CHAPTER 4
AGGREGATE DEMAND & SUPPLY

4.1 Introduction

This chapter continues a mathematical approach to macroeconomic interactions but marks the transition from algebra to a more intuitive geometric view. Mathematics is important to us because it is a convenient shorthand notation as well as a familiar "this" to help us understand an unfamiliar "that". Even if math hasn't been your favorite or best subject, you've been studying it for many years and surely know more about solving equations than about analyzing the macroeconomic consequences of interacting events and policies in a world of scarcity.

But don't forget that it is economics—scarcity, choices, and outcomes—that is our real concern. The equations and graphs of these models are useful only insofar as they can simulate the interactions of real people in the real world. As we continue working with the IS-LM model, converting it into an "aggregate demand curve" and then adding a theory of "aggregate supply", remind yourself that this is not just an algebraic exercise or a geometric puzzle. The lives of actual people, all of us, are affected by every major economic event and every policy success or failure. In the poorest economies, where so many live on the very edge of subsistence, unfavorable events and policy mistakes can have the most tragic consequences.

The classical model, introduced in Chapter Two, predicted that an economy organized around self-interest and markets, with a relatively passive role for government, would have many desirable characteristics, including a built-in "thermostat"—the process of market-clearing—to guide it automatically to full employment. In the midst of the Great Depression, the assurance from economists that the downturn was a "temporary disequilibrium phenomenon" and, from politicians, that "prosperity was just around the corner" seemed increasingly mistaken and, finally, ridiculous. By 1933, with 25% of the labor force out of work, real output 30% below its 1929 level, and vast losses of wealth from the collapse of stock and bond markets and the (uninsured) failure of many banks, patience with the "invisible hand" was wearing thin.

This was a time of profound economic crisis in the industrialized economies of the West, not unlike the present situation in the nations of the former Soviet bloc.\(^1\) The Classical model appeared to offer little insight into either why economic performance collapsed during the early Thirties or how it could be improved. We seemed to be both "adrift without a rudder" and "taking on water rapidly". Policy-makers were likened to cruise directors scurrying to find the optimal arrangement of deck chairs—on the Titanic. But neither nautical nor mathematical nor any other metaphors seemed able to guide us out of the storm to a safe harbor.

The IS-LM model of aggregate demand is a modern textbook embodiment and extension of the alternative theory proposed by John Maynard Keynes in *The General Theory of Employment, Interest, and Money* (1936). Keynes and his followers were convinced that a

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\(^1\)An important difference is that the current crises in Russia and other formerly-planned economies represent the failure of a large, obtrusive role for government in the economy. The hoped-for solution, ironically, is the same "invisible hand" that seemed to many observers to be the source of the problem in the Thirties.
more realistic model was needed to explain the actual workings of the economy. Though considerably more intricate than the Classical model—hence all the algebra of Chapter Three—it seeks to understand what happens in between positions of Classical long run market clearing. The Keynesian structure considers "short run" situations in which the velocity of money can change and markets can remain uncleared. The inevitable cost of this additional realism is more complexity. But the analytical simplicity of the long run Classical model was purchased at too high a cost if it couldn't deal with economic distress of the magnitudes experienced during the Thirties.

4.2 From “IS-LM” to the Aggregate Demand Curve

It is sometimes joked that economists see everything in pairs—supply and demand, "this or that?", "now or later", "on the one hand..., but then on the other...", and so on. In large part, this duality is imposed by scarcity and the resulting competition for limited resources—more of X means less of Y. But another reason that so many things seem to come in two's in economics is the usefulness of geometry as an analytical and explanatory tool. The two-dimensional surface of the page (and blackboard and computer screen) focuses the spotlight on the relationship between whatever variables we decide to put on the two axes, leaving everything else in the shadows. For example, the six equations summarized in the IS curve are expressed as an explicit relationship between two variables, real output (y) and the real interest rate (r), even though we saw that many other variables and parameters are involved in determining the slope and intercept of that curve. The same is true of the four equations underlying the LM curve—y and r are explicit, while all the parameters and policy instruments that define the connections between money demand and supply remain implicit, defining the slope and intercept of the relationship.

