A Signaling Model of Multiple Currencies*

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In this paper, we demonstrate that it may be socially optimal for countries to have different currencies, even though they have no possibility of independently controlling their money supplies. We assume that agents have heterogeneous preferences over goods of different national origin, and that these preferences are private information. We prove three results. First, for a range of parameters, it is optimal for different countries to have different currencies so that buyers can more efficiently signal their preferences over goods to sellers. Second, if it is socially optimal to have different national currencies, then it is socially optimal for sellers to sell lower quantities to buyers bearing foreign currency. Finally, it is only necessary to have two monies if cross-country trade is optimal. Journal of Economic Literature Classification Number: F33

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1. INTRODUCTION

In this paper, we present a signaling model of money in which it may be socially beneficial to have multiple national monies, even though, contrary to the previous literature on optimum currency areas, there is no possibility for money creation. The environment features pairwise exchange in which individuals' preferences over goods may depend on the goods' country of origin and are private information. There are two currencies that are substitutable at a fixed exchange rate before agents are matched. Using the approach of Kocherlakota and Wallace (1998) to analyze the efficient allocations of resources in this environment, we attempt to determine the conditions under which two monies (as opposed to a single, society-wide, currency) are needed to implement these efficient allocations.

We obtain three results. The main result is that if agents are sufficiently patient, and preferences are heterogeneous, then a first best allocation can be implemented using national monies (but not using a single money). Intuitively, the presence of multiple national monies allows the buyer to credibly signal his preferences to the seller because the buyer makes his decision about what currency to hold before he meets the seller. As a result, production will be differentiated based on the nationality of a buyer; this possibility for differentiation in the production structure, which national currencies enhance, can be optimal because buyers value home and foreign goods differently.

We also show that the commonly observed home goods bias, where buyers tend to buy relatively smaller quantities of foreign goods and may be charged a higher price when carrying foreign money, is an integral part of any optimal allocation with multiple national monies. This difference in price exists even though it is costless to substitute between the two currencies prior to a match.

Our third result is more subtle. If agents receive sufficiently little utility from the consumption of foreign goods, then it may be socially optimal for sellers not to produce for foreign buyers. It might seem that multiple monies should be essential in the implementation of this kind of no-trade outcome: if a buyer shows up holding foreign currency, then a seller knows not to trade with him. We show that this is not the case: there is no need for multiple monies if there is no foreign trade. Instead, no-trade outcomes can be implemented by sellers charging a price (in a single currency) that is low enough to attract domestic buyers, but too high for foreign buyers.

There is, of course, a large literature on multiple currencies and currency unions which builds on Mundell's (1961) work and which emphasizes the role of goods and factor mobility as well as the origins of disturbances.
that may hit the different countries. However, in that literature, the
 distinction between an optimum currency area and separate currency areas
 is fundamentally the same as that between fixed and flexible exchange
 rates. In contrast, the model presented in this paper identifies a potential
 role for separate national currencies even in circumstances where the
 exchange rate is constant.

The model presented in this paper is an extension of the literature of
 random-matching models of international money (which in turn builds on
 the work of Trejos and Wright (1995) and Shi (1995)). None of this
 literature considers models in which multiple monies are essential to
 achieving relatively efficient allocations of resources. In particular, while
 money itself is essential in the work of Matsuyama et al. (1993), Trejos and
 Wright (1997), and Zhou (1997), having two monies does not lead to
 Pareto superior allocations.

Our paper is also related to the work of Townsend (1987). Like us, he
discusses an environment in which agents may choose among multiple
 tokens, and this choice helps allocate resources more efficiently by serving
 as a signal of their type. There are two differences between our papers.
First, agents are sorted along very different dimensions. In our paper,
agents sort themselves according to which nation’s goods they prefer. In
Townsend’s paper, the sorting is over the marginal rate of substitution
between consumption today and consumption next period. Second, all
trade of goods for tokens in our environment is voluntary; this is not true
in Townsend’s setup. In this sense, the tokens in our environment are
more naturally interpretable as currency.

