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MONETARY POLICY

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ABSTRACT

Monetary policy is one of the two principal means (the other being fiscal policy) by which government authorities in a market economy regularly influence the pace and direction of overall economic activity, importantly including not only the level of aggregate output and employment but also the general rate at which prices rise or fall. The ability of central banks to carry out monetary policy stems from their monopoly position as suppliers of their own liabilities, which banks in turn need (either as legally required reserves or as balances for settling interbank claims) in order to create the money and credit used in everyday economic transactions. Important developments both in research and in the actual conduct of monetary policy in recent decades have revolved around the choice of a short-term interest rate versus a reserve quantity as the central bank's direct operating instrument, whether to use some measure of money as an intermediate target, whether to constrain the central bank to follow some fairly simple policy rule, what degree of political independence a central bank should have, and whether to target inflation. Some key areas of ongoing research in this area, as of the beginning of the 21st century, are whether the behavioral process by which monetary policy affects nonfinancial economic activity centers more on money or on credit, quantitative measurement of whatever is the mechanism at work, the trade-off between price inflation and real aspects of economic activity like output and employment, and just why it is that the public in most industrialized countries is as averse to inflation as is apparently the case.

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MONETARY POLICY

Monetary policy is one of the two principal means (the other being fiscal policy) by which government authorities in a market economy regularly influence the pace and direction of overall economic activity, importantly including not only the level of aggregate output and employment but also the general rate at which prices rise or fall. Indeed, the predominant trend over the last half century has been to place increasing emphasis on monetary policy (and correspondingly less on fiscal policy) for these purposes. Governments carry out monetary policy, typically via specialized agencies called central banks, by exploiting their control over the supply of certain kinds of claims against the central bank — hence the label “monetary” — that enable a country’s businesses, banks and individuals to carry out their day-to-day economic affairs. In most financial systems, banks in particular are legally required to hold claims against the central bank in order to create deposits and make loans, and so the central bank’s control over the supply of claims against itself also gives it a form of control over the economy’s money and credit in a far broader sense. The evidence from experience, in one country after another, makes clear that the exercise of this control — monetary policy — powerfully affects a country’s economy, for either good or ill.

1. How Monetary Policy Arises.

Providing money for use in everyday transactions has been a commonplace function of governments for well over two thousand years. In the United States, for example, the U.S.

Constitution explicitly reserves to Congress the power “To coin Money [and] regulate the Value thereof.” Over time, most governments have created specialized central banks to which they delegate this function. The Swedish Riksbank was established in 1668, the Bank of England in 1694, the Banque de France in 1800, and the Netherlands Bank in 1814. The U.S. central bank, the Federal Reserve System, is a relative latecomer, dating only to 1914.

In early days money provided by governments took the form of coins and therefore required a supply of gold, silver or other valued metals, but in the mid eighteenth century some governments also began to issue paper currency. These paper claims typically gave the bearer the right to demand payment in coin, or equivalent weight of metal, and so except under unusual circumstances like wars, governments and central banks mostly limited their issuance of paper money to the supply (later on, some fraction of the supply) of gold or silver actually on hand. But in time the perceived need for such backing disappeared, so that today almost all paper currency is “fiat money” — in other words, it has value only because the government mandates that within the country’s borders it must be accepted as payment in any and all transactions. (Importantly, the government does not mandate, because in a market economy it cannot, the price level at which its currency is accepted.)

In principle, the existence of fiat currency alone would be sufficient to enable a government to carry out a primitive form of monetary policy, distributing paper money to the public, through some device or other, in either small volume or large as it saw fit. In fact, modern central banks conduct monetary policy differently: by exchanging claims against themselves for other claims against the government — typically interest-bearing bills, notes and bonds — in markets in which these instruments are freely traded. For this exchange to be

possible, however, there must be other claims against the government outstanding in the first place.

Hence monetary policy as carried out in practice is made possible by the existence of fiscal policy, in the usual sense of overall government spending and taxing and the government's need to finance any excess of expenditures over revenues by means of borrowing. It is only because on balance over time most governments have spent more than they have taken in — i.e., have run a fiscal deficit — that they have a stock of debt obligations outstanding. Indeed, in the rare circumstance in which a government considers running a fiscal surplus large enough and for long enough to retire most or all of its outstanding debt, questions usually arise about how the central bank will be able to conduct monetary policy.

References: Kindleberger (1993), Chown (1994).

2. How Monetary Policy Works

The chief objectives of monetary policy in modern times have typically been to maintain stability of a country's general price level — that is, to prevent either inflation or deflation — and to promote maximum levels of output and employment. (In many contexts these two objectives are in conflict; see the discussion in Section 4.3 below.) Other often accepted goals of monetary policy include maintaining balance in a country's international trade, preserving stability in its financial markets, and fostering increased capital investment so as to enhance its economic growth over time. With the exception of preserving financial market stability, which is usually taken to be secondary, all of these objectives pertain to aspects of an economy's

nonfinancial economic activity. By contrast, central banks' monetary policy operations take place exclusively in the financial markets. For monetary policy to be effective therefore requires some process, often called the monetary policy "transmission mechanism," by which the purely financial actions taken by the central bank influence the nonfinancial decisions of households and firms.

