A New Theory of Aggregate Supply

By ROGER E. A. FARMER*

Macroeconomic theory contains two competing explanations of business cycle fluctuations. According to the intertemporal substitution mechanism (*ITS*), observed variations in employment represent the optimal response of labor supply to (misperceived) variations in the expected real rate of interest. A competing theory is offered by the literature on overlapping contracts that attributes employment variations to contracted nominal wage rigidities. Such rigidities prevent prices from adjusting in a way that would allow quantities to mimic the theoretical predictions of the Walrasian market-clearing model. Both of these theories incorporate the property that employment converges in the long run to a natural rate of employment.

This paper develops an alternative theory. It presents a model of an economy in which agents are rational utility maximizers with perfect foresight of future prices—nevertheless the competitive equilibrium is Pareto inefficient. This situation arises because the economy does not contain a complete set of markets. Perfect capital markets do not exist because of asymmetric information (*AI*). A complete set of futures markets does not exist because agents have finite lives and trades cannot be negotiated with the unborn. These two sources of market failure are modeled by embedding a theory of *AI* contracts into an overlapping generations model (*OLG*) in which a critical role is played by the additional assumption that in some states of nature bankruptcy may be a binding constraint. The nonexistence of futures markets generates a model with the property that government debt is real wealth which implies that fiscal policy can have a permanent effect on the real rate of interest. The bankruptcy constraint translates changes in the rate of interest into changes in the frequency of contract default—simply stated, a high interest rate increases the probability that a firm will go bankrupt (or that it will layoff workers).[1]

In sharp contrast to either the new classical or the sticky price contract explanations of business cycle fluctuations, this theory is *not* a natural rate theory *even in the long run*. It predicts that the steady-state employment level is an endogenous variable which varies systematically with fiscal policy.

I. Model Structure

In a model with asymmetric information, it is important to be specific about who observes what when. It is convenient for this reason to use a modified form of the overlapping generations model which is adapted from the work of Peter Diamond (1965).

It is assumed that time is divided up into a series of periods and that during each period, agents *either* produce goods *or* they exchange goods. Periods of production are interspersed with periods of exchange and the two sorts of activities are referred to as pro-

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[1] In this paper, output variation is due to bankruptcy. My 1985 paper develops a model in which real interest rate fluctuations generate changes in the frequency of layoffs, but in both instances it is the existence of bankruptcy which causes contract inefficiency. See the discussion of this point in Section XI.

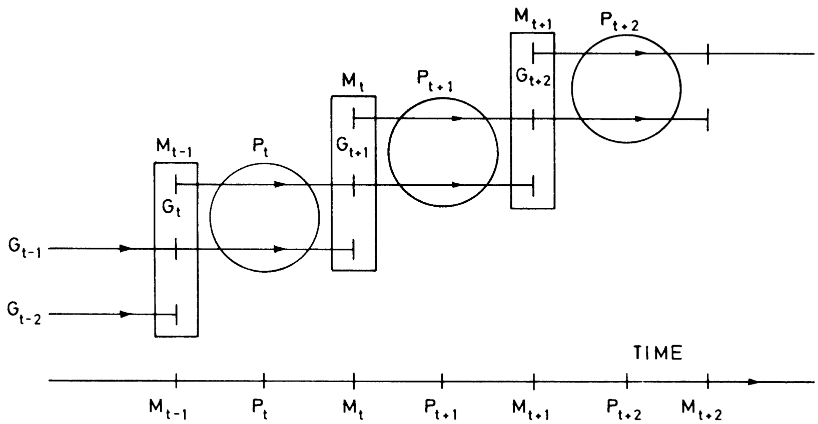

FIGURE 1

duction and market periods, respectively. Market periods are referenced with the notation M_t, $t=1,2\ldots$ and production periods with the notation P_t, $t=1,2\ldots$ and the ordered set $\{M_t, P_t\colon t=0,\ldots,\infty\}$ defines the sequence of all periods. Agents are assumed to live for two production periods and three market periods (see Figure 1 which outlines the temporal sequence of events).

