II. Theoretical Underpinnings

One way in which mode of participation in the labor force may be explored is to use the standard textbook model showing the income-leisure tradeoff underlying a person's labor supply decision (See Henderson and Quandt [1980:24–25], for example). A brief exposition of this model may proceed as follows: Assume that an individual of working-age (who has decided to be a member of the labor force) has a utility function that is defined over income y and leisure L. That is, let

$$u = u(y, L), \tag{1}$$

where $u_y > 0$, $u_{yy} < 0$, $u_L > 0$, $u_{LL} < 0$, and $u_{yL} > 0$. Let income be a linear function of his labor and nonlabor receipts,

$$y = w\ell + V, \tag{2}$$

where w is the wage rate, ℓ is the time spent at work, and V represents net transfers, and define leisure as the residual of the total time available T and labor supply,

$$L = T - \ell. \tag{3}$$

Inserting the expressions on the right hand side of (2) and (3) in (1) yields

$$u = u(w\ell + V, T - \ell), \tag{4}$$

which is a function with ℓ as its only choice variable. Differentiating (4) with respect to ℓ and setting the expression to zero, we derive

$$\frac{u_L}{u_y} = w,$$

a result which implies that a person's optimal labor supply is obtained when the marginal rate of substitution between leisure and income is equal to the wage rate.

A person's mode of participation in the labor force m may then be inferred from his optimal labor supply by classifying it according to the following set of rules:

$$m = \begin{cases} \text{unemployed} & \text{if } \ell = 0 \\ \text{visibly underemployed} & \text{if } 0 < \ell < T^f \\ \text{fully employed} & \text{if } \ell = T^f \text{ and} \\ \text{invisibly underemployed} & \text{if } \ell > T^f, \end{cases}$$

where T^f is the legally mandated number of working hours over the reference period (e.g., 40 hours a week).

As an expositional device for explaining why labor time may vary across individuals for a given wage rate or over wages for the same individual,[1] this model does well. As the

[1] As the student of labor economics well knows, labor supply may vary across individuals for a given wage because of differences in preferences (i.e., in the relative valuations of income and leisure), which are possibly due to differences in background, or because of differences in nonlabor incomes (which tend to be positively correlated with reservation wages). It may vary over wages for the same individual because of the changing magnitudes of the substitution and income effects between leisure and other goods that income can buy as wage rates rise—initially increasing in wages (while the substitution effect dominates), but possibly *bending backwards* beyond a certain level of remuneration (if the income effect eventually surmounts the substitution effect).

(sole) basis of an empirical specification of modes of labor force participation, however, it is less appropriate because (particularly over short reference periods such as those employed in labor force surveys) workers tend not to have the luxury of being able to flexibly adjust their working hours.[2] Instead, over periods of short durations, their participation mode in the labor market may be circumscribed more by the conditions of labor demand on offer, which include both wages and the required working hours.[3] Under these circumstances, the more appropriate framework to use as a basis for specifying the determinants of an individual's choice of labor force participation mode—particularly when the data set at hand is based on a short reference period—may be that of a qualitative response model.

As before, let m be the mode of participation of a person in the labor force, where

$$m = \begin{cases} 1 & \text{if the individual is unemployed,} \\ 2 & \text{if he is visibly underemployed,} \\ 3 & \text{if he is invisibly underemployed, and} \\ 4 & \text{if he is fully employed.} \end{cases} \tag{5}$$

Corresponding to each mode m is an income-leisure pair $(w_m\ell_m + V, T - L_m)$, $m = 1, \ldots, 4$, which is possibly determined by demand side conditions and which yields value $u_m = u(w_m\ell_m + V, T - L_m)$. Thus, instead of maximizing utility over infinitely many income-leisure pairs as in the case of the continuous choice variables of the standard textbook model, in the present discrete framework, the individual chooses that labor force participation mode which yields the highest utility level among the four states in his choice set. In other words, he chooses that mode m^* which yields utility u^*, where

$$u^* = \max\{u_1, \ldots, u_4\}. \tag{6}$$

[2] Arguably, over periods of a year or longer, workers tend to have more control of their time allocation problem. They are then able to schedule their vacation and sick leaves or even negotiate new working arrangements, which in effect adjust their labor supply. Hence, when the reference period of labor force participation data covers sufficiently long durations, it may be possible to explore labor supply (and, by extension, modes of participation) by specifying a double censored tobit model of total number of hours or days worked.

[3] This is perhaps particularly true for the visibly underemployed who, by definition, would like to put in longer hours but are precluded from doing so by labor demand conditions.

III. Empirical Specification

Given full information about their income and leisure opportunities and knowing their preferences on these opportunities, the economically rational individuals of our theoretical model follow a fully deterministic behavioral rule (which is described by (6)) in arriving at their labor force participation decision. It is a rule that has no room for error, randomness, or uncertainty. Researchers who attempt to study the determinants of labor force participation modes, however, have the disadvantage of not being privy to the full set of factors that motivate the decisions of labor force participants. Instead, researchers are only able to observe the choices taken by the individuals and certain of their demographic and socioeconomic characteristics which are possibly related to tastes and preferences. Thus, what may be a deterministic procedure for workers appears as stochastic events to researchers who do not have complete information on the decisionmaking process.

To cast the point more formally, let

$$u_m = v_m(y \mid \mathbf{x}) + \varepsilon_m, \tag{7}$$

where $v_m(y \mid \mathbf{x})$ is that part of the utility function that is determined by the individual's demographic and socioeconomic characteristics $\mathbf{x}$ and ε_m is the influence on utility of unobserved factors.[4] Since researchers do not observe ε_m, they cannot determine u_m exactly. Consequently, although the individual may be following the behavioral rule described by (6), the researchers are unable to predict with certainty what the individual's mode of labor force participation will be. To take an illustrative case: two persons (indexed by j and k) who are otherwise identical in their observed demographic and socioeconomic characteristics (so that $v_{mj} = v_{mk}$ for $m = 1, \ldots, 4$) may nonetheless be observed to have chosen different modes of participation in the labor force because of differences in their unobserved factors.

Still, the researchers may utilize the information on the observed mode (5), the behavioral rule presumed to be followed by individuals (6), and the assumed decomposition of utility into additively separable functions of observed and unobserved factors (7) to make probabilistic statements on individuals' labor force decisions. For instance, they can posit that

$$\begin{aligned}
\Pr(m^* = 1) &= \Pr(u_1 > u_2, u_1 > u_3, u_1 > u_4) \\
&= \Pr(v_1 + \varepsilon_1 > v_2 + \varepsilon_2, v_1 + \varepsilon_1 > v_3 + \varepsilon_3, v_1 + \varepsilon_1 > v_4 + \varepsilon_4) \\
&= \Pr(\varepsilon_2 < \varepsilon_1 + v_1 - v_2, \varepsilon_3 < \varepsilon_1 + v_1 - v_3, \varepsilon_4 < \varepsilon_1 + v_1 - v_4)
\end{aligned}$$

or, in general, that, for $m = 1, \ldots, 4$,

$$\Pr(m^* = m) = \Pr(\varepsilon_i < \varepsilon_m + v_m - v_i, \text{for all } i \neq m).$$

Suppose that the vs have the form

$$v_m = \theta_{m0} + \boldsymbol{\theta}_m' \mathbf{x} + \gamma_1 y_m + \gamma_2 y_m^2 \qquad \text{for } m = 1, \ldots, 4,$$

where the θ_{m0}s are the intercept terms, the $\boldsymbol{\theta}_m$s are coefficient vectors of the observed demographic and socioeconomic characteristics $\mathbf{x}$, and $\gamma_1 > 0$ and $\gamma_2 < 0$ are the coefficients of

[4] It may be noted that since a given level of income y implies a given amount of leisure L, without loss of generality, the latter variable may be suppressed.

income in participation mode m, which are expected to have a concave effect (so that the value of the utility function in participation mode m increases with income in that mode, but at a decreasing rate). If the disturbance terms, ε_1, ε_2, ε_3, ε_4, are assumed to be identically and independently distributed with type I extreme value distribution, then it is a straightforward procedure to show (See Maddala [1983:60–61], for instance) that

$$\Pr(m^* = m) = \frac{\exp(z_m)}{\sum_{i=1}^{4} \exp(z_i)} \qquad \text{for } m = 1, \ldots, 4,$$

where

$$z_1 = \gamma_1 y_1 + \gamma_2 y_1^2$$

and, for $i, m \neq 1$,

$$\begin{aligned} z_j &= (\theta_{j0} - \theta_{10}) + (\boldsymbol{\theta}_j - \boldsymbol{\theta}_1)'\mathbf{x} + \gamma_1 y_j + \gamma_2 y_j^2 \\ &= \beta_{j0} + \boldsymbol{\beta}_j'\mathbf{x} + \gamma_1 y_j + \gamma_2 y_j^2. \end{aligned}$$

