On The Use of Local Currency When Less

Inflationary Currencies are Available:

An Overlapping Generations Model

by

Benjamin Eden
UCLA
and
The Hebrew University

Why do economic agents tend to use the local currency even when there exists a foreign currency with a lower rate of inflation? The standard argument is that the local currency provides liquidity services. This argument does not explain why foreign currencies cannot provide such services. A more detailed analysis may use a bilateral exchange economy, as in Jones (1976), to argue that if in a particular country all economic agents do not accept foreign currencies it may be optimal from the individual point of view to hold the more inflationary local currency. The question is why, by not accepting the less inflationary foreign currency, the local residents, as a group, fail to adopt what looks like a Pareto improving convention.

In a recent paper Kareken and Wallace (1978) pointed out this problem. They use Samuelson's overlapping generations model to argue that only government-imposed capital controls can account for differences in the rates of inflation among currencies.[1/]

Here I propose an overlapping generations model which can generate differences in the rates of inflation in the absence of capital control. Its main characteristics are: the absence of an auctioneer; the possibility of advertising the price of goods in terms of any currency or any combinations of currencies; the absence of government intervention in the market for foreign exchange; costless transactions; imperfect and assymetric information. The argument is that sellers know relatively more about the economic conditions in their own country and can therefore figure out the "market price" more

---

[1/] They also claim that in the absence of government intervention the exchange rates are indeterminate and therefore a policy of laissez faire is not feasible.

accurately in terms of the local currency. This advantage of the local currency may compensate for its higher rate of inflation, thus providing a rationale for its use.

It will be shown that depending on the rates of return on foreign currencies, the local currency may either be valued or not. If it is valued, then that value is independent of the rates of return on foreign currencies. This result is different from the standard formulation of the demand for money function, which postulates that any change in the rates of return on holding foreign currencies has an effect on the demand for the domestic currency (see, for example, Calvo and Rodriguez [1977], Barro [1978] and Abel et al. [1979]).

I may add that there is a great deal of scepticism about the usefulness of the overlapping generations model as a model of money (see, for example, the discussion of Tobin to Wallace [1980]). In particular the omission of transaction costs bother those who think that such costs should be an important ingredient in any model of money. It seems, however, that by not allowing for transaction costs we are forced to think about problems which otherwise will be too easily dismissed. For this reason, I find the overlapping generations model a useful tool.

I shall start by describing the model under the assumption of risk neutrality. I shall then consider the case of risk aversion and discuss the empirical implication of the model.

The Model

There are many countries. At the beginning of each period N identical individuals are born in each country. Individuals live for two periods and cannot move to other countries. At the time of birth each individual is endowed with one unit of a tradable and a non-storable consumption good. He consumes, however, only in the second period of his life. Preferences are the same for all individuals across all countries and all generations. I shall start by assuming that preferences can be described by the Von-Neumann Morgenstern utility function

$$(1) \qquad u(c) = c$$

where c is the quantity of the good consumed in the second period of one's life. Thus, $u(\ )$ exhibits risk neutrality.

Fiat money is the only asset and it is typically used by the old and by the government to buy the consumption good from the young. Each country has its own currency.

Governments employ armies. The quantity of the consumption good which is required to support the army of country i at time t, $g_i(t)$, is random. For simplicity it is assumed that $g_i(t)$ is stationary, independent across time and countries and may have only two possible realizations: $g_i(t) = g_i$ with probability q_i and $g_i(t) = g_i - z_i$ with probability $1-q_i$, where $g_i \geq z_i \geq 0$ and g_i is not too large in a sense that will become apparent later. The only way of financing government spending is by printing money and collecting an inflation tax. It is assumed that the level of government real spending does not affect the individuals' utility.

Thus, here government spending leads to both real and monetary disturbances. The assumption of perfect correlation between the two types of disturbance is not crucial and is adopted only for convenience. The assumption that the level of real government spending does not affect individuals' welfare may also be relaxed without affecting the main results. The assumption that governments' expenditures are independently distributed excludes the possibility of major and long wars. The relaxation of this assumption will complicate the analysis and may change some of the results.

