The Exchange Regime, Resource Allocation, And Uncertainty

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Abstract
The role of nontraded goods has received considerable attention from economists attempting to assess the relative merits of fixed versus flexible exchange rate regimes. The traditional view is summarized in McKinnon’s [10, 719] statement: "...if we move across the spectrum from closed to open economies, flexible exchange rates become both less effective as a control device for external balance and more damaging to internal price stability. Yet, as is widely recognized, the classification of goods into traded or nontraded depends upon the exchange rate. If an economy is not in long—run equilibrium, its position on the spectrum from closed to open economies will depend, in part, upon current exchange rate policy.

Disciplines
Behavioral Economics | Economic Theory | International Economics | Operations and Supply Chain Management
THE EXCHANGE REGIME, RESOURCE
ALLOCATION, AND UNCERTAINTY*

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No. 106
The role of nontraded goods has received considerable attention from economists attempting to assess the relative merits of fixed versus flexible exchange rate regimes. The traditional view is summarized in McKinnon's [10, 719] statement: "...if we move across the spectrum from closed to open economies, flexible exchange rates become both less effective as a control device for external balance and more damaging to internal price stability." Yet, as is widely recognized, the classification of goods into traded or nontraded depends upon the exchange rate. If an economy is not in long-run equilibrium, its position on the spectrum from closed to open economies will depend, in part, upon current exchange rate policy.

While there is little debate that changes in the exchange rate will change the line of demarkation between traded and nontraded good sectors, there is substantial controversy concerning the effects of the exchange rate on the allocation of resources between sectors. One view is that floating rates inhibit international trade and investment; the net effects leading to fewer resources in the export sector and more resources being allocated to the import competing and, presumably, nontraded good sectors. Aliber [1, 178] presents evidence that floating rates have increased exchange risk, price risk, and hedging costs by a factor of five to ten. This evidence is used to support the argument that: "Increased uncertainty about exchange rates is likely to lead to a reduction in international transactions relative to domestic transactions, and so production is less specialized internationally; the analogy is to a tax, however modest, on international transactions..." When the exchange rate is considered to be an endogenous variable, Aliber's argument loses some of its
force. Flexible rates might encourage trade if the primary cause of exchange rate variability is external price instability.

Another view stems from the observation that a change in the exchange rate alters the relative price of commodities. These relative price changes will serve as signals to resource owners so that flexible rates will induce resource movements between sectors. Again, in assessing this argument, it is necessary to consider the type of disturbance producing the exchange rate changes. Kreinen and Heller [6], and Lanyi [8] argue that if disturbances originate in the capital account, any resulting exchange rate changes can induce socially wasteful changes in the allocation of resources. However, Thursby [13] argues that exchange rate changes will lead to a reallocation of resources only if the induced relative price changes are deemed to be of a permanent nature. In an indirect test of this proposition, using a mix of empirical and simulation techniques, Thursby finds: "In a majority of our simulations we find no significant difference in export variation under fixed and flexible rates..."

In our recent paper in this journal [2], we argued that there is greater pressure for resource movements between sectors with fixed rates than with flexible rates. Although resource allocations were assumed to be exogenous, it was shown that price formation of nontraded goods is fundamentally different under the alternative exchange regimes. The model used postulates that commodity demands depend, in part, upon the domestic money supply and that the money supply is constant with flexible rates but serially correlated (through the balance of payments mechanism) with fixed rates. As such, the demand for and price of nontraded goods will be serially correlated with fixed rates but not with flexible rates. On this basis we argued that resource allocations to the nontraded goods sector (and hence the traded goods sector) should be serially correlated with fixed rates but not with flexible rates, regardless of the source of disturbances.
One problem with the works cited above (including our own) is that resource allocation is not considered from a microeconomic/optimization perspective. Papers by Helpman and Razin [4] and Lapan and Enders [9] have extended Samuelson’s [12] overlapping generations model to analyze exchange regimes in a manner consistent with optimizing behavior. Rather than postulating equations for aggregate macroeconomic equilibrium, behavioral rules can be derived assuming that agents maximize expected utility and have rational expectations. The behavioral rules of individuals are aggregated to obtain market clearing conditions. The purpose of this paper is to extend the overlapping generations model to consider the role of nontraded goods and the effects of an exchange regime on resource allocation. It will be shown that the different distribution of prices under the two exchange regimes will lead to differences in resource allocation for a small open economy. As opposed to the Enders and Lapan results, the price of nontraded goods with fixed rates is not necessarily serially correlated. When labor allocations are endogenous, labor movements between sectors will tend to eliminate any serial correlation in prices. First, we show that if all goods are traded, resource allocation and expected utility will be invariant to the exchange regime. In the presence of nontraded goods it is shown:

1) With flexible rates, the amount of resources allocated to any one sector will be constant over time. With fixed rates, resource allocation will respond to circumstances within the domestic and foreign economies. This is in contrast to the view that flexible rates lead to more variability in resource allocations than fixed rates.

2) The size of the nontraded goods sector is dependent upon the exchange regime. A fixed rate acts to increase the average size of the nontraded goods sector at the expense of traded goods so that more resources are allocated to traded goods with flexible rates than with fixed rates. The view that the preferred exchange regime depends upon the degree of "openness" must be modified when the size of traded and nontraded goods sectors are endogenous. Our results also challenge the view that flexible rates expand the import-competing sector and contract the export sector.
Section II describes the model, derives the optimal decision rules for individual agents, and considers aggregate macroeconomic equilibrium. The nature of the model is such that individuals maximize expected utility and have rational expectations. In Section III we solve the model for the case in which there are only traded goods. It is shown that resource allocations are invariant to the exchange regime and that individuals are indifferent to fixed or flexible rates. Sections IV and V reintroduce nontraded goods and demonstrate points 1 and 2 above. Conclusions and directions for further research are presented in Section VI.