2. THE ENVIRONMENT

Consider a random-matching model similar to the one by Trejos and
Wright (1997). There are two countries, A and B, and three types \( i \) of
agents in each country, with \( i \in \{1, 2, 3\} \); there are equal measures of each
type. In every period, agents find a single match, and an agent is matched
with somebody from his own country with probability \( p > 1/2 \).

Agents of type \( i \) produce type \( i \) goods at a cost of \( y_i \) in terms of the
utility measure and get utility from consuming type \((i + 1)\) goods. A type \( i \)
agent’s momentary utility function is given by \( \alpha u(c_{i+1}^f) + u(c_{i+1}^d) - y_i \),
where \( c_{i+1}^f \) is consumption of foreign goods of type \( (i + 1) \) and \( c_{i+1}^d \) is
consumption of domestic goods of type \((i + 1)\). The parameter \( \alpha \)
assumed to lie in the interval \([0, 1]\); furthermore, \( u \) is \( C^2 \), \( u(0) = 0 \),
\( u'(0) = \infty, u'(\infty) = 0 \), \( u' > 0 \), and \( u'' < 0 \). All agents discount the future
using a discount factor \( \beta \), where \( 0 < \beta < 1 \). (See Zhou (15) for a similar
type of heterogeneity in preferences.)
If $\alpha < 1$, then individuals derive less utility from consuming foreign than from consuming domestic goods. This lower utility value is meant to represent a variety of things. For example, it captures the notion that it may be more difficult to assess the quality of foreign goods, reflecting possibly different quality standards across countries and other informational constraints. It could also reflect that contract enforceability is often more difficult in cross-border trade.

There are three frictions in the environment. The first is that record keeping is limited because money is the only type of record keeping possible. The second is that allocations must obey sequential individual rationality: within a match, individuals are always free to choose autarky instead of the allocation in that match. The final friction is that in any match between a buyer (type $i$) and a seller (type $(i + 1)$), the nationality of the buyer is unobservable and the nationality of the seller is observable. The first two frictions result in a possible role for money in a random-matching environment and are standard in this literature. Taken together, the two frictions are sufficient to guarantee that an intrinsically useless token currency can allow society to obtain Pareto superior allocations (see Aiyagari and Wallace 1991 and Kocherlakota 1998).

The third friction introduces a particular form of incomplete information into the model. In its absence, it is optimal for lower production to take place in cross-country matches than in intra-country matches. But the third friction implies that it may be hard to implement differential production levels for cross-country and intra-country matches, because buyers in cross-country matches may claim to be whatever nationality gets them a lower price.

While the third friction refers specifically to private information about the nationality of the buyer, the following results are quite general and apply also to several alternative interpretations of this friction. What really matters is that, given all of the observable characteristics of the buyer, the seller does not know whether the buyer prefers the seller's nationality of goods. Hence, when we talk about the nationality of the buyer being unobservable, it is important to keep in mind that we are, equivalently, referring to the nationality of the goods preferred by the buyer. There is also considerable empirical support for this notion that the nationality of traders, or goods, is important in trading outcomes.\(^1\)

In an environment characterized by the lack of a double coincidence of wants and by the sequential individual rationality constraint, a producer will only produce if he receives some promise of future benefits in exchange for producing today. This means that there must be some

\(^1\)See the literature on home bias in trade and asset allocations; for example, Stockman and Tesar (1995).
record-keeping technology that keeps track of past production on the part of any agent.

We consider a record-keeping technology consisting of two distinct (say, red and blue) tokens or currency. We assume that tokens are durable and indivisible and do not enter preferences or production technologies. Individuals can hold at most one token at any point in time (either a red or a blue one). However, an individual who has a red (blue) token can transform it into a blue (red) token. A crucial feature of this record-keeping technology is that this transformation can only be done at the beginning of each period, before the individuals know with whom they will be matched. We also assume that agents who hold currency are physically unable to produce.\(^2\)

### 3. SOCIAL PLANNER’S PROBLEM

In this section, we consider the problem of a social planner who seeks to determine an optimal allocation of resources, given the frictions and record-keeping technology described above. We assume that half of the agents in country A are initially endowed with red tokens and half of the agents in country B are initially endowed with blue tokens. Subsequently, we analyze allocations in which this distribution of currencies persists over time: should agents from country A (B) receive blue (red) tokens, they always choose to exchange them for red (blue) ones. Because currency substitution can only take place before matches, and because currency-holding is so strongly associated with nationality, agents can use the multiple tokens to make credible ex-ante announcements of their nationality. It is this ex-ante nature of the announcements (as opposed to the ex-post announcements made with one currency) that makes gains in welfare possible.