There is no auctioneer. Trade is executed by a clearing house and a bank. Before the beginning of actual trade the clearing house gets offers by phone, from all the world's sellers (members of the young generation), which state the terms in which they are willing to exchange the consumption good for money. A seller may offer different fractions of his endowment for different prices which may be stated in terms of different currencies. For example, he may offer a third of a unit for one pound, a third for two pounds and a third for half a dollar. After the clearing house has received all the offers from the young generation it starts to receive orders, by phone, from buyers, which are filled on a first come first served basis.[2/] It is assumed that information about advertised prices, phone calls and the delivery of the goods are costless.

[2/] Assume for example, that the clearing house has in its stock offers to sell 10 units for 1 pound per unit, 10 units for 2 pounds per unit and 1 unit for 1 dollar. If in this case, a buyer asks to exchange 10 pounds and 2 dollars for goods the clearing house will give him the best deal that it has at the moment: 10 units for 10 pounds and a unit for one dollar, leaving him one dollar which will not be exchanged.

After the sellers have received money in exchange for goods, they may go to the bank to exchange currencies. A seller may offer the bank 1000 marks for 500 dollars (i.e., to exchange 1000 marks for dollars at 2 marks per dollar), or he may offer to exchange 1000 marks for dollars at the best exchange rate the bank can get for him. After receiving all the offers the bank tries to satisfy as many as possible on a first come first served basis.

Note that the trade in currencies is done after the trade in goods is completed and all the advertised prices of goods are known. The assumption is that the consumption good must be consumed at the beginning of the period (at a point in time) while money is being held during the period.

I shall describe the behavior of economic agents under certain expectations and then use market clearing conditions to rationalize these expectations.

Sellers at time t expect that the supply of currency i, M_i, will increase by $(\alpha_i - 1)$ percent if the current level of real government spending in country i is g_i units and by $(\beta_i - 1)$ percent if government spending is $g_i - z_i$ units, where $\alpha_i > \beta_i \geq 1$. The expected distribution of $M_i(t)$ given $M_i(t-1)$ is thus

$$(2) \qquad M_i(t) = \begin{cases} \alpha_i \, M_i(t-1) & \text{with probability } q_i \\ \beta_i \, M_i(t-1) & \text{with probability } 1-q_i \end{cases}$$

The evolution of M_i is described in the tree diagram of Figure 1.
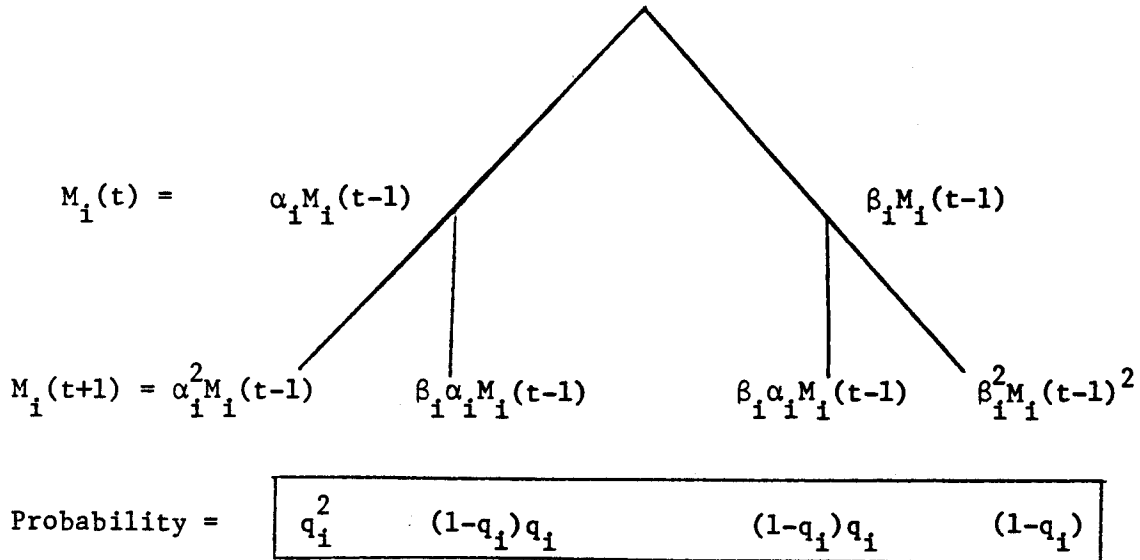
The evolution of the supply of currency i *