II. The Basic Model

In extending the overlapping generations model, we consider a small open economy which produces two traded goods and a single nontraded good. The purpose of including two tradables is to avoid the oversimplification that a flexible exchange rate completely insulates the economy from external disturbances. In accord with the Monetary Approach and the intergenerational model, assume that:

i) All individuals live for two periods. They supply one unit of labor in the first period of life and are retired in the second. During the work period, the individual must decide how to allocate labor time between each of two traded goods and a single nontraded good.

ii) Output of each of the three goods is stochastic, but expected output of each is linear in labor time allocated to that good. Labor is the only factor of production, and expectations concerning the stochastic components of production conform to true probability distributions.

iii) Commodities are not storable across periods; further, the only store of value for any individual is domestic currency. Individuals
acquire domestic currency during their working period of life in order to finance consumption when retired.

iv) In the beginning of their work period, each individual must decide how to allocate labor time among the three commodities. At this time, the individual's information set contains the true distributions of the stochastic output disturbances and the mechanism generating market clearing prices. When the labor allocation is made, there is both price and output uncertainty. Once outputs are realized, the individual must decide how much of each to consume (sell). This decision is made with full knowledge of market clearing prices. The proceeds of these sales (saving) are carried into the retirement period. In the retirement period, the individual chooses how much of each good to consume at market clearing prices. After consumption in retirement, all members of the retired generation leave the economic system, and a new generation is born to replace them. The population is unchanging in that the working and retired generations have the same number of people.

v) The world consists of two countries, one of which is small in the sense that the foreign currency prices of traded goods are independent of its actions. The only policy decision of governments is the choice between fixed and flexible exchange rates. If the small country experiences a balance of payments deficit or surplus, its money supply will change. The money supply effect in the large country is negligible.

vi) All individuals have the same utility function, all maximize expected utility, and all have rational expectations.
II.A The Individual Maximization Problem

Let all individuals have a utility function which is log-linear in the consumption of each good in each period of life. The utility function of any member of generation $t$ is:

\[ U = \sum_{i=1}^{3} \left[ \theta_i \text{ln} c_{it} + \theta_i \text{ln} c_{it+1} \right] \]

$c_{ij}$ is the consumption of good $i$ in period $j$, $\theta_i$ is a share parameter of the utility function such that $\sum \theta_i = 1$. As there are no interest-bearing assets, and the individual works only in period $t$, the budget constraint is:

\[ \sum_{i=1}^{3} P_{ij} q_{it} = \sum_{i=1}^{3} P_{ij} c_{ij} \]

$P_{ij}$ is the domestic currency price of good $i$ in period $j$, and $q_{it}$ is the amount of good $i$ produced by a member of generation $t$. Production technology is such that:

\[ q_{it} = a_{it} l_{it} \quad (i = 1, 3) \]

$l_{it}$ is the amount of labor time allocated to good $i$ in period $t$, $\sum l_{it} = 1$, and $a_{it}$ is the stochastic production disturbance for good $i$ in period $t$. The $a_{it}$ are identically and independently distributed with known means, finite variances, and the disturbances across products are independent:

\[ E(a_{ij}^2) = \bar{a}_i^2 \quad i=k \text{ and } j=1 \]
\[ E(a_{ij} a_{k1}) = \begin{cases} E(a_{ij}^2) & i=k \text{ and } j=1 \\ \bar{a}_i \bar{a}_k & \text{otherwise} \end{cases} \]

We also assume that the realizations of the productivity disturbances are identical for residents of a particular country, but productivity disturbances and distributions may differ across countries. Letting starred (*) variables represent the large country counterpart of the small country variables; for any $i$ and $t$, the $a_{it}$ are identical for all members of generation $t$ in the small
country, but $a_{it}$ need not equal $a_{it}^*$. As will be shown below, different distributions of $a_{it}$ versus $a_{it}^*$ will influence labor allocation decisions.

Let $m_{t+1}$ denote the amount of money that an individual born at $t$ takes into period $t+1$. Thus, in $t+1$, an individual born in period $t$ will maximize:

$$\sum_{i=1}^{3} \ln c_{it+1} + \lambda[m_{t+1} - \sum_{i=1}^{3} P_{it+1}c_{it+1}]$$

Maximizing with respect to the $c_{it+1}$ yields the nominal demands for commodities during retirement:

$$P_{it+1}c_{it+1} = \theta_i m_{t+1} \quad (i = 1,3) \quad (6)$$

Given these consumption rules, the individual will select $c_{it}$ and $m_{t+1}$ during period $t$ in order to maximize:

$$E[\sum_{i=1}^{3} \ln c_{it} + \sum_{i=1}^{3} \ln (\theta_i m_{t+1}/P_{it})] + \lambda[\sum P_{it}(q_{it} - c_{it}) - m_{t+1}]$$

In equation 7) expectations run over the $P_{it+1}$. Define $y_t$ to be the individual's nominal income ($y_t = \Sigma P_{it}q_{it}$). Nominal consumption demands for commodities during the work period of life are:

$$P_{it}c_{it} = \theta_i y_t/2 \quad (i = 1,3) \quad (8)$$

and money holdings are:

$$m_{t+1} = y_t/2 \quad (9)$$

Using the decision rules given by equations 6, 8, and 9, the individual will allocate labor time to maximize:

$$E(U) = E[\sum_{i=1}^{3} \ln (\theta_i y_t/2P_{it}) + \sum_{i=1}^{3} \ln (\theta_i m_{t+1}/P_{it})]$$

$$= E[2\sum_{i=1}^{3} \ln (\theta_i y_t/2) - \sum_{i=1}^{3} \sum_{j=t}^{t+1} \ln (P_{ij})]$$

Which is equivalent to maximizing:

$$E[\ln (P_{1t}a_{1t}^{-1}a_{1t} + P_{2t}a_{2t}^{-1}a_{2t} + P_{3t}a_{3t}^{-1}a_{3t}(1-1_{1t}-1_{2t}))]$$

$$= E[\ln (P_{1t}a_{1t}^{-1}a_{1t} + P_{2t}a_{2t}^{-1}a_{2t} + P_{3t}a_{3t}^{-1}a_{3t}(1-1_{1t}-1_{2t}))]$$

$$= E[\ln (P_{1t}a_{1t}^{-1}a_{1t} + P_{2t}a_{2t}^{-1}a_{2t} + P_{3t}a_{3t}^{-1}a_{3t}(1-1_{1t}-1_{2t})))]$$
with respect to $l_{1t}$ and $l_{2t}$, where the expectations operator runs over $a_{it}$ and $P_{it}$. The first order conditions for an interior solution are:

a. $E[(P_{1t}a_{1t} - P_{3t}a_{3t})/y_t] = 0$

b. $E[(P_{2t}a_{2t} - P_{3t}a_{3t})/y_t] = 0$ \hspace{1cm} (12)

Equation 12) indicates that labor allocations will depend upon the distributions of the $a_{it}$ and $P_{it}$. While there is little reason to suppose that the productivity disturbances will be influenced by the exchange regime, price distributions will depend upon whether the rate of exchange is fixed or floating. As such, resource allocation will depend on the exchange regime via the effects of the exchange rate on price distributions. In order to determine the price distributions under the alternative exchange regimes, we now analyze market clearing conditions.