We analyze only stationary allocations that satisfy the sequential individual rationality constraints and use the following notation. For a given individual, \( V_0 \) represents the utility associated with having zero units of money, \( V_d \) is the utility associated with holding one unit of ‘domestic’ currency (the color of token that others of the same nationality are holding), and \( V_f \) is the utility associated with holding the ‘foreign’ currency. (In any given allocation, no agent will actually have utility \( V_f \), but we need to calculate it to make sure that all agents want to hold their domestic currencies.) If a buyer announces that his nationality is different from that of the seller, we let \( z_f \in \{0, 1\} \) denote whether the buyer gives

\(^2\)Without this assumption, if there are two types of tokens, then it is efficient for agents to trade, say, red tokens for blue tokens and some additional goods (see Aiyagari et al., 1996).
his money to the seller and let $y_f$ denote the amount of goods produced by the seller should an exchange take place. If the buyer announces that his nationality is the same as that of the seller, we let $z_d$ and $y_f$ represent the corresponding quantities.

The planner then solves the following maximization problem:

$$\max_{z_d, z_f, y_d, y_f} \quad 0.5V_d + 0.5V_0$$

subject to

\begin{align*}
V_d &= p\left[u(y_d)/6 + \beta\{z_dV_0 + (1 - z_d)V_d\}/6 + 5\beta V_d/6\right] \\
&\quad + (1 - p)\left[\alpha u(y_f)/6 + \beta\{z_fV_0 + (1 - z_f)V_d\}/6 + 5\beta V_d/6\right] \\
V_0 &= p\left[-y_d/6 + \beta\{z_dV_0 + (1 - z_d)V_0\}/6 + 5\beta V_0/6\right] \\
&\quad + (1 - p)\left[-y_f/6 + \beta\{z_fV_0 + (1 - z_f)V_0\}/6 + 5\beta V_0/6\right] \\
V_f &= p\left[u(y_f)/6 + \beta\{z_fV_0 + (1 - z_f)V_f\}/6 + 5\beta V_f/6\right] \\
&\quad + (1 - p)\left[\alpha u(y_d)/6 + \beta\{z_dV_0 + (1 - z_d)V_f\}/6 + 5\beta V_f/6\right] \\
V_d &\geq V_f \\
-y_d + \beta[z_dV_d + (1 - z_d)V_0] &\geq \beta V_0 \\
-y_f + \beta[z_fV_d + (1 - z_d)V_0] &\geq \beta V_0 \\
u(y_d) + \beta[z_dV_0 + (1 - z_d)V_d] &\geq \beta V_d \\
u(y_f) + \beta[z_fV_0 + (1 - z_f)V_d] &\geq \beta V_d \\
y_d, y_f &\geq 0.
\end{align*}

\footnote{As in Kocherlakota and Wallace (1998), we can motivate the planner’s constraint set as consisting of the set of allocations that are stationary and symmetric equilibrium outcomes of a class of mechanisms. The class of mechanisms under consideration here includes all mechanisms such that within a match, the mechanism maps action choices into an allocation of money and goods within the match. Because of the sequential individual rationality friction, the mechanisms are restricted to have the property that any agent can always choose an action that guarantees an autarky allocation of resources, regardless of the announcements and actions chosen by his trading partner. We can guarantee the existence of a solution to the social planner’s problem by imposing an (irrelevant) upper bound $y_{\text{max}}$ on the planner’s choice of $y_d$ and $y_f$, where $y_{\text{max}}$ is sufficiently large that $u(y_{\text{max}}) - y_{\text{max}} < 0$.}
Constraints (1)–(3) serve to define $V_d$, $V_o$, and $V_f$. These definitions reflect that agents meet those with the same nationality with probability $p$ and, correspondingly, agents with a different nationality with probability $(1 - p)$. Moreover, in each of these meetings, six different matches are possible, as there are three types of agents and agents may either hold their domestic currency or hold no currency at all.