$M_i(t) = \qquad \alpha_i M_i(t-1) \qquad\qquad\qquad\qquad \beta_i M_i(t-1)$

$M_i(t+1) = \alpha_i^2 M_i(t-1) \qquad \beta_i \alpha_i M_i(t-1) \qquad \beta_i \alpha_i M_i(t-1) \qquad \beta_i^2 M_i(t-1)^2$

Probability $= \quad \boxed{q_i^2 \qquad (1-q_i)q_i \qquad\qquad (1-q_i)q_i \qquad\qquad (1-q_i)}$

Figure 1

*Each "branch" describes a possible realization of $\left[M_i(t), M_i(t+1) \right]$. The probability with which each "branch" will occur is given in the table below the "tree".

The sellers also expect the demand for the good in terms of currency i to be infinitely elastic at a price, $P_i(t)$, which is contingent on the supply of currency i. The expectations regarding the price are given by

(3)
$$P_i(t) = \beta_i P_i, \qquad \text{if } M_i(t) = \beta_i M_i(t-1); \text{ and}$$
$$P_i(t) = \alpha_i P_i, \qquad \text{if } M_i(t) = \alpha_i M_i(t-1),$$

for all i. Similarly, they expect the supply of the good at time t+1 to be

infinitely elastic at the price

$$P_i(t+1) = \beta_i P_i(t), \qquad \text{if } M_i(t+1) = \beta_i M_i(t); \text{ and}$$

(4)

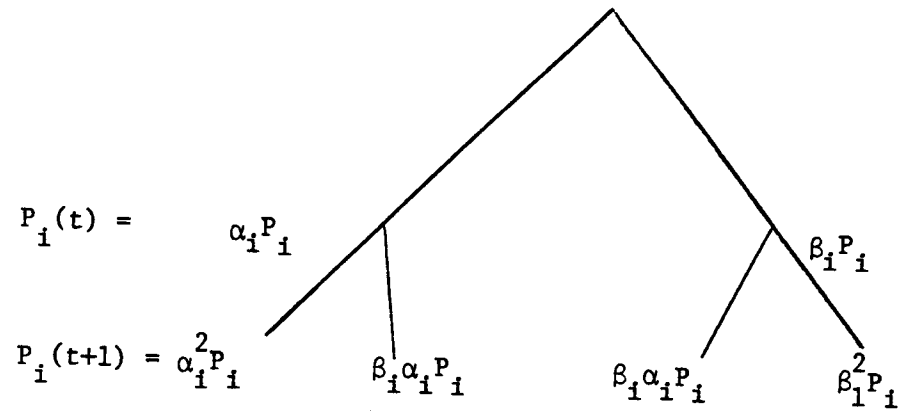$$P_i(t+1) = \alpha_i P_i(t), \qquad \text{if } M_i(t+1) = \alpha_i M_i(t).$$

The expected rate of return on advertising in terms of currency i, $E[P_i(t)/P_i(t+1)]$, depends on the information which is available to the seller at time t. I shall denote this expected rate of return by r_i if the expectations are based on information about the realization of $M_i(t)$ and the "correct" price is advertised, and by R_i if the expectations are based only on the realization of $M_i(t-1)$ and given this information, the optimal price is advertised. The expectations (3) and (4) are illustrated by the "tree" diagram of Figure 2. The table below the "tree provides the raw data for computing the rates of return for alternative information sets.

Finally, the sellers expect that after the completion of the trading in goods, they will be able to exchange any amount of currencies at exchange rates which ensure that the real rate of return on holding money will be the same for all currencies. That is

(5) $\quad \underset{t+}{E} [e_{ij}/P_j(t+1)] = \underset{t+}{E} [1/P_i(t+1)]$ for all i,j,

where e_{ij} is the exchange rate between currencies i and j (so that a unit of currency i buys e_{ij} units of currency j) and $\underset{t+}{E}$ is the expectation operator which is based on information which is available after the completion of the trade in goods at time t. Note that if the expectations (5) are correct, the assumption of risk neutrality implies that the bank will not be used.

