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THE DETERMINANTS OF LABOR FORCE PARTICIPATION: AN EMPIRICAL ANALYSIS

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INTRODUCTION

Before the mid-1960's economists generally accepted, with two major exceptions, the neoclassical theory of aggregate labor supply, i.e., the theory that the number of workers supplied to the market varied with wages, population, and work preferences, with work preferences and population treated as exogenous and outside the realm of economics. The two major exceptions were the "additional" worker and "discouraged" worker effects. The additional worker effect is based upon the idea that, as unemployment rates rise, additional or "secondary" breadwinners enter the labor market to maintain family income. In neoclassical terms, increased unemployment shifts the aggregate labor supply curve to the right. The "discouraged" worker effect, on the other hand, states that as unemployment rates and the average duration of unemployment rise, individuals will become discouraged and stop seeking work, thus dropping out of the labor force. In neoclassical terms, when unemployment rises the "discouraged" worker effect causes the aggregate labor supply curve to shift to the left. Seminal articles by Tella [16] and Dernberg and Strand [4] in the mid-1960's devoted attention to the relative importance of the two effects. They concluded that the discouraged worker effect was dominant. Subsequently, the U.S. Department of Labor began publishing regular estimates of the number of discouraged workers in the economy.

During the second half of the sixties and the seventies, renewed attention was directed to aggregate labor supply theory because of unexpected changes in the actual data. The rate of growth of the civilian

labor force, which is approximately equal to the aggregate quantity of labor supplied, had unexpectedly begun to accelerate rapidly. The acceleration, which was the result of fundamental societal changes in such things as birth rates, the status of the family, and the role of women, fostered an interest in extending the neoclassical theory of labor supply.

The progress on extending the theory is probably best seen in John Seater's unified model of consumption, labor supply, and job search [14], at least as it relates to the individual work/leisure decision. Seater views the individual as a utility maximizer who must decide how best to divide his time among labor, leisure, and job search. Wages are viewed as a means of achieving consumption goods, but an individual may forego consumption for leisure, or present for future consumption via investment in job search time, etc.

The set of models that best show the progress in measuring aggregate labor force behavior, however, view the household rather than the individual as the primary economic unit. Wachter [18], in a 1972 paper, outlines a relative income model that relates changes in labor supply to the difference between the household's desired or anticipated standard of living and its actual standard of living. When the differential is large, additional persons (more specifically, additional members of the household) enter the labor market. Wachter's view of labor force participation broadens the older additional worker effect, which related unemployment to the supply of additional workers. A recent article by Leonall Anderson [1] provides another example of a labor force model that uses the household as the basic decision-making unit.

Other recent research on labor supply theory stresses the distorting effects of governmental programs such as unemployment insurance and

various welfare programs on the labor supply curve (see Cagan [2] and McElhattan [5]). These analyses emphasize that governmental programs designed to alleviate poverty and/or unemployment raise the unemployed worker's reservation wage (the wage below which he finds it undesirable to accept employment) and the time that the unemployed worker can spend in job search.

This paper will develop and test empirically a simple reduced form model of labor supply in order to (1) provide guidelines for developing more accurate labor supply equations in large econometric models and (2) aid in determining the extent to which the acceleration in labor force participation is attributable to economic rather than sociological forces. The first section of the paper is devoted to developing the model of labor supply that will be tested in subsequent sections. The subsequent sections are devoted to the empirical test of the model.

THE MODEL OF LABOR SUPPLY

The early neoclassical theory of labor supply, which stressed the effect of real wages on the hours of labor supplied by the individual (given work-leisure preferences and demographic factors), can be specified as follows:

$$Q_L = f(W),\ f' > 0 \text{ if } W < W_o, f' < 0 \text{ if } W > W_o\ .$$

Q_L is the number of labor hours supplied by an individual, W is the real wage, and W_o is the level of real wages at which workers substitute leisure for labor. By incorporating (1) a modernized additional worker effect--i.e., the worker's offer of his services depends not only upon the wage offered to him but also upon his household's income relative to its expenditure plans, (2) a modernized "discouraged" worker effect--i.e., an individual's decision to be in the labor force depends upon his perception

of economic opportunity, (3) the effects of governmental programs on labor-leisure choices, and (4) the effects of sociological forces, e.g., the women's movement; the labor supply function can be augmented and respecified. If Q_L now represents the quantity of labor hours supplied by the household,

$$Q_L = f(W, Y_h - Y_h^e, S, E_o, G),\ f_2 \leq 0,\ f_3 > 0,\ f_4 > 0,\ f_5 < 0,$$

$Y_h - Y_h^e$ represents the difference between actual and budgeted purchasing power of the household, S represents a vector of sociological variables that increase labor force participation, G represents a vector of governmental programs that increase the worker's reservation wage, and E_o represents perceived employment opportunity.

Since it is impractical to estimate each household's supply function separately, aggregate labor supply is usually assumed to be represented by the behavior of a typical household. The typical behavior of members of one demographic subset of the labor force, however, often differs radically from that of members of another demographic group (see Wachter [13] and Sniderman [10]). For example, sexagenerians view employment quite differently from persons in their twenties and the older workers react differently to work incentives. As a result, the aggregate labor supply is actually composed of an amalgam of quantitatively and qualitatively different labor supply functions. Based upon the presumption that labor force behavior patterns are more homogenous within age-rate-sex cohorts, the empirical work in this paper on labor supply therefore involves estimating several cohort labor supply functions rather than one aggregate function. The labor force is separated into only eight cohorts, although a further degree of disaggregation would have been preferable. The labor supply function that will be tested in the subsequent part of the paper

is specified as follows:[1]

$$Q_i = f^i(W_i, \ Y_h - Y_h^e \ _i, \ S, \ E_o, \ G, \ P_i),$$

$i = 1, 2, \ldots, 8.$

Where white males 20-24=1, white females 20-24=2, nonwhite males 20-24=3, nonwhite females 20-24=4, white males 25-64=5, white females 25-64=6, nonwhite males 25-64=7, and nonwhite females 25-64=8.

Q_i represents the quantity of labor supplied by each group and P_i represents the population of the group. W_i $(Y_h - Y_h^e)_i$, and E_o now represent wages offered to members of the group, deviation of actual and expected household purchasing power for a typical cohort's family, and perceptions of employment opportunities, respectively.

One can establish the following a priori hypotheses:

1. Female and younger male labor force participation is affected more strongly by household budgetary surprises than is older male labor force participation.

2. Older white male labor force participation is affected less strongly by changes in employment opportunity than the labor force participation of the other cohorts.