I refer to generations with the notation G_t where the subscript t corresponds to the first production period of the representative agent's life. A representative agent of generation t is born in market period M_{t-1} at which there are three generations present—the newly born generation G_t, the generation G_{t-1} each of whom is in the transition from youth to old age, and the old generation G_{t-2}, each of whom is about to die. There is no growth and so each generation contains the same number of individuals.

In the first production period P_t, the individual supplies labor services that are combined with a single unit of capital. Labor and capital are combined according to the provisions of a contract that is written at the market period M_{t-1} immediately preceding production. It is assumed that production takes place on distinct "islands" and that there is no auction market for labor. There is a single good which may be consumed or used as capital in the following period. It is produced using a Leontieff technology and the gross quantity of output that is available on each island in each period (including depreciated capital) is given by

$$(1)\quad y_t = k_t(1-d-\Delta l_t)+\alpha\min(k_t, l_t)s.$$

The labor supply decision is dichotomous, $l_t\in\{0,1\}$. The worker chooses whether or not to work after observing a random productivity shock, s, and if he or she chooses to work then depreciation occurs at a faster rate than would otherwise be the case. The symbol d represents depreciation due to natural wastage, decay, etc., and Δ represents the additional depreciation that occurs if the machine is used for productive purposes.

In equilibrium, optimizing agents will invest a single unit of capital with each worker and (because of the assumption that the technology is Leontieff) this allocation will be independent of the rate of interest. The assumption of a fixed coefficient technology is restrictive, but nothing of substance hinges on it,[2] and it does result in a considerable clarification of the mechanism by which the rate of interest can affect the probability of bankruptcy. In Section V, I show that a higher real interest rate will cause a loss in output because more firms go bankrupt and because asymmetric information causes firms

[2]My 1985 paper presents a model in which the technology allows capital-labor substitution that has qualitatively similar results.

to write contracts in which bankruptcy may be inefficient. The assumption of a Leontieff technology allows us to abstract from the mechanism of capital-labor substitution (that would also suggest that a higher rate of interest would be associated with less output) and it serves to clarify the role of bankruptcy.

The random productivity shock s is assumed to be an independent drawing from a probability density function $h(s)$ with support in the interval [0,1]. Each worker receives a different drawing from the same density function. I refer to the wage as w_t and to the gross return to the capital owners (one plus the interest rate) as R_t.

At the market meeting M_t, the worker and the capitalist divide up the output y_t according to the provisions of the contract that was written at the previous market meeting. The worker consumes the amount c_t^0 and allocates the rest of his/her income across a portfolio of assets that may consist of contracts with the new generation of workers, or of holdings of government debt that pays a guaranteed real return $\bar{R}_t$ in the following period.

At the final market meeting of life, the individual consumes an amount c'_{t+1}, equal to his or her gross portfolio returns, and dies.

II. Risk and Time Preference

Nothing of substance in this analysis hinges on attitudes to risk and it is expositionally convenient for the presentation of a theory of contracts with default if both parties to the contract are risk neutral. The usual way of modeling preferences under uncertainty is to assume that agents maximize expected utility—but the assumption of lifecycle von Neumann-Morgenstern (N-M) utility functions links risk preferences and time preferences in an overly restrictive way.[3] To separate these factors I adopt the ordinal certainty equivalence (*OCE*) representation of preferences developed by Larry Selden (1978, 1979) as an alternative to the standard expected utility hypothesis.

At market meeting M_t, the agent will make choices over the certain-uncertain consumption pairs $c_t^0 \times c'_{t+1}$. At this point in time, wage uncertainty has been realized but the portfolio return is a random variable. The work by Selden allows one to define an ordinal utility index $u(c_t^0, \hat{c}'_{t+1})$ that expresses time preferences. $\hat{c}'_{t+1}$ is the certainty equivalent of the uncertain consumption stream $c_{t+1}(R_{t+1})$ that is found by defining a separate N-M utility functional to express the individual's attitudes to risk. We shall be concerned with the case in which agents are risk neutral. This implies that the agent will choose the bundle $c_t^0, \hat{c}'_{t+1}$ to maximize

$$u\left(c_t^0, E\left[\left(w - c_t^0\right)R_{t+1}\right]\right). \tag{2}$$

An implication of this specification is that the investor cares only about the mean of the distribution of the random portfolio return R_{t+1}.