The evolution of the price of consumption in terms

of currency i *

$$P_i(t) = \qquad \alpha_i P_i \qquad\qquad\qquad \beta_i P_i$$

$$P_i(t+1) = \alpha_i^2 P_i \qquad \beta_i \alpha_i P_i \qquad \beta_i \alpha_i P_i \qquad \beta_i^2 P_i$$

Probability =	q_i^2	$(1-q_i)q_i$	$(1-q_i)q_i$	$(1-q_i)^2$
real rate of return when the "correct" price is advertised =	$1/\alpha_i$	$1/\beta_i$	$1/\alpha_i$	$1/\beta_i$
real rate of return when $\beta_i P_i$ is advertised =	β_i/α_i^2	$1/\alpha_i$	$1/\alpha_i$	$1/\beta_i$
real rate of return when $\alpha_i P_i$ is advertised =	$1/\alpha_i$	$1/\beta_i$	0	0

Figure 2

*Each of the four "branches" describes a possible realization of $\left[P_i(t), \ P_i(t+1) \right]$. The first row in the table below the "tree" gives the probability with which each branch will occur (compare to Figure 1). The second row gives the real rate of return on using the currency when the "correct" price is advertised. The third row gives the rate of return when the lower price is advertised (which is lower than the maximum when the higher price is "correct") and the last row gives the rate when the higher price is advertised (which is zero when the lower price is "correct", since in this case the seller will not be able to sell).

It is assumed that the young know the current realization of the local money supply but only the one period lag of foreign money supplies.

To appreciate the implication of this assumption I shall use the table in Figure 2 to compute the value of the information about the realization of $M_i(t)$, given that currency i is used. If the seller observes $M_i(t) = \beta_i M_i(t-1)$ he will advertise the price $\beta_i P_i$, getting an expected real rate of return equal to: $(1-q_i)/\beta_i + q_i/\alpha_i$. If he observes $M_i(t) = \alpha_i M_i(t-1)$ he will advertise $\alpha_i P_i$ and get the same expected rate of return. Thus

$$(6) \qquad r_i = (1-q_i)/\beta_i + q_i/\alpha_i .$$

If he does not observe the realization of $M_i(t)$ and advertise the lower price $\beta_i P_i$, his expected real rate will be

$$(7) \qquad (1-q_i)^2/\beta_i + 2(1-q_i)q_i/\alpha_i + q_i^2\beta_i/\alpha_i^2 = r_i(1-q_i) + r_i q_i \beta_i/\alpha_i .$$

If he does not observe the realization of $M_i(t)$ and advertise $\alpha_i P_i$ his expected rate of return will be

(8) $(1-q_i)0 + q_i r_i$.

He will advertise $\alpha_i P_i$ if (8) is greater than (7) and will advertise $\beta_i P_i$ otherwise. Thus,

(9) $R_i = \max [(1-q_i)r_i + r_i q_i \beta_i/\alpha_i, \; q_i r_i]$,

and the value of having the information about the realization of $M_i(t)$, VI_i, is therefore

(10) $VI_i = r_i - R_i = \min [q_i(1-\beta_i/\alpha_i)r_i, \; (1-q_i)r_i]$.

Note that the value of the information is strictly positive.

Seller i (a member of the young generation who is a resident of country i), will advertise his endowment in terms of the local currency if and only if

(11) $r_i \geq R_j$ for all $j \neq i$.

Using (10) to restate (11), we get

(12) $R_i + VI_i \geq R_j$ for all $j \neq i$.

Since $VI_i > 0$, (12) implies that the local currency may be used when $R_i < R_j$. Thus, to an outsider (say a resident of country k, $k \neq i,j$) currency i looks like it promises a lower rate of return than the alternative currency j. But to the local seller it promises a higher rate of return since he can predict the

market price only in terms of the local currency.

Market clearing is required to rationalize the sellers' expectations. When $P_i(t)$ clears the market and N is large, the individual seller will not be able to sell at a price which is higher than $P_i(t)$ but will be able to sell all his supply at $P_i(t)$. Similarly, if $P_i(t+1)$ clears the market, the buyer (an individual who was born at time t) will be able to buy his entire demand at $P_i(t+1)$ but will not be able to buy at any lower price. Thus market clearing at $P_i(t)$ $[P_i(t+1)]$ rationalizes the expectation of infintely elastic demand (supply) at this price. (See Arrow [1959].)

