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Intertemporal Substitution and Aggregate Fluctuations

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Prepared for the Carnegie-Rochester Conference, April 20 and 21, 1979. This ~~work~~ research was supported by the National Science Foundation through a grant to the NBER and is part of the NBER's Program on Economic Fluctuations. The opinions expressed are those of the author and not the NBER.

"People work harder and longer when there is more work to do." This common-sense proposition contradicts the received ~~the~~ wisdom of macroeconomics, ~~here~~ where an increase in the demand for labor may raise employment in the Keynesian ~~long~~ short run, but after wages have time to adjust, employment returns to its normal level. This ~~basic~~ idea has given rise to an ~~enormously~~ enormously active and controversial ~~and often~~ area of research attempting to show ~~why~~ why people work more in booms and less in recessions even though their work would be unchanging over time in a full neoclassical equilibrium. ~~According to the~~ ~~dominant view,~~ Fluctuations in employment result from confusions of nominal and real variables, errors in expectations about wage and price movements, contractually predetermined prices and wages, and the like, within this general line of thought. Movements of the money stock, especially unexpected movements, are an important influence on employment, even though money is essentially neutral in the long run.

An alternative view of fluctuations accepts ~~rather~~ the common-sense view that people work harder when there is more work to do as the appropriate outcome of the meeting of buyers and sellers in the labor market, rather than an artifact of imperfect information, inability to write complete contracts, and the other limitations emphasized by the ~~dominant~~ ^{dominant} line of thought. According to what I will call the "intertemporal substitution" model of fluctuations, people work harder in some years than in others because the market rewards them for

this pattern. People are not tricked into extra work in a boom; they find the work desirable because the return, in the relevant intertemporal sense, is unusually high. In slumps, people do less work because the productivity of labor is lower and, again, the ~~return to~~ ^{financial rewards of} work reflect the fact that it is not a good time to work.

Disagreement about the possible importance of intertemporal substitution cuts across ~~the~~ traditional classifications of macroeconomists. Belief in a normal or natural level of employment is as much a classical view as a Keynesian one, so the intertemporal substitution hypothesis is neither Keynesian nor classical. Further, because the hypothesis does not rest on errors in expectations, the rationality of expectations does not have any striking implications for it. Still, rational expectations theorists have been drawn ~~to~~ to the intertemporal substitution hypothesis because it promises help in explaining the persistence over time in the effects of monetary and other expectations ~~errors~~. The dean of the rational expectations school, Robert Lucas, was one of the ~~the~~ authors of the most famous expositions of the intertemporal substitution model.¹ That paper is probably even more famous for introducing one of the first formalizations of the role of

¹"Real Wages, Employment, and Inflation", (1969), with Leonard Rapping.

expectation errors in macroeconomics. Much criticism of the intertemporal substitution model has been directed at Lucas and Rapping's formulation of it, and specifically at the large role it assigns to errors in perceiving the current real wage.² Many economists have received the impression that intertemporal substitution takes place only because of workers' misunderstanding of movements in relative prices/ in the intertemporal substitution model. However, in fact, the issues of substitution and expectation or perception errors can be completely divorced. The present paper ~~looks only~~ ~~at~~ concentrates on substitution that is induced by genuine and appropriate changes in relative prices.

Another source of misunderstanding of the intertemporal substitution model is the claim that it makes all movements in employment and unemployment voluntary, and so misses the essential insight of Keynesian economics. A recurrent theme in the ^{discussion} ~~criticism~~ of the intertemporal substitution model is the ~~claim~~ ^{criticism} that it makes ~~all~~ employment fall by raising quits, when in fact quits are low during a downturn.³

This criticism has not been taken very seriously by the proponents of the theory of intertemporal substitution.

An attempt is made in this paper to reconcile the ^{apparent} ~~fact that~~ ~~employment decisions seem to be made~~ ^{determination of} unilaterally by employers ^{employment}

²For example, in Tobin (1972), ~~who~~ writes, "I conclude that it is not possible to regard fluctuations of unemployment on either side of the zero-inflation rate as mainly voluntary, albeit mistaken, extensions and contractions of search activity."