Under these assumptions, unbiased and efficient estimates of the parameters, β_{m0} and $\boldsymbol{\beta}_m$ $(m = 1, \ldots, 4)$ as well as γ_1 and γ_2, can be obtained by maximizing the log-likelihood function of the resulting mixed logit model with respect to these parameters. This log-likelihood can be written as

$$\begin{aligned} \ln L &= \sum_{t=1}^{T} \sum_{m=1}^{4} s_{mt} \ln \mathrm{P}_{mt} \\ &= \sum_{t=1}^{T} \left\{ -\ln \left[\sum_{i=1}^{4} \exp(z_{it}) \right] + \sum_{m=1}^{4} s_{mt} z_{mt} \right\}, \end{aligned}$$

where P_{mt} is the probability that the tth person in the sample chooses labor force participation mode m and the s_{mt}s are a set of four mutually exclusive dummy variables for each observation t such that

$$s_{mt} = \begin{cases} 1 & \text{if } m_t^* = m \text{ and} \\ 0 & \text{otherwise.} \end{cases}$$

IV. Data Set and Variables

Our data set is drawn from the sample of households which are common to both the Labor Force Survey (LFS) of the third quarter of 1994 and the Family Income and Expenditures Survey (FIES) of the same year. Regular undertakings of the National Statistics Office (NSO), the LFS and FIES are nationally (and regionally) representative surveys that collect information on demographic and socioeconomic characteristics of the population. Their sample consists of some twenty-five thousand households from 73 provinces and 14 chartered cities of the Philippines.

The distinction between the two surveys is that while the LFS, which is carried out quarterly, focuses on employment-related factors in order to monitor developments in the domestic labor market, the FIES, which is a triennial activity, gathers data on components of household incomes and expenditures, in part to provide information for the national income accounts. The two surveys do share a common sampling frame, however, and start an FIES year with the same sample, 25 percent of which is replaced every quarter for the LFS. Thus, given the appropriate key fields, researchers can identify the remaining 50 percent of the original sample households shared by both the FIES and the third quarter LFS and in effect expand the set of variables for which individual and household information are available.

Administered during the first week of October, the third quarter LFS has two notable features: First, for a subset of variables pertaining to the labor force, the reference period used spans the entire quarter (instead of just the week prior to the survey as in the LFS of other quarters). Second, information on labor supply and earnings is available. Thus, with the LFS for the third quarter, it is possible to construct data on wage rates, as is done in this paper.

To generate the cross-section sample of labor force participants, we adopted the following criteria: Included were individuals from sample households who were between 15 and 64 years of age at the time of the survey and who were reported as either unemployed or employed wage earners in all jobs that they held during the reference period.[5] Excluded were boarders and domestic helpers, since data on these persons tend to be less reliable, members of the armed forces who, by definition, are not considered part of the civilian labor force, and individuals with missing values on the variables used in the logit estimations. Given these *sample selection rules*, the data set came to 20,876 observations.

Table 1 contains the schedule of variables used in our logit regression and their descriptive statistics. As may be gleaned from the table, the first four variables in the list comprise the set of mutually exclusive dummy variables (denoted as m in Section II) showing the various participation alternatives to the labor force (for wage earners). These participation modes are operationally defined as follows: A person is classified as unemployed if he is reported as not having worked either as a private or government employee during the reference quarter; he is considered visibly underemployed if his working hours in all jobs held during the reference quarter sum up to less than 480 hours; he is categorized as having been invisibly

[5] Self-employed individuals and workers in family-owned enterprises were not included because, for the first group, labor supply is not well-defined and, for the second group, a significant proportion of compensation for work is possibly not monetized.

underemployed if his reported number of working hours in all jobs held during the reference quarter exceeds 480 hours and he is reported as desiring additional work; and he is identified as fully employed if his working hours in all jobs held during the reference quarter is 480 hours or more and he does not desire more work. From the sample means of these dummy variables, it may be noted that 2.5 percent of the sample are unemployed, 21.9 percent are visibly underemployed, 10.2 percent are invisibly underemployed, and 65.3 percent are fully employed.

As for the explanatory variables, Table 1 indicates that the conditional variables consist of the potential income of the wage earner in each mode of labor force participation. These (choice attribute) variables are operationally defined as the sum of per capita household income (less the earnings of the person concerned) and the wage earner's predicted income in each labor force participation mode.[6] Per capita household income net of personal wage earnings serves as a correlate of reservation income, while potential wage income is a measure of the monetary benefits of choosing a particular mode of employment.

With regard to multinomial variables (whose values do not change with respect to the mode of participation chosen), Table 1 shows that these include dummy variables on gender ($male = 1$), marital status ($married = 1$), and location of residence ($urban = 1$ and $region_r = 1$, for $r = 1, 2, \ldots, 15$), as well as continuous variables on the person's age, attainments in each of the three levels of education, potential work experience ($age - educational\ attainment - 6$ in years), and the number of household members belonging to specific age groups.

The descriptive statistics of these multinomial variables indicate that the sample of labor force participants in the third quarter of 1994 was dominated by males (65.3 percent), married persons (57.6 percent), and urban residents (71.0 percent). They also imply that the sample was quite young, the mean age being 34.0 years with a standard deviation of 11.7 years. And they suggest that the educational attainment of the sampled workers was relatively high, with 5.7 years, 2.6 years, and 1.2 years as the mean lengths of schooling completed in the elementary, secondary, and tertiary levels, respectively.[7] The mean duration of potential work experience is calculated to be 18.5 years, suggesting that the sampled labor force participants have spent some time in the labor market. As for the age composition of the workers' households, Table 1 indicates that relatively few were from families with many young or old members (the mean number of household members 6 years old and younger, 7 to 14 years, and 65 years old or older being 0.8, 1.1, and 0.2, respectively) and that proportionately more workers were from households with members of working ages (the mean number of members 15 to 64 years being 4.0). Finally, the sample means of the mutually exclusive set of dummy variables on region of residence show that, at the time of the survey, most of the sampled workers were located in the National Capital Region (NCR) (22.5 percent), in Region IV (Southern Tagalog) (16.6 percent), and in Region III (Central Luzon) (13.3 percent). On the other hand, the least represented regions were the Cordillera Autonomous Region (CAR) and the Autonomous Region of Muslim Mindanao (ARMM), where, respectively, only 1.5 percent and 1.1 percent of the sampled workers were found.

[6] The regression results of the equations used to predict wage incomes in each of the three employed states are reported in the Appendix. For the unemployed state, wage income was set to zero.

[7] These numbers suggest that the mean years of schooling completed is about 9 years, which translates into three years of high school education being completed.

V. Regression Results

Table 2 reports the results of our mixed logit regression. It shows that the coefficient estimates of the conditional variables (namely, potential income in each mode of labor force participation and its square) as well as those of a number of personal background variables are statistically different from zero. Given the nonlinear specification of some of the variables as well as of the logit probabilities, however, it is difficult to infer the marginal effects of individual factors on the probabilities of the labor force participation modes from the regression results. Consequently, we compute these at the sample means of the income variables and for given profiles of workers, and present them in Table 3.

As shown in Table 3 for a 35-year old male worker who is single, has had two years of college education, resides in NCR, and lives by himself, the marginal effect of increasing the worker's monthly income in a particular labor force participation mode—all other things held constant—is to increase the likelihood that the hypothetical worker would choose that particular mode. To illustrate, suppose that our hypothetical worker, when unemployed, is provided a monthly subsidy of P1,000 (i.e., $\Delta V = 1000$), then the table predicts that the probability that he would choose to be unemployed would increase by 1.3 percent, whereas the probabilities that he would be visibly underemployed, invisibly underemployed, or employed would decrease by 0.2 percent, 0.1 percent, and 1.0 percent, respectively. Instead, if his monthly wage income from full employment were to increase by P1,000, then the probability that our worker would choose to be fully employed would increase by 7.5 percent, whereas his probabilities of unemployment, visible underemployment, and invisible underemployment would decrease by 1.0 percent, 4.9 percent, and 1.6 percent, respectively.

The objection may be raised, however, that Table 3 gives the impression that the marginal effects of incomes on the probabilities, which in the table are calculated at given points in the regressor space, are constant, when they are not, particularly because the regression results indicate that the marginal utility of income is itself not constant.[8] Consequently, to impart a sense of how the probabilities are affected by changing levels of monthly incomes, we provide graphical depictions in Figures 1 and 2.

