

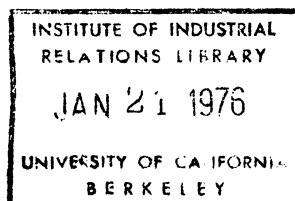
PUBLIC SERVICE EMPLOYMENT AND THE SUPPLY
OF LABOR TO THE PRIVATE SECTOR)

by

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INTRODUCTION

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"Public Service Employment and the Supply of Labor to the Private Sector," by Robert Frank is one of the reports submitted to the Manpower Administration of the U.S. Department of Labor by members of a research group at Berkeley concerned with the design and impact of public service employment programs. We use the term "public service employment program" to refer to any policy designed to combat urban poverty through use of Federal subsidies to increase employment of disadvantaged workers.

In this paper Frank argues that serious flaws in existing labor supply studies compromise the usefulness of these studies in assessing the impact on private labor markets of large scale public service employment expansions. He formulates a labor supply model which eliminates many of the most serious difficulties in existing studies and employs data from the Survey of Economic Opportunity to estimate the parameters of this model for several demographic subgroups. The most striking feature of the resulting estimates is the presence of a very substantial wage elasticity of supply for virtually every subgroup. Frank offers these estimates in support of his tentative conclusion that public service employment expansions of the magnitude currently envisioned will not produce serious dislocations in private labor markets.

Readers interested in other aspects of public employment programs may wish to consult some or all of the other project reports. These include:

"The Effect of Legitimate Opportunities on the Probability of Parolee Recidivism," by Philip Cook

"The Inflationary Effects of Public Service Employment," by Philip Cook and Robert Frank

"A Proposal to Improve the Design of the Public
Employment Program," by Laurence Seidman

"The Public Employment Program in San Francisco,"
by Michael Wiseman

"An Expanded Public Service Employment Program:
Some Supply and Demand Considerations," by Frank
Levy and Michael Wiseman

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PUBLIC SERVICE EMPLOYMENT AND THE SUPPLY
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R. H. Frank

Summary and Conclusions

Depending on the size of the wage elasticity of the supply of labor, public service employment expansions of the scale envisaged in current legislation may produce serious dislocations in private low wage industries. If labor supply is highly wage inelastic, as numerous empirical studies suggest, then output reductions and/or price increases in low wage industries loom as probable side effects of step ups in public hiring of the disadvantaged.

This Section of the report begins by making the point that serious specification and measurement errors essentially disqualify the existing studies of labor supply as a basis for assessing the probable side effects of public service employment expansions.

An alternative labor supply specification is then carefully derived within the framework of a simple intertemporal model of the household labor supply decision. The major departures of this specification from those of previous studies are three.

First, emphasis is placed on the current wage, as opposed to some permanent or long run wage, as the appropriate price determinant of current labor supplied.

Second, an effort is made to account for the influences of macroeconomic labor market disequilibria on microeconomic supply decisions. This effort involves first the construction of a microeconomic measure of labor supply which includes estimates of hours of work sought but not realized. Also

involved is specification of a variable measuring the individual's expected length of job search as a determinant of the supply decision. This attempt to control for the influence of overall labor market tightness was felt to be especially important because the data used to estimate the parameters of the model pertain to 1966 (a year of very full employment), while the specific purpose of the model is to assess labor supply responses to public service expansions in 1973 (which is likely to be, by comparison, a slack employment year).

Finally, emphasis is placed on the importance of developing empirical measures of supply and wages which are stochastically independent. Failure to take this step appears to have led to a consistent undervaluation of the influence on supply of wages in several previous studies.

Using the 1967 Survey of Economic Opportunity data file, the model is estimated for each of fourteen demographic population subgroups. The most striking feature in the empirical results is the finding that, over a broad range of wage values, increases in wage rates are associated with large increases in the quantity of labor supplied for each of the fourteen subgroups studied. This finding is entirely consistent with the presence of a strong and general positive wage elasticity of labor supply which so many other labor supply investigations have failed to detect.

The performance of the job search variables is disappointingly weak and it is concluded that longitudinal data are necessary for the proper evaluation of the influence of overall labor market demand conditions on individual supply decisions.

On the strength of the wage elasticity values implied by the estimated labor supply functions, the tentative conclusion is offered that currently planned public service employment expansions will not cause seriously dislocative side effects in private low wage industries.

PUBLIC SERVICE EMPLOYMENT AND THE SUPPLY
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R. H. Frank

1. Introduction

As outlined by Seidman [1973] and Cook and Frank [1973], the basic principles of a composition of demand inflation theory indicate that public service employment expansions should be targeted for labor force groups in excess supply. By side-stepping the process of bidding for workers who are already employed, a public service employment expansion can produce a given level of employment stimulus with less inflationary pressure than can the alternative procedure of generalized aggregate demand expansion.

It should be kept in mind, however, that while the policy of targeting public service jobs for labor force groups with high unemployment rates does serve to minimize upward pressure on wages, it does not assure that public service employment expansions will be completely free from disruptive economic side effects. Recent work by Hall [1970], Holt, Kaitz and others indicates that the incidence of long term unemployment is very low in the U.S. and that the high unemployment rates characteristic of some labor market groups are due to frequent job turnover with accompanying spells of short term unemployment. These findings imply that large scale public service employment expansions, even if targeted for high unemployment groups, will involve public hiring of a possibly substantial number of workers who would otherwise have offered their services to the private sector.

Depending on the values of certain important parameters, such a reduction in the potential labor force available to the private sector may produce serious dislocations and may militate against some important PSE objectives.

If, for example, the potential labor force is characterized by highly wage inelastic labor supply schedules, and if technical substitution possibilities are widely available to low wage industries (implicit here is the assumption that the target groups consist largely of low-wage individuals), two basic difficulties arise: first, the increase in PSE payrolls may be accompanied by a nearly offsetting reduction in private payrolls; second, attempts at input substitution in favor of skilled labor and capital may represent additional inflationary pressure in already tight factor markets.

Alternatively, if a wage inelastic labor supply schedule is accompanied by few technical substitution possibilities and a highly price-elastic industry product market, then the capital-skilled labor inflation problem is avoided, but the low-wage employment reduction persists and is now accompanied by a possibly large diminution of low wage industry output.

Interest in public service employment expansion is in part related to concern over the existence of an alleged private sector bias in the American economy (as articulated, for example, by Galbraith in The Affluent Society). If such a bias exists, the private sector output reduction just mentioned may not seem to imply a serious welfare loss, provided that the increase in public employment compensates fully for the private sector employment reduction. A glance at a table of predominantly low wage industries (Table I.1) reveals, however, that the working poor are not generally concentrated in industries whose output has been the object of social criticism. Output reductions or large price increases in such low wage industries as nursing homes, work clothing, or children's hosiery have important welfare implications which should not be neglected. If these dislocative effects promise to be very large, policy makers may wish to consider transitional taxes and subsidies and related compensatory measures.

TABLE I.1

Peripheral Industries in the United States, Average Wage Rates
and the Percentage of Workers, by Industry, Employed at
Wage Rates Below \$1.60 in 1966 Dollar Equivalent

Industry	Average Hourly Earnings (for all workers in industry)	Percent Below \$1.60/hour
Southern Sawmills and Planing Mills	\$1.25	88.2
Nursing Homes and Related Facilities	1.19	86.3
Work Clothing	1.24	77.1
Children's Hosiery Mills	1.33	76.9
Men's and Boys' Shirts	1.26	75.5
Laundries and Cleaning Services	1.26	75.4
Men's Hosiery Mills	1.37	71.7
Synthetic Textiles	1.57	55.5
Cigar Manufacturing	1.39	55.4
Cotton Textiles	1.53	54.5
Wood Household Furniture	1.57	50.8
Footwear	1.64	49.3
Women's Hosiery Mills	1.55	50.0
Fertilizer Manufacture	1.67	41.7
Hospitals	1.86	41.2
Candy and Other Confectionery	1.87	34.2
Brick and Structural Clay Tile	1.91	33.9
Wool Textiles	1.59	32.7
Structural Clay Products	2.08	20.8
Miscellaneous Plastic Products	1.95	19.9
Men's And Boys' Suits and Coats	2.12	19.5
Textile Dyeing and Finishing	1.96	16.7
Retail Trade		
Limited Price Variety Stores	1.31	87.9
Eating and Drinking Places	1.14	79.4
Hotels and Motels	1.17	76.1
Drug and Proprietary Stores	1.56	71.3
Gasoline Service Stations	1.52	66.7
Apparel and Accessory Stores	1.70	59.7
Department Stores	1.75	59.6
Miscellaneous Retail Stores	1.75	58.0
Retail Food Stores	1.91	47.6
Building Equipment and Hardware Dealers	1.98	39.4
Furniture, Furnishings, and Applicances	2.10	38.4
Motor Vehicle Dealers	2.40	28.7

Source: Barry Bluestone, "The Tripartite Economy," p. 25,
Poverty and Human Resources, Aug. 70.

Only for the case in which labor supply schedules are highly wage elastic can policymakers proceed under the assumption that large scale public service employment expansions will not induce either a sizeable reduction in private, low-wage employment or an inflationary tightening of substitute factor markets.

An investigation of the existing literature on labor supply reveals that most empirical findings are to the effect that this final, most favorable alternative does not obtain: estimates of the elasticity of labor supply with respect to wages are in most cases very small and for many labor market groups may even be negative (the celebrated "backward bending" supply schedule for labor). Two recent studies Hall (1972) and Boskin qualify these results somewhat by finding significantly positive wage effects for certain labor force sub-groups, albeit a small percentage of the total number of groups studied. The general impression appears to remain that the supply of labor is, on balance, highly wage inelastic.

Although the empirical techniques employed by Hall and Boskin embody significant improvements over those employed in previous labor supply studies, several difficulties stand in the way of a direct application of their findings to the question of what effects public service employment expansion will have on the private sector.

One of these is associated with the manner in which Hall and Boskin handled the possibility of disequilibrium observations in their data. In both studies, labor supply was measured by an estimate of hours worked, with no attempt to make compensating adjustments for periods of unemployment.

While this procedure is defensible in general terms on the grounds that Hall and Boskin studied data for 1966, a year in which the average unemployment rate was very low, there is

evidence that some labor force subgroups did suffer from high unemployment throughout the boom of the late sixties. This phenomenon should be dealt with explicitly when the policy issue being considered is particularly concerned, as in this case, with the labor market behavior of low wage, high-unemployment groups.

A related difficulty with the Hall-Boskin studies is the treatment accorded the influence of general labor market tightness on individual labor supply. In order to employ data from 1966 (a full employment year) for the purpose of assessing labor market effects of a public service employment expansion in 1973 (which is likely to be, by comparison, a slack employment year) some attempt must be made to appraise the labor supply response to changing conditions of labor market tightness. Neither study made such an attempt, with the result that their predictive power is essentially limited to peak periods in the business cycle.

One further difficulty in applying the Hall-Boskin results to our public service employment question relates to a technical econometric issue. In an effort to solve what they felt was an important errors in variables problem associated with their wage data, both Hall and Boskin used a procedure for generating individual wage estimates on the basis of personal characteristics.

These wage imputations frequently differ substantially from an individual's true wage, but because Hall and Boskin felt that these differences are not related to the stochastic error terms in the labor supply regressions they had specified, the imputed wages were used in place of the recorded wages for labor supply estimation purposes. When coupled with the particular estimate of labor supply used by Hall and Boskin, this procedure produces what is probably an extremely serious negative bias in the estimated labor supply response coefficient for wages: Hall and Boskin estimated annual hours worked (their labor supply

variable) as the quotient of annual wage earnings and the imputed wage just mentioned. This estimate has the property that whenever the imputed wage is higher than the true wage, the hours worked figure will be lower than the true hours worked figure and vice-versa. The standard errors of the Hall-Boskin wage imputation equations lie between 40 and 50%, with the result that the hours and wage variables in the Hall-Boskin labor supply regressions have a large spurious negative relationship.

More than any other, this final difficulty argues against using the Hall and Boskin studies, which are in many ways the best available, as a basis for serious labor market policy analysis.

In order to assess the effects of public service employment expansions on the supply of labor to the low wage private sector, an alternative labor supply analysis was undertaken in which many of the most serious difficulties which characterize existing studies were eliminated. This report is devoted to a summary of this analysis and its implications for public policy.

Section II presents a detailed discussion of the micro-economic labor supply model, which is followed in Appendix IV by a summary of the parameter estimates obtained by fitting the model for several demographic groups using data from the 1967 Survey of Economic Opportunity. The most striking feature in the empirical results is the finding that for widely divergent demographic groups and for a broad range of wage values, increases in wage rates are associated with large increases in the quantity of labor supplied. This finding is entirely consistent with the presence of a strong and general positive wage elasticity of labor supply which so many other labor supply investigations have failed to detect. Because the empirical findings in Appendix IV are based on a carefully specified model of individual labor market behavior, they are offered, albeit cautiously, as a basis for the policy conclusion

that public service employment expansions of the magnitude envisioned in current legislation will not produce serious dislocations in the private sector.

2. The Labor Supply Model

The existing labor supply literature is large and diverse, and no attempt is made here at a formal summary of this literature. The format of the presentation will instead be to develop a micro-economic labor supply model directly, pointing out at each stage the important similarities to and differences from existing models. The most important departures of this research from previous work involve the specification and measurement of the influence of wage rates and the treatment accorded the effect of labor market demand conditions on individual labor supply decisions.

The discussion essentially sidesteps the question of functional form for labor supply relationships, emphasizing instead a careful derivation of the appropriate forms of the economic determinants of labor supply and their proper empirical measurement.

A. Labor Supply Determinants

Textbook descriptions of the labor supply decision are often presented in the following manner: a series of job opportunities, each carrying a different wage rate, is presented to an individual who responds by choosing, for each case, the number of hours per period he wishes to work.

The empirical relevance of this description has been questioned on the grounds that, in practice, the structure of existing job categories appear to offer the individual little opportunity to vary the number of hours he may work each period. The existence of part-time jobs and jobs which routinely offer a choice of overtime work does very little to soften the observation that most jobs in the American economy offer the standard 40 hour work-week.