Assuming that the parameters α_i, β_i, q_i are such that (11) holds for all i, then in each country only the local currency is used and the market clearing condition is

$$(13) \qquad P_i(t)N = M_i(t) \qquad \text{for all i,t .}$$

Thus the expectations (3), (4) are roughly correct if

$$(14) \qquad P_i = M_i(t-1)/N .$$

To rationalize expectations with respect to the exchange rate (5), note that it is possible to infer the realization of all the money supplies by observing the advertised prices of goods and therefore the market for foreign exchange operates under full information. When the exchange rates satisfy (5) the entire supply of each currency is willingly held by the local residents and therefore money markets are cleared.

Finally, to rationalize the sellers' expectations about the evolution of $M_i(t)$, the real revenue from the inflation tax must equal government expenditures, that is

(15) $\qquad (\alpha_i - 1) M_i(t-1) / \alpha_i P_i = g_i$

(16) $\qquad (\beta_i - 1) M_i(t-1) / \beta_i P_i = g_i - z_i$.

Substituting (14) in (15) and (16) we get

(17) $\qquad (\alpha_i - 1) N / \alpha_i = g_i$

(18) $\qquad (\beta_i - 1) N / \beta_i = g_i - z_i$.

This completes the description of the equilibrium solution. Note that in equilibrium expectations are rational and sellers use the currency that maximizes their expected utility.[3]

The requirement that given the information available to each seller, the local currency will yield a higher expected real rate of return than any alternative currency, (11), combined with (17) and (18) imply a limitation on the parameters α_i, β_i, q_i and thus on the average rate of change in the local money supply, the average rate of inflation and the average size of the budget. A government that exceeds this limit and violates (11) will not be

---

[3] This equilibrium is not unique. If expectations are that currency i will have no value, sellers in country i will advertise the good in terms of the foreign currency which promises the highest expected real rate of return. In this case currency i will indeed have no value. (this is similar to the standard result that there always exists a non-monetary equilibrium, see Wallace [1980]). However, we do not have here the problem of indeterminacy as in Karaken and Wallace (1978), since it can be shown that expectations other than (2) - (5) which assign strictly positive values to all currencies must be incorrect.

able to collect any inflation tax without imposing restrictions on the mobility of capital. This is illustrated by the following example.

An Example

I consider a simple example in which $\beta_i = \beta_1 = 1$, $\alpha_i > \alpha_1 > 1$, $q_i = q_1 = 1/2$ for all i.[4/] Thus currency 1 is less inflationary in comparison with all other currencies. In this case if seller i advertises the lower foreign price, P_1, his expected real rate will be (see Figure 2)

$$(19) \qquad 1/4 + \alpha_1/2 + \alpha_1^2/4.$$

If he asks the higher price $\alpha_1 P_1$ his expected real rate will be

$$(20) \qquad 1/4 + \alpha_1/4 .$$

Since (19) is always larger than (20) he will prefer to advertise the lower price, P_1, if he chooses to use currency 1. If he advertises in terms of the local currency his expected real rate will be

$$(21) \qquad 1/2 + \alpha_i/2 .$$

Comparing (21) with (19) implies that he will prefer the local currency if and only if

$$(22) \qquad \alpha_1/\alpha_i \geq 1 + (1/\alpha_1 - \alpha_1)/2 .$$

In Table 1, I calculate the maximum possible value of α_i which will satisfy (22) for a given value of α_1.

[4/] Note that $\beta_i = 1$ implies $z_i = g_i$. See (18).

(a) $(\alpha_1 - 1)$	(b) $(\alpha_i - 1)$ cannot exceed	(b)/(a)
0.05	0.104	2.08
0.1	0.216	2.16
0.15	0.337	2.24
0.20	0.469	2.34
0.25	0.612	2.44

Table 1

In this example the average rate of inflation in country i may be more than twice the average rate in country 1, without inducing the residents of country i to substitute the foreign currency for the local currency.[5]

To illustrate the limitation on government spending in country i, I use (17) to calculate the maximum percentage of GNP that, on average, can be collected, as inflation tax. The results are presented in Table 2. In this example, if country 1 collects on average between 2% - 10% of GNP then country i can collect almost twice as much.

[5] If instead of a lag of one period the supply of foreign currencies is known with a lag of a few periods, the maximum possible difference in the rates of inflation is likely to be greater.

