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THE EFFECTS OF ECONOMIC DEVELOPMENT ON LIFE CYCLE WAGE RATES AND LABOR SUPPLY BEHAVIOR IN MALAYSIA*

David M. BLAU

University of North Carolina, Chapel Hill, NC 27514, USA

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This paper uses retrospective earnings and work history data on a sample of Malaysian married couples to estimate the determinants of earnings and family labor supply. The sample data are merged with aggregate time series data on the Malaysian economy so that the effects of both individual and aggregate determinants of wage rates are explored. Dissaggregation of the analysis by cohort, education and race permits estimation of the differential impact of economic development on different groups. The results suggest substantial variation in the extent of participation by different groups in the development process.

1. Introduction

This paper reports the results of a study of the impact of economic development on the wage rates and labor supply decisions over the life cycle of households in a developing country, Malaysia. A major concern in development economics in recent years has been how the benefits of aggregate growth and development are distributed among different groups. This concern has led economists to study the relationship between the pace and other characteristics of development and changes in the relative or absolute incomes of various groups.[1] A natural approach to this topic would be to follow a sample of individuals over time in order to infer how various characteristics of the development process affected the income and behavior of the individuals in the sample. However, researchers have been forced to compare the incomes of groups with different composition at different times, for example the poorest 10% of the population at two different dates, because of the lack of panel data for LDCs of the type now relatively widely available for developed countries.

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[1]A recent book by Fields (1980) summarizes much of the literature on inequality and development.

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The present study uses a unique source of data from a household survey in Peninsular Malaysia in which repeated observations on a sample of households have been generated from retrospective work and earnings histories on several cohorts. This data set enables one to follow the behavior of a given set of individuals for a number of years, in some cases almost 30 years, during which the Malaysian economy grew and changed dramatically. The retrospective survey data are merged with aggregate time series data on key development indicators for the Malaysian economy to provide a unique source for assessing the effects of economic development on individuals.

The paper focuses on analyzing the determinants of market wage rates and self-employment earnings of a sample of married spouse-present Malaysian couples. Both individual and aggregate determinants of wage rates are explored. Estimates of a model of family labor supply are then presented from which labor supply elasticities with respect to own and spouse's wage rates are derived. The analysis is disaggregated by cohort (as well as by education and race) so that changes in the behavior of successive cohorts exposed to changing labor market conditions can be examined.

The empirical results indicate among other things that (1) wage rates are influenced in the expected direction by aggregate variables only for certain groups and cohorts, while for others the effects are sometimes in the opposite direction from what was expected, (2) the amount of variation in labor supply of individuals over time in response to changing wage rates is substantially less than the variation of labor supply across individuals due to different wage rates, (3) correlation between unobserved determinants of tastes and wage rates is an important empirical phenomenon that strongly affects estimates of wage elasticities, and (4) there has been substantial variation across racial, educational and cohort groups in the extent of participation in economic development in Malaysia.

The remainder of the paper contains a brief description of trends in the Malaysian economy (section 2), theoretical analysis of a life cycle model of family labor supply along with a discussion of estimation issues (section 3), a description of the data (section 4), an analysis of the empirical results (section 5), and the conclusions of the study (section 6).

2. Trends in the Malaysian economy

This section provides a very brief overview of changes in the Malaysian economy since the 1950s, and illustrates life cycle and cohort trends in wage rates.

The Malaysian economy has undergone dramatic growth and structural transformation since the 1950s. Per-capita real domestic product more than doubled between 1950 and 1976, with the annual growth rate varying between 1% from 1950–1960 to almost 5% from 1970–1977.[2] Malaysia has a

[2]These and the following data are from Young, Bussink and Hassan (1980).

very open economy, with exports accounting for about half the value of GNP, and has consistently run a balance of payments surplus. In addition to rapid export growth Malaysia has attained high savings rates (29% of GNP in 1977) and has seen the share of Gross Domestic Investment in GNP double from 10% to 20% between 1953 and 1970 and reach 23% by 1977. Agriculture still accounts for the largest single sectoral share of the labor force, but that share declined swiftly from 63% in 1960 to 44% in the mid-1970s. Of the major commodities produced in Malaysia rubber remains the most important, accounting by itself for over one quarter of the entire labor force, but the share of export earnings derived from rubber has declined from almost one half in 1961 to less than one quarter in 1976.

In spite of this impressive record of growth and transformation serious questions have been raised about the extent to which different groups in the economy have participated in the development process. Lack of improvement in real wages over long periods, continued concentration of racial groups by sector, and above all evidence of increasing inequality in the income distribution have contributed to a widespread sense of dissatisfaction with the results of Malaysian growth [Young, Bussink and Hassan (1980)].

Are the dramatic changes experienced by the Malaysian economy reflected in substantial improvement in wages for more recent cohorts? To provide some initial evidence on this issue, life cycle wage profiles for several cohorts of married men are presented in fig. 1. The data are from the sample used below in the estimates of the family labor supply model, and are described in detail in section 4. The cohorts are defined by year of marriage and the profiles are presented separately for Chinese and Malays, the two main ethnic groups in Malaysia.

One might have expected the more recent cohorts to benefit from the relatively rapid economic growth rate achieved over the last two decades in Malaysia by attaining higher age–wage profiles than earlier cohorts. On average this turns out to be true for men, as shown in fig. 1, but the relationship is by no means monotonic. The 1950 marriage cohort of Chinese men has an age–wage profile everywhere below that of more recent cohorts, but the profile of the 1972 cohort is below that of the 1967 cohort. For Malay men the 1950 cohort's profile remained steep longer than the 1955 cohort's so the earlier cohort ended up at a higher peak wage. This suggests that cohort effects caused, for example, by variations in cohort size, may have been quite important in determining wage rates, as Welch (1979) has suggested for the United States.