3. White female labor force participation is affected most strongly by the long-term changes in the social climate.

The first hypothesis follows from the observation that relatively more females and younger males are "secondary" workers than are prime-age males, 25-64. As a result, an unpleasant surprise with respect to expected household income will draw a relatively larger number of females and younger males into the labor force. The second stems from the observation that

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[1]Teenagers were excluded on the grounds that their labor supply function is specified differently from that of older workers. See Sniderman [15].

older white males, having been least troubled by discriminatory employment opportunity in the past, will benefit least from its reversal. The third hypothesis follows from the fact that the women's movement has primarily affected white female labor force participation.

Proxies for Theoretical Variables

Much of the difficulty associated with empirical tests of theoretical models revolves around choosing proxies to capture the effects of unobservable theoretically postulated variables. First, the theoretical model of labor supply relates the explanatory variables to the quantity of labor supplied in hours. The data on hours of work, however, are not available by demographic group. As a result, the quantity of labor supplied is assumed to be denominated in numbers of persons. In addition, it was necessary to accept the definitions used by the U.S. Department of Labor, so it is assumed that the quantity of labor supplied by each cohort is equivalent to its civilian labor force.

Secondly, data on actual and planned household purchasing power were unavailable by cohort group. The proxy chosen to represent household budgetary stress, therefore, had to be based upon aggregate data. It is defined as the difference between the percentage change (annual rate) in U.S. real capita disposable personal income in the current quarter and the percentage change over the previous four quarters, but with one exception. The exception is that the percentage change in the relative price of food is deducted from the percentage change in real per capita disposable personal income in order to capture the differential effects of changes in the household's power to purchase postponable rather than non-postponable items. It was also assumed that households formulate expenditure plans by extrapolating income changes in the recent past. The budgetary stress

variable, SB is specified as follows:

$$SB_t = \left[\left(\frac{YDPC_t}{YDPC_{t-1}} - \frac{PF_t}{PF_{t-1}}\right) + 1\right]^4 - \left[\left(\frac{YDPC_{t-1}}{YDPC_{t-5}} - \frac{PF_{t-1}}{PF_{t-5}}\right) + 1\right]$$

where YDPC = per capita disposable personal income, 1972 dollars,

PF = relative price of food (food component of Consumer Price Index divided by all item Consumer Price Index), and

t = time in quarters.

An inverse relation between SB and labor force participation indicates the presence of an additional worker effect, i.e., workers entering the labor force in response to household budgetary stress.

Thirdly, wage data are not available by cohort. The wage variable that was used in the estimation, average real hourly earnings of production workers (adjusted for overtime and interindustry shifts), represents mostly wages of adult males. The lack of wage data for the cohorts was especially unfortunate, because average earnings of production workers is not an appropriate proxy for the incentive effects of wages on female labor force participation. Wage data for production workers, in fact, was negatively associated with female labor force participation if at all, which suggested that it was proxying an additional worker effect rather than a wage incentive effect.

Fourthly, real GNP was chosen to proxy the effects of cyclical economic fluctuations on worker perceptions of employment opportunity, thus capturing the traditional discouraged worker effect. Other sources of employment opportunity such as the effects of the Equal Opportunity Act could not be proxied directly, but it could be assumed that the effects of long-term changes in economic opportunities would be captured as part of the long-term trend.

Fifthly, the model included a variable designed to represent the effects of governmental programs on the costs of accepting employment. The variable that was chosen to proxy this effect was the number of participants in the Food Stamp program. This proxy was chosen because participation in this program since 1971[2] has increased more rapidly than in other such governmental programs. Bonus food stamps issued in 1971, for example, cost the Federal government $500 million. This cost had risen to $5.0 billion by 1977. Increased food stamp distribution is assumed to increase the reservation wages of workers in the household, and an increase in food stamp participation is thus assumed to be associated with a decrease in labor supply. There is, however, an ambiguity associated with the choice of this proxy as well.

In order to be eligible for food stamps, all able-bodied adults in the applicant's household (excepting persons responsible for the care of children or aged dependents, students, or those already employed for at least 30 hours a week) are required to register for work with the state or local unemployment office. This work registration requirement applies only to households who are not eligible for other forms of public assistance, but since 1972 work registration has been required for recipients of other federal welfare programs. If the work registration requirement were controlling, an increase in food stamp participation would be associated with an increase in the measured labor supply. Apparently, however, the registration requirement is not controlling, for the empirical results discussed later in this paper show increased food stamp participation to be associated with decreases in labor force participation.

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[2]The period of extraordinary labor force growth began in 1972, as will be shown subsequently. The Food Stamp program has been in effect since August, 1962, but its major growth has come about since the Act was amended in January, 1971.

Finally, it was found that changes in real wages, real GNP and food stamp participation were correlated, particularly in the 1972-1978 period. To remove this multicollinearity, it was necessary to modify the real wages and food stamp variables using an instrumental variable technique. Accordingly, changes in real wages were regressed on changes in real GNP, and the residual (de-cyclicized real wages) was used to measure the wage incentive effect on labor force participation. Changes in food stamp participation were de-cyclicized in a like manner.

The Civilian Labor Force data, which are used to proxy the quantity of labor supplied, have two serious limitations. First, the definition of the Civilian Labor Force fails to distinguish between part-time or full-time workers, nor does it allow recognition of differences in the number of overtime hours worked. Second, persons who will not actually accept employment at existing wage rates are often included in the measured data. These individuals may be searching for certain jobs at higher wage levels, jobs in specific occupations or locations, or they may not be willing to accept employment at all. Since increases in average real weekly benefits paid under unemployment insurance programs are assumed to motivate increased divergence between the actual and the measured labor supply, average real benefits are also included in the analysis as an explanatory variable.

Preliminary Data Adjustments

Because it was hypothesized that labor force participation changed radically after 1971, the labor force data were adjusted to facilitate a juxtaposition of labor force behavior in the 1965-1971 and 1972-1978 periods before the supply functions were estimated. The reasoning behind the hypothesis is shown quite dramatically in Chart I.