³See, for example, Tobin (1972) and Modigliani (1977).

with the hypothesis that the consequent changes in employment represent intertemporal substitution of work at one time for work at another in line with changes in relative r wages.

Probably the most serious misunderstanding of the substitution model is the claim that it rests on movements of real wages that do not in fact take place.¹ To a first approximation, there is no pattern of cyclical fluctuation of the relative prices of produced goods and labor, and so no reason to expect ~~along~~ substitution along this margin as a regular feature of cycles. But the intertemporal substitution model rests on variations in the relative price of current labor against future labor. This point was clearly spelled out in Lucas and Rapping's original paper, but was not fully incorporated in their empirical results. Recently Barro (1978) has developed a more complete theoretical model of intertemporal substitution in general equilibrium.

My purpose here is to set forth a simple empirical version of the intertemporal substitution model, to estimate its key parameters, and then to inquire at length whether the story told by the model about aggregate fluctuations makes sense in view of other evidence about intertemporal substitution. In particular, I will draw on recent microeconomic evidence on labor supply based on panel data and the negative income tax experiments.

¹Again, see Tobin (1972) and Modigliani (1977).

Within a formal model, the common-sense view--that people work more when there is more work to do--requires that aggregate supply be reasonably elastic with respect to the relative wage and that aggregate demand be reasonably inelastic. Then an exogenous burst of demand, say from the government's decision to pursue a costly war, bring about an increase in the ~~the~~ current wage compared to the discounted future wage, so people work harder and the production of goods rises. In addition, the price of current goods rises relative to the discounted price of future goods, so people substitute away from current goods. Thus total output rises, but by less than the amount of the exogenous shift fo of demand.

for labor?

The evidence presented here suggests that ~~aggregate demand and supply~~ ~~considered as functions of the relative price have slopes with about the same magnitude~~ an increase of one percent in the relative price raises supply by about \$ 26 billion and depresses demand by ~~the same~~ \$ 11 ^b billion. Thus ~~the~~ output rises by \$ ⁶ billion for every \$10 billion exogenous ^e increase in demand. The sampling errors associated with these estimates are unfortunately rather high.

The amount of intertemporal substitution of labor implied by these results is exceeds what is generally found in microeconomic research by around a factor of ~~two~~ ^{five}. Cyclical fluctuations in productivity and some other considerations may help reduce the gap. On the demand side, the estimated amount of substitution may be rather lower than is suggested by a model where the timing of investment can be altered fairly easily, and is closer to the

level that would be expected for consumption of goods by itself.

Nothing in the paper can be said to confirm the intertemporal substitution model as against ~~the~~ classical or Keynesian alternatives. Two of the central findings of the work--that exogenous demand has positive influences on aggregate real output and on real interest rates--are equally true of conventional Keynesian models. Rather, the paper shows the inadequacy of existing criticisms of the intertemporal substitution model, both at the theoretical and empirical levels.

1. Microeconomic theory of intertemporal labor supply

It is useful to review the standard theory as developed[✓] in Lucas and Rapping and in several other places. Individuals have preferences over present and future work and present and future consumption of goods. They have ~~an~~ endowments of time available in the present and future, valued by wage rates that, for now, will be considered known with certainty. They may also ~~have a certain amount of~~ ^{hold some} wealth. Consumption goods are available¹ at known prices, and consumers may borrow or lend at a given nominal interest rate to move resources from present to future ~~or the reverse~~ or the reverse. Formally, with

c_1, c_2 : present and future consumption of goods

L_1, L_2 : present and future work

r : real interest rate

w_1, w_2 : present and future real wages

A : real assets other than the value of time,

there are goods demand and labor supply equations for year 1:

$$c_1 = d_1(r, w_1, w_2, A)$$

$$L_1 = s_1(r, w_1, w_2, A)$$

and a similar pair for year 2. The substitution effects of changes in the relative prices are as follows:

