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Money: A Market Microstructure Approach

The new monetary economics predicts that deregulation and financial innovation will lead to a moneyless world. This paper uses a market microstructure approach to show that a common medium of exchange that serves as unit of account will remain a necessary instrument to reduce transaction costs. This finding is supported by empirical evidence from foreign exchange markets.

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EVER SINCE BLACK (1970) proposed that in efficient financial markets, indirect exchange via money is inefficient, doubts have been voiced regarding the efficiency of monetary exchange. Black as well as others, such as Fama (1980, 1983), argue from an efficient market standpoint. If all assets are priced efficiently, a direct transfer of assets may serve as a substitute for payments with money. They predict that "money" will no longer be required as a medium of payment. Rather financial innovation will make it possible to pay with a wide variety of assets. In such a system, the unit of account and medium of exchange function would be separated. Related are papers by Cowen and Kroszner (1987, 1994), Greenfield and Yeager (1983), and Hall (1982, 1983). The whole set of ideas has become known as the "new monetary economics" (NME).

The NME has been criticized by a number of authors.[1] A central point of the critics has been that the NME relies on a Walrasian model to demonstrate the inefficiency of monetary exchange. Once the Walrasian framework is abandoned, the assumption that agents are indifferent with respect to the type of asset they receive as payment is no longer tenable (Hoover 1988, pp. 152–53, White 1984, p. 708). If there are

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1. See, for instance, Hoover (1988), McCallum (1985), and White (1984, 1986).

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positive transaction costs, economic agents will prefer the one asset with the lowest costs as medium of exchange or settlement. Such an asset also evolves naturally as unit of account (White 1984, p. 711).

In spite of these criticisms, the idea received renewed attention with the advent of Internet banking, new trading platforms, online trading, etc. Thus, Mervyn King stated in 1999

> Is it possible that advances in technology will mean that the arbitrary assumptions necessary to introduce money into rigorous theoretical models will become redundant, and that the world will come to resemble a pure exchange economy? Electronic settlements in real time hold out that possibility. (King 1999)[2]

However, financial innovation and cost reduction also benefit monetary exchange. So, the question is how relative costs of monetary and nonmonetary exchange are affected by current innovations. As White points out (using mutual share banking as an example of nonmonetary exchange):

> The analytical question in this case—why money transfer and cash-inventory services should be jointly produced with deposits at lower cost than with mutual fund shares—awaits further research. (White 1984, p. 708)

In this paper, a market microstructure approach will be used to tackle this question and explore the implications for the future of money.[3] Market microstructure theory provides explanations of the costs using a market and allows for a comparison of the relative costs of different institutional setups.[4] Therefore, it makes it possible to compare the relative costs of monetary and nonmonetary exchange. A market microstructure model of money has a lot in common with older approaches that explain the use of money with information costs (see Brunner and Meltzer 1971, Alchian 1977).

Analytically, the question whether or not money[5] will prevail has to be separated from the question whether or not currency will survive. It may well be that the use of currency will be discontinued some time in the future but that money will survive in the form of deposits. Therefore, the following analysis will focus on the comparison of a monetary regime based on deposits with nonmonetary exchange.

Focusing on deposits rather than currency distinguishes the present analysis from papers such as Capie, Tsomocos, and Wood (2003) who focus on currency payments. Another important feature of the present analysis is the assumption that transactions

2. See also Browne and Cronin (1995), Miller (1998), and Niehans (1982).

3. It has been pointed out by other authors already that a market microstructure model can usefully be employed in monetary theory. For instance, Goodhart (1989, p. 2) proposes to use a model with a market maker instead of the Arrow-Debreu Walrasian auctioneer in order to analyze monetary phenomena.

4. See Madhavan (2000) for a survey.

5. In the present study, “money” is defined as a good that serves as a common medium of exchange and that has a fixed price of 1 in terms of the unit of account.

involve the use of specialized traders. Thus, the basis of the analysis is the present real-world institutional setup and not some hypothetical state of the world with either no coordination mechanism at all (as in search-theoretic models) or a perfect coordination mechanism (as in Walrasian models). The problem of finding a suitable counter party has been solved by the existence of specialized traders who offer to buy or sell goods and asset at quoted prices. This sets the present analysis apart from search-theoretic models such as Kiyotaki and Wright (1989) and puts it closer to trading post models such as Howitt (2005). It differs from these models, however, because the alternative that is analyzed is not goods-barter versus monetary exchange but "financial barter" (see below) versus monetary exchange. Moreover, the perspective is reversed by starting from monetary exchange and asking whether the fall in technical costs may trigger a switch to financial barter.