II.B Market Clearing Conditions

From the perspective of the small country, the foreign currency prices of traded goods are exogenous while the price of the nontraded good is determined internally. The market for the nontraded good clears when supply is equal to the demand by the working generation plus the demand by the retired generation. Let $N$ denote the number of people in each generation. Since all residents of the small country within a generation experience the same productivity disturbances, aggregate supply of the nontraded good (say good 3) in period $t$ is: $Na_{3t}$. From equation 8), each member of the working generation will demand $\theta_3 y_t/(2P_{3t})$ units of the nontraded good. Lagging time subscripts one period in order to obtain the demand for the nontraded good at $t$ by people born in $t-1$, equation 6) indicates that a person born in $t-1$ will demand $\theta_3 m_t/P_{3t}$ units of the nontraded good. The market for the nontraded good clears when:

$$Na_{3t} = N\theta_3 y_t/(2P_{3t}) + N\theta_3 m_t/P_{3t}$$ \hspace{1cm} (13)
Under fixed exchange rates, the balance of payments is the difference between the value of traded good outputs (good 1 and good 2) and the demands for tradables. Since there is no active monetary policy, the balance of payments in period $t$ is:

$$N(m_{t+1} - m_t) = N \sum_{i=1}^{2} (P_{i,1t} - \theta_i y_{i,t}/2 - \theta_i m_t)$$

(14)

Lastly, under any exchange regime, commodity arbitrage requires:

$$P_{it} = e_t^* P_{it}^*$$

(15)

where $e$ is the domestic currency price of the large country's currency. Under fixed rates, $e$ is fixed (for convenience at unity) while under flexible rates the money supply is constant so that $N(m_{t+1} - m_t) = N m_t = \bar{M}$.

Given labor allocations and the distributions (realized values) of the $a_{it}$ and $P_{it}^*$, equations 13-15 can be solved for the distributions (realized values) of the $P_{it}$ and either the money supply or exchange rate. Domestic price distributions, however, are essential for determining the labor allocations (see equation 12). Thus, equations 12-15 must be solved simultaneously in order to obtain the overall equilibrium. Before solving the system, it is necessary to ascertain the mechanism generating foreign prices.

We let the structure of the large country replicate that of the small country with the following exceptions:

i) All prices are determined internally.

ii) The money supply is constant, regardless of the exchange regime.

iii) While functional forms are equivalent, parametric values may differ from those of the small country. Thus, production functions in the large country are linear, but labor allocations and productivity disturbances can differ across countries.

Using starred variables to represent the large country counterpart of small country variables, it is easily shown that:
Individuals recognize that equation 16) determines the distribution of prices in the large country. For simplicity, we normalize units such that $m^* = 1/2$. Under fixed rates $P_{1t} = P_{1t}^*$ and $P_{2t} = P_{2t}^*$, while under flexible rates the relative price ratio of traded goods is $P_{1t}/P_{2t} = P_{1t}^*/P_{2t}^*$. Thus, the relative price ratios of traded goods are invariant to the exchange regime, and flexible rates will not be able to insulate an economy from external disturbances.

In order to highlight the role of nontraded goods, in Section III we assume that $\theta_3$ is zero: in essence there are two traded goods. We demonstrate that fixed and flexible rates are "identical" as long as there is no nontraded goods sector. Section III serves as a reference point for Section IV, which reintroduces nontraded goods.

III. The Completely Open Economy

In this section we consider the case in which there are no nontraded goods. The analysis follows directly from Section II by letting the taste parameter for nontraded goods ($\theta_3$) equal zero.\footnote{5} We demonstrate that labor allocations to the traded goods sectors depend upon the distribution of the productivity disturbances, but labor allocations are invariant to the exchange regime. This section, then, supports Thursby's argument that exchange rate changes do not induce resource movements between sectors. It is also shown that expected utilities under the two regimes are equal, regardless of the magnitude or source of disturbances.\footnote{6}

Since $l_{3t}$ will be zero, substitute the condition $l_{1t} + l_{2t} = 1$ into equation 11). The first order condition for an interior solution is:

$$E[(P_{1t}^* a_{1t}^* - P_{2t}^* a_{2t}^*)/(P_{1t}^* a_{1t}^* l_{1t} + P_{2t}^* a_{2t}^*(1 - l_{1t}))] = 0$$

where: $l_{2t} = 1 - l_{1t}$

\begin{equation}
P_{it}^* = 2M_{it}^*/a_{it}^* \quad (i = 1, 3)
\end{equation}
defining $v_t = P_{2t}/P_{1t} = a_{1t}^* / a_{2t}^*$, equation 17) can be written as:

$$E[(a_{1t} - v_t a_{2t}^*)/(a_{1t} - 1 + v_t a_{2t}^* (1-1))]=0$$  \hfill (18)

Since $v_t$ and the $a_{it}$ are independent of the exchange regime, the solution for the $l_{it}$ will be invariant to the exchange regime. Clearly, flexible rates do not act to contract the export sector and expand the import-competing sector: relative prices are equally variable under either exchange regime. Because the productivity disturbances are assumed to be serially uncorrelated and independently distributed, inspection of equation 18) indicates that the amounts of labor allocated to each good will be time independent. In this regard, our results are in accord with those of Thursby. Any relative price change in period $t$ does not convey any information concerning prices in $t+1$. As such, individuals do not perceive price change in $t$ to reflect a permanent change. Labor allocations respond to the distributions of the $a_{it}$ and $a_{it}^*$. Resources will only move between sectors if there are changes in the distribution of the productivity disturbances.

Given that labor supplies are constant and invariant to the exchange regime, it is possible to demonstrate that expected utility levels are invariant to the exchange regime. Using the commodity demand functions and equation 9, the utility of a member of generation $t$ will be:

$$U_t = \theta_1 \ln(y_t / P_{1t}) + \theta_2 \ln(y_t / P_{2t}) + \theta_1 \ln(y_t / P_{1t+1})$$

$$+ \theta_2 \ln(y_t / P_{2t+1})$$

where: $y_t = P_{1t} q_{1t} + P_{2t} q_{2t}$ as $\theta_3$ and output of good 3 are zero.

