The Neutrality of Optimal Government Financial Policy: Supplying the Intergenerational Free Lunch

Dean D. Croushore*  

Many recent analyses of the economic impact of government debt and monetization make use of the overlapping-generations model. (Samuelson, 1958; Diamond, 1965; Barro, 1974; Wallace, 1981; Kyrkken and Wallace, 1980; Sargent and Wallace, 1981.) This model is a useful device because it makes many variables endogenous and provides a microeconomic foundation for macroeconomics. The model specifies Only utility functions which individuals maximize and some restrictions on the trades which agents may undertake are specified in such a model. Because the overlapping-generations (OG) model gets so much mileage out of such a simple structure, the results obtained are often misinterpreted. In this paper we seek to use it to analyze the differing effects on the economy of decisions by government to issue debt and/or money. In addition to interpreting the OG model itself, we demonstrate some interesting features of some standard "debt neutrality" results, with a focus on the redistributive actions of the government.

In our base model, a neutrality theorem for optimal government financial policy is developed along the lines of Wallace (1981). In a framework in which the government acts to maximize social welfare, any change in debt or money issuance may be offset by an appropriate change in taxation. Neither the interest rate nor the inflation rate is affected. However, this neutrality result requires very strong assumptions about government behavior and taxation. Thus the "neutrality" theorems actually demonstrate the stringency of the conditions needed for debt or money to be neutral, and suggest that in any realistic model, neutrality is quite unlikely to hold.

The basic overlapping-generations model is discussed in section I. The impossibility of trade across generations creates a friction in the model. This friction is interpreted in terms of satisfying micro-equilibrium and macro-equilibrium equations. The perfect solution to the overlapping-generations friction is possible if government (broadly defined) provides an "intergenerational free lunch" by appropriate choices of borrowing and printing money, as analyzed in section II. Section III presents a neutrality proposition for changes in the money stock and stock of government debt. We explore the possibility of redistributing income across wealth classes while keeping macroeconomic variables (the interest rate and the inflation rate) unchanged. A numerical example illustrates the neutrality results. The results are discussed and interpreted further in section IV.

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1. THE OVERLAPPING-GENERATIONS MODEL

There are several advantages to using the overlapping-generations model for providing a microeconomic foundation for macroeconomic results. It is the only type of model which allows interactions between people who are at different stages of their life cycle. This is especially useful for analyzing savings behavior, since it is easy in this model to have agents work for part of their lives, and be retired later. Technically, the overlapping-generations model is nice because it allows long-term analysis of problems (since the stream of generations may continue forever) while still maintaining a tractable maximization problem for individuals, since their lives aren’t infinite. Since the analysis begins with individual utility maximizing functions, welfare analysis of alternative policies can be performed. Furthermore, all macroeconomic variables are endogenously determined, given the structure of the model.

The interactions between agents in the model are demonstrated in figure 1. Time is shown horizontally and the generation number (the time at which the generation was born) is shown vertically. Horizontal lines show the aging of each generation as time goes by, while vertical lines show the interactions between different generations. In a two-period OG model agents are young (y) and old (o). Interaction between agents occurs only once in the lifetime with each surrounding generation. For example, people of generation two may engage in exchanges with old people of generation one at time two and with young people of generation three at time three. The three-period OG model is a bit richer. Agents are young (y), middle-aged (m), and old (o), and have two periods of overlap with each surrounding generation.

In this section we set up a model for analyzing the effects of government debt and money issuance under conditions of a perfect foresight equilibrium. We use this model to set up an overlapping-generations friction, similar to that of Samuelson (1958). We reinterpret this friction in terms of alternative sets of equilibrium conditions, which we term macro-equilibrium and micro-equilibrium.

Money is an intrinsically useless asset, held only because it serves as a store of value. The nominal return on money is restricted to be zero. Bonds are alternative assets which pay an endogenously determined interest rate. There is a minimum denomination on bonds, so that they can only be held by people with relatively high income or wealth.

People live two periods, working only during the first period of their lives. There is one good, which is used solely for consumption. The good can be continuously stored until the following period. At time t, N(t) identical poor people are born, who produce α(t) units of output in their first year of life, and N(0) identical rich people are born, who produce β units of output while young, where β > α. (Bryant and Wallace, 1980; Sargent and Wallace, 1981) Both rich and poor populations grow at the same rate n.

