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The Effect of Taxation on Labor Supply in a Developing Country: Evidence from Cross-Sectional Data

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Abstract

This study estimates the labor supply response of workers to taxation in a developing country, Indonesia. A large, cross-sectional data set provides information on the labor supplies and demographic characteristics of a sample Indonesian workers. Labor supply elasticities are estimated for male and female workers, by region and occupation classification. The estimated labor supply elasticities are similar in magnitude to previous estimates for workers in developed countries. Also, as in developed countries, female workers in Indonesia tend to be more tax responsive than male workers. The study is the first to apply modern econometric techniques to the estimation of labor supply elasticities for a developing country.

THE EFFECT OF TAXATION ON LABOR SUPPLY IN A DEVELOPING COUNTRY: EVIDENCE FROM CROSS-SECTIONAL DATA

I. Introduction

The analysis of the effect of taxation on labor supply has been of considerable interest to economists in developed economies in recent years.[1] Measures of the responsiveness of labor supply to changes in marginal tax rates are essential to the evaluation of tax efficiency and equity.[2] However, due primarily to the lack of suitable cross-section labor supply data, the analysis of labor supply in developing countries has been largely qualitative.[3] Little is known about whether and to what extent workers in developing countries respond to tax changes.

The present study is one of the first to apply modern econometric techniques to cross-section labor supply data from a developing country.[4] The country of investigation is Indonesia, an island country in the Pacific rim, whose territory extends about 5,000 km from east to west around the equator. The approach followed is to estimate labor supply functions for workers in a cross-section sample of Indonesian households. Based on the estimated results, labor supply elasticities measuring the expected percentage change in labor supply for a one percent change in the disposable wage rate are calculated for workers of different sexes, regions of residence, and education levels. The study finds that Indonesian workers respond to increases in taxation by reducing their labor supply, but like

workers in developed countries, the response is small, particularly for male workers. Furthermore, female workers are more responsive than other workers to tax changes.

The response of workers to an increase in taxation can be decomposed into two opposing effects, an income effect and a substitution effect. By reducing the reward for work, an income tax induces workers to work less and consume more leisure. However, the substitution effect is countered by an income effect that favors work if leisure is a normal good. By reducing income, an increase in taxation leads to reduced consumption of all normal goods, including leisure. The consequence of these two opposing effects is indeterminate theoretically and can be resolved only through empirical investigation.

The efficiency cost of taxation, termed the dead-weight loss or excess burden of taxation, depends not on the overall tax effect, but on the substitution effect. By distorting economic behavior, in this case labor supply behavior, the tax reduces the utility of workers who can no longer maintain their pre-tax utility levels even if the revenues from the tax are returned to them in lump-sum fashion. The larger the substitution effect of a tax, the larger its excess burden. Hence, one focus of this investigation is to estimate the magnitude of substitution effect of income taxation in Indonesia.

In developing countries, the orientation of labor supply studies is toward understanding the labor market structure and the conditions that result from unemployment and underutilization

of labor, internal migration, and wage differentials or wage dualism.[5] It has been presumed that labor supply in developing countries is nonresponsive to changes in taxation, perhaps because of the limited scope of personal income taxation in most developing countries. However, income taxation is of growing importance in countries such as Indonesia who are turning to income taxation to compensate for losses in government revenue from other sources.[6] Between 1983 and 1985, the number of individual income taxpayers in Indonesia increased by nearly 70 percent from 327,547 in 1983 to 554,272 at the end of 1985.[7] Based on this trend, it is not too early for economists to turn their attention to the microeconomics of taxation and labor supply in developing countries.

This study was made possible by the availability of an outstanding source of data, Indonesia's National Social-Economic Survey for the 1982 interviewing year. This data set contains information on earnings, hours of work, types of occupation, and other socio-economic variables for a large sample of Indonesian workers.[8] A sub-sample of 1,353 households from this data set was used as the basis for this study.

In the next section, a theoretical model explaining labor supply decisions is proposed and used to justify an empirical model of Indonesian labor supply. Section III describes the data and estimation techniques, and section IV contains the estimation results. A summary and discussion of the results is found in section V.

II. Theoretical Model

The model of this study assumes that individuals determine their hours of work by weighing the benefits of consumption against those of leisure. In making their decisions, individuals are constrained by the amount of time available and by the limitation that income is equal to the sum of earned income and non-work (or property) income.