2.1 Demand for central bank liabilities. The key to how this mechanism works is that, in part for reasons of convenience and in part as a matter of law, participants in a country's nonfinancial economy need to hold claims against its central bank — the outstanding total of which is usually called the country's "monetary base."

At the simplest level, currency is usually a claim on a country's central bank. Individuals who buy everyday items for cash, and the businesses with which they deal, therefore need to hold and exchange central bank liabilities. In the past, sudden large increases in the public's demand for currency, when not met by an increase in currency supplied by the central bank, often triggered financial crises and consequent economic downturns. In modern times, however — especially since World War II — most central banks have passively supplied whatever changing volume of currency the public seeks. As a result, demand for currency typically plays no significant role in the monetary policy process.

Instead, what matters are the claims that the country's private-sector banks hold in the form of deposits — which are usually called "reserves" — at the central bank. For several reasons, the banks' need for these reserves expands or contracts roughly in pace with the overall level of activity taking place in the nonfinancial economy:

First, in many countries banks must, by law, hold such reserves in proportion to the volume of deposits (or if not their total deposits, then some forms of deposits) that they have outstanding. Hence the ability of the banking system to create deposits for businesses and households to use in executing transactions that they do not make in cash depends on the quantity of reserves that they can obtain. The volume of transactions to be executed via bank check, and hence banks' need to hold reserves, clearly varies with overall economic activity.

Second, a bank's ability to make loans depends on its ability to create deposits. A loan is an asset to the bank, while a deposit is the bank's liability. Apart from changes in the bank's capital due to retained profits or new securities issues, its total assets and total liabilities must expand or contract together (in other words, the balance sheet must always balance). The same is true for a country's banking system as a whole. The requirement that banks hold reserves in proportion to their deposits therefore also means that they must hold reserves in order to advance credit to businesses or households. Credit needs also vary with levels of economic activity.

Third, although some countries (for example, Canada, New Zealand, the United Kingdom) do not impose legal reserve requirements, their banks hold balances at the central bank to use for settling the claims among themselves that arise whenever an account holder at one bank deposits a check drawn on another bank. Moreover, even in some countries that do have reserve requirements (for example, the United States), as of the beginning of the twenty-first century a large part of the balances that banks hold at the central bank are likewise held primarily for purposes of settling interbank claims. The standard way of effecting such transfers is to shift reserves, on the books of the central bank, from one bank to the other. (In recent years

some countries have developed systems to allow banks with claims against one another to offset them, one against the other, without central bank participation; but settlement of the net amount due from one bank to the other still occurs by transferring reserves at the central bank.) Central banks, which are risk-free because of their governmental authority and backing, have a natural advantage in providing interbank settlement services. Even so, in order to ensure that banks have a need for balances at the central bank, some countries that do not impose legal reserve requirements against deposits legally require their banks to use the central bank for net settlements.

In a variety of ways, therefore, the everyday working of a modern economy and its financial system creates a demand for central bank reserves (or, including currency, for the monetary base). Moreover, on each count the demand for reserves plausibly grows as economic activity expands.

References: Friedman and Schwartz (1963), Dewald (1963), Goldfeld and Sichel (1990).

2.2. The central bank as monopolist. The central bank's power to conduct monetary policy stems from its role as the sole source of reserves (or, again, monetary base) to meet this demand. In short, the central bank is a monopolist over the supply of its own liabilities.

2.2.1. Open market operations. The most common procedure by which central banks either increase or reduce the outstanding supply of bank reserves is through "open market operations" — that is, buying or selling securities (normally the debt obligations of the central bank's own government) in the free market. When a central bank buys securities, it makes payment by increasing the reserve account of the seller's bank. Doing so increases the total

volume of reserves that the banking system collectively holds. Conversely, when a central bank sells a security, it takes payment by reducing the reserve account of the buyer's bank. Doing so decreases the total volume of reserves. Although private-sector banks regularly trade existing reserves among themselves, no bank, nor any other market participant, can add to or take away from the total volume of reserves that all banks together hold. The central bank is a monopoly supplier (or withdrawer) of reserves to the banking system as a whole.

Expanding or shrinking the total volume of reserves in this way matters because banks can trade reserves among one another and, importantly, because they do so in a free market in which they exchange reserves for other assets. Reserves are usually costly for banks to hold because the central bank pays only a low rate of interest — often zero — on these balances. Hence any bank that has more reserves than it needs will typically try to exchange them for some interest-bearing asset like a Treasury bill or other short-term debt instrument. If the banking system as a whole has excess reserves, however, more banks will seek to buy such instruments than to sell them. In the absence of some other force acting on the market at the same time, the result is to bid up these instruments' price, thus reducing the interest rate earned by investors who hold them. (Movements in the price of any fixed-interest debt instrument correspond to movements in the opposite direction of the interest rate it bears.)