The “participation” constraints (5)–(8) are the usual sequential individual rationality constraints that guarantee that the participants in a match prefer the allocation to autarky. Constraint (4) is a “currency-switching” constraint. It guarantees that a seller who receives foreign currency will immediately exchange it for domestic currency, and that any buyer who holds domestic currency will not want to switch to holding foreign currency. It is assumed throughout that, before matches, it is costless to substitute between different currencies. Adding transaction costs for currency exchanges would not alter the main points of the paper.

The main question that concerns us is when the solution to the planner’s problem can be implemented using one currency instead of two. In the above setting, with two currencies that can only be traded before matches, individuals are able to commit to prematch announcements of their nationality. (The currency-switching constraint is essentially an incentive-compatibility condition reflecting this decision.) With only a single currency, individuals can only be distinguished using within-match announcements of nationality. This consideration motivates the following definition.

**Definition 1.** Two currencies are essential if all solutions to the planner’s problem fail to satisfy at least one of the following two conditions:

$$u(y_d) + \beta [z_d V_o + (1 - z_d) V_d] \geq u(y_f) + \beta [z_f V_o + (1 - z_f) V_d] \quad (10)$$

$$\alpha u(y_f) + \beta [z_f V_o + (1 - z_f) V_d] \geq \alpha u(y_d) + \beta [z_d V_o + (1 - z_d) V_d]. \quad (11)$$

Conditions (10)–(11) are within-match truth-telling constraints. Condition (10) indicates that a domestic buyer will only announce his true type (i.e., that he is domestic) if the utility from the ensuing exchange is at least as large as announcing his type untruthfully (i.e., claiming that he is a foreign buyer). Correspondingly, condition (11) indicates that a foreign buyer will only announce his true nationality if the resulting utility does not fall short of announcing untruthfully that he is domestic. If a solution to the planner’s problem is to be implementable using a single currency, then the solution must satisfy these two constraints because it must be possible to implement the solution by relying solely on within-match announcements.
of nationality by the buyer. The two conditions also embed the requirement that in a one-currency world, $V_d = V_f$.

Later in the paper, we prove that $z_d = 1$ in any solution to the planner’s problem. Hence, there are two possible instances in which it is not essential to have two currencies (that is, both conditions in Definition 1 are satisfied). First, it could be that there is cross-country trade ($z_f = 1$) but $y_d = y_f$, so that there is no need to distinguish nationality in order to determine production levels. Alternatively, it could be that there is no cross-country trade ($z_f = 0$) and foreigners do not want to pretend to be domestic buyers ($\alpha u(y_d) + \beta V_d \leq \beta V_0$).

4. RESULTS

In this section, we derive the three main results concerning the properties of optimal allocations. First, if $y_f > 0$ in all solutions to the planner’s problem, then two monies are essential if and only if $y_d > y_f$ in all solutions to the planner’s problem. This shows that if two currencies are essential in a world with trade between the two regions, then sellers charge a higher price to holders of foreign currency than to holders of domestic currency. Second, we use the first result to show that two monies are essential for a nonempty set of parameters.

Finally, we prove that if two monies are essential, then $y_f > 0$ in all solutions to the planner’s problem. This rules out the possibility that we need two monies to implement zero interregional trade. Instead, if zero interregional trade is optimal, then (we demonstrate that) a foreign buyer is unwilling to give up a token to buy the quantity of goods being produced by a seller.

Before proving these results, it is useful to note that domestic production is always optimal.

**Lemma 1.** *In any solution to the planner’s problem, $y_d > 0$.*

**Proof.** Suppose it is optimal to set $y_d = 0, z_f = 1$, and $y_f > 0$. Consider some allocation such that $z_d = 0$ and $z_f = 1$. Such an allocation can only be in the constraint set if $y_f = 0$ (because otherwise $V_d - V_f < 0$), which implies that it provides zero utility to the planner. Hence, setting $z_d = 0$ is only optimal if zero is the highest utility level that the planner can attain.