The paper is organized as follows. In Section 1, monetary and nonmonetary exchange will be defined and the respective costs analyzed. Section 2 uses a market microstructure approach to tackle the question under what conditions nonmonetary exchange could be efficient. Section 3 provides empirical evidence from foreign exchange (fx) markets to support the general findings of this paper.

1. EXCHANGE WITH AND WITHOUT MONEY

As the discussion above has demonstrated, there is a widespread belief that financial innovation will have a profound effect on the future of money and payments. But there is no agreement as to the precise nature of the future system of exchange. Excluding barter or "e-barter" (see Capie, Tsomocos, and Wood 2003), three different scenarios can be distinguished as

- monetary separation (one unit of account, many media of exchange flexibly priced in the unit of account);
- financial barter (many units of account, many media of exchange);
- monetary exchange (one unit of account, media of exchange fixedly denominated in the unit of account).

In monetary exchange, one special asset is used as a unit of account and at the same time as a medium of exchange. From the point of view of the money holder, the chief disadvantage of money is the fact that it is noninterest bearing or—if it pays interest—that the interest rate is lower than the interest on alternative investments. Thus, there is an opportunity cost of holding money.

In a system of monetary separation, the role of the state is confined to defining the common unit of account. This unit is used to express prices of goods and services and value debits. Actual exchange, however, takes place using a wide array of goods and assets. A more radical vision is that of a completely moneyless world in which neither a common medium of exchange nor a common unit of account is used (Cowen and Kroszner 1994). Such a system will be referred to as "financial barter." Monetary separation has a lot in common with financial barter because the need to settle in different assets leads to a split of markets in many respects similar to financial barter.[6] Therefore, both monetary separation and financial barter will be jointly labeled as "nonmonetary exchange."

In a moneyless world, less effort seems to be required to make a payment. After all, in principle, all liquid assets can be used in order to make a payment. Thus, the buyer of good x can simply transfer asset a_1 in order to pay for good x. However, there are two potential problems that may arise: first, the determination of the payment asset and, second, the determination of the relative price of the payment asset in terms of the unit of account. If the buyer determines the payment asset, the seller may end up with an asset he does not wish to hold and which he therefore has to sell. This would not be a problem if transaction costs (including bid–ask spreads) were zero, but they are not. If the seller determines the payment asset, the buyer may have to acquire the asset chosen by the seller before he is able to make the payment. Moreover, in order to determine the amount of the payment asset that needs to be transferred buyers and sellers need to agree on the relative price between the "pricing asset" and the payment asset. There would be no problem agreeing on a price if bid–ask spreads were uniform across assets. This is not the case.

Consequently, the typical purchase transaction in a moneyless world either involves a financial market transaction by the buyer (assuming that the seller determines the payment asset) or by the seller (assuming that the buyer determines the payment asset).

A shift from monetary to nonmonetary exchange would be efficient if the costs of nonmonetary exchange were lower than the costs of monetary exchange.

The costs to be considered are:

- Brokerage fees
  In a monetary world, brokerage costs are the costs of buying and selling assets. In a nonmonetary world, brokerage costs are the costs of exchanging one asset against another.
- Opportunity costs
  Opportunity costs of holding money consist of interest foregone of money holders. To some extent, opportunity costs also arise in a moneyless world. Whenever buyers and sellers do not wish to transact with the same medium of exchange, one of them has to accept a temporary deviation from his optimal portfolio.[7]

6. In the literature, there has been a debate whether such a system would be feasible (see Rogers and Rymes 2001 and the literature cited therein). The critics of monetary separation argue that the price level is indeterminate in such a system. In the following, the problem of determinacy will be ignored. Rather, it will be analyzed how such a system would perform in terms of transaction costs.

