



POLICY DISCUSSION PAPERS

The 2007 Summer Workshop on Money, Banking and Payments: An Overview

By Ed Nosal and Randall Wright

DECEMBER 2007

NUMBER 23

POLICY DISCUSSION PAPER

The 2007 Summer Workshop on Money, Banking and Payments: An Overview

By Ed Nosal and Randall Wright

The 2007 Summer Workshop on Money, Banking, Payments and Finance met at the Federal Reserve Bank of Cleveland this summer, as we have over the past several years. The following document summarizes and ties together the contributions presented at the workshop this year.

Ed Nosal is a senior economic advisor at the Federal Reserve Bank of Cleveland and Randall Wright is the James Kim Professor of Economics at the University of Pennsylvania.

Materials may be reprinted, provided that the source is credited. Please send copies of reprinted materials to the editor.

POLICY DISCUSSION PAPERS

Policy Discussion Papers are published by the Research Department of the Federal Reserve Bank of Cleveland. To receive copies or to be placed on the mailing list, e-mail your request to 4dsubscriptions@clev.frb.org or fax it to 216-579-3050. Please send your questions, comments, and suggestions to us at editor@clev.frb.org.

Policy Discussion Papers are available on the Cleveland Fed's site on the World Wide Web: www.clevelandfed.org/Research.

Views stated in *Policy Discussion Papers* are those of the authors and not necessarily those of the Federal Reserve Bank of Cleveland or of the Board of Governors of the Federal Reserve System.

ISSN 1528-4344

Introduction

The 35 papers presented at this year's meeting can be broadly grouped into five topics: foundations, which involves work on relatively deep issues in monetary theory; central banking and monetary policy, which concerns applied issues more or less directly related to policy making; fiscal and monetary policy, which involves the interconnections between these two types of policy; financial intermediation and banking, which is concerned with intermediation in general and especially the roles of banks; and money and bonds, which considers the relation between two particular assets and asks how they interact.

Foundations

Quasilinear preferences are very convenient in several fields of economics, but especially in modern monetary economics. In "Stationarity and Degeneracy in a Commodity Money Model," Ricardo Cavalcanti and Daniela Puzzello take a step toward a better understanding of the role of quasilinearity by examining the implications of these preferences for optimal allocations in a theoretic analysis of an economy with commodity money. In the first stage, agents are randomly matched, with exogenous probabilities they are either producers or consumers in that match, and they then make decisions on whether or not to trade. In the second stage, agents part and decide to produce and consume a different (storable) good that can act as commodity money, although the storage technology is subject to shocks. Cavalcanti and Puzzello take an implementability approach. They find that the planner's problem can be reduced to a sequence of very simple (essentially static) problems. They also show that the distribution of money may or may not be degenerate, and that allowing buyers to make take-it-or-leave-it offers is optimal. Quasilinearity is the key to these results. The approach can be extended to more complex environments, and hence the tools they develop may prove quite generally applicable.

In "Competing Auctions in a Monetary Economy," Richard Dutu, Benoit Julien, and Ian King consider an economy where goods are allocated by ascending bid auctions, and sellers compete for buyers through the reserve price of their auction. The environment has several novel and interesting features. First, sellers decide on the quantity of the good to be auctioned. There is a trade-off for sellers between production costs and the expected number of buyers they attract. Also, sellers compete in both the posted quantity and the reserve price. Buyers choose how much money to bring to the market, which implies a trade-off between the cost of holding money and the expected gain from winning an auction. The model predicts that inflation cannot be too low or too high for a monetary equilibrium to exist and that increasing inflation decreases the equilibrium-posted quantity and the number of buyers. Efficiency is attained for the lowest

Stationarity and Degeneracy
in a Commodity Money Model

Ricardo Cavalcanti and
Daniela Puzzello

Competing Auctions in a
Monetary Economy

Richard Dutu, Benoit Julien,
and Ian King

possible inflation rate that is compatible with the existence of monetary equilibrium. This kind of work greatly extends our understanding of monetary economies because it shows how alternative mechanisms like auctions (and unlike bargaining or price posting, for example, as in most previous work) can be incorporated.

In “Counterfeiting as Private Money in Mechanism Design,” Ricardo Cavalcanti and Ed Nosal describe counterfeiting activity as the issuance of private money that is difficult to monitor. Their approach, which extends the basic random-matching model of money, allows a tractable welfare analysis of currency competition. They show that it is not efficient to eliminate counterfeiting completely, and argue that their model is consistent with the idea of imperfect monitoring. This kind of analysis aids our understanding of how money may work when it is possible to cheat the system by counterfeiting.