This observation undoubtedly played an important role in the decision of many labor market researchers to reformulate the labor supply decision as the all or none choice between working and not working. Bowen and Finegan are perhaps the best known proponents of this view of the labor supply decision. Though many have found this approach useful for certain policy applications, Bowen and Finegan themselves are very clear about their reservations concerning the ability of a dichotomous labor force participation variable to adequately characterize variations in individual labor market behavior [Bowen and Finegan (1969), p. 31].

Such reservations have been reinforced as data have accumulated which show that large numbers of people routinely move in and out of the labor force, and experience periods of employment which exhibit substantial variations in length.

As it has become clear that some segments of the labor force can and do achieve flexibility in the amount they work by simply moving into and out of employment, the conventional textbook description of the labor supply decision has regained much of its original appeal.

The textbook description is usually expanded somewhat by selecting the family, rather than the individual, as the labor supply decision making unit. Family heads are generally presumed to have a firm attachment to the labor force (though this is by no means a necessary assumption), while other family members are thought to more freely adjust the allocation of their time between labor and leisure as labor market conditions warrant. The model developed below is based on essentially this view of the labor supply decision.

Corresponding to the belief that people can and do achieve flexibility in the amount they work, the dependent variable chosen for this study is an estimate of the number of hours of employment sought by the individual during a period

of one year. These estimates are constructed using data from the 1967 Survey of Economic Opportunity by a procedure which is described in detail in Appendix I below.

Basically, each estimate consists of the sum of an estimate of hours worked during the year plus an estimate, where appropriate, of the number of additional hours of work which were sought during the year but not realized. This measure of labor supply, which is hereafter denoted as H^* is essentially a measure of labor force participation which is defined over a continuous range of outcomes.

Many economists continue to view the labor supply decision as a two step procedure: the individual (or the family in which the individual lives) first decides whether he is to work at all (the labor force participation decision) and then, if he has decided to work, he decides how much to work. The factors which are discussed as determinants of these two decisions exhibit substantial but not complete overlap. Heavy emphasis has traditionally been placed on the degree of labor market tightness as a determinant of the labor force participation decision while the decision of how much to work has usually been analyzed in terms of wage and income variables.

The hours sought measure of labor supply employed in this study facilitates the alternative view that the individual (or family) evaluates labor market conditions facing him and makes not two decisions but one: his choice of an optimal flow of labor services which he wishes to offer. Denoted below by H^* , this flow is determined both by variables which measure the availability of work and by variables which measure the financial attractiveness of work. The following two subsections are devoted to a detailed discussion of how these two basic types of supply determinants are most appropriately specified.

B. Income and Wage Variables

While the conventional labor-leisure tradeoff analyses have always made clear that the wage rate and non-wage income are important determinants of an individual's labor market behavior, some controversy exists over which of the many alternative forms of these variables are most appropriate for use in the empirical study of questions related to labor supply.

In cross section data, for example, observations on wages and income may be thought of as the sum of two component parts: one representing the permanent or long run value of the variable and another representing a transitory deviation from the permanent value. If the individual's response to the transitory component is markedly different from his response to the permanent component and if the transitory component is large in relation to the permanent component, then the use of observed wage or income variables in labor supply regressions may lead to parameter estimates which are substantially biased. Only if the supply response is the same for both transitory and permanent components will an ordinary least squares regression of supply on observed wage and non-wage income variables produce unbiased parameter estimates.

Milton Friedman [1957], in his Theory of the Consumption Function, argues that intertemporal utility maximization considerations lead the individual to seek a smooth pattern of consumption expenditure which is consistent with his expected flow of permanent income. Friedman's model seems to have led many labor supply researchers to conclude that a transitory change in wage (and hence in income) prospects would little affect an individual's pattern of leisure consumption. In their empirical work, therefore, these researchers (Hall, Boskin, Kalachek and Raines) have specified estimates of the individual's permanent or expected wage as labor supply determinants.¹ This procedure fails to recognize, however, that a transitory change

in the wage represents, in addition to a transitory change in income prospects, a change in the current price of leisure relative to consumption goods.

Some insight into the question of how transitory variations in wages and income affect an individual's demand for leisure (supply of labor) is afforded by an analysis of the following simple intertemporal model.

An individual is assumed to have a utility function which is defined over leisure and goods and which takes the same form in each of T periods.² Choosing goods as the numeraire and assuming that the individual may borrow or lend without interest,³ he is presumed to maximize the sum:

$$\text{II.1.} \quad \sum_{i=1}^T U(C_i, L_i) ,$$

subject to

$$\sum_{i=1}^T (k - L_i)w_i + Ty_n \geq \sum_{i=1}^T C_i$$

where,

L_i = i^{th} period leisure consumption,

C_i = i^{th} period goods consumption,

w_i = i^{th} period wage rate,

k = total time available for work in each period,

and y_n = non wage income in each period.

Writing the Lagrangian expression as:

$$\text{II.2.} \quad \mathcal{L} = \sum_{i=1}^T U(C_i, L_i) + \lambda \left(\sum_{i=1}^T (k - L_i)w_i + y_n - \bar{C}_i \right),$$

and neglecting the possibility of corner solutions, the first order conditions for a constrained maximum are

$$\text{II.3. } \frac{\partial \mathcal{L}}{\partial C_i} = \frac{\partial U(C_i, L_i)}{\partial C_i} - \lambda = 0 \quad i=1, \dots, T.$$

$$\frac{\partial \mathcal{L}}{\partial L_i} = \frac{\partial U(C_i, L_i)}{\partial L_i} - \lambda w_i = 0$$

$$\frac{\partial \mathcal{L}}{\partial \lambda} = \sum_{i=1}^T \overline{(k - L_i)w_i + y_n - C_i} = 0.$$

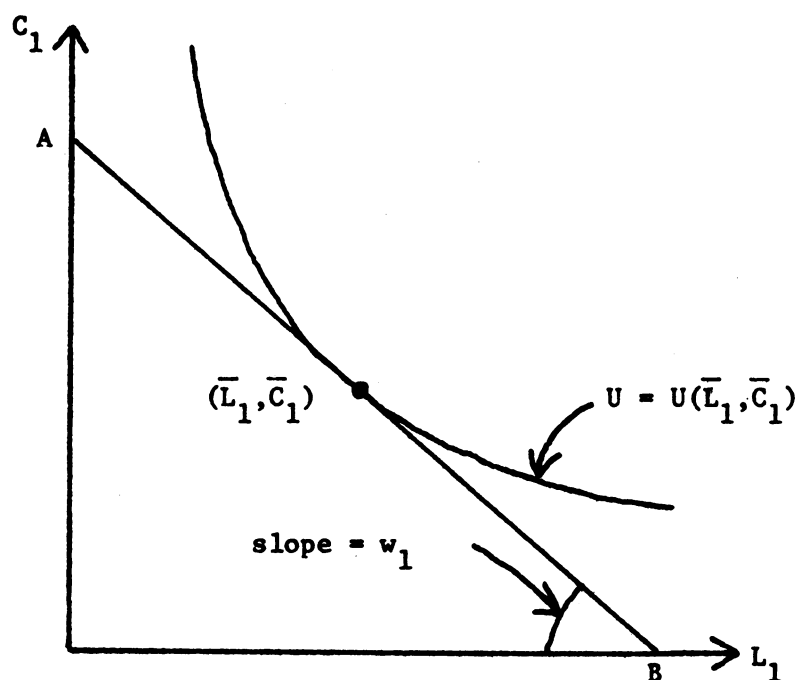
The system II.3. may be solved implicitly for the current period demand for leisure:

$$\text{II.r. } L_1 = L_1(w_1, w_2, \dots, w_t, y_n, k).$$

While the wage rate in each of the T periods enters into the determination of the quantity of leisure demanded in the current period, the influence of the current wage in equation II.4. is fundamentally distinct from that of other wages: w_1 alone serves to determine the marginal rate of substitution between current period goods and current period leisure. The current period goods-leisure equilibrium values may be described as the point of tangency between a hypothetical current period budget constraint and a goods-leisure indifference contour in C_1, L_1 plane:

(see Figure II.1. following)

Figure II.1.



In Figure II.1, the slope of this budget constraint is given by the current wage and its intercept on the goods axis is determined by the time constraint k , the set of all wages w_1, \dots, w_T , and non wage income y_n .

By this interpretation of the C_1, L_1 equilibrium determination, the variables k, w_1, \dots, w_t, y_n function in an analogous way to that of money income in the standard two-good, single-period Marshallian demand analysis.

As a practical matter it is unreasonable to assume that individuals know with certainty the wage rate they will face in each of T future periods. For simplicity, I assume that individuals have well formed expectations concerning the permanent, equilibrium level of their wage, denoted by w_p , and that they behave as if they expect with certainty that w_p will obtain

in each of the remaining $T-1$ periods.

In the empirical work which follows, I adopt the simplifying procedure of reducing the separate budget constraint positioning variables y_n, k, w_1, \dots, w_T into a single variable which may be characterized as a flow measure of the individual's potential permanent income. This summary variable, denoted by y_p , measures the sum of permanent non wage income and potential permanent labor income. Potential permanent labor income is given by the produce of the permanent wage, w_p , and the maximum number of hours available for work in each period, k . y_p is assumed to determine the goods intercept of the current period budget constraint (AB in Figure II.1.); the details of the empirical approximation of y_p are discussed in Appendix I.

To recapitulate briefly, the current period leisure demand function I employ below will be of the form:

$$\text{II.5.} \quad L = L(w, y_p),$$

where w is the current period wage and y_p is potential permanent income as defined above. II.5. leads to a current period labor supply function by the following simple transformation:

$$\text{II.6.} \quad H^* = k - L(w, y_p) = H^*(w, y_p).$$

Like the income concept suggested by Kesters, and subsequently employed by Hall and Hill, the income term in II.6. represents a potential rather than an actual value. It is the income which could be earned if the individual devoted all of his time to work, none of leisure. Actual income is of course an outcome, not a determinant, of the labor supply decision.

Taking $T = 2$ simplifies the system of first order conditions II.3. sufficiently that it is possible to assess the leisure demand effects of a transitory change in the wage. In Appendix VI below it is established that if goods are normal

(i.e., not inferior) then a positive (negative) change in the current wage rate, with no change in future wage rates is associated with an unambiguously positive (negative) change in the current quantity of labor supplied:

$$\text{II.7.} \quad \frac{\partial H_1^*}{\partial w_1} > 0$$

This result contrasts with the standard single period result that the effect of a wage change, being the sum of a substitution and an income effect of opposite signs, is theoretically indeterminate. The two period counterpart of this standard single period result is that the effect on current labor supplied of a permanent change in the wage rate (i.e., a change in w_1 which persists into period 2) cannot be determined.⁵

One final proposition is stated without proof, namely that current labor supply responds negatively to changes in non wage income:

$$\text{II.8.} \quad \frac{\partial H_1^*}{\partial y_n} < 0.$$

As mentioned above, it has been the practice of many recent labor supply studies to take the family, not the individual, as the labor supply decision making unit. Koster's approach was to maximize a family utility function defined over consumption goods, husband's leisure and wife's leisure. He obtains labor supply equations for the husband and wife, each of which has as arguments family non wage income and the wage rates of both spouses. Carrying out a similar procedure in an intertemporal framework leads to a labor supply function in which current and future wages of the husband and wife, as well as current and future non wage income appear as arguments.

Following Hall, I make the assumption that the leisure of the husband and the leisure of the wife are neither substitutes nor complements. This assumption permits the exclusion of the husband's current wage from the wife's labor supply function and vice versa. The income effects of changes in the spouse's permanent wage are incorporated by redefining the term y_p in equation II.6. to be the potential permanent income per family adult. The latter figure is given by the sum of family individual potential permanent incomes divided by the number of family adults. Though motivated somewhat differently, the term y_p is calculated in the same way as Hall's whole income variable in Hall (1972).

In theory, transitory variations in income should no more influence the consumption of leisure in the model which generated II.5. than do such transitory variation influence general consumption in Friedman's model. If a transitory income variation is due to a transitory wage change, any resultant effect on leisure consumption should be interpreted as a price effect rather than an income effect. In practice, however, persons with imperfect access to capital markets and with little savings may find it impossible to maintain the theoretically optimal consumption path in the face of large negative transitory variations in income. For such persons, negative transitory variations in income are likely to have a positive effect on labor supply.

In the empirical results presented below a measure of family negative transitory income is therefore included among the labor supply determinants for certain individuals.

C. Labor Market Demand Conditions

In this section I propose what I feel is a substantive modification of the procedures used by other researchers in specifying the way in which availability of work considerations

influence the individual's labor supply decision.

A standard practice in labor force participation studies⁶ has been to use some form of the unemployment rate as a measure of the availability of work. By the traditional queue theory of the labor market, a fixed number of jobs is apportioned to labor force participants according to their place in line in a grand labor market shape up. Those near the head of the queue -- generally those with large stocks of human capital -- are hired first and employers move down the line until all the jobs are exhausted. Against this backdrop, prospective labor force participants are presumed to evaluate their likelihood of ending up in the unhired portion of the queue. In periods of slack demand, this probability will appear high to many, thus discouraging them from seeking work. In periods of brisk demand, conversely, prospective job seekers perceive the probability of finding themselves in the unhired portion of the queue as low and correspondingly more of them decide to actively seek work.

In recent years an alternative to the queue theory has appeared in the form of a growing body of literature which formulates questions of unemployment in terms of a process of job search.⁷ This literature emphasizes the sizeable flows between employment and unemployment which are observed to occur in the American economy. It has influenced many labor economists to abandon the view that when aggregate demand conditions are slack it becomes impossible for many individuals to find work in favor of a more moderate view which holds that as demand conditions vary the average length of time required to find work also varies. In recessions it is not impossible for job seekers to find work -- it simply takes longer.

This view prompts the notion that an individual measures the difficulty of finding work not by his estimate of the probability that he would never find work at all but by the amount of time he expects it will take him to find work should

he search. In the following discussion of the determinants of this expected length of job search, it will be pointed out that, in many key applications, unemployment rates of employment change measures bear little relationship to the length of time required to secure employment.