7. If the seller gets to choose the payment asset, for a short period of time, the buyer has to hold an asset which he does not wish to hold. If the buyer gets to choose the payment asset, the seller receives an asset he does not want to hold and that he will have to sell. Thus, the shift from monetary exchange to nonmonetary exchange transforms opportunity costs but does not reduce them to zero: instead of permanently holding an exchange asset with low or zero interest people have to temporarily hold an asset that they do not wish to hold. This entails costs in terms of a departure from the optimal risk–return position.

- Technical costs
  All of the three types of exchange involve digital information that travels over electronic networks. In all cases, an account has to be kept with a financial institution.
- Costs of negotiating the payment medium
  If there is no common medium of exchange, the two parties involved in a transaction need to negotiate which medium of exchange shall be used.
- Computational costs
  These are the costs of determining the price in terms of a unit of account and medium of exchange. If there is no common unit of account, it becomes more complex to compute the price of a good and the amount of the agreed settlement asset that has to be offered (accepted) in payment.[8]
- Costs of issuing money
  Under current conditions, issuing deposits involves the costs of providing convertibility between currency or base money and deposits.

In order to facilitate the analysis of the implications of technological change on the relative costs of monetary and nonmonetary exchange, a number of simplifying assumptions will be made.

First, since deposit-based monetary payments as well as a nonmonetary payments are carried out through electronic networks, technical costs will be assumed to be equal. Moreover, technical progress is likely to affect technical costs for both types of payments in a similar way. Therefore, technical costs of payer and payee can be excluded from the comparison below.

Second, opportunity costs also have to be taken into account in a nonmonetary regime. However, such costs are likely to be small. Therefore, in order to simplify the analysis, they will be excluded from the analysis.

Third, computational and negotiation costs are difficult to quantify and will thus be excluded.

Fourth, under competition, there should be no profits from issuing money.[9] Thus, the costs of issuing money should equal seigniorage income. Therefore, net costs are assumed to be zero.

The second and third assumptions introduce a bias against money. However, they are not problematic as long as the comparison shows that monetary exchange is less costly than nonmonetary exchange. In this case, relaxing these assumptions will simply reenforce the initial result. Should nonmonetary exchange prove to be less costly, the result would have to be reviewed under relaxed assumptions.

Given the four assumptions above, the costs of monetary and nonmonetary exchange can be simplified to

$$C^m = (\omega + \beta)b^m + (t_b + t_s)P_x r^m \quad \text{Costs of monetary exchange,} \tag{1}$$

8. See also Niehans (1978, ch. 7).

9. In almost all market economies, deposit creation is a competitive business carried out by commercial banks.

where b^m corresponds to the brokerage fee in the well-known cash management model (e.g., Baumol-Tobin), for each purchase, there will be an average of ω ($\omega \leq 1$) "trips to the bank" of the buyer and β ($\beta < 1$) trips to the bank of the seller, r^m corresponds to the opportunity cost variable known from cash management models, $t_{b(s)}$ is the average time money that is held by a buyer (subscript b) or seller (subscript s) before it is spent or deposited,[10] and P_x is the size of the transaction

$$C^{nm} = \delta b^{nm} \quad \text{Costs of nonmonetary exchange,} \tag{2}$$

where b^{nm} are the brokerage costs of buying/selling assets in a nonmonetary world, and δ corresponds to the probability that buyer and seller do not wish to transact with the same asset.[11]

Thus, what remains as costs of monetary exchange are the "classical" cash management costs (brokerage costs and opportunity costs).

As technical progress drives down b^m, agents will engage in more active cash management and ($\omega + \beta$) will be rising. Under "perfect cash management" (i.e., $\omega = \beta = 1$), there would be one asset sale (by the buyer) and one asset purchase (by the seller) per payment transaction. In such a case, it seems plausible to assume that the asset sale (purchase) will take place immediately before (after) the transaction so that t_b and t_s both converge toward zero. Consequently, interest forgone would also converge toward zero and the costs of cash management would consist only of brokerage fees:

$$C^m = 2b^{\mathrm{m}}. \tag{3}$$

In addition, given that the market share of each asset is likely to be tiny, δ is close to 1 ($\delta \approx 1$). Therefore, the condition for a switch to nonmonetary exchange can be written as

$$b^{nm} < 2b^m. \tag{4}$$

Thus, in order for nonmonetary exchange to prevail, brokerage costs per nonmonetary transaction need to be smaller than two times brokerage costs per monetary transaction. At first, such a result may seem odd, but a nonmonetary system would require fewer transactions. For each purchase and sale in goods' markets, there would only be one purchase or sale in financial markets, whereas a monetary system requires two transactions.