It is apparent that for most cohorts the Chinese profiles are higher at almost all ages than the profiles for Malays. This disparity has been the subject of much debate, turmoil and policy action in Malaysia since the 1960s but does not appear to have narrowed dramatically for recent cohorts. The profiles appear quadratic in general, at least for the earlier cohorts with

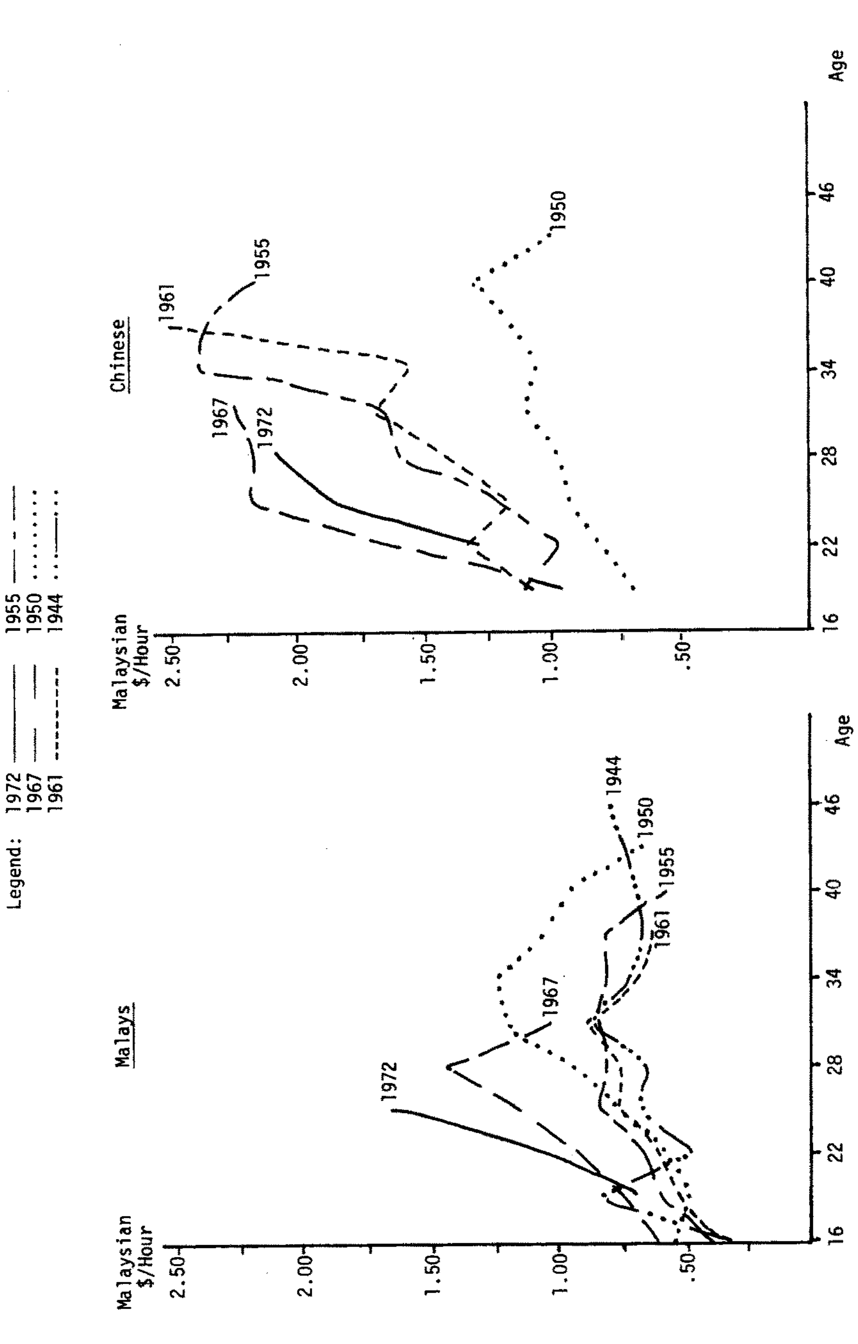

Fig. 1. Male wage profiles by age for Malay and Chinese marriage cohorts (profiles labeled by average year of marriage of each cohort). Note: there were insufficient observations to construct a profile for the 1944 cohort of Chinese men.

a long enough span of observation. This is consistent with the predictions of standard models of optimal accumulation of human capital.

Wage profiles for women are not presented here. The quadratic shape characteristic of the husbands' profiles is generally absent for the wives, suggesting less post-schooling human capital investment, a finding consistent with the substantially lower rate of female labor force participation. It appears that women have benefitted less than men from economic growth in Malaysia since only in a couple of cases are the profiles for more recent cohorts noticeably higher than for earlier cohorts. It is also interesting to note that the persistent racial disparities that characterized the male wage profiles are absent for women.

3. Theoretical framework and estimation issues

This section describes a model of life cycle family labor supply based on a framework developed by Heckman and MaCurdy (1980) for a single individual. Their model was designed to take advantage of the availability of panel data on labor supply and wage rates by allowing one to summarize a variety of unobservable life cycle influences on labor supply choices in the form of a 'fixed effect' that can be estimated directly or easily differenced out of the model.

Couples are assumed to maximize the present discounted value at the beginning of marriage of an intertemporally separable utility function,

$$U(i,t)=U(L_{\mathrm{M}}(i,t),\ L_{\mathrm{F}}(i,t),\ G(i,t);\ e(i,t)), \qquad t=1,\dots,T, \quad i=1,\dots,I, \tag{1}$$

where $L_{\mathrm{M}}(i,t)$ and $L_{\mathrm{F}}(i,t)$ are leisure hours of husband and wife i in period t, $G(i,t)$ is consumption of a composite commodity by couple i in period t, $e(i,t)$ represents a set of taste-conditioning variables, T is the horizon and I is the number of couples. Contemporaneous strong separability of the utility function in L_{M} and L_{F} on the one hand and G on the other hand is also assumed, so that the analysis can be confined to labor supply alone. Assuming a fixed horizon, perfect foresight concerning future wage rates and prices, and a perfect capital market with equal borrowing and lending rates, couple i faces a lifetime wealth constraint of the form

$$A(i,0)=\sum_{t=1}^{T}\left(\frac{1}{1+r}\right)^{t}(P(t)G(i,t)-W_{\mathrm{M}}(i,t)H_{\mathrm{M}}(i,t)-W_{\mathrm{F}}(i,t)H_{\mathrm{F}}(i,t)), \tag{2}$$

where $A(i,0)$ represents initial assets, r is the interest rate, $P(t)$ the price index of G, W_{M} and W_{F} are wage rates and H_{M} and H_{F} are hours worked of husbands and wives, respectively. The assumption of perfect foresight in the context of a rapidly changing economy is not particularly realistic. However, the alternatives to this assumption create difficult problems for analysis and estimation. Static expectations imply that current wages and wealth enter the labor supply functions, but retrospective wealth data are not available in the survey used in this study. Rational expectations imply that the optimal forecasts of future variables enter the labor supply functions, but these are extremely complicated to calculate. Adaptive expectations imply that lagged wages and wealth enter the labor supply functions with weights that decline with elapsed time. This assumption cannot be implemented because of the absence of wealth data, and also results in a much less parsimonious specification of labor supply functions. The assumption of perfect foresight yields a relatively simple specification of the labor supply functions, as shown below, and is therefore maintained here to facilitate analysis and estimation of the model.