The other signatory to a contract will be a newly born individual whose utility will indirectly depend on the wage w_t. In order to define how this agent will behave when faced with an uncertain prospect, I shall adopt a straightforward generalization of the *OCE* representation of preferences. It is assumed that the agent looks ahead to the choice that he or she will make in the following period and replaces c_{t+1}^0 with its certainty equivalent. This is found by defining a separate N-M utility functional to express attitudes to first-period consumption risk. It is also assumed that this functional is linear in c_{t+1}^0, which implies that the young agent will care only about the mean of the distribution of w_t.[4]

[3]The only N-M utility function that allows both parties to a contract to be risk neutral is of the form $\alpha + \beta c_t^0 + \gamma c'_{t+1}$; it implies that individuals have linear indifference curves.

[4]Formerly, it was assumed that at M_t the young agent maximizes $u(\hat{c}_{t+1}^0, \hat{c}'_{t+2})$ where

$$\hat{c}_{t+1}^0 = v^{0^{-1}}\left[\int_s v^0\left(c_{t+1}^0\right)h(s)\,ds\right];$$

$$\hat{c}'_{t+2} = v'^{-1}\left[\int_s v'(c'_{t+2})h(s)\,ds\right].$$

Risk neutrality is imposed with the assumption that v^0 and v' are linear functions.

III. Aggregation Issues and Expectations

The introduction of noise at the micro level provides a motivation for the use of contracts, but it is inconvenient at the level of the economy as a whole. In order to sidestep some of the issues that are introduced by a stochastic rational expectations equilibrium, it is assumed that there exists a continuum of agents in each generation—agents are indexed by the random productivity shock that they receive in their youth. This assumption implies that aggregate output and relative prices will be nonrandom even though the output of each individual firm is a random variable. Aggregate output will be equal to the integral of the output of each individual firm, given by

$$Y=\int_0^1 y(s)\cdot h(s)\,ds. \tag{3}$$

In Section VIII, a rational expectations equilibrium will be defined. My assumption that there is no noise at the macro level implies that there is no aggregate uncertainty and so this equilibrium concept will reduce to the more tractable assumption of perfect foresight. Before describing the properties of a perfect foresight equilibrium, I describe in detail the sorts of contracts that would be written by rational agents in this economy.

IV. Contracts

Recent work in the theory of implicit contracts (Costas Azariadis, 1983; Sanford Grossman and Oliver Hart, 1981) has shown that asymmetric information induces employment distortions if the party with superior information is risk averse. Complete income insurance is precluded by the existence of moral hazard, but partial insurance is achieved at the cost of some productive inefficiency. The theory developed below is related to this work.

It is assumed that a contract is written between a risk-neutral worker/entrepreneur and a risk-neutral owner (or owners) of capital, and that it is the worker who has superior information. In place of risk aversion, assume that the worker has limited resources and so bankruptcy is a possible option in some states. This assumption causes the worker/entrepreneur to act as if he or she were risk averse and to write a contract in which employment is lower on average than it would be if both agents were symmetrically informed. An important implication of using a bankruptcy constraint to generate risk-averse behavior is that the magnitude of the employment distortion is predicted to vary systematically with the rate of interest.[5]

A contract is defined to be a payment to the owner of capital $R(s)$ and an employment level $l(s)$ as a function of the state of nature. Contracts that are written at market meeting M_{t-1} stipulate how the proceeds of production in production period P_t are to be divided between the worker and the capitalist. Assume that the worker must design a competitive contract in order to maximize his or her own expected wage, subject to the various constraints on the set of feasible contracts which are described below.

