Keynesian Macroeconomics without the LM Curve

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David Romer

T
he IS-LM model has been a central tool of macroeconomic teaching and practice for over half a century. Legions of earlier writers have offered criticisms of the model that have become familiar with the passage of time: the model lacks microeconomic foundations, assumes price stickiness, has no role for expectations, and simplifies the economy's complexities to a handful of crude aggregate relationships. But countless teachers, students, and policymakers have found the model to be a powerful framework for understanding macroeconomic fluctuations.

Recent developments have created new difficulties for the IS-LM model. Although the new difficulties are less profound than the traditional ones, they are more likely to be fatal. Like all models, the IS-LM model is not universal. Its assumptions and simplifications make it better suited to analyzing some issues than others, and to describing some economic environments than others. But neither the issues nor the environment of macroeconomic fluctuations are fixed. In terms of issues, one major change is that the debates between Keynesians and monetarists about the relative effectiveness of monetary and fiscal policy that were central to macroeconomics in the 1960s and 1970s now play only a modest role in the analysis of short-run fluctuations. In terms of the environment, one important change is that most central banks, including the U.S. Federal Reserve, now pay little attention to monetary aggregates in conducting policy. But the IS-LM model is particularly well-suited to presenting the debates between Keynesians and monetarists, and one of its basic assumptions is that the central bank targets the money supply.

In short, recent developments work to the disadvantage of IS-LM. This observation suggests that it is time to revisit the question of whether IS-LM is the best

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choice as the basic model of short-run fluctuations we teach our undergraduates and use as a starting point for policy analysis. The thesis of this paper is that it is not.

There is an old adage that it takes a theory to beat a theory. Joining the many earlier authors who have pointed out weaknesses in the IS-LM model, and describing how many of those weaknesses are particularly important for macroeconomics today, will not persuade economists to depart from the model unless I can show that there are alternatives that avoid some or all of its weaknesses without encountering even greater ones. I therefore make the case against IS-LM mainly by presenting a concrete alternative. The alternative replaces the LM curve, along with its assumption that the central bank targets the money supply, with an assumption that the central bank follows a real interest rate rule. The new approach turns out to have many advantages beyond the obvious one of addressing the problem that the IS-LM model assumes money targeting. As I describe over the course of the paper, it avoids the complications that arise with IS-LM involving the real versus the nominal interest rate and inflation versus the price level; it simplifies the analysis by making the treatment of monetary policy easier, by reducing the amount of simultaneity, and by giving rise to dynamics that are simple and reasonable; and it provides straightforward and realistic ways of modeling both floating and fixed exchange rates.

The fact that there is one alternative that appears superior to IS-LM for macroeconomics today does not mean that this particular alternative is necessarily the best baseline model. In addition to presenting my specific alternative to IS-LM, I therefore also briefly consider some other possibilities.

The IS-LM Model

The simplest version of the IS-LM model describes the macroeconomy using two relationships involving output and the interest rate. The first relationship concerns the goods market. A higher interest rate reduces the demand for goods at a given level of income. In almost all formulations of the model, it reduces investment demand; in many, it also reduces the demand for consumer durables or for consumption in general. In open-economy versions with floating exchange rates, it bids up the value of the domestic currency and thereby reduces net exports. Because a higher interest rate reduces demand, it lowers the level of output at which the quantity of output demanded equals the quantity produced. There is thus a negative relationship between output and the interest rate. This relationship is known as the IS curve; the name comes from the fact that in a closed economy, the condition that the quantity of output demanded equals the quantity produced is equivalent to the condition that planned investment equals saving.

The second relationship concerns the money market. The quantity of money demanded—that is, the demand for liquidity—increases with income and decreases with the interest rate. This liquidity preference combines with the quantity of money supplied by the central bank to determine equilibrium in the money

Figure 1
The IS-LM Diagram
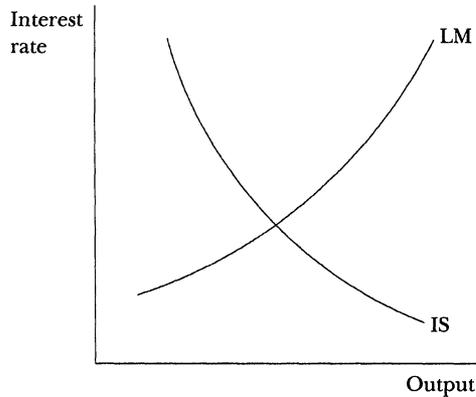
market. If the money supply is fixed, a rise in aggregate income, by increasing the demand for liquidity, raises the interest rate at which the quantity of money demanded equals the supply. This positive relationship between output and the interest rate, based on the liquidity preference-money supply relationship, is known as the LM curve.

The two curves are shown in Figure 1. Their intersection shows the only combination of output and the interest rate where both the goods market and the money market are in balance; thus it shows output and the interest rate in the economy. An increase in government purchases or a decrease in taxes shifts the IS curve to the right, and thus raises both output and the interest rate as the economy moves up along the LM curve. The size of the effect on output depends on the slopes of the two curves and on the size of the shift of the IS curve. Similarly, an increase in the money supply shifts the LM curve down, and thus lowers the interest rate and output; the size of the output effect depends on the slopes of the curves and the amount the LM curve shifts. Many of the debates between Keynesians and monetarists came down to debates over the values of various parameters underlying the two curves.

The basic version of the model assumes a fixed price level; thus it cannot be used to analyze inflation. This observation illustrates the point that one cannot discuss whether a model is "good" without knowing what issues it is intended to address. Inflation was of little concern in the 1950s and early 1960s, and so the basic IS-LM model was enormously valuable. But when inflation became important in the late 1960s and 1970s, the model needed to be changed. The rise of inflation led to extensions of the model to incorporate aggregate supply, leading to the IS-LM-AS model we use today.