Since $\theta_1 + \theta_2 = 1$, rearrangement yields

$$U_t = 2\ln(y_t / P_{1t}) + 2\theta_1 \ln(\theta_1 / 2) + 2\theta_2 \ln(\theta_2 / 2) - \theta_2 \ln(P_{2t} / P_{1t})$$

$$+ \theta_2 \ln(P_{1t+1} / P_{2t+1}) + \ln P_{1t} - \ln P_{1t+1}$$

Note that the term $y_t / P_{1t} = a_{1t}^* / a_{2t}^*$ is invariant to the exchange regime since labor supplies, output disturbances, and relative prices are identical under fixed and flexible rates.
The difference between fixed and flexible rates (if any) is to be found in comparing \((\ln P_{lt} - \ln P_{lt+1})\) under the alternative exchange regimes. Thus:

\[
E(U_{fix}) - E(U_{flex}) = E[\ln(P_{lt}/P_{lt+1})]_{fix} - E[\ln(P_{lt}/P_{lt+1})]_{flex} \tag{21}
\]

As long as foreign prices are a stationary process, \(E[\ln(P^*_lt/P^*_lt+1)] = 0\), so that when the rate of exchange is fixed, \(E[\ln(P_{lt}/P_{lt+1})] = 0\). Under flexible exchange rates, the nominal money supply is constant. Multiply each side of equation 9 by \(N/P_{lt}\) to obtain:

\[
\frac{\bar{M}}{P_{lt}} = \frac{(Ny_{lt})}{(2P_{lt})} \text{ where: } \bar{M} \text{ is the constant value of the money supply} \tag{22}
\]

Thus:

\[
\frac{P_{lt+1}/P_{lt}}{\text{flex}} = \frac{(y_{lt}/P_{lt})}{(y_{lt+1}/P_{lt+1})} = \frac{(a_{lt}\bar{Y}_{lt} + v_{t}a_{2t+1})}{(a_{lt+1}\bar{Y}_{lt+1} + v_{t+1}a_{2t+1})} \tag{23}
\]

As is the case for fixed rates: \(\bar{Y}_{lt} = \bar{Y}_{lt+1}\) and both \(a_{lt}\) and \(a_{lt+1}\) are identically and independently distributed. As long as foreign prices are stationary, then \(E[\ln(P_{lt+1}/P_{lt})_{\text{flex}}] = 0\), and expected utilities under the two regimes are identical.

Fischer [3], Laffer [7], and Mundell [11] have argued that fixed rates should be used if disturbances are real and internal, while flexible rates are preferable, if disturbances are external. The essence of the argument is that flexible rates insulate an economy from external disturbances while internal will be contained within the domestic economy. With fixed rates, external disturbances will alter domestic prices, but individuals can save (via the balance of trade/payments mechanism) when domestic output is randomly high in order to consume when output is low. Our result showing that individuals are indifferent to the exchange regime (regardless of the source of disturbances) stems from two sources.\(^7\) Recall that relative prices are invariant to the exchange regime in a world of two traded goods: flexible rates no more insulate the economy from relative price movements than do fixed rates. Secondly, in the context of the intergenerational model, individuals can save
even if the exchange rate is flexible. Investigating the mechanisms by which fixed and flexible rates allow individuals to transfer real purchasing power to their retirement period illustrates the different forms of risk present in each system.

With a fixed rate, the working generation can save through the balance of trade mechanism as indicated by Fischer, Laffer, and Mundell. Money holdings (savings) and utility of the working generation in $t$ will be positively related to the magnitudes of domestic productivity disturbances and foreign prices in period $t$: the greater domestic productivity and foreign prices, the greater is the income of the working generation. As domestic and foreign productivity (and hence foreign prices) are uncorrelated, fixed rates allow for international risk sharing during the work period. In considering the retired generation, note that their value of real money holdings and utility will be negatively related to the magnitude of foreign prices and unaffected by levels of domestic outputs. The utilities of overlapping generations, then, will be negatively correlated with fixed rates. If the exchange rate is flexible, utilities of overlapping generations will be positively correlated: flexible rates allow for intergenerational risk sharing. While relative prices are determined in the rest of the world, absolute price levels will be negatively related to domestic productivities. The real value of cash balances held by the retired will be positively related to the output of the workers. The utility of an individual born at $t$ will be positively related to productivity in $t$ and in $t+1$. Since disturbances at $t$ and $t+1$ are uncorrelated, flexible rates allow for intergenerational risk sharing.

In the next section we reintroduce nontraded goods and show that resource allocation patterns differ under the two exchange regimes. One of the factors influencing the demand for nontraded goods is money balances held by the retired generation. As the money supply is constant with flexible rates but
endogenous with fixed rates, demands and labor allocations will be time dependent in a predictable way if the exchange rate is fixed. Labor allocations will remain constant if the rate of exchange is flexible.

IV. Nontraded Goods

In this section we reintroduce nontraded goods. It will be shown that the presence of nontraded goods act to break the equivalence of the two exchange regimes. In any period, real commodity demands of the retired generation are positively related to holdings of cash balances (see equation 6). In the event that the small country experiences a payments surplus in t-1, the working generation in period t will anticipate a relatively large demand for commodities. As the only price which can be affected is the nontraded good's price, the working generation in t will allocate more labor to nontraded goods than if there had been payments equilibrium in period t-1. Under flexible rates, however, the money supply is constant over time. As such, labor allocations will be time dependent in a fixed rate system and time independent under flexible rates. In the absence of a nontraded goods sector, a balance of payments surplus in t-1 will have no effects upon relative prices that prevail in period t, accounting for the constancy of the labor supplies in Section III. It is the presence, then, of nontraded goods which account for the time dependency of the labor supply decisions shown below.

Consider flexible exchange rates: under flexible rates, equations 13, 14, and 16 can be solved for the price of the nontraded good and the rate of exchange:

\[ p_{3t} = \frac{3tM}{(Na_{3t}^{1/3})} \]

\[ e_t = \frac{2M [1 - \theta \gamma]}{[N_1^{1/3} t^{a_1/3} + N_2^{1/3} t^{a_2/3}]} \]

Equations 15, 16, 24, and 25 determine the distribution for prices that individuals use in their labor supply decision. Substitute these four equations
into equations 12a and b to obtain the first order conditions for an interior solution:

\[ E[((a_{1t}/a_{1t}^*)^3)l_3t]/(l_1^ta_{1t}/a_{1t}^* + l_2^ta_{2t}/a_{2t}^*)] = \theta_3/1-\theta_3 \]

b. \[ E[((a_{2t}/a_{2t}^*)^3)l_3t]/(l_1^ta_{1t}/a_{1t}^* + l_2^ta_{2t}/a_{2t}^*)] = \theta_3/1-\theta_3 \]  

Adding 26a and 26b, and recalling that \( E l_{1t} = 1 \), the solution for labor in the nontraded goods sector is:

\[ l_{3t} = \theta_3 \]  

Using 27) and either 26a or 26b, the solution for \( l_{1t} \) is given by the value of \( l_{1t} \) such that:

\[ E[(a_{1t}/a_{1t}^*)/(l_1^ta_{1t}/a_{1t}^* + (1-l_1t-\theta_3)a_{2t}/a_{2t}^*)] = 1/1-\theta_3 \] 