A. *Competition*

It is assumed that the worker/entrepreneur must bid for funds in a competitive contract market. Capital is rented from a member of the older generation who is assumed to have an alternative store of wealth which pays an expected return of $\overline{R}_t$. Since the capitalist is assumed to be risk neutral, a feasible contract must satisfy the constraint[6]

$$E\left[R_t(s)\right]\geq \overline{R}_t. \tag{4}$$

B. *Incentive Compatibility*

It may be shown that the allocation which results from an *AI* contract may always be duplicated by another contract in which it is in the interest of the agent to tell the truth

[5] Bankruptcy constraints are explored elsewhere in the literature by David Sappington (1983) and a related model at the micro level is developed by Joseph Stiglitz and Andrew Weiss (1981).

[6] Note that the assumption that the capitalist is risk neutral could be relaxed to allow risk-averse behavior. The assumption that there is no aggregate uncertainty would allow the individual investor to obtain complete income insurance through portfolio diversification and an individual risky contract would not offer a risk premium in equilibrium.

(Milton Harris and Robert Townsend, 1981; Robert Myerson, 1979). There will, therefore, be no loss to restricting attention to those contracts for which truth telling is an optimal strategy.

Since the worker may only choose two employment levels $l \in \{0,1\}$, it is clear that the capitalist will only be able to distinguish between two states. The set of feasible contracts will consist of those that make one payment R_1 if $l=1$, and another payment R_0 if $l=0$. *Ex post*, the worker will observe s and choose that employment level which maximizes his or her wage, where the wage will equal the value of the firm minus the payment to the capitalist:

$$(5)\quad w_t = (1-d)+\alpha s-\Delta-R_1 \qquad \text{if } l=1;$$
$$w_t = (1-d)-R_0 \qquad \text{if } l=0.$$

The entrepreneur will operate only if the first of these expressions exceeds the latter, that is, only if $\alpha s \geq \Delta + (R_1 - R_0)$.

C. *Limited Liability*

Since the worker has no initial wealth, payments to the capitalist can be no greater than the scrap value of capital. This places an additional constraint on the set of feasible contracts

$$(6)\quad R_0 \leq 1-d.$$

This constraint turns out to be critical to the theory developed below.

V. The Optimal Contract

A Pareto optimal contract will solve the following problem:

$$(7)\quad \operatorname*{Max}_{R_0,R_1}\,(1-d)-R_0+\int_{\alpha s=\Delta+R_1-R_0}(\alpha s-\Delta-(R_1-R_0))h(s)\,ds,$$

subject to

$$(8)\quad R_0+\int_{\alpha s=\Delta+R_1-R_0}(R_1-R_0)h(s)\,ds \geq \overline{R},$$

$$(9)\quad R_0 \leq 1-d.$$

If the two parties to the contract were symmetrically informed, then the optimal employment rule would be given by

$$(10)\quad l=1 \quad \text{if} \quad \alpha s \geq \Delta.$$

That is, they would produce only if the state is sufficient to cover the excess depreciation involved. If bankruptcy were not a problem then the *AI* contract could mimic this rule by choosing a fixed interest payment independently of the state. This contract would take the form

$$(11)\quad R_1 = R_0 = \overline{R}$$

$$(12)\quad l=1 \quad \text{if} \quad \alpha s \geq \Delta.$$

But if the worker has limited wealth and if this constraint is binding then the optimal contract will take the following form:[7]

$$(13)\quad R_0 = 1-d,$$

$$(14)\quad R_1 = \min\{R_1 | E[R(s)] = \overline{R}\};$$

where

$$(15)\quad E[R(s)] = (1-d) + (R_1-(1-d))\int_{\alpha s=\Delta+R_1-(1-d)} h(s)\,ds,$$

$$(16)\quad l=1 \quad \text{if} \quad s \geq \Delta + R_1 - (1-d).$$

Here R_1 represents the gross return to risky debt that exceeds the expected market return in equilibrium because there are some states in which default occurs. Figure 2 is the graph of the expected value of a debt contract as a function of R_1.