In “On the Uniqueness of Steady State Monetary Equilibrium in the Alternating Market Model of Money,” Randall Wright does the following. First, he presents a model that generalizes the one in Lagos and Wright, which is a very tractable framework for monetary theory and policy analysis, based on quasilinear preferences. Then he clears up the following loose end in previous analyses of these kinds of models: previously, only under rather severe conditions on bargaining or nonstandard assumptions on preferences and technology has it been known that a unique monetary steady state exists. Wright proves uniqueness without any conditions on bargaining or nonstandard assumptions on primitives. This is very useful, since many people are currently using the framework, and they have been previously forced to present only an incomplete characterization of steady states. Now one can say in these papers that the equilibrium being analyzed is unique. As a corollary, it is shown that the model implies monotone comparative statics for a wide class of parameter changes.

In “A Hotelling Model with Money,” Dean Corbae and Borghan Narajabad study how tastes and technology simultaneously determine product variety and the choice of exchange mechanism (e.g., money versus barter). They study the interaction between the exchange mechanism and product variety. The novel part of the analysis follows from the observation that the addition of more barter shops substitute for one another while the addition of more money shops actually complement one another. They solve for optimal incentive feasible allocations and implement the solution as a trading post economy.

In “One Money or Two Monies?” Mei Dong and Janet Hua Jiang show that having two monies (instead of just one) improves welfare in an environment with private information. They use a version of the Lagos-Wright model, where activities in each period occur over two sequential stages characterized by first centralized and then decentralized trade. At the beginning of each period, agents possess two layers of private information, which pertains to probability distributions over their taste and technology parameters. Agents sort themselves by choosing different monies before the realization of the shocks. The existence of a second money improves welfare because the sorting relaxes

Counterfeiting as Private Money in Mechanism Design

Ricardo Cavalcanti and Ed Nosal

On the Uniqueness of Steady State Monetary Equilibrium in the Alternating Market Model of Money

Randall Wright

A Hotelling Model with Money

Dean Corbae and Borghan Narajabad

One Money or Two Monies?

Mei Dong and Janet Hua Jiang

incentive-compatibility constraints associated with the private information about the taste parameter. This kind of theory greatly enhances our understanding of the kinds of institutions that work well under various types of frictions, including private information.

In “Markets and Relationships in a Learning Economy,” Luis Araujo and Raoul Minetti pursue a new explanation for the determination of market structure. Generally speaking, one can think of two basic structures under which exchange occurs. In one—transactions-based—agents engage in spot trades, and frequently break matches with current partners to match with new ones. In another—relationship-based—agents repeatedly exchange within a match. In many markets, some exchanges occur in each mode. The empirical structure of market exchange exhibits sharp cross-country variation, and it is sometimes argued that variations in the structure of markets can help explain cross-country differences in economic performance. Araujo and Minetti study the structure of the credit market that arises when agents must learn about aggregate productivity from market exchange. This kind of model allows one to relate credit market structure to macroeconomic fundamentals, such as the persistence and volatility of aggregate productivity, and hence may ultimately be useful for empirical or policy analysis.

Markets and Relationships in
a Learning Economy

Luis Araujo and Raoul Minetti

Central Banking and Monetary Policy

Economists working in the area of monetary theory and policy have had two goals. They have tried to formulate models of monetary policy in which money (currency) has a well-understood role. And they have hoped to find that optimal policy is guided by simple principles that are not too dependent on details of the model.

In “Optimal Central-Bank Intervention: An Example,” Alexei Deviatov and Neil Wallace study optimal policy in an example that satisfies the first goal but not the second. The ingredients of the example are: (i) heterogeneity in the degree to which different people are monitored; (ii) idiosyncratic shocks that give rise to heterogeneity in earning and spending realizations; and (iii) central-bank intervention in a credit market in which the participants are those who are heavily monitored. Ingredient (i)—the existence of people who are hardly monitored—gives rise to a role for money: those who are hardly monitored cannot get credit. The combination of (i) and (ii) produces the following problem: the hardly monitored are at times liquidity constrained, and at other times, they have so much liquidity that they have little incentive to earn more. Finally, (iii) implies that the connection between central-bank intervention and the liquidity problem is indirect because those who are hardly monitored are not participants in the market in claims. That accounts for why the example does not satisfy the second goal. Although (i)-(iii) are not controversial, there is no other analysis of optimal policy in the literature that rests on those ingredients. There are several reasons. First, only recently have models

Optimal Central-Bank
Intervention: An Example

Alexei Deviatov and
Neil Wallace

been formulated that augment (ii) with ingredients (i) and (iii). Second, because most models of central-bank intervention do not satisfy the first goal, the idea that central-bank activity should be geared to solving the economic problem implied by (i) and (ii) is not widely accepted. But perhaps it ought to be. Central banks have a monopoly on money. If money has a role because some people are imperfectly monitored, then it is not far-fetched to suggest that management of that monopoly should be directed at something closely related to what makes money important. Moreover, recall that central banks in several countries emerged as legally mandated monopoly issuers of banknotes from systems in which there were originally many private banks issuing notes. Given such a monopoly, there is a role for two arrangements that partially substitute for private note issue: trade in claims among the would-be issuers of private banknotes (something like a credit market); and central-bank participation in such trade. The model in this paper includes versions of those arrangements.