Figure 1 graphs the probabilities of the labor force participation modes for our hypothetical worker as his monthly income in unemployment increases from P1,000 to P20,000. The figure shows that, as his unemployment income increases, the probability that the worker would choose to be unemployed initially increases at an increasing rate until the curve reaches an inflection point at around P9,000; thereafter, although the probability continues to increase, it does so at a decreasing rate. In terms of the mode of labor force participation that would most likely obtain, however, Figure 1 suggests that our hypothetical worker would prefer to be fully employed until his unemployment income exceeds P9,000. Only then does unemployment begin to dominate all the other forms of labor force participation as the worker's preferred mode.

[8] Since, statistically, $\hat{\gamma}_1 > 0$ and $\hat{\gamma}_2 < 0$, the marginal utility of income is declining as income rises, which is consistent with risk aversion.

In contrast, when our hypothetical worker's monthly income from full employment increases from P1,000 to P20,000, Figure 2 indicates that full employment dominates throughout as the worker's preferred mode of labor force participation.

Turning to the multinomial variables, note from Table 2 that more or less the same set of demographic and socioeconomic (but not locational) variables apparently explains the probabilities of (visible and invisible) underemployment and full employment.[9] In particular, years of secondary and tertiary education completed, number of elderly household members, and interactions of the dummy variables on sex and marital status, of married males and years of potential work experience, and of age and years of college education completed tend to have statistically significant coefficient estimates. Moreover, the signs of these estimates for each variable tend to be the same across the probabilities of labor force participation modes. Hence, we infer from these results that there is some consistency between our empirical model and the stochastic process that generated the data set used.

But what are the results in terms of the marginal effects of the factors with statistically significant coefficient estimates? Table 3 provides some rather interesting and not altogether obvious outcomes. For instance, the table indicates that, compared to single or married women or to married men, single men are less likely to be fully employed. Specifically, our calculations show that our hypothetical worker is 9.9 percent less likely to be fully employed than a female worker who is single, but has otherwise similar characteristics. And he is 2.5 percent (8.5 percent) less likely to be fully employed than a female worker who is married (a male worker who is married).

In retrospect, two reasons may account for this finding: First, Filipino families may tend to rely less on sons than on the household heads (who tend to be the married males), the spouses of the heads (who tend to be the married females), or the unmarried daughters for financial support. Indeed, the burden of having to provide for the family's needs tends to fall most heavily on the shoulders of the household heads, which explains why married males have higher probabilities of being invisibly underemployed or fully employed (and lower probabilities of being unemployed or visibly underemployed) than their unmarried peers. Second, although the stylized fact on the labor force participation of married women is that they tend to work less, i.e., they tend to be unemployed, to be visibly underemployed, or not to be part of the labor force, this inference may have had as their source casual observations that did not control for the age composition of the household. In other words, an omitted variable problem may be at the heart of the often cited correlation between the marital status of women and unemployment or visible underemployment, the omitted variable being the presence of small children and the elderly in the households of most married women.[10] Once the age composition of household members is accounted for, however, as it is in our regression specification, it may be that married women are more likely to be fully employed

[9] The left out mode is the state of unemployment.

[10] What this means is that the presence of small children or the elderly in a household makes a worker opt for the less time-intensive modes of participation in the labor force. At the same time, however, the presence of small children or the elderly tends to be highly correlated with the marital status of women. Thus, when the age composition of the household is omitted from the set of regressors, its effect shows up most prominently in the variable with which it enjoys a high correlation, namely, the marital status of female workers.

than single men of otherwise identical backgrounds, as our regression results indicate. In any case, this finding is certainly consistent with those of Alonzo *et al.* (1996) and Alba (1999): The first study claims that, unlike the situation in other countries, married women in the Philippines do not supply less labor hours relative to other demographic segments; the second finds that the wage-age trajectory of single men is not as steep as those of single women and married men and women.[11]

A second, somewhat thought provoking outcome is the influence of age on the labor force participation mode of the worker. As shown in Table 3, it has the effect of decreasing the likelihood of unemployment and visible underemployment, and of increasing the likelihood of invisible underemployment and full employment, of unmarried workers as well as of married female workers. And it has the impact of increasing the probabilities of unemployment and visible underemployment, and of decreasing the probabilities of invisible underemployment and full employment, of married male workers.[12] More precisely, for unmarried workers and married female workers, each additional year translates into declines of 0.1 percent and 0.2 percent in their probabilities of unemployment and visible underemployment, respectively, and into increases of 0.01 percent and 0.3 percent in their probabilities of invisible unemployment and full employment, respectively. For married males, on the other hand, each year of growing older works out into increases of 0.02 percent and 0.3 percent in their probabilities of unemployment and visible underemployment, respectively, and into decreases of 0.1 percent and 0.2 percent in their probabilities of invisible underemployment and full employment, respectively.

In the case of unmarried workers as well as of married female workers, the results are as may be expected: As a worker grows older, she is not only likely to be afforded more opportunities for finding the working conditions she prefers (which accounts for the higher probability of full employment), she may also have to take on an increasing share of the family's financial burdens (which accounts for the higher probability of invisible underemployment). In the case of married male workers, however, the results are rather unanticipated. For what can possibly account for the increasing propensities for unemployment and visible underemployment and the decreasing tendency for invisible underemployment and full employment of married male workers as they age? A specification problem may be the culprit here. What may be happening is that, as they grow older, married males may be increasingly bearing the major portion of the family's financial obligations. In response, the more able married males may then be selecting themselves out of the wage-earning activities into self-employment, where rewards for effort may be better. If so, the age effect for married males would reflect the omitted variable effect of ability or productivity. In other words, married male wage

[11] Indeed, Alba (1999) finds that the single men do so poorly that, although they start out (*i.e.*, at age 18) with wages that are second only to those of married men, these compensation rates are soon exceeded (at age 21) by those of married women and eventually (at age 44) by the wage rates of unmarried women.

[12] We make a distinction in the marginal effect of age for married men (relative to the other possible sex and marital status configurations) because the coefficient estimates of the interaction between married males and experience are statistically significant. Thus, in the case of married men, we calculate the marginal effect of age by including its indirect effect through experience (holding *years of schooling* fixed).

earners may be found to have higher probabilities of unemployment and visible underemployment (and lower probabilities of invisible underemployment and full employment) as they grow older because only the less able of the cohorts remain as wage earners.[13]

Indeed, the same argument may be used to explain the marginal effects of married males' potential work experience on the probabilities of their labor force participation modes. As reflected in Table 3, married male workers are calculated to have a higher likelihood of being unemployed (0.1 percent) and to have lower probabilities of being invisibly underemployed (0.1 percent) and fully employed (0.4 percent). And a possible reason for this result is that the more able of those with longer work experience are no longer engaged in wage earning activities.

A third, mildly striking result is the effect of the worker's educational attainment on his modes of participation in the labor force. For a 35-year old male who is single, lives alone, resides in NCR, and has had three years of high school education, Table 3 shows that an additional year of high school education increases his probabilities of unemployment, invisible underemployment, and full employment by 0.7 percent, 0.2 percent and 1.8 percent, respectively, but decreases his probability of being visibly underemployed by 2.8 percent. On the other hand, as a result of an additional year of schooling, an otherwise identical person who has had two years of college education would see his probabilities of unemployment and full employment increase by 0.2 percent and 3.4 percent, respectively, and his probabilities of visible and invisible underemployment decrease by 3.4 percent and 0.2 percent, respectively.

Perhaps what these results capture is the combined effects of the educated workers' reservation wages and the conditions of labor demand that they face. Educational attainment may be correlated with the reservation wage or with resources that afford a longer job search. And this may be what accounts for the increase in the probability of unemployment of educated workers. At the same time, however, education may be taken by employers as a signal of worker quality or productivity, which may confer on educated workers more bargaining power in negotiations on the terms of their employment. And this may be what accounts for the decrease in the probability of visible underemployment of workers whose highest attainment is a high school education as well as for the decrease in the probabilities of visible and invisible underemployment of workers who have had college education.

In contrast to the results already discussed, the marginal effects of the number of elderly household members on the probabilities of labor force participation modes have a more straightforward interpretation. Table 3 shows that the presence of an additional elderly member in the household increases the hypothetical worker's probabilities of unemployment and visible underemployment by 0.7 percent and 0.1 percent, respectively, and decreases his probabilities of invisible underemployment and full employment by 0.2 percent and 0.6 percent, respectively. The obvious explanation for this is that the presence of elderly persons in a household exacts enormous demands on the time of adult members, which then prevents them from taking part in the time-intensive modes of labor force participation.

