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Tobin replies to Woodford

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Thank you very much for your cordial welcome, and my thanks as well to Professor Gebauer's assistants for inviting me to participate in honoring him on this splendid occasion. I can think of no one whom I would take greater pleasure in having the honor of addressing in an assembly like this. Professor Gebauer is not only a personal friend but also someone whom I admire very much at a professional level. This is true for two specific reasons that I would like to mention.

One of the aspects of Professor Gebauer's approach to economics that I have long admired is not only his breadth of interest within the field but also his willingness – more than that, his dedication – to attempting to incorporate in his thinking, in a meaningful way, ideas that originate outside the discipline. I think in this respect he is following the finest traditions of our profession. Adam Smith was a moral philosopher before he was an economist; indeed, Smith never thought of himself as an economist, but always as a philosopher. Before Smith, Hume was also a moral philosopher. Coming down into the nineteenth century, Mill, Marx and Marshall were all, at the least, *political* economists. Not until Marshall's *Principles* did the label „economics“ even come into common usage. But even then, the people who now did „economics“ always thought of what they were doing as part of a broader – and, if I might say so, deeper – enterprise than economics narrowly construed in this new vocabulary. Likewise in the twentieth century, many of the great economists, while now recognizing that what they were doing was economics as we currently understand it, nonetheless drew a significant part of their inspiration from outside the discipline. (I think in the first instance of Samuelson, but of course there are many others.) As I have known Professor Gebauer over the years, one of the things I have admired most is the breadth of his conceptual approach to what he sees that he is doing.

The second aspect of Professor Gebauer that I think bears mentioning is amply demonstrated by the fact that it is, after all, his assistants – his students over the years – who have put together the gathering at which we are assembled today. His dedication to his students, not merely in the sense of educating them in the classroom and through their dissertations, but also in maintaining his role as a mentor throughout their continuing professional and even personal lives, is strong testament to Professor Gebauer's values as a human being. In this regard he reminds me of one of the great

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nineteenth-century figures from my college at Cambridge University, Oscar Browning of King's. Browning apparently took exception when his colleagues, asked „What do you teach?“, would reply „I teach English,“ or „I teach chemistry“ or „I teach physics.“ Browning would always reply, „I teach young men.“ (In today's setting, he would have said, „I teach young men and women.“) I think of Professor Gebauer as someone who, if asked, „Wolfgang, what do you teach?“, would likewise reply „I teach young men and women.“

I have been asked to speak on some fundamental issue in monetary theory. The talk I have prepared bears the title „Tobin Replies to Woodford.“ I have no doubt that if James Tobin were still with us he would be perfectly capable of replying to Michael Woodford on his own and would need no help from me. Alas, Tobin is no longer with us and so there is a need for someone to reply for him. For purposes of today's conference, I assign myself that task.

What is the issue on which Woodford requires some response from Tobin? I go back to a puzzle, on which I wrote some years ago, concerning how monetary policy works. This inquiry has an interest that has well outlasted the specific context in which it first arose, but to put the subject in its proper setting perhaps I should say something also about the original context. I attended a conference, at Oxford, at which I was asked to reflect on the principal problem that monetary policy would face in the year 2025. (The purpose of the conference was to assemble a group of economists, political scientists and engineers to assess, for each of a series of specific areas – population growth, energy, climate, work arrangements, and so on – the prospects, and in particular the principal problems, to be confronted 25 years later.¹) What struck me as most interesting was to contemplate the threat to the efficacy of monetary policy that I saw, and still see, coming from the spread of electronic moneys as a substitute either for currency or, more importantly, for bank money, in the execution of ordinary transactions.

My purpose today is not to talk about the electronic money controversy, but rather the more fundamental question of how central banks conduct monetary policy in the first place. The e-money controversy, however, led to a debate that also included Charles Goodhart (who is here today), Charles Friedman and, of particular relevance for my purposes today, Michael Woodford. The question I raised at the time, which seems to me in retrospect to transcend the concern we had then over the electronic money issue, is how central banks manage to affect interest rates and asset returns more generally in what are in practice very large markets – and, through the effect that they have on interest rates and asset returns in these very large markets, how central banks manage to exert an influence on economic activity and price setting in very large economies – all on the basis of what are, in practice, very tiny transactions.

¹ The conference proceedings were published in Cooper, R.N./Layard, R (2002). My contribution to the volume was titled „Threats to the Future Effectiveness of Monetary Policy.“

To take the example of the United States, the outstanding quantity of bank reserves these days is only about \$40 billion. Hence whether the central bank is pursuing a policy that involves a zero rate of growth of bank reserves (which most economists would normally consider *a priori* to be a restrictive policy) or a rate of growth of, say, 15 percent per annum (which most would think is fairly expansionary) is only a matter of whether *in the course of an entire year* the central bank is buying an additional \$6 billion of securities and thereby creating an additional \$6 billion of reserves. But Salomon Brothers probably buys \$6 billion worth of securities every morning, as do many of the country's other major banks and broker-dealer firms. Nobody thinks those firms' trading has the kind of effect on interest rates and asset returns, and thereby on the economy, that we commonly associate with monetary policy. What is it that gives the central bank the ability to execute such small transactions and yet have effects on these very large markets?