The essential feature of the aggregate supply extensions of IS-LM is that higher output leads to a higher price level. There are many different ways of formulating this relationship. Output's impact on prices can operate directly through firms'

price-setting decisions, or indirectly through wages. The lack of complete nominal flexibility (which is what is needed for the AS curve in output-price level space to be upward-sloping rather than vertical) can be justified on the basis of adjustment costs, imperfect information, or contracts. The price level that prevails when output equals its normal level (or "natural rate") can be determined by rational forward-looking expectations, by inertia from past levels of inflation, or by a combination. Many formulations of the AS part of the model have been proposed, but they all involve a positive relationship between output and the price level.

Thus, the IS-LM-AS model consists of three equations in three unknowns: output, the interest rate, and the price level. Depicting a three-equation model graphically is difficult. The standard strategy is to combine the IS and LM curves to obtain a relationship between output and the price level. Given the fixed money supply—the assumption on which the LM curve is based—a higher price level reduces real money balances. Thus, for a given level of income, the interest rate at which the quantity of money demanded equals the supply rises. The LM curve therefore shifts up, and the IS and LM curves intersect at a lower level of output than before. This inverse relationship between the price level and output is known as the aggregate demand curve. The aggregate demand and aggregate supply curves then determine output and the price level. They are shown in Figure 2.

In judging whether the IS-LM-AS model is the best baseline model to use in analyzing short-run fluctuations today, it is wrong to criticize it for being too simple. A model must be simple if it is to serve as a comprehensible basic framework. A principle *virtue* of the IS-LM-AS model is that many students and policymakers with little or no previous exposure to economics can, after some effort, master its mechanics, understand its intuition, and apply it to novel situations. The fact that the model is somewhat challenging for most first-time users means that a noticeably more complicated model would not have this advantage.

The relevant question, then, is whether the IS-LM-AS model's choices about how to construct a simple macroeconomic model are the best ones for analyzing short-run fluctuations today. The model's two best-known and most controversial choices are, I believe, essential. The first of these is to assume that the price level does not adjust completely and immediately to disturbances. This lack of perfect nominal adjustment causes monetary changes to affect real output in the short run. It also creates a channel through which other changes in aggregate demand, such as changes in government purchases, have real effects. This is not the forum to rehash the question of whether incomplete nominal adjustment is an important feature of actual economies. But my own view is that any model without it is unusable as a reasonable baseline for understanding most actual fluctuations.

The model's second key controversial choice is to dispense with microeconomic foundations. The demands for consumption, investment, and money, the nature of price adjustment, and so on are simply postulated and defended on the basis of intuitive arguments, rather than derived from analyses of households' and firms' objectives and constraints. The benefit of this lack of foundations is enormous simplification. Even the easiest models with microeconomic foundations are

Figure 2
The AD-AS Diagram
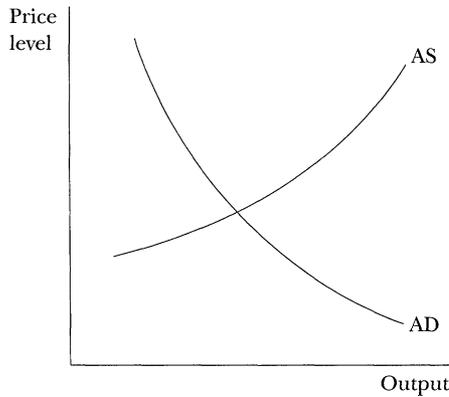
much harder than the corresponding ingredients of IS-LM-AS. For example, the micro-based permanent income model of consumption is much more complicated than the simple assumption that consumption depends on current disposable income. Further, the predictions of the simplest models with microeconomic foundations appear no more accurate than those of the corresponding ad hoc formulations in IS-LM-AS. For example, the permanent-income hypothesis implies that changes in current disposable income affect consumption only to the extent that they affect permanent income, while the traditional IS-LM-AS consumption function implies that they have a large direct effect on consumption. The truth appears to be squarely in between (for example, Campbell and Mankiw, 1989). Thus moving from the ad hoc assumption in IS-LM-AS to a relatively simple formulation based on intertemporal optimization has little or no benefit in terms of realism, but a large cost in terms of ease. The tradeoff is similar for grounding the analysis of investment demand, money demand, price rigidity, and so on more strongly in microeconomic foundations: even the easiest models are dramatically harder than their IS-LM-AS counterparts, and not obviously more realistic.

When we move from the IS-LM-AS model's fundamental features to its tactical choices, however, its merits become less clear. My presentation already suggests three aspects of the model that are difficult, inconsistent, or unrealistic. First, despite my references to "the" interest rate, in fact different interest rates are relevant to different parts of the model: the real interest rate is relevant to the demand for goods and thus to the IS curve, while the nominal rate is relevant to the demand for money and thus to the LM curve. Second, the aggregate demand and aggregate supply curves are relationships between output and the price level, while what we are typically interested in understanding is the behavior of output and inflation. For example, in the postwar United States, negative shocks to aggregate demand have led to falls in inflation, not to declines in the price level. Third, as I mentioned at the outset, the model assumes that the central bank sets a fixed

money supply. But most central banks pay little attention to the money supply in making policy.

The next section therefore describes a concrete alternative to the IS-LM-AS model. Like IS-LM-AS, the alternative assumes imperfect nominal adjustment and lacks microeconomic foundations. The main change is that it replaces the assumption that the central bank targets the money supply with an assumption that it follows a simple interest rate rule.[1]

This paper presents the essential features of the new approach, compares it with IS-LM-AS, and explains why I believe it is preferable. A companion paper exposits the new approach at a level suitable for undergraduates and in a way that is compatible with mainstream intermediate macroeconomics texts (Romer, 1999). That paper is available on the web at ⟨http://elsa.berkeley.edu/~dromer/index.html⟩.

The IS-MP-IA Model

Monetary Policy

The key assumption of the new approach is that the central bank follows a real interest rate rule; that is, it acts to make the real interest rate behave in a certain way as a function of macroeconomic variables such as inflation and output. This assumption is a vastly better description of how central banks behave than the assumption that they follow a money supply rule. Central banks in almost all industrialized countries focus on the interest rate on loans between banks in their short-run policy-making. In the United States, for example, the Federal Reserve conducts monetary policy mainly by manipulating the federal funds rate.