Consider what happens to the value of a debt contract as R_1 is increased beyond the

[7]It is possible to show that this contract will also be optimal for a range of values of $\overline{R}$ if the worker is risk averse. In this case $R_1 > R_0$ even if bankruptcy is not binding.

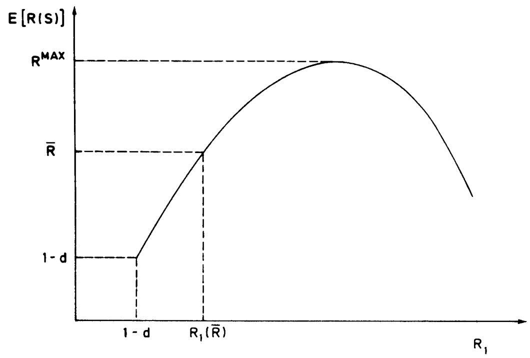

FIGURE 2

point $R_1 = 1-d$ at which payment of the contract is guaranteed. Initially, raising R_1 will increase the expected value of the contract because the capitalist receives more in those states in which production occurs. But a higher value of R_1 is associated with a higher probability of bankruptcy and this effect tends to reduce the value of a contract. Eventually this second effect outweighs the former and the expected value of a contract attains a maximum which I denote R^{Max}. It is assumed sufficient regularity of the density function of s such that this maximum is unique.

This argument implies that there may be two values of R_1 for which the expected value of a risky contract is equal to $\bar{R}$ but the smallest of these values will Pareto dominate the other because it ensures a higher expected wage for the worker. For values of $\bar{R}$ in the range $[1-d, R^{\text{Max}}]$, the gross interest payment on risky debt R_1 will be described as an increasing function of the return to alternative assets $\bar{R}$. This function is represented by equations (14) and (15) which I refer to with the shorthand notation

$$(17) \quad R_1 = R_1(\bar{R}) \quad \text{for} \quad \bar{R} \in [1-d, R^{\text{Max}}].$$

VI. Aggregate Supply

If the rate of interest increases, then entrepreneurs will be forced to offer a higher return on contracts and the probability of bankruptcy in each location will be higher. But across the entire economy the full distribution of states will be realized and so an increase in the probability that each individual goes bankrupt will be translated into an increase in the observed frequency of contract failures. The aggregate supply of output in the economy is described by the following:

$$(18) \quad Y = (1-d) + \int_{\alpha s = \Delta + R_1(\bar{R}) - 1 + d} (\alpha s - \Delta) h(s)\, ds.$$

Notice that aggregate output decreases if R_1 increases. But R_1 is an increasing function of $\bar{R}$ that implies that for gross interest rates in the range $[1-d, R^{\text{Max}}]$, aggregate output will be a decreasing function of the market rate of return.

$$(19) \quad Y = Y(\bar{R}) \quad \text{for} \quad \bar{R} \in [1-d, R^{\text{Max}}],$$

where

$$(20) \quad dY/d\bar{R} < 0.$$

In a model in which the real interest rate varies systematically with government policy variables, this theory predicts that policy may have permanent effects on output and employment. The overlapping generations model is one framework which has these implications and in the remainder of this paper I explore the relationship between fiscal policy and aggregate supply that is generated by the mechanism described above.

VII. Asset Demand

Since the economy contains only one produced good, Walras' law implies that a description of asset market equilibrium is sufficient to characterize the equilibrium of the economy. At market M_t, each member of generation G_t solves the problem:

$$(21) \quad \underset{c_t^0}{\text{Max}}\, u\left[c_t^0, \bar{R}_{t+1}(w_t - c_t^0)\right].$$

The solution will generate an asset demand function for each agent of the form

$$(22) \quad a_{t+1} = a_{t+1}(w_t, \bar{R}_{t+1}).$$

At M_t, the wage of each individual is no longer a random variable, since the production shock has been realized. However, the distribution of wages across the population is nontrivial as each agent receives a different drawing from $h(s)$. Each agent's wage will be described as a function of the previous period's rate of interest and of the productivity shock in his or her specific location, found by subtracting the interest payment to the owners of capital from the value of the firm.