α_1	(a) the average inflation tax as a percentage of GNP in country 1: $(\alpha_1-1)/2\alpha_1$	(b) the maximum average inflation tax as a percentage of GNP in country 1: $(\alpha_1-1)/2\alpha_1$	(b)/(a)
1.05	.023'	.047	1.974
1.1	.045	.088	1.940
1.15	.065.	.126	1.932
1.20	.083'	.159	1.914
1.25	.100	.189	1.895

Table 2

Risk Aversion

It was shown that risk neutral sellers will specialize and advertise the price of their endowment in terms of a single currency. I will argue that this is also true when sellers are risk averters. The difference is that in the case of risk aversion sellers will choose to use the bank for diversifying their portfolios, while in the case of risk neutrality the bank was not used.

To see this claim, note that when governments' expenditures are independently distributed the rates of return on currencies (r_i) are also independently distributed. Since we assume that there are many currencies the law of large numbers implies that it is possible to construct a portfolio of all currencies which will promise an almost certain return. By following a strategy of advertising in terms of the local currency and exchanging it later for a diversified portfolio, seller i can get the mean rate of return, r_i, with certainty. Assumption (11) implies that this is the highest rate of return that he can get and therefore this strategy is optimal from the individual point of view.

Ross (1976) rigorously developed the result that the influence on a well-diversified portfolio of independent risks becomes negligible as the number of assets goes to infinity. He claimed that a relationship like (5) represents a quasi equilibrium in which markets are approximately cleared. If, however, the conditions for applying the law of large numbers do not hold (either there are few currencies or the returns are not independently distributed) then there may be a reason to advertise fractions of the endowment for different currencies.

Implications with respect to the specification of the demand for money function

The above analysis may be used to examine the argument that any change

in the real rates of return on holding foreign monies will effect the demand

for domestic money function. For example, Abel et al. (1979) argue that in

addition to the expected rate of inflation, the demand for money is a con-

tinuous function of the rate of return on holding foreign monies. (They do

not specify if all foreign monies or only some are relevant.) The implicit

assumption must be that, at the margin, the consumer is indifferent between

using the local currency and using the foreign currency and therefore even

a slight change in the rate of return on holding the foreign currency will

induce substitution. This may be consistent with a model in which the quantity

of the local currency enters as an argument in the utility function and the

marginal utility of money is declining.

Our model suggests that, to the local seller, the real rate of return

on advertising in terms of the local currency is, in general, strictly higher

than on advertising in terms of foreign currencies and the advantage of using

the local currency does not diminish as more of it is being used. In general,

a small change in the rate of return on holding foreign currencies will there-

fore have no effect on the demand for domestic real balances. Strictly speaking,

this argument requires a model in which the saving decision is not trivial. For

an outline of such a model, see the appendix.

This suggests that the forward premium in Abel et al. serves as an approximation for the expected real rate of return on using the local currency.[6] This is similar to Frenkel (1977, 1979) who uses the forward premium as a measure of the expected rate of inflation.

---

[6] Abel et al. controlled for the expected rate of inflation by introducing the actual inflation rate as a variable in the regression. Even if their assumption about the expectations mechanism is correct, it does not imply that they controlled for the expected real rate of return. In particular, when the variance of the rate of inflation is substantial, as in the German hyperinflation, the expected rate of inflation is not a good proxy for the expected real rate of return. See Eden (1976) for this argument and Eden and Blejer (1980) for the application to the German hyperinflation.

Conclusions

Sellers may choose to advertise their merchandise in terms of the more inflationary local currency because they can better forecast the "market price" in terms of the local currency. This result does not require risk aversion.

Since there is a separate market for foreign exchange (i.e., the bank) even risk averters will choose to advertise their merchandise only in terms of a single currency. They will then go to the bank and diversify their portfolios. This result may depend on the assumptions which allow the use of the law of large numbers.

The equilibrium solution has the property that depending on the rates of return on foreign currencies, the local currency may either be valued or not. If it is valued, then that value is independent of the rates of return on foreign currencies. The implication is that the demand for domestic money is not a continuous function of the rates of return on foreign currencies.