The dividing line between an interest rate rule and a money supply rule can be a fine one. For example, if the central bank adjusts the interbank lending rate to keep the money supply as close as possible to an exogenous target path, then it would be best to call this policy a money targeting rule. But most central banks do not behave this way. In the United States, the Federal Reserve chooses the federal funds rate to try to achieve its objectives for inflation and output, and monetary aggregates play at most a minor role in those choices. Indeed, the Federal Reserve's setting of the funds rate over the past 15 years is well described by a simple function of inflation and output alone (Taylor, 1993).

The same is true in other countries. Even in Germany, where there were money targets beginning in 1975 and where those targets played a major role in official policy discussions, policy from the 1970s through the 1990s was better

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[1] Because of the new approach's many advantages over IS-LM-AS, variants of it have surely been developed by many instructors. Yet to my knowledge it is not used as the main approach in any intermediate macroeconomics text. It is employed, however, by Taylor (1998) in his principles text. In addition, Hall and Taylor (1997, Chapter 16) use a version of the new approach as an auxiliary model in their chapter on economic policy.

described by an interest rate rule aimed at macroeconomic policy objectives than by money targeting.[2] The Bundesbank's money targets were explicitly tied to underlying inflation targets, and implicitly to output and exchange rate objectives. The Bundesbank was willing to miss the money targets when they conflicted with those macroeconomic objectives. As a result, one can provide an excellent description of German monetary policy over the past 25 years in terms of the Bundesbank's adjustment of interest rates to inflation, output, and the exchange rate, with only a secondary role for monetary aggregates.

Finally, the dominance of interest rates over monetary aggregates in the conduct of monetary policy is not a recent phenomenon. In the United States, for example, only in the 1979–1982 period did monetary aggregates play a significant role in policy. Indeed, an essential part of the traditional monetarist critique of policy was that central banks were not targeting the money supply.

This discussion shows the first advantage of the new approach over IS-LM-AS:

Advantage 1. The assumption that the central bank follows an interest rate rule is more realistic than the assumption that it targets the money supply.

Because of this characteristic, students find the model easier to relate to discussions of policy. For example, news articles about central bank decisions concerning interest rates are much more common than articles about their money targets.

An important feature of the new approach is that the interest rate rule is a rule for the real interest rate. Most central banks use the nominal interbank rate as their short-term instrument. Nonetheless, there are two reasons for focusing on a real rate rule.[3]

The first reason is realism. When the central bank is fixing the nominal rate, an increase in expected inflation reduces the real rate until the bank reexamines its choice of the nominal rate. Thus for the very short run, a nominal rate rule provides a better description of central banks' behavior than a real rate rule. But central banks reexamine their choice of the nominal rate frequently. When they decide whether to change their target level of the nominal rate, they take changes in expected inflation into account; thus they are effectively deciding how to set the real rate. For example, the Federal Reserve raised the nominal federal funds rate at least one-for-one with increases in expected inflation in some important episodes in the 1980s (Goodfriend, 1993). Once we consider horizons beyond the very short run, a real interest rate rule is more realistic than a nominal rate rule.

The second reason for assuming that the central bank follows a real interest rate rule is that it is important to the model's simplicity and coherence. In the

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[2] The discussion in this paragraph is based on Clarida and Gertler (1997). See also von Hagen (1995), Bernanke and Mihov (1997), and Laubach and Posen (1997).

[3] For the central bank to be able to follow a real interest rate rule, it must be able to affect the real rate. As described below, it cannot do so if prices are completely flexible. Thus, the assumption that the central bank is able to follow a real interest rate rule makes the model Keynesian.

IS-LM model, because the real rate is relevant to the IS curve and the nominal rate to the LM curve, a change in expected inflation shifts one of the curves: the LM curve if the diagram is in output-real rate space, the IS curve if it is in output-nominal rate space. Moreover, since inflation is determined within the model, expected inflation and the resulting movements of one curve relative to the other should be determined within the model as well. But trying to develop a model along these lines leads to a formulation that is much too complicated to explain in a way that is understandable. As a result, standard presentations of IS-LM take expected inflation as exogenous.

By assuming that monetary policy focuses on the real interest rate, the new approach avoids these difficulties. With this assumption, expected inflation matters only for the technical task facing the central bank of manipulating the money supply to follow its real rate rule. It is not difficult to describe how expected inflation affects this task, as I show later. Thus a second advantage of the new approach appears:

> **Advantage 2.**   The new approach describes monetary policy in terms of the
> real interest rate.

For a real interest rate rule to keep inflation from rising or falling without bound, the target real rate must depend on inflation. For example, fixing the real rate produces explosive inflation or deflation unless the fixed rate exactly equals the rate that causes output to equal its natural level. This difficulty is a specific instance of the general result that monetary policy must have a nominal anchor if it is to keep nominal variables from rising or falling without bound.

The simplest real interest rate rule is one that makes the real rate a function only of inflation: $r = r(\pi)$, with the function assumed to be increasing. The intuition behind this rule is straightforward. The central bank would like to have low inflation and high output. When inflation is high, its concern about inflation predominates, and so it chooses a high real rate to contract output and dampen inflation. When inflation is low, it is no longer as concerned about inflation, and so it chooses a lower real rate to increase output. This real interest rate rule replaces the LM curve of conventional Keynesian models.

This discussion shows a third advantage:

> **Advantage 3.**   A real interest rate rule is simpler than the LM curve.

The real interest rate rule is a direct assumption about the central bank's behavior, whereas the LM curve has to be derived from an analysis of the money market. With the new approach, one can therefore get to important issues more quickly and easily and postpone consideration of the money market to a discussion of the mechanics of how the central bank controls the real rate. Alternatively, for a principles-level treatment, one can leave out the money market altogether.