The total number of hours available to each spouse in each period is standardized at unity so the time constraints are

$$L_j(i,t)+H_j(i,t)=1, \qquad j=\mathrm{M},\ \mathrm{F}, \tag{3}$$

The couple's problem, therefore, is to choose $L_{\mathrm{M}}(i,t)$, $L_{\mathrm{F}}(i,t)$ and $G(i,t)$ to maximize the discounted sum of utility

$$\sum_{t=1}^{T}\left(\frac{1}{1+\rho}\right)^{t} U(i,t),$$

subject to the wealth and time constraints, where ρ is the rate of time discount. The first-order conditions for leisure hours, given an interior solution for couple i in period t with both spouses working, are

$$\left(\frac{1}{1+\rho}\right)^{t}\frac{\partial U(i,t)}{\partial L_j(i,t)}-\lambda_i\left(\frac{1}{1+r}\right)^{t} W_j(i,t)=0, \qquad j=\mathrm{M},\ \mathrm{F}, \tag{4}$$

where λ_i represents the Lagrangean multiplier for couple i on the combined wealth and time constraints and can be interpreted as the marginal utility of wealth at the beginning of marriage. Although λ_i is a function of all past, current and future wage rates and prices as well as initial assets it does not change over time, given the assumption of perfect foresight. Hence, as Heckman and MaCurdy pointed out, λ_i summarizes the effects on current decisions of all past and future variables and allows one to isolate the effects of the current exogenous variables on current decisions.

For an interior solution the first-order conditions can be solved to give labor supply functions for both spouses,

$$H_j(i,t)=H_j(W_{\mathrm{M}}(i,t),\ W_{\mathrm{F}}(i,t),\ \lambda_i,\ P(t),\ e(i,t),\ t), \qquad j=\mathrm{M},\ \mathrm{F}. \tag{5}$$

Each spouse's labor supply in a given period is a function of all of the exogenous variables in that period, including wage rates, λ_i, $P(t)$, taste-conditioning variables, and time itself. If the second-order conditions are satisfied then the model predicts unambiguously that the contemporaneous response of labor supply to an increase in the own wage is positive,

$$\frac{\partial H_j(i,t)}{\partial W_j(i,t)}>0, \qquad j=\mathrm{M, F},$$

and that the cross-spouse wage effects,

$$\frac{\partial H_j(i,t)}{\partial W_k(i,t)}, \qquad j,k,=\mathrm{M, F}, \quad j\neq k,$$

are negative if spouse's leisure hours are substitutes in the family utility function. There are no income or wealth effects of a current wage rate change in this model to confound the substitution effects because holding λ_i (the marginal utility of wealth) constant means that wealth is being held constant as well so that a change in the current wage is wealth-compensated.

Empirically, corner solutions with zero hours of labor supply by the wife are quite common in LDCs. In this case the first-order conditions are identical to (4) with '=' replaced by '>' in the condition for the wife in (4), and the resulting labor supply functions are

$$H_\mathrm{M}(i,t)=H_\mathrm{M}(W_\mathrm{M}(i,t),\ \lambda_i,\ P(t),\ e(i,t),\ t), \tag{6}$$

$$H_\mathrm{F}(i,t)=0. \tag{7}$$

To complete the model, equations for $e(i,t)$ and the wage rates are specified,

$$e(i,t)=e(Y(i,t),\ \gamma(i),\ \varepsilon(i,t)), \tag{8}$$

$$W_\mathrm{M}(i,t)=W_\mathrm{M}(Z_\mathrm{M}(i,t),\ \theta_\mathrm{M}(i),\ U_\mathrm{M}(i,t)), \tag{9}$$

$$W_\mathrm{F}(i,t)=W_\mathrm{F}(Z_\mathrm{F}(i,t),\ \theta_\mathrm{F}(i),\ U_\mathrm{F}(i,t)). \tag{10}$$

In these equations $Y(i,t)$, $Z_\mathrm{M}(i,t)$ and $Z_\mathrm{F}(i,t)$ are vectors of observable exogenous variables hypothesized to affect tastes for leisure, the husband's wage rate and the wife's wage rate, respectively. The terms $\gamma(i)$, $\theta_\mathrm{M}(i)$ and $\theta_\mathrm{F}(i)$ are individual-specific fixed effects, summarizing unobserved, time-invariant characteristics of individuals that affect preferences and wage rates. Finally,

$\varepsilon(i,t)$, $U_M(i,t)$ and $U_F(i,t)$ are mean-zero, constant variance, serially uncorrelated disturbances that may be contemporaneously inter-correlated.

The parameters of the model can be shown to be identified (assuming linearity, as discussed below) as long as Z_M and Z_F each contain at least one variable not also present in Y. This condition, which amounts to the requirement that there be some exogenous variation in wage rates uncorrelated with variation in preferences, is satisfied in the present context because of the availability of aggregate variables that affect wage rates but are unlikely to be correlated with preferences. In cross-sectional studies of labor supply behavior this condition for identification is usually satisfied by arbitrarily restricting the set of variables hypothesized to affect tastes.

In order to estimate the model functional forms for the equations must be specified. By specifying a quadratic utility function and linearizing the resulting first-order conditions, linear labor supply functions are obtained.[3] Assuming linearity for eqs. (9)–(11) as well yields a set of linear equations for the whole model. Numerous within and cross-equation restrictions, many of them non-linear, on the parameters of the labor supply equations make estimation by full information maximum likelihood (FIML) desirable. This was attempted but was discovered to be infeasible when more than one or two variables were included in Y, Z_M and Z_F. Thus least squares methods were used instead.

In order to consistently estimate the parameters of the model by least squares, two econometric issues must be addressed. First, the fixed effects $\lambda(i)$, $\gamma(i)$, $\theta_M(i)$ and $\theta_F(i)$, represent the combined effects of a variety of unobservable variables on the marginal utility of wealth, preferences, and wage rates. Some of these unobservables are likely to be correlated with some of the observable variables included in the equations as determinants of wages or preferences. For example, unobserved components of the stock of human capital such as innate ability that affect wage rates could be positively or negatively correlated with the observable components such as education and experience included among the Z's. Unobservable preferences for leisure embodied in $\gamma(i)$ could be correlated with variables such as age and education that might be included in Y. Under these circumstances, estimation by ordinary methods, with the unobservables as part of the disturbances, would yield biased parameter estimates because the included variables, the

[3] Specifically the utility function is assumed to be of the form

$$U(i,t)=(a_1+e(i,t))L_M(i,t)-a_2L_M^2(i,t)+(a_3+e(i,t))L_F(i,t)-a_4L_F^2(i,t)$$
$$+a_5G(i,t)-a_6G^2(i,t)+a_7L_M(i,t)L_F(i,t),$$

where the a's are parameters. Maximizing this function subject to the combined wealth and time constraints and then linearizing the resulting first-order conditions around $t=0$, $e(i,t)=0$, $L_M(i,t)=0$, $L_F(i,t)=0$, $\lambda(i)=1$, $W_M(i,t)=1$ and $W_F(i,t)=1$ yields linear labor supply equations as approximations to the true equations.