The last set of multinomial variables consists of the indicators of the workers' region of residence as well as the interactions of these factors with an urban dummy. As was mentioned

[13] It may be noted, though, that the marginal effects of age on the probabilities are really quite small.

earlier, the regression results for these attributes are unlike those of the other hypothesized determinants in that their coefficient estimates tend to be statistically different from zero, not by factor (in this case, a particular region) across labor force participation modes (as in the case of the other multinomial variables), but by mode of labor force participation across regions. Specifically, as reported in Table 2, the statistically significant coefficient estimates tend to be those of invisible underemployment. And as shown on Table 3, these tend to translate into higher probabilities of being invisibly underemployed for workers residing in regions other than NCR. Indeed, if the marginal effects of regional location on unemployment are compared with those on (visible and invisible) underemployment (and those on full employment), it is readily seen that a negative marginal effect on unemployment tends to be associated with a positive marginal effect on underemployment (whereas a positive marginal effect on unemployment tends to be correlated with a positive marginal effect on invisible underemployment or a negative marginal effect on full employment).

More specifically, the results on the workers' region of residence seem to be of three types. First, compared to workers in NCR, workers in Ilocos, Central Luzon, Eastern Visayas, and Northern and Central Mindanao seem to enjoy more employment opportunities. Once employed, however, they apparently have to contend with underemployment (rather than be fully employed). Second, workers in Bicol, Western Visayas, Western and Southern Mindanao, as well as those residing in the Southern Tagalog region have higher probabilities of unemployment, which tend to be positively associated with the probabilities of invisible underemployment and negatively associated with the probabilities of full employment. The lone exception is Central Visayas, where workers face a higher probability of being unemployed and a lower probability of being invisibly underemployed than workers residing in NCR. Third, in urban areas outside NCR, workers seem to have less employment opportunities. In addition, they apparently face either higher probabilities of underemployment and lower probabilities of full employment, as in the case of workers residing in Central Luzon and Southern Tagalog, or lower probabilities of full employment, as in the case of workers based in Western Mindanao and the Cordillera Autonomous Region. Thus, in general, workers who reside outside of NCR may be said to have higher probabilities of unemployment and underemployment and lower probabilities of full employment.

VI. Conclusion

In economies where the sale of one's labor services is an important source of income, the state of a person's well-being may well be indicated by the extent of his participation in the labor market. This in itself is sufficient reason for the government to ensure that labor (and related) markets work properly—for laws to be enacted that protect workers' rights and for macroeconomic policies to be adopted that bring about a stable environment and that promote economic growth and expand employment opportunities so that workers may be fully employed over their working lives. For the government to legislate the right laws and to formulate the correct policies, however, it must be informed about the economic behavior of its constituents. This is where research can hope to make its contribution.

This paper explored the correlates of various modes of labor force participation in the Philippines, using data from Labor Force Survey of the third quarter of 1994 and the Family Income and Expenditures Survey of the same year. The parameters of a mixed logit model of labor force participation alternatives were estimated in which potential income in each mode and the worker's demographic and socioeconomic characteristics were specified as regressors. The results of the regression indicated that (a) the probability of a worker's being in a particular mode of labor force participation is a concave function of potential income in that mode, (b) relative to other demographic segments, unmarried male workers are the least likely to be fully employed, (c) years spent in high school and college increase both the probability of unemployment and of full employment, (d) the presence of elderly household members has a negative (positive) impact on the probabilities of invisible underemployment and full employment (unemployment and visible underemployment), and (e) in general, workers who reside outside of NCR have higher probabilities of unemployment and underemployment and lower probabilities of full employment.

On the basis of these findings, some research questions and policy issues may be pursued. For instance, the positive influence of education on unemployment needs to be verified and the reasons for it need to be explored at greater length. Questions on it certainly abound: Is it a manifestation of educated unemployment, i.e., of too many educated workers competing for few available jobs? Is it a seasonal (i.e., third quarter) job search phenomenon? Is it a matter of the wage offers to educated workers being below their reservation wages? In the same vein, the reasons for the higher likelihood of unemployment and underemployment (and the lower probability of full employment) in regions outside NCR may be investigated in more depth. Is it a case of employment opportunities being concentrated only in the metropolis? Are wage rates too low in the regions, possibly because of poor compliance with regional wage directives? Are there too few able workers, perhaps due to outmigration? Or is this merely a seasonal (third quarter) phenomenon? And in the case of the impact of elderly household members on the labor force participation modes of people of working-ages, perhaps what needs to be done is to establish more support mechanisms for elderly care at the community level so that household members who choose to join the labor force would enjoy a wider range of opportunities.

Table 1
Descriptive Statistics of the Variables

Variables	Mean	Standard Deviation	Minimum Value	Maximum Value
Unemployed	0.0257	0.1583	0	1
Visibly underemployed	0.2192	0.4137	0	1
Invisibly underemployed	0.1024	0.3031	0	1
Fully employed	0.6527	0.4761	0	1
Personal income if unemployed	1446.93	4878.05	-164566.37	17879.44
Personal income if visibly underemployed	3010.01	5198.61	-158363.67	182974.44
Personal income if invisibly underemployed	4119.89	5277.46	-158976.39	184101.95
Personal income if fully employed	4345.74	5412.27	-155389.41	184825.75
Male	0.6526	0.4762	0	1
Married	0.5761	0.4942	0	1
Age	33.9517	11.6660	15	64
Years of elementary education completed	5.6834	0.9826	0	6
Years of high school education completed	2.6138	1.7971	0	4
Years of college education completed	1.1766	1.7369	0	5
Potential work experience	18.4779	12.3382	0	58
Urban resident	0.7102	0.4537	0	1
National Capital Region (NCR)	0.2249	0.4175	0	1
Region I (Ilocos)	0.0412	0.1989	0	1
Region II (Cagayan Valley)	0.0308	0.1728	0	1
Region III (Central Luzon)	0.1333	0.3399	0	1
Region IV (Southern Tagalog)	0.1661	0.3722	0	1
Region V (Bicol)	0.0430	0.2028	0	1
Region VI (Western Visayas)	0.0837	0.2769	0	1
Region VII (Central Visayas)	0.0655	0.2474	0	1
Region VIII (Eastern Visayas)	0.0306	0.1721	0	1

Table 1

Descriptive Statistics of the Variables

Variables	Mean	Standard Deviation	Minimum Value	Maximum Value
Region IX (Western Mindanao)	0.0270	0.1620	0	1
Region X (Northern Mindanao)	0.0446	0.2065	0	1
Region XI (Southern Mindanao)	0.0628	0.2426	0	1
Region XII (Central Mindanao)	0.0200	0.1399	0	1
Cordillera Autonomous Region (CAR)	0.0157	0.1244	0	1
Autonomous Region of Muslim Mindanao (ARMM)	0.0109	0.1039	0	1
Number of household members 6 years old and below	0.8240	1.0603	0	7
Number of household members between 7 and 14 years old	1.0967	1.2001	0	11
Number of household members between 15 and 64 years old	3.9502	1.8717	1	12
Number of household members 65 years old and over	0.1791	0.4608	0	4

Number of observations = 20876

Results of Mixed Logit Regression of Labor Force Participation Modes

	Visibly Underemployed	Invisibly Underemployed	Fully Employed
Conditional Variables			
Personal income (in hundred thousand pesos)		41.02620 7.439 **	
Personal income squared (in hundred thousand pesos)		-0.00012 -2.133 *	
Multinomial Variables			
Constant	3.11473 3.582 **	1.27425 1.374	3.22054 3.684 **
Female x Single	0.03913 0.310	0.38370 2.821 **	0.74161 6.272 **
Male x Married	0.74003 2.691 **	1.63344 5.717 **	1.46043 5.497 **
Female x Married	0.96113 2.865 **	0.71708 2.001 *	1.08077 3.345 **
Single x Experience	-0.00159 -0.069	-0.02867 -1.152	-0.02322 -1.011
Married Male x Experience	-0.03596 -1.630	-0.06887 -2.875 **	-0.05691 -2.577 **
Married Female x Experience	-0.00620 -0.246	-0.03556 -1.306	-0.03497 -1.391

Table 2

Results of Mixed Logit Regression of Labor Force Participation Modes

	Visibly Underemployed	Invisibly Underemployed	Fully Employed
Years of elementary education completed	-0.10576	-0.21882	-0.13767
	-0.526	-1.018	-0.684
Years of high school education completed	-0.41421	-0.26580	-0.28335
	-4.071 **	-2.450 *	-2.851 **
Years of college education completed	-0.65890	-0.71312	-0.69048
	-5.411 **	-5.750 **	-6.134 **
Age x Years of elementary education completed	0.00219	0.00567	0.00487
	0.515	1.229	1.141
Age x Years of high school education completed	0.00148	-0.00048	0.00035
	0.484	-0.149	0.117
Age x Years of college education completed	0.01136	0.01804	0.01954
	2.846 **	4.495 **	5.199 **
Region I (Ilocos)	0.92387	1.01764	0.59391
	1.928	2.014 *	1.249
Region II (Cagayan Valley)	0.53929	0.70345	-0.07488
	1.298	1.582	-0.181
Region III (Central Luzon)	0.96897	0.91078	0.63758
	2.643 **	2.352 *	1.752
Region IV (Southern Tagalog)	0.10353	-0.19418	-0.52253
	0.454	-0.770	-2.346 *
Region V (Bicol)	0.20959	1.30380	-0.85889
	0.605	3.716 **	-2.453 *