In “Adverse Selection and the Role of Monetary Policy,” Daniel Sanches and Steve Williamson discuss the following issue. When agents engage in monetary exchange, they may be imperfectly informed about the future trading opportunities of their trading partners. This creates an inefficiency relative to full information, and policy can potentially correct this distortion. Sanches and Williamson, following Lagos and Wright, assume agents alternate between centralized and decentralized exchange. However, centralized markets are segmented and, as a result, the value of money will be different in each location. In decentralized exchange, agents are bilaterally matched and contracts are distorted due to private information. When the central bank is able to intervene in both locations, the Friedman rule can correct all frictions. When financial trade is allowed across locations in the centralized market, prices are equalized and the Friedman rule can again work. However, when the central bank is constrained to intervene in only one location, the Friedman rule is in general not feasible and it is not generally possible to eliminate the frictions entirely.

In “Public Information and Monetary Policy,” Marie Hoerova, Cyril Monnet, and Ted Temzelides study monetary policy in a model where uncertainty can lead to a discrepancy between agents’ beliefs and true fundamentals. Following the work of Morris and Shin, the key feature is that investment decisions are subject to a “beauty contest” element: additional consumption is more beneficial if other agents also consume more of the good. The model departs from Morris and Shin’s static approach by introducing an infinite time horizon and making money essential. The spatial separation of agents prevents prices from being fully revealing, and allows the authors to study the interplay between monetary and informational frictions. A central assumption in the model is that monetary policy is the only way for the central bank to credibly transmit its information about fundamentals. The model offers an information-based argument for the idea that higher nominal rate hikes occur less frequently than lower ones.

Adverse Selection and the Role of Monetary Policy

Daniel Sanches and Steve Williamson

Public Information and Monetary Policy

Marie Hoerova, Cyril Monnet, and Ted Temzelides

In “Central Bank Design with Heterogeneous Agents,” Aleksander Berentsen and Carlo Strub study alternative decision-making models for the determination of monetary policy. They consider a model where agents have either a high or a low utility from consumption. The main consequence of this heterogeneity is that there is a two-point distribution of money holdings and, therefore, monetary policy has redistributive effects. Simple majority voting, supermajority voting, a policy board, and other mechanisms for determining policy are compared. The social planner’s desired policy is the Friedman rule. This can be attained if, under simple majority voting, the agents with low-inflation preferences have the majority. Under bargaining, the first-best can only be attained when transfers are feasible. Under all other central bank designs the equilibrium outcome does not attain the first-best. One interesting result is that when there are two separate economies, one populated by agents with low preferences for consumption and the other by agents with high preferences for consumption, each prefers the Friedman rule. If these two economies form a monetary union, however, then a deviation from the Friedman rule can occur.

Central Bank Design with
Heterogeneous Agents

Aleksander Berentsen and
Carlo Strub

In “Uncertainty, Inflation and Welfare,” Jonathan Chiu and Miguel Molico study the costs and the redistributive effects of inflation in the presence of partially-insurable idiosyncratic risk. Building on Lagos and Wright, the model emphasizes two empirically plausible features. First, economic agents face idiosyncratic uncertainty regarding productivity, preferences, and trading opportunities. Second, agents are unable to fully insure against such risk. These features introduce a technical challenge, since to solve the model, one must keep track of the distribution of money holdings (note they generalize the standard model by relaxing the assumption of quasilinear preferences). The model is calibrated and solved computationally. They find that the long-run welfare costs of low and moderate inflations are on average 40% smaller than predicted by a complete-market model. This style of work greatly enhances the class of models we can study by showing how to solve much more complicated environments that we usually analyze on the computer.

Uncertainty, Inflation and
Welfare

Jonathan Chiu and Miguel
Molico

In “Elastic Money, Inflation, and Interest Rate Policy,” Allen Head and Junfeng Qiu study optimal monetary policy in an environment where aggregate shocks affect individual agents asymmetrically, and exchange may be conducted using either bank deposits (inside money) or fiat currency (outside money). By controlling interest rates, the monetary authority can affect the price level and consumption, thus providing insurance against unfavorable shocks. The paper thus links two principal components of monetary policy: an interest-rate-based stabilization policy and an optimal long-run inflation rate. Assuming aggregate shocks affect agents differently, the inability of some agents to perfectly insure generates an essential role for money and opens up the possibility that monetary policy may improve welfare. Under the optimal policy, the central bank, together with the private banking system, may help insure against unanticipated shocks.