Chart I

UNEMPLOYMENT RATE AND EMPLOYMENT PRESSURE INDEX
FOR ALL CIVILIAN WORKERS, 16 AND OVER

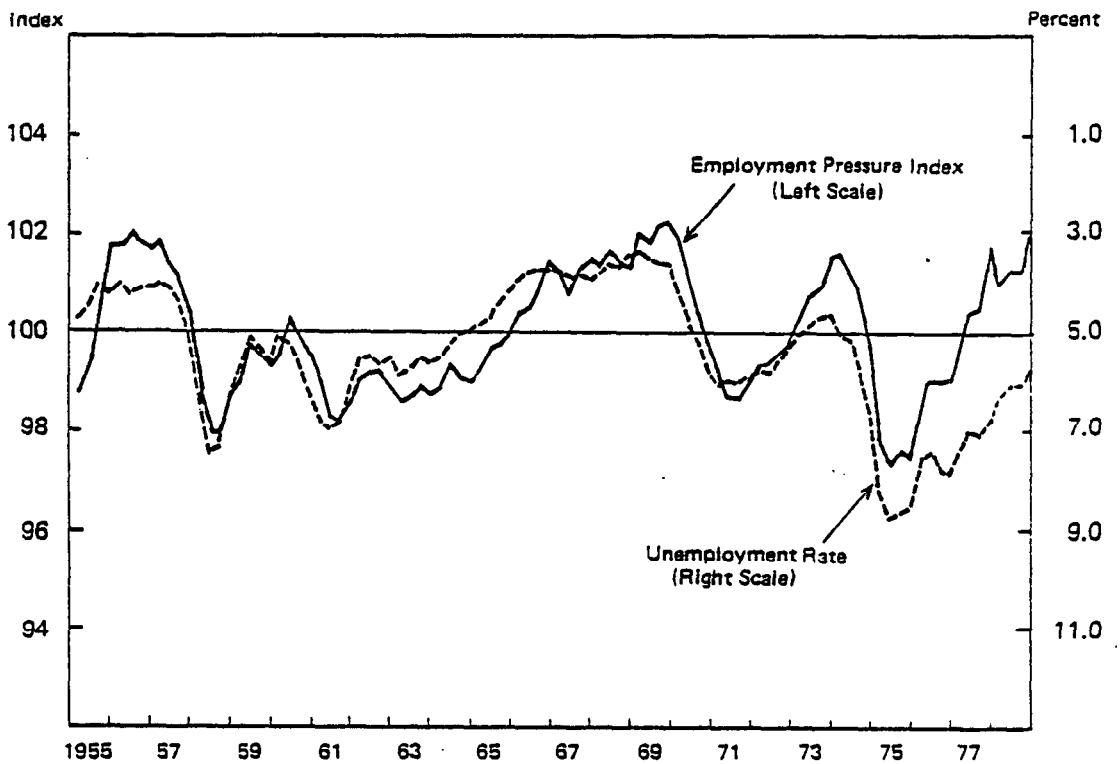

Chart I depicts the employment pressure index[3] for all civilian workers, sixteen and over, plotted against the unemployment rate (inverted) for the 1955-1978 time period. It shows that the employment pressure index, actual employment divided by a population-adjusted employment trend, moved in tandem with the unemployment rate from 1955 through 1971 but that the two series began to diverge in 1972. The chart thus illustrates that employment was growing, during the 1972-1978 interim, at rates that would have brought about substantial declines in the unemployment rate if the labor force had been growing at its historical rate. Thus, had labor force participation conformed to its longrun trend, the unemployment rate would have declined to approximately 3.1 percent by the fourth quarter of 1978. Contrast the chart's depiction of labor markets during the 1975-1977 interim to the prevailing view as it is stated by George Perry [11, p. 26].

> From 1975 through 1977, all available measures of tightness in either labor markets or product markets registered ample slack. And no large upward movements have occurred in particular components of the price level since the organization of Petroleum Exporting Countries increased oil prices in 1974. Yet despite all these disinflationary developments, the rate of inflation, by any broad measure, has continued at a historically high rate. . . .

In order to illustrate the change in the labor force since 1971, even more dramatically, population-adjusted trend equations were estimated over the 1955-1971 time period,[4] and the estimated parameters were used

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[3]Developed at this Bank. See Cullison "An Employment Pressure Index as an Alternative Measure of Labor Market Conditions," Review of Economics and Statistics, February 1975.

[4]These equations were of the form used to derive the employment pressure index for Chart 1, $E_i = \beta_{i1} + \beta_{i2} \cdot t + \beta_{i3} \cdot t^2 + \beta_{i4} \cdot P_i$, where E_i represents employment of the ith cohort, t represents time, P_i represents civilian noninstitutionalized population of the ith cohort, and β_{ij} represent parameters.

to derive employment trend estimates for the entire 1955-1978 time period. These trend estimates were used to calculate the employment pressure indexes, which are shown in conjunction with unemployment rates in Chart II.

The detailed breakdowns in Chart II show post-1971 divergences between the employment pressure indexes and the unemployment rates (inverted) to be especially pronounced for female workers. Most remarkable is the bottom chart, which depicts the employment pressure index and unemployment rate for adult nonwhite females. Although the nonwhite female unemployment rate remained in the 10%-12% range after the 1975 recession, that labor force group was experiencing such extraordinarily rapid increases in employment that their employment pressure index ended 1978 at 115.3. Thus, nonwhite female employment at year-end 1978 was 15.3% higher than would have been predicted by extrapolating the 1955-1971 employment trend. Additional attention will be devoted to this remarkable situation subsequently.