Results of Mixed Logit Regression of Labor Force Participation Modes

	Visibly Underemployed	Invisibly Underemployed	Fully Employed
Region VI (Western Visayas)	0.51628	0.43874	-0.53889
	1.927	1.491	-1.974 *
Region VII (Central Visayas)	-0.10417	-1.27019	-0.00326
	-0.297	-2.573 *	-0.010
Region VIII (Eastern Visayas)	1.59368	2.37839	0.78175
	2.182 *	3.208 **	1.071
Region IX (Western Mindanao)	0.22713	1.02155	-0.40899
	0.498	2.162 *	-0.905
Region X (Northern Mindanao)	0.37998	0.99165	-0.13657
	0.841	2.160 *	-0.306
Region XI (Southern Mindanao)	0.33089	0.88664	-0.63580
	0.994	2.559 *	-1.906
Region XII (Central Mindanao)	1.94229	1.50749	0.63651
	2.661 **	1.991 *	0.871
Cordillera Autonomous Region (CAR)	-0.09229	0.92108	0.21253
	-0.119	1.175	0.289
Autonomous Region of Muslim Mindanao (ARMM)	18.60940	18.80590	17.35670
	0.003	0.003	0.003

Table 2

Results of Mixed Logit Regression of Labor Force Participation Modes

	Visibly Underemployed	Invisibly Underemployed	Fully Employed
Region I x Urban	-0.76251	-0.58681	-0.56468
	-1.336	-0.978	-1.013
Region II x Urban	0.26197	0.44714	0.40294
	0.367	0.605	0.574
Region III x Urban	-1.74394	-1.84691	-1.36528
	-4.793 **	-4.739 **	-3.828 **
Region IV x Urban	-0.68554	0.21938	-0.50112
	-3.153 **	0.912	-2.392 *
Region V x Urban	0.39145	-0.30504	0.46294
	0.829	-0.640	0.992
Region VI x Urban	-0.37453	-0.24018	-0.11530
	-1.248	-0.736	-0.389
Region VII x Urban	0.46724	2.28079	0.60576
	1.034	4.006 **	1.391
Region VIII x Urban	-0.85936	-0.57570	-0.43261
	-0.972	-0.647	-0.494
Region IX x Urban	-0.72711	-2.14973	-0.33450
	-1.395	-3.684 **	-0.669
Region X x Urban	0.25410	-0.30006	0.20788
	0.484	-0.560	0.405
Region XI x Urban	-0.52594	-0.05576	-0.38827
	-1.469	-0.153	-1.104

Table 2

Results of Mixed Logit Regression of Labor Force Participation Modes

	Visibly Underemployed	Invisibly Underemployed	Fully Employed
Region XII x Urban	-1.36678	-0.37528	-0.94985
	-1.463	-0.391	-1.023
CAR x Urban	-0.49409	-2.06210	-0.58777
	-0.564	-2.166 *	-0.715
ARMM x Urban	-18.29710	-19.93590	-17.37880
	-0.003	-0.003	-0.003
Number of household members 6 years old and below	-0.00402	0.02910	-0.04774
	-0.076	0.533	-0.938
Number of household members between 7 and 14 years old	0.04605	0.03452	0.03063
	1.062	0.761	0.729
Number of household members between 15 and 64 years old	-0.05036	0.01563	0.00034
	-1.839	0.545	0.013
Number of household members 65 years old and over	-0.18584	-0.23673	-0.20110
	-1.962 *	-2.330 *	-2.252 *
Log Likelihood Function		-17381.5	
Number of Observations		20876	

Notes:

1. The left out category for the dependent variable is the state of unemployment.
2. Asymptotic t-statistics are provided below the coefficient estimates.

* - significant at .05 level.

** - significant at .01 level.

Table 3

The Marginal Effects of the Variables on the Probabilities of Labor Force Participation Modes[a]

Variables	Unemployment	Visible Underemployment	Invisible Underemployment	Full Employment
Personal income when unemployed	1.33358×10^{-5}	-2.25992×10^{-6}	-7.34594×10^{-7}	-1.03412×10^{-5}
Personal income when visibly underemployed	-2.23994×10^{-6}	5.52212×10^{-5}	-3.51393×10^{-6}	-4.94673×10^{-5}
Personal income when invisibly underemployed	-7.23487×10^{-7}	-3.49167×10^{-6}	2.01928×10^{-5}	-1.59777×10^{-5}
Personal income when fully employed	-1.01717×10^{-5}	-4.90902×10^{-5}	-1.59569×10^{-5}	7.52189×10^{-5}
Single female (vs. single male)	-0.01564	--	-0.01111	0.09868
Married female (vs. single male)	-0.01939	0.00582	-0.01168	0.02526
Married male (vs. single male)	-0.01838	-0.07608	0.00982	0.08464
Age	-0.00118	-0.00200	0.00006	0.00312
Age (for a married male)	0.00023	0.00330	-0.00113	-0.00241
Experience (for a married male)	0.00080	--	-0.00108	-0.00427
Years of high school education completed[b]	0.00738	-0.02822	0.00245	0.01840
Years of college education completed	0.00177	-0.03426	-0.00158	0.03407
Number of household members 65 years old and over	0.00657	0.00128	-0.00229	-0.00556
Region (vs. National Capital Region)				
Region I (Ilocos)	0.00127	--	-0.03535	--
Region III (Central Luzon)	-0.01709	0.05040	0.01245	--
Region IV (Southern Tagalog)	0.01429	--	--	-0.11772
Region V (Bicol)	0.01136	--	0.20841	-0.32553
Region VI (Western Visayas)	0.00705	--	--	-0.22121
Region VII (Central Visayas)	0.00205	--	-0.03737	--
Region VIII (Eastern Visayas)	-0.02280	0.10040	0.13495	--
Region IX (Western Mindanao)	0.00441	--	0.11382	--
Region X (Northern Mindanao)	-0.00223	--	0.08082	--
Region XI (Southern Mindanao)	0.00914	--	0.11075	--
Region XII (Central Mindanao)	-0.02194	0.23950	0.03164	--

Table 3

The Marginal Effects of the Variables on the Probabilities of Labor Force Participation Modes[a]

Variables	Unemployment	Visible Underemployment	Invisible Underemployment	Full Employment
Region x Urban area (vs. National Capital Region)				
Region III (Central Luzon)	0.07160	0.07091	0.01170	-0.15420
Region IV (Southern Tagalog)	0.04339	0.02427	--	-0.13572
Region VII (Central Visayas)	-0.00289	--	0.08054	--
Region IX (Western Mindanao)	0.00127	--	-0.03535	--
Cordillera Autonomous Region (CAR)	0.00165	--	-0.04612	--

[a]Unless otherwise indicated, the marginal effects are calculated for a 35-year old male who is single, has had 2 years of college education, resides in the National Capital Region, and lives alone. Incomes in alternative modes of labor force participation are set at the sample means.

[b]The marginal effects are calculated at 3 years of high school education completed and zero years of college education attended.