Effect of higher real interest rates on present consumption:

negative

Effect of higher current real wage on present consumption:

presumably positive

Effect of higher future real wage on present consumption:

ambiguous

Effect of higher real interest rate on present labor supply:

presumably positive

Effect of higher present real wage on present labor supply:

positive

← Effect of higher future real wage on present labor supply:

presumably negative

The basic logic of the intertemporal substitution model holds that the observed responses to cyclical movements in relative prices should be essentially pure substitution effects, as cyclical variations have little effect on lifetime well-being, which is the relevant concept of income. Thus the central question ~~concerning~~ treated in this paper is whether the set of changes in relative prices that accompany a boom or a recession are compatible with the increase or decrease in labor supply that takes place. Possible changes that might explain, say, the rise in employment in a boom are:

1. The present real wage rises.
2. The future real wage falls.
3. The real interest rate ^{rises} falls.

Of these, the second seems highly unlikely and has not received any attention. Most discussion of cyclical labor supply has focussed on the role of temporary reductions in the real wage. But the third suggestion, a rise in the real interest rate, is

these are

not
should be 0

clearly pointed out by Lucas and Rapping and deserves an examination as well.

The transplantation of the two-period analysis to the real world where people work and consume for many years requires some additional comment. Of course, the complete intertemporal model has the relative prices for all future years as arguments of the demand and supply functions for this year. Condensation to the two-period version requires the hypothesis that all future years can be combined into a Hicksian composite good. If any departure of the real wage and the real interest rate this year ^{from their normal values} is expected to be corrected by next year and all succeeding years, then the composite good theorem applies, and the demand and supply functions can be written just as functions of the current real wage and real interest rates and real wealth. More generally, if the current values of the real wage and interest rate provide all the information that is needed to predict the path by which they will return to normal over the future, then it will still be true that the demand functions ~~can~~ can be written as functions of contemporaneous variables alone. The latter explanation of the role of the variables will be relied upon in the empirical work presented here, as it turns out that movements in the variables persist for well over a year.

Under a general specification of preferences, changes in real wages and in real interest rates have distinct substitution

effects and so should enter separately in econometric work. This observation led Lucas and Rapping to include both variables in their regressions, though the interest rate was eventually omitted from their final equations. I am not aware of any successful attempts to measure the independent contribution of interest rates ~~and~~ in intertemporal labor supply; certainly microeconomic research has nothing to say on this point because there is no ^{usable} cross-sectional variation in interest rates. There is an additional assumption about preferences ~~that~~ whose implication is that the effects of real wages and interest rates ~~and~~ combine in a certain way: The intertemporal utility function is assumed to be separable in goods and work. Then a composite substitution variable,

$$s_t = (1+r_t)w_t$$

indexes the effect ^{of} ~~variables~~ both variables. When s_t is temporarily high, labor supply will be above normal, and vice versa.

2. Econometric evidence on the joint movements of the relevant variables

The principal empirical weakness of the intertemporal substitution model is the high elasticity of labor supply it seems to require: Aggregate fluctuations involve large movements in ~~the~~ employment and small movements in the ~~current~~ ratio of the current real wage to the discounted future real wage. If the ~~change in~~ changes in employment are movements along a labor supply curve, it must be quite elastic, or so the argument goes. The first step in examining this line of attack on the intertemporal substitution model is to find out how elastic the labor supply curve implicit in the aggregate data actually is. Now any model has a right to some residuals, so it is not adequate just to look at the plot of employment against the substitution variable. Nothing less than a full econometric untangling of the supply function from the demand function will answer the question. Of course, the elasticity of the supply function is not the only issue. If it turns out that the supply function is plausibly inelastic, but that almost all fluctuations in employment are attributed to unexplained shifts of the supply curve rather than to movements along the curve, then the intertemporal substitution model has little that is interesting or new about it.

~~Separation~~ Separation of demand curves from supply curves is a very well understood econometric problem. If the model

hypothesizes random shifts of both curves, then identification requires that there be some exogenous variable that has predictable effects on one curve and not the other. The obvious candidate in aggregate supply and demand is government purchases of goods and services (I will call this government expenditures for short, but it should be understood to exclude transfers). Periodically the government absorbs an abnormal fraction of employment and output, mainly to pursue wars. Provided these contributions to demand are unrelated to the random shifts in the schedules (in other words, intertemporal substitution is not a major factor in the determination of government expenditure), then the relation between government expenditure on the one hand and employment and the substitution variable, on the other, provides information about the slopes of the supply and demand curves. If supply is relatively elastic and demand relatively inelastic, then real output should rise by almost as much as government expenditures rise, and the effect on the substitution variable should be small. This is the view of what actually happens in the US economy held by most of the critics of the intertemporal substitution theory, and they go on to argue the implausibility of the elastic labor supply needed to rationalize the joint movements of the variables within the model. At the opposite pole is what might be called the classical view: supply is inelastic and demand is elastic, so a bulge in government expenditures has little effect on output and a positive effect on the substitution variable--private demand declines by almost as much as

government expenditures rise.