Let k denote the minimum real size on bonds. People may either buy or sell bonds, but not both.

Legal restrictions or transactions costs are assumed to prevent people from sharing ownership on bonds.

Each individual maximizes a logarithmic utility function:

\[ U = \ln c_t + \delta \ln c_0, \]

where δ is the time discount rate, 0 < δ ≤ 1, and ln is the natural logarithm. Savings is defined as the difference between real production by a young person, and consumption while young. Young people must save to provide for old-age consumption. Saving may take one of three forms:

1. Storage of real output. Real output may be stored without deterioration. Thus storage pays a real return of zero.
2. Holding money. Money pays a fixed nominal return of zero. Its real return thus depends upon the rate of inflation. The price of goods in terms of money at time t is p(t).

The inflation rate is defined by the formula:

\[ \pi(t) = \frac{p(t+1)}{p(t)} - 1. \]

3. Holding bonds. Bonds pay an endogenously determined rate of return denoted R in nominal terms, or r in real terms. The real and nominal returns are related by the formula:

\[ 1 + r = \frac{1 + R}{1 + \pi}. \]
The form of saving which an individual chooses obviously depends upon the rates of return. Bonds are held only if \( R > 0 \), and the minimum denomination requirement is met. For \( R < 0 \), money dominates bonds. Money is held only if deflation occurs, that is \( \pi < 0 \). Otherwise storage dominates money. Because we are interested in analyzing economies in which money and bonds coexist, the model is set up such that the nominal interest rate on bonds is non-negative, and deflation occurs.

Suppose the production of rich individuals is so large that they easily meet the minimum denomination for bonds, but poor people are unable to do so. With \( R \geq 0 \) and \( \pi \geq 0 \), the rich hold bonds and the poor hold money. Utility maximization leads to the following consumption and saving decisions:

<table>
<thead>
<tr>
<th>Consumption:</th>
<th>Poor</th>
<th>Rich</th>
</tr>
</thead>
<tbody>
<tr>
<td>Young</td>
<td>( \frac{1}{1 + \delta} )</td>
<td>( \frac{1}{1 + \delta + \pi} )</td>
</tr>
<tr>
<td>Old</td>
<td>( \frac{\delta}{1 + \delta} )</td>
<td>( \frac{\delta}{1 + \delta + \pi} )</td>
</tr>
<tr>
<td>Saving (real):</td>
<td>( \frac{\delta}{1 + \delta} )</td>
<td>( \frac{\delta}{1 + \delta} )</td>
</tr>
</tbody>
</table>

Next we must solve for the equilibrium inflation rate and interest rate. There are three markets to be cleared at equilibrium: goods, money, and bonds. Equilibrium in two markets leads to equilibrium in the third via Walras’s Law. We choose to examine the money and bonds markets.

We first define the concept of macro-equilibrium. Macro-equilibrium is said to occur whenever inflows to and outflows from a market are equal, regardless of the individual transactions involved. We then consider the bond and money markets as pools of funds, which reach equilibrium when funds coming in equal funds flowing out. For example, young people who purchase bonds add loanable funds to the pool, while those who receive interest and principal payments take funds out of the pool.

Young rich people demand bonds in the nominal amount:

\[
D_t(t) = N_t(t) \delta' t(t) - N_t(t) \frac{\delta}{1 + \delta} p(t).
\]

where \( \delta' t(t) \) is the real saving of each rich person at time \( t \). Old rich people receive principal and interest on bonds at time \( t \) in the nominal amount:

\[
S_t(t) = \left(1 + R(t - 1)\right) D_t(t - 1) - \left(1 + R(t - 1)\right) N_t(t - 1) \frac{\delta}{1 + \delta} p(t - 1).
\]

For simple equilibrium to hold at all time, we must have \( D_t(t) = S_t(t) \) for all \( t \). This leads to the solution:

\[
i(t) = n(t)
\]

for all \( t \). The real interest rate on bonds equals the population growth rate. Poor young people desire to hold money in the nominal amount:

\[
D_t(t) = N_t(t) s(t) p(t) - N_t(t) \frac{\delta}{1 + \delta} p(t).
\]

where \( s(t) \) is the real saving of each poor person at time \( t \). Poor people trade money for goods at time \( t \), supplying money in the nominal amount:

\[
S_t(t) = D_t(t - 1) - N_t(t - 1) \frac{\delta}{1 + \delta} p(t - 1).
\]

Simple equilibrium holds at all time when \( D_t(t) = S_t(t) \) for all \( t \). The only solution is:

\[
r(t) = \frac{\delta}{1 + \delta}
\]

for all \( t \). Inflation occurs at such a rate as to make the real return on money equal to the population growth rate. These results hold only for \( n > 0 \), otherwise storage dominates bonds and money.