Elastic Money, Inflation, and
Interest Rate Policy

Allen Head and Junfeng Qiu

In “The Optimal Inflation Target in an Economy with Limited Enforcement,” Gaetano Antinol., Costas Azariadis, and James Bullard formulate the central bank’s problem of selecting an optimal long-run inflation rate as the choice of a distorting tax. Households are divided into cash agents who store value in currency alone, and credit agents who have access to both currency and loans. The planner’s problem is equivalent to choosing inflation and nominal rates consistent with a resource constraint, along with an incentive constraint that ensures credit agents do not default on obligations. In this environment, deflation may not be feasible since it subsidizes currency at the expense of loans, leading credit agents to default. An inflation rate higher than the minimum required to slacken debt constraints is equivalent to a distortionary income transfer from cash agents to credit agents. With a little imagination, one can potentially interpret these findings as consistent with the “comfort zones” articulated by some central banks.

In “Information Aggregation and Central Bank Communication,” Pierre-Olivier Weil and Manuel Amador consider a monetary economy with no explicit microfoundations (they use a cash-in-advance constraint), but model carefully uncertainty about the value of aggregate productivity. Information is initially dispersed among households, and households learn by observing the distribution of nominal prices. This distribution, however, will not fully reveal productivity because prices are affected by the unknown level of the money supply. When the central bank discloses information about money, it has a direct beneficial effect since households can extract more information about productivity. But there is also a countervailing effect: after an announcement, households rely more on public and less on private information, and this tends to reduce the informational content of prices. It is shown that, in some circumstances, a policy announcement can reduce welfare. Whether this is empirically relevant in practice is an open issue, but it is important to see how these kinds of effects can arise in principle.

High-inflation economies often experience reductions in quantity and variety in the marketplace. Previous models explain the first phenomenon, but not the second. In “Inflation and Variety,” Mei Dong endogenizes the effect of inflation on both quantity and variety. Two market structures for decentralized trade are considered: bargaining and competitive search. For both market structures, inflation reduces quantity per trade and variety. The bargaining outcome entails a double holdup problem, since firms make ex ante investments in variety, and consumers make ex ante investments before being matched. The terms of trade are generally inefficient due to both the inflation and bargaining distortions. The Friedman rule is the optimal policy but is unable to achieve simultaneously the efficient quantity and variety under bargaining. In contrast, in competitive search equilibrium the Friedman rule achieves the efficient allocation. The model is calibrated and used to measure how much of the welfare cost of inflation can be traced back to a reduction of variety, and how much to a reduction in quantity.

The Optimal Inflation Target
in an Economy with Limited
Enforcement

Gaetano Antinol., Costas
Azariadis, and James Bullard

Information Aggregation and
Central Bank Communication

Pierre-Olivier Weil and Manuel
Amador

Inflation and Variety

Mei Dong

In “Welfare-Improving Departures from the Friedman Rule,” Ed Nosal discusses the following. If a departure from the Friedman rule is to be socially optimal, there must exist some kind of counterbalancing benefit associated with holding a non-interest-bearing asset. The literature has offered some potential benefits. Nosal identifies a new avenue. The basic idea is that if there is an option value associated with putting off the purchase of certain kinds of goods, then individuals may be “too choosy” when purchasing these goods. For example, individuals may spend too much time shopping for an illiquid durable, such as a used car, in hopes of finding a better car tomorrow. Since it is costly to hold money, a non-zero interest rate will make people less choosy in terms of the goods that they purchase, and this, in turn, can increase social welfare.

Welfare-Improving
Departures from the
Friedman Rule

Ed Nosal

Fiscal and Monetary Policy

In models of monetary exchange, where prices are determined by bargaining, output tends to be too low. The introduction of production subsidies is, therefore, a natural idea. In “Optimal Monetary and Fiscal Policies in a Search-Theoretic Model of Monetary Exchange,” Pere Gomis-Porqueras and Adrian Peralta-Alva investigate whether sales taxes and production subsidies, in conjunction with a monetary policy, can restore efficiency. They find production subsidies, and taxes are able to improve the allocation. There are multiple combinations of taxes, subsidies and (sometimes strictly positive) inflation rates that yield efficiency. When government expenditures are positive, the optimal policy must trade off inflation with tax distortions. Although the efficient allocation cannot be achieved in this case, there are large welfare gains associated with having good fiscal and monetary policies in place.

Optimal Monetary and Fiscal
Policies in a Search-
Theoretic Model of Monetary
Exchange

Pere Gomis-Porqueras and
Adrian Peralta-Alva

When there is a trade-off between the number of transactions (the extensive margin) and the quantity of goods exchanged in each trade (the intensive margin), the Friedman rule may be suboptimal. However, if the government has additional instruments, such as those associated with fiscal policy, the optimality of the Friedman rule may be restored. In “The Optimum Quantity of Money Revisited: Distortionary Taxation in a Search Model of Money,” by Moritz Ritter, a distortionary tax is introduced into a monetary search model. The introduction of an additional policy instrument does not resurrect the optimality of the Friedman rule, since inflation plays a special role in altering agents’ search decisions. Deviating from the Friedman rule also increases the effectiveness of sales taxes, because an increase in the tax tightens an already binding money constraint.

