelihood of the data: that is the probability of observing the transitions in the data set. The vector of unknown parameters is estimated to maximize this likelihood.

To write down the Likelihood function we need to define the utility function. We take a linear approximation:

$$U(V(j), L_j) = c + \alpha \log(V(j)) + (1 - \alpha) \log(L_j)$$

and,

$$U(V(0), L_0) = c + \lambda \log(E[V(0)]) + (1 - \lambda) \log(L_0)$$

The parameter $\lambda$ indicates that individuals may not value in the same way the monetary value of a certain job offer than that of an uncertain job offer. For risk averse individuals $\lambda < \alpha$ and for risk taker individuals $\lambda > \alpha$.

Thus, for every individual transiting from state 0 (unemployed) to state $s$ ($j=employed$ or 0=unemployed) we define the probabilities:

$$P_i(0 \rightarrow j) = v_j (1 - v_j) P_i(j > 0) + v_j v_j P_i(j > j) P(j > 0)$$

$$= v_j P_i(j > 0) + v_j v_j (P(j > 0)(P_i(j > j) - 1))$$

and

$$P_i(0 \rightarrow 0) = 1 - P_i(0 \rightarrow j) - P_i(0 \rightarrow j)$$

where $P_i(j > 0)$ gives the probability that the job taken provides better utility than waiting and is given by:
\[ P_i(j > 0) = Pr\left( \log(w_{ij}) > \lambda \log(\mathbb{E}(V_i(0))) + (1 - \lambda) \log(L_j) - \alpha \log(A_{ij}) \right) \]

\[ = Pr\left( \log(w_{ij} > \lambda \log(\mathbb{E}(V_i(0))) + (1 - \lambda) \log(L_j) - \alpha \log(A_{ij}) \right) \]

and \( P_i(j > j) \) gives the probability that the job taken provides better utility than a job offer that could have been received from the other sector \( (j) \) and is given by:

\[ P_i(j > j) = Pr\left( \log(w_{ij}) > \lambda \log(\mathbb{E}(V_i(0))) + (1 - \lambda) \log(L_j) - \alpha \log(A_{ij}) \right) \]

\[ = Pr\left( \log(w_{ij}) > \lambda \log(\mathbb{E}(V_i(0))) + (1 - \lambda) \log(L_j) - \alpha \log(A_{ij}) \right) \]

The log likelihood function is then given by:

\[ L(v_i, v_F, \alpha, \lambda) = \sum_i \log\mathbb{P}(0 \rightarrow s) \]

The estimation is performed separately by region (6), gender (2), age (3) and education level (3).

The Data

We work with the Monthly Employment Survey PME (Pesquisa Mensal de Emprego). The PME was redesigned and started its new series in March, 2002. It is a monthly rotating panel of individuals from six major metropolitan areas in Brazil (Belo Horizonte, Porto Alegre, Rio de Janeiro, Salvador, São Paulo and Recife). Every month, households’ members are asked questions about their socio-economic and labor status. Approximately 100,000 individuals answer the survey every month. PME has a rotating scheme that aims to allow researchers to follow individuals over time. Every household answers the survey for four consecutive months, then stays out of the sample for eight months and then returns for another four-month period of interviews. Therefore it is possible to build a monthly panel where one has information on the employment status of individuals in two consecutive months. We use data from March/2002 until September/2009, which gives a panel with 90 periods.

As in many Latin American countries, informality is a very important characteristic of the Brazilian labor market. We use as the criteria to define a formal or informal sector job the ‘carteira de trabalho’ (working card), which needs to be signed in order to be eligible for the unemployment benefits and

<table>
<thead>
<tr>
<th>Table 1: Summary Statistics</th>
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</thead>
<tbody>
<tr>
<td><strong>Number of observations</strong></td>
</tr>
<tr>
<td><strong>Individuals that remained unemployed</strong></td>
</tr>
<tr>
<td><strong>Individuals that moved to informal jobs</strong></td>
</tr>
<tr>
<td><strong>Individuals that moved to formal jobs</strong></td>
</tr>
</tbody>
</table>

**Basic Statistics**

<table>
<thead>
<tr>
<th>Age</th>
<th>Mean</th>
<th>Std Dev</th>
<th>Minimum</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>18</td>
<td>7.8</td>
<td>11.0</td>
<td>0</td>
<td>70</td>
</tr>
</tbody>
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<table>
<thead>
<tr>
<th>Gender</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Males</td>
<td>74728</td>
</tr>
<tr>
<td>Females</td>
<td>93749</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Years of Education</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 - 3</td>
<td>10876</td>
</tr>
<tr>
<td>4 - 7</td>
<td>33756</td>
</tr>
<tr>
<td>8 - 10</td>
<td>38406</td>
</tr>
<tr>
<td>11 or more</td>
<td>85439</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Real wage differential</th>
<th>R$ (sep/09)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Informal</td>
<td>421.84</td>
</tr>
<tr>
<td>Formal</td>
<td>637.11</td>
</tr>
</tbody>
</table>

As in many Latin American countries, informality is a very important characteristic of the Brazilian labor market. We use as the criteria to define a formal or informal sector job the ‘carteira de trabalho’ (working card), which needs to be signed in order to be eligible for the unemployment benefits and
contribute to the pension system. Moreover, we limited our database to individuals who were unemployed in month \( m \) and either became an employee (with or without carteira) or remained unemployed in month \( m+1 \) (see below summary statistics as well as the monetary values of the different options).