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of the Great Depression

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May 1978

Working Paper #: 114

PACS File #: 2980

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A Simple General Equilibrium Model  
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by John Bryant\*

The only widely accepted explanation for the Great Depression is that of Keynes. Keynes' position is that the Great Depression was an unemployment equilibrium resulting from deficient demand. The economy is characterized by multiple equilibria at different levels of demand, and the crash shocked the economy to an inferior low demand equilibrium. The government could, then, by imposing high demand, shock us back to a high demand equilibrium. An implication is that demand management is crucial to the stability of the economy. One problem with this analysis is that in the forty years since the publication of the General Theory, Keynesians have failed to produce a single general equilibrium model with Keynes' multiple equilibria.

There is, however, a class of general equilibrium models that do have multiple equilibria. Models of valued fiat money are characterized by at least two equilibria, a fiat money and a nonfiat money equilibrium.

A very simple model is presented below in which the jumping from a fiat money to a nonfiat money equilibrium yields Great Depression-like results. While our currency was not fiat at the time of the Great Depression, is it not possible that the financial institutions played a fiat money-like role? While we do not have a coherent model of financial institutions, we do know that the disruption of these institutions was

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\*The author is indebted to John Danforth and especially Neil Wallace for valuable discussion. Views expressed do not represent the Federal Reserve Bank of Minneapolis. Errors are the author's responsibility.

one of the major features of the Great Depression. The implication of our not having a good model of financial institutions is not that they are unimportant, but that we cannot predict the effects of disrupting them. Our story is that, possibly because of misinterpretation of government guarantees, people treated commercial bank demand deposits as fiat money.<sup>1/</sup> When in the crash people observed that such deposits were not fiat money, the economy jumped to a much inferior nonfiat money equilibrium. However, the validity of this story is not crucial, for if so simple an equilibrium model of fiat money generates global instability in output and employment, a fortiori such pathological behavior can characterize a more sophisticated model of the financial system.

The presented model is bare bones and thus does not have the richness to explain many of the phenomena of the Great Depression, and it should be viewed as a polar case. First the model is presented, then some alternative ways to enrich the model will be sketched. However, the simplicity of the model is a virtue as it isolates the important elements and eliminates the extraneous.

#### The Model

The model is a simple variation on the Samuelson pure consumption loans model.<sup>2/</sup> There are  $N$  identical individuals born each period and they live two periods. They have perfect foresight. In his first period an individual is endowed with  $L$  units of nontransferable leisure, while in the second he is endowed with nothing. There is a linear zero intercept technology available to the individual to transform leisure hours into a transferable but nonstorable consumption good. One hour of work yields  $w$  units of good where  $w < 1$ . The consumption good and

leisure are perfect substitutes in the utility function of the individual where one hour of work equals one unit of goods. The individual maximizes his two-period utility using utility function  $U(C_1, C_2)$ .  $U$  is two-smooth, increasing in its arguments, concave,  $U_1(0, C_2) = \infty = U_2(C_1, 0)$ ,  $C_1$  and  $C_2$  are strictly noninferior and strictly gross substitutes, and there exists an  $S > 0$  such that  $\lim_{\epsilon \rightarrow 0} \epsilon U_2(L-S, \epsilon S) > U_1(L-S, 0)$ . There exists a quantity of NM dollars of fiat money which the young get from the old in exchange for goods.

We consider the representative consumer of generation  $t$  where the subscript  $t$  is dropped for simplicity. Let  $P$  be the current rate of exchange of goods for dollars and  $P'$  be the next period value of that variable.  $1/P$  is the price level as usually interpreted. The individual must choose hours of work,  $W$ , and dollars of money holding,  $m$ , to maximize his utility given  $P, P'$ .

His problem is

$$\max_{W, m} U(C_1, C_2)$$

subject to

$$C_1 = L - W + wW - Pm$$

$$C_2 = P'm$$

$$Pm \leq wW$$

$$W \leq L.$$

If  $P' = 0$ ,  $W = 0$  and  $C_2 = 0$ . As  $w < 1$ , the individual will never produce for consumption, but only for sales,  $wW = Pm$ . As  $U_1(0, C_2) = \infty$ ,  $W < L$  always. As  $U_2[L, 0] = \infty$ ,  $P' > 0$  implies  $W > 0$ .

For  $P, P' > 0$  the problem can be written

$$\max_W U[L-W, \frac{P'}{P} w W].$$

The first-order condition is

$$-U_1[L-W, \frac{P'}{P} w W] + \frac{P'}{P} w U_2[L-W, \frac{P'}{P} w W] = 0.$$

This can be written as  $W = f(\frac{P'}{P})$ .  $f$  is continuous and single valued by strict noninferiority of  $C_1, C_2$ , is strictly increasing by the strict gross substitutes assumption, and is bounded below by the assumption that  $\lim_{\epsilon \rightarrow 0} \epsilon U_2(L-S, \epsilon S) > U_1(L-S, 0)$ . The domain of  $f$  is  $(0, \infty)$  and its range is within  $[S, L]$ .

The current old get no benefit from dollar holding so they trade all their NM dollars to the young for goods,  $NwW$  goods. Our equilibrium condition is that

$$(I) \quad \frac{NwW}{P} = NM.$$

Substituting in the optimal decision rule for  $W$  and rearranging yields

$$(II) \quad Nwf(\frac{P'}{P}) = PNM.$$

We are now ready for our central proposition.

