# Evil Is the Root of All Money

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A traditional view of money is that it lubricates trade when there is no double coincidence of wants. The classic example, due to Knut Wicksell (1934), has three types of agents, and three physically distinct commodities. Type I wants a commodity supplied by type II, type II wants a commodity supplied by type III, and type III wants a commodity supplied by type I. Thus, no pair of agents wants each other's commodity. In the absence of a well-functioning market, money allows the agents to trade bilaterally: an agent accepts money not for its own sake, but because he can exchange it for what he wants. One of the three commodities could serve as money; or an outside object, such as fiat money, might be used.

To justify why the agents cannot simply trade their commodities through a market, there must be some physical trading friction. Search or matching frictions are often invoked, but unfortunately noncompetitive models of this kind, though ingenious and elegant, are difficult to incorporate into a standard macroeconomic framework. Moreover, to us, it is not clear that physical trading frictions are indispensable to monetary theory.

## I. Two $\theta$'s: Borrowing and Resalability Constraints

Our approach to modeling money places limited *commitment* center stage, rather than physical trading frictions. We assume a perfectly competitive environment where agents freely meet and trade in a marketplace, but debtors who issue IOUs (paper) cannot necessarily pledge all of their future income. For moral-hazard reasons, there may be an upper bound, $\theta_1$, say, on the fraction of future income that a debtor D can credibly commit to repay.

We also place emphasis on limits to the *resalability,* or negotiability, of paper. In the *ex ante* market, D is free to issue his paper to any of many potential creditors, promising to make a future delivery (up to D's commitment limit). But between the date of issue and the date of delivery, an initial creditor C may not be able to resell D's paper on to a third party, C′, at least not quickly, at a fair price. For example, after the date of issue, C may have privately learned something about D, and adverse selection causes the market for "second-hand" paper to break down. Alternatively, it may take time for a new creditor C′ to verify the authenticity of the paper; or the outsider C′ may be less able than the insider C to enforce D's promise, insofar as D gets locked in with C *ex post.* Whatever the reason (asymmetric information, delay in verification, or special leverage), the conclusion is broadly the same: after D's paper has been initially issued, it may not be fully liquid. At one extreme, where the paper cannot be resold, D in effect makes only a *bilateral* commitment, to deliver to the agent who buys his paper at the date of issue. At the other extreme, where the paper is perfectly resalable, D makes a *multilateral* commitment, to deliver to any bearer of his paper, and the paper can circulate. Let $\theta_2$ be an indicator of resalability: $\theta_2$ equal to 0 corresponds to paper that cannot readily be resold; $\theta_2$ equal to 1 corresponds to paper that can. The mnemonic is that the subscript 1 on $\theta_1$ corresponds to the initial sale of paper, and the subscript 2 on $\theta_2$ corresponds to a subsequent resale.

The two constraints need to be thought about separately. The first constraint, the borrowing constraint, has received attention in the macroeconomics literature. A number of moral-hazard stories have been invoked to rationalize why people face borrowing constraints. The second

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constraint, the resalability constraint, has received much less attention in the formal literature, but we think is just as important.[1]

## II. A Three-Date Example

We see the lack of double coincidence of wants as an essential part of any theory of money, but not necessarily over physically distinct commodities. Rather, the emphasis can be on dated goods. Consider an intertemporal version of Wicksell's triangle, with three dates, 1, 2 and 3, and a single, non-storable good at each date. There are three types of agents (I, II and III) with an equally large number of each type. An agent of type I wants to consume goods at date 1 but is endowed with date-3 goods. An agent of type II wants to consume goods at date 2 but is endowed with date-1 goods. An agent of type III wants to consume goods at date 3 but is endowed with date-2 goods.