The resulting lower interest rate on short-term market instruments means, in turn, a reduced opportunity cost of holding zero-interest reserves. Only when market interest rates fall to the level at which banks collectively are willing to hold all of the reserves that the central bank has supplied will the financial system reach an equilibrium. Conversely, if banks in aggregate have fewer reserves than they need, more banks will seek to sell bills (in exchange for

reserves) than to buy them. The consequence is that market interest rates, and hence the opportunity cost on reserves, will rise to the level at which banks are content to make do with only the existing supply of reserves (perhaps because, along the way, they have shrunk their outstanding deposits and credit).

Hence an “expansionary” open market operation (in which the central bank expands the supply of reserves) creates downward pressure on short-term interest rates not only because the central bank is itself a buyer in the securities market but, more importantly in quantitative terms, because it leads banks to become buyers of securities as well. And for just the same reasons, a “contractionary” open market operation puts upward pressure on short-term interest rates. By operating in this way, central banks can easily influence the interest rates on whatever short-term debt instruments banks regularly exchange for reserves. Under ordinary conditions, a well functioning central bank following these procedures can pick some short-term interest rate (in many countries the central bank focuses on the overnight interbank lending rate) and establish that rate at whatever level it chooses.

2.2.2. Reserve requirements. In a banking system that imposes reserve requirements, an alternative way for the central bank to achieve the same objective would be to adjust the stated percentage indicating how much in reserves banks are required to hold in relation to their outstanding deposits. Lowering the reserve requirement, and therefore reducing the demand for reserves, has roughly the same effect as an expansionary open market operation, which increases the supply of reserves; either action creates downward pressure on interest rates. Conversely, raising reserve requirements is equivalent to a contractionary open market operation. Although in principle central banks could therefore carry out monetary policy by either means, in practice

most central banks rely on open market operations most of the time, usually using changes in reserve requirements only to achieve more technical objectives having to do with the composition of the banking system's liabilities.

2.3.3. Central bank lending. Another way in which central banks can change the supply of reserves is by lending reserves directly to some bank. In most countries that have reserve requirements, such direct lending of reserves (which for historical reasons is sometimes called "rediscounting," or lending at "the discount window") is normally small in scale, and it plays only a minor role in the monetary policy process. Especially in countries that impose no reserve requirements, however, lending directly to banks is an important part of how the central bank supplies reserves, and it provides an alternative mechanism for controlling interest rates.

Because no bank will pay more to borrow elsewhere than the rate at which it can freely borrow from the central bank — and, similarly, will not sell a higher-yielding Treasury bill rather than borrow at a lower rate in order to continue holding it — setting the interest rate at which the central bank lends reserves to the banks effectively establishes a floor for short-term market rates. In some countries (for example, Canada and New Zealand), the central bank confines the market rates on bills and similar short-term instruments to trade within a narrow range by imposing both a floor and a ceiling: setting an interest rate at which it will lend to banks as well as a (slightly lower) interest rate that it will pay banks on their holdings of reserve balances.

References: Modigliani et. al. (1970), Meulendyke (1998).

2.3 Effects on the nonfinancial economy. For monetary policy to achieve its objectives with respect to the nonfinancial economy, there must be some causal process by

which the changes that the central bank brings about in short-term interest rates in turn affect real output and employment, or prices and wages, or both. Economic theory, as well as empirical observation, suggests a variety of avenues by which such influences can operate.

2.3.1 Influences on the demand for goods and services. In an economy with well developed credit markets, households and firms frequently borrow to finance their spending. Firms' investment in new factories and machinery, and households' investment in houses and in durable consumer goods like automobiles and home appliances, are especially likely to rely on borrowed funds. Fluctuations in interest rates naturally affect the willingness to undertake such expenditures. Although the central bank directly controls only the interest rates on short-term instruments like Treasury bills, the longer-term interest rates applicable to borrowing for these purposes mostly move in the same direction as short-term rates because banks and other investors are able to substitute among different debt instruments in their asset portfolios. Hence monetary policy affects these other rates as well. Moreover, because banks' ability to create credit depends on having reserves, by decreasing the supply of reserves the central bank can induce banks in particular to cut back on lending in ways that go beyond merely charging a higher interest rate, including rationing credit among would-be borrowers.

The same process of portfolio substitution that leads long-term interest rates to rise (and hence the prices of long-term bonds to fall) when short-term interest rates rise also leads to downward pressure on the market prices of other assets, most prominently equity securities and real estate. Because these price-sensitive assets bulk so large in the total asset holding of households (and sometimes firms too) in many countries, monetary policy also therefore

influences an economy's level of total wealth. Changes in wealth also normally influence the demand for goods and services.

Yet a further extension of the same portfolio substitution process enables monetary policy to influence the value of a country's currency in international markets, which matters because foreign exchange rate fluctuations in turn also affect the demand for a country's output. Lower interest rates in one country, not matched in other countries, ordinarily lead its currency's exchange rate to depreciate. A lower exchange rate makes that country's goods cheaper compared to goods produced elsewhere, thereby stimulating demand abroad for the country's exports while depressing demand at home for foreign imports. On both counts the currency depreciation increases aggregate demand within the country.