The Optimum Quantity
of Money Revisited:
Distortionary Taxation in a
Search Model of Money

Moritz Ritter

A growing body of evidence suggests that ongoing relationships between consumers and firms may be important for understanding price dynamics. In “Optimal Fiscal and Monetary Policy in Consumer Markets,” David Arseneau and Sanjay Chugh investigate whether the existence of such customer relationships has important consequences for the conduct of long-run and short-run policy. They explore this question using the

Optimal Fiscal and Monetary
Policy in Consumer Markets

David Arseneau and
Sanjay Chugh

Ramsey framework of optimal policy, in the tradition of Lucas and Stokey. A central result is this: when consumers and firms are engaged in long-term relationships, optimal inflation volatility is very low even though all prices are completely flexible. This finding contrasts with the standard perception from Ramsey models based on Walrasian markets. Echoing the basic intuition of models based on sticky prices, unanticipated inflation in Arseneau and Chugh's environment causes a type of relative price distortion, which stems from fundamental trading frictions that give rise to long-lived customer relationships. All of this research shows it can be very important to consider how fiscal and monetary policies interact and hence ought not be studied only in isolation.

Financial Intermediation and Banking

In "Financial Deepening, Inflation, and Economic Growth," Aleksander Berentsen and Shouyong Shi develop a general equilibrium framework to analyze the relationship between the operation of the financial system, monetary policy, and growth. The financial sector, the innovation sector, and the production sector compete for labor. Hence, changes in policy affect the allocation of time and therefore growth. They first investigate the dynamic interactions between financial development and growth by analyzing how financial innovation affects growth, and, in turn, how growth affects the financial system. They then study how inflation affects financial deepening and growth. They calibrate their model to U.S. data, and perform two quantitative experiments. First, they measure the welfare gains that arise from an exogenous reduction of the cost of intermediation. Second, they assess the welfare effects of a permanent reduction of the inflation rate. A number of empirical studies suggest that excessive inflation, even if anticipated, impairs the performance of financial markets. Researchers have highlighted three regularities: there is cross-section evidence of a negative association between long-run inflation and financial activities; the marginal impact of inflation diminishes rapidly; and there is a discrete drop in activity at high inflation levels.

In "Inflation and Intermediation Frictions," Gabriele Camera presents a theory of the inflation-finance relationship, whose predictions are consistent with these observations. He adds intermediation to the Lagos and Wright model of money. Some features of his model are: cash is needed to support trade on input and output markets; producers need short-term credit for working capital; and intermediation is costly. He shows how inflation, even at modest levels, can degrade the asset transformation process performed by financial intermediaries, which can disrupt financial and real activities if inflation is high.

In "Banks, Liquidity Insurance, and Interest on Reserves in a Matching Model of Money," Valerie Bencivenga and Gabriele Camera introduce banks as in Diamond-Dybvig into Lagos-Wright. Each period, an agent experiences a private shock before entering the decentralized market, which determines if he is a buyer or a seller, and if he is a buyer,

Financial Deepening,
Inflation, and Economic
Growth

Aleksander Berentsen and
Shouyong Shi

Inflation and Intermediation
Frictions

Gabriele Camera

Banks, Liquidity Insurance,
and Interest on Reserves in
a Matching Model of Money

Valerie Bencivenga and
Gabriele Camera

whether marginal utility is high or low. A bank is a coalition of agents that accepts deposits in the centralized market, holds some reserves of cash to meet withdrawal demand in the decentralized market, and invests the rest. Agents alter their money holdings by making withdrawals in the decentralized market at a fixed cost. Since banks cannot observe the realization of the shocks, bank contracts must be incentive compatible. Banks improve welfare if the cost of withdrawals is not too large. When the cost is small the optimal deposit contract allows agents to achieve the allocation in the decentralized market they would have chosen if they had known the realization of shock prior to choosing their asset position.

In “The Venture Capital Cycle,” Rafael Silveira and Randall Wright propose a model of private equity, which builds on recent developments in search theory. First they describe how the venture capital market is in reality characterized by the following cycle: (i) first capitalists raise funds; (ii) capitalists and entrepreneurs match over time, and decisions are made as to which projects get funding; (iii) after matching, both parties take active roles in implementation; (iv) when eventually a project matures, capitalists take their profits and leave to start the cycle anew. The authors model this rigorously yet with an eye toward a realistic description of institutional details. They analyze various margins, including entry by capitalists, the flow of funds into the market, the decisions to start new ventures, and investment in the project during implementation. They study the duration of each phase in the cycle and the returns to the parties. The model is tractable, and it is easy to prove strong results concerning existence, comparative statics, etc. The implications for policy on this market are discussed. This is part of a large recent body of research trying to integrate finance with search-theoretic models in macro and monetary economics.