There are two interesting aspects of the macro-equilibrium solution. First, the rates of return on money and bonds are identical, yet the solution in which all rich people hold bonds and all poor people hold money is stable. If a single rich person switches from bonds to money, the real return from bonds rises above the real return on money, and the rich person then switches back to holding bonds.

Second, the solution is one in which the poor trade only with the poor and the rich trade only with the rich. We call this the segmented-society solution, and it is typical of restricted-transactions overlapping-generations models. Total consumption by the rich (young and old), when the real interest rate equals the population growth rate, is equal to \( N_t(t) \beta s(t) \), which is precisely equal to the output of the young rich. Similarly, the total output of the young poor is precisely equal to the consumption of all the poor. Thus, no trading occurs across economic classes.

So far, we have considered only macro-equilibria in the bond market and the money market. As was first pointed out by Samuelson (1958), the difficulty in attaining such equilibrium is that private citizens alone are unable to make contracts with each other, due to the overlapping-generations structure.

A rich young person wishes to purchase a bond which yields income in old age. But only the people who are available to sell bonds to rich young people are rich old people. They will not be alive in the next period, to repay the interest and principal on such a bond. All rich young people want to buy bonds, but no agent in the model can sell them.

A similar situation holds with women. A poor young woman wants to give up goods and get money from a poor old person. But if money is a liability to an older poor person, such a trade would be unacceptable, because the latter would not be alive in the following period and could not repay the liability. All poor people want to hold money, but there is no supplier.

This problem of forming contracts between generations when the same people aren’t alive for any two periods, is known as the overlapping-generations friction. Inflows to the bond and money markets equal outflows under macro-equilibrium. But it is necessary to verify the existence of contracts between people. For every purchaser of a bond, there must be a seller. Money must be issued by some agent. We define micro-equilibrium to hold when every individual contract is verified.

In this model, micro-equilibrium requires that some agent sell bonds in a minimum real size \( k \) and repay principal and interest on those bonds in the next period. Some agent must also issue money. If this cannot be done, then money and/or bonds cannot exist, and storage of goods must be used. The following table displays the results of individual consumption and saving.
decisions under storage and in micro-equilibrium using money and bonds. Everyone is clearly better off if money or bonds can be used.

<table>
<thead>
<tr>
<th>Consumption</th>
<th>Poor Money</th>
<th>Storage Rich Bonds</th>
</tr>
</thead>
<tbody>
<tr>
<td>Young</td>
<td>$\frac{1}{1 + \delta^\alpha}$</td>
<td>$\frac{1}{1 + \delta^\alpha}$</td>
</tr>
<tr>
<td>Old</td>
<td>$\frac{\delta}{1 + \delta^\alpha}$</td>
<td>$\frac{\delta}{1 + \delta^\alpha}$</td>
</tr>
<tr>
<td>Saving</td>
<td>$\frac{\delta}{1 + \delta^\alpha}$</td>
<td>$\frac{\delta}{1 + \delta^\alpha}$</td>
</tr>
</tbody>
</table>

II. THE INTERGENERATIONAL FREE LUNCH

What is clearly needed in this economy is some organization to pool funds so that the macro-equilibrium result can be obtained. The overlapping-generations friction prevents the achievement of the optimal micro-equilibrium by private agents acting individually. The type of organization needed to achieve micro-equilibrium will henceforth be called the government. However, such a role could be played by private organizations, such as a banking industry. The organization’s role is to provide an ongoing pool of funds for all agents. An analysis of the externalities which may exist which might force a government, rather than a private industry, to take this role, is beyond the scope of this paper.

We assume that the government can and does take actions which allow the achievement of micro-equilibrium. Government comes into existence solely to sell bonds and issue fiat money, ensuring that micro-equilibrium holds at the interest rate and inflation rate which would arise under macro-equilibrium.