2.3.2 Demand effects on prices, employment and wages. If a central bank's monetary policy stimulates the demand for its economy's goods and services, and there is no immediate matching change in supply, the result will be to create upward pressure on prices. Higher prices (and, in some cases, the mere appearance of increased demand for their product) in turn lead businesses to seek to produce more. In industries that are labor intensive, increasing production means hiring more workers. Hence monetary policy also influences employment. In order to attract more workers, however, firms normally have to pay higher wages. Hence an increase in output and employment due to expansionary monetary policy usually means upward pressure on both prices and wages — in other words, inflation. Conversely, tight monetary policy that depresses output and employment normally lessens inflation (or, if prices and wages are not rising to begin with, causes deflation).

2.3.3. Price misperception effects on aggregate supply. Under some economic theories, this tendency for output to increase and prices to rise following expansionary monetary policy has a different interpretation. Here what matters is that the increased prices due to greater aggregate demand come as a surprise. If a firm mistakenly interprets a rise in the general price level for a rise only in the price of its own specific product, it will, as before, choose to expand production. The immediate effect is the same, but once the firms that react in this way realize their mistake, their incentive to maintain higher production disappears.

Under this theory, therefore, monetary policy can still influence both output and prices, but the effect on prices is lasting while that on output is only temporary. Extending the logic of this theory to the labor market similarly leads to the conclusion that monetary policy has lasting effects on wages but only temporary effects on employment. (Just how temporary these effects on output and employment are, and how large or small, is a matter of much research; see sections 4.2 and 4.3 below.)

2.3.4 Effects on prices and wages only. Yet a further extension of this same line of theorizing suggests that if people understood that the effects of monetary policy on output and employment are merely temporary — and, importantly, if they also understood what the central bank is doing as it is doing it — there would be no real consequences of monetary policy at all but only the influence on prices and wages. In other words, monetary policy would be “neutral.” Although constructs that deliver this conclusion appear frequently in theoretical work, evidence to the contrary (i.e., evidence that monetary policy does have real effects) is sufficiently widespread that current-day interest in this line of thought focuses less on whether

monetary policy is neutral than on the theoretical rationale for understanding why it is not (see again section 4.3 below).

References: Friedman (1968), de Leeuw and Gramlich (1969), Lucas (1973), Blanchard (1990).

3. The Design of Monetary Policy

Monetary policy is problematic not only because the central bank's goals are sometimes in conflict — for example, the desire to avoid inflation versus the desire to boost output and employment — but also because the various mechanisms by which central bank actions affect the nonfinancial economy mostly play out only over time, often involving lags measured in years rather than weeks or months. Many important aspects of the economic circumstances in which the central bank's actions will be having their effect are, therefore, not just unknown but unknowable when the decisions governing these actions are taken.. Much of the study of monetary policy since World War II, in the academic world as well as in the research departments of central banks, has focused on how to structure the conduct of monetary policy so as best to achieve the desired objectives while laboring under these handicaps.

3.1 The monetary policy instrument. It is first necessary to establish what the central bank can and cannot do. Most obviously, because of its monopoly position it can fix the quantity of reserves (or, including currency, the monetary base). Doing so affects the market equilibrium that establishes the entire constellation of interest rates on all debt instruments. Alternatively, the central bank can set the interest rate on any one class of debt instrument by continuously supplying whatever amount of reserves is consistent with market equilibrium at the

chosen interest rate level, allowing market forces to determine what volume of securities the central bank buys or sells and hence the quantity of reserves it supplies. (The market equilibrium also determines the interest rates on all other debt instruments.) A variant of this latter strategy is for the central bank to set the foreign exchange rate of its currency, again by supplying whatever amount of reserves is consistent with market equilibrium at the chosen exchange rate level.

By contrast, the central bank — trading only in the securities market, and making or taking payment by adjusting the supply of reserves — cannot directly set the volume of banks' deposits, or of their lending. Nor can the central bank directly determine real output, or prices, or any other aspect of nonfinancial economic activity. Central bank actions exert an influence over banks' creation of deposits and credit, and over output and prices in the nonfinancial economy (that is normally the point of pursuing a conscious monetary policy in the first place), but they are only one among many such influences on these economic processes.

If all other influences bearing on output or prices (or whatever else constitutes the ultimate objective of monetary policy) were completely known in advance, it would make no difference whether the central bank conducted policy by fixing the supply of reserves or by setting an interest rate or the exchange rate. These operating strategies would be fully equivalent. Because many forces bearing on the central bank's objectives are unpredictable, however, the choice of "instrument" by which to implement policy matters for the effectiveness of policy. In general, the more uncertainty surrounds the behavior of households and firms in the markets for goods and services — for example, the strength of consumer spending, or of business investment — the more advantage there is to fixing the quantity of reserves. By

contrast, the more uncertainty surrounds behavior in the financial markets — households' and firms' demands to hold deposits versus other assets, their desire to borrow, the willingness of banks to lend, and so on — the more advantageous it is to set the price of reserves (in other words, an interest rate).