$$(23)\quad w_t = \max\{0, (\alpha s - \Delta - R_1(\overline{R}_t)\} \equiv \phi(s, \overline{R}_t).$$

The function ϕ is analogous to the factor price frontier described by Diamond in the context of an auction market economy, but the mechanism by which the interest rate affects the wage is different. To obtain an aggregate asset demand function, the individual functions must be integrated across the distribution of agents

$$(24)\quad A_{t+1} = \int_s a_{t+1}[\phi(s, \overline{R}_t), \overline{R}_{t+1}]\, h(s)\, ds$$

or

$$(25)\quad A_{t+1} = A(\overline{R}_t, \overline{R}_{t+1}).$$

Since R_1 is an increasing function of $\overline{R}_t$, each individual's wage will be a *nonincreasing* function of $\overline{R}_t$ that is strictly decreasing for all those individuals who receive a positive wage. (See equation (23).) Hence A_{t+1} will be decreasing in $\overline{R}_t$. It is also customary to assume that asset demands are increasing in the future interest rate $\overline{R}_{t+1}$, that is,

$$(26)\quad A_1 < 0; \quad A_2 > 0.$$

VIII. Asset Market Equilibrium

The supply of assets as a store of wealth is composed of the private stock of capital debt, K_t, and of the stock of government debt, B_t. The asset market will be in equilibrium when

$$(27)\quad A(\overline{R}_t, \overline{R}_{t+1}) = K_{t+1} + B_{t+1}.$$

But since there will be a single unit of capital inelastically supplied in each location (and a single unit in aggregate), this condition becomes

$$(28)\quad A(\overline{R}_t, \overline{R}_{t+1}) = 1 + B_{t+1}.$$

I define an equilibrium for the economy as a sequence of positive real numbers $\{\overline{R}^*_t\}_{t=0}^{\infty}$ and an associated sequence of asset demand functions such that (28) holds for all t. At market meeting M_t, the interest payment $\overline{R}^*_t$ is predetermined and so the equilibrium sequence $\{\overline{R}^*_t\}_{t=0}^{\infty}$ is completely determined by the sequence of government debt issues $\{B_t\}_{t=0}^{\infty}$. I focus on policy rules of the form $B_t = B$ for all t, and assume that the difference equation (28) converges to a unique stationary solution.[8] These assumptions allow me to unambiguously describe the effects of a change in policy regime on the stationary state of the economy.

IX. Policy Effectiveness

Figure 3 depicts an asset market equilibrium in the stationary state. The example is drawn for the case of a uniform density function and an asset demand function of the form $a = w \cdot \overline{R}/(1+\overline{R})$ but the qualitative features of this example are shared by a broad class of economics.[9]

The stationary asset demand function is increasing for low values of $\overline{R}^*$ as the positive effect of the future interest rate on asset

[8]This assumption is made by Diamond. The dynamics of the economy I describe are identical with the model described in his work and although we arrive at an aggregate asset demand function by a different route, its qualitative properties are similar to the nonstochastic economy which incorporates capital-labor substitution.

[9]This example was calculated numerically for values of $\alpha = 8$, $h(s) = 1$, $1 - d = \Delta = 0$. The individual asset demand functions are given by

$$a = R_{t+1}\phi(s, R_t)/(1 + R_{t+1})$$

where $\phi = \max\{0, \alpha s - R_1(R_t)\}$;