Figure 3
The IS-MP Diagram

The IS-MP and AD-IA Diagrams
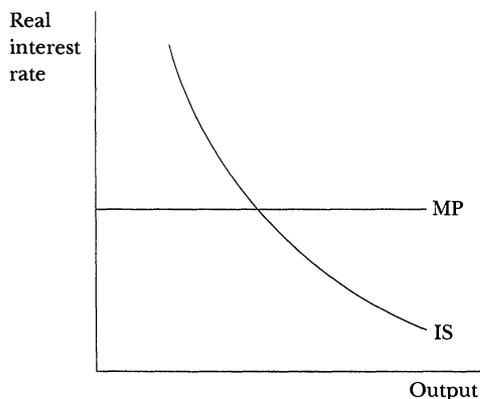
The IS-MP and AD-IA Diagrams

Since the central bank's choice of the real interest rate depends only on inflation, for a given inflation rate the real rate rule is just a horizontal line in output-real rate space. I refer to the line as the MP curve (for monetary policy). It is shown together with a standard downward-sloping IS curve in Figure 3. Their intersection determines output and the real interest rate for a given inflation rate. To put it differently, inflation determines the central bank's choice of the real rate, and the IS curve then determines output.

By assumption, an increase in inflation causes the central bank to raise the real rate. Thus the MP curve shifts up. The shift is shown in the top panel of Figure 4. The economy moves up along the IS curve, and so output falls. Thus, there is an inverse relationship between inflation and output; this is shown in the bottom panel of the figure. Since this relationship summarizes the demand side of the economy, it is natural to call it the aggregate demand curve. It differs from the aggregate demand curve of the traditional approach, however. Here, higher inflation causes the central bank to increase the real interest rate, which reduces output. In IS-LM, in contrast, a higher price level reduces the real money stock, and thus raises the equilibrium interest rate at a given level of output.

This discussion shows a fourth advantage of the new approach:

> **Advantage 4.** In the new approach, the aggregate demand curve relates inflation and output.

In the traditional AD-AS approach, the aggregate demand curve relates the price level and output. One therefore has to explain that the model implies that a negative aggregate demand shock does not actually lead to a lower price level, but to a price level lower than it otherwise would have been. This point is omitted altogether in some treatments. Even when it is explained, it is sufficiently subtle that

Figure 4
The Aggregate Demand Curve
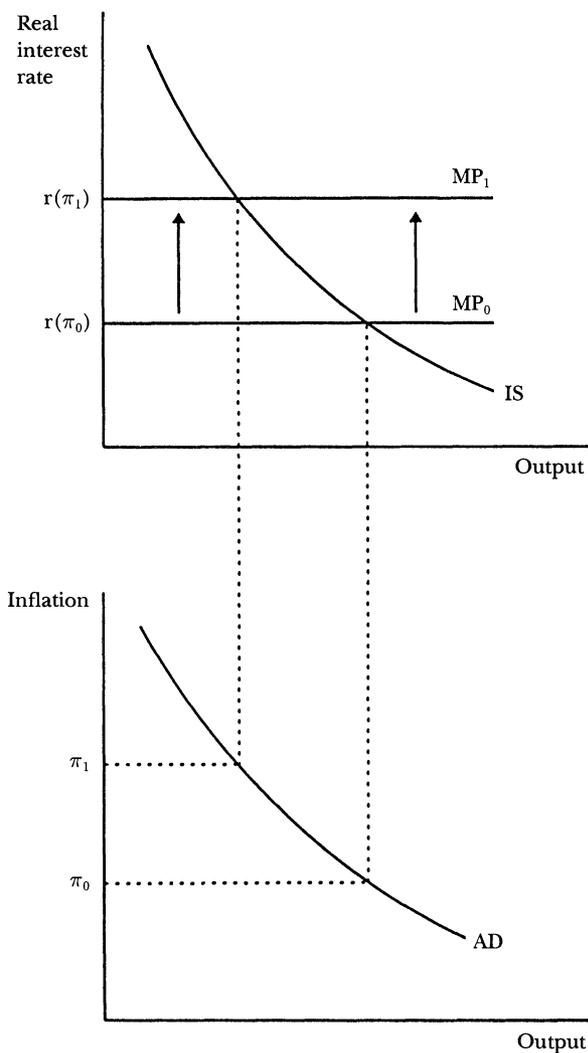
many students end up confused about the model's predictions or about the distinction between the price level and inflation.

The remaining step is to bring in aggregate supply. The easiest approach follows Taylor (1998). This approach assumes that inflation at any point in time is given, and that in the absence of inflation shocks, inflation rises when output is above its natural rate and falls when output is below its natural rate. There are two assumptions here. The first is that the immediate impact of an increase in aggregate demand falls entirely on output. This assumption is a convenient simplification; and the fact that output appears to respond more rapidly than inflation to aggre-

Figure 5
The Determination of Inflation and Output at a Point in Time
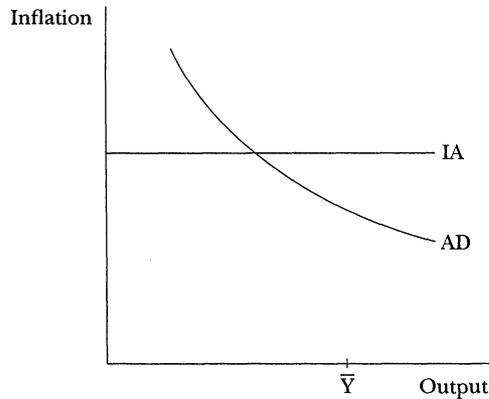
gate demand shocks suggests that it is a reasonable approximation (for example, Gordon, 1990). The second assumption is that when output equals its natural rate and there are no inflation shocks, inflation is steady. This assumption fits the evidence that there is inflation inertia, and that as a result inflation cannot normally be reduced without a period when output is below its natural rate.

The assumption that inflation is given at a point in time implies that the short-run aggregate supply curve is horizontal in output-inflation space. Since the aggregate supply relationship determines how inflation changes with output, I refer to this line as the inflation adjustment (IA) line. Figure 5 shows the AD and IA curves. Their intersection determines inflation and output.[4]

The model's mechanics are straightforward. Inflation is inherited from the economy's past. Inflation determines the real interest rate, and the real rate determines output. Thus:

Advantage 5.   In the simplest version of the model, there is no simultaneity.