Z's and Y's, would be correlated with the disturbances. The simplest way to handle this difficulty, given the availability of several observations on each couple, is to difference out the individual mean over time of each variable for each observation. Given the hypothesis that the fixed effects are indeed fixed, i.e., unchanging over time, this will eliminate them from the equations, along with any observable non-time-varying variables and will thus remove the source of potential bias,[4] along with the possibility of obtaining consistent estimates of the parameters of non-time-varying variables such as education and race.

The other potential source of econometric difficulty arises if the disturbance in the preferences equation, ε, is correlated with the disturbances in the wage equations, U_M and U_F. This possibility cannot be ruled out since, for example, individuals with a strong preference for leisure may have worked relatively little in the past, accumulated relatively little human capital, and hence have a low wage rate. This would cause the wage rates, which are included as regressors in the hours equations, to be correlated with the disturbances of the hours equations, again resulting in a violation of the usual assumptions of ordinary least squares (OLS) estimation. This problem can be handled by using two-stage least squares (2SLS) to estimate the hours equations with the wage rates replaced by instrumental variable estimates from the wage rate equations. This will permit consistent estimation of the key parameters of interest, the labor supply responses to wage rate changes.

The complete model to be estimated consists of the two labor supply and two wage rate equations if the wife works, and the husband's labor supply and wage rate equations if the wife does not work. The IT observations are split into two groups depending on whether or not the wife works in a given period. Note that the allocation of an observation to one group or the other is determined by comparing non-market and market opportunities and is thus influenced by the same exogenous variables that enter the wage rate and hours equations. This implies that the two samples are non-randomly selected so that selectivity bias could arise in the least squares estimates. There is, unfortunately, no way around this problem in the present context

[4]To show this, consider the following simple model:

$$Y_{it} = a + bX_{it} + cZ_i + V_i + U_{it},$$

where a, b and c are parameters, X_{it} is a time-varying variable, Z_i is a non-time-varying variable, V_i is the fixed effect and U_{it} the disturbance. Add the equations for household i over the T periods and divide by T to obtain

$$\bar{Y}_i = a + b\bar{X}_i + cZ_i + V_i + \bar{U}_i,$$

where '$\bar{\ }$' signifies a mean of a variable for household i. Subtracting this equation from the previous one yields

$$Y^*_{it} = bX^*_{it} + U^*_{it},$$

where * signifies deviation from the household mean. This equation is estimated by least squares to obtain an unbiased estimate of b, but c cannot be estimated.

since there are no exogenous variables that determine allocation between the samples that are not also present in the equations of interest. The estimates of the model presented below should be interpreted with this caveat in mind.

4. Description of the data

The data used in this study are taken from the 1976–1977 *Malaysian Family Life Survey* (MFLS) of Peninsular Malaysian households in which at least one ever-married woman aged under 50 years at the time of the survey was present.[5] This study uses only the small fraction of data that pertain to retrospective earnings and work histories collected from husbands and wives in the subsample of households with a husband present at the time of the survey. Retrospective data may contain recall errors that increase as events further in the past are surveyed, but careful efforts to cross-check responses from different household members and sections of the survey have probably reduced the extent of this problem.

The events covered by the retrospective histories for some of the older cohorts extend as far back in time as the end of World War II and for all age groups extend forward to the year of the survey. One of the goals of this study is to merge the MFLS data with aggregate time series data on the Malaysian economy. This will permit estimation of the effects of some key development indicators on wage rates and will aid in identifying the labor supply effects of wage rate changes that are of central importance. The brief sketch of the Malaysian economy in section 2 suggests several candidates for aggregate determinants of wage rates. These include real gross domestic product per capita (*GDP*), the price of rubber (*RP*), and the amount of cultivated land per capita (*LAND*). *GDP* is a proxy for total factor productivity growth and is expected to be positively correlated with wage rates as long as labor supply is not perfectly elastic.[6] Given the openness of the economy, *RP* which represents an indicator of world demand for a Malaysian export which accounts for a substantial share of employment, can also be expected to have a positive effect on wage rates. *LAND* should have a positive effect on the marginal product of labor and hence on the wage rate too. After some experimentation with these and several other aggregate variables, it was determined that *GDP*, *RP* and *LAND* provided the 'best' aggregate explanators of wage variation over time.

Fig. 2 shows the time trends of the three aggregate variables, all scaled so

[5]See Butz and DaVanzo (1978) for a summary of the survey.

[6]The well-known surplus labor model of economic development does postulate perfectly elastic supply of labor at an institutionally determined subsistence wage rate, but empirical studies have convincingly refuted the empirical relevance of the model for Egypt [Hansen (1969)], Thailand [Bertrand and Squire (1980)], and India [Rosenzweig (1980)], as well as Malaysia [Barnum and Squire (1979)].