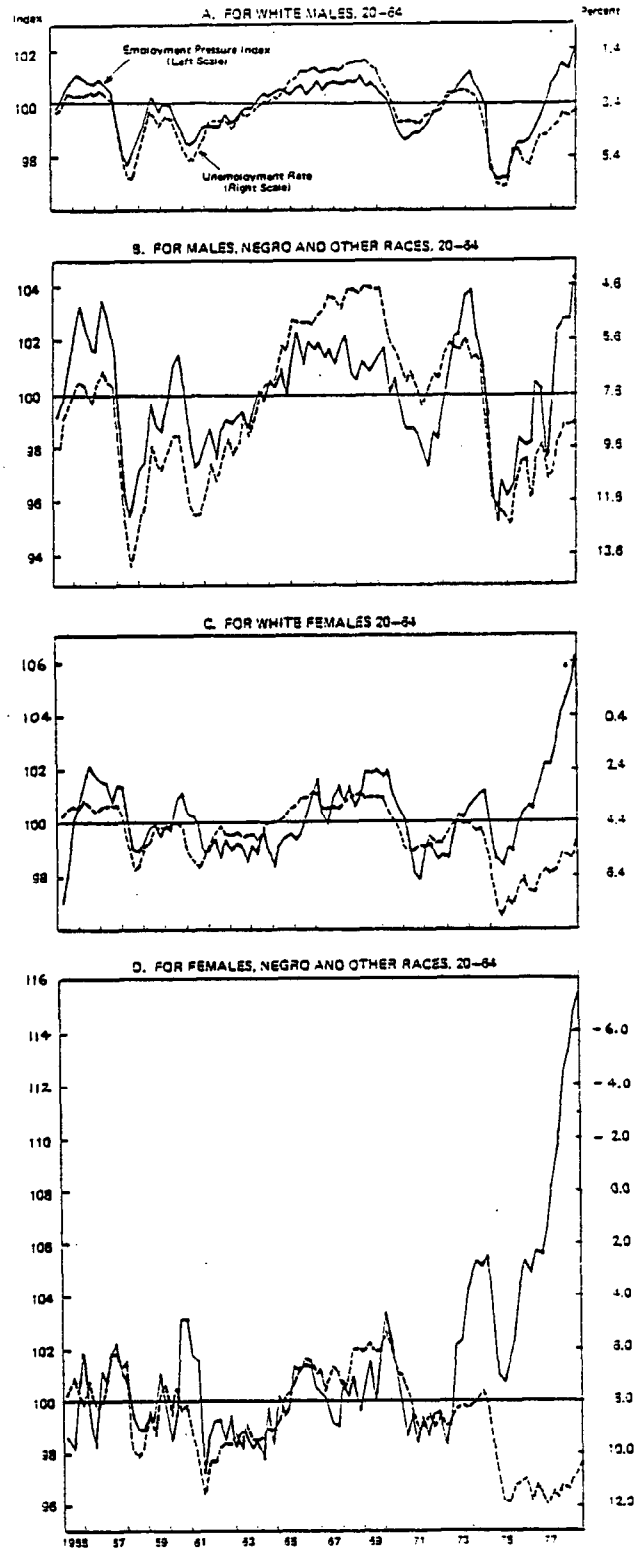
To develop civilian labor force trend estimates, each of the employment trend data sets was divided by its 1955-1971 average employment rate. The extrapolated 1955-1971 labor force trend was then subtracted from the actual civilian labor force values. The resulting sets of data thus provide direct measures of both short-run variations in the labor supply and longer-term deviations from the 1955-1971 trend.

ESTIMATING THE MODEL

Overview.--The labor supply function was estimated with ordinary least squares, and the results are shown in Table 1. The empirical results suffer to some extent from the incomplete nature of the model. Ideally, a demand function should have been specified and the model should have

Chart 1

UNEMPLOYMENT RATE AND EMPLOYMENT PRESSURE INDEX
(1955–1972 TREND PARAMETERS)



REGRESSION COEFFICIENTS, "t" STATISTICS FOR REGRESSIONS OF DE-TRENDED LABOR FORCES* ON EXPLANATORY ECONOMIC VARIABLES

(All variables are in first differences except SB.)

	Constant	SB	SB	WP	WP	GNP 72	GNP 72	UI	UI	FS	FS	Standard Error	Corrected R^2
White Males 20-24				Lag 1**		Lag 3							
1972-I to				17.23		1.61						41.43	0.25
1978-IV				(1.19)		(3.35)							
1978-III				20.04		1.59						39.69	0.31
				(1.44)		(3.46)							
1977-IV				21.39		1.74						40.42	0.34
				(1.36)		(3.53)							
1965-II to 1971-IV						Lag 0	Lag 2	Lag 2					
	29.77					-1.77	-1.85	12.08				38.11	0.23
	(2.46)					(-1.69)	(-1.89)	(1.43)					
Nonwhite Males 20-24		Lag 4						Lag 3					
1972-I to		0.88						5.05				13.81	0.30
1978-IV		(2.57)						(2.10)					
1978-III		0.87						4.80				14.04	0.28
		(2.50)						(1.88)					
1977-IV		0.95						6.21				14.24	0.33
		(2.65)						(2.16)					
1965-II to 1971-IV		Lag 0				Lag 2	Lag 4	Lag 0					
		-0.68				-0.62	0.60	5.87				11.01	0.24
		(-1.36)				(-2.30)	(2.21)	(2.60)					
White Females 20-24				Lag 0		Lag 1		Lag 1		Lag 4			
1972-I to	16.34			-35.98		0.65		13.85		-1.87		34.91	0.33
1978-IV	(2.02)			(-3.00)		(1.37)		(2.25)		(-1.56)			
1978-III	19.11			-39.57		0.63		10.28		-2.11		31.33	0.41
	(2.61)			(-3.65)		(1.48)		(1.81)		(-1.96)			
1977-IV	20.25			-38.59		0.51		13.63		-2.03		32.95	0.35
	(2.49)			(-3.13)		(1.10)		(1.90)		(-1.64)			
1965-II to 1971-IV		Lag 0	Lag 1										
		-3.35	-6.22									47.40	0.25
		(-1.55)	(-2.88)										
Nonwhite Females 20-24		Lag 3		Lag 2		Lag 0	Lag 3						
1972-I to	-15.01	-0.90		-16.07		0.71	0.45					11.08	0.61
1978-IV	(-5.24)	(-3.31)		(-3.90)		(4.39)	(2.94)						
1978-III	-14.91	-0.94		-17.30		0.75	0.44					11.22	0.60
	(-5.13)	(-3.33)		(-3.77)		(4.28)	(2.73)						
1977-IV	-14.99	-0.93		-16.72		0.77	0.45					11.80	0.61
	(-4.74)	(-3.11)		(-3.29)		(4.05)	(2.62)						