The simplest possible model of this process is the following:
 Measure employment by real GNP, say x_t . Output and employment are known to have a close functional relationship in US data. Some deeper reasons for using x_t as the employment measure are discussed later in this paper. A parallel assumption is that the price level also measures the wage rate. Again, this does little injustice to the facts since real wages are virtually an exact trend except in 1974. Under these simplifications, the substitution variable, s_t , is just the real interest rate, r_t .

Let the supply function be

$$(1) \quad x_t = \alpha + \beta s_t + u_t$$

and the demand function be

$$(2) \quad x_t = \gamma - \theta s_t + g_t + v_t$$

The random variables u_t and v_t measure unexplained shifts of the two functions. Real government purchases of goods and services, g_t , is assumed uncorrelated with u_t and v_t . The reduced form of this system is

$$(3) \quad x_t = R_x + \frac{\beta}{\beta + \theta} g_t + \eta_t$$

$$(4) \quad s_t = R_s + \frac{1}{\beta + \theta} g_t + \zeta_t$$

Here k_x and k_s are constants and η_t and v_t are random reduced form disturbances; all of these are functions of the structural parameters and disturbances, but there is nothing to be gained by writing out the dependence explicitly.

The real interest rate is not observed directly, so the second reduced form equation ~~A~~ cannot be estimated in this form. Restating the substitution variable in nominal terms gives

$$s_t = r_t^N + \log p_t - \log p_{t+d}$$

where r_t^N is the nominal interest rate and d is the number of time periods over which the interest rate applies. Now actual behavior at time t responds not to s_t , but to $s_t + \epsilon_t$, where ϵ_t is the error made in time t in forecasting the future price, p_{t+d} . Thus the appropriate reduced form equation for s_t itself is

$$(5) \quad s_t = k_s + \frac{1}{\beta + \theta} g_t + v_t - \epsilon_t$$

The structural system becomes

$$(6) \quad x_t = \alpha + \beta s_t + u_t + \beta \epsilon_t$$

$$(7) \quad x_t = \delta - \theta s_t + q_t + v_t - \theta \epsilon_t$$

structural
The ~~structural~~ residuals will not be measures of the shifts in supply and demand alone, but will also contain the price ~~exp~~ expectation errors, ϵ_t , which will cause the two residuals to be negatively correlated.

Estimation of the system is straightforward. A regression of output, x_t , on government expenditures, g_t , gives an estimate of $\frac{\beta}{\beta + \theta}$ (see equation 3). ~~A regression of~~ ^{one minus this is} ~~government expenditures~~ ^{an estimate of} ~~output~~ ^{of} ~~on~~ ^{of} ~~gives an~~ ^{estimate of} ~~estimate of~~ (this regression need not actually be run since its coefficient is the first coefficient ~~is~~ one ~~less~~ ^{less} the coefficient of the first regression). A regression of the real interest rate ex post, s_t , on g_t gives an estimate of $\frac{1}{\beta + \theta}$ (see equation 5). Dividing the first two ^{numbers} ~~coefficients~~ by the third gives estimates of β and θ , the slopes of the supply and demand functions. Alternatively, numerically identical estimates can be obtained by applying full information maximum likelihood to the structural equations, 6 and 7.

In the preliminary results presented there, x_t is measured as real GNP in 1972 prices with an exponential trend removed, and g_t is measured as real government purchases of goods and services with trend removed. The price in the substitution variable ~~are~~ ^{is} measured by the GNP deflator and the nominal interest rate

by the rate on one-year commercial paper. The future price in s_t is thus four quarters ahead. Data are quarterly and span 1948 through 1978, third quarter.