This feature of the model is particularly desirable for principles courses. The full IS-LM-AS model, with its three equations in three unknowns, is too complicated for many students taking their first economics courses.

In Figure 5, the AD and IA curves intersect at a point where output is below its natural rate, $\bar{Y}$. The inflation-adjustment assumption is that below-normal output causes inflation to fall. Thus the IA line shifts down. It is both easier and more realistic to assume that it shifts down continuously rather than in discrete steps. The

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[4] A natural alternative to this assumption of inflation adjustment is the standard assumption of an expectations-augmented aggregate supply curve. I discuss how to use this approach to aggregate supply with the IS-MP approach to aggregate demand, and its advantages and disadvantages relative to the inflation-adjustment approach, in the concluding section.

Figure 6
Adjusting to Long-Run Equilibrium
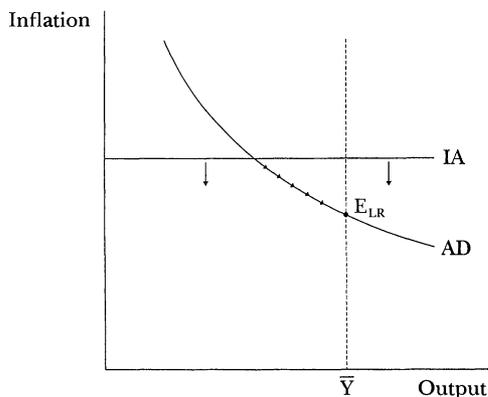
economy moves down along the AD curve, with inflation falling and output rising. This movement is shown in Figure 6. The process continues until output reaches its natural rate (point E_{LR} in the figure). At that point, inflation is steady, and there are no further changes until the economy is hit by a shock.[5]

A departure of output from normal causes inflation to change, which causes the central bank to change the real interest rate, which moves output back toward normal. These simple dynamics allow one to describe the paths of the major macroeconomic variables from the time of a shock until the economy's return to long-run equilibrium. These dynamics are realistic. For example, they are consistent with the overwhelming evidence that a disinflation coming from a shift in monetary policy involves a period of below-normal output and high real interest rates. Thus:

**Advantage 6.** The model's dynamics are straightforward and reasonable.

In IS-LM-AS, in contrast, whenever money growth and inflation differ, the real money stock changes, and so the LM curve shifts. As a result, the path of the economy after a shock usually has output overshooting its natural rate and involves spirals in output-inflation space. These dynamics are complicated and of little interest.[6]

An example may make the model clearer. The economy starts in long-run equilibrium: output is at its natural rate and inflation is steady. Then consumer

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[5] I follow the usual custom of neglecting the fact that the natural rate of output is rising over time.
[6] The analysis in Taylor (1998) illustrates the new approach's ease. His book analyzes fluctuations at a depth comparable to that in standard intermediate books. For example, it provides a thorough description of the effects of fiscal and monetary policy on GDP, the components of GDP, and inflation in the short, medium, and long runs. It also follows the path of the economy in more complicated scenarios, such as a boom-bust cycle in monetary policy.

Figure 7

The Effects of a Fall in Consumer Confidence
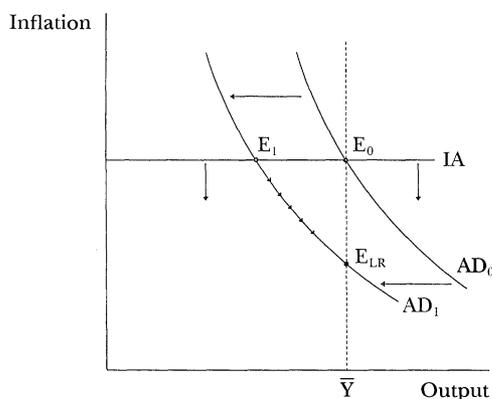
confidence falls. Specifically, the consumption function shifts down, so that consumption for a given level of disposable income is lower than before.

We can use the IS-MP diagram to find the short-run effect on output. The fall in consumer confidence shifts the IS curve to the left in the usual way. Since inflation does not respond immediately, the MP curve does not move. Thus the IS-MP analysis implies that in the short run, output falls and the real interest rate is unchanged.

The same analysis implies that at any given level of inflation, output is lower than it would have been before. That is, the fall in consumer confidence shifts the aggregate demand curve to the left. The shift is shown in Figure 7. The immediate effect of the change is to move the economy from E_0 to E_1. Inflation is unchanged, and (as the IS-MP analysis showed) output falls.

With output below the natural rate, inflation begins to fall. As it falls, the central bank lowers the real interest rate, increasing output. That is, the economy moves down along the aggregate demand curve, as shown by the arrows in the figure. The process continues until output is restored to its natural rate (point E_{LR} in the figure). The end result is lower inflation and a lower real interest rate. This account appears to capture important aspects of macroeconomic developments in the United States during the 1990 Gulf War and its aftermath: there was a fall in output led by a decline in consumption, inflation declined, and reductions in interest rates led to a gradual return of output to normal.

The Money Market

The presentation so far assumes that the central bank influences the real interest rate, but says nothing about how it does this. This omission is important: the presentation has not described either what central banks actually do or the circumstances under which they are or are not able to influence the real rate.

Central banks act by injecting or draining high-powered money from financial markets. Thus analyzing the central bank's influence over the real rate requires examining the market for money. It is easiest to frame the discussion using the conventional equation for equilibrium in the money market, $M/P = L(i, Y)$. The left-hand side is the supply of real money balances. The right-hand side is the demand, which is assumed to be decreasing in the nominal interest rate and increasing in output.