Under a given set of institutional conditions the average length of time required for a given worker to secure a particular type of job should depend negatively on the level of excess demand for labor in the job category in which he seeks employment. Many economic theories, including the theory which underlies the Phillips curve, rest on the assumption of a stable transformation between excess demand and the unemployment rate in a single labor market. If one were to study a single labor market over time, then, one might reasonably expect that the unemployment rate would, through its link to excess demand, be an appropriate surrogate measure of the job search time conditions in that labor market. Thus, for a time series analysis of a single labor market area, some form of the unemployment rate may be an acceptable specification for describing the influence of expected job search time on the individual's labor supply offer.

If one studies many labor markets at a single point in time, however, the appropriateness of the unemployment rate as a measure of search conditions comes into serious question. Two different labor markets may have identical recorded unemployment rates, yet because of institutional differences, exhibit markedly different job search characteristics. A labor market which has a high rate of unemployment, for example, because of extensive job turnover (with the result that jobs are encountered after only brief search) will exert far less of a discouraging influence on workers than a similarly high unemployment labor market which is characterized by low turnover and long periods of job search. Similar criticisms apply to the use of employment change data in cross section.

It appears reasonable to assume that an individual's

perceptions of job search conditions (summarized henceforth by t_i , denoting the i^{th} individual's expected length of job search) are formed in general, by observing the labor market experiences of others with whom he comes in contact. If he observes that others undergo protracted periods of job search, t_i will be large; seeing others find jobs quickly, on the other hand, causes t_i to be small. In this process the individual is likely to weigh most heavily those observations which pertain to people with labor market qualifications similar to his own.

A measure of the actual length of an individual's job search appears in many current data sources as the duration of unemployment. The SEO data specifically facilitate the calculation of average duration of unemployment per spell of unemployment for those individuals sampled who were unemployed one or more times in 1966. In Appendix I below an estimate of t_i is constructed for each individual under the assumption that he expects that it will take him as long to secure work as was observed, on the average, for other job seekers in his labor market area with similar personal characteristics.

For an individual who is currently working, of course, search time is effectively zero, at least for the particular category of job which he holds. For such an individual who is satisfied with his current work schedule, the search conditions of interest for supply estimation purposes are those which obtained during the period in which his current job was secured. In particular, if search conditions have deteriorated markedly since the current job was secured, it is inappropriate to employ current search conditions to explain current supply. On the other hand, if job search conditions have improved since the current position was secured, as is likely to be the case for most individuals in the 1967 SEO survey, and if individuals continue to be satisfied with their current work schedules, then current search conditions are appropriately specified as determinants

of current labor supply. If, in response to improved search conditions, individuals wish to augment their current work effort, then current search conditions are again appropriate supply determinants provided one uses an hours sought supply measure such as described in section II.B. above.

The unemployment variable employed to measure labor market tightness by labor force participation theorists is argued to influence the individual in two offsetting ways: When unemployment goes up, work becomes harder to find, which, in turn, discourages the individual from seeking work; unemployment increases, on the other hand, tend also to be associated with deteriorations in family income positions, which may move some workers to seek additional work.

In the labor supply theory presented here, the supply stimulating influence of transitory deteriorations in the family income position is specified, where appropriate, by a direct measure of family negative transitory income. This procedure eliminates the need for specifying added worker effect considerations into an availability of work variable. The availability of work variable t_1 is thus free to enter in an unambiguous way in the labor supply model presented here: As work becomes easier to find, ceteris paribus, individuals respond by seeking more employment, never less.⁸

I now digress briefly to discuss an interesting theoretical implication of the use of a job search measure of labor market tightness. I argued above that, for a given job category and for a given set of institutional conditions, the length of job search is determined by the level of excess demand for labor.

Suppose there is a well defined labor market for a particular job category with the demand for labor given by:

II.9. $D = D(w, \alpha),$

where w is the wage and α is a shift parameter.

Suppose also that the individual labor supply relations aggregate to form a market supply relation given by:

$$\text{II.10.} \quad S = S(w, t),$$

where t is an index of job search conditions and where other supply determinants are suppressed for simplicity. The job search relationship for this labor market is summarized by:

$$\text{II.11.} \quad t = t(X),$$

where

$$\text{II.12.} \quad X = \frac{D - S}{D}, \text{ a conventional measure of excess demand.}$$

Next I assume that labor market equilibrium⁹ is characterized by:

$$\text{II.13.} \quad D(w, \alpha) = S(w, t).$$

Equations II.9. - II.13. may be solved implicitly for equilibrium values of w and t :

$$\text{II.14.} \quad \bar{w} = \bar{w}(\alpha),$$

$$\bar{t} = \bar{t}(\bar{X}(\bar{w}, \alpha))$$

$$= \bar{t} \left[\frac{D(\bar{w}, \alpha) - S(\bar{w}, \bar{t})}{D(\bar{w}, \alpha)} \right] = \bar{t}(0).$$

Note that in II.14. the equilibrium level of the job search conditions index is given independently of the value of α . This observation states the comparative statics result that a permanent shift in demand, denoted by a change in α , produces no change in the equilibrium length of job search time.

To be sure, a demand shift will in the short run result in some non-zero level of excess demand which in turn will

translate into a change in job search conditions. The explicit dynamic mechanism whereby the market moves to its new equilibrium position may be lengthy and complicated, and the short run supply shifts associated with these transitory variations in search conditions may be of considerable policy importance. Nonetheless, the contention that a permanent augmentation of the demand for labor cannot be expected to sustain a permanent increase in the rate of labor force participation¹⁰ is of interest in that it appears to conflict with the views of most labor force participation theorists who have studied the discouraged worker effect in detail.

D. Non Economic Supply Determinants

In addition to such purely economic variables as the wage, permanent income and job search conditions, it is clear that many other variables of a less distinct economic character also exert important influences on the labor market behavior of individuals. Some of the most important of these are mentioned briefly below.

1. Family Position. Jacob Mincer [1962] has attempted to formalize the influence of family position on labor supply by introducing the concept of a home wage facing each family member. Members of the family whose services are valued highly at home -- the wife in many instances--face a high home wage, making work at home attractive relative to work in the market place.

2. Number and Ages of Children. How many children there are in the family and whether or not they are in school may also be interpreted as exerting a home wage type of labor supply influence.

3. Number of Adults. Hall [1972] finds that the number of hours people work declines as the number of adults in the family increases. He offers economies of scale in consumption (or possibly childcare) as one possible rationalization of such

an effect. Another possibility is that persons who choose to live in multi-adult families may simply have labor-leisure preferences which systematically differ from other individuals.

4. Education. Many economists have conjectured that education influences individual labor supply decisions.¹¹ Some argue that education itself influences individual attitudes toward work. Or, it may be the case that educational attainment is simply correlated with attitudes towards work or other labor supply determinants such as ambition or health.

5. Other Non Economic Determinants. A further attempt is made to control for tastes by partitioning the sample into supply groups on the basis of race, sex, age and family position. Finally, a variable is included which denotes whether or not individuals are residents of a poverty area.

E. Summary of the Model

I have described an hours sought measure of labor supply and discussed some of its most important determinants. For the i^{th} individual in a given labor supply group (which is defined on the basis of race, sex, age and family position) the basic labor supply relationship may be summarized as:

$$II.15. \quad H_i^* = H_i^* (w_i, y_{pi}, y_{ti}, t_i, E_i, N_i, C_i, P_i),$$

where

- H_i^* = i^{th} individual's hours sought,
- w_i = i^{th} individual's current wage rate,
- y_{pi} = i^{th} individual's family potential permanent income,
- y_{ti} = i^{th} individual's family transitory income,
- t_i = i^{th} individual's expected length of job search,
- E_i = i^{th} individual's level of educational attainment,
- N_i = i^{th} individual's number of family adults,

- C_1 = i^{th} individual's children's ages,
 P_1 = i^{th} individual's residence: poverty area or non poverty area.

The signs of the first partial derivatives of H_1^* with respect to each of its arguments are summarized by: (see Table II.1.)

This completes the qualitative discussion of the determinants of individual labor supply. A detailed discussion of the question of how the 1967 OEO SEO data file may be employed in the construction of quantitative measures of labor supply and its determinants is presented in Appendix I below. Included in this discussion is an analysis of the question of spurious correlation between supply and wage variables mentioned in the introductory section.

3. Empirical Results and Conclusions

A. The Sample

The sample employed in this study is virtually the same as the one employed by Hall [1972]. Basically, it consists of adults (16 years and older) living in one of the twelve large Standard Metropolitan Statistical Areas identified in the 1967 Survey of Economic Opportunity. Adults with the following characteristics were excluded:

1. Those who attended school in 1966
2. Married men with wife not present
3. Persons living in families receiving public assistance
4. Persons living in families with more than \$1,000 in non-wage income in 1966
5. Those whose race was not classified as black or white
6. Those who had health problems limiting kind or amount of work

For a detailed description of the rationale behind these eliminations, see Hall [1972], pp. 43, 44.

TABLE II.1

Sensitivity of Hours Supplied

$\frac{\partial H_i^*}{\partial w_i}$	$\frac{\partial H_i^*}{\partial y_{pi}}$	$\frac{\partial H_i^*}{\partial y_{ti}}$	$\frac{\partial H_i^*}{\partial t_i}$	$\frac{\partial H_i^*}{\partial E_i}$	$\frac{\partial H_i^*}{\partial N_i}$	$\frac{\partial H_i^*}{\partial C_i}$	$\frac{\partial H_i^*}{\partial P_i}$
+	-	- or 0 ¹	-	?	?	- or ? ²	?

¹ for $dy_{ti} < 0$, $\frac{\partial H_i^*}{\partial y_{ti}} < 0$; for $dy_{ti} \geq 0$, $\frac{\partial H_i^*}{\partial y_{ti}} = 0$.

² $\frac{\partial H_i^*}{\partial C_i} < 0$ for mothers of preschool children, of indeterminate sign for others.

B. Regression Results

For each race (white and black), separate regressions were estimated for each of the following subgroups of the sample:

1. Husbands
2. Wives
3. Female heads of families
4. Unmarried male relatives
5. Unmarried female relatives
6. Single men
7. Single women

Following Cohen, Lerman, and Rea, Kalacheck and Raines, and Hall, I employed the procedure of partitioning the range of each labor supply determinant into several discrete intervals, each of which was entered separately as a dummy variable in each labor supply regression function.

Provision was made in the specification for interactions between age and wage, potential permanent income, transitory income and search time variables. For almost all variables in the regressions, separate coefficients were estimated for persons in the lower one third and upper two thirds of the potential permanent income distribution of their respective supply groups. The 33rd percentile potential permanent income values for each supply group are listed in Appendix V, and the labor supply regressions appear in Appendix IV. In Tables A-IV-1 through A-IV-IV, the cutoff point between the two income groups is denoted Y_{P_3} .

For each class of variables (e.g., wage, permanent income, expected search time, etc.) the regression coefficients represent deviations (in hours per year) from an arbitrarily chosen reference category. In Table A-IV-1, for example a 25 year old white husband earning a wage in the \$2.50-2.99 interval is estimated to supply, 149 hours per year more, ceteris paribus, (in particular, holding Y_p the same), than the same man in the \$2.00 to 2.49 interval. The latter individual, in turn, supplies 267 hours per year more than the individual in the \$1.75-1.99 wage

interval. An estimate of an individual's total supply may be calculated by summing the regression coefficients for the variable intervals which apply to him. Again referring to Table A-IV-1 for an example, the 25 year old white husband with an hourly wage of \$2.65, potential permanent income of \$4,800 per year (putting him in the upper two thirds of his supply group's potential permanent income distribution), 4 to 6 weeks expected search time, 2 adults in the family, in the top third of his age group's educational attainment distribution, no children and not living in a poverty area is estimated to supply $518 + 1709 + 149 - 14 + 0 + 116 + 0 - 240 + 0 + 0 = 2228$ hours per year.

The most striking feature about the empirical results in Tables A-IV.1 through A-IV-14 (and the one which is of particular importance for the assessment of the impact on private labor markets of expansions in public service employment) is the finding of a consistently strong and positive wage effect for each of the fourteen demographic subgroups studied. Potential permanent income variable coefficients were insignificantly different from zero with the exception of a few unexpectedly large negative coefficient values for the lowest income interval for single individuals (Tables A-IV-11, 12, 13). Taken together, the current wage and potential permanent income coefficients are completely consistent with the existence of a strongly positive wage elasticity of labor supply response over a broad range of wage values for each of the fourteen groups studied. The common impression of vertical or backward bending supply curves for most groups finds no support whatever in the wage and income coefficients in Tables A-IV-1 through A-IV-14.

These results contrast with those of Hall. He reports wage and income coefficients which are, for a majority of the groups he studied, inconsistent with the a priori expectations established by the theory of labor supply. This contrast probably owes to a systematic negative bias in Hall's wage coefficients

resulting from the technique he employed to estimate hours worked (this point was mentioned briefly in the introduction and is discussed in more detail in Appendix I). The bias in the Hall wage coefficients was avoided in this study by using a transformation of the SEO recorded wages as the labor supply regressor while using an imputed wage for the purpose of estimating hours worked.

Unfortunately, the use of the imputed wage, which is in general a very imprecise measure of the true wage, for the construction of hours worked estimates is not a costless procedure. The imprecision with which labor supply is measured contributes a great deal of noise to the labor supply regressions. Accordingly, the absolute magnitude of the supply regression coefficients must be treated with caution and in many cases skepticism. In Table A-IV-1, for example, I choose not to believe that white husbands earning \$3.50 and above supply 1082 hours per year more than white husbands earning \$2.00 to 2.49. The coefficients of the wage imputation regressions in Appendix I make it difficult for an individual to be imputed a wage in excess of \$3.50. For prime-wage white husbands, however, fully one fifth of the sample had a recorded SEO wage of \$3.50 or more. The unusually high coefficient on the wage variable for this group is thus likely to reflect overestimates of supply caused by wage imputations which were too low. Similarly, I suspect that for most groups, the coefficients for the lowest wage intervals overstate somewhat the magnitude of the negative impact of low wages on labor supply.