The simple regressions of x_t and s_t on g_t ~~provide all the~~ ARC:
~~relevant information in the data.~~

$$x_t = 394 + 0.75 g_t$$

(10) (.09)

$$\hat{\sigma}_x = 13 ; \quad R^2 = 0.36 ; \quad DW = 0.17$$

$$s_t = -0.045 + .00049 g_t$$

(-.014) (.00013)

$$\hat{\sigma}_s = .018 ; \quad R^2 = 0.11 ; \quad DW = 0.36$$

The implied slopes and standard errors (from FIML) are

$$\beta = 1507 \qquad \theta = 532$$

(431) (126)

Unfortunately, both equations show very serious autocorrelation.

The same equations with ~~a~~ autoregressive corrections are

$$x_t = 408 + 0.61 g_t$$

(16) (0.15)

$$\hat{\sigma}_x = 5$$

$$s_t = .019 + .00026 g_t$$

(.032) (.00036)

$$\hat{\sigma}_s = .011$$

and the corresponding estimates of the slopes are:

$$\beta = \begin{array}{l} 2654 \\ (2922) \end{array}$$

$$\theta = \begin{array}{l} 1135 \\ (1301) \end{array}$$

Much of the apparent precision of the first set of results is lost when account is taken of serial correlation. It remains true, however, that the demand curve slopes downward and the supply curve slopes upward even in the second set of results.

The corrected results provide relatively little information about the slope of the supply function. The t-statistic of a little under 1 means that it is about two-thirds probable that the slope is positive. The single most likely value of β , 2654, corresponds to an elasticity of ~~the~~ labor supply with respect to the wage of 5.6. However, much lower elasticities, or higher ones for that matter, are not at all inconsistent with the results. This attempt to measure the slope of the supply function obviously cannot settle the issue of the plausibility of the substitution model.

Of the two implications of the model for the relations among the data, there is no problem measuring and confirming the positive effect of government expenditures on real output. Every dollar of extra expenditure raises real GNP by about 60 cents. The extreme classical prediction of zero effect (corresponding to completely inelastic labor supply) is overwhelmingly rejected, as are all positive effects below about 0.30. The second relationship, between expenditures and the ex post real interest rate, is the source of the

imprecision in the estimates of β and ϵ (recall that the regression coefficient of s_t on g_t is in the denominator of the expressions for β and ϵ). There is so much noise from other sources of fluctuations in interest rates and present and future prices that it is difficult to measure the influence of government expenditures. This problem could be solved by incorporating variables that measure the other sources of fluctuations. An obvious starting point is to try to eliminate the price expectation error from the ~~the~~ reduced form equation for s_t .

My experiments in this direction have not been very successful. I have tried to take advantage of the information available about errors in forecasting future prices by estimating a simple price forecasting equation. Prices ~~4~~ 4 quarters ahead can be forecast with a standard deviation of about 1.5 percent with a simple linear combination of current and lagged prices and the money supply. ~~Put~~ Putting the residuals from this forecast equation into the reduced form equation for s_t does reduce the standard error of the coefficient of g_t , but only slightly, from .00030 to .00027. Further, the coefficient itself drops to .00012 from .00026, so the evidence for an effect of exogenous demand on real interest rates becomes even weaker. I also tried the econometrically more satisfactory procedure of estimating the forecasting equation and the s_t equation jointly with multivariate regression. Again, the standard error of the estimated coefficient of g_t improved, but the coefficient itself became smaller.

Much more work needs to be done on the reduced form ~~of~~ equation for the real interest rate. As it stands, it is almost impossible to pick out the positive effect of exogenous shifts in demand from the many other influences on the real interest rate ex post. ~~With~~^M next step will be to measure real interest rates as the realized return to capital. In addition, a good deal of work remains to put the intertemporal substitution variable on the appropriate after-tax basis.

3. Microeconomic evidence on intertemporal labor supply

The elasticity of labor supply with respect to transitory variations in effective wages can be measured econometrically using data collected from individuals over time in panel studies. The variation found in micro data is just the opposite of that found in the aggregate data examined in the previous section: there is little observable variation in interest rates, but a great deal in real wage rates. Considerable faith in the assumptions that link wages and interest rate effects is required to draw the two bodies of data evidence together.