Theorem I:

- A. There is a unique monetary equilibrium characterized by a constant price level and  $W > 0$ .
- B. There is a nonmonetary equilibrium (an equilibrium with  $P = 0$  in all periods) characterized by  $W = 0$ .
- C. The monetary equilibrium is Pareto superior to the nonmonetary equilibrium.<sup>3/</sup>

Proof:

- A. From (II) there is a unique constant positive price equilibrium at price  $\bar{P} = \frac{W}{M}f(1) = \frac{W}{M}W$ . Consider any other positive equilibrium price sequence  $\{P_t\}$  with  $P_t \neq \bar{P}$  in some period  $t$ . Suppose  $P_t > \bar{P}$ . Then from (II) and the monotonicity of  $f$ ,  $P_{t+1}/P_t > 1$ . Indeed, by using (II) iteratively we see that  $\{P_{t+k}\}$  must be growing at an increasing percentage rate. But this is not feasible as  $\{P_t\}$  is bounded above uniformly by  $\frac{W}{M}L$  from (II) and the upper bound of  $f$ . Suppose  $0 < P_t < \bar{P}$ . Then  $\{P_{t+k}\}$  must be falling at an increasing percentage rate. This implies  $\lim_{k \rightarrow \infty} P_{t+k} = 0$ , but this is impossible from (II) and the lower bound on  $f$ . Suppose that for some equilibrium price sequence  $\{P_t\}$  not zero in every period, for some  $k_0$ ,  $P_{k_0+1} = 0$ . Then  $W_{k_0} = 0$ , which from the equilibrium condition (I) implies  $P_{k_0} = 0$ . Let the first nonzero element occur at time  $k_1 + 1$  where  $k_1 > k_0$ . Then  $W_{k_1} > 0$ , which implies  $P_{k_1} > 0$  from the equilibrium condition (I), contradiction.
- B. We have seen that for  $\{P_t\} = \underline{0}$ ,  $W = 0$  satisfies the equilibrium condition and the individual maximization problem.
- C. As  $W = 0$  is feasible for the individual in the fiat money equilibrium, the fiat money equilibrium is revealed preferred to the nonfiat money equilibrium for the current young and future generations. As the current old consume only the real value of money holdings, the fiat money equilibrium is superior for them as well. Note the role of the unusual assumption on utility which yields the lower bound on  $f$ . Without this assumption there could be multiple monetary equilibrium price sequences characterized by different inflation rates--all Pareto superior to the nonmonetary equilibrium, however.

We take the depression to be a completely surprise shift from the monetary to the nonmonetary equilibrium.

### Refinements

In this model people work only for future consumption, all they can consume in the future is the fruits of current labor, and fiat money is the only means of transacting for the fruits of one's labor. This should be viewed as a polar case of what we do see in reality. We do work for future consumption, and fiat money is an efficient means of transacting. The model can easily be modified to include endowments in the second period of existence and other means of transacting.<sup>4/</sup>

As with the "new-new" labor economics, people not working at all does depend upon the utility of "leisure."<sup>5/</sup> For example, in our simple model if  $C_1 = wW - Pm$ , then  $W = L$  if  $w > 0$ . However, as we did not observe mass starvation in the depression, this assumption does not seem unreasonable.

In the simple model "firms" are factored into the individuals' problem. This can be changed to have separate firm entities.

In the nonfiat money equilibrium nobody works at all, but they are not searching for work and therefore are not unemployed. This is easily fixed in a model with multiple means of transaction and two-period endowments by having individuals drawn from a pool and randomly assigned to one of two production technologies, more profitable and less profitable. Individuals have to pay a small "search cost" to belong to the pool. With the fiat money equilibrium both technologies are used, but in the nonfiat money equilibrium only the more profitable is used (if the model is rigged right). In this way not everyone is idle in the



"depression," but those who are are unemployed. And, of course, productivity is higher in the "depression." If there are separate firms, a similar result can be achieved by having individuals come in two kinds, skilled and unskilled, but having the only means of discriminating being to employ them a short time.

The model has the depression, the change from fiat to nonfiat money, a complete surprise. Instead, one could assume that there are subjective probabilities of moving from one to the other. One could further suppose that the probabilities are not independent and assume learning.

In short, there are an innumerable number of ways to enrich the model to make it more "realistic."

#### Conclusions

We have produced a simple general equilibrium model with multiple equilibria, one of them being an unemployment equilibrium. One can tell a story as to why this model may apply to the Great Depression. Moreover, if so simple a model can generate multiple equilibria, a fortiori more complex models of the financial system can exhibit instability.

In the model inadequate demand is not the problem but the shift from a fiat money to a nonfiat money equilibrium. More generally, we explain the Great Depression as a shift to a less efficient means of transacting. This implies that demand management is not the means to avoid another depression, rather careful regulation (or deregulation!) of the financial markets is the answer.

## Footnotes

1/ This story is the product of John Kareken and Neil Wallace.

2/ See [5].

3/ A similar theorem is proved in [3] and [6].

4/ See [6].

5/ See [1] and [2].

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