In the case of bonds, micro-equilibrium requires that the demand for bonds equal the supply of bonds. Then the interest and principal payments on bonds equal interest and principal receipts by bondholders. The government sells bonds to persons who are young and repays their principal and interest when they are old. We write the micro-equilibrium condition that the demand for bonds equals the government supply of bonds as:

\[ D_G(t) = S_G(t). \]

The government ensures that micro-equilibrium holds at the macro-equilibrium solution by supplying bonds in the precise nominal amount:

\[ S_G(t) = N_G(t - 1) \frac{\delta}{1 + \delta} [1 + R(t - 1)] p(t). \]

The bond market clears at \( t = t \) for all \( t \). The government has a nominal deficit, as conventionally defined, of \( R(t) - 1 \) at time \( t \),\(^1\) and a debt at time \( t \) of \( N_G(t) \frac{\delta}{1 + \delta} p(t) \). Repayment of principal and interest at time \( t \) is \( 1 + R(t - 1) N_G(t - 1) \frac{\delta}{1 + \delta} p(t - 1) \), which exactly equals the amount borrowed. The government debt is refinanced each period by new borrowing, so the government can never have an unbalanced cash flow. This is a true Ponzi scheme, as the debt always exists but need never be repaid, since time never ends.

In the money market, micro-equilibrium can be reached by having the government issue (any amount of) money, which is a general obligation paying no interest. If we denote government money outstanding (in nominal terms) at time \( t \) by \( M(t) \), then micro-equilibrium requires that:

\[ D_M(t) = M(t). \]

The price level at time \( t \) is then determined according to:

\[ p(t) = M(t) \left( \frac{N_G(t) \frac{\delta}{1 + \delta} [1 + R(t - 1)]}{1 + \delta^\alpha} \right). \]

The inflation rate is thus determined by the change in the nominal money supply:

\[ 1 + \pi(t) = \frac{p(t + 1)}{p(t)} \left( \frac{M(t + 1)}{M(t)} \right) \left( \frac{N_G(t) \frac{\delta}{1 + \delta} [1 + R(t - 1)]}{N_G(t - 1) \frac{\delta}{1 + \delta} [1 + R(t - 1 - 1)]} \right) \]

The simple-equilibrium solution of \( \pi(t) = -n/1 + n \) comes about only for a constant nominal money supply \( M(t) = M(t + 1) \) for all \( t \).

When the government follows the debt and monetary policies suggested above, both macro- and micro-equilibrium hold in all markets. The real interest rate is \( n \), and deflation occurs so that \( p(t) = n/1 + n \). Second-period consumption of the rich and poor is higher by a factor of \( 1 + n \) than if storage is used.

Everyone in all generations is clearly made better off when government issues debt and money, so we call this situation "an intergenerational free lunch." The overlapping-generations friction is completely eliminated at no cost. Micro-equilibrium holds at the macro-equilibrium solution.

The intergenerational free lunch (IGFL) idea has taken many different forms in the macroeconomic literature. The argument that government debt may be beneficial to society, as presented by Tobin (1952), Feldstein (1976), and McCulloch (1984), because interest payments can be financed by additional debt and not taxes, involves the same mechanism as the IGFL. The IGFL is shown to completely clear in overlapping-generations models of money as presented by Samuelson (1958), Cass and Yaari (1966), and many others. (Kareken and Wallace, 1980)

III. THE NEUTRALITY PROPOSITION

We now analyze what happens when debt and money are changed from the levels which supply the intergenerational free lunch. The government is given the power to impose lump-sum taxes and transfers. It collects lump-sum per-capita taxes on the young and old, poor and rich, at time \( t \).\(^1\) Total tax collections are equal to:

\[ x(t) = \frac{\delta}{1 + \delta} \left( N(t - 1) \pi(t) + N(t - 1) \pi(t) + N(t - 1) \pi(t) + N(t - 1) \pi(t) \right). \]

where \( \pi(t) \) represents the nominal lump-sum tax levied on a person in the \( p \)th year of life (\( i = n \) young, \( i = 0 \) of age) of economic class \( h = p \) poor, \( h = r \) rich). We assume that people cannot escape the taxes and that the tax system is costless to administer. At time \( t \), the government sells bonds in the nominal amount \( S_G(t) \) and pays interest and principal on bonds in the amount: \( 1 + R(t - 1) N(t) \frac{\delta}{1 + \delta} [1 + R(t - 1)] S_G(t - 1) \). The government issues new money (or retires old money, if negative) in the amount:

\[ m(t) = M(t) - M(t - 1). \]
The budget constraint faced by the government is:

\[ 1 + R(t) - 1] S(t+1) = S(t) + X(t) + m(t) \]

Expenditures on bonds (interest and principal payments) are financed by issuing new bonds, collecting taxes, and issuing money.