con't	Constant	SB	SB	WP	WP	GNP 72	GNP 72	UI	UI	FS	FS	Standard Error	Corrected R^2
Nonwhite Females 20-24													
1965-II to 1971-IV				Lag 1 21.05 (1.95)	Lag 2 -19.40 (-1.81)			Lag 1 -6.75 (-2.38)				14.92	0.23
White Males 25-64		Lag 3		Lag 1	Lag 2					Lag 0			
1972-I to		-6.04		80.31	-53.83					-6.20		90.86	0.28
1978-IV	22.25 (1.29)	(-2.70)		(2.21)	(-1.56)					(-1.88)			
1978-III	18.07 (1.03)	-5.61 (-2.47)		81.72 (2.25)	-43.49 (-1.22)					-6.69 (-2.02)		90.56	0.27
1977-IV	19.37 (1.01)	-6.14 (-2.53)		105.95 (2.49)	-52.28 (-1.31)					-6.79 (-1.91)		93.72	0.31
1965-II to 1971-IV		Lag 0	Lag 1			Lag 0		Lag 1	Lag 3				
	30.31 (1.62)	-5.20 (-1.83)	-4.19 (-1.48)			-3.24 (-2.04)		-35.23 (-2.58)	-46.23 (-2.96)			61.69	0.34
Nonwhite Males 25-64		Lag 3		Lag 0	Lag 1			Lag 0		Lag 0			
1972-I to		-1.91		-30.04	32.22			19.15		-3.80		33.43	0.36
1978-IV	13.18 (2.06)	(-2.30)		(-2.29)	(2.47)			(2.44)		(-2.60)			
1978-III	11.21 (1.78)	-1.65 (-2.04)		-29.12 (-2.31)	34.83 (2.75)			19.85 (2.63)		-4.27 (-2.98)		32.14	0.40
1977-IV	11.90 (1.70)	-1.64 (-1.87)		-33.28 (-2.37)	41.26 (2.71)			18.28 (2.04)		-4.35 (-2.83)		33.86	0.37
1965-II to 1971-IV		Lag 2 -2.18 (-2.98)				Lag 1 -0.89 (-3.42)		Lag 0 14.31 (4.83)				15.42	0.55
White Females 25-64								Lag 3		Lag 0			
1972-I to	54.38							-27.92		-8.59		90.37	0.24
1978-IV	(3.18)							(-1.79)		(-2.88)			
1978-III	44.71 (3.11)							-42.69 (-3.16)		-10.05 (-4.03)		74.60	0.45
1977-IV	42.27 (2.74)							-50.90 (-3.32)		-9.37 (-3.61)		75.43	0.46
1965-II to 1971-IV				Lag 0 -173.62 (-2.47)		Lag 1 -7.33 (-3.35)	Lag 3 7.76 (3.50)					98.09	0.44
Nonwhite Females 25-64				Lag 0	Lag 5	Lag 0	Lag 2	Lag 0		Lag 0			
1972-I to	24.48			-15.38	-31.78	0.57	0.54	18.75		-3.42		29.27	0.15
1978-IV	(3.17)			(-1.35)	(-2.26)	(1.43)	(1.12)	(2.52)		(-2.49)			

con't	Constant	SB	SB	WP	WP	GNP 72	GNP 72	UI	UI	FS	FS	Standard Error	Corrected R^2
Nonwhite Females 25-64				Lag 0	Lag 5	Lag 0	Lag 2	Lag 0		Lag 0			
1972-I to	23.05			-20.00	-33.78	0.63	0.88	18.13		-2.87		26.06	0.26
1978-III	(3.34)			(-1.95)	(-2.69)	(1.76)	(1.97)	(2.73)		(-2.30)			
1977-IV	18.32			-21.33	-38.29	0.74	0.93	16.00		-2.67		24.17	0.34
	(2.73)			(-2.12)	(-2.92)	(2.11)	(2.20)	(2.46)		(-2.27)			
1965-II to 1971-IV		Lag 1						Lag 1					
		-5.31						-9.28				23.99	0.50
		(-4.85)						(-2.06)					

Definitions

$$SB = \left(\frac{YDPC_t}{YDPC_{t-1}} - \frac{PF_t}{PF_{t-1}} + 1\right)^4 - \left(\frac{YDPC_{t-1}}{YDPC_{t-5}} - \frac{PF_{t-1}}{PF_{t-5}} + 1\right)$$

PF = Relative price of food (food component of CPI/All item CPI).

YDPC = Per capita disposable personal income, 1972 dollars.

WP = Real average hourly earnings of private nonfarm production workers, adjusted for overtime and inter-industry shifts and de-cyclicized.***

GNP 72=Gross National Product measured in 1972 dollars.

UI = Average weekly benefits under unemployment compensation programs measured in 1972 dollars.

FS = Number of persons participating in Food Stamp program, de-cyclicized.***

*Actual Civilian Labor Force less Population-Adjusted Trend (1955-1972 parameters).

**Lags are denoted in quarters.

***Instrumental variable developed, actually residual from regression on real GNP.

been estimated simultaneously. The demand side, however, is quite complicated in this disaggregated model because of the interrelationships between the demand for workers from one cohort group and the quantity of workers supplied by other cohort groups.

This paper, by ignoring the demand side, thus risks the danger of simultaneous equation bias. Some of the peculiarities of the data, however, make the problem less serious than it might be. The supply function was estimated separately for the 1965-1971 and the 1972-1978 time periods.[5] Although the two periods were kept separate in order to focus attention on the reasons behind the post-1971 divergence of labor force participation from its past historical pattern, the splitting of the time periods turned out to be useful in evaluating the simultaneous equation bias.

As will be discussed at greater length subsequently, the labor supply equations fit over the 1972-1978 time period were consistently better, in that only two of the regression coefficients bore the incorrect sign, compared to eight incorrect signs in the 1965-1971 time period. These differences suggest the possibility that simultaneous equation bias, which seems to have affected the results for the 1965-1971 period,[6] may have had considerably less serious effects in the 1972-1978 period. The characteristics of the economy in 1972-1978 also suggest that possibility.

The economy in 1972-1978 was characterized by large fluctuations in the aggregate demand, since that period included such events as the severe 1973-1975 recession, the OPEC-sponsored oil price adjustments, the floating

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[5]The model could not be estimated for the 1955-1965 time period because of insufficient data.

[6]See subsequent discussion.

of the dollar, and the recovery of the economy from the Nixon wage-price control program. As a result, relatively large fluctuations in demand for labor[7] apparently traced out the supply function.

The regression coefficients reported in Table 1 were estimated from quarterly data over four time periods, 1965-II to 1977-IV, 1972-I to 1977-IV, 1972-I to 1978-III, and 1972-I to 1978-IV. The three different sets of regression results for the post-1971 period are reported to indicate in summary form the stability (or lack thereof) of the estimated coefficients over time.[8] In the event that a regression coefficient for one or another of the proxies is missing from a particular equation, its absence means that it explained little if any of the variation in the labor force.[9] All data were converted to first differences.[10]

The estimated coefficients were generally stable in the post-1971 period, but there was one major exception--the set of regression results for older white and nonwhite females. For these cohorts, the results estimated over the 1972-I to 1978-IV time period differed substantially from the results estimated over the 1972-I to 1978-III time period. Not only were the regression coefficients substantially different, but the R^2 (corrected) values were substantially lower for the regressions estimated

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[7]The Standard deviations for quarter-by-quarter percent changes in real GNP and the GNP Implicit Deflator, for example, were 0.78 and 0.34, respectively in the 1965-1971 period, but 1.21 and 0.61 in the 1972-1978 period.

[8]Regression results were examined for all periods beginning with the 1972-I to 1976-II time period and continuing through the 1972-I to 1978-III period, but the changes in the coefficients reported in the table between the 1972-I to 1977-IV time period and the 1972-I to 1978-III time period adequately illustrate the changes in the coefficients over the longer interim.