Appendix

To show that small changes in the rates of return on foreign currencies will have no effect on the demand for domestic money, I consider a version of the above model in which the saving decision is not trivial. Instead of a fixed endowment I shall assume that a young person can use his time in the first period to produce the good according to the linear production function

$$\text{(A1)} \qquad c = L$$

where $0 \leq L \leq 1$ is the time spent at work. All individuals have the common utility function

$$\text{(A2)} \qquad v(1-L) + u(c)$$

where $1-L$ is first period leisure and c is second period consumption. It is assumed that $v(\ )$ and $u(\ )$ are strictly monotone, differentiable with $v'' < 0$ and $u'' \leq 0$.

Assuming that (11) holds, a young resident of country i whose expectations are given by (3) – (5) will choose the amount of work, L_i, which solves[7]

$$\text{(A3)} \qquad v'(1-L_i) = r_i\, u'\, (r_i L_i) \ .$$

The total output in country i is thus NL_i and if we modify (14) to: $P_i = M_i(t-1)/NL_i$, expectations are correct and the equilibrium description is similar to the one in the text.

---

[7] In (A3), r_i is non random, since the seller plans to go to the bank and insure himself by diversifying his portfolio.

A change in the probability distribution of local government spending that leads to an increase in r_i will lead to an increase in L_i and (using the market clearing condition: $M_i(t)/P_i(t) = NL_i$) to an increase in the equilibrium quantity of domestic real balances.[8] However, changes in the probability distributions of foreign government expenditures that do not violate (11) will have no effect on the equilibrium level of $M_i(t)/P_i(t)$.

---

[8] Note also that an increase in r_i implies here an increase in GNP. This is similar to the long run upward sloping Philips curve in Friedman (1977).

References

Abel, A., Dornbusch, R., Huizinga, J. and Marcus, A. "Money Demand During

   Hyperinflation," Journal of Monetary Economics, 5, January 1979, 97-104.

Arrow, K.J. "Toward a theory of price adjustment." In M. Abramovitz et al.

   The Allocation of Economic Resources, Stanford: Stanford University Press,

   1959, pp. 41-51. Also in Arrow and Hurwicz Studies in Resource Allocation

   Processes, Cambridge: Cambridge University Press, 1977, 380-393.

Barro, R.J. "A Stochastic Equilibrium Model of an Open Economy Under Flexible

   Exchange Rates," Quarterly Journal of Economics, Vol. XCII, February 1978,

   149-165.

Calvo, G.A. and Rodriguez, C.A. "A Model of Exchange Rate Determination Under

   Currency Substitution and Rational Expectations," Journal of Political

   Economy, 85, no. 3, 1977, 617-25.

Eden, B. "On the Specification of the Demand for Money: The Real Rate of

   Return versus the Rate of Inflation," Journal of Political Economy, vol. 84,

   6, December 1976, 1353-1359.

_____ and Blejer, M.I. "On the Specification of the Demand for Money

   Function Under Rapid Inflation: Some Empirical Evidence," Canadian Journal

   of Economics, XIII, No. 1, February 1980, 171-176.

Frenkel, J.A. "The Forward Exchange Rate, Expectations and the Demand for

   Money: The German Hyperinflation," American Economic Review, 67, No. 4,

   September 1977, 653-670.

_____ "Further Evidence on Expectations and the Demand for Money

   During the German Hyperinflation," Journal of Monetary Economics, 5,

   January 1979, 81-96.

Friedman, M. "Nobel Lecture: Inflation and Unemployment," <u>Journal of Political Economy</u>, vol. 85, 3, June 1977, 451-473.

Jones, R.A. The origin and development of media of exchange," <u>Journal of Political Economy</u>, 84, August 1976, 757-777.

Kareken, J.H. and Wallace, N. "Samuelson's consumption loan model with country-specific fiat monies," July 1978, University of Minnesota and the Federal Reserve Bank of Minneapolis, Staff Report No. 24 (forthcoming in the <u>QJE</u>).

Ross, S.A. "The arbitrage theory of capital asset pricing," <u>Journal of Economic Theory</u>, 13, December 1976, 341-360.

Wallace, N. "The overlapping generations model of fiat money" in Kareken and Wallace (Ed.) <u>Models of Monetary Economies</u> 1980, Federal Reserve Bank of Minneapolis, p. 48-83.