In part this is a familiar story that has to do with the role of the central bank as a monopolist over the supply of its own liabilities and, further, the unique role that these liabilities play in the economy. I am going to take all of that as well known and therefore not requiring further elaboration. Let me simply say that the puzzle, if we take it to be that, has gotten to be more of a puzzle in recent years. At least in the United States, the central bank now executes (almost) no transactions for purposes of carrying out monetary policy. When the Federal Reserve System wants to move the federal funds rate from 1 percent, where it is today, to 1.25 percent, where most people assume it will be a month from now, it will execute no transactions. It will simply make an announcement, and the announcement will be sufficient.

This is an extraordinary circumstance from the perspective of economic theory. From the viewpoint of standard textbook models, the idea that some authority can simply announce what interest rates in the market are supposed to be, and have the markets fall into line accordingly, seems very strange. One possible explanation is that the central bank stands willing, if necessary, to execute extremely large transactions in order to bring about the interest rate level it has announced, and that everyone understands this to be so. Charles Goodhart has written, in precisely this vein, that what makes these announcements (or, if any take place, token transactions) so effective is that the market construes that behind the announcement (or the token action) stands the well understood willingness and ability of the central bank to execute transactions in extremely large volumes – indeed, volumes large enough to make a difference for prevailing market-wide interest rate levels. Goodhart has also been sharp in pointing out the potential fiscal implications for the government that would lead one to question whether the central bank really has this ability, and I have here nothing to say here on this issue beyond Goodhart's comments.

The issue I would like to address is the suggestion by Woodford that what gives the central bank the ability to set market interest rates is instead its ability to determine the interest rate on its own liabilities by paying and charging respective interest rates

separated by only a narrow spread, or „channel.“ Woodford’s primary theoretical argument is that while the ability and willingness to execute transactions in extremely large amounts would be required in an American-style system, in which the interest rate paid on central bank liabilities is zero, if the central bank instead operates by being willing to pay, say, 1.20 percent on deposits in its liabilities while charging 1.30 for loans in its liabilities, then the effect is to constrain the rate on those liabilities without having to execute either actually or potentially large transactions – and maybe no transactions at all – and, further, that through setting the interest rate on its own liabilities the central bank can affect the prevailing structure of interest rates and asset returns more generally.

A crucial implication of Woodford’s argument is that, in the absence of some signal from the central bank’s pricing of its own liabilities, the market would have no way to establish the rate structure for the remaining assets. The market would, of course, be able to establish *relative* prices. But it would have no way of establishing the absolute rate structure, so that, within any given relative configuration, interest rates could be very high or very low, and the markets simply would not know what to do.

The question that immediately arises is then: Is this a story about nominal interest rates only, or is it also about real rates? If we were talking about the long run, then Woodford’s claim would be easy enough to understand by saying it is only about nominal rates. In the long run the central bank presumably has the ability to establish whatever inflation rate it chooses, and in the absence of knowing how much inflation the central bank will create, the market has no way to know at what level to set nominal rate levels. In the short run, however, the story is rather different. In the short run, which I take for this purpose to be not just today and tomorrow but out to some horizon that corresponds to business cycle frequencies, the rate of inflation that people expect is highly constrained. Nobody believes, for example, that the central bank has the ability suddenly to create 20 percent inflation one or even two years hence. The issue for the short run is then whether the market will, as the Woodford hypothesis implies, have no ability to establish a level of *real* interest rates and asset returns in the absence of some signal from the central bank about what those interest rates and asset returns should be.

How would Tobin respond to this claim? The Tobin approach – here I have in mind the body of work that originated in Tobin’s 1963 paper in the Commission on Money and Credit volume but is best known to the profession from his 1969 paper in the *Journal of Money, Credit and Banking* – starts from the proposition that asset markets clear. Specifically, we have to think of a vector of asset demands coming into equilibrium with the corresponding vector of asset supplies, and we also have to say something about where these supplies and the corresponding demands come from.

If we constrain the discussion to focus on a closed economy, which is not necessary in general but is useful for this morning’s purposes, then the vector of asset supplies includes a scalar quantity of capital which is given in the short run, then zeros

corresponding to each of the different forms of inside borrowing and lending that have to be in zero net supply (for every private borrower there must be a private lender), then a quantity of interest-bearing government liabilities (which in a non-Ricardian economy we can take to be outside wealth), and then finally the quantity of central bank liabilities. The role of monetary policy in this context is to adjust the relative quantities of the final two elements of the asset supply vector I have described, namely, to increase or decrease the quantity of its own liabilities that the public holds, and correspondingly to decrease or increase the quantity of interest-bearing non-central bank government liabilities that the public holds.