[9]Whenever the "t" statistic for a particular regression coefficient fell below 1.0 (the 70 percent confidence level for this set of regressions), the variable was dropped.

[10]The matrices of simple correlation coefficients among the independent variables are shown in the Appendix for purposes of reference.

on the 1972-I to 1978-IV period. The source of this instability was an unexplained surge in 25-64 female labor force participation during the fourth quarter of 1978. Since this one-period surge may be an aberration or a data error that subsequently will be revised, however, it has been ignored for the present. Subsequent discussion of the results for the post-1971 time period will be based upon the regression coefficients estimated over the 1972-I to 1978-III time period.

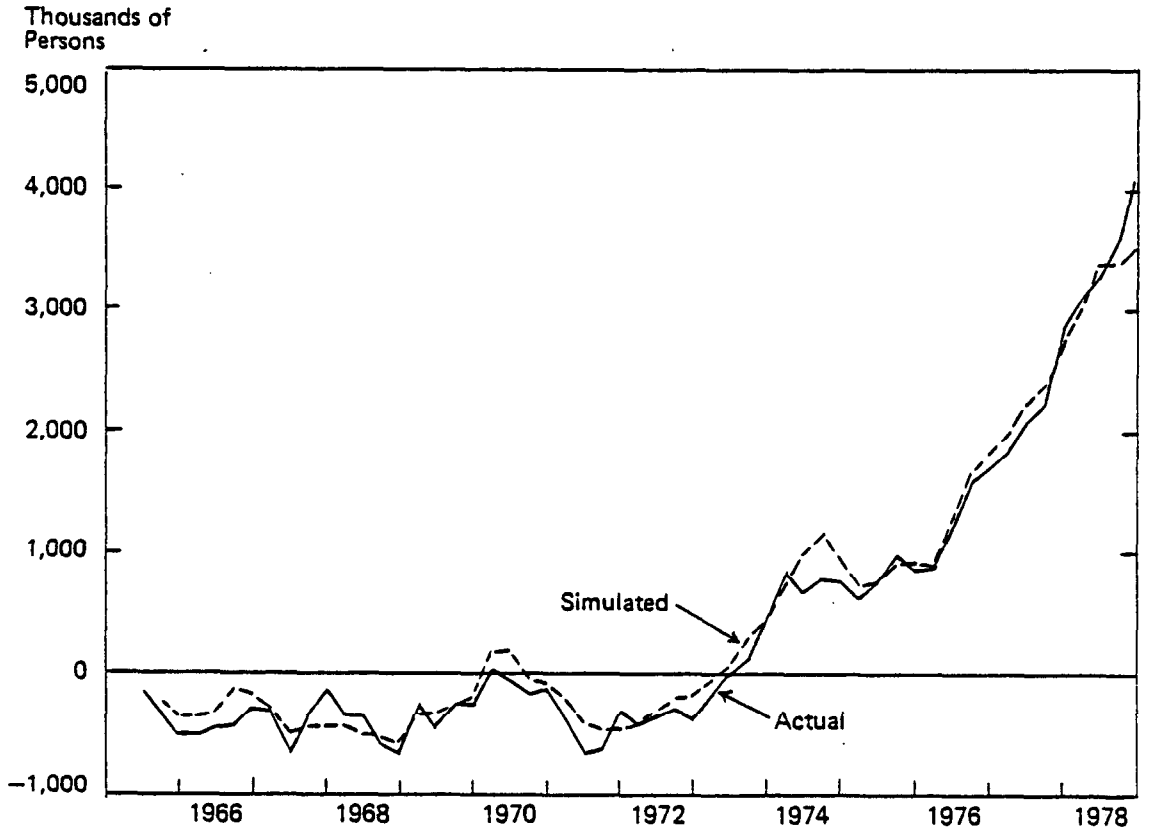
Chart III shows the actual detrended civilian labor force plotted against the values simulated from the model. The simulation was performed using two sets of dummy variables that allowed one set of regression coefficients (estimated over the 1965-1971 period) to provide the estimates for the early period and another set (estimated over the 1972-1978 period) to provide the estimates for the later period. Since the equations were estimated using first differenced data, the simulation technique first inserted actual 1965-II data values, then estimated subsequent values. No actual data were inserted in the series after 1965-II. The simulated data explained 98.6 percent of the variation in the actual detrended data over the sample period, 1965-II to 1978-III, and 98.4 percent of the variation over the entire period (including 1978-IV).

Evaluation of the Individual Regression Coefficients

Trend.--One of the basic motivations for this study was the hope of finding an explanation for the post-1971 change in the U.S. worker's work/leisure preferences. The observation that such a change in fact occurred may be corroborated in part by examining the post-1971 trend estimates shown in the table (the constant terms in these equations). Because of the preliminary data adjustments, any remaining trend represents a change from that in evidence before 1972.

Chart III

ACTUAL AND SIMULATED CIVILIAN LABOR FORCE, 20–64 (DE-TRENDED)*



*1955–1971 trend, and extrapolation of that trend, deleted

Regression coefficients representing trend were significantly different from zero at a better-than-95% confidence level in five of the eight regressions performed over the 1972-1978 time period. In the cases of both white and nonwhite females (25-64), the trend was highly significant and positive. Since the continuation of the 1955-1971 trend was already adding a large number of persons (an average of 158 thousand per quarter over the 1972-1978 time period) to the white female labor force (25-64), the additional 50 thousand per quarter trend over the 1972-1978 time period meant that long-term noneconomic forces accounted for an average increase in the mature white female labor force of almost 4% per year over the 1972-1978 period. The mature nonwhite female 25-64 labor force also trended toward substantially increased labor force participation in the 1972-1977 time period, rising almost 5% per year on average.

Budgetary Stress.--The proxy for budgetary stress, SB, had been expected to carry a negative sign and to be particularly applicable to female and young male labor force participation, since these groups have been thought to contain a larger percentage of "secondary" workers than the other groups. The expectation of a negative sign was fulfilled except for the younger nonwhite male group, whose participation was positively related to changes in the SB variable in the 1972-1978 period. The positive sign, although inexplicable, is highly significant. It undoubtedly indicates either that the equation is imporperly specified and that a key variable has been omitted or that a simultaneous equation bias appeared in that equation. The SB variable is not highly correlated with the other independent variable in the equation, however. Budgetary stress, interestingly enough, was inversely related to 20-24 nonwhite male labor force participation in the early time period.