In many respects, the labor allocation decision with flexible rates and nontraded goods is similar to our results in Section III above. Since \( a_{1j} \) and \( a_{1j}^* \) are serially uncorrelated, labor allocations to the traded goods sector (\( l_{1t} \) and \( l_{2t} \)) will be constant over time. This is to be contrasted to fixed rates for which it will be shown that labor allocations are time dependent. In addition:

i) The solution for \( l_{1t} \) (and thus \( l_{2t} \)) will depend upon the distributions of the domestic and foreign output disturbances. Thus, the distribution of foreign outputs (prices) will affect the domestic economy, even if the exchange rate is flexible. Flexible rates do not insulate the domestic economy from external disturbances.

ii) Since equation 28) is not linear, specialization will not occur in reference to only the mean of the probability distribution.9/

Suppose that the small country has a comparative advantage in the
ex ante sense that \( E(a_{2t}) < E(a_{1t}) = E(a_{1t}^*) = E(a_{2t}^*) \). As we demonstrate in the next section, the country may allocate more labor to good 2 if the variance of good 2 is low relative to that of other goods.

iii) It is the ratios of the domestic to foreign disturbances which are important. As such, if \( a_{1t} \) is distributed as \( a_{2t} \) and \( a_{1t}^* \) is distributed as \( a_{2t}^* \), labor allocations to each of the two traded goods sectors will be equal \( l_{1t} = l_{2t} = (1 - \theta_3)/2 \). If the domestic economy is uniformly more or less variable than the rest of the world, labor allocations will not change.

Under fixed exchange rates, the situation is quite different. Substitute equations 13, 15, and 16 into 12a and 12b to obtain:

\[
\begin{align*}
\text{a. } & E[(a_{1t}/a_{1t}^* - a_{2t}/a_{2t}^*)/(1 - l_{1t}/a_{1t}^* + l_{2t}/a_{2t}^* + \theta_3/m_{2t}^*)] = 0 \\
\text{b. } & E \left[ (2\theta_3m_{2t}^* - a_{2t}^2[2(1 - l_{1t} - l_{2t}) - \theta_3]/a_{2t}^* \right]/ \\
& (a_{1t}/a_{1t}^* + a_{2t}/a_{2t}^* + \theta_3/m_{2t}^*) = 0
\end{align*}
\]

(29)

Given the money supply in \( t \) and the distribution of \( a_{1t} \) and \( a_{1t}^* \), equations 29a and 29b can be solved for \( l_{1t} \) and \( l_{2t} \) and (as \( \Sigma l_{1t} = 1 \)) \( l_{3t} \). However, with a fixed exchange rate, the money supply will not be constant over time. Of particular importance is the fact that the money supply at \( t \) is in the information set of the working generation in \( t \) at the time the labor supply decision is made. Note that lagging equation 14) one period yields the money supply at \( t \) (\( m_t \) or \( Nm_t \)) in terms of events in \( t-1 \). Thus, in marked contrast to flexible rates, the solutions for the \( l_{1t} \) will be changing over time if the exchange rate is fixed. As opposed to the results of Kreinen and Heller, Lanyi, and Thursby,
there is more variation in resource allocations with fixed rates than with flexible rates.

In equations 29a and b, the expectations operator runs over the $a_{it}$ and $a^*_t$ but not the $l_{it}$ or $m_t$ - the $l_{it}$ are choice variables and $m_t$ is in the information set at $t$. Given the distributions of the $a_{it}$ and $a^*_t$, inspection of 29a shows that the larger is $m$, the smaller is the sum of $l_{1t}$ and $l_{2t}$ (i.e., the greater is $l_{3t}$). The greater the current value of the money supply, the larger the expected output of the nontraded good (from equation 3, $q_{3t} = a_{3t} l_{3t}$). When the money supply is above its mean value, workers anticipate the above average demand for the nontraded good and allocate more labor to that sector.

As labor allocations are time dependent when the exchange rate is fixed, questions concerning the effects of the exchange regime on sector size must be answered in reference to average (or expected) sector size. Unfortunately, it is not possible to explicitly solve for the expected labor allocations unless the distributions and realizations of the productivity disturbances are specified. We tackle this problem in Section V by simulating the model using Monte Carlo techniques.

V. Simulating the Model

As shown above, under flexible exchange rates the allocation of labor to each of the traded goods will depend upon the distributions of the domestic and foreign productivity disturbances. Under fixed rates, labor allocations to all three sectors will depend upon the distributions and realizations of the productivity disturbances. The realizations of the productivity disturbances are important under fixed rates since the small country's money supply will respond to differences in realized outputs across countries.
Since labor allocations are not distribution-free, our simulation results are designed to be illustrative as opposed to definitive. We assume that all productivity disturbances are binomially distributed. In providing simulation results, we would like to be able to use a commonly used distribution. A second reason for using the binomial is its simplicity and concurrent savings in computer costs. Lastly, we have experimented with several multinomial distributions; they yield the same qualitative results as the binomial.

While all productivity disturbances are assumed to be drawn from the binomial distribution, the means and/or variances of the distributions are allowed to differ across countries and commodities. Specification of the parameters of each distribution allows us to solve for labor supplies under flexible rates. With fixed exchange rates, it is also necessary to know the particular realizations of the output disturbances in order to generate the money supply and labor allocations for each time period. After simulating the model for fifty periods, the mean values of labor allocations have been calculated and are reported in the following tables as expected labor allocations under fixed exchange rates: \( E(l_{it}) \). As allocations are time independent with flexible rates, they are reported as \( l_{it} \).

Table 1 indicates how labor allocations depend upon the share of nontraded goods in consumption \( (\theta_3) \). It is assumed that all disturbances have a mean of unity and that \( \theta_1 = \theta_2 \). There is a 50% chance that any disturbance will take on the value of .5 and a 50% chance that it will be 1.5.

Since all distributions are identical, the labor allocations under flexible rates are such that \( l_{3t} = \theta_3 \) and \( l_{1t} = l_{2t} = (1 - \theta_3)/2 \); under fixed rates, \( l_{1t} = l_{2t} \). As expected, the table shows that labor allocated to the nontraded goods sector is positively related to \( \theta_3 \) under either regime. All else equal, the greater is \( \theta_3 \), the greater will be the demand for nontraded goods.
Table 1: Labor Allocations and the Share of Nontraded Goods