Now, to overcome the lack of double coincidence of wants, it is enough to suppose that each type-I agent can make a full bilateral commitment to deliver date-3 goods to someone who buys his paper at date 1, and that each type-III agent can make a similar commitment to deliver date-2 goods (i.e., it is enough to suppose that $\theta_1$ equals 1 for each agent of types I and III). In the date-1 market, everyone trades their endowment for what they want, and the first-best is achieved. After date 1, there is no need for markets to reopen, because there are no further gains from trade. In particular, the type-III agents who purchase type-I agents' paper at date 1 hold on to it until it matures at date 3. It does not matter whether this paper is resalable at date 2, since there is no need for it to be resold.

In short, if there are no borrowing constraints then an Arrow-Debreu market that opens only at date 1, achieves a first-best allocation.[2] If everyone's $\theta_1$ equals 1, the values of $\theta_2$ are irrelevant.

This is no longer true if there is less than full bilateral commitment. To illustrate what might happen, let us make the stark and asymmetric assumption that, although each type-I agent can make a full bilateral commitment to deliver at date 3, type-III agents default on any promise to deliver at date 2. In other words, $\theta_1$ equals 1 for type-I agents but equals 0 for type-III agents.

Now the question of resalability matters. Suppose type-I agents can make only bilateral commitments. That is, suppose their paper cannot be resold: their $\theta_2$ equals 0. Then the economy collapses to autarky, because type-III agents have nothing to offer at date 1, and type-I agents cannot sell their paper to type-II agents who do not want date-3 goods. We assume that everyone gets a small benefit from consuming their endowment; there are no gifts.[3]

The situation is rescued, though, if type-I agents can make multilateral commitments, so that their paper can be resold: their $\theta_2$ equals 1. Markets open at dates 1 *and* 2. Initially, at date 1, type-II agents use their endowments of goods to buy type-I agents' paper promising to deliver (to the bearer) date-3 goods. Then, at date 2, type-II agents resell this paper to type-III

[1] Our approach is related to the long tradition of modeling money and liquidity in economies with transactions costs (see Joseph Ostroy and Ross Starr, 1990).

[2] The date-1 market need not be centralized through an auctioneer. Instead agents can make bilateral deals: type-II agents use their endowment to buy paper from type-III agents, who in turn use these goods to buy paper from type-I agents. In the absence of any physical trading frictions, though, there is no need to examine the trading mechanism in this much detail.

[3] We also assume that, although a type-I agent can make a (bilateral) commitment to deliver his own date-3 endowment, he cannot commit to deliver anyone else's endowment, in particular, a type-III agent's date-2 endowment. If he were able to make such a commitment, the first-best could be achieved by means of the following trades. At date 1, type-II agents trade their endowments for promises by type-I agents to deliver at date 2. At date 2, type-III agents trade their endowments for promises by type-I agents to deliver at date 3; and then type-I agents use these goods to redeem their promises to type-II agents. Finally, at date 3, type-I agents use their endowments to redeem their promises to type-III agents. In effect, the type-I agents are acting as middlemen: all trades are conducted through them. To rationalize why a type-I agent can commit to deliver his own goods but not anyone else's, consider an economy in which "endowments" are in fact returns on physical assets, and the agent can commit to deliver (at least part of) the return on his own assets by offering the assets as security: if he defaults, his creditors can seize them. However, he cannot offer other people's assets as security. This is the basis for the stationary production economy we discuss in Section III.

agents, in exchange for goods. Finally, at date 3, the paper is redeemed: type-III agents collect goods from type-I agents. Everyone ends up with what he wants, and the first-best is achieved.

The type-II agents do not buy the type-I agents' paper at date 1 because they intend to keep it until maturity at date 3: they do not want to consume date-3 goods. Rather, they buy it because they expect to resell it at date 2. The paper acts as *inside money:* privately issued securities used as a medium of intertemporal exchange. It provides *liquidity,* the means of short-term saving: by type-II agents between dates 1 and 2, and by type-III agents between dates 2 and 3.

Notice that, thanks to the resalability of the type-I agents' paper, the fact that type-III agents cannot be trusted is not a problem, because at date 2 they pay for their purchases of paper using their endowments of goods, in a spot transaction.