Unfortunately, the individual supply group samples were too small to allow for a satisfactory test for the presence of wage-income interactions. Such interactions are potentially very important and should be investigated carefully as future data permit.

The most disappointing feature of the empirical results was the inconclusive performance of the expected search time variables. The search coefficients bore no systematic resemblance to the theory developed in section II-C. Because of the crude way in which the search variable was constructed, however, these coefficients should be viewed with an additional measure of caution. The standard errors printed beneath the search coefficients were calculated under the assumption that the expected search time assigned to the individual coincides exactly with the search time which he himself perceives. This assumption is not very likely to be satisfied given the extremely tentative nature of the search regressions by which these expected search times were assigned. Longitudinal data for a period which includes at least one business cycle (such as have been compiled by Herbert Parnes) are probably necessary for a more satisfactory investigation of the effects of job search conditions on labor supply.

The transitory income coefficients displayed an almost random distribution of signs and only rarely took on values in excess of their standard error estimates. The regressions do not support the hypothesis of a strong added worker effect, though the tests are not very powerful since only a small minority of families contained individuals who experienced unemployment in 1966.

With the exception of white wives and a few other groups, there was a noticeable trend for the number of hours supplied to increase as the number of family adults increases. The education variables frequently had large coefficients but did not seem to exhibit any strong patterns across supply groups. If anything, there was a tendency for persons with high education levels to supply fewer hours. Coefficients for the children variables were large only for wives and had the expected signs. The income interaction term was often important here, with upper income wives showing more of a supply reduction than lower income wives

to the presence of school age children.

Very interestingly, the coefficient of the poverty area residence variables, while always negative, were generally very small and insignificantly different from zero. This result is consistent with the claim that observed differences in labor market behavior of poverty and non-poverty area residents are explained more by differences in economic opportunity than by fundamental differences in behavioral relationships.

C. Concluding Remarks

A theory of individual behavior is developed and tested in this research. When such a theory is tested successfully against cross section data it is customary to issue the general caveat that only carefully generated experimental data can be used in the construction of rigorous tests of the hypotheses under question. There is no assurance, for example, that differences in supply associated with wage rates are the result of the wage differences and not of some unmeasured underlying differences in preferences.

The Parnes data and longitudinal data from several income maintenance experiments will soon be available and will facilitate much more powerful tests of the wage, income, search and other effects than were possible with the SEO data. Until then, the preliminary judgment is offered that labor supply schedules appear to be sufficiently wage elastic that public service employment expansions of the magnitude envisioned in current legislation will not produce serious dislocations in the private sector.

FOOTNOTES

1. Hall [1972, p. 10], for example, writes: "...individuals who are offered an unusually high wage may supply fewer hours of work than those who receive the same wage routinely. The resulting correlation of [the wage and error terms] makes the estimation formally analogous to that of estimating the consumption function from cross section data."

2. The assumption of a utility function which does not change over time is most reasonable when T is small; I envision the three year planning horizon spoken of by Friedman [1963].

3. For the purposes of the present analysis, the introduction of a positive rate of interest serves only to complicate the notation.

4. Suits [Impacts of Monetary Policy] has criticized Friedman's formulation of the permanent income hypothesis of consumption on the grounds that the observed flow of permanent income is itself the outcome of a family decision rather than a truly exogenous determinant of consumption. A promising area for further research is the investigation of the determinants of family consumption, redefined to include the consumption of leisure as well as goods and services.

5. How a permanent change in the wage affects current labor supply in practice will naturally depend on the way in which individuals form expectations regarding the level of their permanent wage. One commonly used formulation of expectations formation is the lagged adaptive procedure. Individuals may estimate their permanent wage at time t, for example, by a calculation such as

If so, any permanent

$$w_{pt}^e = \sum_{i=0}^{\infty} b_i w_{t-i}$$

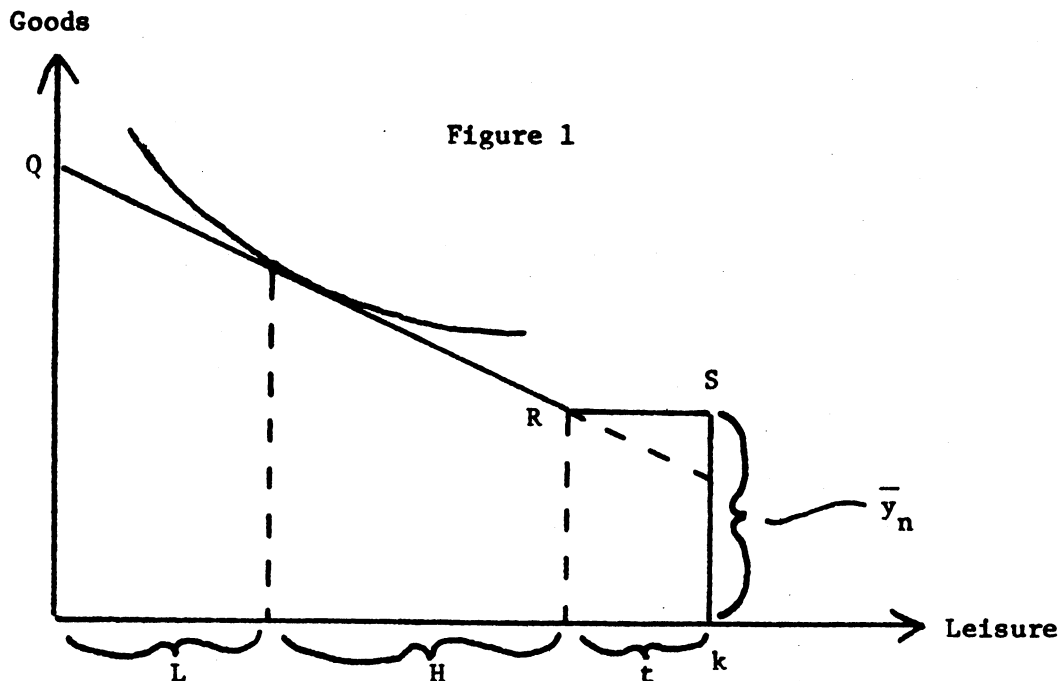
increase in the true wage will, in the initial periods, be interpreted by the individual as being in part a transitory increase

and in part a permanent increase. Over time the full increase will come to be recognized as permanent. Since the labor supply response to a transitory wage increase is larger than to a permanent wage increase, the assumption of adaptive expectations formation leads to the conclusion that the short run elasticity of labor supply with respect to permanent wages is greater than the corresponding long run elasticity. Such a result is an interesting contrast to the analogous producer theory result that firms' output price elasticity of supply is greater in the long run than in the short run.

6. See, e.g., Mincer [1966] and Mooney [1967]. The CLR study cited earlier used unemployment change data as an additional measure of the availability of work.

7. See, for example, Phelps, et al.

8. This statement appears reasonable in the context of the following simple model in which individual leisure demand, neglecting job search effects, is given by $L(w, y_n)$, where w is the wage rate and y_n is non-wage income. If k total units of time are available and if t units of time are required to secure a job, the individual's budget constraint is represented in the goods-leisure plane by QRS in Figure 1.



Neglecting the possibility of right hand corner solutions, the kinked budget constraint QRS in Figure 1 may be replaced by the straight-line budget constraint QRT. QRT is the budget constraint which would obtain if search time were zero and non-wage income were given by $\bar{y}_n - wt$. Under the constraint QRT, the number of hours the individual chooses to work, denoted as H, is then given by:

$$(i) \quad H = k - t - L(w, \bar{y}_n - wt).$$

An equivalent expression for H is obtained by observing that:

$$(ii) \quad C = wH + \bar{y}_n, \text{ and solving for}$$

$$(iii) \quad H = \frac{C - \bar{y}_n}{w}.$$

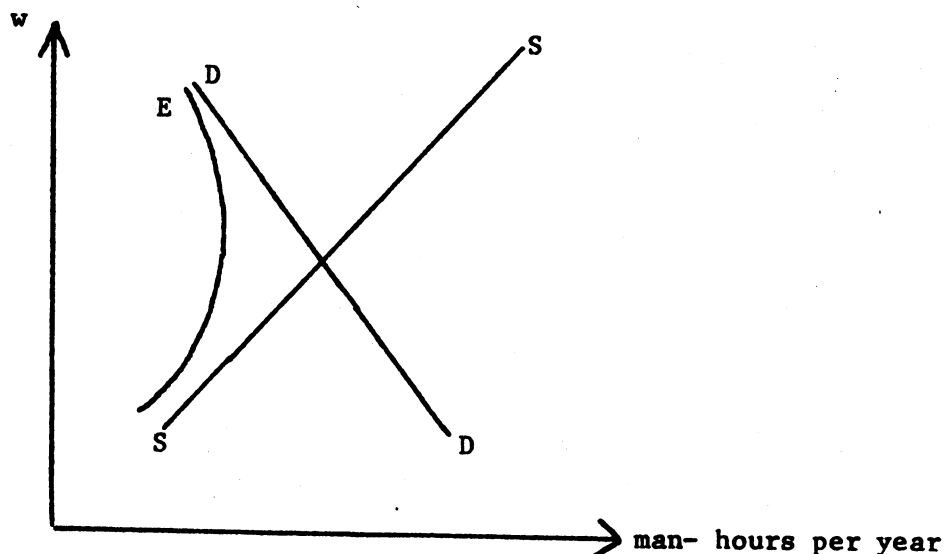
Then,

$$(iv) \quad \frac{\partial H}{\partial t} = \frac{1}{w} \frac{\partial C}{\partial t} = \frac{w}{w} \frac{\partial C}{\partial \bar{y}_n} = - \frac{\partial C}{\partial \bar{y}_n}.$$

Thus the only restriction necessary for $\frac{\partial H}{\partial t} < 0$ is that goods not be inferior (i.e., that $\frac{\partial C}{\partial \bar{y}_n} > 0$).

9. The concept of an equilibrium used here does not require that actual employment be equal to either supply or demand. Following Hansen, I assume the existence of an employment curve (EE in Figure 1) which lies everywhere to the left of the supply and demand curves. At any wage rate there simultaneously exist vacant jobs (the horizontal distance from EE to the demand curve DD) and unemployed workers (the horizontal distance from EE to the supply curve SS). The equilibrium is arbitrarily assumed to correspond to the wage level for which vacancies and unemployment are equal.

Figure 1



10. Specifically, there will be no permanent outward shift of the supply schedule. It is possible that the higher wage level associated with the new equilibrium will, if sustained, induce a permanent increase in labor force participation.

11. Bowen and Finegan [1966], for example, demonstrated a strong positive correlation between labor force participation rates and the level of educational attainment. Their study, however, made no attempt to control for the effects of wage differences, a large part of which are due to differences in educational attainment.

APPENDICES and BIBLIOGRAPHY

APPENDIX I

**Constructing Empirical Measures of Labor Supply
and Its Determinants**

A. Wages and Hours Worked

SEO wage data are limited to a direct measurement of the hourly wage of all sampled individuals who were working during the March 1967 survey week. In periods of general wage inflation, such as 1966-67, the wage earned by a worker in March of a given year tends, of course, to exceed his average hourly wage for the previous year. To take this effect into account the assumption was made that the hourly wage of each worker in 1966-67 grew at the proportional monthly rate of .58%, which is the observed average monthly rate of wage inflation for private non farm employees during 1966 (see [24] p. 276). Under this assumption, a worker earning an hourly wage of w_0 in January, 1966, would be observed to earn approximately $1.08w_0 = w_1$ in March, 1967. The hourly wage in mid-1966, denoted by w_a , is then given in terms of the March 1967 wage by:

$$A-I.1. \quad w_a = .96w_1 .$$

For individuals who were not working in March of 1967 (and for whom there is consequently no SEO wage observation) a procedure is employed which is essentially the same as the one developed by Hall and Boskin. First, for all individuals in each of four race-sex groups for whom the SEO wage entry is present, wages are regressed on a set of personal characteristics: education, residence, union status, country of birth, and health. Wage imputations are then generated by applying the estimated coefficients from these regressions to the personal characteristics of those individuals with missing SEO wage entries.

The before tax average hourly nominal wage for these individuals is then computed by using this wage imputation in place of w_1 in equation A-I.1.

The appropriate wage for use as a labor supply regressor is the real (cost-of-living-deflated) after tax wage. This wage is generated by dividing w_a in equation A-I.1. by the appropriate

SMSA price index and multiplying the result by $(1-r)$, where r is an estimate of the marginal federal income tax rate facing the individual. The estimate of r used was calculated with the use of a subroutine supplied by Michael Boskin.

The wage regressor thus constructed will frequently differ from the true 1966 real after tax hourly wage even in the case of those individuals for whom the SEO wage observation is present. This measurement error gives rise to a downward bias in the estimate of the wage coefficients in labor supply regression functions. Hall and Boskin believed this bias to be serious enough to warrant the use of the imputed wage as a labor supply regressor for all individuals, not just those with missing wage observations. Estimating efficiency is lost in this procedure and there is substantial room for questioning whether there really do exist important instrumental variables in the imputed wage regression which are truly exogenous to the labor supply system (i.e., which do not themselves systematically influence labor supply apart from their influence on wages). My personal judgment is that the two step procedure does not hold a clear enough promise for gain to warrant its use.

The SEO data file contains no direct observation on the annual number of hours worked by individuals. There is, however, an observation on total 1966 gross wage earnings for each individual, which, given the proximity of the SEO interviews (March, 1967) to the federal income tax payment deadline (April 15), will be reasonably accurate for most persons. One strategy for estimating 1966 hours is to compute the quotient of 1966 wage earnings and an estimate of the gross 1966 hourly nominal wage rate.

One estimate of the gross 1966 hourly nominal wage rate exists in the form of w_a in equation A-I.1. To the extent that w_a is an imperfect measure of the true 1966 wage rate, however, its use for the construction of an hours worked estimate is

inappropriate when the labor supply wage regressor is also constructed from w_a : When w_a overestimates, the true wage hours worked will be underestimated and vice versa. A spurious negative relationship between hours worked and wages is the result, the seriousness of which depends on the degree of inaccuracy of w_a .