Figure 1
Probabilities of Labor Force Participation Modes
for a single male, 35 years old, with 2 years of college, lives alone, and resides in NCR

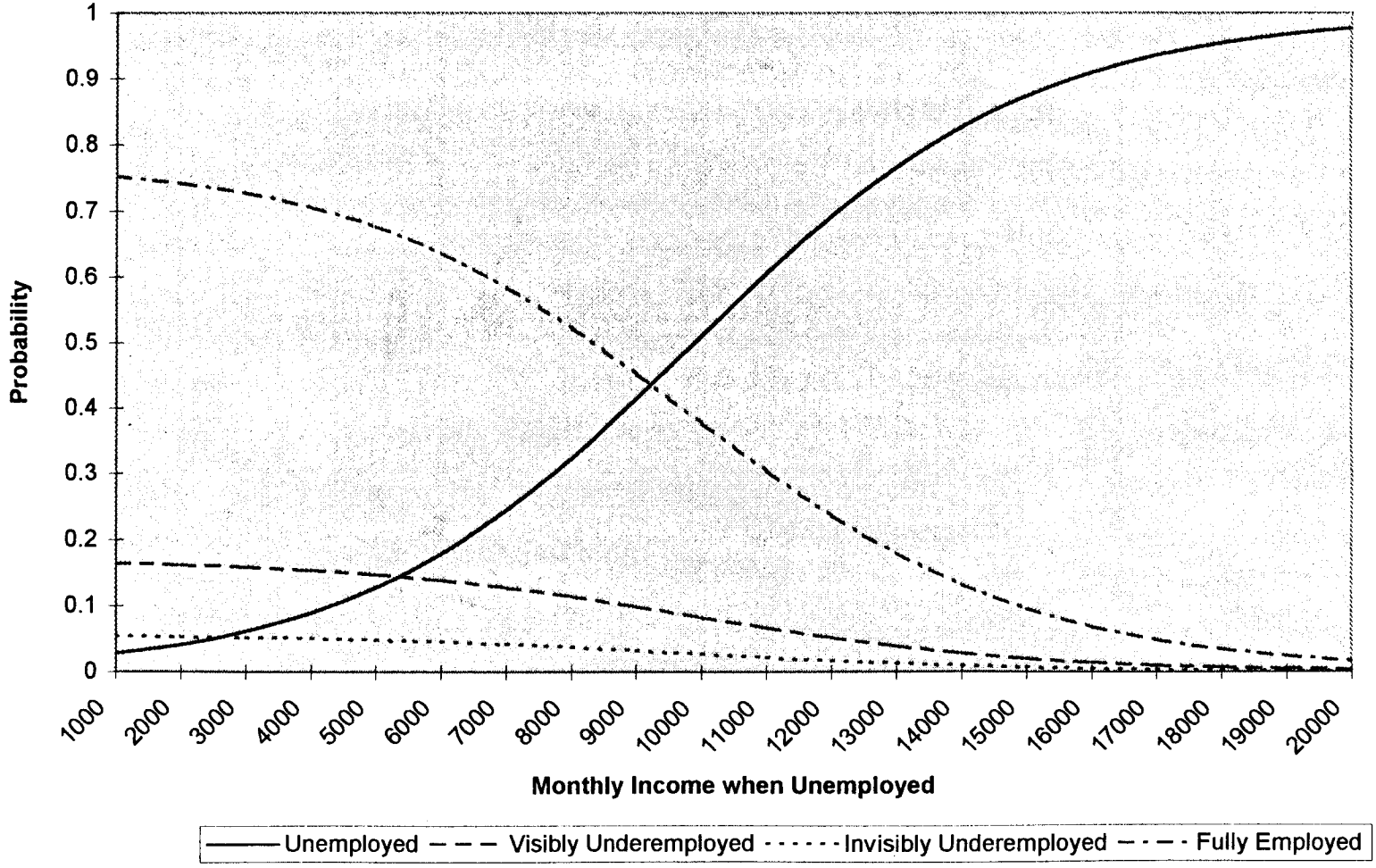
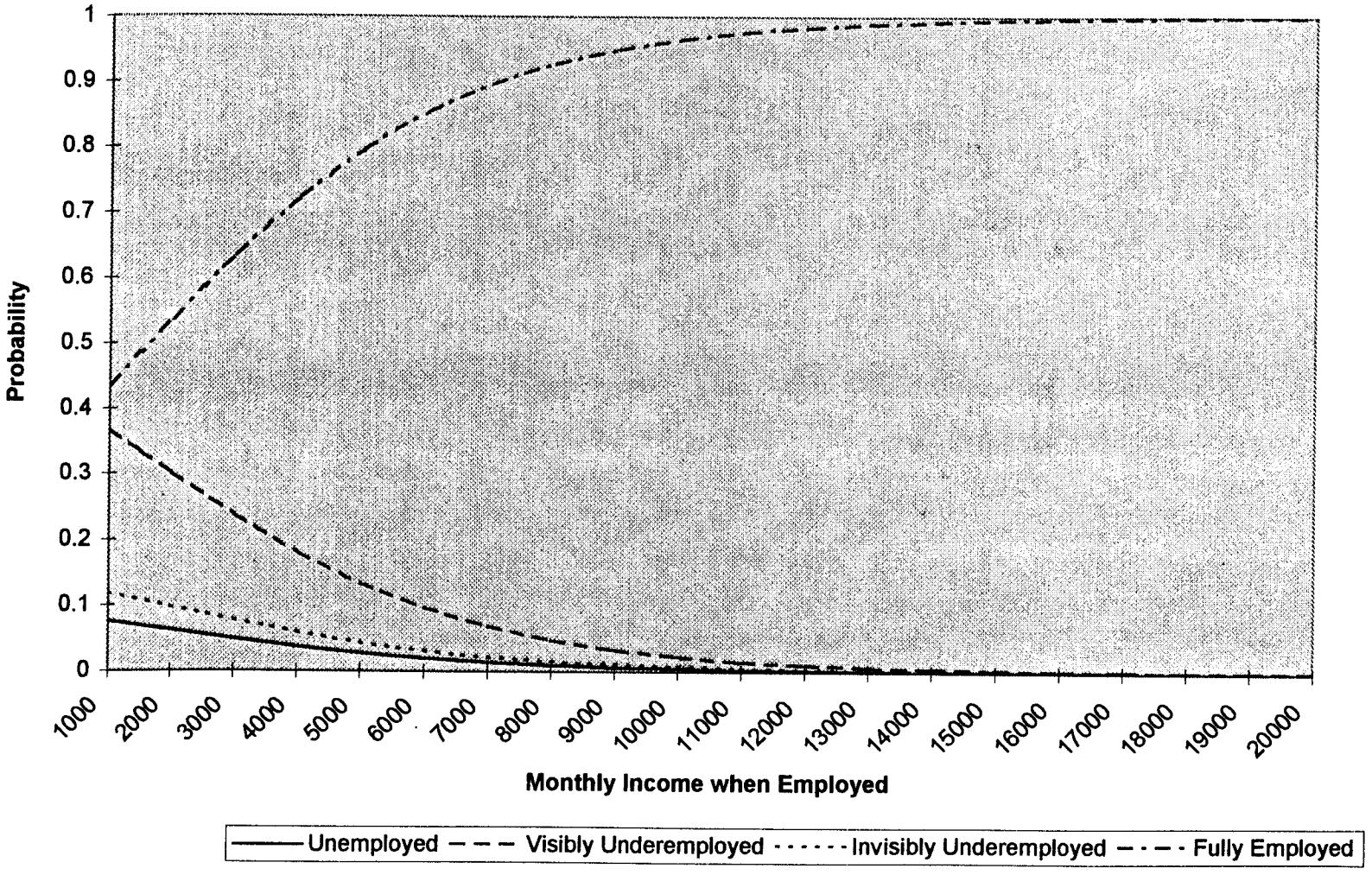


Figure 2
Probabilities of Labor Force Participation Modes
for a single male, 35 years old, with 2 years of college, lives alone, and resides in NCR



Appendix Table
Wage Regressions

Variables	Visibly Underemployed		Invisibly Underemployed		Fully Employed	
	Coefficient Estimates	t-Statistics	Coefficient Estimates	t-Statistics	Coefficient Estimates	t-Statistics
Constant	5.84617	50.385 **	6.18185	37.764 **	6.39980	101.254 **
Age	0.03787	6.489 **	0.04380	5.488 **	0.03660	12.665 **
Age squared	-0.00040	-5.401 **	-0.00047	-4.539 **	-0.00037	-10.123 **
Male	0.25013	6.531 **	0.09072	2.136 *	0.14827	9.686 **
Married	-0.07230	-1.714	-0.00538	-0.104	0.05034	2.906 **
Male x Married	0.34971	7.234 **	0.21142	3.689 **	0.10642	5.236 **
Years of elementary education completed	0.01602	1.743	0.04408	2.946 **	0.02254	3.307 **
Years of high school education completed	0.02909	3.764 **	0.04471	4.762 **	0.05302	14.378 **
Years of college education completed	0.13113	10.259 **	0.12918	11.446 **	0.10279	26.325 **
Urban	0.06505	2.568 *	0.11906	3.928 **	0.12009	9.858 **
Region I (Ilocos)	-0.27125	-4.292 **	-0.31896	-4.178 **	-0.35865	-14.382 **
Region II (Cagayan Valley)	-0.34673	-5.372 **	-0.32968	-4.016 **	-0.29114	-9.590 **
Region III (Central Luzon)	-0.19143	-4.179 **	-0.18768	-3.169 **	-0.21066	-13.413 **