This illustrates a very general idea. The power of one agent to make a multilateral commitment can substitute for a lack of trust in other agents. We believe that this is the key to explaining why the circulation of inside money can be essential to the smooth running of an economy.[4]

The question of trust arises so sharply in this example because we have switched from physically distinct commodities to dated goods—from the type dimension to the time dimension. In Arrow-Debreu, these two dimensions are treated on a par: trust is ignored. Implicitly, it is assumed either that all economic agents are entirely trustworthy or that the auctioneer has adequate power to enforce all promises.

We think that factoring in a lack of trust, placing a limitation on the degree of commitment, is of primary importance. In particular, we think that it is a fruitful starting point for a theory of money. Hence the title of this paper: "Evil Is the Root of All Money." Evil is a strong word. If the moral category is thought too severe for something as mild as breaking a promise, then the title might be changed to "Distrust Is the Root of All Money" (see Douglas Gale, 1982 [chapters 6 and 7]).

## III. A Stationary Model

From the above three-date, deterministic example we learn that a theory of money (inside money) need not depend on an infinite horizon, or on the presence of uncertainty.

That said, the three-date example has serious limitations. To address quantitative macroeconomic issues, a model with a longer time horizon is required: macroeconomic data do not naturally correspond to a model with an initial or a terminal date. In addition to having more symmetry across periods, it would be natural to have more symmetry across agents. As the example stands, there is no justification for why type-I agents can commit but type-III agents cannot. Finally, if we want to allow for the possibility that fiat money circulates along with inside money, then we need an infinite horizon, to sustain beliefs.

In Kiyotaki and Moore (2000, 2001) we construct a stationary model based on a symmetric variant of the three-date example. The model is of a production economy, rather than exchange; but there is still no uncertainty. Infinitely-lived agents undertake a sequence of projects. A project fully employs an agent for three periods, from the initial investment through to final completion; no one can operate overlapping projects. In a symmetric equilibrium, start times are evenly distributed, so that in effect there are three populations indexed by whether an agent invests at dates 1, 4, 7, ... , or dates 2, 5, 8, ... , or dates 3, 6, 9, ... . An agent starting a new project at date $t$ can borrow against a fraction $\theta_1$ of the date $t + 2$ output. Someone buying such paper can resell a fraction $\theta_2$ at date $t + 1$. Aside from $\theta_1$ and $\theta_2$, the model is entirely standard: investment costs are convex in the scale of the project; everyone gets a concave utility from daily consumption, and discounts the future; markets are competitive. Here, $\theta_1$

[4] A number of papers model the circulation of private securities in environments with physical trading frictions, such as spatial separation or matching frictions. For models of inside money with spatial separation, see, for example, Robert Townsend and Neil Wallace (1987), Scott Freeman (1996), and Costas Azariadis et al. (2000). For matching models of inside money, see, for example, Ricardo Cavalcanti et al. (1999), Cavalcanti and Wallace (1999), and Stephen Williamson (1999).

corresponds to the borrowing constraint of an agent starting a new project; it measures the degree of bilateral commitment he can make to an initial creditor. The fraction $\theta_2$ corresponds to the resalability constraint facing the initial creditor in the next period; it measures the debtor's degree of multilateral commitment.

It is interesting to see how the two constraints feed into each other. On the one hand, remember that in the three-date exchange example if there were no borrowing constraints, resalability would not matter. More generally, in our stationary production economy we find that, even though there may be less than full bilateral commitment, if there is enough, then multilateral commitment is not needed; the economy works well without inside money. Specifically, we show that if $\theta_1$ is higher than some critical value $\theta_1^*$, itself strictly less than 1, then the economy achieves the first-best.

On the other hand, we find that, if paper can circulate as money because there are no resalability constraints, then the economy works well even though people may not be able to borrow very much (i.e., even though the supply of paper is not very great). The critical value $\theta_1^*$, which is sensitive to $\theta_2$, is lower for higher values of $\theta_2$. A little multilateral commitment goes a long way.