$$R_1(R_t) = 1 - (1 - R_t/2)^{1/2}, \quad R_t \in [0,2].$$

The aggregate asset demand function is given by

$$A = R_{t+1}\left(2 - R_t/2 + 2(1 - R_t/2)^{1/2}\right)/(1 + R_{t+1}).$$

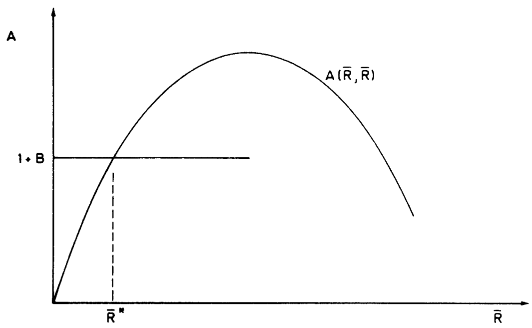

FIGURE 3

demand dominates the negative effect of the current interest rate on the wage. Eventually this function must slope down as asset holdings are bounded above by wealth that decreases with the interest rate. In order for an equilibrium to exist, the economy must be productive enough (the parameter α in the production function, equation (1), must be large enough) so that there exists an interest rate at which the old can be induced to hold the supply of assets. In terms of Figure 3, the stationary asset demand function must attain a value which exceeds $1+B$.

I define a fiscal policy in terms of the value of B. It is clear from this definition that changes in fiscal policy can affect the stationary equilibrium interest rate and it follows from the assumption that the economy converges to a stationary equilibrium that we can sign the direction of this effect. In the stationary state,[10]

$$dR^*/dB = 1/(A_1 + A_2) > 0. \tag{29}$$

Any policy that generates a higher real rate of interest will reduce output by increasing the frequency of contract failures, but, in an economy in which debt is net wealth, a policy that raises the real value of government debt will have exactly this effect.

[10]Around the stationary state, the time path of the interest rate will be approximated by the linear difference equation $dR_{t+1} = (A_1/A_2)\,dRt$, from which follows that $|A_2| > |A_1|$ if the economy converges. But since $A_2 > 0$, by assumption, this argument implies that $dR^*/dB > 0$.

It follows that, in an economy in which debt is net wealth and some agents are better informed than others, fiscal policy will be able to permanently alter the steady-state frequency of contract failures.

X. The Government Budget Constraint

My description of policy in terms of the stock of debt has a counterpart in the more traditional definition of fiscal policy that refers to the market for flows. These two definitions are related by the government budget constraint

$$G_t = B_{t+1} - R_t B_t, \tag{30}$$

where G_t represents government purchases of goods.

In the stationary state this constraint takes the form

$$G = B(1-R). \tag{31}$$

This constraint is simpler than the government budget constraints that are encountered in most macroeconomic models because I have not explicitly modeled a monetary sector, nor included a source of tax revenues. Neither of these complications would significantly alter the conclusion that, in a model in which debt is net wealth, fiscal policy will have real effects.

I have deliberately avoided modeling taxes to avoid unnecessarily complicating the account of aggregate supply. (In a model in which bankruptcy is important, not even a lump sum tax will be nondistortionary because it will alter the probability of default.) As a result, the government cannot run a budget surplus in this model—G_t must always be nonnegative. However, it should be apparent that nothing of substance hinges on this issue and a model that allowed for taxes would have qualitatively similar properties.[11]

Another possible modification to the model would involve the addition of a motive for

[11]Note that if the interest rate is positive in equilibrium ($R > 1$), then the government must own some private capital, i.e., $B < 0$. This feature follows from the restrictive assumption of no taxes.

holding money that would permit a discussion of the relationship between inflation and aggregate supply. Money may be included in a variety of ways, but any method that has the property that only real balances matter will generate steady-state equilibria in which the rate of inflation equals the rate of monetary expansion. It follows that monetary hybrids of the model described in this paper are likely to have the property that any steady-state inflation rate is compatible with a variety of equilibrium levels of aggregate supply.

XI. Conclusions

The existing literature explains output variation over the business cycle in one of two ways. The equilibrium school attributes output fluctuations to voluntary variations in labor supply in response to perceived variations in intertemporal prices. The neo-Keynesian explanation hinges on prices that are slow to adjust. Both of these explanations are usually coupled with behavioral assumptions that generate the proposition that aggregate supply is independent of policy choices in the long run. In contrast, this paper suggests that output fluctuations are best described as movements of a rational expectations equilibrium in a model in which the equilibrium rate of employment is a function of rationally anticipated government policy rules. This suggests that excessive unemployment is a long-run phenomenon that will not go away if the economy is left to its own devices—if government policy has real effects, then it is important to choose the right policy. There are many possible criticisms of the arguments that have led to this position, some of which are discussed below.