The maximization problems faced by individuals change because of the introduction of taxes. Solving the maximization problems, we find that the new choices of the rich and poor are given by:

**Consumption:**

<table>
<thead>
<tr>
<th>Poor</th>
<th>Rich</th>
</tr>
</thead>
<tbody>
<tr>
<td>[ \frac{1}{1 + \delta} [\alpha - PVT_p] ]</td>
<td>[ \frac{1}{1 + \delta} [\beta - PVT_r] ]</td>
</tr>
</tbody>
</table>

| Old | \[ \frac{\delta}{1 + \delta} [\alpha - PVT_p] \] | \[ \frac{\delta}{1 + \delta} [\beta - PVT_r(1 + \delta)] \] |

| Saving | \[ \frac{\delta}{1 + \delta} [\alpha - PVT_p] + \frac{\delta^2}{1 + \delta} \] | \[ \frac{\delta}{1 + \delta} [\beta - PVT_r(1 + \delta)] + \frac{\delta}{1 + \delta} \] |

\[ \cdot [1 + \pi(t)] \]

PVT_p and PVT_r are the real present values of taxes imposed on the poor and rich, respectively:

\[ PVT_p = \frac{\tau_p}{p(t)} + \frac{\tau_p^2}{p(t+1)} [1 + \pi(t)] \]

\[ PVT_r = \frac{\tau_r}{p(t)} + \frac{\tau_r^2}{p(t+1)} + \frac{\delta}{1 + \delta} [\beta - PVT_r(1 + \delta)] \]

Market-clearing conditions for bonds and money now depend upon the size of taxes. Bond-market clearing occurs when bonds supplied by the government \[ S(t) \] equal bonds demanded by individuals \[ D_b(t) \]:

\[ S(t) = N_p(t) \frac{1}{1 + \delta} \left[ \delta p(t) + \delta^2 p(t+1) + R(t) \right] \]

Money-market clearing occurs when the money supply equals money demand:

\[ M(t) = N_p(t) \frac{1}{1 + \delta} \left[ \delta p(t) + \delta^2 p(t+1) \right] \]

We assume that the government pursues purposeful policies designed to provide the intergenerational free lunch, as in the preceding section. The government can do this by the appropriate choice of its instruments \( S(t), M(t), \tau(t), \tau_p(t), \tau_r(t) \), and \( R(t) \), in order to set \( \pi(t) = -n/1 + n \), and \( i(t) - n \) for all \( t \). The tradeoff between taxes, bonds, and money are now examined dynamically.

We wish to demonstrate that the government can choose any time path of bond sales and money issuance desired, provided that it adjusts taxes or transfers properly, such that neither inflation nor interest rates are affected. The idea is fairly simple but the large number of variables and the dynamic comparison of different paths renders the proof a bit complicated. Consequently, it is left to an appendix that is available on request.

The main result of the proof is that any time path of the money stock and any time path of government borrowing can be combined with the appropriate lump-sum taxes to prevent any change in the equilibrium interest rate and inflation rate. This can be done without affecting the welfare of individuals, a case we refer to as being micro-neutral. This is the case considered in the models of Wallace (1981) and Barro (1974). However, it is also possible to redistribute income between members of the different wealth classes, a case we refer to as being macro-neutral, since it can be done without affecting the macroeconomic variables (interest rate and inflation rate).

The following numerical example is intended to help in understanding the neutrality proposition and its implications.