For a representative individual, the utility function is assumed to take the CES form:

$$(1) \qquad U = [aY^{-b} + (1-a)L^{-b}]^{-1/b}$$

where $0 < a < 1$ and $b > -1$ are constants that may vary over individuals, Y is income, and L is hours of leisure consumed. Utility is maximized subject to an income constraint:

$$(2) \qquad Y = wH + P - T$$

and a time constraint:

$$(3) \qquad L + H = k$$

where w is the hourly rate of pay, H is hours of work, P is property income, T is the personal income tax liability, and k is total time available.

It is assumed that the Indonesian income tax, which is a bracket tax, can be approximated by:

$$T = t\,[\,wH + P] \tag{4}$$

where t is the individual's bracket tax rate. Combining (2) through (4), the budget constraint can be written as:

$$Y = W(k - L) + I \tag{5}$$

where $W = w(1 - t)$ and $I = P(1 - t)$.

Maximizing (1) subject to (5) yields the following first order condition:

$$L = M^{-s}\, W^{-s}\, Y \tag{6}$$

where $M = a/(1-a)$ and $s = 1/(1+b)$. Dividing by Y and taking logs yields:

$$\ln L/Y = -s \ln M - s \ln W. \tag{7}$$

Since s is always positive, (7) states that the leisure-income ratio is negatively related to the disposable wage rate. If the stochastic specification of (7) follows the ordinary specification, this equation can be estimated using ordinary least squares. The random error term can be interpreted as

unobserved variables representing differences in tastes among individuals.[9] The estimated coefficients can be used to derive estimates of the utility parameters a and b as follows:

$$a = M/(1+M) \tag{8a}$$

$$b = (1-s)/s. \tag{8b}$$

The effect of a change in the disposable wage on leisure can be found by computing the elasticity of leisure with respect to the wage. First, solve equation (7) for L independently of Y:

$$L = [M^{-s}W^{-s}\ (kW + I)]/(1 + M^{-s}W^{1-s}). \tag{9}$$

Next, differentiate (9) by W and apply the standard elasticity definition. This yields:

$$\epsilon_{LW} = - s + [kW/(kW + I)] + [(1-s)(1 - D)/D] \tag{10}$$

where $D = 1 + M^{-s}W^{1-s}$. Since the change in income is not controlled for, (10) must be interpreted as an uncompensated elasticity. The sign of ϵ_{LW} is ambiguous unless specific values for each parameter and variable are inserted.

The compensated elasticity can be derived by taking the income effect into account. This is done by applying the elasticity definition to the Slutsky equation:

(11) $$\epsilon_{LW}^{comp} = \epsilon_{LW} - [kW/(kW + I)] + [(1-D)/D].$$

While the uncompensated elasticity may be either positive or negative, the compensated elasticity is expected to have a negative sign.

Since the interest is in the response of labor supply rather than leisure, the leisure elasticities can be converted into labor supply elasticities using (3). This yields:

(12a) $$\epsilon_{HW} = - \epsilon_{LW} L/H$$

(12b) $$\epsilon_{HW}^{comp} = - \epsilon_{LW}^{comp} L/H.$$

While these formulae are formidable, they involve parameters that can be easily estimated from the leisure-income share equation, (7). In the next section, the estimation procedure is described.

III. The Empirical Model and its Estimation

In order to convert equation (7) into an estimation model, it is assumed that $M = a/(1-a)$ varies across households reflecting differences in preferences for consumption and leisure. In particular, it is assumed that:

(13) $$\ln M = c_0 + c_{1i} X_i$$

where X_i represents various demographic factors such as age, sex, education, region of residence, and number of children. Inserting (13) into (7) leads to the following estimation model:

$$(14) \qquad \ln L/Y = \beta_0 + \beta_1 \text{ Age} + \beta_2 \text{ Sex} + \beta_3 \text{ Education} + \beta_4 \text{ Region} + \beta_5 \text{ Children} + \beta_6 \ln W + u$$

where $\beta_0 = -sc_0$, $\beta_i = -sc_{1i}$, $i = 1,\ldots,5$, and $\beta_6 = -s$. It is assumed that the error term, u, is normally distributed with zero mean and constant variance. Hence, ordinary least squares estimates of (14) are unbiased. The estimated slopes of this equation provide efficient estimates of the desired elasticities.

The data for estimating equation (14) were drawn from Indonesia's National Social-Economic Survey for the 1982 interviewing year. This survey was conducted by the Central Bureau of Statistics and contains about 350,000 individual cases covering all regions of Indonesia. The data were designed to provide information on households' socio-economic situations, including labor supply.