Where does the vector of asset demands come from? As is well known from standard portfolio theory going back well before Tobin, but to which Tobin also importantly contributed, asset demands depend on the wealth position of the private sector and also on the vector of expected returns that the public thinks it will earn on those assets and the uncertainties that it attaches to those expected asset returns. To make the discussion simple (although this too is not central to the argument that I want to make), I will invoke two assumptions: that asset demands are proportional to (in the usual technical phrase, linear homogeneous in) wealth; and that the objective function investors seek to maximize is one in which no higher-than-second order moments matter, so that knowing the variance-covariance structure of the uncertainties surrounding future returns is sufficient. As Vance Roley and I showed in a series of papers some years ago,² we then can derive linear homogeneous asset demand functions in which the asset demands are proportional to wealth and the demands depend upon the expected asset returns in a linear way with coefficients readily derivable from the variance-covariance matrix. There is a redundancy in the system, however, and this was central to Tobin's story. The redundancy is also what allows the Tobin story to speak to the conundrum I am addressing.

The redundancy, of course, is that there is one fewer independent degree of freedom in the system of asset demands I have described than there are assets. What the system can determine, by the equilibrium in which the demand for each asset is equal to the supply of each asset, is either -1 relative rates of return (for an N -asset system) or, if there is some fixed anchor in which one absolute rate of return is determined somewhere else, the other -1 absolute rates of return, given the one that is fixed elsewhere. (There are, as a technical matter, two forms of this solution: the more familiar one, in which we assume that one of the rates of return is taken as risk-free by the market, in which case we have the standard form of the capital asset pricing model; and, if there is no risk-free asset, a model with a somewhat more complicated but conceptually equivalent set of relationships.³) In a market with N assets and an asset supply-demand equilibrium able to establish -1 relative returns, there is, therefore, room for one independently set benchmark. What is it?

² See, for example, Friedman, B.M./Roley, V.V. (1987).

³ See again Friedman, B.M./Roley, V.V. (1987).

Woodford's story, I believe, would be that what is independently determined in this system is the rate of return on bank liabilities, as set by the channel the central bank announces. To use again the example of the current situation of monetary policy in the United States, suppose that next month the Federal Reserve says it will pay on reserves 1.20 percent and it will charge on reserves 1.30. Doing so will presumably bring about the desired rate of approximately 1.25 on central banks liabilities. Given the prevailing inflation rate of, say, 2 percent, this in turn will fix the real federal funds rate at minus 0.75. The key issue, however, is the role of capital in the system. Capital provides yet another anchor, which in a Tobin framework is likely to be competitive with the real rate of return on central bank liabilities as an anchor to the system.

The real rate of return on capital comes from the role of capital in the production function. At any given time there is a fixed amount of capital, and there is a production function in which the ability to produce goods and services depends on the economy's resources, importantly including the capital stock. This capital stock is fixed in the short run, and it is relatively inflexible over the medium run because of well known costs of adjustment. Further, all of the empirical evidence we have on the production function suggests that, within the relative range (and for a developed economy), the curvature of the convex production frontier is relatively minor, so that even fairly large changes in capital intensity imply only small changes in the marginal product of capital.

Hence we have two competing anchors: one, which the central bank is setting, and a second, which comes from the capital stock. How can these two be reconciled? Tobin's 1969 paper showed that in the short run there can be a disequilibrium in which the existing capital is worth either more or less than its reproduction cost (in Tobin's language, q differs from 1), and therefore the central bank has the ability to change the structure of asset returns by fixing the real rate of return on its own liabilities. If the resulting price of capital differs from the reproduction cost, the real rate of return to holders of capital between now and when the capital market comes back into equilibrium will be different from the rate that we simply read off of the slope of the production function.

Here we come back to the conundrum from which I started. If this is the appropriate conceptual framework, we are in a world in which potentially very large changes in central bank liability positions are necessary, because we now have to contemplate a sufficiently large change in the vector of existing asset supplies to alter the pricing of the entire vector of assets. The capital that is being priced is typically very large; in the U.S. economy, for example, the capital-output ratio is typically thought to be in the neighborhood of 2.5 to 3.0, so that with a \$10 trillion economy we are talking about \$25 trillion to \$30 trillion of capital. The right way to understand Woodford's claim in a coherent theoretical context is to posit an asset supply-demand equilibrium in which, given costs of adjustment on the capital stock, there is a disequilibrium not in the

supply of and demand for capital but in the *price* of capital that is traded versus the reproduction price of new capital. All this is compatible with the central bank's establishing whatever real rate of return it wants on its liabilities, but only if the vector of asset supplies changes by enough to give us the rate of return variation as delivered by the asset demand structure coming into equilibrium with the asset supply structure.

To conclude: Does Woodford's story make sense theoretically? Yes, going back to Tobin's model gives us a way of understanding it fully. But thinking about Woodford's claim through the lens of Tobin's theoretical framework does not do away with the puzzle of how the central bank affects asset market markets, and ultimately the economy, on the basis of negligible-size transactions. Indeed, it only highlights all the more why this is a puzzle.