SB had been expected to be an especially important determinant of female and young male labor force participation, but contrary to expectations it turned out to affect mature male participation more strongly than it did any other group, other than young nonwhite females. Labor force participation was generally associated with lagged budgetary stress if it was significantly associated at all. This delayed response had been expected, for individuals usually must modify or postpone other activities in order to enter the labor force.

Real Wages.--Real hourly earnings of nonfarm production workers was associated with labor force participation of three of the four male groups with the expected positive sign, at least in periods of steadily changing real wages. The real wage proxy was not statistically significant in the nonwhite male 20-24 regression. The real wage proxy, however, had a statistically significant net negative association (again in periods of steadily changing real wages) with all female labor force groups during the 1972-1978 time period, except white females 25-64. The latter cohort has had no statistically significant association with the real wage proxy in the later period, although there was a significant negative association in 1965-1971. As noted earlier, the proxy for wages, based as it is upon the average real earnings of production workers, is not a good proxy for the earnings of female workers. As a result, WP undoubtedly proxies a part of the additional worker effect (according to which the wife enters the labor market when the husband's real wage falls) that is not wholly accounted for by SB. SB and WP, however, are not highly correlated.

Employment Opportunity.--Real GNP was chosen to proxy the effects of cyclically induced changes in employment opportunity (and perceptions of opportunity) on labor force participation because it is a widely-

publicized coincident economic indicator. Since it was hypothesized that the larger the increase in real GNP, the better the prospective worker's chance of finding a job, a positive relation was expected between real GNP and labor force participation. During the 1972-1978 period, significant positive associations were found to exist between real GNP and participation of younger white males and females, younger nonwhite females, and older nonwhite females; and no statistically significant negative relationships were found.

The labor force participation of younger workers was expected to be subject to wider cyclical fluctuations as a result of changes in employment opportunity than the labor force participation of older workers. The properly signed and statistically significant coefficients found for three of the four younger groups in the 1972-1978 period were consistent with that hypothesis. The participation of 25-64 nonwhite females was also found to be subject to a discouraged worker effect.

During the 1965-1971 time period, statistically significant negative associations were found with all male groups. These results appear to be anomalous and suggest substantial simultaneous equation bias in the 1965-1971 time period (as discussed earlier), but it was necessary to include real GNP in those equations or suffer a large loss in the R^2's. The consistency of the finding, in that all male groups had negative associations with real GNP in the early period and no labor force group did in the later period, casts particular suspicion that the regressions may have been measuring labor demand in 1965-1971, not labor supply.

Employment opportunity, of course, is only partially proxied by real GNP. Noncyclical changes in employment opportunity are often included in the trend, although they also show up with changes in other coefficients

as well. As was noted earlier, nonwhite female labor force participation changed dramatically after 1971. This change was illustrated not only by the change in the trend coefficient, but also by the changes in the other coefficients as nonwhite female participation became generally more related to economic forces. The explanation for these changes is probably related to long-run changes in economic opportunity for nonwhite females. The Equal Opportunity Act (which became law on March 24, 1972) had, along with other programs designed to remedy the effects of racial and sexual discrimination, a more-than-proportionate influence on the hiring of nonwhite females. Also, dramatic changes were taking place in the occupational structure of nonwhite female labor force during the 1965-1978 time period. In 1965, roughly 30 percent of employed nonwhite females were working as private household workers; by the end of 1977, less than 8.5 percent were so employed.

Governmental Programs.--Participation in the food stamp program was assumed to raise the worker's reservation wage, so the number of persons in the program was expected to be negatively associated with labor force participation. As the table shows, this expectation was fulfilled. The food stamp program, according to the analysis, has had statistically significant effects on the labor force participation of older workers and of younger white females. These results indicate that the program's work registration requirements, mentioned earlier, have not been effective for older workers. However, more of the exclusions from the work registration requirements apply to older workers.

The food stamp program was found to have no statistically significant effect on labor force participation in the earlier period, but it was a much different program before it was amended in January 1971. According

to a Federal court ruling [12], for example, the 1971 amendments changed the U.S. food stamp policy from one of supplementing the diets of low income households to one of guaranteeing those households an adequate diet.

Real average weekly benefits under unemployment insurance programs were expected to be positively related to labor force participation. The positive sign was expected because, as was pointed out earlier, individuals are required to be unemployed and seeking work (i.e., in the labor force) in order to qualify for unemployment benefits. Positive and statistically significant associations were found between average real weekly benefits and participation of all nonwhite males, older nonwhite females, and younger white females in the 1972-1978 period. One implication of this finding is that workers in these groups, seeing higher benefits, deliberately "seek" jobs only to qualify for unemployment benefits. Such behavior is exactly what critics of the unemployment insurance program have predicted that it would produce. Another implication, however, is that higher benefits induce workers to stay in the labor force and look for a job when they might otherwise have become discouraged and have dropped out. This behavior is exactly what supporters of the program have predicted.

Although four of the eight regression coefficients had the predicted sign, participation of one of the groups, mature white females, was statistically significant and negatively associated with average real unemployment insurance benefits in the 1972-1978 period. To date, no plausible rationale has been developed for a negative sign on real unemployment insurance benefits. Its appearance probably indicates an unresolved missing variable bias. Three of the associations were negatively signed in the 1965-1971 analysis, again possibly indicating demand rather than supply effects.

SUMMARY AND CONCLUSIONS

The model, as noted above, has limitations in that some of the proxy variables were inadequate and, especially in the case of real wages, ambiguous. As Chart III shows, however, the model predicts well during the sample period. The simulated labor force does not go off track through accumulated errors, and it explains over 98 percent of the change in the actual labor force. The model appears to track slightly better during the post-1971 period, excepting of course the fourth quarter of 1978.

The estimation results of the model clearly show the extent of the change in labor force participation since 1971. Very few similarities were in evidence between the 1965-1971 regressions and the 1972-1978 regressions in either the regression coefficients or the explanatory variables themselves. Moreover, the empirical results leave no doubt that workers in each cohort respond differently to various economic incentives and disincentives.

The empirical results were generally consistent with the postulates of the theoretical model, with of course some outstanding exceptions. Perhaps the most unsatisfactory result was the negative sign between older white female labor force participation and real average unemployment insurance benefits. Table 4 summarizes the signs of the coefficients relative to expectations. As noted at the outset, the results of the 1972-1978 estimation is far superior with respect to the signs of the coefficients. Only in two cases, budgetary stress for the young nonwhite male cohort and average unemployment insurance benefits for the older white female cohort, were the signs clearly inexplicable. The explanatory power of the model seems such that the relatively few unsatisfactory results may be left to further research.