Let the parameters take the following values:

\[ \alpha = 6 \quad \beta = 20 \quad \delta = 0.9 \quad n = 1 \]

\[ \pi(t) \quad \text{Time discount rate} \]

\[ \alpha = 0.8 \quad \beta = 0.9 \quad \delta = 0.9 \quad n = 1 \]

\[ \pi(t) \quad \text{Population growth rate} \]

\[ \pi(t) \quad \text{(population doubles each period).} \]

Given these parameters, in the optimal simple equilibrium, the individual choice variables are stationary and are given by:

\[ \pi(t) = 10.53 \quad \pi(t) = 18.95 \quad \pi(t) = 9.47 \]

\[ \pi(t) = 5.68 \quad \pi(t) = 2.84 \]

Suppose that the following initial conditions hold at time \( t = 1 \):

\[ N_p(t) = 16 \quad \text{Population of the poor} \]

\[ N_r(t) = 32 \quad \text{Population of the rich} \]

\[ M(t) = 45.47 \quad \text{Money supply} \]

\[ S(t) = 303.16 \quad \text{Government debt} \]

\[ p(t) = 1.0 \quad \text{Price level.} \]

We now consider the following situation. For \( t < 4 \), we let \( M(t) = 45.47 \) and \( S(t) = 303.16 \). At \( t = 4 \) there is a one-time increase in the money supply and in the debt, so that for \( t > 4 \), \( M(t) = 55.47 \) and \( S(t) = 403.16 \). The money supply is raised permanently by 10 and the debt is raised permanently by 100.

The lump-sum taxes and transfers which are needed to ensure micro-neutrality are:

For \( t < 4 \)

\[ \tau(t) = \tau(t) = \tau(t) = \tau(t) \]

For \( t = 4 \)

\[ \tau(t) - \tau(t) - \tau(t) = 0 \]

\[ \pi(t) = -0.625 \]

\[ \pi(t) = -3.125 \]

\[ X(t) = -110.00 \] (net tax increase of the government).

For \( t > 4 \)

\[ \tau(t) = \tau(t) = \tau(t) = \tau(t) \]

\[ X(t) = 0 \]
An example of a macro-neutral tax policy which redistributes income from rich to poor is given by:

\[
\begin{align*}
q(t) &= q(0) - 1.25 \quad q(t) \neq q(0) \\
\frac{p(t)}{p(0)} &= 2.8125 \\
q(t + 1) &= q(t + 1) - 0.125 \quad q(t + 1) = 6.8125 \\
\frac{p(t + 1)}{p(t)} &= 6.3125
\end{align*}
\]

for all \( t \geq 4 \). The real interest rate remains unchanged at \( n \), the inflation rate remains unchanged at \( -\frac{n}{1 + n} \), but consumption streams change to:

\[
\begin{align*}
C_F - 10.21 &= C_F + 18.38 \\
C_F - 3.78 &= C_F - 6.81
\end{align*}
\]

Neutrality occurs in this case because the government adjusts lump-sum taxes and transfers very precisely, in the same fashion as in Wallace (1981). The demand for bonds rises by exactly the same amount as the increase in government debt. The demand for money rises by exactly the amount of the increased money supply. Under micro-neutrality there is no change in the present value of taxes facing any individual, and no change in the interest rate or inflation rate, so individuals' budget constraints are unchanged. Taxes substitute perfectly for bonds and money.

Of course, the point of this exercise is not to suggest that money and government debt are neutral in a real economy. In fact, what the result shows is how difficult it is to achieve neutrality. Neutrality requires two somewhat unrealistic assumptions: (1) that the government seeks to maximize social welfare, and (2) that the government has available to it lump-sum taxation, which it uses appropriately. The results of this model are useful as a basis for comparison with models which have more realistic assumptions about the government's goals or the tools available to it.

IV. INTERPRETATION AND CONCLUSIONS

A primary goal of this paper has been to demonstrate a simple overlapping-generations model. From the specification of the utility functions of agents and the generational structure, equilibrium solutions were generated easily. The simplicity of the OG model is an important attribute.

A widely held notion about the effects of government financing is that monetization leads to inflation and that government borrowing leads to higher interest rates. The neutrality proposition presented in this paper suggests that the optimal policy of the government is one which adjusts taxes on individuals so that choices about monetization and borrowing are irrelevant.

Any analysis of government asset exchanges (such as those achieved via open-market operations) must begin by explaining the reasons for existence of all assets and the coexistence of different types of assets with (potentially) different rates of return. In this model, the overlapping-generations friction explains the existence of assets, and the denomination restrictions explain coexistence. The government's provision of the intergenerational free lunch allows both frictions to be overcome perfectly, thus allowing the neutrality of alternative financial-policy paths.