With the LM approach, the appropriate measure of money is not clear. The argument for making money demand a function of the nominal rate is that money pays no nominal interest (or a nominal rate that does not vary with market-determined nominal rates), and thus that the opportunity cost of holding money is the nominal rate. M should therefore be some measure of noninterest-bearing money, such as the stock of high-powered money. But M is also supposed to be a variable that the central bank is holding fixed in the face of shocks. This is emphatically not an accurate description of how central banks treat high-powered money (or any other quantity of noninterest-bearing money).

In the MP approach, in contrast, the appropriate concept of money is unambiguously high-powered money. Here M is not a variable the central bank is targeting, but rather one it is manipulating to make interest rates behave in the way it desires. This is an excellent description of high-powered money. Moreover, for high-powered money, the assumption that the opportunity cost of holding money is the nominal rate is appropriate. In addition, the assumption that the central bank can control the money stock is a much better approximation for high-powered money than for broader measures of the money stock. To summarize:

Advantage 7. With the new approach, the correct concept of money to consider is unambiguous.

One corollary of this observation is that the new approach allows one to dispense with the confusing and painful analysis of how the banking system "creates" money.

The key issue here is whether an increase in the money stock lowers the real interest rate. If it does, the central bank can adjust the money stock to control the real interest rate, and so it can follow a real rate rule. But if the increase does not lower the real rate, the assumption that the central bank follows a real rate rule cannot be justified.

To analyze this issue, the first step is to decompose the nominal interest rate into the real interest rate and expected inflation. Thus the condition for equilibrium in the money market becomes $M/P = L(r + \pi^e, Y)$. The real interest rate now appears explicitly in the equilibrium condition.

The easiest way to proceed is to begin by assuming complete price rigidity, both now and in the future. That is, the price level equals some exogenous value and expected inflation is always zero. Analyzing this case shows how the central bank can affect the real rate under simple assumptions and provides a starting point for analyzing what happens when there is price adjustment.

    To analyze the central bank's ability to influence the real rate under complete price rigidity, one needs to consider the standard experiment of the central bank increasing the money supply when the money market is initially in equilibrium. Since the price level is fixed, real money balances, M/P, rise. With expected inflation fixed at zero, the demand for real money balances is $L(r, Y)$. The supply of real balances now exceeds the demand at the initial values of r and Y. Restoring equilibrium in the money market requires a fall in r, a rise in Y, or both. Since the economy must be on the IS curve, the increase in the money supply cannot cause only a fall in the real rate or only a rise in output. Instead, the economy moves down the IS curve, with r falling and Y rising, until the quantity of real balances demanded rises to match the increase in supply. Thus in this simple case the central bank can change the real interest rate by changing the supply of high-powered money.[7]

    We are now in a position to analyze what happens when prices are not completely rigid. There are two ways that prices may adjust to an increase in the money stock. First, some prices may be completely flexible, and may therefore jump when the money stock increases. Second, there can be a gradual rise of the price level to its higher long-run equilibrium level.

    The immediate adjustment of some prices dampens the impact of the increase in the money stock on the quantity of real balances. As a result, a smaller move down the IS curve is needed to restore equilibrium in the money market than when prices are completely fixed. Equivalently, the central bank must raise the money stock by more than before to achieve a given reduction in the real rate. But as long as the immediate response of the price level is smaller than the rise in the money stock, the central bank is able to reduce the real rate.

    In contrast, gradual adjustment of some prices after the increase in the money stock strengthens the impact of a change in the money supply. If the price level rises gradually after the increase in the money stock, the increase raises expected inflation. The nominal interest rate is therefore higher than before for a given real rate, and so the quantity of real balances demanded at a given r and Y is lower than before. The imbalance between the supply and demand of real balances at the old r and Y is therefore greater than in the case of permanently fixed prices, and so a larger move down the IS curve is needed to restore equilibrium. Equivalently, a smaller increase in the money stock is needed to achieve a given fall in the real rate.

    The important point of this analysis is simply that the increase in the money stock lowers the real interest rate; the only exception is the extreme and unrealistic case when all prices are completely and instantaneously flexible, so that the price

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[7] Rather than just showing that a monetary expansion moves the economy down the IS curve, one can derive the LM curve for a given level of the money supply and show how an increase in the money supply shifts the curve down. But since the central bank adjusts the money supply to ensure that the real rate and output lie on the MP curve, the LM curve plays no important role. Thus I believe it is clearer not to introduce it at all. If, however, one wants to compare money targeting and a real interest rate rule, showing how the central bank is moving the LM curve under a real rate rule is useful.

level jumps immediately by the same proportion as the money stock. Thus, except in this one case, the central bank can follow a real rate rule like the one assumed in the model. Describing exactly how it must adjust the quantity of high-powered money in response to various disturbances to follow a particular rule is of no great interest. When I teach this material, I tell my students that, having shown that it is possible for the central bank to affect the real interest rate, we can leave the specifics of how it needs to adjust the money supply to follow its real rate rule to the professionals at its open-market desk.

This analysis shows a further advantage of the new approach:

Advantage 8.   One can fully incorporate endogenous changes in expected inflation into the analysis of the aggregate demand side of the model.

Changes in expected inflation affect how the central bank must adjust the money stock to follow its real interest rate rule, but have no further effects on aggregate demand.

The Open Economy

The last step in describing the new approach is to bring in open-economy considerations. A common approach to modeling floating exchange rates in intermediate and principles macroeconomics is to assume that different countries' assets are perfect substitutes, that there are no barriers to capital flows, and that real exchange rate expectations are static. With these assumptions, the domestic real interest rate must equal the world real interest rate. As a result, these assumptions require a different approach than either IS-LM, where the interest rate is helping to equilibrate the goods market and the money market, or IS-MP, where the central bank is setting the interest rate. Likewise, the usual baseline approach to the case of fixed exchange rates begins by stating that since fixing the exchange rate requires the central bank to trade domestic for foreign currency at the fixed rate, such a system makes monetary policy passive. Thus the central bank can neither peg the money supply, as in IS-LM, nor adjust it to follow an interest rate rule, as in IS-MP.