Now consider any allocation in which $z_f = 1$. Set $z_d = 0$ and $y_f = 0$. We can rewrite the seller’s and buyer’s participation constraints to be

$$-y_d(1 - 2\beta/3) + \beta p\{u(y_d) + y_d\}/6 \geq 0 \quad (12)$$

$$u(y_d)(1 - 2\beta/3) - \beta p\{u(y_d) + y_d\}/6 \geq 0. \quad (13)$$
Then, there exists \( y_d > 0 \), which satisfies the constraints to the social planner’s problem. Why? Increase \( y_d \) from zero; because \( u'(0) = \infty \), this relaxes the seller’s constraint. On the other hand, it relaxes the buyer’s constraint as long as \( 1 - 2\beta/3 - \beta p/6 > 0 \), which is true because \( \beta < 1 \) and \( p < 1 \). Thus, by setting \( z_d = 1 \), it is always possible to find some allocation that gives positive utility to the planner; hence, \( z_d = 0 \) is always suboptimal.

Intuitively, because \( u'(0) = \infty \), it is always optimal to have domestic production.\(^4\)

The first proposition demonstrates that if interregional trade is optimal, multiple currencies are essential if and only if the produced quantities are smaller for individuals who have foreign currencies than for individuals who have domestic currencies.

**Proposition 1.** Suppose \( y_f > 0 \) in all solutions to the planner’s problem. Then \( y_d > y_f \) in all solutions to the planner’s problem if and only if two monies are essential.

**Proof.** Note that if \( y_d < y_f \), then \( V_d < V_f \), which violates the currency-switching constraint. So, an allocation can only satisfy the planner’s constraints if \( y_d \geq y_f \).

From Lemma 1, we know that \( y_d > 0 \), which from the domestic buyer’s participation constraint implies that \( V_f > V_d \). It follows from the seller’s participation constraint that if \( y_f > 0 \) for all solutions to the planner’s problem, then \( z_f = 1 \) for all solutions to the planner’s problem. Hence, we need only prove that if \( z_f = 1 \) in all solutions to the planner’s problem, then \( y_d > y_f \) in all solutions to the planner’s problem if and only if two monies are essential.

Now suppose two monies are essential and \( y_d = y_f \) and \( z_f = 1 \) in some solution to the planner’s problem. From Lemma 1, \( z_d = 1 \). Because \( z_f = 1 \), the truth-telling constraints in the definition of essentiality are satisfied; this yields a contradiction, and so it is not essential to have two currencies.

On the other hand, if \( y_d > y_f \) and \( z_f = 1 \) in all solutions to the planner’s problem, then the second truth-telling constraint in the definition of essentiality is violated (foreigners always want to pretend to be domestic to get the lower price). The proposition follows.

\(^4\)It is important to emphasize that even though \( u'(0) = \infty \), it is still possible in an optimum that \( y_f = 0 \). Intuitively, if \( y_f = 0 \) and \( y_d > 0 \), increasing \( y_f \) while leaving \( y_d \) fixed may lower welfare. This is because once \( y_f \) is made positive, \( z_f \) has to be positive, and the buyer’s participation constraint requires \( a u(y_f) \geq \beta(V_d - V_b) \). If \( a \) is small, then \( y_f \) has to be relatively large if there is to be cross-country trade without changing \( y_d \). In particular, the requisite value of \( y_f \) may be so large that \( a u(y_f) < y_f \).
This proposition demonstrates that if multiple currencies are essential, then the produced quantities are smaller for individuals who have foreign currencies than for individuals who have domestic currencies. Intuitively, multiple currencies are only essential if the planner wants to treat people who are carrying foreign currency differently from those who are carrying domestic currency. This “difference” means that those who have foreign currency get a different amount in exchange for their currency. Furthermore, in order to preserve the linkage between color of token and nationality, it must be true that people receive more from domestic matches than from foreign matches. In this sense, Proposition 1 implies that it may be optimal to see deviations from the Law of One Price beyond those attributable to the zero transaction costs involved in exchanging currencies.

The following proposition describes conditions under which it is essential to have multiple monies.