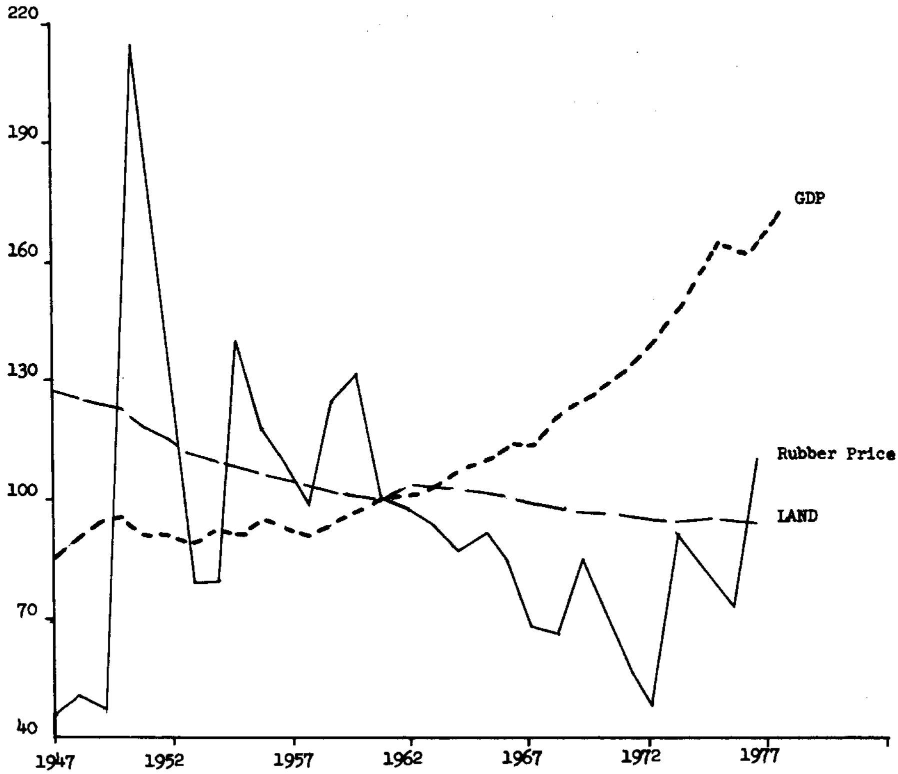

Fig. 2. Trends in real gross domestic product per capita (*GDP*), cultivated land per capita (*LAND*), and the price of rubber in Malaysia, 1961 = 100. Sources: figures for *GDP* are from V.V. Bhanoji Rao, *National Accounts of West Malaysia 1947–1971* (Heinemann Educational Books, Singapore), updated through 1976 with data from Young, Bussink and Hassan (1980). Figures for *LAND* are from Lim Chong-Yah, *Economic Development of Modern Malaya* (Oxford University Press, Kuala Lumpur, 1967), updated through 1976 with data from Young, Bussink and Hassan (1980) and from the West Malaysia *Bulletin of Monthly Statistics*. The rubber price series is for no. 1 ribbed smoked sheet in Kuala Lumpur, taken from the United Planting Association of Malaysia, 78th *Annual Report* (Kuala Lumpur, 1979).

that 1961 = 100. *GDP* has grown along a fairly smooth curve while *LAND* has declined steadily, as growth in total cultivated land has been swamped by population growth. The price of rubber fluctuated much more than the other two indicators and thus should serve as a useful variable for picking up short run wage variation while *GDP* and *LAND* capture longer run trends.

For the purposes of this paper the MFLS data are structured into six cohorts according to date of marriage and the model is estimated separately for each cohort as well as jointly for the whole sample. The time from date of marriage to the survey date is divided into three year periods and averages of the variables are calculated for each period. The choice of length of period in a discrete-time model is inherently arbitrary, and three years was chosen here because it corresponds roughly to the way in which the data were collected.[7] For the empirical specification of the endogenous variables labor supply for each spouse was measured as annual hours of work, calculated as weeks worked per year multiplied by usual weekly hours and divided by 8,760, the total number of hours in a year. The number of working hours is assumed to be chosen voluntarily.[8] An hourly wage rate was calculated by converting all earnings data to an annual basis, deflating to 1967 values and dividing by annual hours. A substantial proportion of the Malaysian labor force is self-employed so the wage rate should be interpreted literally as average earnings per hour of work. Although the processes governing earnings determination may be quite different for wage employees and the self-employed, the same underlying human capital and other productivity variables are involved, with the exception that unobserved physical assets and managerial skills no doubt play an important role for the self-employed.[9] However, if these unobserved variables change relatively slowly over time then they will be captured as part of the fixed effects $\theta_M(i)$ and $\theta_F(i)$ and will not cause biased estimates if they are differenced out of the estimating equations.

The next step is to specify empirically the sets of exogenous variables Y, Z_M and Z_F that are hypothesized to affect tastes and wage rates. Although the MFLS is rich in variables, few of them can legitimately be considered exogenous in a life cycle context. For example, in a country in which migration has been very common it does not seem appropriate to treat the location of an individual's residence in a given period (urban vs. rural) as an exogenous variable. Similar concerns arise with other variables such as type of occupation (self-employed vs. employee) and industry (farm vs. non-farm), fertility, etc., all of which are probably jointly determined with labor supply. The set of exogenous variables is therefore limited to include age, education, race and cohort of each spouse, all of which are assumed to affect tastes and wage rates, as well as the three previously described aggregate variables which affect wage rates but not tastes. In addition some quadratic terms in age as well as interactions between age and the aggregate variables were tested in the results reported below. Race is included because of the multiracial nature of Malaysian society, with ethnic Malays, Chinese and Indians accounting for approximately 53%, 36%, and 10% of the population,

[7]The respondents were asked to report hours and earnings for each date at which they started or ended a job or else every three years if there was no job change.

[8]Unemployment is assumed to be voluntary in the model. Involuntary unemployment is likely to be relatively rare in an economy characterized by widespread possibilities for self-employment.

[9]See Blau (1983) and Vijverberg (1983) for analyses of self-employment using the MFLS data.

respectively. Because cohorts are indexed by date of marriage the inclusion of age along with time elapsed since marriage implicitly fixes age at marriage as well. This may not be a good choice for an exogenous variable but is difficult to avoid given that the analysis is conditional upon a marriage having occurred in the first place.

Table 1 presents sample means by race and marriage cohort for education and age at marriage of each spouse, the only non-time-varying variables. Age at marriage has increased by about five years for men and six years for women for all three racial groups from the 1944 to the 1972 marriage cohorts.[10] Education levels have grown substantially, particularly for women, who averaged only about one year of education in the earliest cohort. The Chinese–Malay educational gap appears to have narrowed somewhat for both sexes and the male–female gap has narrowed substantially for Chinese

Table 1

Sample means by race and marriage cohort for non-time-varying variables.

Cohort number	6	5	4	3	2	1
Year of marriage	1944	1950	1955	1961	1967	1972
Husband's age at marriage						
Malays	21.2	23.4	23.5	23.5	25.8	26.4
Chinese	21.6	25.6	24.9	26.5	26.4	26.7
Indians	22.6	25.1	24.4	25.3	26.5	22.7
Wife's age at marriage						
Malays	14.3	15.8	17.3	17.9	20.1	20.2
Chinese	16.6	19.2	19.8	21.0	22.4	22.3
Indians	14.9	16.8	17.2	18.1	20.6	21.7
Husband's education						
Malays	3.6	3.8	3.5	4.3	5.5	7.2
Chinese	4.7	4.2	4.6	5.2	6.9	7.6
Indians	3.3	3.9	5.5	6.4	6.5	8.4
Wife's education						
Malays	0.6	0.9	1.8	3.4	4.5	5.7
Chinese	1.6	1.0	2.5	3.4	4.4	6.4
Indians	1.0	1.4	3.7	4.0	4.2	3.3
Number of households						
Malays	31	60	71	79	85	44
Chinese	13	39	40	60	81	34
Indians	3	14	24	23	20	7
Number of three year periods observed per household	11	9	7	5	3	2

[10]Very small sample sizes for Indians preclude the identification of separate trends for this group.

and Malays in both percentage and absolute terms. The total sample size of 728 households represents the subsample of the original 1,262 households with a husband present at the time of the survey and with non-missing data on all variables.