Here, as with the treatment of monetary policy, both realism and ease of modeling are promoted by departing from the usual baseline assumptions. The idea that central banks cannot influence their economies' real interest rates and money supplies is clearly not correct. Throughout the world, central banks following both floating and fixed exchange rate policies manipulate their domestic real interest rates and money supplies to combat inflation, stimulate output, and defend exchange rates. Assuming away this basic fact not only requires students to learn a new set of tools to study the open economy, but also makes it hard for them to relate what they are learning to what they hear about policy.

It is therefore better to model the open economy in a way that allows the domestic interest rate to differ from the world interest rate, and thus that allows the central bank to follow an interest rate rule. Specifically, I use the common alter-

native assumption that a country's net foreign investment—that is, domestic purchases of foreign assets minus foreign purchases of domestic assets—is a decreasing function of the domestic real interest rate. With this assumption, the domestic interest rate can differ from the world interest rate.

The companion paper spells out the specifics of how one can use this approach to analyze both floating and fixed exchange rates (Romer, 1999). In both cases, the IS-MP diagram can still be used to analyze aggregate demand.[8] It is then necessary to supplement the IS-MP diagram to see how the economy's international transactions are determined. This additional analysis can be presented using straightforward diagrams. In the case of floating exchange rates, the additional analysis shows the determination of net exports and the exchange rate. In the case of fixed exchange rates, it shows the determination of the change in the central bank's reserves of foreign currency and which monetary policies are feasible and which are not. With a fixed exchange rate, setting the real rate at the level implied by the interest rate rule may lead to an imbalance between the supply and demand of foreign currency at the fixed exchange rate. If supply exceeds demand, the central bank is gaining reserves of foreign currency; if demand exceeds supply, it is losing reserves. In the latter case, if the central bank does not have enough reserves it must abandon either the fixed exchange rate or the interest rate rule. Thus, although the desire to fix the exchange rate does not completely determine monetary policy, it constrains it.

The usual baseline assumption that the domestic real interest rate must equal the world real interest rate is a special case of the model. As capital mobility increases, net foreign investment becomes more responsive to the real interest rate. In the case of floating exchange rates, this increased responsiveness makes the IS curve flatter. If mobility is almost perfect, the IS curve is almost flat at the world interest rate. In the case of fixed exchange rates, greater capital mobility means that a given change in the domestic interest rate has a larger effect on the central bank's reserves of foreign currency. If mobility is almost perfect, even a very small departure from the world interest rate causes enormous reserve losses or gains. Thus the model can be used to analyze high capital mobility under both floating and fixed exchange rates.

This discussion shows three final advantages of the new approach:

Advantage 9. The same framework can be used to analyze a closed economy, floating exchange rates, and fixed exchange rates.

Advantage 10. With the new approach, one can show how a fixed exchange rate constrains monetary policy without adopting the unrealistic view that it completely determines it.

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[8] In the case of fixed exchange rates, I simplify by assuming the central bank fixes the real exchange rate. This assumption is only slightly unrealistic in most cases, and it eliminates a feedback from inflation to aggregate demand that would complicate the analysis considerably.

Advantage 11.   The new approach shows the asymmetry in a fixed exchange rate system: the central bank is free to pursue policies that create reserve gains, but beyond some point cannot pursue policies that create reserve losses.

Other Possibilities

The framework I have described is only one alternative to the traditional IS-LM-AS approach. This section sketches some other possibilities. I begin by discussing two variants on the IS-MP-IA model I have presented, and then consider more substantial departures.

An Upward-Sloping MP Curve
I have presented a model with a real interest rate rule that depends only on inflation. But central banks are likely to make the real rate depend on output as well. Cutting the real rate when output falls and raising it when output rises directly dampens output fluctuations. Further, because high output tends to increase inflation and low output to decrease it, such a policy also dampens inflation fluctuations. Thus it is natural to consider the possibility that the central bank's choice of the real interest rate depends on output as well as inflation. Formally, this assumption is $r = r(Y, \pi)$, with the function increasing in both arguments. This assumption implies that the MP curve is upward-sloping rather than horizontal.

Deciding whether to model the central bank's choice of the real rate as a function of inflation alone or as a function of both inflation and output involves the usual tradeoff between realism and simplicity. The assumption of an upward-sloping MP curve is more realistic. But it complicates the model by making the real interest rate determined by the intersection of the IS and MP curves rather than by the MP curve alone.

For a principles course, where simplicity is crucial, I recommend the version with a real interest rate that depends only on inflation. Indeed, with this version of the model, little is gained by introducing the IS-MP diagram; it is easier to work with only the Keynesian cross and AD-IA diagrams. For intermediate courses, however, I believe that the version with an upward-sloping MP curve is on balance preferable. Having a system of two equations in two unknowns is not overly difficult, and the assumption that the central bank raises the real rate when output rises makes it easier to tie the presentation of the model to discussions of policy-making.

An Expectations-Augmented Aggregate Supply Curve
A second variant of the model replaces the assumption that inflation adjusts gradually with the more standard assumption of an expectations-augmented aggregate supply curve: $\pi = \pi^* + \lambda[Y - \bar{Y}]$, where π^* is core inflation and λ is a positive parameter that reflects how rapidly inflation responds to departures of

output from its natural rate.[9] This equation states that inflation equals its core level if output equals its natural rate, rises above the core level if output is above its natural rate, and falls below the core level if output is below its natural rate. Combining this equation with the IS curve and an upward-sloping MP curve produces a system of three equations in three unknowns (Y, π, and r) that can be analyzed in the same way as the IS-LM-AS model. Even in this case, however, the IS-MP-AS approach is more realistic and direct than IS-LM-AS and avoids the complications involving the real versus the nominal interest rate and inflation versus the price level.

As in standard presentations of IS-LM-AS, with an expectations-augmented aggregate supply curve it is often helpful to focus on the case where core inflation is given by last period's actual inflation: $\pi_t^* = \pi_{t-1}$. This assumption gives rise to dynamics like those with the inflation-adjustment approach: inflation rises when output is above its natural rate and falls when output is below its natural rate. There are only two slight differences. The initial impact of a shock now falls on both output and inflation, rather than only on output. And because the model is set in discrete time, the AS curve shifts in discrete steps rather than smoothly like the IA curve.