<table>
<thead>
<tr>
<th>Value of $\theta_3$</th>
<th>$E(1_{1t})$</th>
<th>$E(1_{2t})$</th>
<th>$E(1_{3t})$</th>
<th>$\rho_{L3, M}$</th>
<th>Fixed Rates</th>
<th>Flexible Rates</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.0</td>
<td>0.5</td>
<td>0.5</td>
<td>0.</td>
<td></td>
<td>0.5</td>
<td>0.5 0.</td>
</tr>
<tr>
<td>.1</td>
<td>0.444</td>
<td>0.444</td>
<td>0.112</td>
<td>0.9999</td>
<td>0.45</td>
<td>0.45 0.1</td>
</tr>
<tr>
<td>.2</td>
<td>0.391</td>
<td>0.391</td>
<td>0.219</td>
<td>0.9997</td>
<td>0.4</td>
<td>0.4 0.2</td>
</tr>
<tr>
<td>.3</td>
<td>0.339</td>
<td>0.339</td>
<td>0.322</td>
<td>0.9995</td>
<td>0.35</td>
<td>0.35 0.3</td>
</tr>
<tr>
<td>.4</td>
<td>0.289</td>
<td>0.289</td>
<td>0.422</td>
<td>0.9993</td>
<td>0.3</td>
<td>0.3 0.4</td>
</tr>
<tr>
<td>.5</td>
<td>0.240</td>
<td>0.240</td>
<td>0.520</td>
<td>0.9992</td>
<td>0.25</td>
<td>0.25 0.5</td>
</tr>
<tr>
<td>.6</td>
<td>0.195</td>
<td>0.195</td>
<td>0.611</td>
<td>0.9602</td>
<td>0.2</td>
<td>0.2 0.6</td>
</tr>
<tr>
<td>.7</td>
<td>0.145</td>
<td>0.145</td>
<td>0.709</td>
<td>0.9576</td>
<td>0.15</td>
<td>0.15 0.7</td>
</tr>
<tr>
<td>.8</td>
<td>0.091</td>
<td>0.091</td>
<td>0.818</td>
<td>0.9025</td>
<td>0.1</td>
<td>0.1 0.8</td>
</tr>
</tbody>
</table>

1. The mean and variance of all productivity disturbances are 1.0 and 0.25 respectively. It is also assumed that $\theta_1 = \theta_2 = (1 - \theta_3)/2$.

2. For fixed rates, labor allocations may not sum to unity because of rounding.
The column labeled $\rho_{L3,M}$ shows the simulated value of the correlation coefficient between the money supply in a period and the amount of labor allocated to the nontraded goods sector in that period (as the money supply is constant with flexible rates, there is not a corresponding column for the flexible rate case). The large value of the correlation coefficient supports the claim that the demand for nontraded goods is positively related to the domestic money supply. Agents respond by allocating more labor to the nontraded goods sector in periods for which the demand for the nontraded good is expected to be above average. As the demand for the nontraded good is positively related to the money supply, labor allocated to this sector is also positively related to the money supply.

Perhaps the most striking result in Table 1 is that the average amount of labor in the nontraded good sector is greater (unless $\phi_3 = 0$) with a fixed rate than with a flexible rate. Thus, fixed rates - on average - increase the size of the nontraded good sector. It cannot be claimed that flexible rates always allocate resources away from sectors in which there is exchange risk: rather exchange risk is endogenous. Using equations 24) and 27), under flexible rates the price of the nontraded good is $P_{3t} = 2M/a_{3t}$. The price of the nontraded good is singularly determined by the productivity disturbance in that sector. Domestic currency prices of traded goods $[e_t P^{t*}, e_t P^{t*}]$ are determined by conditions in both countries (see equation 25). With a fixed rate, the situation is reversed: traded goods prices are determined by productivity disturbances in the traded good sector $[P_{1t} = P^{t*} = 1/a_{1t}^{t*}$ and $P_{2t} = P^{t*} = 1/a_{2t}^{t*}]$ while the price of the nontraded good depends upon current disturbances and (through the money supply effect) events in previous periods. Risk-averse individuals, then, tend to allocate more labor to the nontraded good sector when the exchange rate is fixed than when the rate is flexible. It is the different channels by which prices are determined under the two regimes.
which lead to different price distributions and resource allocations. While not reported in the table, the price of the nontraded good was not found to be serially correlated with a fixed rate. When labor allocations are exogenous (as in Enders and Lapan [2]), prices will be serially correlated. In a rational expectations framework with serially uncorrelated productivity disturbances and "costless" labor reallocations, labor movements between sectors will tend to eliminate any predictability (serial correlation) in prices.

Table 2 indicates how changes in the relative variability of foreign to domestic output disturbances alters labor allocations. The means of the productivity disturbances (both domestic and foreign) are all unity, but the variance of the foreign productivity disturbances increase as one reads down the table. As in Table 1, in Table 2 we assume that domestic output disturbances have a 50% chance of taking on the value of .5 and a 50% change of being 1.5. Under flexible rates, all labor allocations are constant ($l_i = \theta_i$, $i = 1,3$) over time. With fixed rates, the greater the variability of foreign to domestic output, the more labor is allocated to the nontraded goods sector. Risk-averse individuals are acting to avoid the risks of foreign price variability by producing nontraded as opposed to traded goods. Table 2 acts to reinforce the main point of Table 1. Note that even if foreign disturbances are less variable than domestic disturbances, more labor is allocated to the nontraded goods sector with fixed rates than with flexible rates. To explain, recall that from equation 15), $P_{1t}/P_{2t}$ will be invariant to the exchange regime. Uniformly increasing the variability of foreign prices affects this relative price equally in the two exchange regimes. Yet, the argument made previously remains in force: with fixed (flexible) rates, the price of each traded (the nontraded) good is determined in a single market.
Table 2: Labor allocations and the variability of foreign output

<table>
<thead>
<tr>
<th>Variance of Foreign Output</th>
<th>Fixed Rates</th>
<th>Flexible Rates</th>
</tr>
</thead>
<tbody>
<tr>
<td>$E(1_{1t})$</td>
<td>$E(1_{2t})$</td>
<td>$E(1_{3t})$</td>
</tr>
<tr>
<td>(.1)$^2$ = .01</td>
<td>.3265</td>
<td>.3265</td>
</tr>
<tr>
<td>(.2)$^2$</td>
<td>.3264</td>
<td>.3264</td>
</tr>
<tr>
<td>(.3)$^2$</td>
<td>.3257</td>
<td>.3257</td>
</tr>
<tr>
<td>(.4)$^2$</td>
<td>.3243</td>
<td>.3243</td>
</tr>
<tr>
<td>(.5)$^2$</td>
<td>.3221</td>
<td>.3221</td>
</tr>
<tr>
<td>(.6)$^2$</td>
<td>.3190</td>
<td>.3190</td>
</tr>
<tr>
<td>(.7)$^2$</td>
<td>.3143</td>
<td>.3143</td>
</tr>
<tr>
<td>(.8)$^2$</td>
<td>.3074</td>
<td>.3074</td>
</tr>
</tbody>
</table>

1. The mean of all productivity disturbances are unity. The variance of all domestic disturbances is (.5). Also in the table, all $\theta_i$ are equal to 1/3.