Even though the world seems still far away from the state described above ($\omega = \beta = 1$), there is no doubt that transaction costs have been falling substantially.

10. It corresponds to $1/(2k)$ in standard cash management models (where k is the number of trips to the bank).

11. For two randomly picked buyers and sellers, $\delta \equiv 1 - \mathrm{Prob}_i(a_x)\,\mathrm{Prob}_j(a_x)$, where $\mathrm{Prob}_i(a_x)$ ($\mathrm{Prob}_j(a_x)$) is the probability that buyer i (seller j) wishes to transact with asset a_x. The average of $\mathrm{Prob}(a_x)$, for the economy as a whole, can be approximated with the market share of asset a_x.

Therefore, it is worthwhile to analyze in more detail the relative size of brokerage costs in a monetary (b^m) and a nonmonetary world (b^{nm}) and how they are affected by technological change. Below, a market maker model will be used to shed light on this question.

2. BROKERAGE COSTS: A MARKET MICROSTRUCTURE APPROACH

Brokerage costs consist of an individual's time and effort and of the costs of using the market. The first category is difficult to measure. Some authors have argued that these costs can be reduced substantially via the use of automated processes. Thus, in the future, they may increasingly lose significance. In addition, it can be assumed that these costs are roughly the same for monetary and nonmonetary transactions. Therefore, the focus will be on the second category, the costs of using the market. These costs consist of explicit fees and implicit costs that arise from the spread between buying and selling prices. Moreover, when larger quantities are involved, market participants have to take into account that the market price may move against them (market impact). Technical progress can reduce some of the transaction costs but—as will be shown—it cannot totally eliminate them.

Transaction costs in financial markets do not just consist of hardware and software costs. An important cost component consists of the costs of market making. Without market makers, it could be difficult and time consuming to find a trading partner who is willing to trade at an acceptable price. The service provided by this type of trader is "immediacy" (Demsetz 1968). The price for this service usually consists of the difference between the bid and the ask price (the "spread"). In a market without designated market makers, limit orders perform the same function as a market maker (Stoll 1985, p. 73). In this case, the argument developed below applies to those market participants who place limit orders.

In a frictionless world, the spread would be zero. Matching purchases and sales would be costless. However, in the real world, market makers encounter a number of "frictions" (Stoll 2000). These frictions are the cause of positive trading costs. The principal types of frictions are processing costs, inventory risk, and adverse information. These costs have to be recovered via the spread. In addition, if market makers have market power, the spread may contain monopoly rents.

Using a much quoted model of Madhavan and Smidt (1991), it can be shown that the bid–ask spread equals:[12]

$$p_t^{\text{ask}} - p_t^{\text{bid}} = 2[\chi + (\psi + \tau)(1 + \chi)], \tag{5}$$

where ${p_t}^{\text{ask(bid)}}$ are quoted prices; ψ reflects execution costs; τ reflects fixed costs of market making due, for instance, to the opportunity costs of time; and χ reflects the

12. Abstracting from order size effects and the influence of "animal spirits" of speculators on the spread.

effect of adverse information. Since the costs of a single purchase or sale are equal to one-half of the spread, brokerage costs are equal to the term in square brackets.

$$b = \chi + (\psi + \tau)(1 + \chi). \tag{6}$$

Technological change has been (and still is) driving down the technical costs of trading ψ. This effect applies to monetary as well as nonmonetary trading. As these costs are approaching zero, (6) can be simplified to

$$b = \chi + \tau + \chi\tau. \tag{7}$$

According to equation (7), the costs that will remain, even if technical trading costs are driven close to zero, are the costs of adverse information and the fixed costs of market making.