A sub-sample with 1,353 cases was selected from the larger sample to include those households likely to be affected by the income tax. The sub-sample included those:

i who were heads of households or working spouses,[10]

ii whose ages were between 21 and 65 years,

iii whose educational attainment was high school and above,

iv who worked more than 10 hours per week during the survey year, and

v who were employed in the private sector.[11]

Mean hours of work for the sub-sample was 47.8 hours per week with a standard deviation of 13.0 hours, while mean wage income

per month was Rp. 89,647 with a standard deviation of Rp. 68,530. Table 1 shows the distribution of hours worked by education, occupation, and income level and Table 2 shows the distribution of wage income by education, occupation, sex, hours worked, and age.

Income tax liabilities were not available in the data and had to be estimated based on 1982 Indonesian income tax law. The bracket rates ranged from 5 percent to 50 percent (Table 3). For each worker, the bracket tax rates were applied to income in excess of a tax free limit of Rp. 240,000 annually for the taxpayer personally, Rp. 240,000 for the spouse, and Rp. 120,000 for each child who is dependent on the taxpayer, altogether not exceeding five persons. The tax liabilities of spouses were calculated based on their individual incomes according to Indonesian tax law.

The demographic variables available in the data set included age, sex, education, region of residence, and number of children. Age was measured in number of years. Education was represented by three dummy variables:

$Educ_1$ = 1 if vocational high school background
= 0 otherwise;

$Educ_2$ = 1 if academy background
= 0 otherwise;

$Educ_3$ = 1 if university background
= 0 otherwise.

The omitted education category, general high school education, was captured in the intercept term. Region and sex were also represented by dummy variables:

Region = 1 if from urban area
= 0 otherwise;
Sex = 1 if male
= 0 if female.

Number of children was the number of minor children in the family.

The hourly wage rate had to be constructed from information on wage income and hours of work. Gross wage income was divided by hours of work to obtain the wage per hour. This was then multiplied by one minus the bracket tax rate to yield the net (disposable) wage rate, W. Income, Y, which forms the denominator of the dependent variable, was calculated by subtracting the worker's estimated tax liability from his or her gross income.

The results of the estimation are presented in the next section.

IV. Estimation Results

The model was first estimated on the entire sub-sample of workers and then separately on the male and female workers. The results of the ordinary least squares estimations are shown in Table 4. In all the estimations, the R^2s and adjusted R^2s, exceeded .59, suggesting a good fit to the data. The coefficients of the demographic variables were of expected sign.

Older workers and male workers take less leisure (work more) than younger workers and female workers. In most cases, the education variables were not significantly different from zero, although it appears that vocational high school graduates consume more leisure (work less) than other workers, particularly if they are female. Children tend to influence female workers to work less outside the home and male workers to work more. Furthermore, urban workers tend to consume less leisure (work more) than rural workers.

As expected, the sign of the coefficient of ln W is negative and significantly different from zero in all three estimations. Recall from the previous section that the negative of this coefficient provides an estimate of s = 1/(1+b), a measure of the substitutability between income and leisure. For combined male and female workers, the estimate of s is .814, indicating that income and leisure are neither perfect complements (s=0) nor perfect substitutes (s=infinity). Also, since s is not equal to one, the CES function does not reduce to the Cobb-Douglas form.

Next, the data were sorted by region and the model was separately estimated for each region. These results are shown in Table 5. Indonesia is a heterogeneous country with over 300 ethnic groups and as many languages. The sorting of the data by region was an attempt to see if this heterogeneity affected the estimation results. As seen in the table, the coefficient of the wage variable is always significant and of the expected negative sign. Although the demographic variables were not significant

factors in several of the provinces, for Jakarta, the capital region, the demographic variables were generally significant and of expected sign. Jakarta is the center of government as well as of private activities. Workers in Jakarta may be able to vary their working hours according to their age, sex, and education level more easily than can workers in other provinces.

As a last attempt to capture differential effects of other variables not included in the equations, an estimation was conducted by splitting the observations according to their occupational classifications. The results are shown in Table 6. The coefficient of the wage variable is significant and of expected sign for all occupations. For managers, the estimated value of s exceeds 1, suggesting a substitute relationship between income and leisure for these workers. The coefficients of the demographic variables follow expected patterns.

Based on these results, uncompensated and compensated elasticities were computed for all workers and by sex. Table 7a shows the estimated labor supply elasticities for the whole sample by tax bracket, while Tables 7b and 7c show the same information by sex. Note that for all groups, the uncompensated elasticity is near zero but the compensated elasticity is of the expected positive sign and of modest size. The compensated elasticities for the female sample exceed those of the male sample and show no particular pattern over the tax brackets. On average, the compensated male labor supply elasticity is .50 for

males and .59 for females. In the last section, the implications of these findings are discussed.