2. Both foreign output disturbances have a .5 probability of taking on the value $1-\varepsilon$ or $1+\varepsilon$. The variance of each foreign disturbance is $\varepsilon^2$. All disturbances are uncorrelated.
In Table 3 we change the mean and variance of one of the traded goods (good 2). We spare the reader another explanation of why more labor is allocated to the nontraded good with fixed, as opposed to flexible, rates. Not surprisingly, the table indicates that increasing the mean or decreasing the variance of good 2 acts to increase the amount of labor allocated to good 2 and decrease the amount of labor allocated to good 1. If comparative advantage is measured by the means of the productivity disturbances, a nation may tend to specialize in the good for which it has a comparative disadvantage if the variance of that good is low. To illustrate, let $E(a_{2t}) = .9$ and $\text{Var}(a_{2t}) = (.5)^2$ while all other disturbances have a mean of 1.0 and variance of $(.5)^2$.

From row 11 in the table it is seen that labor allocations to goods 1 and 2 are .4213 and .2454 with flexible rates and expected allocations with fixed rates as .4188 and .2219 respectively. Under either regime, more labor is allocated to the sector in which there is a comparative advantage. However, if the variance of $a_{2t}$ falls to $(.1)^2$, more labor is allocated to the good in which there is a comparative disadvantage (.3215 and .3296 for fixed rates and .3071 and .3596 for flexible rates).

The table also indicates that there tends to be more specialization in accord with comparative advantage when the exchange rate is fixed. Define:

$$S = \frac{E(l_{1t}^e)}{E(l_{2t}^e)} = \frac{l_1}{l_2}$$

The value of $S$, or the specialization ratio, measures the extent to which specialization occurs under the alternative exchange regimes. When $S > 1$, relatively more labor is allocated to good 1 than good 2 with a fixed rate than with a flexible rate. From the last column in Table 3, it is seen that when there is a comparative advantage in good 1, the specialization coefficient is greater than unity, and when there is a comparative advantage in good 2 the specialization coefficient is less than unity. To explain why fixed rates are more conducive to specialization in accord with comparative advantage, recall
Table 3: Labor Allocations and Asymmetric Means and Variances

<table>
<thead>
<tr>
<th>Good 2 of Good 2</th>
<th>Variance of Good 2</th>
<th>Fixed Rates</th>
<th>Flexible Rates</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>E(1_{1t})</td>
<td>E(1_{2t})</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1_1</td>
<td>1_2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1/3</td>
<td>1/3</td>
</tr>
<tr>
<td>0.8</td>
<td>(.1)^2 = .3125</td>
<td>.4359</td>
<td>.2076</td>
</tr>
<tr>
<td></td>
<td>(.2)^2 = .3357</td>
<td>.4480</td>
<td>.1938</td>
</tr>
<tr>
<td></td>
<td>(.3)^2 = .3582</td>
<td>.4784</td>
<td>.1687</td>
</tr>
<tr>
<td></td>
<td>(.4)^2 = .4951</td>
<td>.5177</td>
<td>.1290</td>
</tr>
<tr>
<td></td>
<td>(.5)^2 = .5526</td>
<td>.5526</td>
<td>.0929</td>
</tr>
<tr>
<td>0.9</td>
<td>(.1)^2 = .3215</td>
<td>.3215</td>
<td>.3296</td>
</tr>
<tr>
<td></td>
<td>(.2)^2 = .3357</td>
<td>.3357</td>
<td>.3139</td>
</tr>
<tr>
<td></td>
<td>(.3)^2 = .3582</td>
<td>.3582</td>
<td>.2891</td>
</tr>
<tr>
<td></td>
<td>(.4)^2 = .3868</td>
<td>.3868</td>
<td>.2574</td>
</tr>
<tr>
<td></td>
<td>(.5)^2 = .4188</td>
<td>.4188</td>
<td>.2219</td>
</tr>
<tr>
<td></td>
<td>(.6)^2 = .4427</td>
<td>.4427</td>
<td>.1852</td>
</tr>
<tr>
<td>1.0</td>
<td>(.1)^2 = .2179</td>
<td>.2179</td>
<td>.4351</td>
</tr>
<tr>
<td></td>
<td>(.2)^2 = .2322</td>
<td>.2322</td>
<td>.4198</td>
</tr>
<tr>
<td></td>
<td>(.3)^2 = .2553</td>
<td>.2553</td>
<td>.3948</td>
</tr>
<tr>
<td></td>
<td>(.4)^2 = .2859</td>
<td>.2859</td>
<td>.3616</td>
</tr>
<tr>
<td></td>
<td>(.5)^2 = .3221</td>
<td>.3221</td>
<td>.3221</td>
</tr>
<tr>
<td></td>
<td>(.6)^2 = .3617</td>
<td>.3617</td>
<td>.2791</td>
</tr>
<tr>
<td>1.1</td>
<td>(.1)^2 = .1256</td>
<td>.1256</td>
<td>.5253</td>
</tr>
<tr>
<td></td>
<td>(.2)^2 = .1392</td>
<td>.1392</td>
<td>.5111</td>
</tr>
<tr>
<td></td>
<td>(.3)^2 = .1612</td>
<td>.1612</td>
<td>.4878</td>
</tr>
<tr>
<td></td>
<td>(.4)^2 = .1910</td>
<td>.1910</td>
<td>.4560</td>
</tr>
<tr>
<td></td>
<td>(.5)^2 = .2275</td>
<td>.2275</td>
<td>.4169</td>
</tr>
<tr>
<td></td>
<td>(.6)^2 = .2693</td>
<td>.2693</td>
<td>.3722</td>
</tr>
<tr>
<td>1.2</td>
<td>(.1)^2 = .0437</td>
<td>.0437</td>
<td>.6024</td>
</tr>
<tr>
<td></td>
<td>(.2)^2 = .0576</td>
<td>.0576</td>
<td>.5826</td>
</tr>
<tr>
<td></td>
<td>(.3)^2 = .0765</td>
<td>.0765</td>
<td>.5683</td>
</tr>
<tr>
<td></td>
<td>(.4)^2 = .1048</td>
<td>.1048</td>
<td>.5388</td>
</tr>
<tr>
<td></td>
<td>(.5)^2 = .1395</td>
<td>.1395</td>
<td>.5022</td>
</tr>
<tr>
<td></td>
<td>(.6)^2 = .1801</td>
<td>.1801</td>
<td>.4593</td>
</tr>
</tbody>
</table>

1. It is assumed that $\theta_1 = \theta_2 = \theta_3 = 1/3$. Further, all productivity disturbances, other than that of domestic production of good 2 have a mean of unity and variance of (.5)^2.