Thomas MaCurdy (1978) has recently completed a study of the evidence in the Panel Study of Income Dynamics for adult men. Everyone in his sample works at least part of each year, so the relevant margin of substitution is the number of hours of work, not the discrete decision about whether to work at all. MaCurdy assumes that workers' perceptions of lifetime well-being do not change from year to year, but rather can be treated as unobserved permanent individual characteristics. Then the observed response of hours to changes in wages is interpreted as a pure substitution effect. He estimates the elasticity directly by regressing the log of hours of work on the log of the wage. The resulting elasticities range from .09 to .23, depending on the details of the specification. This research tends to confirm the general view that adult males do not vary their hours of work in a way that is sensitive to wages.

A similar study~~r~~ has been carried out by James Heckman and MaCurdy (1977) for adult women. They find, again in accord with earlier research, that women are much more sensitive to changes in wages. For women ~~in~~ whose wages are beyond the reservation point that draws them into the labor market, the estimated elasticity of hours of work with respect to the wage is 6.6.

So far as I know, there are no~~r~~ comparable studies of intertemporal labor supply ~~decision~~ among teenagers, who are probably ~~more~~ similar to adult women.

As it stands, this body~~r~~ of evidence suggests an aggregate wage elasticity of labor supply of around 2, ~~but~~ but virtually all of that comes from ~~women~~ women and teenagers. Observed cyclical fluctuations in employment are disproportionately concentrated among women and teenagers, but are noticeable among men as well.

Another highly relevant body of evidence has been collected by the various negative income tax experiments. I cannot do justice to all of the findings of the experiments, but will offer the following broad summary: The typical experiment~~r~~ offered a three-year period of increased income ~~at~~ its subjects, ~~and~~ along with a tax of about 50 percent on earnings. The typical adult male subject reduced his labor supply ~~x~~ by 3 hours per week and the typical ~~adult~~ adult female subject by about 2 hours per week. However, only about half of the subjects were actually influenced by the tax and transfer provisions of the experiment; the rest had total incomes in excess of the critical ~~point~~ point where payments reached~~r~~ zero

under the benefit formula. Putting all this together gives a rough estimates of the wage elasticities of 0.26 for men and 0.66 for ~~men~~ women. This is somewhat higher than MaCurdy's estimates for men and very much lower than Heckman and MaCurdy's estimates for women. Part of the difference may be attributable to the rather different compositions of ~~the~~ the two samples. For aggregate labor supply, the ~~w~~ evidence from the negative income tax experiments suggests an overall wage elasticity of about 0.40.

4. The Institutional Setting of Labor Supply Decisions

One of the most deep-seated objections to the intertemporal substitution model of aggregate ~~fluctuations~~ fluctuations comes from its apparent contradiction to the way that decisions about employment and hours of work are actually made. Instead of consulting the relevant prices, wages, ^{and} interest rates to decide how much time to spend in the labor market, workers simply show up for their jobs every day and do whatever work is available. When business is strong, employers ask for and receive extra effort from their workers; in some cases they pay for it through overtime hours and sometimes it is just part of the job. In times of slack, employers unilaterally depress hours of work through temporary layoffs, reduced work weeks, and so on. Even ~~the~~ outside the blue-collar industrial sector where provisions for varying annual hours of work are highly formalized, it is clear that employers expect more from workers in times of brisk demand than in times of slack. By and large, it is employers, not workers, who actually make decisions about the volume of work.

Closely related to this misgiving ~~is~~ about the intertemporal substitution model is the contention that the relevant market signals are diluted almost to non-existence by the time they reach the typical worker. As argued earlier, interest rates are the major stimulus in the aggregate ~~for~~ intertemporal substitution. But consumer interest rates, both for borrowing and lending, are highly regulated and do not ~~fluctuate~~ fluctuate nearly enough to induce the requisite substitution of labor supply over time.