Models in which money or bonds are not neutral may be interpreted in terms of how they differ from the model of this paper. In the seminal contribution by Diamond (1965), increased government debt is shown to cause the interest rate to rise. However, as pointed out by Bierwag, Grove, and Khang (1969), Diamond's results occur because taxes are imposed only on the young people of his model. Lump-sum taxation imposed on both old and young can be used to eliminate all debt effects. Similar restrictions on tax rates explain the non-neutrality of debt in the model of Helpman and Sadek (1979). Transactions costs explain the "inefficiency of interest-bearing national debt" in the model of Bryant and Wallace (1979). The existence of transactions costs leads to the non-neutrality of money in studies by Jovanovic (1982), Grossman and Weiss (1983), and Romerberg (1984). Imperfect capital markets arising due to informational asymmetries lead to the non-neutrality of debt studied by Webb (1981), and of money in the Freeman model (1985).

In all these models, non-neutrality of money or bonds arises because the "frictions" in the models cannot be overcome completely. It is then possible to determine some optimal supply of money or debt. This suggests that the path of future research ought to be along the lines of public finance, in which we build models which incorporate the major frictions of actual economies and examine the costs and benefits of alternative forms of government finance (Beiter 1983). For example, given the absence of lump-sum taxation it may be optimal to finance government spending partly using debt, which is costly to society when it exists, drives the interest rate away from the growth rate of the economy, partly using money, the costs of which arise when the inflation rate differs from the optimal level (e.g., \( \pi_n/n \) in the model of this paper), and partly by distortionary taxation, which imposes deadweight losses and collection costs.

In this model, the social optimum occurs at "golden rule" rates of return to money and bonds. It may be the case that certain frictions in a model cause the returns on money and bonds to differ. Wallace (1985) suggests that neutrality of government debt only holds where money is not dominated by bonds in rate of return. That result is certainly not challenged in this paper, but the converse fails to hold, as the numerical example showing macro-neutrality in section III illustrates. Money and bonds pay identical returns, yet individuals can be affected (income redistributed) according to the government's tax choice. The distinction between micro- and macro-neutrality is a crucial one.

A brief discussion on strategies for modeling money is in order. In this paper, money and bonds are not substitutes due to the segmentation of markets. This assumption was made in order to show the results of the paper in the most straightforward manner possible. A model in which money and bonds are substitutable may be desirable for examining other questions. The present model can be modified to allow substitutability by modeling agents having a range of real incomes rather than just two income classes. With a given minimum bond size, government policy changes lead some people to switch between holding money and holding bonds. An additional implication of this paper is that models of money in which money is valued in the utility function cannot achieve neutrality results. For example, in McCubbins (1983), the utility function of the individual is of the form \( U = U(c, c, M, B) \). If the nominal money supply increases, then each person must hold more nominal money. A neutrality result will lead to \( c, c \), and the time path of \( c, c \) remaining constant when the money supply increases, but this increases utility. Consequently, no neutrality theorem holds. The money-in-the-utility-function approach must either be rejected as a model of money, or it must include more things in the (indirect) utility function, such as taxes.

The results of this paper are also relevant for empirical analysis of the effects of government debt on interest rates and, in particular, the Ricardoan Equivalence Theorem. The difference between micro- and macro-neutrality suggests that empirical investigation of each
hypothesis could be done differently. Time-series analysis on aggregate variables could be used to examine the hypothesis of micro-neutrality, while cross-sectional time-series analysis would be appropriate for investigating micro-neutrality. Further, significant changes in the tax structure ought to yield changes in the response to debt and money changes, if neutrality holds.