V. Conclusions

This study is unique in applying modern econometric techniques to a cross-section data set of labor supply for a developing country. The purpose of the study was to explore the response of labor supply to changes in the disposable wage rate after controlling for demographic differences. Both uncompensated and compensated labor supply elasticities were calculated for various groups of workers. The uncompensated elasticities for all workers range from -.02 to -.07 while the compensated elasticities range from .33 to .58. In general, the compensated elasticities tend to be larger for females than for males.

It is interesting to compare these results with similar results for workers in developed countries. Table 8 presents uncompensated and compensated labor supply elasticities for males and females based on studies in developed economies. For males, the compensated elasticities for developed countries range from -.08 to .20, while in this study they range from .31 to .55. For females, the compensated elasticities for developed countries range from -.11 to 2.72, while in this study they range from .37 to 1.22. Hence, for males, the compensated elasticity estimates tend to be slightly higher than for males in developed countries, while for females, they are in a tighter range. Overall, one would have to conclude that the estimated elasticities for the

developing country of Indonesia do not vary greatly from similar estimates for developed countries.

One reason for estimating compensated labor supply elasticities is to calculate the deadweight loss or excess burden per dollar of taxation. Following Stiglitz (1988), deadweight loss per dollar of tax revenue can be calculated according to the following formula:

$$\text{(14)} \qquad \text{Deadweight Loss/Tax Revenue} = \tfrac{1}{2}\, t\, \epsilon_{HW}^{comp}$$

where t is the marginal tax rate. The deadweight loss varies positively with the marginal tax rate and with the compensated labor supply elasticity.[12] Substituting from the results of this study, the deadweight loss per dollar of tax revenue for Indonesia ranges from .013 to .061 depending on the marginal tax rates. The deadweight loss can be interpreted as the efficiency cost of raising a dollar of tax revenue. For Indonesia, the deadweight loss per dollar of income tax revenue appears to be fairly low, particularly for low marginal tax rates.[13]

Much work remains to be done in the analysis of the effects of taxation on labor supply in developing countries. The model of this study focussed on the labor supply of individuals, while we suspect from evidence in developed economies that the labor supplies of workers in the same family are interdependent.[14] Since the Indonesian income tax treats spouses separately for tax purposes, we felt justified in using the simpler individual

model. The data set used in this study did not lend itself to a family labor supply analysis.

Another interesting extension of this analysis would be to treat the budget constraint as piecewise-linear and use mathematical programming to solve the optimization problem. This technique has been attempted by several authors using U.S. data.[15] The procedure usually followed is to estimate the labor supply parameters in two steps. In the first step, the utility-maximizing segment of the budget constraint is located, and in the next step, the coefficients of the labor supply function are estimated using a non-linear maximum likelihood or Tobit procedure. Initial attempts to apply this technique to the Indonesian data yielded labor supply elasticities of similar magnitude to those obtained using the simpler OLS technique. The more complicated technique was therefore abandoned.

Table 1
Mean Weekly Hours of Work by Education, Occupation, and Income

Educational Attainment	mean	cases
1. General High School Graduates	48.82	599
2. Vocational High School Grad.	47.59	594
3. Academy Graduates	45.61	90
4. University Graduates	42.84	70
Occupational Classification	**mean**	**cases**
1. Professional & Technicians	40.07	213
2. Managerial	45.91	23
3. Administrative	47.10	357
4. Sales worker	49.89	137
5. Service worker	48.96	101
6. Agriculture worker	45.51	33
7. Production wkr & operator	50.94	487
8. Others	61.00	2
Income Classification	**mean**	**cases**
1. less than 10,000	29.88	17
2. 10,000 - 19,999	34.65	38
3. 20,000 - 29,999	41.05	103
4. 30,000 - 39,999	46.39	101
5. 40,000 - 49,999	48.75	177
6. 50,000 - 59,999	49.82	142
7. 60,000 - 69,999	48.25	89
8. 70,000 - 79,999	49.92	172
9. 80,000 - 89,999	50.01	68
10. 90,000 - 99,999	50.22	99
11. 100,000 - 129,999	49.09	118
12. 130,000 - 159,999	49.86	83
13. 160,000 - 199,999	47.57	69
14. 200,000 - 249,999	49.68	35
15. 250,000 - 299,999	46.68	23
16. 300,000 - 349,999	50.89	9
17. 350,000 - 399,999	41.16	6
18. 400,000 -	49.25	4

Source : Calculated from the data tape.