Actual practice in this regard has varied over time and across countries. Especially in the 1970s and 1980s, many central banks experimented with strategies based on fixing the quantity of reserves (or of the monetary base), or its growth rate. As of the beginning of the 21st century, however, most central banks of large countries (including in particular the U.S. Federal Reserve System, the European Central Bank and the Bank of Japan) operate by setting an interest rate.

References: Poole (1970), Sargent and Wallace (1975).

3.2 Intermediate targets. The central bank cannot directly set the amount of money in its financial system, in the usual sense of “money” that includes both currency and bank deposits. Given the reserves supplied by the central bank, banks can normally create either more deposits or less than what a strict application of the required reserve ratio implies. Also, reserve requirements typically do not apply to all forms of bank deposits, and there are sometimes different required ratios for different kinds of deposits. For all of these reasons, the central bank cannot directly control the volume of bank credit either.

Much empirical work over many years, however, has gone into documenting the relationships between money and either income or prices — especially between money and future income or prices — and there has been some research on comparable relationships for credit. Moreover, the data-reporting mechanism in most countries is such that money and credit

are known before output and prices. To the extent that money, for example, displays a reliable relationship with the aspects of nonfinancial economic activity that the central bank ultimately seeks to influence, conducting monetary policy as if the quantity of money itself, or its growth rate, were the objective of policy — that is, using money as an “intermediate target” — in effect enables policy to respond to unwanted movements in output or prices before they occur (or at least before they are directly observed). Especially in the 1970s and 1980s, following the demonstration that in many countries fluctuations in money had borne just such a relationship to subsequent fluctuations in both income and prices, many central banks adopted intermediate targets of this kind. Some central banks also, or instead, adopted analogous targets for credit growth.

In time, however, this way of conducting monetary policy fell out of favor in most countries for several reasons. First, research showed that using money (or credit) as an intermediate target amounts to a way of exploiting the information contained in observed movements of money itself, but that it fails to make use of other information provided by the many different financial and economic variables that the central bank can also observe on a timely basis. Moreover, except under special circumstances that are unlikely to be met in practice, using money (or credit) as an intermediate target fails to use efficiently even the information provided by observations of money itself.

Second, there was never a sound theoretical basis for knowing which measure of money was the right one to target (currency plus checking accounts only? currency plus all bank deposits? other combinations?), and even within any one country empirical evidence on which measure had the closest relationship to income and prices was often mixed. Presumptions that

different measures of money would show roughly similar growth rates, over time horizons (like a year or so) that matter for implementing an intermediate targeting strategy, proved mistaken. Hence a central bank at any given time could conclude that it needed either to add reserves or withdraw them, depending on which measure of money it chose to target.

Third, and most importantly, by the 1990s the empirical relationships between money (or credit) and either income and prices had broken down in many countries. The United States was a particularly strong example of this phenomenon, as the predictive power of U.S. money growth with respect to either income growth or price inflation mostly disappeared. Standard explanations for the breakdown of these relationships included financial innovations that enabled money holders to switch more easily among different kinds of deposits, or between deposits and other assets; new patterns of wealth holding in the wake of the high inflation of the 1970s and early 1980s; and the advancing integration of world financial markets. But for whatever reason, the previously observed predictive power associated with money disappeared, and without it there was little rationale left for using any measure of money as an intermediate target for monetary policy.

References: Friedman (1975), Friedman (1997).

3.3 Rules versus discretion. One reason the use of money as an intermediate target had been so attractive in the first place was that, far more than simply setting a short-term interest rate, it supposedly provided an “anchor” to a country’s price level — or, if the central bank was targeting money growth, to the inflation rate. (Once the empirical relationship between money and prices broke down, this supposition bore much less force.) A second reason was that, again in a way that an interest rate cannot, money could potentially serve as the basis for very simple

rules for conducting monetary policy. For example, always seeking to have money grow at a constant percentage rate (which some economists have advocated) may be sub-optimal, but it is not inherently flawed on theoretical grounds. By contrast, always setting some interest rate at a constant value is inherently unstable, under standard theory leading to either hyperinflation or hyperdeflation.

The long-standing preference among some economists (and many others) for rules to govern monetary policy reflects, in the first instance, matters less of economics than of political economy: the desire for governance “by laws, not by men,” concern over the anti-democratic implications of entrusting an important dimension of government policy to unelected specialists, populist resentment that such specialists often represent the society’s “elites,” and fears that the chosen individuals might act in their own rather than the public’s interest. But in the 1970s and 1980s a new line of theory suggested a more specifically economic ground for favoring rules for monetary policy: that the sequential, discretionary decisions made even by fully knowledgeable and perfectly well-intentioned central banks were “dynamically inconsistent” in a way that accounted for the high and stubbornly chronic inflation that had appeared throughout the world’s industrialized economies in the 1970s.