2. The distribution of good 2 is such that it has a 50% chance of taking on values mean-$\Sigma$ and mean+\$.

3. The specialization coefficient is $[E(1_{1t})/E(1_{2t})] + 1_1/1_2$. 
that tradable prices in the small country are invariant to productivity. If the mean disturbance of good 2 is low relative to that of good 1, individuals can allocate more labor to good 1 without altering the expected marginal value product. Under flexible rates, the more labor allocated to a sector, the lower the expected price in that sector (of course, in equilibrium relative tradable prices will be invariant to the exchange regime). Thus, if the mean of the disturbance to good 2 is low (high) relative to that of good 1, less (more) labor will be allocated good 2 with a flexible rate.

From equations 12-15, labor allocations do not depend upon the distribution of the disturbances in the nontraded goods sector. Since it is the ratios of foreign to domestic disturbances which are important, it is not necessary to repeat Tables 2 and 3 for domestic and foreign disturbances respectively. Thus, Tables 1-3 characterize the labor allocation decision for all cases of the binomial distribution. The remaining issue, then, concerns expected utility comparison under the two regimes. As shown in Section III, individuals would be indifferent to the two regimes if the share of nontraded goods was zero. Intuition suggests that if the share of nontraded goods was unity, the two regimes would be identical. Our simulation results indicate that for any $0 < \theta_3 < 1$, fixed rates are preferable to flexible rates. While the degree of risk aversion is also an important determinant of the choice between exchange regimes (see Lapan and Enders [9]), our results indicate that the presence of nontraded goods favors fixed rates. Again, fixed rates spread the risks of nontraded good variability more effectively than flexible rates. Consider a random increase in productivity of the nontraded good. Under either regime, the price of the nontraded good would fall and both generations would consume more of the nontraded good, while the higher income of the working generation would induce them to consume more tradables as well. With fixed rates, the increase demand for tradables would not affect the retired
generation. With flexible rates, absolute prices of tradables would rise, to the detriment of the retired generation.

VI. Conclusions

Using a utility maximizing framework, we have investigated resource allocation under fixed and flexible exchange rates. We have shown that the size of the nontraded good sector is an endogenous variable, depending upon the sources and distributions of disturbances as well as the exchange regime itself. It is not appropriate to use the "openness" of an economy as the criterion to assess the relative merits of fixed versus flexible rates: the extent to which an economy is open will depend upon current exchange rate policy. We have also shown that economies with flexible rates will appear to be more open than economies with fixed rates. With flexible rates, the price of nontraded goods will primarily be determined by events in the nontraded goods sector, but tradable prices will be determined by domestic and foreign events. With fixed rates, however, tradable prices will be determined by foreign events while the price of the nontraded good will be determined by domestic and foreign events. Risk-averse individuals will allocate more resources to the nontraded good sector if the exchange rate is fixed. This result contrasts with the argument that a flexible rate increases uncertainty and leads to less trade and specialization.

It has been claimed that flexible exchange rates lead to more interindustry resource movements than fixed rates. Our results argue the reverse: resource allocations will be constant with flexible rates but responsive to the balance of payments when the exchange rate is fixed. The resource movements that occur with fixed rates, however, cannot be called "unnecessary". With fixed rates, resources move in anticipation of changes in
demand for nontraded goods. If anything, such reallocations are socially useful.

While we believe that our model yields some interesting implications about resource allocation under fixed versus flexible rates, additional work needs to be done in this area. Under flexible rates, labor allocations were shown to be unchanging over time. If we had assumed that productivity disturbances were serially correlated, labor allocations under either regime would be serially correlated. Uncorrelated disturbances were assumed in order to highlight the greater pressure for resource movements with fixed rates. We have also assumed a very specific form for the utility function. It would be desirable to extend our results to differing degrees of risk aversion and commodity substitutability. To date we have not been able to extend the results in this direction. Lastly, it would be of interest to introduce other factors of production and other stores of value into our framework. In spite of these qualifications, we believe that an intergenerational model of the sort developed in this paper yields several new insights into resource allocation under alternative exchange regimes.
Footnotes

* Respectively, the authors are Associate Professor and Professor of Economics at Iowa State University. This material is based upon work supported by the National Science Foundation under Grant Soc-7907066. We would like to thank the National Science Foundation for their generous support.

1. The model used extended Fischer's [3] monetary model of the balance of payments. Within Fischer's framework, it is possible to explicitly model the effects of internal and external disturbances on the domestic economy.

2. This result follows from our assumptions that resource adjustments are costless, the underlying disturbances are serially uncorrelated, and individuals use the price distributions in allocating their labor time. If sectoral productivity disturbances were serially correlated, prices would also be serially correlated in order for expected marginal products to be equal across sectors.

3. As is well known from the work of Kareken and Wallace [5] and Helpman and Razin [4], if domestics can hold foreign currency, fixed and flexible rates are identical in all respects. In order to avoid this difficulty, we assume that domestics hold only domestic currency.

4. In Lapan and Enders [9] we show that in a one-good world the degree of relative risk aversion is crucial in the determination of whether expected utility is greater with a fixed rate or with a flexible rate. If the degree of relative risk aversion was equal to unity, expected utility under the two regimes would be identical. Increasing risk aversion acts to favor flexible rates, and decreasing risk aversion favors fixed rates. Adding two sectors to the model greatly complicates the analysis: for
tractability we use a utility function for which the degree of relative risk aversion is unity. As such, we refrain from making normative conclusions about the exchange regimes.

Clearly the relevant labor supply decision is for \( l_1 + l_2 = 1 \), since the demand for nontraded goods will be zero.

6. Differing degrees of relative risk aversion would alter this result; see footnote 4. In essence, we extend Lapan and Enders [9] to a two traded goods world.

7. Again, we remind the reader that the degree of relative risk aversion is important for this result. However, investigating the reasons why expected utilities are equal helps to clarify the labor allocation effects of the next section.

8. In the absence of nontraded goods, the exchange regimes yield identical labor allocations and expected utilities. Realized utility and the amount of each good consumed will depend upon the realizations of the productivity disturbances and the exchange regime.

9. A similar result is obtained by Turnovsky [14].

10. This result depends upon the form of the utility function. If the elasticity of substitution differs from unity, labor allocations will depend upon disturbances in other sectors. We have not been able to solve the system for the case in which the elasticity of substitution differs from unity.

11. A table of these results has not been included in order to save space. Interested readers are welcome to write for such tables and the computer program used to generate our simulation results. Furthermore, we have not reported the simulated values of the serial correlation for the price of the nontraded good. There was never any significant serial correlation in any of our simulations.
REFERENCES