5. Estimation results

Table 2 presents linear regression estimates of equations explaining wage rates for husbands and wives for all cohorts combined. The estimates are presented both with the fixed effects and other non-time-varying variables left

Table 2

Linear regression estimates of wage equations for husbands and wives, all cohorts combined.[a]

	Husbands		Wives	
	Undifferenced	Differenced	Undifferenced	Differenced
Age	3.6	1.7	0.09	−0.24
	(4.8)	(2.0)	(0.3)	(1.0)
Age squared	−1.3	−0.77	0.13	0.78
	(5.4)	(2.9)	(0.3)	(3.1)
GDP	−0.72	−0.15	−0.09	−0.31
	(4.1)	(0.5)	(0.4)	(0.9)
LAND	8.3	1.9	2.2	1.9
	(3.4)	(0.7)	(2.1)	(1.4)
Rubber price	0.29	0.42	−0.05	0.03
	(0.7)	(1.7)	(0.3)	(0.4)
Age * *LAND*	−2.8	−1.2		
	(3.3)	(1.4)		
Age * Rubber price	−0.08	−0.17		
	(0.6)	(2.1)		
Years of education	0.17		0.16	
	(27.4)		(17.7)	
D-Chinese	0.42		−0.13	
	(8.7)		(1.9)	
D-Indian	−0.006		−0.07	
	(0.1)		(1.0)	
Intercept	−9.2		−1.7	
	(4.5)		(1.4)	
$R^2(F)$	0.23	0.02	0.21	0.01
	(73.1)	(12.6)	(27.5)	(3.0)
n	3,759	3,759	1,365	1,365

[a] *T*-statistics are in parentheses. *Age* is measured in units of 100 months, *GDP* in thousands of 1959 Malaysian dollars per capita, *LAND* in cultivated acres per capita, and the rubber price in hundreds of Malaysian sen per pound. Cohort dummies were also included in the undifferenced regressions. The dependent variable is measured in 1967 Malaysian dollars per hour.

in and differenced out. In the undifferenced regressions education stands out among the individual characteristics as a major determinant of wage rates of both spouses, with race (Chinese) and the quadratic in age significant as well. Large effects of education on wage rates in Malaysia have been noted previously [Mazumdar (1981)] and have been attributed in part to institutional factors present in the Malaysian economy, as well as the usual human capital factors. It is argued that education is the main criterion for selection into relatively well-remunerated public sector jobs so that education serves as a screening device as well as or perhaps even instead of a productivity measure. This hypothesis cannot be tested here due to lack of data on public versus private employment for all but the most recent job. However, it is shown in Blau (1983) that returns to formal education are especially low in the self-employment sector, a finding that suggests that the returns to education may be partly due to screening.

For men real GDP per capita (*GDP*) has an unexpected significant negative effect on wages while cultivated land per capita (*LAND*) has a significant positive effect, as expected. Both estimates suggest that a negative aggregate trend in real wages is being picked up, since *GDP* rose and *LAND* fell throughout most of the sample period. The *Age–LAND* interaction effect is estimated to be significantly negative, suggesting that the apparent negative real wage trend was less pronounced for older workers. In the undifferenced regression for wives *LAND* also has a positive significant effect.

The negative effect of *GDP* on wages is surprising in view of the rapid growth of the Malaysian economy. Using the same data Smith (1983, p. 52) estimated a (log) wage regression including a time trend along with a large set of individual variables and two aggregate variables. The estimated time trend is virtually zero after controlling for the other variables. Smith's estimation techniques controlled for fixed effects in wages, so before accepting the negative *GDP* effect on wages the results from the differenced regressions shown in table 2 should be examined, since differencing eliminates any bias caused by fixed effects.

The coefficients in the differenced regressions will differ from those in the undifferenced regressions if the fixed effects captured in the disturbances of the latter were correlated with any included variables. This appears to have been the case, since for husbands the differenced regressions show no significant effects of *GDP* and *LAND* but instead a positive and marginally significant effect of the price of rubber (*RP*) on wage rates. The estimate of the *Age–RP* interaction effect is significant and negative, suggesting that older workers benefit less from periods of high rubber prices. Whether this is due to a concentration of younger workers in the rubber sector is not clear. In the differenced equation for wives, *LAND* still has a positive significant effect. The differenced equations have much lower R^2 values than the undifferenced equations, indicating that it is substantially more difficult to explain individual life cycle variation than it is to explain variation across individuals.

The *Age* and *Age* squared coefficients suggest an early peak in wages, with the age effect at the mean age in the sample estimated to be negative. This contrasts with conventional cross-section results [e.g., Sumner (1981)] in which peak wage rates are estimated to occur much later, a finding that may be due to the confounding of age and cohort effects in cross-section data.

Table 3 gives the husband's wage equation results estimated separately for each of the cohorts, with the entire differenced regressions and education and race coefficients from the undifferenced regressions reported. These results

Table 3

Husbands' differenced wage equations and selected coefficients from undifferenced equations, by cohort.[a]

Cohort average marriage year	1972	1967	1961	1955	1950	1944
	Differenced equations					
Age	−6.0	13.7	2.9	−3.6	2.2	−1.5
	(0.7)	(1.5)	(0.8)	(1.0)	(1.6)	(0.9)
Age squared	−1.6	−4.6	0.53	0.84	−0.48	0.29
	(1.0)	(2.0)	(0.5)	(0.9)	(1.0)	(0.4)
GDP	1.4	0.52	−0.66	0.86	−1.4	0.27
	(1.0)	(0.4)	(0.8)	(0.9)	(2.4)	(0.4)
LAND	−40.0	33.7	8.3	−17.5	5.5	−6.4
	(1.1)	(1.1)	(0.7)	(1.6)	(1.2)	(1.4)
Rubber price	−0.91	−0.90	−2.3	−0.05	0.12	0.94
	(0.6)	(0.4)	(2.3)	(0.0)	(0.3)	(2.3)
Age * *LAND*	8.3	−14.4	−4.5	3.2	−1.6	1.7
	(0.7)	(1.4)	(1.2)	(1.0)	(1.2)	(1.2)
Age * Rubber price	0.23	0.25	0.72	−0.15	−0.04	−0.31
	(0.4)	(0.4)	(2.5)	(0.5)	(0.3)	(2.5)
$R^2(F)$	0.04	0.04	0.04	0.04	0.04	0.04
	(0.9)	(2.9)	(4.6)	(5.3)	(5.6)	(2.3)
	Undifferenced equations					
Years of education	0.22	0.20	0.21	0.15	0.16	0.06
	(9.7)	(12.2)	(17.0)	(9.5)	(14.3)	(5.0)
D-Chinese	0.54	0.54	0.57	0.57	0.03	0.62
	(3.2)	(3.7)	(6.1)	(4.4)	(0.3)	(7.7)
$R^2(F)$	0.46	0.28	0.40	0.16	0.19	0.25
	(13.0)	(20.3)	(49.0)	(16.7)	(23.0)	(13.6)
n	166	538	748	905	978	424