Jonathan Chiu and Cesaire Meh, in “Banking, Liquidity and Inflation,” extend the analysis of Silveira and Wright by considering the role that financial intermediaries may play in the funding of projects. They show that financial intermediation improves the allocation but the welfare effects depend on monetary policy. For low inflation, intermediation is not useful; for moderate inflation rates, it is useful to individuals but actually reduces aggregate welfare; and for high inflation intermediation improves aggregate welfare. Absent financial intermediaries, capitalists need to bring liquidity to the market to purchase ideas for new projects. Since innovators who sell ideas have random reservation prices, some entrepreneurs end up with too much liquidity and others end up with too little. This problem is mitigated by having an intermediary that channels funds across entrepreneurs.

Banking panics have been associated with price declines in both the United States and Japan. Fisher hypothesized that banking panics are a consequence of mismatches in bank balance sheets, where liabilities are nominal and assets are real. Because of this, a decrease in the price level raises the real value of existing nominal obligations but has

The Venture Capital Cycle

Rafael Silveira and
Randall Wright

Banking, Liquidity and Inflation

Jonathan Chiu and
Cesaire Meh

no effect on the real value of assets and, hence, decreases bank value. In “Banking and Intermediation,” Francesca Carapella develops a model to analyze this hypothesis. In the model banks play two roles: they lend to firms, and they contribute to the payment system by providing an alternative to outside money. If banks default, this alternative is lost and all purchases must be in cash. In this event, the demand for cash increases and, consequently, prices fall. Carapella shows that there exists an equilibrium that features lower prices when banking panics and defaults occur. The environment is suitable for analyzing policy similar to that suggested by Friedman and Schwartz, whose insight was that during the Depression looser monetary policy may have helped.

In “Moneychangers and Commodity Money,” Vincent Bignon and Richard Dutu address the issue of the imperfect recognizability in a commodity money system. They construct a model that has light and heavy metal coins, imperfect recognizability, and a technology that enables agents to have their coin assessed and certified. They show that such a technology reduces the set of equilibria where heavy coins are not traded when they are not recognized as heavy, a version of Gresham’s law. Also, they show that Gresham’s law and certification cannot coexist as equilibria. They show that welfare is higher when heavy coins are certified. The technology also restricts the set of equilibria characterized by circulation of light and heavy coins trading at the same price when not recognized. However, circulation-by-tale survives for high discount rates. This kind of work not only aids our understanding of historical episodes, it also helps us to think about modern issues like the possibility or desirability of private monies.

There are numerous historical episodes in which individuals complained about there being a shortage of small coins. The lack of small change appears to have caused the following problem. In order to complete a purchase, a buyer has to pay too much or forgo the transaction altogether. In “A Model of Small-Change Shortages,” Angela Redish and Warren Weber build a matching model with two indivisible commodity monies. This takes seriously the idea that monies are coins with different intrinsic values. Both the case in which the supplies of silver and gold available for coinage are fixed and the case in which minting and melting are permitted are examined. For the case in which the supplies of the two metals are fixed, there exist equilibria in which both monies are used for trades and the lower-valued money is used to make change in some transactions. Increasing the supply of small coins can improve welfare. These findings are consistent with the historical complaints about small-change shortages, and, again, also help us to think about modern issues in monetary economic theory and policy.

Self-regulatory organizations, or SROs, play an important role in the securities industry. While self-regulation is viewed as having advantages over direct regulation, this view can be questioned. The incentive to self-regulate may be reduced as competition for listing and trading volume among organizations (exchanges) increases. In “Competition among Exchanges and Enforcement Policy,” Cecilia Caglio and Andrea Pescatori explore

Moneychangers and Commodity Money

Vincent Bignon and Richard Dutu

A Model of Small-Change Shortages

Angela Redish and Warren Weber

Competition among Exchanges and Enforcement Policy

Cecilia Caglio and Andrea Pescatori

this idea. They ask whether the presence of multiple for-profit SROs results in lax self-regulation as a means of attracting business, and what effect enforcement policy has on the division of rents. A costly-state-verification model is developed where SROs compete by setting enforcement policy and transaction fees. Transactions are executed by brokers, but investors do not observe cash flow, and brokers try to minimize payments by misreporting true flows. An investigation can occur when a transaction takes place, and the likelihood of a successful investigation depends upon the amount of resources invested and the efficiency of monitoring. If fraud is detected, the SRO imposes a penalty on the broker. It is shown that competition among for-profit SROs generates a “race to the bottom” for enforcement, which ultimately reduces SRO profits and increases broker profits.