**Proposition 2.** There exists $\beta^*$ and a function $\alpha^*(\beta)$ such that if $\beta \geq \beta^*$ and $1 > \alpha \geq \alpha^*(\beta)$, then two monies are essential.

**Proof.** We show first that for $\alpha = 1$ and $\beta$ sufficiently near 1, the participation constraints are slack in the social planner’s problem. To see the validity of this claim, let $y^*_d$ denote the production quantities in the social planner’s solution when the constraints are not imposed because $\alpha = 1$, $y_d$ and $y_f$ are equal. Then, the buyer’s and seller’s participation constraints can be rewritten as

\begin{align}
-y^*_d(1-2\beta/3) + \beta\left[p(u(y^*_d) + y^*_f)/6 + (1-p)(u(y^*_d) + y^*_f)/6\right] &\geq 0 \\
u(y^*_d)(1-2\beta/3) - \beta\left[p(u(y^*_d) + y^*_f)/6 + (1-p)(u(y^*_d) + y^*_f)/6\right] &\geq 0.
\end{align}

Because $u(y^*_d) - y^*_d > 0$, these inequalities are satisfied for $\beta$ sufficiently near 1. It follows that for $1 > \beta \geq \beta^*$, and $\alpha = 1$, the planner’s constraints do not bind.

It follows from the Theorem of the Maximum that if $\alpha$ is near 1, and $\beta \geq \beta^*$, then the participation constraints are slack in the solution to the planner’s problem. Now, for any $\alpha$ and $\beta$, if the participation constraints are not binding in a solution to the planner’s problem, $y_d = u'^{-1}(1)$ and $y_f = u'^{-1}(1/\alpha)$. Because $y_d > y_f$, the theorem follows from Proposition 1. \qed
Proposition 2 shows that if \( \alpha \) is near 1, and agents are patient enough, then the planner's constraints do not bind. Unless \( \alpha = 1 \), we know from Proposition 1 that implementing the planner's solution when no constraints bind requires two monies because the solution involves cross-country trade and two different levels of production. Thus, if individuals are sufficiently patient, and preferences are heterogeneous (\( \alpha < 1 \)), multiple currencies are essential. (Note that if there were some cost of substituting between the two currencies, then multiple currencies would only be essential if \( \alpha \) were bounded away from 1.)

The final proposition demonstrates that if multiple currencies are essential, there is interregional trade.

**Proposition 3.** Suppose multiple currencies are essential. Then, in any solution to the planner’s problem, \( y_f > 0 \).

**Proof.** Lemma 1 implies that \( (V_d - V_o) > 0 \) in any solution to the planner’s problem. Hence, if \( z_f = 1 \) in a solution to the planner’s problem, then the foreign buyer’s participation constraint implies that \( y_f > 0 \). Thus, to prove the proposition, we need only prove that in any solution to the planner’s problem, \( z_f = 1 \).

We prove this by contradiction. Assume two monies are essential, and that \( (y_d, y_f, z_d, z_f) \) solves the planner’s problem, where \( z_f = 0 \). When \( z_d = 1 \) and \( z_f = 0 \), the domestic buyer’s truth-telling condition (10) is equivalent to the domestic buyer’s participation constraint (7), and so must be satisfied. Since two monies are essential, it follows that the foreign buyer’s truth-telling condition (11) is violated, and so \( \alpha u(y_d) + \beta V_0 > \beta V_d \).

To establish the contradiction, we use the fact that \( \alpha u(y_d) + \beta V_0 > \beta V_d \) to show that the allocation \( \hat{y}_d = y_d, \hat{y}_f = y_d, \hat{z}_f = 1, \) and \( \hat{z}_d = 1 \) satisfies the planner’s constraints and increases the planner’s objective relative to \((y_d, y_f, z_d, z_f)\). Indeed, it is trivial to see that the new allocation increases the planner’s objective, because \( \alpha u(y_d) > \beta (V_d - V_o) \geq y_d \).