To avoid this problem, a separate estimate of the 1966 hourly wage was computed for the purpose of estimating hours worked: Wages (when present) were regressed on all of the personal characteristics mentioned in the previous discussion on wage imputation, plus two additional categories relating to occupation and job stability.

The results of these regressions (which are summarized in Appendix II) were used to impute a wage to each individual in the sample. Hours worked estimates were then computed as the quotient of 1966 wage earnings and this imputed wage. These estimates appear seriously imprecise, owing to the large unexplained variances in the wage regressions, but the deviations have the important property of being statistically unrelated to any measurement errors which are present in the wage regression (at least in the case of individuals for whom the SEO wage observation is present).

B. Labor Supply

As mentioned in the introductory section, labor supply (H^*) is defined as hours actually worked plus an adjustment, whenever appropriate, for hours of work sought but not realized. Some of the most important procedures for adjusting hours worked estimates to reflect labor market disequilibrium are as follows:

1. Full Time Workers With One Period of Unemployment. The case of an individual who worked full time except for a two month period of unemployment during the sample year would, for example, be treated first by assuming that the rate at which the individual worked during the employed period was one with which

he was satisfied (in the sense that he desired neither to increase nor decrease his workload). It would then be assumed that he sought this same level of employment during his period of unemployment. The procedure for computing the supply variable for this individual would then consist simply of augmenting the estimate of his actual hours of work by a factor of 1/6. The step most open to question in this adjustment procedure appears to be the assumption that the rate of work during the employed period is one which accords with the worker's preferences. The procedure would be misleading, for example, if the individual actually wanted to be working part time instead of full time during his employed period. Unfortunately, the data do not appear to allow for any test of this assumption, but there are a priori considerations which do suggest that full time workers tend not to be among those groups of the population likely to exhibit a preference for part time work.

Wives, students, the elderly, and the infirm comprise the great majority of individuals in the labor force with a preference for less than full time work; moreover, members of each of these groups face serious obstacles to accepting full time work in the event that their preference for part time work cannot be fulfilled; because of family, health, school and other constraints, people in these groups generally must choose between part time work and no work at all. Thus the assumption that individuals observed working full time are not working significantly more than they wish to work may not seriously distort the supply measure sought here.

ii. Part Time Workers. On the question of whether part time workers are working at a level with which they are satisfied, the SE0 interview data facilitate a relatively precise evaluation procedure. Part time workers interviewed were asked the reason for working part time and their responses were categorized as follows:

1. Slack work: for full time workers, hours were reduced because of slowdowns in employer's production schedule.
2. Searched for full time work but could find only part time work.
3. Illness or disability.
4. Going to school or keeping house.
5. Did not want full time work.
6. Other.

Individuals whose responses fell in any of the last four categories would be assigned a supply response equal to an estimate of their hours worked during the survey period. For a worker whose response falls in either of the first two categories, however, a supply response is assigned in the following manner: An average is calculated for hours worked during periods of employment by non-part time workers in the same personal characteristics category as the part time worker in question. This average is translated into a rate of hours offered per unit of time which is then used to calculate an imputed annual supply offer for the part time worker. For example, the dissatisfied part time worker who is male, black, aged 25 - 34, and married would be assigned a supply response estimated from the average supply rate calculated for full time workers in the same sample with the same personal characteristics.

iii. Full Time Workers With No Unemployment. The simplest case of all is that of the full time worker with no periods of unemployment during the sample year. Here the supply response is simply the estimate of annual hours worked computed, as before, by the procedure described in section A.I.A. above.

When performing adjustment procedures of the kinds described in the preceding three subsections, one of the most disturbing possibilities of error is that those individuals who are neither working nor seeking work may respond to the surveyor's

questions by characterizing themselves as being unemployed. For such individuals the adjustment procedures result in an over-estimate of labor supplied. No attempt is made to compensate for this difficulty in the case of the three groups described above. However, for many members of the following group for whom the problem of over-estimates may be quantitatively very important, a slightly different procedure is explored.

iv. Workers With More Than One Period of Unemployment.

Much of the recent theoretical and empirical research into the functioning of low wage labor markets points to the fact that chronic job turnover appears to be an established pattern for many individuals. The behavior pattern of this group, labelled secondary workers or participants in the Secondary Labor Market, is explained as a rational response to a basically unfavorable set of economic circumstances. Though secondary workers might display more stable employment patterns if their labor market opportunities were to improve, it is largely inappropriate, given the current nature of the labor market opportunities they face, to interpret secondary workers' frequent spells of joblessness as representing involuntary unemployment. Yet it is precisely the fact that employment surveys have repeatedly recorded multiple spells of unemployment for large numbers of low wage workers which has supplied the empirical impetus for the development of the dual labor market theory. The following supply adjustment procedure attempts to take into account the likelihood that much of the recorded unemployment of secondary workers is properly interpreted as voluntary joblessness.

The first step in the adjustment procedure is to identify which individuals in the sample are to be considered secondary workers. The Dual Labor Market Theory holds that jobs in the U.S. economy tend to dichotomize along the following two dimensions: stability of employment and working conditions. Loosely speaking, unstable jobs with unattractive

working conditions are manned by secondary workers, other jobs being manned by the group termed primary workers. Using the wage level as an index of working conditions and frequency of unemployment as an indicator of employment stability, an individual in the sample is classified as a secondary worker if his wage is in the lower half of the wage distribution in his labor market area and if he has experienced two or more periods of unemployment during the sample year. Labor supply for these individuals is then reckoned as hours worked plus one half of the nominal total of hours sought while unemployed, computed as for other individuals in the sample. The factor one-half by which nominal-hours-sought-while-unemployed is discounted for secondary workers is purely arbitrary. Recognizing the rather tentative nature of this supply adjustment procedure, an alternative set of results was calculated for which the labor supply of secondary workers was computed exactly as for all other individuals in the sample. Because a maximum of only 6% of any supply group was affected by the discounting procedure, the results were virtually unaffected, and are not reported.

C. Permanent Wages

An estimate of the permanent wage, which is used below in the calculation of potential permanent income is calculated in the same manner as the Hall-Boskin imputed wage regressor described in Section A.II.A.

D. Potential Permanent Income

For a family in which there are N adults, potential permanent income per family adult, denoted as Y_p in the labor supply equation III.B.10., is calculated according to the following algorithm:

$$A-I.2. \quad Y_p = \frac{\sum_{i=1}^N (k_i w_{p_i} + y_{n_i})}{N}$$

where,

k_i = the maximum amount of time which the i^{th} adult has available for work

w_{p_i} = after tax, price deflated wage of the i^{th} family adult

y_{n_i} = after tax, price deflated non-wage income of the i^{th} family adult.

In most instances k_i is taken to be 2000. For some individuals, such as students and those with health disabilities, smaller values of k_i are assigned. y_{n_i} is calculated from the SEO as the sum of rental, dividend, and net interest income, an imputation to the ownership of durables and land and including federal income tax related adjustment. A possible difficulty with the non-wage income component of y_p is that, unlike the labor income component, it was not constructed in such a way as to eliminate transitory variations. Transitory variations in non-wage income are undoubtedly concentrated in the interest component of business and farm income. Because I have followed Hall's procedure of excluding families with large amounts of income from such sources this difficulty is probably not serious. The procedures for calculating k_i and y_{n_i} are exactly the same as those used by Hall and Boskin, a more complete description of the details of which appears in Hall [1972], chapters 3 and 4.

E. Transitory Income

For individuals living in families, negative transitory income is estimated as the amount of current labor income lost per family adult because of involuntary unemployment of other members of the family. Labor income lost due to unemployment is calculated as the product of the after tax, price deflated wage

estimate and the estimate of the number of hours of work sought but not realized. Ideally, one would also wish to include a measure of negative transitory non-wage income as well; unfortunately, however, the SEO data do not easily lend themselves to such a calculation.

F. Job Search Conditions

Serious limitations in the quantity and quality of unemployment related entries in the SEO data file stand in the way of a truly adequate assessment of job search conditions in 1966. Of all persons in the overall labor supply sample only 8.8% were recorded as having at least one job hunting stretch in 1966. The responses concerning the lengths and frequencies of these job hunting stretches must be treated with considerable caution. With these reservations in mind, the following procedure was employed.

For individuals in each of four race-sex groups who looked for work in 1966, the average duration per spell of unemployment was regressed against the following characteristics: SMSA, occupation, wage, age, education, union status, and poverty/non-poverty status of neighborhood. The assumption implicit in this procedure that occupation, age, etc., have the same impact on search conditions in each of twelve geographically distinct labor markets is very seriously open to question. The much preferred procedure of estimating a separate detailed regression for each SMSA was unfortunately precluded by insufficient numbers of observations.

Using the results of these regressions (which are summarized below in Appendix III) an expected length of job search was imputed for each individual in much the same manner employed in the wage imputation described in A.I.A. above.

G. Education

Educational attainment was measured in relative terms for each of several age groups. Individuals were assigned one of three values on the basis of whether they were in the bottom, middle or top third of educational attainment within their particular age group.

APPENDIX II

Wage Imputations for Hours Worked Estimation

TABLE A-II-1

Left Hand Variable: Logarithm of March 1967 Hourly Wage Rate

Characteristic	Sex-Race Group			
	Male		Female	
	White	Black	White	Black
Constant	1.219 (.029)	.953 (.033)	.704 (.147)	.778 (.072)
Age				
14 - 15	-.989 (.094)	-.624 (.114)	-.080 (.136)	.266 (.326)
16 - 17	-.653 (.059)	-.455 (.068)	-.115 (.101)	-.264 (.073)
18 - 19	-.419 (.049)	-.283 (.045)	-.310 (.058)	-.228 (.047)
20 - 24	-.206 (.031)	-.062 (.030)	-.095 (.043)	-.081 (.030)
25 - 34	.000 -	.000 -	.000 -	.000 -
35 - 44	.101 (.023)	.081 (.022)	.010 (.040)	.029 (.024)
45 - 54	.138 (.023)	.076 (.024)	.042 (.039)	.025 (.026)
55 - 64	.104 (.027)	.000 (.030)	.029 (.045)	-.042 (.033)

TABLE A-II-1, Cont.

Characteristic	Sex-Race Group			
	Male		Female	
	White	Black	White	Black
Education				
0 - 3	.318 (.060)	-.155 (.043)	-.059 (.117)	-.136 (.061)
4 - 6	-.174 (.040)	-.131 (.030)	-.210 (.075)	-.087 (.038)
7 - 9	-.150 (.024)	-.099 (.023)	-.137 (.042)	-.157 (.026)
10 - 11	-.056 (.026)	-.077 (.024)	-.070 (.041)	-.117 (.025)
12 -	.000 -	.000 -	.000 -	.000 -
13 - 14	.067 (.028)	.119 (.032)	.095 (.043)	.095 (.031)
15 -	.108 (.050)	.177 (.067)	.073 (.079)	.060 (.080)
16 -	.299 (.033)	.179 (.053)	.255 (.056)	.255 (.055)
17 - 20	.225 (.037)	.381 (.723)	.338 (.070)	.391 (.066)

TABLE A-II-1, Cont.

SMSA	Sex-Race Group			
	Male		Female	
	White	Black	White	Black
Baltimore	-.103 (.046)	-.063 (.032)	.007 (.075)	-.170 (.032)
Chicago	-.045 (.028)	.040 (.030)	.025 (.042)	.039 (.031)
Cleveland	-.161 (.044)	-.044 (.043)	-.105 (.080)	-.008 (.048)
Detroit	.083 (.033)	.118 (.032)	.029 (.053)	.009 (.034)
Houston	.031 (.049)	-.241 (.036)	-.136 (.076)	-.311 (.037)
Los Angeles	.022 (.023)	.125 (.031)	.094 (.036)	.079 (.032)
New York	.000 -	.000 -	.000 -	.000 -
Philadelphia	-.033 (.031)	.013 (.035)	.020 (.063)	.028 (.045)
Pittsburgh	.048 (.041)	.023 (.067)	.014 (.070)	.158 (.054)
St. Louis	.016 (.046)	-.084 (.045)	.140 (.051)	-.010 (.041)
San Francisco	.099 (.031)	.166 (.037)	.090 (.048)	.033 (.032)
Washington, D.C.	.052 (.039)	.026 (.030)	-.044 (.078)	.018 (.036)

TABLE A-II-1, Cont.

Characteristic	Sex-Race Group			
	Male		Female	
	White	Black	White	Black
Residence at age 16 United States	.000 -	.000 -	.000 -	.000 -
Foreign	-.123 (.028)	-.013 (.075)	-.038 (.045)	.040
Union membership Non-member	.000 -	.000 -	.000 -	.000 -
Member	.101 (.019)	.137 (.018)	.142 (.037)	.013 (.025)
Health No effect on work	.000 -	.000 -	.000 -	.000 -
Some effect	-.123 (.031)	-.100 (.032)	-.052 (.051)	-.051 (.032)
Job stability Steadily employed	.000 -	.000 -	.000 -	.000 -
Unemployed once	-.066 (.036)	-.057 (.031)	-.054 (.049)	-.052 (.033)
Unemployed twice	-.061 (.069)	-.004 (.051)	-.182 (.119)	-.104 (.063)
Unemployed three or more times	-.044 (.050)	-.058 (.042)	.147 (.095)	-.095 (.048)

TABLE A-II-1, Cont.