[a] *T*-statistics are in parentheses. See notes to table 2 for units of measurement of the variables.

can aid in identifying ways in which successive cohorts have responded to the rapidly changing economic environment in Malaysia. Table 3 reveals some interesting differences for individual parameters. For instance, it appears that the rubber price effect along with the age interaction are significant only for the 1961 and 1944 cohorts, and are of opposite signs for these two cohorts. This suggests that the 1944 cohort may have benefited while young from the very high Korean War peak in rubber prices but that neither cohort six nor most of the other cohorts have been affected much by other rubber price fluctuations. *LAND* and *GDP* are significant for one cohort each as well, suggesting that trends in these variables have had markedly different effects on different cohorts. The education coefficients in the lower panel of table 3 tell a story of rising absolute returns to education, with the upward trend having leveled off for the most recent cohorts. The Chinese wage advantage is moderately lower for the more recent cohorts than for the oldest cohort (the 1950 cohort is an anomaly) but dropped by only a small amount from the 1955 cohort through the 1972 cohort, confirming the results presented above in fig. 1.

For wives the results of estimating wage equations separately for each cohort (not presented here) indicate a decline in the returns to education for recent cohorts, a decrease in the wage advantage of Malay over Chinese women, and virtually no significant effects of the aggregate variables.

The next step in the analysis was to estimate equations explaining annual hours worked by husbands and wives. For the periods in which both spouses worked, eqs. (5) were estimated, and for the periods in which the wife did not work the husband's labor supply equation alone is estimated, as dictated by eqs. (6)–(7). Table 4 presents several different estimates of the wage elasticities from these equations and the full sets of coefficient estimates are available from the author. The OLS parameter estimates are consistent only if there is no correlation between the disturbances in the preference and wage rate equations. If such correlations are present then 2SLS estimates are more appropriate.[11]

The OLS estimates of own-wage elasticities for the sample in which the wife worked are all negative and in several cases significant, thus leading to rejection of the unambiguous prediction of the life cycle model that own-wage elasticities should be positive. However, in the 2SLS results the estimated own-wage elasticities either become positive or remain negative but far from significant at conventional levels. The life cycle model's predictions are most appropriately tested by the differenced estimates, which are generally not significantly different from zero, indicating little life cycle labor supply response to wage rate changes. In the sample in which the wife did

[11]The wage equations for wives presented in table 2 were used as the first stage equations for the wife's wage. For husbands the first-stage wage equations are estimated separately for the samples in which the wife did and did not work.

Table 4
Alternative estimates of elasticity of annual hours worked with respect to own- and spouse's wage rate.

	Husband		Wife	
	Own-wage elasticities			
Sample: Wife worked				
Undifferenced data				
OLS	−0.07	(5.9)	−0.09	(9.3)
2SLS	0.33	(1.2)	−0.02	(0.1)
Differenced data				
OLS	−0.01	(1.2)	−0.03	(3.8)
2SLS	−0.01	(0.1)	−0.10	(1.1)
Sample: Wife did not work				
Undifferenced data				
OLS	−0.03	(4.9)		
2SLS	0.17	(2.4)		
Differenced data				
OLS	−0.01	(1.7)		
2SLS	0.05	(0.9)		
	Cross-wage elasticities			
Sample: Wife worked				
Undifferenced data				
OLS	−0.09	(0.6)	−0.03	(3.3)
2SLS	0.19	(0.9)	0.24	(0.8)
Differenced data				
OLS	0.00	(0.5)	−0.00	(0.6)
2SLS	−0.13	(1.2)	0.00	(0.0)

not work the own-wage elasticity estimates for the husband are generally positive and significant. However, even in this case if one takes differenced 2SLS as the 'best' estimates then the results do not reject but neither do they lend much support to the life cycle model. The estimates of cross-spouse wage elasticities are generally positive, though insignificant in the 2SLS cases.

There are few previous studies of labor supply in LDCs with which the results of this study may be compared. Mazumdar (1981) estimated models explaining the probability of employment for various demographic groups in Malaysia, but his models did not include wage rates. Rosenzweig (1980) used cross-section data to estimate models explaining annual days worked by rural men and women in India. His estimation technique corrected for possible simultaneity bias in the wage rates using a method similar to that employed in this paper, but his use of cross-section data precluded accounting for fixed effects. Rosenzweig estimated negative, significant own wage effects on labor supply for men, and positive, marginally significant own wage effects for women. The results in table 4 indicate that accounting for fixed individual effects in labor supply affects estimated wage elasticities substantially, so it is possible that Rosenzweig's estimate of a backward-bending supply of labor curve for men does not represent a true life cycle effect. Other studies using the MFLS data [Smith (1983), Vijverberg (1983)] do not estimate labor supply functions.

Labor supply models estimated separately for each cohort generally resulted in imprecise wage elasticity estimates with no marked trends across cohorts and are not reported here. However, stratification by education of the husband revealed some interesting differences, reported in table 5. Elasticity estimates from the husbands' differenced wage equation show substantial variation by education groups but no clear pattern. The results from the wives' equations show that wives of more highly educated husbands benefited substantially more from *GDP* growth than wives of less educated husbands. The *GDP* results suggest that the growth process in Malaysia appears to have provided the greatest benefits to those groups whose wage rates were already the highest. Another interesting contrast appears in the undifferenced husband's wage equation, where it can be seen that the wage elasticity with respect to education is substantially larger for high education groups than for the less well educated, suggesting either that the skills associated with higher education are still relatively scarce or, perhaps more likely, that public sector hiring policy plays a major role in determining the returns to education in Malaysia. The proportional wage advantage of Chinese men declines sharply as education rises, suggesting that while discriminatory public sector hiring practices may have contributed to elimination of the racial wage gap among the highly educated, the gap remains significant among the majority of Malaysian men.

Disaggregation of the results by ethnic group also reveals some striking patterns, illustrated by the selected results presented in table 6. A negative aggregate wage trend for Indian men is apparently being picked up by the significant negative estimate on *GDP*, while for Malay and Chinese men the coefficients on *GDP* are insignificant. On the other hand, rubber prices appear to have been negatively correlated with wage rates of Chinese and Malay men but the coefficient estimate for Indians is virtually zero. All three groups exhibit negative effects of *LAND* on wage rates but the estimated effect is significant only for Indians. Perhaps because of their historical concentration in the rubber sector Indians appear to be affected in quite different ways than other groups by aggregate developments.