Table 2
Mean Monthly Wage Income by Education, Occupation, Sex, Weekly Hours of Work, and Age

Educational Attainment	mean	cases
1. General High School Graduates	86,65	599
2. Vocational High School Grad.	79,28	594
3. Academy Graduates	126,51	90
4. University Graduates	155,71	70
Occupational Classification	**mean**	**cases**
1. Professional & Technicians	96,25	213
2. Managerial	197,43	23
3. Administrative	91,63	357
4. Sales worker	81,05	137
5. Service worker	71,90	101
6. Agriculture worker	55,36	33
7. Production wkr & operator	88,79	487
8. Others	49,00	2
SEX	**mean**	**cases**
1. Female	66.72	154
2. Male	92.58	1199
Number of hours worked	**mean**	**cases**
1. 10 - 24	49.01	58
2. 25 - 34	61.95	73
3. 35 - 44	97.77	381
4. 45 - 59	90.90	646
5. 60+	91.06	190
AGE	**mean**	**cases**
1. 20 -24	47.03	92
2. 25 -29	69.84	275
3. 30 -34	93.98	385
4. 35 -39	95.93	269
5. 40 -44	103.61	171
6. 45 -49	125.65	80
7. 50 -54	107.66	45
8. 55 -59	75.95	24
9. 60 -64	110.50	12

Notes : Net wage income is in Rp.000.-/month.
$ 1. = ±Rp.1000.

Table 3

Indonesian 1982 Income Tax Brackets

Taxable Income (In Rp.000)			Marginal Income Tax Rates
0	-	240	5%
240	-	480	6%
480	-	720	7%
720	-	960	8%
960	-	1,200	9%
1,200	-	1,500	10%
1,500	-	1,800	12%
1,800	-	2,400	14%
2,400	-	3,000	16%
3,000	-	3,900	18%
3,900	-	4,800	20%
4,800	-	6,000	23%
6,000	-	7,200	26%
7,200	-	8,700	29%
8,700	-	10,500	33%
10,500	-	12,600	37%
12,600	-	15,000	41%
15,000	-	18,000	45%
18,000	-	up	50%

Sources : Decree of the Minister of Finance of the Republic of Indonesia concerning the determination of Tax Free Income Limit and Income Tax Rate for 1982.

Table 4
Ordinary Least Squares Estimation Results

GROUP	CONSTANT	LN W	AGE	SEX	E1	E2	E3	CHILDR	REG
1. FEMALE & MALE	-.005	-.814	-.005	-.396	.041	-.033	.058	-.005	-.127
(T ratio)	(-.040)	(-39.2)	(-3.04)	(-9.74)	(4.51)	(-.612)	(.949)	(-.631)	(-3.63)
R^2 = .61141 Adjusted R^2 = .60906 F value = 260.595									
2. FEMALE	.390	-.856	-.017	-	.305	.101	.169	.063	-.157
(T ratio)	(.932)	(-11.4)	(-2.74)	-	(3.15)	(.623)	(.952)	(1.912)	(-1.26)
R^2 = .62885 Adjusted R^2 = .61093 F value = 35.0970									
3. MALE	-.491	-.802	-.004	-	.007	-.048	.048	-.012	-.122
(T ratio)	(-3.67)	(-37.5)	(-2.22)	-	(.279)	(-.845)	(.751)	(-1.56)	(-3.37)
R^2 = .59332 Adjusted R^2 = .59089 F value = 244.04719									