Characteristic	Sex-Race Group			
	Male		Female	
	White	Black	White	Black
Occupation: Professional and technical	.074 (.031)	.093 (.047)	.153 (.148)	.270 (.080)
Managers, Officials, and Proprietors	.111 (.031)	-.032 (.057)	.237 (.152)	.060 (.120)
Clerical workers	-.136 (.030)	-.039 (.031)	.142 (.143)	.038 (.071)
Sales workers	-.064 (.036)	-.216 (.066)	-.086 (.149)	-.263 (.091)
Craftsmen and foreman	.000 -	.000 -	.000 -	.000 -
Operatives	-.163 (.024)	-.070 (.024)	-.008 (.144)	-.098 (.071)
Private household workers	-.487 (.024)	-.258 (.348)	-.483 (.159)	-.397 (.072)
Service workers	-.261 (.032)	-.241 (.028)	-.152 (.145)	-.171 (.070)
Farm laborers	-.296 (.114)	-.074 (.156)	-	-
Laborers	-.192 (.040)	-.074 (.028)	.179 (.317)	.039 (.151)
Number of observa- tions:	2906	1973	1657	1585
Standard error: (hours per year)	.412	.343	.482	.324
SS Residuals:	486.9	227.2	374.6	161.9

APPENDIX III

Expected Search Time Imputation

TABLE A-III-1

Left Hand Variable:
Average Duration per Spell of Unemployment

	Sex-Race Group			
	Male		Female	
	White	Black	White	Black
Constant	7.86 (1.60)	11.21 (1.98)	7.99 (1.34)	8.98 (1.82)
SMSA Baltimore	-.37 (2.25)	-1.53 (1.71)	3.79 (3.14)	-.01 (2.52)
Chicago	-4.20 (1.50)	-2.29 (1.84)	-.70 (1.94)	-1.08 (2.05)
Cleveland	-3.48 (2.47)	.42 (2.32)	4.37 (3.73)	-.59 (2.85)
Detroit	-2.43 (1.56)	-.47 (1.55)	2.43 (2.57)	2.74 (1.98)
Houston	-4.11 (2.66)	-1.91 (1.96)	-5.64 (2.70)	-2.87 (2.62)
Los Angeles	.62 (.99)	.79 (1.50)	1.53 (1.34)	-.22 (1.77)
New York	.000 -	.000 -	.000 -	.000 -
Philadelphia	-1.16 (1.64)	-.10 (1.80)	3.80 (2.36)	3.13 (2.07)
Pittsburgh	-.10 (1.68)	4.24 (4.23)	-.22 (2.80)	6.12 (4.71)
St. Louis	-.42 (2.01)	2.23 (2.17)	.01 (3.44)	4.72 (2.40)
San Francisco	-.42 (1.06)	4.28 (1.79)	.01 (1.46)	4.72 (2.44)
Washington, D.C.	-.36 (2.53)	-1.96 (1.64)	-2.50 (4.77)	.817 (2.05)

TABLE A-III-1, Cont.

	Sex-Race Group			
	Male		Female	
	White	Black	White	Black
WAGE				
Lower 1/3 of SMSA wage distribution	- .86 (1.05)	-1.58 (1.19)	-2.26 (1.38)	-2.04 (1.27)
Middle 1/3	.000 -	.000 -	.000 -	.000 -
Upper 1/3	- .86 (.88)	-2.74 (1.07)	- .61 (1.40)	.59 (2.53)
AGE				
16 - 24 (unmarried only)	.77 (1.13)	-1.72 (1.30)	-2.50 (1.30)	.82 (1.37)
25 - 59 (unmarried)	.000	.000	.000	.000
16 - 59 (married)	-	-	-	-
60+	6.54 (1.44)	.80 (2.14)	.24 (2.06)	1.63 (2.87)
EDUCATION				
Lower 1/3 of own age group	2.43 (.92)	- .07 (1.07)	- .22 (1.32)	1.10 (1.29)
Middle 1/3	.000 -	.000 -	.000 -	.000 -
Upper 1/3	.40 (1.26)	.44 (1.95)	- .49 (1.65)	-2.49 (2.20)
UNION MEMBERSHIP				
Member	- .58 (.78)	-1.21 (.96)	-1.48 (1.27)	-3.16 (1.49)
Non-member	.000 -	.000 -	.000 -	.000 -
POVERTY AREA				
Resident	.06 (.89)	1.30 (.87)	1.78 (1.34)	.52 (1.04)
Non-resident	.000 -	.000 -	.000 -	.000 -
Number of observations	449	545	292	422
Sum of squared residuals	2.069×10^4	4.209×10^4	1.606×10^4	3.912×10^4
Standard error of the regression	7.02	9.03	7.82	9.98

TABLE A-III-1, Cont.

	Sex-Race Group			
	Male		Female	
	White	Black	White	Black
Occupation:				
Professional and Technical	- .48 (1.87)	2.77 (3.28)	-2.00 (1.99)	-1.77 (2.95)
Managers, Officials proprietors	-1.15 (2.08)	2.68 (4.43)	- .33 (3.41)	-4.53 (10.20)
Clerical workers	.000 -	.000 -	.000 -	.000 -
Sales workers	- .62 (2.05)	3.24 (3.59)	.06 (2.82)	3.32 (2.81)
Craftsmen and foremen	-1.48 (1.41)	-1.24 (1.93)	-3.41 (4.06)	.28 (4.65)
Operatives	- .20 (1.35)	-1.18 (1.71)	1.68 (1.45)	3.24 (1.64)
Private house- hold workers	-5.89 (7.18)	-2.35 (6.66)	7.29 (3.18)	-2.90 (2.04)
Service workers	1.18 (1.56)	-2.18 (1.72)	-1.94 (1.69)	1.73 (1.51)
Laborers	- .57 (1.53)	.30 (1.72)	-1.79 (8.14)	-2.73 (7.22)
Unclassified	- .67 (2.38)	4.56 (3.23)	-.811 (8.10)	6.19 (3.73)

APPENDIX IV

Labor Supply Regressions

Table A- IV.- 1: White Husbands

Left hand variable: $\frac{\text{Earnings}}{.96w_{\text{imputed}}} + \text{Unemployment} = **$

Constant	518 (258)	Age: 16-59 60+	1709 (288)
			0

Current Wage

Age	0 \$1.49	1.50 1.74	1.75 1.99	2.00 2.49	2.50 2.99	3.00 3.49	3.50 up
16-59	-586 (148)	-409 (151)	-267 (121)	0	149 (85)	239 (102)	1082 (93)
60+	1171 (258)	186 (249)	140 (168)	0	955 (181)	794 (250)	2706 (208)

Potential Permanent Income

Age	0 \$2999	3000 3499	3500 3999	4000 4999	5000 5999	6000 up
16-59	17 (211)	-56 (173)	0	-14 (117)	95 (148)	193 (155)
60+	205 (348)	0 (383)	0	185 (261)	276 (273)	174 (280)

Transitory Income

Age	Y_P	0	0-\$100	\$100-up
16-59	$0 - Y_{P_3}$	0	-65 (207)	-10 (188)
16-59	$Y_{P_3} +$	0	-218 (244)	-142 (199)
60+	$0 - Y_{P_3}$	0	-153 (724)	1517 (539)
60+	$Y_{P_3} +$	0	840 (806)	-113 (428)

A-IV-1: cont.

Expected Search Time (weeks)

Age	Y_P	0-4	4-6	6-8	8-10	10-12	12+
16-59	$0-Y_{P_3}$	327 (172)	245 (135)	0	207 (135)	127 (189)	--
16-59	$Y_{P_3} +$	261 (100)	116 (89)	0	524 (127)	427 (284)	--
60+	$0-Y_{P_3}$	--	--	0	129 (462)	-154 (355)	--
60+	$Y_{P_3} +$	--	--	0	668 (223)	-391 (191)	--

Number of Adults

Y_P	2	3 or more
$0-Y_{P_3}$	0	0 (98)
$Y_{P_3} +$	0	134 (86)

Education

Y_P	Bottom 1/3	Middle	Top
$0-Y_{P_3}$	97 (109)	0	-136 (155)
$Y_{P_3} +$	123 (96)	0	-240 (79)

Children

Y_P	None	Preschool & School	School only
$0-Y_{P_3}$	0	240 (112)	147 (122)
$Y_{P_3} - up$	0	20 (81)	130 (91)

Poverty Area	-125 (87)
Non Poverty	0

Number of observations: 2913

Standard error: 1381 hours per year

R^2 : .2549

SS Residuals: .54578 x 10¹⁰

Standard Errors in Parentheses

Table A- IV- 2: Black Husbands

Left hand variable: $\frac{\text{Earnings}}{.96w_{\text{imputed}}} + \text{Unemployment} = H^{**}$

Constant	2712 (251)	Age: 16-59	-440 (260)
			60+ 0

Current Wage

Age	0 \$1.49	1.50 1.74	1.75 1.99	2.00 2.49	2.50 2.99	3.00 3.49	3.50 up
16-59	-344 (680)	-201 (66)	-4 (59)	0	246 (63)	577 (99)	560 (101)
60+	-686 (164)	-576 (158)	-619 (150)	0	-72 (320)	1280 (424)	1720 (498)

Potential Permanent Income

Age	0 \$2999	3000 3499	3500 3999	4000 4999	5000 5999	6000 up
16-59	99 (122)	192 (118)	0	40 (55)	73 (82)	201 (127)
60+	-519 (250)	-490 (284)	0	-145 (154)	-172 (231)	-589 (274)

Transitory Income

Age	Y_P	0	0-\$100	\$100-up
16-59	$0 - Y_{P_3}$	0	94 (146)	-155 (117)
16-59	$Y_{P_3} +$	0	137 (120)	-61 (82)
60+	$0 - Y_{P_3}$	0	-345 (576)	163 (375)
60+	$Y_{P_3} +$	0	-659 (342)	-41 (351)

A-IV-2: cont.

Expected Search Time (weeks)

Age	Y_P	0-4	4-6	6-8	8-10	10-12	12 +
16-59	$0-Y_{P_3}$	63 (463)	-233 (156)	0	-164 (94)	-144 (106)	-275 (118)
16-59	$Y_{P_3} +$	159 (234)	-65 (100)	0	-85 (67)	-213 (72)	-462 (80)
60+	$0-Y_{P_3}$	--	347 (907)	0	238 (277)	-199 (258)	-1426 (226)
60+	$Y_{P_3} +$	--	-391 (598)	0	-445 (296)	-396 (263)	-1817 (233)

Number of Adults

Y_P	2	3 or more
$0-Y_{P_3}$	0	104 (70)
$Y_{P_3} +$	0	76 (58)

Education

Y_P	Bottom 1/3	Middle	Top
$0-Y_{P_3}$	40 (73)	0	-317 (185)
$Y_{P_3} +$	60 (50)	0	-102 (74)

Children

Y_P	None	Preschool & School	School only
$0-Y_{P_3}$	0	-48 (78)	175 (89)
$Y_{P_3} - \text{up}$	0	125 (52)	207 (65)

Poverty Area	-51 (39)
Non Poverty	0

Number of observations: 1885

Standard error: 783 hours per year

R^2 : .4110

SS Residuals: .11169 x 10¹⁰

Table A-IV -3: White Wives

Left hand variable: $\frac{\text{Earnings}}{.96w_{\text{imputed}}} + \text{Unemployment} = H^{**}$

Constant	1356 (263)	Age: 16-59 60+	642 (273)
			0

Current Wage

Age	0 \$1.49	1.50 1.74	1.75 1.99	2.00 2.49	2.50 2.99	3.00 3.49	3.50 up
16-59	-922 (62)	-903 (59)	-677 (59)	0	357 (100)	942 (173)	1201 (139)
60+	-1099 (195)	-98 (208)	-877 (233)	0	230 (323)	-170 (497)	--

Potential Permanent Income

Age	0 \$2999	3000 3499	3500 3999	4000 4999	5000 5999	6000 up
16-59	59 (104)	158 (90)	0	-77 (65)	-238 (80)	-490 (83)
60+	328 (228)	-120 (268)	0	19 (197)	-41 (215)	-99 (216)

Transitory Income

Age	Y_P	0	0-\$100	\$100-up
16-59	$0 - Y_{P3}$	0	-148 (122)	-53 (76)
16-59	$Y_{P3} +$	0	-153 (175)	-218 (482)
60+	$0 - Y_{P3}$	0	-265 (838)	-73 (272)
60+	$Y_{P3} +$	0	49 (82)	271 (110)

A-IV-3: cont.

Expected Search Time (weeks)

Age	Y_P	0-4	4-6	6-8	8-10	10-12	12+
16-59	$0-Y_{P_3}$	271 (109)	148 (86)	0	99 (69)	135 (86)	432 (133)
16-59	$Y_{P_3} +$	203 (82)	108 (60)	0	25 (50)	113 (64)	415 (161)
60+	$0-Y_{P_3}$	461 (415)	-41 (168)	0	104 (243)	-274 (59)	1142 (391)
60+	$Y_{P_3} +$	36 (202)	41 (121)	0	7 (130)	371 (179)	742 (572)

Number of Adults

Y_P	2	3 or more
$0-Y_{P_3}$	0	-94 (53)
$Y_{P_3} +$	0	-210 (48)

Education

Y_P	Bottom 1/3	Middle	Top
$0-Y_{P_3}$	-111 (57)	0	-339 (88)
$Y_{P_3} +$	-102 (50)	0	-303 (50)

Children

Y_P	None	Preschool & School	School only
$0-Y_{P_3}$	0	-699 (62)	-469 (71)
$Y_{P_3} -up$	0	-659 (44)	-410 (50)

Poverty Area	-85 (54)
Non Poverty	0

Number of observations: 2898

Standard error: 796 hours per year

R^2 : .3247

SS Residuals: .17993 x 10¹⁰

Table A- IV -4: Black Wives

Left hand variable: $\frac{\text{Earnings}}{.96w_{\text{imputed}}} + \text{Unemployment} = H^{**}$

Constant	1972 (476)	Age: 16-59 60+	590 (484)
			0

Current Wage

Age	0 \$1.49	1.50 1.74	1.75 1.99	2.00 2.49	2.50 2.99	3.00 3.49	3.50 up
16-59	-1118 (85)	-879 (90)	-665 (101)	0	-33 (141)	204 (205)	95 (207)
60+	-645 (411)	-29 (477)	-32 (578)	0	70 (724)	--	--

Potential Permanent Income

Age	0 \$2999	3000 3499	3500 3999	4000 4999	5000 5999	6000 up
16-59	-83 (138)	-56 (133)	0	-88 (55)	-325 (85)	-433 (129)
60+	-77 (400)	17 (43)	0	28 (208)	-558 (328)	-422 (388)

Transitory Income

Age	Y_P	0	0-\$100	\$100-up
16-59	$0 - Y_{P3}$	0	-21 (146)	43 (98)
16-59	$Y_{P3} +$	0	-35 (141)	15 (69)
60+	$0 - Y_{P3}$	0	317 (525)	87 (302)
60+	$Y_{P3} +$	0	34 (577)	0 (442)

A-IV-4: cont.