It is not clear whether the inflation-adjustment approach or the expectations-augmented approach is more realistic. The inflation-adjustment approach surely overstates the importance of inflation inertia and understates the extent to which aggregate demand movements initially affect inflation, but the expectations-augmented view surely errs in the opposite directions. Thus the decision about which approach is preferable depends mainly on one's views about the importance of expectations. If one thinks that issues involving expectations are crucial to understanding short-run fluctuations, it is natural to use the expectations-augmented approach and focus on alternative theories of the determination of core inflation, π^*. If one does not want to give a central place to those issues, it is natural to use the inflation-adjustment approach. This approach is easier, and one can incorporate a discussion of expectations into it: one can explain why a change in expectations of future inflation is likely to affect current wage-setting and price-setting, and thus shift the IA line. For principles courses, the importance of simplicity strongly favors the inflation-adjustment approach. My own view is that this approach is on balance preferable for intermediate courses as well.

A Money Market Equilibrium Curve

Both the LM curve and the MP curve show the combinations of the interest rate and output where the money market is in equilibrium; they merely do so for different assumptions about monetary policy. This observation raises the possibility

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[9] I refer to π^* as "core" rather than "expected" inflation because in many models, the inflation rate that prevails when output equals its natural rate is not the rational expectation of inflation. In the absence of any better alternative, however, I follow the usual practice of referring to this specification of aggregate supply as an expectations-augmented aggregate supply curve.

of using a more general approach. One could show that many sets of assumptions imply an upward-sloping curve in output-real interest rate space where the money market is in equilibrium for a given inflation rate. Such a curve arises not just if the central bank fixes the money supply and prices are completely rigid or if it follows a real interest rate rule that depends on inflation and output. For example, it occurs if the central bank is targeting inflation or nominal GDP growth but puts some weight on smoothing the path of the real rate. One could use an analysis of a range of policies to motivate an upward-sloping "money market equilibrium" curve relating the real interest rate and output, and not tie the analysis to any specific assumption about policy.

The obvious advantage of this approach is that it is more general: a single model can encompass a range of assumptions about monetary policy. But the greater abstraction makes the model harder for students to use and to relate to actual economies. For example, this approach does not deliver clear-cut answers about what types of developments shift the money market equilibrium curve.

A More Complicated View of Financial Markets

One area in which both the IS-LM and IS-MP approaches may have simplified too far is in their treatment of financial markets. In both models, the only feature of financial markets that matters for the demand for goods is "the" real interest rate; and in both, monetary policy has a powerful and direct influence on that interest rate. In practice, however, the demand for goods depends on many different interest rates, and on how much credit is available at those rates. The impact of monetary policy on many of those rates, and on credit availability given those rates, is tenuous and uncertain. Thus it might be desirable to split the analysis of financial markets. One part would analyze how various developments in financial markets affect the demand for goods; the other would analyze how various forces, including monetary policy, affect interest rates and credit availability.

This two-pronged approach would emphasize that many aspects of financial markets other than the particular interest rate controlled by the central bank affect aggregate demand, and it would highlight from the beginning many of the difficulties and uncertainties of actual policy-making. The obvious disadvantage of this approach is that it would not produce a framework as simple or powerful as IS-LM or IS-MP.

Conclusion

All of the models described in this paper would be recognizable to Keynes, Hicks, and their contemporaries. All of them emphasize the markets for goods and money and the behavior of inflation; all of them have imperfect nominal adjustment; and all of them are specified in terms of aggregate variables.

As I argued above, these features of the models are probably virtues: Keynes and Hicks appear to have made the right fundamental choices about how to

develop a simple baseline model of short-run fluctuations. Perhaps someday we will find a framework fundamentally different from IS-LM-AS and the alternatives described here that provides a more powerful tool for basic macroeconomic analysis. In the meantime, however, any changes to the IS-LM-AS framework that make it more realistic and powerful are useful. I hope that the modifications presented in this paper are examples of such changes.

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References

Bernanke, Ben S. and Ilian Mihov. 1997. "What Does the Bundesbank Target?" *European Economic Review.* June, 41, pp. 1025–1053.

Campbell, John Y. and N. Gregory Mankiw. 1989. "Consumption, Income, and Interest Rates: Reinterpreting the Time Series Evidence." *NBER Macroeconomics Annual.* 4, pp. 185–216.

Clarida, Richard and Mark Gertler. 1997. "How the Bundesbank Conducts Monetary Policy," in *Reducing Inflation: Motivation and Strategy.* Romer, Christina D. and David H. Romer, eds. Chicago: University of Chicago Press, pp. 363–406.

Goodfriend, Marvin S. 1993. "Interest Rate Policy and the Inflation Scare Problem: 1979–1992." *Federal Reserve Bank of Richmond Economic Quarterly.* Winter, 79, pp. 1–24.

Gordon, Robert J. 1990. "What Is New-Keynesian Economics?" *Journal of Economic Literature.* September, 28, pp. 1115–1171.

Hall, Robert E. and John B. Taylor. 1997. *Macroeconomics.* Fifth edition. New York: W. W. Norton.

Laubach, Thomas and Adam S. Posen. 1997. "Disciplined Discretion: Monetary Targeting in Germany and Switzerland." *Essays in International Finance.* December, No. 206.

Romer, David. 1999. "Short-Run Fluctuations." August, ⟨http://elsa.berkeley.edu/~dromer/index.html⟩.

Taylor, John B. 1993. "Discretion versus Policy Rules in Practice." *Carnegie-Rochester Conference Series on Public Policy.* December, 39, pp. 195–214.

Taylor, John B. 1998. *Economics.* Second edition. Boston: Houghton Mifflin.

von Hagen, Jürgen. 1995. "Inflation and Monetary Targeting in Germany," in *Inflation Targets.* Leiderman, Leonardo, and Lars E. O. Svensson, eds. London: Centre for Economic Policy Research, pp. 107–121.