Table 5
Estimation Results by Province

PROVINCES	CONSTANT	LN W	AGE	SEX	E1	E2	E3	CHILDR	REG
DI ACEH	-.937	-.796	.010	-.017	-.059	.248	-.171	-.073	-.304
(68)	(-1.424)	(-10.8)	(1.43)	(-.054)	(-.676)	(1.41)	(-.535)	(-3.20)	(-2.78)
NORTH SUMATERA	-.457	.703	.002	-.677	.097	-.340	.296	.014	-.223
(95)	(-.799)	(-6.91)	(-.380)	(-4.02)	(.870)	(-1.6)	(.989)	(.491)	(-1.67)
WEST SUMATERA	-.658	-.653	-.015	-.097	.048	.105	-.822	-.044	-.340
(41)	(-.759)	(-4.17)	(-1.45)	(-.289)	(.275)	(.27)	(1.766)	(-.944)	(-1.47)
RIAU	-1.289	-.680	.014	-.784	.114	.068	000	-.069	.045
(35)	(-1.556)	(-6.24)	(1.23)	(-2.09)	(.831)	(.23)	(-)	(-1.60)	(.173)
JAMBI	-.480	-.859	.006	000	.089	.000	.000	-.023	-.168
(29)	(-.689)	(-8.55)	(.741)	(-)	(.931)	(-)	(-)	(-.739)	(-1.13)
SOUTH SUMATERA	-.927	-.657	-.007	-.274	.077	.134	.146	.019	-.217
(58)	(-1.756)	(-5.89)	(-.915)	(-1.77)	(.774)	(.372)	(.529)	(.680)	(-1.22)
BENGKULU	-	-	-	-	-	-	-	-	-
(4)	-	-	-	-	-	-	-	-	-
LAMPUNG	3.29	-1.34	-.008	-1.00	.030	.000	.709	.145	-.425
(21)	(1.746)	(-4.38)	(-.416)	(-2.46)	(.097)	(-)	(1.03)	(1.437)	(-1.10)
DKI JAKARTA	-1.260	-.628	-.009	-.305	.126	-.271	-.158	-.002	.000
(297)	(-4.72)	(-14.0)	(-2.47)	(-4.38)	(2.58)	(-3.03)	(-1.61)	(-.129)	(-)
WEST JAVA	.463	-.966	-.008	-.185	.009	.189	.021	.006	.164
(107)	(.966)	(-13.0)	(-1.52)	(-1.33)	(.107)	(1.02)	(.091)	(.281)	(1.77)
CENTRAL JAVA	-.1306	-.694	-.009	-.338	.072	.152	-.104	-.029	-.498
(75)	(-.240)	(-7.08)	(-1.33)	(-2.11)	(.605)	(.710)	(-.294)	(-.917)	(-2.93)
YOGYAKARTA	.311	-.819	-.011	-.599	.013	-.097	.286	.010	.053
(64)	(.477)	(-7.41)	(-1.25)	(-3.15)	(.078)	(-.326)	(1.352)	(.182)	(.319)
EAST JAVA	-.577	-.511	-.025	-.652	-.052	-.605	-.247	.021	-.341
(91)	(-.820)	(-4.10)	(-3.05)	(-3.89)	(-.369)	(-2.48)	(-.759)	(.499)	(-1.93)
BALI	.957	-.898	-.009	-.556	-.144	-.240	-.214	.004	-.183
(49)	(1.460)	(-7.74)	(-.925)	(-3.53)	(-.995)	(-.872)	(-.631)	(.097)	(-1.09)
WEST NUSA TENGGARA	-2.654	-.481	.013	-.036	.280	.094	1.297	-.017	.036
(19)	(-1.635)	(-1.84)	(.488)	(-.054)	(.600)	(.118)	(1.581)	(-.167)	(.093)
EAST NUSA TENGGARA	.560	-.867	-.010	-.124	.102	.238	-.426	.016	-.486
(36)	(.570)	(-3.82)	(-.605)	(-.377)	(.353)	(.440)	(-.694)	(.281)	(-.925)
EAST TIMOR	-	-	-	-	-	-	-	-	-
(4)	-	-	-	-	-	-	-	-	-
WEST KALIMANTAN	.238	- 891	-.009	-	-.172	-.288	-.169	.045	-
(21)	(.301)	(-8.40)	(-.873)	-	(-1.41)	(-1.12)	(-.654)	(1.054)	-
CENTRAL KALIMANTAN	-.245	-.845	-.011	-.190	-.075	-	-	-.008	.586
(15)	(-.106)	(-2.58)	(-.379)	(-.471)	(-.231)	-	-	(-.049)	(1.83)
SOUTH KALIMANTAN	.629	-1.00	.003	.087	.021	-.295	.010	-.028	-.308
(43)	(.745)	(-7.42)	(.270)	(.426)	(.150)	(-.964)	(.052)	(-.494)	(-1.38)
EAST KALIMANTAN	1.978	-1.07	-.012	-.651	-.217	-.517	-	.040	-.192
(26)	(3.580)	(-10.0)	(-.878)	(-1.98)	(-1.98)	(-2.46)	-	(1.162)	(-1.64)
NORTH SULAWESI	-.878	-.641	-.010	-.272	-.333	-.184	-.423	.050	-.176
(65)	(-1.09)	(-4.43)	(-1.10)	(-1.00)	(-2.12)	(-.537)	(-.960)	(.836)	(-.928)
CENTRAL SULAWESI	-	-	-	-	-	-	-	-	-
(8)	-	-	-	-	-	-	-	-	-
SOUTH SULAWESI	-.690	-.754	-.015	-.516	-.211	-.214	-.051	.032	-.408
(40)	(-.571)	(-4.024)	(-.830)	(-.891)	(-.975)	(-.606)	(-.140)	(.504)	(-1.58)
SOUTHEAST SULAWESI	-.425	-.762	-.012	-.315	-.093	-.837	.384	.038	-
(15)	(-.220)	(-2.12)	(-.211)	(-.383)	(-.183)	(-.926)	(.394)	(.248)	-
MALUKU	-.767	-.666	-.006	-	-.086	.528	-	-.068	-.660
(16)	(-.507)	(-2.40)	(-.277)	(-)	(-.252)	(1.372)	(-)	(-.610)	(-2.03)
IRIAN JAYA	-.161	-2.56	.464	-.527	1.225	1.677	2.170	-1.60	-1.48
(11)	(-.160)	(-4.58)	(4.09)	(-1.57)	(5.139)	(4.221)	(3.097)	(-4.90)	(-5.05)