We then need to show that the new allocation satisfies the planner’s constraint set. Constraint (4) is satisfied trivially because \( V_d = V_f \). To see that the seller’s participation constraints (5)–(6) are satisfied, note that

\[
\hat{V}_d = p \left[ u(y_d)/6 + \beta \hat{V}_o/6 + 5\beta \hat{V}_d/6 \right] + (1-p) \left[ \alpha u(y_d)/6 + \beta \hat{V}_o/6 + 5\beta \hat{V}_d/6 \right]
\]

\[
\hat{V}_o = p \left[ -y_d/6 + \beta \hat{V}_d/6 + 5\beta \hat{V}_o/6 \right] + (1-p) \left[ \{-y_d/6 + \beta \hat{V}_d/6\} + 5\beta \hat{V}_o/6 \right].
\]
It follows that
\[-y_d + \beta \hat{v}_d - \beta \hat{v}_b > -y_d + \beta V_d - \beta V_b \geq 0. \quad (18)\]

It is left to verify constraint (8) (from which (7) follows trivially). We know that since the original allocation satisfies (8),
\[\alpha u(y_d) \geq \beta (V_d - V_b) = (\beta/6)[u(y_d) + y_d] / (1 - 2\beta p/3 - (1 - p)\beta). \quad (19)\]

Establishing (8) for the new allocation is equivalent to proving that
\[\alpha u(y_d) \geq \beta (\hat{v}_d - \hat{v}_b) \quad (20)\]
\[= \beta (1 - 2\beta/3)^{-1} \{p[u(y_d) + y_d]/6 + (1 - p)[\alpha u(y_d) + y_d]/6\}. \quad (21)\]

But this follows from simple algebra:
\[\alpha u(y_d)(1 - 2\beta/3) \quad (22)\]
\[= \alpha u(y_d)(1 - 2\beta p/3) - (1 - p)\beta \alpha u(y) + \beta (1 - p)\alpha u(y)/3 \quad (23)\]
\[\geq (\beta/6)\{p[u(y_d) + y_d]/6 + (1 - p)\beta \alpha u(y_d)/3\} \quad (24)\]
\[> (\beta/6)\{p[u(y_d) + y_d]/6 + (1 - p)\beta \alpha u(y_d)/6 + (1 - p)y_d/6\}, \quad (25)\]

since \(\alpha u(y_d) > y_d.\)  

Proposition 3 is equivalent to the statement that if cross-region trade is zero in the solution to the social planner’s problem, then it cannot be essential to have multiple currencies. Intuitively, whenever \(z_f\) equals zero in a solution to the planner’s problem, the value of money in domestic trades exceeds a foreign buyer’s valuation of \(y_d;\) otherwise, the planner would implement an exchange of one unit of money for \(y_d\) in cross-country meetings. Hence, to implement an optimal no-trade outcome, the seller need only offer to produce \(y_d\) units of output for a token of currency; only domestic buyers will accept his offer because the foreign buyers do not find domestic goods sufficiently valuable to give up a token of currency for \(y_d\) units of output.
5. CONCLUSIONS

Currently, there is a large disparity in the modeling of environments with multiple currencies and the modeling of environments of single currencies. So-called deep models of money (Samuelson, 1958; Townsend, 1980; and Kiyotaki and Wright, 1991) place a great emphasis on the actual usefulness to society of money in efficiently allocating resources. Yet, even the “deepest” models of international currencies do not give rise to a motivation for having different currencies.

The purpose of this paper is to take a step toward eliminating this disparity. The model in this paper develops an economic environment in which multiple national currencies may play an essential role in achieving an optimal allocation of resources. It is assumed that the buyer’s valuation of different nationalities of goods is private information. In this environment, multiple currencies allow agents to make a credible announcement of how they evaluate goods from different countries before they are actually matched. The paper identifies the conditions under which this ability of agents to make a credible announcement before being matched allows society to achieve a better allocation of resources.

According to the model in this paper, the recent push toward an economic and monetary union in Europe (EMU) may be seen as an optimal response to a growing consumer indifference toward the nationality of goods’ producers (perhaps reflecting in a broader sense increased harmonization of produced standards or better cross-border contract enforceability). However, this interpretation is tentative at best, given the simple and abstract nature of the model. In future work, it would be useful to attempt to relax some of the relatively stringent assumptions of the model, including the indivisibility of currencies and the feature that currencies are the only signaling device for an agent’s nationality.

REFERENCES