The essence of the dynamic inconsistency (or “time inconsistency”) argument is that many central banks understandably seek to boost output and employment above the level that market forces would otherwise establish — for example, in order to offset distortions, due to taxes and economic regulation, which artificially discourage economic activity — and that, under some theories, a way to do so is to generate inflation that comes as a surprise to producing firms (see Section 2.3.3 above). But once the central bank has already generated any particular

rate of inflation, which individuals and business decision makers expect to continue, a yet higher rate is then necessary to create the needed surprise. This process goes on until the inflation rate is so high that the cost of any further increases in inflation per se outweighs the consequent gain in output. At that point output reverts to its normal level, but inflation remains high. Bringing inflation back down would depress output and create unemployment (unless producers fully expected this reversal to occur).

Because the dynamic inconsistency argument placed discretionary decision making at the center of the industrial countries' inflation problem, much of the discussion generated by this line of theory in the 1970s and 1980s pointed to the need for some kind of monetary policy rule as the most straightforward solution. Judged from this perspective, the disinflation that followed was, in most countries, strong counter-evidence. By the early 1990s (earlier still in many countries), inflation had fallen sharply in most of the industrialized world. In many countries this disinflation occurred without any change in the central bank's institutional procedures, and certainly without the adoption of a monetary policy rule. The United States, for example, brought down inflation with no change at all in Federal Reserve structure or operations. Even in countries that did change their approach to monetary policy — for example, by adopting an inflation target (see section 3.5 below) — the change typically came after inflation had already subsided.

A formal rule is not the only way to overcome dynamic inconsistency, however. Research on this issue showed that the central bank's awareness of the importance of its public reputation ("credibility") acts in some circumstances in the same way as a rule imposed by an outside authority. So does appointing central bank decision makers whose aversion to inflation

is more pronounced than that of the general public. Hence it remains unclear to what extent theories based on dynamic inconsistency provide a good account of the rise and fall of postwar inflation.

References: Kydland and Prescott (1977), Barro and Gordon (1983), Rogoff (1985).

3.4 Central bank independence. The debate over rules versus discretion in monetary policy, especially in the context of the theory of dynamic inconsistency, also focused attention on the differing status of different countries' central banks, both legally and de facto. Questions central to this issue include whether the central bank has the authority to establish the objectives of monetary policy ("goal independence") and/or to carry out policy operations as it sees fit in pursuit of objectives even if they may be determined by other parts of the government ("instrument independence"), whether the central bank's officials are subject to removal over matters of policy, how long such officials serve in office, and so on.

Much of the link between this discussion and the dynamic inconsistency debate sprang from the observation that in countries where the central bank was more independent either legally or de facto — for example, Germany, Switzerland and the United States — the economic performance of monetary policy, especially in terms of price stability, was better on average. The inference that some economists drew from this relationship was that the motivation to carry out policy in a dynamically inconsistent way (specifically, to seek higher output and employment by creating surprise inflation) was mostly imposed on the central bank from outside. Hence a more independent central bank would deliver lower inflation. At the same time, however, other research pointed out that a key corollary of this line of reasoning — the implied tendency for more independent central banks to find it less costly, in terms of

foregone output and employment, to reduce inflation by any given amount (see Section 4.3 below) — did not correspond to observed cross-country differences.

One result of this line of research and public discussion was that in the late 1990s several countries, most prominently Japan and the U.K., formally granted their respective central banks greater independence. Also, the new European Central Bank, established in 1999, has very substantial independence from the governments of the participating member countries.

References: Cukierman (1992), Debelle and Fischer (1994).

3.5 Inflation targeting. By the 1990s the combination of the demise of intermediate targets for monetary policy based on money (or money growth), the renewed emphasis on interest rate setting as the policy instrument, and the failure (by some lights) to impose rules to limit central bank discretion had left a widely perceived vacuum in the structure of most countries' approach to monetary policymaking. The problem of providing an “anchor” to prices remained. So did the risks associated with step-by-step discretion.

In response, by the end of the decade a number of central banks — in the U.K., Sweden, Canada and Australia, among other countries — adopted formal “inflation targets.” Importantly, adopting an inflation target does not necessarily mean eschewing concern for real economic outcomes like production and employment, nor does it imply the belief (by this time held by relatively few economists) that there is no relationship between such real outcomes and inflation in the short or even the medium run. But a basic rationale for having a formal, quantitative inflation target is the idea, far more widely accepted, that over the long run monetary policy can determine an economy's average inflation rate while it cannot determine its average output or employment. For example, when a central bank seeks to maintain both low

inflation and full-employment output, the relative strength of its preferences between these two objectives determines over what period of time it will seek to return to the targeted inflation rate after some departure has occurred. (If the central bank completely disregarded real outcomes, it would seek to return immediately.)

Yet another hoped-for advantage of having a formally stated (i.e., quantitative) inflation target is to facilitate monitoring and evaluation of the central bank's performance by political authorities as well as the public. The underlying presumption is that, on average over time, the central bank can achieve whatever inflation rate it seeks. Hence failure to satisfy the stated target can be laid at the central bank's door. (Some economists have further formalized this idea by incorporating such targets into optimally designed employment contracts for central bankers; one country, New Zealand, has experimented along these lines.) If inflation targeting does effectively serve this additional purpose, it will therefore also help to address the long-standing concerns about the role of an independent central bank in a democratic society.