While real output (y) and the real interest rate (r) are obviously important, suppose we want to bring a third variable into the spotlight—the price level (P). Instead of going to an awkward three-dimensional graph to look at (y, r, P) relationships, we can accomplish the same thing by linking two 2-dimensional graphs, the familiar IS-LM curves (in y and r) plus a new aggregate demand (AD) curve (in y and P). Both are a complete representation of the same ten-equation aggregate demand model of Chapter Three, differing only in which variables are explicit (on the axis) and which left implicit (in the intercept and slope). You might think of this as first looking at an elephant (the 10 equation model) from the front (IS-LM graph) and then going to the rear for another view (the AD graph). These different perspectives on the same creature can provide further clues as to the nature of "elephantness" (or aggregate demand).

Let's now derive and incorporate this twin view of aggregate demand into our analytical framework. We start with the IS-LM view of y and r and transform it into a picture of an aggregate demand curve showing the underlying relationship between y and P. Starting at point A in the top graph of Figure 4.1 with a price level of P₀, suppose some outside event causes the price level to double to 2P₀. What happens to the level of aggregate demand? We know from the last chapter that an increase in the price level lowers the real value (or purchasing power) of the given nominal money supply (that is, +ΔP leads to -Δ(M₀/P). This reduces the horizontal intercept of LM, shifting the curve from LM(P₀) to LM(2P₀) and sliding it along IS. Equilibrium is now at point B, with a higher real interest rate (+Δr) and a lower level of aggregate demand (-Δy).

Now move down to the bottom graph of Figure 4.1. It is simply another way to portray
the underlying 10 equation model of demand and therefore tells exactly the same story. A doubling of the price level moves the economy from point A to B. The only difference is that we now see this movement in terms of the price level and aggregate demand (P and y) rather than the interest rate and aggregate demand (r and y). Plotting the initial values (y₀, P₀) at A and the new equilibrium values (y₁, 2P₀) at B and connecting these two points reveals a familiar downward-sloping demand curve (AD).

But note that the negative slope of the aggregate demand curve has little in common with the income and substitution effects underlying the derivation of demand curves for individual commodities in microeconomics. Like its cousin the Classical aggregate demand curve, this curve tells a story of declining demand for real goods and services as the average level of prices rises. But unlike the Classical curve, there is no presumption of constant velocity of money and, as you will see, fiscal policy is no longer "powerless" to alter aggregate demand. Anything that shifts IS, including changes in fiscal policy, will also shift this aggregate demand curve. In addition, anything that shifts LM except changes in the price level, shifts AD as well.²

Figure 4.1 From IS-LM to AD Why Does the Aggregate Demand Curve Slope Downward?

\[ +\Delta P \Rightarrow -\Delta M/P \Rightarrow +\Delta r \Rightarrow -\Delta i \text{ and } -\Delta x \Rightarrow -\Delta y \Rightarrow -\Delta c \]

In words, this says that an increase in the price level initially decreases the real value of the given nominal money supply, thereby shifting the LM curve to the left and raising the real rate of interest. This, in turn,

² The impact of the price level on the real demand for output is already built into the slope of AD (-ΔP \Rightarrow +Δy). To also shift AD as the price level changes would be to count its impact twice.
reduces both investment and net export spending (equations 4 and 5), setting off a multiplier process \((-\Delta y \leftrightarrow -\Delta c)\) as we move up the IS curve. In sum, the \(+\Delta P\) triggers a sequence of events that ends in \(-\Delta y\), a relationship that defines the downward slope of the AD curve.

4.3 Adding a Simple Model of Aggregate Supply

With so many moving parts in this ten-equation/two-graph model of aggregate demand, it’s easy to get distracted by all the machinery and forget that it’s a theory of demand only. It completely ignores the most fundamental economic fact of life—scarcity. Before going any further with our analysis, then, we need to remedy this by incorporating the process through which limited inputs are transformed into output. This is done by adding a model of aggregate supply.

In the earlier discussion of the classical approach to aggregate supply we found that constant market-clearing implied a vertical aggregate supply curve, AS*, that defined the full employment level of real output. Changes in the price level \(\pm \Delta P\) led to equiproportional changes in money wages \(\pm \Delta W\) that left the real wage, hence employment and output, unchanged. Scarcity kept us from getting beyond full employment while market-clearing ensured that we wouldn’t get stuck below it. Equilibrium only occurred at full employment, achieved through automatic market clearing—the classical “thermostat” in action.