Notes : The number under the provinces are the numbers of observations.
The number in parentheses are t-ratios

Table 6
Estimation Results by Occupation

	OCCUPATION	CONSTANT	LN W	AGE	SEX	E1	E2	E3	CHILDR	REG
1.	PROFESSIONAL & TECHNICIAN	1.008	-.867	-.015	-.481	.088	-.103	.132	-.047	-.211
	(T RATIO)	(2.43)	(-11.5)	(-2.79)	(-4.96)	(.767)	(.717)	(.864)	(-1.84)	(-2.01
	R^2 = .62921	Adjusted R^2 = .61438	F VALUE = 42.42403	Number of cases = 209						
2.	MANAGERIAL	2.202	-1.1.	-.021	-.344	-.196	-.731	-.178	.081	-.0129
	(T RATIO)	(1.27)	(-4.283)	(-1.29)	(-1.35)	(-.843)	(-2.70)	(-.901)	(1.593)	(-.021)
	R^2 = .73603	Adjusted R^2 = .58519	F VALUE = 4.879	Number of cases = 23						
3.	ADMINISTRATIVE	.125	-.885	-.005	-.083	.002	-.039	-.054	.003	-.120
	(T RATIO)	(.608)	(-25.72)	(-1.65)	(-1.48)	(.057)	(-.520)	(-.054)	(.314)	(-1.93)
	R^2 = .71414	Adjusted R^2 = .70750	F VALUE = 107.4249	Number of cases = 353						
4.	SALES WORKER	-.609	-.734	-.011	-.271	-.066	.0158	.132	.016	.057
	(T RATIO)	(-1.52)	(-11.37)	(-1.99)	(-2.22)	(-.835)	(.093)	(.710)	(.663)	(.355)
	R^2 = .59251	Adjusted R^2 = .56664	F VALUE = 22.90127	Number of cases = 135						
5.	SERVICE WORKER	-.079	-.762	-.019	-.333	.108	-.891	.011	.024	-.013
	(T RATIO)	(-.147)	(-9.774)	(-2.80)	(-2.19)	(1.08)	(-1.94)	(.025)	(.856)	(-.109)
	R^2 = .85803	Adjusted R^2 = .54855	F VALUE = 16.03692	Number of cases = 100						
6.	AGRICULTURAL WORKER	.508	-.750	-.004	-.900	-.375	-.533	-.177	-.015	-.388
	(T RATIO)	(.482)	(-3.889)	(-.330)	(-1.70)	(1.40)	(.701)	(-.349)	(-.229)	(-1.49)
	R^2 = .63722	Adjusted R^2 = .51629	F VALUE = 5.26946	Number of cases = 33						
7.	PRODUCTION WORKER & OPERATOR	-.609	-.794	.001	-.299	.050	.010	-.208	-.004	-.050
	(T RATIO)	(-2.73)	(-24.97)	(.645)	(-2.39)	(1.25)	(.092)	(-.972)	(-.376)	(-.982)
	R^2 = .60958	Adjusted R^2 = .60294	F VALUE = 91.72929	number of cases = 479						

Table 7a

Estimated Elasticities for the Whole Sample

Number of cases	Marginal Tax Rate	ϵ_{HWComp}	ϵ_{HW}
528	00	.58	-.06
203	.05	.51	-.06
190	.06	.51	-.07
122	.07	.47	-.07
90	.08	.47	-.05
54	.09	.48	-.04
39	.10	.46	-.06
19	.12	.51	-.05
54	.14	.43	-.03
24	.16	.55	-.02
20	.18	.44	-.02
5	.20	.56	-.07
4	.23	.45	-.03
1	.37	.33	-.05

NOTES :
1. ϵ_{HW} = uncompensated elasticity of labor supply with respect to wage rate.
2. ϵ_{HWComp}= compensated elasticity of labor supply with respect to wage rate.