Appendix Table

Wage Regressions

Variables	Visibly Underemployed		Invisibly Underemployed		Fully Employed	
	Coefficient Estimates	t-Statistics	Coefficient Estimates	t-Statistics	Coefficient Estimates	t-Statistics
Region IV (Southern Tagalog)	-0.36250	-8.517 **	-0.11585	-2.562 *	-0.17070	-11.185 **
Region V (Bicol)	-0.53077	-9.478 **	-0.24865	-4.453 **	-0.44093	-14.722 **
Region VI (Western Visayas)	-0.55509	-12.069 **	-0.43900	-7.490 **	-0.40500	-18.969 **
Region VII (Central Visayas)	-0.60329	-10.282 **	-0.50036	-6.861 **	-0.39251	-19.705 **
Region VIII (Eastern Visayas)	-0.62855	-9.657 **	-0.61154	-9.121 **	-0.39641	-12.540 **
Region IX (Western Mindanao)	-0.71363	-9.744 **	-0.53087	-5.910 **	-0.54181	-17.720 **
Region X (Northern Mindanao)	-0.80792	-13.652 **	-0.23202	-3.681 **	-0.52416	-20.835 **
Region XI (Southern Mindanao)	-0.48190	-9.375 **	-0.26379	-5.389 **	-0.34594	-14.206 **
Region XII (Central Mindanao)	-0.52477	-7.734 **	-0.32335	-3.710 **	-0.38454	-9.354 **
Cordillera Autonomous Region (CAR)	-0.23528	-2.042 *	-0.35965	-2.549 *	-0.33569	-9.435 **
Autonomous Region of Muslim Mindanao (ARMM)	-0.58986	-5.124 **	-0.30246	-2.065 *	-0.38134	-8.635 **

Appendix Table
Wage Regressions

Variables	Visibly Underemployed		Invisibly Underemployed		Fully Employed	
	Coefficient Estimates	t-Statistics	Coefficient Estimates	t-Statistics	Coefficient Estimates	t-Statistics
Professional, technical, and related workers	0.61910	9.783 **	0.29342	4.434 **	0.50131	18.825 **
Administrative, executive, and managerial workers	0.68117	5.352 **	0.07507	0.807	0.65201	18.004 **
Clerical and related workers	0.36797	5.184 **	0.15567	2.614 **	0.34953	13.672 **
Sales workers	0.29520	5.330 **	0.18556	2.970 **	0.19953	7.507 **
Service workers	0.18322	4.538 **	0.09734	1.889	0.14711	6.441 **
Production and related workers	0.29993	10.381 **	0.29200	7.337 **	0.38795	18.970 **
Workers not classified by occupation	-0.03874	-0.195	0.27602	0.827	0.39395	3.725 **
R-squared	0.3317		0.3869		0.4164	
Adjusted R-squared	0.3272		0.3782		0.4151	
Log Likelihood Function	-5065.71		-1818.04		-11107.70	
Number of Observations	4576		2137		13626	

* - significant at 0.05 level

** - significant at 0.01 level

References

Alba, Michael M. 1999. "Exploring the Existence and Measuring the Components of the Gender Wage Differential in the Philippines." CBE Working Paper Series. De La Salle University. Manila, Philippines.

Alonzo, Ruperto, Susan Horton, and Reema Nayar. 1996. "Women in the Labour Market in the Philippines." In *Women and Industrialization in Asia.* Susan Horton, ed. London: Routledge, 244–273.

Arellano, Manuel and Costas Meghir. 1990. "Labor Supply and Hours Constraints." In *Microeconometrics: Surveys and Applications.* Jean-Pierre Florens, Marc Ivaldi, Jean-Jacques Laffont, and Francois Laisney, eds. Oxford: Basil Blackwell.

Ashenfelter, Orley. 1980. "Unemployment as Disequilibrium in a Model of Aggregate Labor Supply." *Econometrica* **48**: 547–564.

Ermisch, John and Robert E. Wright 1993. "Wage Offers and Full-Time and Part-Time Employment of British Women." *Journal of Human Resources* **28**: 111–133.

Ham, John C. 1982. "Estimation of a Labour Supply Model with Censoring due to Unemployment and Underemployment." *Review of Economic Studies* **49**: 335–354.

Henderson, James M. and Richard E. Quandt. 1980. *Microeconomic Theory: A Mathematical Approach.* Third edition. New York: McGraw-Hill.

Hill, M. Anne. 1983. "Female Labor Force Participation in Developing and Developed Countries—Consideration of the Informal Sector." *Review of Economics and Statistics* **65**: 459–468.

Hill, M. Anne. 1989. "Female Labor Supply in Japan: Implications of the Informal Sector for Labor Force Participation and Hours of Work." *Journal of Human Resources* **24**: 143–161.

Horton, Susan, Ravi Kanbur and Dipak Mazumdar. 1994. *Labor Markets in an Era of Adjustment. Vol. 1* Washington, D.C.: Economic Development Institute of the World Bank.

Killingsworth, Mark R. 1981. *Labor Supply.* Cambridge: Cambridge University Press.

Maddala, G. S. 1983. *Limited-Dependent and Qualitative Variables in Econometrics.* Cambridge: Cambridge University Press.

Maloney, Tim. 1987. "Employment Constraints and the Labor Supply of Married Women (A Reexamination of the Added Worker Effect)." *Journal of Human Resources* **22**: 51–61.

World Bank. 1995. *World Development Report.* Oxford: Oxford University Press.

Yamada, Tadashi, Tetsuji Yamada, and Frank Chaloupka. 1987. "Using Aggregate Data to Estimate Part-Time and Full-Time Work Behavior of Japanese Women." *Journal of Human Resources* **22**: 574–583.

Discussion Paper No. 9903 January 1999

Estimating the Modes of Labor Force Participation in the Philippines

by

*Michael M. Alba and Emmanuel F. Esguerra**

*Associate Professor, De La Salle University and
Assistant Professor, School of Economics
University of the Philippines, respectively.

Preliminary. Do not quote.

Estimating the Modes of Labor Force Participation in the Philippines

Michael M. Alba and Emmanuel F. Esguerra*

January 1999

Abstract

This study explores the correlates of various modes of labor force participation in the Philippines. Data from the Labor Force Survey of the third quarter of 1994 and the Family Income and Expenditures Survey of the same year are used to estimate the parameters of a mixed logit model in which potential income, a function of wage offers, constitutes the conditional variable and socioeconomic and demographic characteristics are the multinomial variables. The results suggest that (a) the probability of a worker's being in a particular mode of labor force participation is a concave function of potential income in that mode, (b) unmarried male workers are the least likely to be fully employed, (c) years spent in high school and college increase both the probability of unemployment and of full employment, (d) the presence of elderly household members has a negative impact on the probabilities of invisible underemployment and full employment and a positive impact on the probabilities of unemployment and visible underemployment, and (e) in general, workers who reside outside of the National Capital Region have higher probabilities of unemployment and underemployment and lower probabilities of full employment.

* Respectively, Associate Professor, Economics Department, De La Salle University, 2401 Taft Avenue, Manila 1004, Philippines, and Assistant Professor, School of Economics, University of the Philippines, Diliman, Quezon City 1101, Philippines. We wish to thank Raul V. Fabella for his comments on the reasonableness of "negative reservation incomes," the participants of two MIMAP-sponsored workshops for their reactions to preliminary versions of our report on which this article is based, and Vanessa Ann Mina for coordinating with the MIMAP staff to obtain various data files that were considered for this paper, for processing the data set into a form suitable for analysis and econometric estimation, and for running various specifications of our logit regressions. We are grateful as well to the Philippine Development Foundation, Inc./Micro Impacts of Macroeconomic Adjustment Policies (PDFI/MIMAP) Project for financial support.

I. Introduction

Constraints on hours worked constitute an important qualification in the analysis of labor supply (Ashenfelter, 1980). Since workers cannot always freely choose how much labor to offer at the given market wage, a wedge may exist between notional labor supply, on the one hand, and its measurement, which relies on realized hours of work, on the other. In many parts of the world, the available labor force far exceeds the opportunities for employment. Indeed, the World Bank (1995) reports that in some low-income countries a substantial fraction of the labor force work only from fifteen to twenty-eight hours a week, on average, even though many of them prefer to work more. Demand side shocks, such as those brought on by the recent Asian financial crisis, occasionally also play a role, with outright shutdowns causing unemployment and downsizing inducing either unemployment or underemployment. Institutional rigidities (e.g., legislated wage floors), social legislation (e.g., fixing the length of the working day), as well as socially circumscribed gender roles constitute yet other sources of both unemployment (e.g., by branding workers of certain backgrounds as ineligible for hiring) and underemployment (e.g., by forcing workers to accept shorter working hours than what they may be willing to work for). In all these instances, the standard work-leisure dichotomy is inadequate as a guide for empirical work.