But the long run focus of this classical approach treats market-clearing as an event rather than a process of change and re-evaluation that requires information, decision-making, and, inevitably, adjustment through “time”. In later chapters we’ll explore the “time path” traveled by our variables during the process of market-clearing, a topic termed “short run dynamics”. For now, however, we settle for a much simpler, cruder but still useful approximation to this process. Instead of trying to create a continuous movie of the adjustment process from one equilibrium to another (called “dynamics”), we’ll just take a few snapshots along the way (“comparative statics”) to get a rough approximation to the actual path.

We start by defining the interval of time during which markets are not fully cleared as the short run. This term is distressingly vague but nevertheless turns out to be a very useful first approach to issues of recession and depression that can’t be captured in models focused only on long run market-clearing at full employment. Using a concept of short run aggregate supply allows us to examine what happens to output (and other variables) after aggregate demand has shifted but before market-clearing is complete. In the Classical model this was labeled “temporary disequilibrium” and left unexplored.3

In our first approximation to macroeconomic dynamics, let’s do the opposite of the Classical model by supposing that the initial adjustment occurs entirely in output change rather than price change. In terms of the AD/AS graph in Figure 4.2, an increase in aggregate

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3 This is not to say that there were no serious attempts to explain the business cycle until the arrival of John Maynard Keynes and the Great Depression. In fact, a considerable literature on economic fluctuations had developed within the Classical framework throughout the 19th and early 20th Centuries. But it was the long run Classical model that predominated and which told public officials that “hands off” was the best policy in a market economy. While there were many explanations of economic fluctuations put forth in the 19th and early 20th centuries, they were never integrated into a coherent, careful model of the determinants of output and employment over time.
demand now causes an initial movement from A to A’. Shifts in aggregate demand ($\pm \Delta AD$), then, are assumed to move the economy in an "east/west" direction ($\pm \Delta y$) in the short run, but "north/south" ($\pm \Delta P$) in the long run. This is called **short run price rigidity** (or "price stickiness") and we incorporate it into our graph as a horizontal short run aggregate supply curve, $\text{AS}^{\text{SR}}$. How long this rigidity lasts is, of course, crucial for policy-making and an issue we will examine in later chapters. For now, however, we suppose it continues long enough to account for business cycle deviations from full employment that last anywhere from a few months to a year or more.

4 In a later chapter we’ll see that merely assuming rigidities in order to make the model more relevant has its limitations. The specifics of the price adjustment process between short and long run turn out to be both subtle and crucial to short run policy-making.

5 The question of what causes these short run adjustments in real output is at the center of one of the most controversial issues in macroeconomics—the nature of the business cycle. The disagreement is mostly over why, and for how long, real output can diverge from its full employment level. Our current assumption that this occurs temporarily (in something called a "short run") is consistent with several specific and very different hypotheses about why it happens and how long it persists. Alternative stories of the business cycle and their policy implications are the subject of PART III, Short Run Dynamics: Smoothing the Business Cycle & Controlling Inflation.
meet the surge in demand. This yields a horizontal short run aggregate supply curve and also means a temporary movement beyond the economy’s long run production possibility frontier. The PPF is still downward sloping, so scarcity and choice still rule. It simply means that the boundary has some elasticity to it so that even a fully-employed economy can temporarily increase total output in the short run.

"GROSS DOMESTIC PRODUCT"
REAL WORLD COUNTERPART TO REAL OUTPUT

The equivalent terms "real output" and "real income", as represented by the symbol "y", have been used without saying anything about the real world numbers that correspond to this fundamental concept of economic activity. Gross Domestic Product (GDP) is the official measure of total income and output for the overall economy. It is defined as the value of all final goods and services produced within the geographic boundaries of the nation. We'll discuss some of its shortcomings as a measure of economic activity in a later chapter.

GDP has now replaced Gross National Product (GNP) as the official measure in the U.S. in order to facilitate comparisons with other countries, nearly all of which have long used GDP rather than GNP. Whereas GDP measures production within borders regardless of the nationality of the workers or the owners of the firm, GNP measures only output produced by U.S. residents, businesses, and government regardless of where they're located. So the output of a Japanese auto plant located in the U.S. is included in GDP but not GNP. The output of a U.S. textile firm in Mexico would be included in our GNP but not GDP. For the U.S., the numerical difference between the two numbers is very small. For example, in 1990 GDP was $5.514 trillion while GNP was $5.525 trillion, a difference of less than two-tenths of 1%.