Money and Bonds

When agents face binding cash constraints, the introduction of illiquid bonds may improve the monetary allocation. In “The Societal Benefits of Outside versus Inside Bonds,” Aleksander Berentsen and Christopher Waller study the case in which the allocations of illiquid outside bonds and inside bonds are different, and examine optimal policy. A model in the spirit of Lagos and Wright is constructed with money and bonds. Two economies are considered: one with illiquid government bonds and one with inside bonds. Consumers receive preference shocks, which create differential needs for liquidity; after shocks occur but before goods markets open, they trade bonds and money. It is assumed that the government cannot run a deflation since this requires lump-sum taxation. It implies that, with inside bonds, redemption must be voluntary. It is shown that for any positive inflation rate, bonds are essential in both economies. For sufficiently high inflation rates, the allocations in the two economies are the same, while they differ for low inflation rates. The key result is that, under an optimal policy, the allocation with illiquid outside bonds dominates the allocation with inside bonds.

In “Sustained Societal Benefit of Illiquid Bonds,” Ling Sun also studies whether allocative efficiency can be improved by introducing illiquid bonds. Households are heterogeneous, which creates a need for intratemporal consumption smoothing. Since consumers and producers from the same households go to different locations to participate in market activities, money is essential to facilitate trade. When bonds are perfectly liquid, they are perfect substitutes for money and, hence, their rates of return are the same. The allocation in this case is not efficient since marginal utilities of consumers are not equated. Introducing illiquid bonds enables households to engage in intratemporal consumption sharing. Introducing illiquid bonds generates an improvement in efficiency in two ways: by better allocating consumption goods among heterogeneous agents, and by stimulating output by loosening liquidity constraints.

The Societal Benefits of
Outside versus Inside Bonds

Aleksander Berentsen and
Christopher Waller

Sustained Societal Benefit of
Illiquid Bonds

Ling Sun

Much of what passes for money in any well-developed economy is private debt. An almost universal property of private debt instruments is that they are collateralized by some form of capital. It would seem desirable to study environments in which capital can be used to collateralize private debt and collateralized debt can serve as a means of payment. The challenge would be to explain why .at money remains essential, and why agents make good on debt contracts. To this end, in “Money, Capital, and Collateral,” David Andolfatto and Fernando Martin employ a simple assumption that agents can commit to honor debt only up to some value related to their accumulated stock of capital. When constraints are slack, money is inessential. When collateral constraints bind, however, money expands the set of feasible trades. Away from the Friedman rule, both private debt instruments and .at money are essential, with both assets earning an identical return. Hence, when collateral constraints bind, there is an insufficient supply of private money. Collateral constraints become less important at lower rates of inflation.

In “Collateral Secured Loans in a Monetary Economy,” Leo Ferraris and Makoto Watanabe also present a model where anonymous agents use capital goods as a guarantee of repayment. The environment is a version of Lagos-Wright with a competitive credit market. Since monitoring or enforcement is unavailable, agents can obtain loans only by committing capital as collateral. Two situations can arise in equilibrium: one is where the borrowing constraint does not bind, and capital is at the first-best level; the other is where the constraint binds, and capital is too high. The effect of inflation on investment is determined by the marginal net benefit of making a loan relative to that of money holdings. They show, for example, that capital accumulation is decreasing in the rate of inflation if and only if relative risk aversion is below unity.

In “Optimal Risk-Sharing without Commitment in a Model where Money and Collateral are Essential,” David Mills and Robert Reed provide an environment in which collateral arises endogenously, alongside money, to support trade. The new twist is that collateral serves two roles: the first is to provide incentives for borrowers to pay back loans; and the second is to provide insurance for lenders in the event that borrowers default. In order to have both roles, the environment adopts the following features. There are two types of agents, who differ in preferences, endowments, and investment technologies, motivating the need for credit. In order to capture the incentive role for collateral, agents cannot commit to future actions. A tension between two incentive constraints pins down the optimal amount of collateral, such that borrowers with the ability to repay are just indifferent between defaulting or not, while lenders are indifferent between selling the collateral back and liquidating.

In “On the Term Structure of Real Interest Rates and Inflation: Empirical Evidence using Inflation Forecasts,” Joseph Haubrich, George Pennacchi, and Peter Ritchken develop and test a four-state-variable model of the dynamics of the term structure. The state variables correspond to a real interest rate, expected inflation, inflation volatility,

Money, Capital, and Collateral

David Andolfatto and
Fernando Martin

Collateral Secured Loans in a Monetary Economy

Leo Ferraris and
Makoto Watanabe

Optimal Risk-Sharing without Commitment in a Model where Money and Collateral are Essential

David Mills and Robert Reed

On the Term Structure of Real Interest Rates and Inflation: Empirical Evidence using Inflation Forecasts

Joseph Haubrich, George
Pennacchi, and Peter Ritchken

and a stochastic central tendency to which the inflation rate reverts. Expected inflation, its central tendency, and the real rate follow correlated mean-reverting processes whose volatilities are proportional to the volatility of inflation. In turn, actual inflation follows a correlated GARCH process. Analytical solutions for the term structure of nominal bond prices are developed. Analytical solutions for prices of inflation-indexed bonds that have an indexation lag, such as U.S. Treasury Inflation-Protected Securities, are derived. The model can use survey forecasts of inflation, together with price indices and nominal bond yields, to establish a coherent model of the dynamics of the term structure. It also can be used to obtain estimates for real rates, for long rate changes, and so on, and is rich enough to price Treasury Inflation-Protected Securities, including the indexation lag.