It may be observed that the asymmetric information explanation of output fluctuations relies on the nonexistence of equity markets. This is true, but it is a feature explained within the context of the model by the more primitive assumption of asymmetric information. The contracts that are written under asymmetric information have many of the features of the debt contracts observed in the real world. I conjecture that partially relaxing the *AI* assumption will generate contracts that exhibit features of both debt and equity, but that the relationship between the rate of interest and the efficiency of the contract will be similar to the mechanism described in this paper.

In addition to the absence of equity, my explanation relies on the absence of futures markets. It is this assumption that allows the government to influence the terms of intertemporal trade. Once again, this feature is generated by a more primitive set of assumptions—agents have finite lives and that there are no consumption externalities. This latter assumption is potentially controversial since Robert Barro (1974) has shown that by permitting interdependent utilities, it is possible to describe a model in which a bequest motive will provide a substitute for futures markets. The substance of this issue involves the ability of policy to affect the real rate of interest and there would seem to be plausible theoretical justification for adopting a number of views—at this point, the issue must be judged on the empirical content of the research programs within which the alternative candidate theories are embedded.

It may be pointed out that the *AI* theory hinges on the importance of bankruptcy but that most of the output variation over the course of the business cycle is accounted for by variation in the incidence of layoffs. This criticism relies on a restrictive interpretation of the theory. Since I have modeled the entrepreneur and the workers as the same individual, I have been forced to model bankruptcy and unemployment as the same event. It is possible to construct a model (see my 1985 paper) in which these roles are separated and in which a firm writes a debt contract with a creditor and a labor contract with a workforce. In this context it may be demonstrated that an increase in the rate of interest causes the firm to write labor contracts that involve a higher probability of layoffs in every state of nature.

To my knowledge, the predictions of the *AI* model do not contradict any set of well-documented stylized facts although careful empirical work will be required in order to judge its consistency with the data. Recent work by Christopher Sims (1980) suggests that the interest rate is strongly causally prior to industrial production with a sign which is consistent with *AI* theory, but this evidence must be regarded as tentative. Superficially, asymmetric information would appear to contradict the intertemporal substitution hypothesis (*ITS*) that suggests that there is a positive relationship between the interest rate and labor supply. But *ITS* refers to an expected *future* rate of interest in contrast to *AI* theory that relates current output to the *currently* realized real rate. This distinction means that empirical work which attempts to test the *ITS* theory is not directly relevant to *AI* theory.

There are other explanations of aggregate supply that suggest that the interest rate should cause output—for example, a neoclassical explanation which relies on capital labor substitution will have some of the same qualitative predictions. But there is evidence to suggest that workers are constrained in their labor supply decision (John Ham, 1983) which is not well explained within an *ex post* market-clearing framework. The *AI* theory can account for this evidence and yet still retain the concept of market clearing in an *ex ante* sense.

There seems to be no consensus position on the issue of whether fiscal policy can permanently influence the real rate of interest although Robert Shiller (1980) discusses a related issue concerning the effectiveness of Fed interventions on alternative definitions of the real rate. In view of the central role attributed to the real rate of interest by a number of alternative theories, this issue would seem to warrant careful empirical investigation.

It is too early to say if *AI* theory will prove to outperform its competitors as an explanation of business cycle fluctuations. But the evidence that has been brought to bear on existing theory suggests that neither neoclassical nor neo-Keynesian explanations are consistent with the behavior of postwar U.S. time-series data[12]—perhaps the time has come to give careful consideration to an alternative.

[12] Recent examples of studies which fail to support the *ITS* mechanism include work by Joseph Altonji (1982) and Orley Ashenfelter and David Card (1982). Ashenfelter and Card conclude that *neither ITS* theories *nor* sticky price Keynesian models are consistent with time-series evidence.

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