TABLE 4

SUMMARY OF REGRESSIONS, ACTUAL SIGNS VERSUS EXPECTED SIGNS

FOR ESTIMATED COEFFICIENTS OF INDEPENDENT VARIABLES

	Budgetary Stress	Real Wages	Real GNP	Unemployment Insurance Benefits	Food Stamp Participation
Expected Signs	-	+ Males - Females	+	+	-
		(1972-I to 1978-III Regression)			
White males 20-24	0[a]	+	+	0	0
Nonwhite males 20-24	+	0	0	+	0
White females 20-24	0	-	+	+	-
Nonwhite females 20-24	-	-	+	0	0
White males 25-64	-	+	0	0	-
Nonwhite males 25-64	-	+	0	+	-
White females 25-64	0	0	0	-	-
Nonwhite females 25-64	0	-	+	+	-
		(1965-II to 1971-IV Regression)			
White males 20-24	0	0	-	+	
Nonwhite males 20-24	-	0	-	+	
White females 20-24	-	0	0	0	
Nonwhite females 20-24	0	+	0	-	
White males 25-64	-	0	-	-	
Nonwhite males 25-64	-	0	-	+	
White females 25-64	0	-	+	0	
Nonwhite females 25-64	-	0	0	-	

[a]Zero indicates that the variable was not statistically significant.

Changes in labor force participation over recent years have caused perplexing policy questions that are yet to be solved. As an example of one such question--if labor force participation is changing and if the "stickiness" in the unemployment rate in the post-1975-II recovery has been attributable to increased labor force participation, how may one calculate the welfare loss from a given unemployment rate? As an example of another such question, will the economy ever be able to expand rapidly enough to bring the unemployment rate down to historically tolerable levels without bringing about intolerable rates of inflation?

The relationship between the change in output and the change in the unemployment rate, sometimes known as Okun's Law, has been different in the post-1975-II recovery; it has taken a larger-than-usual increase in real GNP to bring about a reduction in the unemployment rate. A change in the realtionship could, theoretically, stem either from (1) an increase in labor productivity, (2) an increase in the employers desired capital/labor ratio, or (3) a change in labor force participation. The latter is the source of the current disparity. A calculation of the relationship between the percent change of real GNP and the percent change of employment supports this assertion. For all recoveries between 1955-I and 1973-IV, a one percent increase in real GNP was associated with a 1.5 percent increase in civilian employment. During the 1975-II to 1977-IV time period, however, a one percent increase in real GNP was associated with a 1.9 percent increase in civilian employment. Thus, employment is currently more responsive than usual to the rate of growth of real output. As a result, the "stickiness" of the unemployment rate can only be attributed to unusually rapid labor force growth. That unusually rapid labor force growth, the raison d'etre for this paper, has been shown to be predictable, by-and-large, and to be related to economic as well as sociological forces.

APPENDIX

Table A-I
Matrix of Simple Correlation Coefficients, Quarterly Data from 1972-I to 1978-III
(All data are in first differences except SB, negative numbers in parentheses indicate lags in quarters.)

	SB (-1)	SB (-2)	SB (-3)	SB (-4)	SB (-5)	WP	WP (-1)	WP (-2)	GNP 72	GNP 72 (-1)	GNP 72 (-3)	UI	UI (-1)	UI (-3)	FS
SB (-1)	1.0														
SB (-2)	-0.04	1.0													
SB (-3)	-0.21	-0.06	1.0												
SB (-4)	0.24	-0.20	-0.07	1.0											
SB (-5)	-0.14	0.28	-0.17	-0.10	1.0										
WP	0.10	0.15	0.04	0.04	-0.01	1.0									
WP (-1)	0.35	0.07	0.12	0.06	0.05	0.36	1.0								
WP (-2)	0.05	0.31	0.01	0.17	0.09	0.00	0.34	1.0							
GNP 72	0.14	-0.19	0.18	0.35	0.11	0.02	0.48	0.45	1.0						
GNP 72 (-1)	-0.04	0.14	-0.19	0.18	0.36	0.07	0.01	0.50	0.41	1.0					
GNP 72 (-3)	-0.16	-0.50	-0.01	0.20	-0.21	0.10	0.22	0.06	0.23	0.19	1.0				
UI	0.37	-0.13	0.02	0.06	-0.07	0.37	0.33	-0.17	-0.11	-0.10	0.02	1.0			
UI (-1)	0.09	0.34	-0.16	0.02	0.11	-0.12	0.34	0.25	0.12	-0.11	-0.03	-0.05	1.0		
UI (-3)	0.05	-0.02	0.04	0.16	-0.06	0.18	0.06	-0.06	0.12	0.36	0.02	-0.11	-0.47	1.0	
FS	0.27	0.01	0.19	0.06	-0.37	0.11	0.36	-0.05	-0.02	-0.42	-0.18	0.60	0.12	-0.15	1.0
FS (-1)	0.21	0.24	-0.04	0.22	0.07	-0.14	0.09	0.32	0.12	-0.02	-0.31	-0.11	0.56	-0.29	0.29

Table A-2

Matrix of Simple Correlation Coefficients, Quarterly Data from 1965-II to 1971-IV
(All data are in first differences except SB, negative numbers in parentheses indicate lags in quarters.)

	SB	SB (-1)	SB (-2)	WP	WP (-1)	GNP 72	GNP 72 (-1)	GNP 72 (-2)	GNP 72 (-3)	UI	UI (-1)	UI (-2)	UI (-3)
SB	1.0												
SB (-1)	-0.06	1.0											
SB (-2)	-0.28	-0.07	1.0										
WP	0.34	0.19	0.10	1.0									
WP (-1)	-0.32	0.35	0.22	0.20	1.0								
GNP 72	0.07	-0.08	-0.22	0.03	-0.10	1.0							
GNP 72 (-1)	-0.59	0.07	-0.11	-0.26	0.00	0.22	1.0						
GNP 72 (-2)	-0.03	-0.58	0.09	-0.13	-0.25	0.29	0.18	1.0					
GNP 72 (-3)	-0.06	-0.03	-0.59	-0.34	0.13	0.24	0.29	0.18	1.0				
UI	0.00	-0.15	0.26	0.15	0.07	-0.11	-0.13	0.40	-0.31	1.0			
UI (-1)	0.04	-0.01	-0.22	0.11	0.17	0.07	-0.07	-0.15	0.41	-0.30	1.0		
UI (-2)	0.12	0.08	0.05	-0.11	0.06	0.23	0.09	-0.08	-0.16	-0.40	-0.20	1.0	
UI (-3)	-0.16	0.11	0.06	0.02	-0.08	-0.16	0.21	0.10	-0.09	-0.07	-0.48	-0.14	1.0

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