Expected Search Time (weeks)

Age	Y_P	0-4	4-6	6-8	8-10	10-12	12+
16-59	$0-Y_{P_3}$	141 (188)	-74 (140)	0	269 (136)	11 (123)	-690 (104)
16-59	$Y_{P_3} +$	242 (169)	-3 (108)	0	171 (96)	132 (95)	-864 (83)
60+	$0-Y_{P_3}$	281 (850)	115 (556)	0	-318 (439)	-787 (702)	-1053 (335)
60+	$Y_{P_3} +$	--	-897 (586)	0	65 (504)	610 (453)	-1223 (326)

Number of Adults

Y_P	2	3 or more
$0-Y_{P_3}$	0	-50 (72)
$Y_{P_3} +$	0	27 (60)

Education

Y_P	Bottom 1/3	Middle	Top
$0-Y_{P_3}$	-23 (74)	0	-200 (169)
$Y_{P_3} +$	0 (55)	0	-302 (83)

Children

Y_P	None	Preschool & School	School only
$0-Y_{P_3}$	0	-430 (79)	37 (91)
$Y_{P_3} - \text{up}$	0	-353 (54)	-123 (67)

Poverty Area	-42 (39)
Non Poverty	0

Number of observations: 1783

Standard error: 787 hours per year

R^2 : .4152

SS Residuals: .10671 x 10¹⁰

Table A- IV - 5: White Female Household Heads

Left hand variable: $\frac{\text{Earnings}}{.96w_{\text{imputed}}} + \text{Unemployment} = H^{**}$

Constant	1680 (250)	Age: 25-59 60+	0
			-746 (346)

Current Wage

Age	0 \$1.49	1.50 2.00	2.00 3.00	3.00 up
25-59	-646 (181)	-707 (142)	0	1408 (220)
60 +	-369 (296)	-121 (287)	0	2497 (784)

Potential Permanent Income

Age	0 \$2999	3000 3999	4000 5000	5000 up
25-59	369 (220)	0	375 (202)	203 (203)
60 +	871 (350)	0	-106 (286)	-47 (250)

Transitory Income

Age	Y_P	0	0-\$100	\$100- u_T
25-59	$0-Y_{P3}$	0	-770 (387)	68 (339)
25-59	$Y_{P3} +$	0	228 (248)	267 (341)
60 +	$0-Y_{P3}$	0	—	773 (471)
60 +	$Y_{P3} +$	0	—	863 (752)

Expected Search Time (Weeks)

Age	Y_P	0-5.9	6-9.9	10 +
25-59	$0-Y_{P_3}$	152 (217)	0	6 (745)
25-59	$Y_{P_3} +$	57 (147)	0	530 (313)
60 +	$0-Y_{P_3}$	-253 (302)	0	-985 (767)
60 +	$Y_{P_3} +$	-220 (194)	0	-248 (550)

Number of Adults

Y_P	2	3 or more
$0-Y_{P_3}$	0	-10 (250)
$Y_{P_3} +$	0	257 (165)

Education

Y_P	Bottom 1/3	Middle	Top
$0-Y_{P_3}$	-203 (177)	0	-488 (349)
$Y_{P_3} +$	-64 (125)	0	-30 (138)

Children

Y_P	none	Preschool & School	School only
$0-Y_{P_3}$	0	-83 (239)	273 (242)
$Y_{P_3} -$	0	-668 (198)	-418 (151)

Poverty Area	161 (125)
Non Poverty	0

Number of observations: 291

Standard error: 716 hours per year

 R^2 : .5424SS Residuals: $.12724 \times 10^9$

Table A- IV - 6: Black Female Heads

Left hand variable: $\frac{\text{Earnings}}{.96w_{\text{imputed}}} + \text{Unemployment} = P^{**}$

Constant	2351 (197)	Age: 25-59 60+	0
			-2365 (894)

Current Wage

Age	0	1.50	2.00	3.00
	\$1.49	2.00	3.00	up
25-59	-743 (135)	-593 (139)	0	47 (257)
60 +	550 (863)	1046 (913)	0	3659 (1239)

Potential Permanent Income

Age	0	3000	4000	5000
	\$2999	3999	5000	up
25-59	-234 (145)	0	-179 (114)	-578 (149)
60 +	20 (289)	0	-36 (285)	-263 (550)

Transitory Income

Age	Y_P	0	0-\$100	\$100-up
25-59	$0-Y_{P_3}$	0	62 (275)	335 (280)
25-59	$Y_{P_3} +$	0	146 (257)	189 (159)
60 +	$0-Y_{P_3}$	0	—	-294 (490)
60 +	$Y_{P_3} +$	0	—	446 (460)

A-IV - 6: cont'd

Expected Search Time (Weeks)

Age	Y_P	0-5.9	6-9.9	10 +
25-59	$0-Y_{P_3}$	220 (216)	0	-165 (234)
25-59	$Y_{P_3} +$	97 (176)	0	28 (118)
60 +	$0-Y_{P_3}$	-353 (587)	0	147 (351)
60 +	$Y_{P_3} +$	—	0	-104 (450)

Number of Adults

Y_P	2	3 or more
$0-Y_{P_3}$	0	-125 (178)
$Y_{P_3} +$	0	129 (109)

Education

Y_P	Bottom 1/3	Middle	Top
$0-Y_{P_3}$	-146 (150)	0	-44 (365)
$Y_{P_3} +$	-20 (99)	0	-197 (149)

Children

Y_P	none	Preschool & School	School only
$0-Y_{P_3}$	0	-371 (179)	-145 (187)
$Y_{P_3} - up$	0	-355 (116)	-117 (118)

Poverty Area	-68 (76)
Non Poverty	0

Number of observations: 430
 Standard error: 732 hours per year
 R^2 : .3032
 SS Residuals: .20983 x 10⁹

Table A- IV - 7: White Unmarried Male Relatives

Left hand variable: $\frac{\text{Earnings}}{.96w_{\text{imputed}}} + \text{Unemployment} = H^{**}$

Constant	2158 (308)	Age: 25-59	0
			-2207 (581)

Current Wage

Age	0 \$1.49	1.50 2.00	2.00 3.00	3.00 up
25-59	-1248 (256)	-252 (190)	0	-429 (209)
60 +	245 (596)	--	0	-41 (428)

Potential Permanent Income

Age	0 \$2999	3000 3999	4000 5000	5000 up
25-59	51 (781)	0	-320 (262)	-619 (308)
660 +	126 (598)	0	211 (538)	464 (545)

Transitory Income

Age	Y_P	0	0-\$100	\$100-up
25-59	$0-Y_{P3}$	0	185 (423)	-146 (300)
25-59	$Y_{P3} +$	0	-5 (742)	-250 (283)
60 +	$0-Y_{P3}$	0	--	-138 (874)
60 +	$Y_{P3} +$	0	-188 (851)	-128 (501)

A-IV-7: cont'd

Expected Search Time (weeks)

Age	Y_P	0-5.9	6-9.9	10 +
25-59	$0-Y_{P_3}$	297 (370)	0	209 (299)
25-59	$Y_{P_3} +$	68 (187)	0	62 (207)
60 +	$0-Y_{P_3}$	-72 (624)	0	168 (489)
60 +	$Y_{P_3} +$	-63 (313)	0	-243 (464)

Education

Poverty Area	-121 (173)
Non Poverty	0

Y_P	Bottom 1/3	Middle	Top
$0-Y_{P_3}$	-113 (222)	0	121 (1034)
$Y_{P_3} +$	-68 (164)	0	-410 (193)

Number of observations: 177

Standard Error: 725 hours per year

R^2 : .5319

SS Residuals: .74645 x 10⁸

Table A- IV - 8: Black Unmarried Male Relatives

Left hand variable: $\frac{\text{Earnings}}{.96w_{\text{imputed}}} + \text{Unemployment} = H^{**}$

Constant	1221 (285)	Age: 25-59 60+	0
			-1465 (622)

Current Wage

Age	0 \$1.49	1.50 2.00	2.00 3.00	3.00 up
25-59	-293 (237)	-174 (181)	0	132 (389)
60 +	-200 (883)	107 (516)	0	—

Potential Permanent Income

Age	0 \$2999	3000 3999	4000 5000	5000 up
25-59	-49 (262)	0	514 (166)	-46 (226)
60 +	54 (572)	0	1121 (491)	147 (535)

Transitory Income

Age	Y_P	0	0-\$100	\$100-up
25-59	$0-Y_{P_3}$	0	102 (615)	830 (461)
25-59	$Y_{P_3} +$	0	-413 (276)	46 (214)
60 +	$0-Y_{P_3}$	0	-275 (877)	1246 (838)
60 +	$Y_{P_3} +$	0	-362 (379)	-64 (327)

A- IV - 8: cont'd

Expected Search Time (weeks)

Age	Y_P	0-5.9	6-9.9	10 +
25-59	$0-Y_{P_3}$	-362 (379)	0	-64 (327)
25-59	$Y_{P_3} +$	-58 (250)	0	137 (181)
60 +	$0-Y_{P_3}$	-551 (746)	0	1114 (738)
60 +	$Y_{P_3} +$	-1006 (832)	0	246 (445)

Education

Poverty Area	-65 (140)
Non Poverty	0

Y_P	Bottom 1/3	Middle	Top
$0-Y_{P_3}$	98 (262)	0	-1656 (510)
$Y_{P_3} +$	9 (155)	0	-420 (251)

Number of observations: 171

Standard Error: 749 hours per year

R^2 : .3745

SS Residuals: .76981 x 10⁸

Table A-IV - 9: White Unmarried Female Relatives

Left hand variable: $\frac{\text{Earnings}}{.96w_{\text{imputed}}} + \text{Unemployment} = H^{**}$

Constant	2089 (201)	Age: 25-59	0
		60+	-1454 (304)

Current Wage

Age	0 \$1.49	1.50 2.00	2.00 3.00	3.00 up
25-59	-709 (185)	-469 (127)	0	1215 (258)
60 +	-369 (209)	-292 (210)	0	—

Potential Permanent Income

Age	0 \$2999	3000 3999	4000 5000	5000 up
25-59	-213 (278)	0	-642 (205)	-603 (208)
60 +	-98 (231)	0	-109 (193)	-239 (200)

Transitory Income

Age	Y_P	0	0-\$100	\$100-up
25-59	$0-Y_{P_3}$	0	85 (441)	-189 (329)
25-59	$Y_{P_3} +$	0	—	49 (358)
60 +	$0-Y_{P_3}$	0	-41 (620)	-126 (315)
60 +	$Y_{P_3} +$	0	-369 (616)	-37 (193)

Expected Search Time (weeks)

Age	Y_P	0-5.9	6-9.9	10 +
25-59	$0-Y_{P_3}$	-235 (213)	0	—
25-59	$Y_{P_3} +$	293 (134)	0	-102 (224)
60 +	$0-Y_{P_3}$	-105 (180)	0	-75 (368)
60 +	$Y_{P_3} +$	121 (113)	0	-125 (263)

Number of Adults

Y_P	1-2	3 or more
$0-Y_{P_3}$	—	-119 (142)
$Y_{P_3} +$	—	15 (91)

Education

Y_P	Bottom 1/3	Middle	Top
$0-Y_{P_3}$	-2 (137)	0	—
$Y_{P_3} +$	-161 (105)	0	56 (124)

Poverty Area	-159 (110)
Non Poverty	0

Number of observations: 317

Standard error: 594 hours per year

 R^2 : .5877SS Residuals: .10020 x 10⁹

Table A- IV - 10: Black Unmarried Female Relatives

Left hand variable: $\frac{\text{Earnings}}{.96w_{\text{imputed}}} + \text{Unemployment} = H^{**}$

Constant	1477 (254)	Age: 25-59	0
		60+	-1282 (572)

Current Wage

Age	0 \$1.49 -461 (220)	1.50 2.00 -274 (224)	2.00 3.00 0	3.00 up 22 (413)
25-59				
60 +	-105 (518)	-96 (533)	0	--

Potential Permanent Income

Age	0 \$2999	3000 3999	4000 5000	5000 up
25-59	310 (225)	0	-290 (128)	-21 (227)
60 +	-73 (269)	0	132 (176)	176 (433)

Transitory Income

Age	Y_P	0	0-\$100	\$100-up
25-59	$0-Y_{P_3}$	0	12 (632)	255 (354)
25-59	$Y_{P_3} +$	0	-1261 (644)	505 (185)
60 +	$0-Y_{P_3}$	0	-23 (639)	-8 (348)
60 +	$Y_{P_3} +$	0	-112 (413)	-59 (248)

A-IV 10: cont'd

Expected Search Time (weeks)

Age	Y_P	0-5.9	6-9.9	10 +
25-59	$0-Y_{P_3}$	-270 (483)	0	-51 (301)
25-59	$Y_{P_3} +$	421 (274)	0	-105 (176)
60 +	$0-Y_{P_3}$	-23 (640)	0	37 (327)
60 +	$Y_{P_3} +$	-43 (502)	0	-93 (257)

Number of Adults

Y_P	1- 2	3 or more
$0-Y_{P_3}$	0	-76 (198)
$Y_{P_3} +$	0	98 (113)

Education

Y_P	Bottom 1/3	Middle	Top
$0-Y_{P_3}$	82 (185)	0	-179 (382)
$Y_{P_3} +$	-41 (112)	0	-314 (186)

Poverty Area	-24 (95)
Non Poverty	0

Number of observations: 241

Standard error: 622 hours per year

R^2 : .5032

SS Residuals: $.79296 \times 10^8$

Table A- IV-11: White Single Men

Left hand variable: $\frac{\text{Earnings}}{.96^w_{\text{imputed}}} + \text{Unemployment} = H^{**}$

Constant	2161 (586)	Age: 25-59 60+	0
			-900 (721)

Current Wage

Age	0 \$1.49	1.50 2.00	2.00 3.00	3.00 up
25-59	-971 (235)	-223 (231)	0	590 (194)
60 +	40 (455)	-98 (271)	0	1307 (343)