References: Svensson (1997), Bernanke et al. (1999).

4. Outstanding Research Questions.

It would be wrong to give the impression that by the end of the twentieth century the combination of experience and research had settled all important questions about monetary policy. Monetary economics is not a laboratory science with the ability to conduct controlled experiments. Hence drawing conclusions from observed evidence is rarely straight forward. Moreover, many questions that bear centrally on how best to conduct monetary policy hinge on how an economy's businesses, households and banks behave in contexts where the changing

economic backdrop and changing institutional arrangements matter importantly. Even if such questions appear settled at some time, therefore, the answers do not necessarily remain valid. As a result, research on monetary policy is, and is likely to remain, ongoing.

4.1. The transmission mechanism. A perennial focus of the monetary policy research agenda is to pin down, as precisely as possible, the behavioral process by which the central bank's actions influence the nonfinancial economy. Part of the problem is not that there are too few potential influences at work, but so many (see section 2.3 above). Most of these quite different theoretical accounts of how monetary policy works are not mutually exclusive. At some abstract level, merely knowing that one or more potential explanations exist is sufficient. But especially for purposes of the quantitative assessment that is required for actual policy implementation (see section 4.2 below), knowing which mechanisms are actually at work, and how much of the overall effect of policy is due to each, is important too.

Yet another part of what makes this research program difficult is the tension between economists' (and other scientists') preference for simple theories and the apparent need in this line of inquiry to take account of the often quite involved circumstances under which banks, businesses and households interact. Extremely simple theories of monetary policy often deliver conclusions that may be appealing intellectually but that observed experience readily contradicts — for example, that monetary policy affects prices but not real economic activity, or that inflation varies in close proportion to money growth. By contrast, theories leading to conclusions more in line with experience tend to be complicated, even messy, and the need to draw more finely focused empirical inferences thwarts easy empirical validation.

The principle focus of current research on the monetary policy transmission mechanism centers on various aspects of the distinction between the “money view” and the “credit view” of how monetary policy works. Under the “money view,” contractionary policy restricts the amount of deposits that banks can create, thereby driving market interest rates higher (so that the nonbank public is willing to hold less money), and the resulting higher interest rates and lower asset prices depress the demand for goods and services. Under the “credit view,” what matters instead is banks’ reduced capacity to extend loans to firms and households seeking to finance expenditures. It is easy enough to specify simple models in which these two accounts are identical. But entirely plausible modifications — for example, that banks ration credit rather than simply raising the interest rate charged until demand equals supply in the loan market, or that some borrowers that normally borrow from banks cannot obtain credit elsewhere — render the two clearly distinguishable. Further, how monetary policy actions affect various parts of the nonfinancial economy is different under these two accounts of how policy works.

References: Bernanke and Blinder (1988), Bernanke and Gertler (1995).

4.2. Quantitative measurement. For a central bank charged with carrying out a country’s monetary policy, even full knowledge of the qualitative process by which policy works at is not sufficient. It is also necessary to have some idea of how much to increase or reduce the supply of reserves, or how far to raise or lower interest rates, in order to achieve any given objective at any particular time. Such knowledge can be no more than a statistical estimate, subject to uncertainty. But having such estimates, and also an informed sense of the associated uncertainty, is crucial.

In recent decades three lines of empirical research have represented attempts to gain such knowledge. “Structural” economic models (i.e., models that use theory to place restrictions on the admissible representation of the behavior under study) allow the use of observed data to measure specific parts of the monetary policy process — for example, how business investment responds to interest rate fluctuations, or how consumer demand varies with stock prices, or how the exchange rate moves as interest rates move. Putting together enough such parts produces a quantitative representation of the monetary policy process as a whole. Here theory matters: the value of the resulting estimates, for either the parts or the whole, depends on the validity of the a priori restrictions imposed. Most central banks estimate and regularly use structural models of this form, although little such work has taken place in the academic world in recent years.

Especially since the 1970s, “vector autoregressions” (sets of equations that intensively exploit the raw covariation over time of a small number of economic variables) have been the main vehicle used in academic research for addressing questions about monetary policy at the aggregative level. When used for purposes like assessing the effects of monetary policy, however, even vector autoregressions are not free from restrictions based ultimately on theory. Most basically, a vector autoregression includes some variables (usually a very small number) and excludes all others. Next, a “causal ordering” is needed to enable a vector autoregression to sort out what is causing what among the included variables. Still richer sets of cross-equation restrictions, similar in some respects to those underlying conventional structural models, allow “structural vector autoregressions” to exploit the covariation in the data yet more fully. But as

in the case of structural models, the resulting estimates depend on the validity of the restrictions imposed.

Beginning in the late 1980s, there has also been renewed interest in combining standard statistical methods with the use of nonquantitative information — drawn, for example, from close reading of minutes of meetings at which central bank officials make decisions about monetary policy. Once translated into some quantitative form by human interpreters, this information can then provide evidence about the overall effectiveness of monetary policy or help evaluate one model of the transmission mechanism against another. To date this work has been carried out for only a few countries.