Taken together, these arguments suggest that workers do not have the freedom to behave the way the intertemporal substitution model wants them to, and even if they had that freedom, the market is unsuccessful in providing the financial incentives that would induce them to vary their hours of work over the cycle. It seems to me that this line of attack has to be taken seriously, but that the recent theory of the employment contract supplies at least a partial answer to it.

Under an employment contract, a worker may grant to the employer the right to determine the level of employment, subject to ~~any~~ limitations spelled out in the contract. Herbert Simon () was one of the first to investigate such contracts. A voluminous recent literature examines contracts where employers bear the risk of temporary fluctuations in demand; under these contracts, efficiency generally requires that employers vary the level of employment even though compensation is certain or nearly certain, (see Phelps and Calvo ()). Part of the original motivation for this line of research was the belief that contracts could provide an explanation for Keynesian wage rigidity--put most precisely, an explanation for the apparent ability of purely nominal shocks to affect the level of employment and output. Though there is still a serious question whether this explanation is successful, the idea of contracts where workers grant the power of employment determination to employers is an important one and is not at all linked to Keynesian theory.

Within the intertemporal substitution theory, employment contracts could arise because employers have ~~the~~ better information about the value of work at different points in the business cycle than do workers. Though markets with sensitively varying wages and interest ~~rate~~

rates could induce the efficient pattern of work, it is ~~more~~ better ~~from~~ from the point of view of managing information for employers to determine the ~~opt~~ pattern of work unilaterally. When there is more ~~work~~ work to do, employers will ask their workers to work harder and longer, and the workers will cooperate even though it costs them foregone time at home because their long-term contract is attractive. If employers act properly, they will simulate the market by equating the ~~margin~~ marginal product of ~~the~~ labor to the marginal value of time. Of course, all the standard problems in the theory of ~~the~~ labor contracts interfere with this process--employers can cheat workers by asking them to work long hours too frequently, workers can default by quitting, and so on.

This line of thought may also help explain cyclical fluctuations in labor productivity. It is a notorious contradiction of the theory of production functions that the same factors produce more output when demand is strong than when it is weak. Recent investigations by Mork () have shown that this is a genuine phenomenon and not an artifact of aggregation.

5. The Role of Money in the Intertemporal Substitution Theory

Money has no explicit role in a simple version of the intertemporal substitution model. What matters in the model is relative prices, and only under special assumptions can the money stock influence important relative prices. The model explains aggregate fluctuations in terms of shifts in the demand function and movements along a fairly elastic supply function (as well as possible shifts of the supply function). There is no logical necessity that the shifts relate to movements in the money stock, and no mechanism within the model by which the money stock can shift the demand curve or the supply curve. Full monetary neutrality, even in the short run, seems the most harmonious assumption about the role of money in the model. Of course, several authors, including Lucas and Rapping at the outset, have coupled the intertemporal substitution model to models of ~~short-run~~ short-run limitations in the diffusion of information. In these hybrids, monetary neutrality fails in the short run, an unexpected monetary expansion can create the impression of high real interest rates (or higher real wages) because of limited information among employees and workers. The effect can last only as long as the lag in the arrival of information. As Lucas () and Sargent () have argued, the transitory real effect of a monetary disturbance could set in motion a longer response within the real economy. For example, costs of adjusting the level of output will make

inventories fall in response to a monetary expansion, and then gradually output will rise to restore the ~~size~~ stock of inventories.

In the US economy, current output and employment ~~and/lagged~~ are closely associated with lagged money--the simple correlation of the ~~percent~~ percent change in this year's real GNP and last year's percent change in the money stock is about 0.65. This correlation represents the greatest challenge to the intertemporal substitution model of fluctuations, either in its pure or hybrid forms, in my view.

The model invites two very different interpretations of the correlation:

1. Money has a strong causal role through expectation errors and a vigorous supply response to those errors.
2. Money responds to the demand shifts that bring about output fluctuations; it has no causal role in ~~those~~ those fluctuations.

Neither interpretation is compelling. Under the first, the economy is suffering large, inappropriate movements of output and employment because of its inability to distinguish the neutral proportional movements in prices associated with changes in the money stock from changes in relative prices. Under the second, it is hard to rationalize the well-documented lag from money to real output. If whatever shifts aggregate demand does so immediately, then the lag from money to output means that money is anticipating demand shifts. If output

responds with a lag to an unobserved ~~minimum~~ determinant of demand, why does money respond instantly? These are old questions--they form the backbone of conventional monetarism. But the intertemporal substitution model contradicts conventional monetarism, and this may be its point of greatest weakness.