A number of studies have explored the implications of employment constraints on labor supply estimation. For instance, Ham (1982) found that labor supply analyses that ignore the presence of constrained workers in the sample result in biased parameter estimates. Extending Heckman's procedure to the case of two selection criteria and applying it to the estimation of labor supply functions, his study rejects the hypothesis that the unemployed and underemployed are unconstrained. In his paper on the labor supply of married women, Maloney (1987) found evidence of the added worker effect which previous studies were unable to establish because they failed to recognize that "the labor supply of married couples is often simultaneously constrained" (p. 53). Using a double censored tobit model to estimate the female spouse's labor supply, he found that unemployment or underemployment of the husband increases the hours put in by the wife in the labor market. Finally, Arellano and Meghir (1990) estimated labor supply by employing a switching regressions model that allows for the probability that workers are constrained. Their results confirm the influence of demand side variables such as unemployment and vacancies on labor supply.

If constraints on hours worked are the rule rather than the exception, then a worker's labor supply decision involves not simply the choice of whether to work or not at a given wage, but, possibly, of the mode of participation in the labor force. The individual may be categorized as being fully employed, underemployed, or unemployed depending upon his choice of hours of work given his characteristics, the prevailing wage rate, and other conditions of labor demand on offer. To the extent that these modes of participation in the labor market can be considered distinct and mutually exclusive states, they can be analyzed as the outcomes of a discrete choice process. A qualitative response model can then be used to analyze the determinants of an individual's choice of labor force participation mode.

Previous studies have analyzed the labor force participation decision based on a broader set of participation alternatives. For instance, Hill (1983, 1989) estimated a multinomial logit model of labor force participation of Japanese women where the categories are family

I. Introduction

Constraints on hours worked constitute an important qualification in the analysis of labor supply (Ashenfelter, 1980). Since workers cannot always freely choose how much labor to offer at the given market wage, a wedge may exist between notional labor supply, on the one hand, and its measurement, which relies on realized hours of work, on the other. In many parts of the world, the available labor force far exceeds the opportunities for employment. Indeed, the World Bank (1995) reports that in some low-income countries a substantial fraction of the labor force work only from fifteen to twenty-eight hours a week, on average, even though many of them prefer to work more. Demand side shocks, such as those brought on by the recent Asian financial crisis, occasionally also play a role, with outright shutdowns causing unemployment and downsizing inducing either unemployment or underemployment. Institutional rigidities (e.g., legislated wage floors), social legislation (e.g., fixing the length of the working day), as well as socially circumscribed gender roles constitute yet other sources of both unemployment (e.g., by branding workers of certain backgrounds as ineligible for hiring) and underemployment (e.g., by forcing workers to accept shorter working hours than what they may be willing to work for). In all these instances, the standard work-leisure dichotomy is inadequate as a guide for empirical work.

A number of studies have explored the implications of employment constraints on labor supply estimation. For instance, Ham (1982) found that labor supply analyses that ignore the presence of constrained workers in the sample result in biased parameter estimates. Extending Heckman's procedure to the case of two selection criteria and applying it to the estimation of labor supply functions, his study rejects the hypothesis that the unemployed and underemployed are unconstrained. In his paper on the labor supply of married women, Maloney (1987) found evidence of the added worker effect which previous studies were unable to establish because they failed to recognize that "the labor supply of married couples is often simultaneously constrained" (p. 53). Using a double censored tobit model to estimate the female spouse's labor supply, he found that unemployment or underemployment of the husband increases the hours put in by the wife in the labor market. Finally, Arellano and Meghir (1990) estimated labor supply by employing a switching regressions model that allows for the probability that workers are constrained. Their results confirm the influence of demand side variables such as unemployment and vacancies on labor supply.

If constraints on hours worked are the rule rather than the exception, then a worker's labor supply decision involves not simply the choice of whether to work or not at a given wage, but, possibly, of the mode of participation in the labor force. The individual may be categorized as being fully employed, underemployed, or unemployed depending upon his choice of hours of work given his characteristics, the prevailing wage rate, and other conditions of labor demand on offer. To the extent that these modes of participation in the labor market can be considered distinct and mutually exclusive states, they can be analyzed as the outcomes of a discrete choice process. A qualitative response model can then be used to analyze the determinants of an individual's choice of labor force participation mode.

Previous studies have analyzed the labor force participation decision based on a broader set of participation alternatives. For instance, Hill (1983, 1989) estimated a multinomial logit model of labor force participation of Japanese women where the categories are family

worker (in the informal sector), employed (in the formal sector), and unemployed. On the other hand, Yamada *et al.* (1987) examined the decision of Japanese married women whether to work full-time, part-time, stay unemployed, or not participate in the labor market. Underpinning the approach adopted in these studies is the argument that a dichotomous model (work vs. not work) fails to capture the underlying behavior if agents ascribe real differences to working in the formal versus informal sectors, and to full-time versus part-time work. Wage rates in part-time employment, for example, are generally lower than in full-time employment (Ermisch and Wright, 1993). Differences in wages and working conditions can also be found between formal and informal sector employment, and a worker may opt for employment in the latter either because of an inability to land a job in the formal sector (which is associated with costly entry) or because informal sector employment provides the desired flexibility in hours worked (which is an important consideration for married women with young children) as well as other non-pecuniary benefits (Hill, 1989).

This paper examines the labor supply decision using a mixed logit specification, in effect basically following the approach taken in previous studies insofar as the use of a polychotomous choice model is concerned. In this study, however, the alternative modes of labor force participation considered are: full employment, invisible underemployment, visible underemployment, and unemployment. This focus serves to underscore the influence of demand-side constraints on hours worked. Data on wage earners from the 1994 Labor Force and Family Income and Expenditure Surveys in the Philippines are used for the analysis. The probability that an individual chooses one of the alternatives is analyzed as a function of the various alternatives' attributes (in this study, the income associated with each alternative), the worker's own characteristics, and other exogenous factors.

The use of a qualitative response model is particularly relevant for the present study in light of the short reference period (i.e., a quarter) that serves as a basis for generating responses to the labor force survey. Especially over such short durations, workers are unable to freely adjust their working hours; instead their level of participation in the labor market is limited by labor demand conditions such as jobs available, prevailing wage rates, required working hours, and other working conditions. Moreover, responses to labor force surveys are generally more informative about the respondent's status of participation rather than actual labor supplied because of the tendency among respondents to report the length of the period employed (in terms of number of hours or weeks) rather than actual hours spent working (Killingsworth, 1983).

The findings of the paper are as follows: (a) The probability of a worker's being in a particular mode of labor force participation is a concave function of potential income in that mode. In other words, as potential income in a particular state of labor force participation increases, the probability that a worker would choose that alternative increases, though at a decreasing rate. (b) Compared to their married counterparts and to single female peers, unmarried male workers are the least likely to be fully employed. This is possibly because Filipino families tend to rely least on sons for financial support. In part, it may also be due to the fact that, as Alonzo *et al.* (1996) found, in the Philippines, married women tend to remain in the labor force during their childbearing years. (c) For women and single

men, the probabilities of unemployment and visible underemployment decrease with age, whereas the probabilities of invisible underemployment and full employment increase with age. For married men, the probabilities of unemployment and visible underemployment are higher for older workers, whereas the probabilities of invisible underemployment and full employment are lower. A possible reason for this rather unexpected result for married men is that, as they get older, the more able among them may be moving out of wage-earning activities and into self-employment. (d) Each additional year of high school increases the probabilities of unemployment, invisible underemployment, and full employment, but decreases the probability of visible underemployment. Each year spent in college increases the probabilities of unemployment and full employment, but decreases the probabilities of visible and invisible underemployment. A possible explanation for these results is that they may be reflecting the countervailing influences of education on labor force participation modes—through reservation wages, on the one hand, and labor demand conditions, on the other. More specifically, better educated workers may have higher reservation wages which increase their probabilities of unemployment for a given wage offer. At the same time, however, higher educational attainment is possibly being used by firms as a signal of worker quality which increases the probability of full employment and decreases the probability of visible underemployment of the better educated workers. (e) As may be expected, the presence of elderly household members has a negative impact on a worker's being invisibly underemployed or fully employed and a positive impact on his being visibly underemployed or unemployed. (f) Compared to the prospects of their peers in the National Capital Region (NCR), the employment opportunities facing wage earners residing in other regions do not seem to be as bright. For these latter set of workers, the probabilities of being unemployed or underemployed are generally higher and the probabilities of being fully employed are generally lower than those of workers in NCR.

The rest of this paper is organized as follows: The theoretical basis for the qualitative response model is discussed in the section that follows. Section III presents the empirical specification of the mixed logit model. In Section IV, the data set and variables used in the estimation are described. Section V reports the regression results. Section VI concludes by drawing out some of the policy and research implications of the findings.