References: Romer and Romer (1989), Sims (1992), Brayton et al. (1997).

4.3 Phillips Curve issues. The trade-off between the desire for price stability and the desire for high output and employment has been a persistently important aspect of monetary policy debate, and consequently of monetary policy research, throughout the postwar era. At the most basic level, the question at issue is how much foregone output or employment is required to bring a high inflation rate down to a lower one (i.e. what is the “sacrifice ratio”). Although some theories give an answer of zero — in other words, they imply that monetary policy is “neutral” — most experience indicates that there are real costs to disinflation. The question that much research has tried to answer from observed evidence is how much.

The sacrifice ratio is not a natural constant, however. An important part of this same line of research has been to establish what factors, especially including factors subject to influence by national policies, cause the trade-off to vary across countries. Possible determinants suggested by familiar theory include labor market institutions governing the

difficulty of hiring or firing workers, the generosity of publicly provided unemployment benefits, the economy's openness to international trade, the degree of central bank independence (see again section 3.4), the central bank's established "credibility," and the extent to which monetary policy decisions are transparent to the public. Research on each of these topics has provided mixed results.

Another empirical magnitude that figures importantly in the way most central banks implement monetary policy is the level of output or employment that is consistent with maintaining an unchanged inflation rate — or, measured in terms of unemployment, the "non-accelerating inflation rate of unemployment" (NAIRU). The rise of inflation in many countries in the 1960s and 1970s led to the conclusion that the NAIRU in these countries was higher than had been thought, so that their central banks had been systematically making monetary policy too expansionary and thereby overstimulating their economies. The failure of inflation to rise in the United States in the 1990s, despite very rapid economic growth and unemployment well below previous NAIRU estimates, similarly led to the conclusion that the U.S. NAIRU had fallen. One more general result of this experience was to lesson confidence in the ability to gauge correctly any given country's NAIRU, and even to call into question the usefulness of such imprecise estimates as are available as a guide for monetary policy. Another was to revive interest in the idea that any country's NAIRU is subject to change over time, driven in part by changes in some of the same factors that influence its sacrifice ratio.

Each of these lines of inquiry is implicitly a question about the short, or at most the medium, run. Implicit in the standard underlying theory is the idea that in the long run monetary policy is neutral — in other words, real aspects of economic performance like output and

employment eventually revert to levels determined by resources, technologies, preferences and other fundamental factors that are independent of the central bank's actions. Even so, there remains a long-run trade-off between the variability of output and employment and the variability of inflation, which the central bank's approach to monetary policymaking does influence. Seeking to understand how this variability trade-off arises, and exploring the implications for it of different ways of conducting monetary policy (see again Section 3) remains an important part of the research agenda in this field.

Finally, a quite different line of research on these issues, prompted in part by the chronic high unemployment and stagnant growth in so many European countries in the last quarter of the twentieth century, has questioned the standard theory that monetary policy is neutral in the long run — so that, for example, a reduction in inflation requires only a temporary loss of output and employment. If the economy's production process adjusts so that some part of the reduced employment never recovers (for example, because some unemployed workers leave the labor force permanently), and similarly for output (for example, because some productive investments are not undertaken), then by analogy to physical processes, real economic activity exhibits "hysteresis." To the extent that such hysteresis occurs, the usual interpretation of the sacrifice ratio in terms of strictly temporary real costs of achieving permanent disinflation is invalid.

References: Feldstein (1979), Taylor (1979), Blanchard and Summers (1986), Ball (1994).

4.4 Costs of inflation. Much of the motivation underlying the conduct of monetary policy is to preserve price stability, or at least a low rate of inflation. For some central banks,

most prominently the German Bundesbank and later the European Central Bank, price stability is the only economic objective formally stated in the bank's charter. For others, like the U.S. Federal Reserve System, price stability is one among just a few objectives set forth.

By contrast, economic theory and empirical analysis have never been able to identify just why movements in an economy's overall price level are so harmful. In the simplest theories, inflation that is anticipated in advance has no real effects at all, and unanticipated inflation merely creates transfers from some groups to others (for example, from creditors to debtors). Abandoning simplicity in favor of realism introduces many avenues for inflation to result in welfare-reducing costs (the classic example is the cost of more closely managing one's assets so as to minimize the higher interest foregone on holding currency). But empirical estimates of the magnitude of such costs are typically small. There is also no evidence that inflation below about 10% per annum reduces an economy's growth rate.

Yet evidence of many forms, including opinion surveys as well as election returns, makes clear that the public in most countries dislikes inflation, and even that the public is willing to accept sizeable real costs as a sacrifice necessary to reduce inflation. One possibility is that the aspect of inflation that most distresses the public is not economic, in any narrow sense, but instead the concern that if the government is not able to carry out this aspect of its responsibilities effectively — providing a medium of exchange has been a government function almost as long as there have been governments — then perhaps the social order may be at risk in other ways as well. In any case, although understanding the costs of inflation has long been on the research agenda surrounding monetary policy, it remains an even more open question than most.

References: Fischer and Modigliani (1978), Driffill et al. (1990).

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