For $\theta_1$ below $\theta_1^*$, the economy is short of liquidity. Paper that can be resold, liquid paper, is issued at a higher price than paper that cannot; illiquid paper has to offer a higher return to compensate for the inconvenience of having to hold it for two periods, until it matures. There is a liquidity premium. Other symptoms of a liquidity shortage are that steady-state output and investment are lower than in a first-best allocation. Furthermore, consumption paths are jagged rather than smooth.

If the liquidity shortage is severe enough ($\theta_1$ and $\theta_2$ low enough), then there is a role for fiat money to circulate alongside liquid paper. Notice that we are not imposing a special role for fiat money here (as, say, in a cash-in-advance model). Rather, there is an endogenous need for additional liquidity in the form of fiat money. In terms of the model, our prediction is that, as technological developments, and changes to legal and financial structures, cause $\theta_1$ and $\theta_2$ to rise, the increase in the supply of inside money will eventually drive out non-interest-bearing fiat money.

There are countervailing forces, however, which our model ignores. First, the demand for liquidity may be rising as fast as the supply. Second, fiat money may be complementary to inside money, rather than a substitute, given that inside money is almost always a promise to pay in cash. Third, cash will always be useful to people who want to conceal their nefarious activities, like drug dealers, because it leaves no electronic trail. If, in due course, crime turns out to be the only reason why people hold cash, then evil will still be the root of all money, but for different reasons than the ones we have outlined above.

## IV. Auctioneers, Planners, and Judges

We have argued that money lubricates trade when there is a lack of double coincidence of wants, but not necessarily over physically distinct commodities. The great advantage of switching to dated goods, and not having to model physical trading frictions, is that one can breathe the pure oxygen of perfect competition. The terms of trade for paper, both new and second-hand, are determined in a marketplace.

One may want to posit an auctioneer whose job is to find the market-clearing prices. Beyond that, however, an auctioneer has no further role. She cannot enforce agents' long-term commitments. We assume that she herself cannot be trusted to make commitments, for otherwise she could usefully supply the economy with additional liquidity.[5] More generally, no planner can be trusted, either to keep her own promise to deliver goods in the future or to punish other people for breaking their promises. In our world, planners can always be bribed not to carry out a punishment.

[5] For example, she could assume the middleman role played by type-I agents in the sequence of trades given in footnote 3. Incidentally, in the standard Arrow-Debreu framework, agents are assumed to commit fully, and the auctioneer has no need to take a position in the market (e.g., to supply paper). It is only when there is limited commitment that a trustworthy auctioneer could usefully contribute additional commitment power to the economy.

We also assume that there is no gain from keeping a record of individual histories, because each agent can always start anew, with a fresh identity. In other words, there is anonymity.[6] This rules out collective arrangements in which, for example, people are disciplined not to renege on promises for fear of being subsequently shut out of the market by everyone else (as in Timothy Kehoe and David Levine [1993]).

At first glance, anonymity seems at odds with the idea that agents can issue paper promising to pay out in the future. However, in our stationary model with production, promises are secured against physical capital, not human capital. If an entrepreneur, who has previously issued paper, were to abscond, he would have to leave behind his productive assets; they cannot be stolen. The holders of his paper would then assume ownership of those assets. Of course, the entrepreneur's specific human capital would be lost, which explains why creditors are unable to get more than a fraction $\theta_1$ of the returns, where $\theta_1$ is strictly less than 1.

This presupposes that there is a legal system in place to verify the authenticity of a paper claim. Judges are able and can be trusted to distinguish legitimate from forged paper. (However, like an auctioneer or a planner, a judge cannot be trusted to provide the economy with additional liquidity or to punish someone who breaks a promise.) Anyone buying second-hand paper also has to verify its authenticity, which slows down the speed of transaction. As we have suggested, delay in verification is one justification for why $\theta_2$ is strictly less than 1.

[6] On the importance of anonymity for monetary theory, see Narayana Kocherlakota (1998) and Kocherlakota and Wallace (1998).

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