FOOTNOTES
1. While the results and method are similar, the model of this paper differs significantly from that of Wallace. Wallace examines stochastic storage and money, while this paper looks at nonstochastic storage, money, and bonds.
2. Traceability in a major problem in models in which agents have infinite lives. The short lives of agents in overlapping-generations models makes the models computationally simple.
3. Obviously money which is "held" from one time to another serves as a store of value. We may assume that money is "used" as a medium of exchange even by those who don't hold it, but we choose to model only the store of value function here.
4. The minimum damnification requirement may be justified by appeal to transactions costs or legal restrictions. Bryant and Wallace (1980), Sargent and Wallace (1981), and Wallace (1983) develop the legal restrictions approach.
5. Different growth rates for rich and poor lead to the same general result, since the markets are segmented.
6. Otherwise everyone could avoid the minimum restriction by buying k + x bonds and selling k of them, on net buying x bonds.
7. The results of this paper hold for a general CES utility function, although the mathematics becomes somewhat more complicated. The logarithmic utility function keeps things simple, without much loss of generality.
8. Because of the perfect-foresight assumption, analysis of bonds may be performed in either real or nominal terms. We choose to analyze everything in nominal terms, since most governments calculate nominal deficits, and market interest rates are in nominal terms.
9. Note that the logarithmic utility function makes consumption and savings growth invariate to the interest rate and inflation rate. This is irrelevant to later results, but makes them mathematically simple.
10. Goods or money are traded for bonds. The requirement that only money be exchanged for bonds, so that the term invariable funds is accurate, is essential.
11. All aggregate variables are written in nominal terms.
12. As in many perfect-foresight or rational-expectations models, multiple equilibria are possible here. We are concerned only with the equilibrium described below, however, and suggest that further specification of the model (such as boundary conditions) would force the model to obtain the relevant equilibrium.
13. Government expenditures consist of interest payments on the debt. The government never collects tax revenues, so it runs a perpetual deficit.
14. As is shown later, the constant nominal money supply is required to satisfy the government budget constraint, since government takes no net cash flow from bond sales and redemptions, and collects no taxes.
15. We assume throughout that taxes are never changed so much as to cause the poor to be unable to hold bonds or to cause the rich to hold money instead of bonds.
16. The existence of bequest motives does not change this analysis in a fundamental way. The literature on how bequests affect the determination of optimal government debt and money supply is substantial. See Ricardo (1820), Vickrey (1961), Barro (1974), Feldstein (1975), Carmichael (1970, 1982), and Burdekin (1983).
17. Barro (1979, 1980) has examined the optimal size of debt given that collecting taxes is costly.
18. This no-substitutability is part of many microfoundations models of money, such as Sargent and Wallace (1981), Grossman and Weiss (1983), Jovanovic (1982), Rotenberg (1984), and Freeman (1985).

REFERENCES


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**THE NEGLECTED MARKET**

Alan Rabin* E. Bruce Hutchinson* and John Abraham**

**INTRODUCTION**

Patinkin [1965] has demonstrated that economic analysis benefits greatly if we view macroeconomic problems by concentrating on markets and excess supplies and demands in those markets. He pays little attention to the flows of saving and investment. In fact, he states [1965, p. 270]:

We have throughout this book deliberately avoided the concept "savings" and its familiar accompaniment, the "savings = investment" condition. This decision has been based on the fact that such a concept is out of place in an analytical framework which views the economy as consisting of a number of goods, each with a price, and each with a market. For savings are clearly not a good, they have no price, and they are not themselves transacted on a market.

This paper also focuses on markets. The purpose of this article is to focus on the market for tangible assets, a market which has often been overlooked in the literature on macroeconomic models. The standard IS-LM framework focuses only on three markets: markets for goods, money, and bonds. The goods market is a market for newly produced consumption and investment goods (in the sense used by Patinkin [pp. 205-6]). It differs from the market for existing goods, or tangible assets (our "neglected market"). In the IS-LM model, there is an implicit bonds-equilibrium curve which goes through the intersection of the IS and LM curves. [Johnson 1972, p. 13] A special truncated version of Walras's Law holds in this model. [Tucker 1971, 1972] For some macroeconomic problems, the addition of the "neglected market" has little bearing. However, when people change their asset preferences between financial assets (bonds) and tangible assets there are dramatic implications for interest rates and macroeconomic variables generally. [Johnson 1972, p. 13]

**THE NEGLECTED MARKET**

According to Ruttledge [1981]:

In addition to owning stocks, bonds, bank accounts, money-market certificates and other financial assets, households also own condominiums, land, used cars, gold and countless other physical assets. This stock of existing goods, or tangible assets, has been produced and trickled over many years... To private investors, tangible assets are substitutes, or alternatives, to financial assets.

Accordingly, the IS-LM model may be amended to include a tangible assets market in which it is the implicit yield on intangible assets. The equilibrium conditions for this extended model are:

(1) \( E(y, \delta, \tau, t) = y \) Commodity Market

(2) \( B'(y, \delta, \tau, t) = B'(y, \delta, \tau, t) \) Bond Market

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