6. Unemployment

Many critics of the intertemporal substitution model find it at ~~an~~ odds with the facts about unemployment. If a recession is just a period when people recognize that lower levels of work are appropriate, why is it accompanied by a bulge in the number of people who say they are looking for work but cannot find it?

Part of the answer comes immediately from what is known about temporary layoffs. About a third of the increase in the unemployed during a recession have not lost their jobs, but are on furlough as part of the process of diminished total work effort. A reduction in effort has three components: less intensive work each hour, shorter hours of work each week, and fewer weeks each year. Those on layoff ~~as~~^{as} part of the last component are counted as unemployed even though they still have jobs, a fact pointed out by Martin Feldstein (). However, the remaining ~~the~~ two-thirds of the increase during a recession are truly jobless. The great majority of them have lost jobs through permanent layoff; the rest of the increase consists of people who have just ~~entered~~ entered the labor force and are taking longer than usual to find work. As many critics have pointed out, none of the increase in the unemployed comes from job-quitters.

Labor contracts can explain the narrow issue of the active role of employers and passive role of workers in the process of reducing total labor supply, it seems to me. A contract that provides for unilateral action by employers in terminating the employment relationship when the marginal value of workers' time threatens to exceed the marginal product of labor makes good sense. We are not surprised that a shift in the composition of demand as away from one sector causes employers in that sector to lay workers off, and the same principle ~~ought to apply~~ ought to apply in the aggregate.

The harder issue is the explanation of the strong tendency for the population to spend a larger fraction of its time looking for work in times of slack. Why does the duration of the typical spell of unemployment lengthen from six weeks in normal times to eight weeks in a recession? This question may have an answer somewhere in the microeconomic theory of job search--indeed, I have made one attempt in this direction by looking at the widening of wage differentials that occurs during a recession (Hall(1975)). Still, the lack of a convincing, complete account of the cyclical behavior of unemployment is a serious weakness of the intertemporal substitution theory.

7. Conclusions

From the microeconomic evidence, one can argue for an elasticity of labor supply with respect to the intertemporal substitution variable of about 1.0, especially if fluctuations in productivity are interpreted as changes in labor effort per hour at work. In terms of the econometric model in section 2, this elasticity corresponds to a value of β of about 500, ^{about one} ~~little~~ ^{f.f.th of} ~~less than~~ its estimated value but easily within the very wide confidence interval^d for that estimate. The aggregate data on output and real interest rates do not reject the intertemporal substitution model. Certainly the case in favor of the model would be stronger if its prediction of a positive relation between government expenditures and the real interest rate could be confirmed with greater precision.

There seems little reason at this stage to expect the majority of practical macroeconomists to give up the conventional IS-LM-^cPhillips Curve model in favor of the intertemporal substitution model. In the conventional model, aggregate supply is highly elastic at a rigid nominal price and wage. Given this property, the profound influence of the money stock on real output is easily rationalized. The explanation of price and wage rigidity ~~it~~ itself still eludes the proponents of conventional macroeconomics, however--one may ask just as well for the conventional model as for the intertemporal substitution model why private

economic arrangements are so vulnerable to huge disruptions from monetary policy.

Some readers may feel that the version of the intertemporal substitution model that emerges from this study ~~is~~ where people work harder when aggregate demand is strong than when it is weak and where ^{they} have granted employers the right to determine the level of work effort--is not too different from the Keynesian model. Certainly the two share an emphasis on aggregate demand that sets them apart from classical or monetarist models. However, their implications for stabilization policy are totally divergent. In the intertemporal substitution model, booms and recessions are times when it is efficient for people to work hard or take it~~is~~ easy. Government policy to offset fluctuations is either ineffective or perverse. In the Keynesian model, stabilization policy is effective and can be used to make everyone better off. This disagreement matters a lot, so the ^{value} of additional knowledge about the nature of aggregate fluctuations is high.