The term χ represents the effects of adverse information. χ will fall, and thus the spread will decrease if the quality of information of the market maker relative to the quality of private information of insiders (relative information) rises. The relative information of the market maker is a function of the number of assets he is trading. As the number increases, relative information declines. Market makers will find it difficult to monitor information for various assets and update prices in a timely fashion. Thus, χ is a positive function of the number of assets traded (n). The number of assets traded by a single trader in monetary exchange (n^m) is likely to differ from the number of assets traded in a nonmonetary world (n^{nm}). Consequently, the costs of adverse information can be written as

$$\chi^{nm} = \chi\Big(\underset{(+)}{n^{nm}}\Big) \quad \text{for nonmonetary exchange,} \tag{8}$$

$$\chi^{m} = \chi\Big(\underset{(+)}{n^{m}}\Big) \quad \text{for monetary exchange.} \tag{9}$$

The term τ reflects the fixed costs of market making due, for instance, to the opportunity costs of time. As in Howitt (2005), τ is a crucial variable. The more transactions a market maker can carry out, the lower the fixed costs per transaction. Assuming that, *ceteris paribus*, the number of transactions rises with the number of assets for which a market maker is quoting prices, τ is a negative function of the number of assets a market maker is trading.

$$\tau^{nm} = \tau\Big(\underset{(-)}{x^{nm}}\Big) = \tau\Big(\underset{(-)}{n^{nm}}\Big) \quad \text{for nonmonetary exchange,} \tag{10}$$

$$\tau^{m} = \tau\Big(\underset{(-)}{x^{m}}\Big) = \tau\Big(\underset{(-)}{n^{m}}\Big) \quad \text{for monetary exchange.} \tag{11}$$

where x^m and (x^{nm}) are the number of transactions carried out by a trader in a monetary (nonmonetary) exchange environment.

When assessing the consequences of a change from monetary to nonmonetary exchange, basically two effects have to be considered.

First, for a given number of underlying exchanges (i.e., portfolio shifts or goods purchases/sales), the number of transactions is cut in half. Nonmonetary exchange requires fewer transactions in asset markets and thus implies lower costs (*ceteris paribus*). This implies that nonmonetary exchange is efficient, as long as per transaction costs are less than twice the per transaction costs in monetary exchange.

$$b^{nm} = (\chi^{nm} + \tau^{nm} + \chi^{nm}\tau^{nm}) < 2b^{m} = 2(\chi^{m} + \tau^{m} + \chi^{m}\tau^{m}). \tag{12}$$

Second, the shift toward nonmonetary trading increases the number of asset markets from n to $n(n-1)/2$. At the same time, the number of transactions per market is reduced. Considering a given number of "underlying transactions" (z), such as sales/purchases of goods or portfolio shifts, there would be $2z$ monetary transactions or, alternatively, z nonmonetary transactions. If there are n assets, a market maker specializing in one asset faces (on average) a transaction volume of $2z/(n-1)$ in a monetary world and $2z/[n(n-1)]$ in a nonmonetary world. Thus, on average, markets in a nonmonetary world are n times smaller than markets in a monetary world. Consequently, in order to generate volume, market makers have to become active in many markets.

To fully appreciate the difference between monetary and nonmonetary exchange, it is instructive to analyze how specialization takes place in a nonmonetary world. First, a market maker cannot simply specialize in one asset. He has to trade at least two assets. However, trading two assets would leave him in one market (say IBM against Toyota) with little volume. In order to increase volume, a market maker would have to increase the number of assets traded. Trying to become a specialized IBM trader, he could offer to trade IBM also against Barclays or CEMEX. However, since he has to be specialized in all four shares in this case, it would also make sense to offer Toyota against Barclays and CEMEX, and Barclays against CEMEX. Thus, he would become a specialist in a set of assets and would be active in all markets where two of these assets are traded against each other. Therefore, for a given number of assets traded n^{nm}, the corresponding number of markets k^{nm} is equal to $n^{nm}(n^{nm}-1)/2$. If the aim is to achieve the same trading volume as in one monetary market, a trader would have to be active in n markets (on average). In this case, the number of assets traded would have to be approximately $(2n)^{0.5}$.[13] For a total number of assets of 5,000, a market maker would have to trade 100 different assets in order to have the same order flow as a market maker specializing in one asset in a monetary world.