Table 7b

Estimated Elasticities for Female Sample

Number of cases	Marginal Tax Rate	ϵ_{HW}^{Comp}	ϵ_{HW}
30	00	.85	-.02
34	.05	.70	-.09
27	.06	.56	-.03
27	.07	.51	-.02
11	.08	.59	-.05
8	.09	.48	-.06
4	.10	.37	-.04
3	.12	.49	-.05
7	.14	.47	-.02
1	.16	1.22	-.15
2	.18	.40	-.01

NOTES :
1. ϵ_{HW} = uncompensated elasticity of labor supply with respect to wage rate.
2. ϵ_{HWComp}= compensated elasticity of labor supply with respect to wage rate.

Table 7c

Estimated Elasticities for the Male Sample

Number of cases	Marginal Tax Rate	ϵ_{HW}^{Comp}	ϵ_{HW}
498	00	.57	-.07
169	.05	.48	-.07
163	.06	.50	-.08
952	.07	.47	-.08
79	.08	.46	-.05
46	.09	.48	-.05
35	.10	.47	-.07
16	.12	.52	-.06
47	.14	.43	-.04
23	.16	.53	-.02
18	.18	.44	-.02
5	.20	.54	-.07
4	.23	.44	-.03
1	.37	.31	-.05

NOTES :
1. ϵ_{HW} = uncompensated elasticity of labor supply with respect to wage rate.
2. ϵ_{HWComp}= compensated elasticity of labor supply with respect to wage rate.

Table 8
Elasticity Estimates from Studies
of Developed Economies

Authors	Country	ϵ_{HW}	ϵ_{HW}^{comp}
Males			
Wales-Woodland	U.S.	0.09	0.20
Ashworth-Ulph	U.K.	-0.13	-0.08
Hausman	U.S.	0.00	0.17
Blomquist	Sweden	0.08	0.12
Hausman-Raud	U.S.	-0.03	0.13
Females			
Ashworth-Ulph	U.K.	0.19	0.33
Hausman	U.S.	0.91	1.41
Nakamura-Nakamura	Canada	-0.30	-0.11
Rosen	U.S.	2.30	2.72
Hausman-Raud	U.S.	0.76	1.09

Source: Hausman (1985), Tables 5.1 and 5.6.

FOOTNOTES

1. Many studies, both theoretical and empirical, focusing on this subject have emerged during the past two decades. For a good survey of studies on labor supply in developed countries, see Killingsworth (1983).

2. For example, studies of the welfare cost of taxation require estimates of the wage elasticity of labor supply. See Ballard, Shoven, and Whalley (1985).

3. For example, Miracle and Fetter (1970) and Miracle (1976) used qualitative historical data drawn from the copper belt of Africa and from Kenya in an attempt to explain whether or not the disappearance of the backward-bending supply curve of labor was due, as was widely assumed, to a change in the strength of the response of Africans to economic incentives. Due to the nature of the data, the labor supply function itself was not derived or estimated. They concluded that if the disappearance of the backward-bending labor supply curve really occurred, it was due to changes in economic conditions rather than to changes in behavior patterns.

4. The only other known study of labor supply in a developing economy using econometric techniques was by Bardhan (1979). Using data collected from nearly 4,900 rural households in West Bengal, Bardhan estimated labor supply functions for peasant agriculture. He found that the wage response of agricultural laborers and small cultivators was positive but not significant. He concluded that labor supply decisions were primarily determined by other economic, social, and demographic constraints, and were not highly responsive to the wage rate.

5. See Fields (1987) for a discussion of these issues and their importance in developing economies.

6. Oil revenues in Indonesia fell from over 70 percent of total government revenue in 1981/82 to less than 40 percent in 1986/87 according to the Republic of Indonesia, Government Budget, 1988/89.

7. See Uppal (1986), p. 29.

8. We are indebted to Dr. Boediono, Head of Pusat Informatika, Badan Litbang, Ministry of Education in Indonesia, and to Biro Pusat Statistik for providing us with access to these data.

9. As pointed out by Killingsworth (1983, p. 133, the unobserved error term that varies from one person to another may be interpreted as a "taste shifter".

10. Usually the head of household is male, but this is not always the case.

11. Government employees were excluded from the sub-sample because their hours of work tend to be fixed.

12. Stiglitz (1988), p. 449.

13. Ballard, Shoven, and Whalley (1985) estimate the excess burden per dollar of tax revenue for the U.S. personal income tax to range between .213 and .374 depending on the assumed values of relevant elasticities.

14. See, for example, Leuthold (1979) who found that increases in the spouse's wage rate tend to significantly decrease the hours worked of the other spouse in two-earner families.

15. See Wales and Woodland (1979) and Hausman (1981).

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