The differenced wage equation results for wives do not exhibit any significant differences across races. The undifferenced wage equation results reveal that the wage elasticity with respect to education is higher for Malays than Chinese for both husbands and wives. Since the average education levels of Malays are well below those of Chinese, this result accords well with the notion that the returns to education are higher at lower levels of education. However, the returns to education for Indians are almost as high

Table 5

Selected elasticities from wage equations stratified by husbands' education.[a]

	Husbands' years of education			
	0–3	4–6	7–10	11+
Husbands' wage equation				
Differenced				
GDP	0.35	−0.66	0.07	−1.31
	(0.9)	(1.8)	(0.1)	(1.4)
LAND[b]	−4.2	0.93	−0.43	−0.75
	(0.9)	(1.2)	(1.3)	(1.9)
Rubber price[b]	−0.07	−0.14	−0.10	−0.13
	(0.8)	(1.4)	(0.4)	(1.2)
Undifferenced				
Education	−0.02	0.59	0.45	2.48
	(0.4)	(4.7)	(1.1)	(9.3)
D-Chinese[c]	0.85	0.46	0.14	0.05
	(8.7)	(10.4)	(1.3)	(0.5)
$R^2(F)$	0.07	0.13	0.18	0.42
	(7.1)	(16.7)	(4.4)	(13.5)
Sample size	1,387	1,747	325	300
Wives' wage equation				
Differenced				
GDP	−0.95	−0.81	−1.0	2.0
	(0.7)	(1.3)	(0.5)	(2.6)
LAND	5.5	1.07	4.7	−1.4
	(1.4)	(0.6)	(0.9)	(0.7)
Rubber price	0.10	−0.01	0.51	−0.15
	(0.5)	(1.2)	(1.7)	(1.2)
Undifferenced				
Education	−0.02	0.29	0.23	1.53
	(0.7)	(5.6)	(1.5)	(7.3)
D-Chinese	0.76	−0.41	−0.46	−0.56
	(3.9)	(2.9)	(1.3)	(3.5)
$R^2(F)$	0.06	0.08	0.39	0.65
	(2.3)	(4.3)	(4.9)	(12.2)
Sample size	499	652	114	100

[a] *T*-statistics from the corresponding coefficient estimates are in parentheses.

[b] The elasticities for *LAND* and the rubber price incorporate the age interactions and are calculated at the mean age.

[c] The figures presented for the Chinese effect are in the form of proportional effects (coefficient divided by mean wage) rather than elasticities.

Table 6
Selected elasticities from equations stratified by ethnic group.

	Malay		Chinese		Indian	
Husbands' wage equation						
Differenced						
GDP	−0.00	(0.0)	0.10	(0.2)	−2.3	(2.8)
LAND	−1.2	(0.8)	−1.7	(0.6)	−1.7	(4.1)
Rubber price	−0.14	(1.5)	−0.08	(1.6)	0.00	(0.4)
Undifferenced						
Education	0.81	(23.6)	0.53	(11.2)	1.17	(17.5)
Sample size	1,955		1,311		493	
Wives' wage equation						
Differenced						
GDP	−0.27	(0.4)	0.37	(0.3)	−0.69	(1.5)
LAND	1.5	(0.8)	2.6	(0.7)	1.7	(1.2)
Rubber price	0.03	(0.2)	0.04	(0.2)	0.02	(1.1)
Undifferenced						
Education	0.60	(13.3)	0.36	(5.4)	0.56	(15.9)
Sample size	627		457		281	
Husbands' labor supply equation, differenced, 2SLS						
Sample: Wife worked						
Husbands' wage	0.46	(0.7)	−0.42	(1.8)	0.03	(0.5)
Wives' wage	0.80	(0.7)	−0.18	(1.6)	0.02	(0.2)
Sample: Wife did not work						
Husbands' wage	0.11	(1.9)	0.19	(1.6)	−0.06	(1.2)
Wives labor supply equation, differenced, 2SLS						
Husbands' wage	0.53	(1.2)	−0.30	(1.7)	−0.05	(1.0)
Wives' wage	0.40	(0.5)	−0.05	(0.6)	0.06	(0.7)

as for Malays among women, and among men are substantially higher in spite of the fact that the education level of Indians is also higher than that of Malays.

Two interesting differences in the labor supply elasticity estimates across ethnic groups appear in table 6. Leisure hours of Chinese husbands and wives appear to be substitutes in utility, given the negative and marginally significant cross-spouse wage elasticities, while no conclusions are possible for the other two groups. In the samples in which the wife did not work, the husband's own wage elasticity is estimated to be positive and marginally significant for Malays and Chinese, but negative and insignificant for Indians. These results suggest the possibility of differences across ethnic groups in tastes for leisure and in the subjective substitutability of spouse's leisure hours.

6. Conclusions

The results of this study indicated that labor supply responses of individuals to changes in wage rates over time are substantially smaller than would be predicted on the basis of cross-section variation. The small labor supply elasticity estimates for men may be due in part to the fact that most men in Malaysia already work at least full time on average throughout the year. For women the results could be due to increases in the value of time in non-market activities simultaneous with market wage increases, but this cannot be tested with the data available. The fixed effects model also revealed a substantially different pattern of effects of aggregate variables on wage rates of men than the conventional estimates, with the price of rubber standing out as a significant positive influence on male wage rates for the sample as a whole.

Overall, the results lend support to the argument that successful development must be defined with respect to the extent of participation in the process, not simply by rates of growth of aggregate indicators. On this score the results of this study are mixed. The largest positive effect of *GDP* was on the wage rates of the least educated group, indicating beneficial effects of growth on the economic status of this group. Similarly, the Chinese, who generally have the highest incomes also have the lowest returns to education. However, in another paper [Blau (1983)] it is shown that the Chinese are disproportionately self-employed, and that the returns to formal education are low in the self-employment sector. Hence, in spite of lower returns to education the Chinese are still better off on average than other groups.

It is clear from a review of evidence from numerous countries that government policy can have a major impact upon the extent to which different groups benefit from economic growth [Fields (1980)]. Government policy in Malaysia has been oriented toward raising the education and income levels of Malays, the largest and poorest ethnic group. The results in this paper show that while the Chinese–Malay education gap has narrowed for recent cohorts, the wage gap has changed by only a small amount for the more recent cohorts. More importantly, the ethnic wage gap is largest among the least educated group and declines sharply as the level of education rises. Hence, to the extent that government policy has succeeded it seems to have provided the most benefit to the more highly educated groups.

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