Consequently, in a nonmonetary world, a market maker is caught up in the trade-off between risk and volume. High volume (and thus low fixed costs per transaction) can only be achieved with a high number of assets traded. Assuming, again, a total of 5,000 different types of assets, a nonmonetary trader making prices for 10–20 assets would have only a fraction of the trading volume of a trader who trades just one asset in a monetary world. At the same time, he would have to deal with much higher costs of adverse information.

13. Solving $k^{nm} = n = n^{nm}(n^{nm}-1)/2$ yields $n^{nm} = (2n + 0.25)^{0.5} + 0.5$.

Thus, the application of the market microstructure approach to monetary theory underlines the particular advantages of monetary exchange. Market makers can specialize in a single asset allowing them to contain risk-related costs, and at the same time, they can serve a fairly big part of the market.[14] A shift toward nonmonetary exchange would inflate the number of markets and lead to higher costs in terms of labor input and higher costs of adverse information than monetary exchange. These findings confirm the results of Alchian (1977) who argues that the main advantage of money is that it allows for the emergence of specialized trade.

3. TRANSACTION COSTS: EMPIRICAL OBSERVATIONS

There are numerous studies showing that transaction costs in financial markets do not simply consist of the technical costs of trading.

First, risk-related costs are quantitatively significant. Various empirical studies have tried to quantify the relative importance of the different factors for the size of the spread. Using NASDAQ data, Stoll (1989, p. 132) finds that order processing costs account for 47% of the spread, adverse information for 43%, and holding costs (including risk) for 10%. A more recent study, Menyah and Paudyal (2000), reports values between 30% and 79% for processing costs, 21%–47% for asymmetric information, and 0%–23% for inventory risk. Stoll (2000) estimates a share of "real frictions" (processing plus inventory costs) of 47% of the spread for NYSE/AMSE and 63% for NASDAQ.

The size of the spread is mainly determined by a number of characteristics of individual assets, such as daily dollar trading volume, the return variance, the stock's market value, the stock's price, and the number of trades per day (Madhavan 2000, Stoll 2000).

There is wide agreement that these factors "explain most of the variability in the bid-ask spread" (Madhavan 2000, p. 213). Moreover, the empirical relationship seems to be surprisingly robust (Stoll 2000, p. 1481). Thus, even if technical costs should fall to zero, there still would be considerable transactions costs.

Second, in order to support the theoretical argument developed above, it is useful to look at markets that are characterized by very low transaction costs. Already today, many of the existing wholesale markets operate with highly sophisticated technical equipment that makes it possible to communicate and trade at extremely low costs. Therefore, these markets can provide insights about the structure of trade in a low-transaction-cost environment. One such market that is particularly interesting in the present context is the foreign exchange market. In the foreign exchange market, different monies are exchanged against each other and a system of financial barter might evolve more naturally than in other markets. If it were true that falling transaction

14. Aspects of competition have been neglected in this analysis. Of course, as traders specialize in smaller market segments, there would be less competition in each segment. The inclusion of this aspect would reenforce the argument in favor of monetary exchange.

TABLE 1

Currency Distribution of Global Fx Market Activity

	April 1989	April 1992	April 1995	April 1998	April 2001	April 2004	April 2007	April 2010
U.S. dollar	90	82	83.3	86.8	89.9	88.0	86.6	84.9
Deutsche mark	27	39.6	36.1	30.1	–	–	–	–
Euro	(33)	(55.2)	(59.7)	(52.5)	37.9	37.4	37.0	39.1
Japanese yen	27	23.4	24.1	21.7	23.5	20.8	17.2	19.0
Pound sterling	15	13.6	9.4	11.0	13.0	16.5	14.9	12.9
All currencies	200	200	200	200	200	200	200	200

Note: Percentage shares of daily turnover.
Source: BIS (1999, 2010).