Papers Presented at the Summer Workshop on Money, Banking, and Payments

August 6–17, 2007

Foundations

Stationarity and Degeneracy in a Commodity Money Model

Ricardo Cavalcanti and Daniela Puzzello

Competing Auctions in a Monetary Economy*

Richard Dutu, Benoit Julien, and Ian King

Counterfeiting as Private Money in Mechanism Design

Ricardo Cavalcanti and Ed Nosal

On the Uniqueness of Steady-State Monetary Equilibrium in the Alternating Market Model of Money

Randy Wright

A Hotelling Model with Money*

Dean Corbae and Borghan N. Narajabad

One Money or Two Monies?

Mei Dong and Janet Hua Jiang

Markets and Relationships in a Learning Economy*

Luis Araujo and Raoul Minetti

Central Banking and Monetary Policy

Optimal Central-Bank Intervention: An Example

Alexei Deviatov and Neil Wallace

Adverse Selection and the Role of Monetary Policy*

Daniel Sanches and Steve Williamson

Public Information and Monetary Policy*

Marie Hoerova, Cyril Monnet, and Ted Temzelides

Central Bank Design with Heterogeneous Agents

Alex Berentsen and Carlo Strub

Uncertainty, Inflation, and Welfare

Jonathan Chui and Miguel Molico

Elastic Money, Inflation, and Interest Rate Policy

Allen Head and Junfeng Qiu

The Optimal Target in an Economy with Limited Enforcement

Gaetano Antinolfi, Costas Azariadis, and James Bullard

Information Aggregation and Central Bank Communication

Pierre-Oliver Weil and Manuel Amador

Inflation and Variety

Mei Dong

Welfare-Improving Departures from the Friedman Rule

Ed Nosal

Fiscal and Monetary Policy

Optimal Fiscal and Monetary Policies in a Search-Theoretic Model of Monetary Exchange

Pere Gomis-Porqueras and Adrian Peralta-Alva

The Optimum Quantity of Money Revisited: Distortionary Taxation in a Search Model of Money*

Moritz Ritter

Optimal Fiscal and Monetary Policy in Customer Markets*

David Arseneau and Sanjay Chugh

Financial Intermediation and Banking

Financial Deepening, Inflation, and Economic Growth

Aleksander Berentsen and Shouyong Shi

Inflation and Intermediation Frictions

Gabriele Camera

Banks, Liquidity Insurance, and Interest on Reserves in a Matching Model of Money

Valerie Bencivenga and Gabrielle Camera

The Venture-Capital Cycle

Rafael Silveira and Randy Wright

Banking, Liquidity, and Inflation

Jonathan Chui and Cesaire Meh

Banking and Intermediation*

Francesca Carapella

Moneychangers and Commodity Money*

Vincent Bignon and Richard Dutu

A Model of Small-Change Shortages*

Angela Redish and Warren Weber

Competition among Exchanges and Enforcement Policy

Cecilia Caglio and Andrea Pescatori

Money and Bonds

The Societal Benefits of Outside versus Inside Bonds*

Aleksander Berentsen and Christopher Waller

Sustained Societal Benefit of Illiquid Bonds

Ling Sun

Money, Capital, and Collateral*

David Andolfatto and Fernando Martin

Collateral-Secured Loans in a Monetary Economy*

Leo Ferraris and Makoto Watanabe

Optimal Risk-Sharing without Commitment in a Model where Money and Collateral Are Essential

David Mills and Robert Reed

On the Term Structure of Real Rates and Inflation: Empirical Evidence Using Inflation Forecasts

Joseph G. Haubrich, George Pennacchi, and Peter Ritchken

*posted on <http://www.clevelandfed.org/research/conferences/2007/august/index.cfm>.



papers

FEDERAL RESERVE BANK OF CLEVELAND
RESEARCH DEPARTMENT
P.O. BOX 6387
CLEVELAND, OHIO 44101

Presorted Standard

U.S. Postage Paid
Cleveland, OH
Permit no. 385

Return Service Requested:
Please send corrected mailing
label to the Federal Reserve
Bank of Cleveland, Research
Department, P.O. Box 6387,
Cleveland, Ohio 44101.