Potential Permanent Income

Age	0 \$2999	3000 3999	4000 5000	5000 up
25-59	-1760 (944)	0	-85 (636)	-280 (587)
60 +	-1100 (486)	0	--	-621 (394)

A- IV -11: cont'd

Expected Search Time (weeks)

Age	Y_P	0-5.9	6-9.9	10 +
25-59	$0-Y_{P_3}$	202 (462)	0	-244 (319)
25-59	$Y_{P_3} +$	-611 (178)	0	-215 (243)
60 +	$0-Y_{P_3}$	-318 (335)	0	-42 (391)
60 +	$Y_{P_3} +$	98 (277)	0	217 (408)

Education

Poverty Area	-110 (127)
Non Poverty	0

Y_P	Bottom 1/3	Middle	Top
$0-Y_{P_3}$	-40 (219)	0	376 (622)
$Y_{P_3} +$	-109 (188)	0	-537 (160)

Number of observations: 298

Standard Error: 977 hours per year

R^2 : .3267

SS Residuals: .26007 x 10⁹

Table A-IV - 12: Black Single Men

Left hand variable: $\frac{\text{Earnings}}{.96w_{\text{imputed}}} + \text{Unemployment} = H^{**}$

Constant

1888 (263)

Age: 25-59

0
-350 (402)

60+

Current Wage

Age	0 \$1.49	1.50 2.00	2.00 3.00	3.00 up
25-59	-660 (127)	-212 (96)	0	850 (168)
60 +	-416 (244)	-705 (192)	0	1352 (466)

Potential Permanent Income

Age	0 \$2999	3000 3999	4000 5000	5000 up
25-59	-1421 (310)	0	-117 (228)	-245 (247)
60 +	-902 (250)	0	-216 (226)	-503 (288)

A- IV-12:cont'd

Expected Search Time (weeks)

Age	Y_P	0-5.9	6-9.9	10 +
25-59	$0-Y_{P_3}$	-410 (208)	0	-596 (193)
25-59	$Y_{P_3} +$	5 (143)	0	116 (97)
60 +	$0-Y_{P_3}$	-792 (315)	0	-140 (191)
60 +	$Y_{P_3} +$	-77 (296)	0	-22 (201)

Education

Poverty Area	-58 (75)
Non Poverty	0

Y_P	Bottom 1/3	Middle	Top
$0-Y_{P_3}$	228 (123)	0	833 (487)
$Y_{P_3} +$	-123 (79)	0	-329 (108)

Number of observations: 338

Standard Error: 562 hours per year

R^2 : .5311

SS Residuals: .98138 x 10⁸

Table A- IV - 13: White Single Women

Left hand variable: $\frac{\text{Earnings}}{.96w_{\text{imputed}}} + \text{Unemployment} = H^{**}$

Constant	1653 (242)	Age: 25-59	0
			-422 (299)
		60+	

Current Wage

Age	0 \$1.49	1.50 2.00	2.00 3.00	3.00 up
25-59	-554 (170)	-354 (129)	0	634 (159)
60 +	-894 (167)	-417 (155)	0	1821 (357)

Potential Permanent Income

Age	0 \$2999	3000 3999	4000 5000	5000 up
25-59	-1677 (485)	0	297 (239)	317 (247)
60 +	-76 (154)	0	53 (138)	-223 (159)

A- IV 13:cont'd

Expected Search Time (weeks)

Age	Y_P	0-5.9	6-9.9	10 +
25-59	$0-Y_{P_3}$	82 (268)	0	—
25-59	$Y_{P_3} +$	-466 (119)	0	-292 (550)
60 +	$0-Y_{P_3}$	-166 (137)	0	-437 (267)
60 +	$Y_{P_3} +$	156 (106)	0	51 (196)

Education

Poverty Area	-233 (78)
Non Poverty	0

Y_P	Bottom 1/3	Middle	Top.
$0-Y_{P_3}$	208 (124)	0	-416 (226)
$Y_{P_3} +$	-7 (113)	0	-323 (92)

Number of observations: 593

Standard Error: 743 hours per year

R^2 : .4729

SS Residuals: .31304 x 10⁹

Table A- IV- 14: Black Single Women

Left hand variable: $\frac{\text{Earnings}}{.96w_{\text{imputed}}} + \text{Unemployment} = H^{**}$

Constant	2069 (184)	Age: 25-59 60+	0 -738 (560)

Current Wage

Age	0 \$1.49	1.50 2.00	2.00 3.00	3.00 up
25-59	-707 (174)	-317 (176)	0	171 (233)
60 +	-662 (524)	-360 (541)	0	—

Potential Permanent Income

Age	0 \$2999	3000 3999	4000 5000	5000 up
25-59	-331 (197)	0	-222 (138)	-269 (184)
60 +	659 (192)	0	-321 (173)	-630 (208)

A- IV 14: cont'd

Expected Search Time (weeks)

Age	Y_P	0-5.9	6-9.9	10 +
25-59	$0-Y_{P_3}$	-316 (310)	0	-147 (214)
25-59	$Y_{P_3} +$	-109 (229)	0	125 (130)
60 +	$0-Y_{P_3}$	759 (387)	0	82 (220)
60 +	$Y_{P_3} +$	-50 (500)	0	-128 (196)

Education

Poverty Area	-66 (76)
Non Poverty	0

Y_P	Bottom 1/3	Middle	Top
$0-Y_{P_3}$	273 (160)	0	56 (652)
$Y_{P_3} +$	-11 (97)	0	-149 (130)

Number of observations: 341

Standard Error: 633 hours per year

R^2 : .4692

SS Residuals: .12624 x 10⁹

APPENDIX V

33rd Percentile of Supply Group
Potential Permanent Income Distributions

	Y_{P_3}
White Husbands	\$4,734
Black Husbands	3,545
White Wives	4,642
Black Wives	3,528
White Female Heads	3,787
Black Female Heads	2,832
White Male Relatives	4,547
Black Male Relatives	3,439
White Female Relatives	4,223
Black Female Relatives	3,013
White Single Men	6,273
Black Single Men	4,564
White Single Women	4,246
Black Single Women	3,050

APPENDIX VI

**The Effect on Labor Supply of a
Transitory Wage Change**

If barred variables denote equilibrium values, system II.3 for $T = 2$ is rewritten as:

$$\begin{aligned} u_C(\bar{c}_i, \bar{L}_i) &\equiv \bar{\lambda} \equiv u_C^i \\ u_L(\bar{c}_i, \bar{L}_i) &\equiv \bar{\lambda} w_i \equiv u_L^i \end{aligned} \quad i = 1, 2$$

A.VI.1.

$$\sum_{i=1}^2 [(k - \bar{L}_i)w + y_n] \equiv \sum_{i=1}^2 \bar{c}_i,$$

where $u_C^i = \frac{\partial U}{\partial c}$ evaluated at (\bar{c}_i, \bar{L}_i) ,

and $u_L^i = \frac{\partial U}{\partial L}$ evaluated at (\bar{c}_i, \bar{L}_i) .

Taking total differentials, A.VI.1 becomes:

$$\begin{aligned} \text{A.VI.2} \quad & \begin{bmatrix} u_{CC}^1 & 0 & u_{CL}^1 & 0 & -1 \\ 0 & u_{CC}^2 & 0 & u_{CL}^2 & -1 \\ u_{LC}^1 & 0 & u_{LL}^1 & 0 & -w_1 \\ 0 & u_{LC}^2 & 0 & u_{LL}^2 & -w_2 \\ 1 & 1 & w_1 & w_2 & 0 \end{bmatrix} \begin{bmatrix} d\bar{c}_1 \\ d\bar{c}_2 \\ d\bar{L}_1 \\ d\bar{L}_2 \\ d\bar{\lambda} \end{bmatrix} = \begin{bmatrix} 0 \\ 0 \\ \bar{\lambda} dw_1 \\ \bar{\lambda} dw_2 \\ \sum_{i=1}^2 (k - \bar{L}_i)dw_i \\ + \sum_{i=1}^2 w_i dk + 2dy_n \end{bmatrix} \end{aligned}$$

System A.VI.2. yields:

$$\begin{aligned} d\bar{L}_1 &= \bar{\lambda} dw_1 \frac{D_{33}}{D} + \bar{\lambda} dw_2 \frac{D_{43}}{C} + \\ \text{A.VI.3.} \quad &+ \left[\sum_{i=1}^2 (k-L_1) dw_i + \sum_{i=1}^2 w_i dk + 2dy_n \right] \frac{D_{53}}{D}, \end{aligned}$$

where D represents the determinant and D_{ij} the ij^{th} cofactor of the coefficient matrix in system A.VI.2.

The concept of a transitory wage change is represented in this simple model by changing the first period wage, holding the second period wage fixed.

Setting dw_2 , dy_n and $dk = 0$ and dividing A.VI.3. by dw_1 yields:

$$\text{A.VI.4.} \quad \frac{\partial \bar{L}_1}{\partial w_1} = \bar{\lambda} \frac{D_{33}}{D} + (k - \bar{L}_1) \frac{D_{53}}{D}.$$

On the right hand side (RHS) of A.VI.4. the terms $\bar{\lambda}$, D and $(k - L_1)$ are non-negative and D_{33} is non-positive under the conventional restriction that U be quasi-concave. It remains to determine the algebraic sign of D_{53} .

Now,

$$\text{A.VI.5.} \quad D_{53} = \begin{vmatrix} U_{CC}^1 & 0 & 0 & -1 \\ 0 & U_{CC}^2 & U_{CL}^2 & -1 \\ U_{LC}^1 & 0 & 0 & -w_1 \\ 0 & U_{LC}^2 & U_{LL}^2 & -w_2 \end{vmatrix}$$

$$= U_{CC}^1 \begin{vmatrix} U_{CC}^2 & U_{CL}^2 & -1 \\ 0 & 0 & -w_1 \\ U_{LC}^2 & U_{LL}^2 & -w_2 \end{vmatrix} + \begin{vmatrix} 0 & U_{CC}^2 & U_{CL}^2 \\ U_{LC}^1 & 0 & 0 \\ 0 & U_{LC}^2 & U_{LL}^2 \end{vmatrix} ,$$

which reduces to:

$$\text{A.IV.6.} \quad D_{53} = (w_1 U_{CC}^1 - U_{LC}^1) \begin{vmatrix} U_{CC}^2 & U_{CL}^2 \\ U_{LC}^2 & U_{LL}^2 \end{vmatrix} .$$

The determinant on the right hand side of A.VI.6. is non-negative under the assumed form of U .

Solving for $w_1 = U_L^1/U_C^1$ from system II.3 yields:

$$\text{A.VI.7.} \quad (w_1 U_{CC}^1 - U_{LC}^1) = \frac{U_L^1}{U_C^1} U_{CC}^1 - U_{LC}^1 ,$$

or,

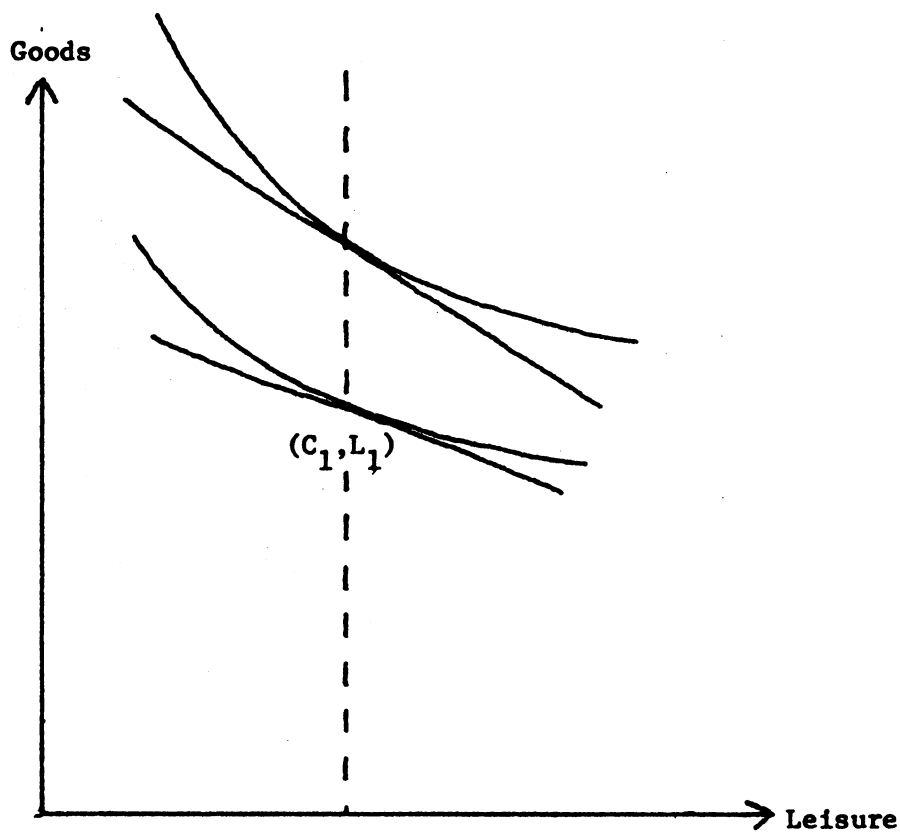
$$\text{A.VI.8.} \quad D_{53} = \frac{U_L^1 U_{CC}^1 - U_C^1 U_{LC}^1}{U_C^1} .$$

The numerator of the RHS of II.B.14 is the same as the

$$\text{numerator of } \frac{\partial (U_L^1/U_C^1)}{\partial C} = \frac{U_C^1 U_{LC}^1 - U_L^1 U_{CC}^1}{(U_C^1)^2} , \text{ which is positive}$$

if C is normal (not inferior) in a neighborhood of the equilibrium values (\bar{C}_1, \bar{L}_1) (see Figure A.VI.1.).

Figure A.VI.1.



Thus the model implies that the normality of goods consumption is a sufficient condition for:

A.VI.9.
$$\frac{\partial \bar{L}_1}{\partial w_1} \leq 0 .$$

A transitory increase in the wage leads to a decrease in the current quantity of leisure demanded, an increase in the current quantity of labor supplied.

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