TABLE 2

Percentage Shares of Some Currency Pairs

	DM	Euro	Yen	UK£		
	1998	2010	1998	2010	1998	2010
Against U.S. dollar	20	27.7	18.5	14.3	8.2	9.1
Against DM	–	–	1.7	–	2.1	–
Against euro	–	–	–	2.8	–	2.7
Against others	10[a]	11.4	0.8	1.9	0.7	1.1
Total share	30	39.1	21.0	19.0	11.0	12.9

Notes: Percentage shares of global daily turnover.
[a]Of which 60% were against non-EMS currencies.
Source: BIS (1999, 2010), own calculations.

costs trigger a switch from indirect exchange to direct exchange, we should observe that all currencies are directly traded against each other.

While it is not completely impossible to directly exchange a particular currency against any other currency, in most cases, such a direct exchange will not take place. Rather, traders will use a "vehicle currency," such as the U.S. dollar. For instance, instead of exchanging Australian dollars into euros directly, traders will usually exchange Australian dollars into U.S. dollars and then U.S. dollar into euros. The explanation for this trading structure is simple. It is usually cheaper to use the U.S. dollar. Since the volume of trade is higher in the U.S. dollar–Australian dollar and the U.S. dollar–euro market, spreads are lower. Thus, two transactions can be cheaper than one.

Table 1 provides the trading shares of some major currencies. In the pre-euro period, the U.S. dollar could be found on one side of transactions accounting for 86.8% of daily turnover (1998). In the other 13.2% of transactions, the Deutsche mark (DM) figured prominently. This can probably be explained by the fact that the DM was the anchor currency in the European monetary system (EMS). DM and U.S. dollar together could be found in transactions that covered about 97% of the entire foreign exchange turnover (U.S. dollar share plus "DM against others"; see Tables 1 and 2). Even for heavily traded currencies, such as the Japanese yen and the UK pound, there are very few non-U.S. dollar/non-DM transactions (see Table 2).

So far, the introduction of the euro has not changed the picture. In April 2010, the market share of the U.S. dollar was 84.9%. Still, the euro does seem to have captured the status of a vehicle currency in a number of Northern European and Central and Eastern European countries. Overall, the combined share of the euro and the U.S. dollar is about 96.3% (U.S. dollar share plus "euro against others"; see Tables 1 and 2). Thus, there are only very few transactions that do not involve a vehicle currency.

The evidence from fx markets shows that although transaction costs are low in these markets, market participants use a common medium of exchange. Thus, there is hardly any "foreign exchange barter" in the foreign exchange market. This example shows that even if the current technical innovations are carried further, making retail payments as efficient as current wholesale transactions, it can be doubted that this would lead to the demise of the use of a common medium of exchange.

4. CONCLUSIONS

This paper provides a comparison of transaction costs in monetary and nonmonetary exchange environments. The focus of the analysis is on brokerage costs because some of the other costs, like technical costs of payer and payee, are likely to be the same for monetary and nonmonetary payments, and other costs, like "computational costs," are difficult to measure.[15]

Brokerage costs consist of "technical costs" (of market makers), opportunity costs, and the costs of adverse information. Technical costs are falling and are likely to full further. Thus, for a comparison of monetary and nonmonetary exchange, opportunity costs and the costs of adverse information will be increasingly important. Using a market microstructure model, it can be shown that in nonmonetary exchange, both types of costs are likely to be much higher than in monetary exchange. The main reason for the higher costs of nonmonetary exchange is that traders have to trade a larger number of different assets and at the same time face a lower volume of trading. Thus, they are less informed and trading involves higher risks and higher fixed costs per transaction.

While the current pace of financial innovation is clearly remarkable, it should not be overlooked that this innovation has mainly to do with the reduction of communication and technical processing costs. Of course, this also reduces transaction costs. However, it is erroneous to assume that a reduction of communication and technical processing costs toward zero reduces overall transaction costs to zero. Transaction costs also depend on many market characteristics such as the size of the market and the volatility of supply and demand. The use of a common medium of exchange that also functions as a unit of account is a way to increase the size of the market and make it more liquid. This reduces transaction costs—when communication costs are high and when they are low.

15. Inclusion of these costs would reenforce the results.

Thus, the notion that deregulation, innovation, and increased competition may eventually lead to a nonmonetary exchange system is not supported.

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