Nominal GDP is measured in current dollars. To make a meaningful comparison across years it must be deflated for changes in the price level, converting it to a constant-dollar measure of real GDP, or gdp to continue our practice of using lower cases letters for "real" values. It is this measure that most closely approximates the concept of real output, y, used in our model.

This alteration of supply side assumptions leaves us with a model in which the initial impact of an increase in aggregate demand will be from point A to A’ in Figure 4.2, as AD shifts along the new short run aggregate supply curve AS\textsuperscript{SR}. Then, as the market-clearing process works its way through the macroeconomy, output will eventually return to its long run full employment level, but at the higher equilibrium price level at point B. Any further shifts in aggregate demand would initially move along a new horizontal short run supply curve through B (not shown in the graph) as prices now become "sticky" at the higher price level, P1.

With this combination of short run price rigidity (horizontal AS\textsuperscript{SR}) and long run market clearing (vertical AS\textsuperscript{L}) we have outlined a simple adjustment path (A to A’ to B in Figure 4.2) of a fully-employed economy undergoing an increase in aggregate demand. This is a simple but significant step toward bringing our analysis closer to the real world. We can incorporate it formally into the model by specifying both short and long run responses in the following expanded version of Equation 10.

\[ P = P_0 \quad (10 \text{ SR}) \]
\[ y^* = F(n^*, k_0, \tau n_0, i_{\text{inst}_0}) \quad (10 \text{ LR}) \]

As before, k_0 is the fixed level of capital stock, \tau n_0 the current level of technology, i_{\text{inst}_0} is the given institutional structure of the economy, and n’ and y’ are the full employment levels of employment and real output, respectively. We have restored scarcity to our analysis, yielding
IN SUMMARY . . . The Expanded AD/AS Model

As we discovered in Chapter 3, dropping the classical "constant velocity of money" assumption definitely complicates the aggregate demand picture by adding a number of interactions to the analysis. For example, we now need to consider the impact of changes in real income on consumption, money demand, tax revenues, and net exports. We must also consider the effect of changes in the real rate of interest on investment, net exports, and money demand. (These relationships are represented, respectively, in the parameters $c_1$, $j_1$, $t_1$, $x_1$, and $i_2$, $x_2$, and $j_2$.)

These interactions are all captured in the IS and LM equations and portrayed in the twin IS-LM and AD graphs. The result is a more complex picture, but also a more realistic and accurate one, in which aggregate demand can be altered not only by changes in monetary policy ($\Delta M_0$), but also by changes in fiscal policy ($\Delta g_0$, $\Delta t_0$) or autonomous private spending ($\Delta z_0$).

Substituting short run "sticky prices" for Classical "market clearing" means that shifts in AD now lead to temporary deviations of output from full employment along AS*$. A recession, for example, doesn't have to be dismissed as a "temporary disequilibrium phenomenon", but can be modeled as the initial consequence of a sudden drop in aggregate demand. Long run market-clearing, sooner or later, brings the economy back to full employment along the vertical AS* curve.

In short, the ten equation Expanded AD/AS model (shown in Figure 4.3) features "long run market clearing", but also adds "short run price stickiness" in which output rather than prices adjusts to changes in aggregate demand. With the velocity of money free to vary, shifts in aggregate demand can come from expenditure changes (public or private) as well as monetary changes.

an AD/AS framework that will guide our thinking for the remainder of the book. The ingredients of this Expanded AD/AS model, as we'll call it, are shown in Figure 4.3.
Part II Basic Macroeconomic Analysis

FIGURE 4.3 THE EXPANDED AD/AS MODEL
This model is "expanded" in the sense that it combines deviations from full employment (in a Keynesian short run, $AS_{sr}$) with a market-clearing return to full employment (in a Classical long run, $AS^*$). The elements of aggregate demand are contained in the 6 equations underlying the IS curve and the 3 equations underlying LM. The AD curve contains all the information included in IS and LM, with the focus on $y$ and $P$ rather than $y$ and $r$.

4.4 Three Applications of the Expanded AD/AS Model

Let's begin using the model by looking at three events—first a decline in autonomous investment spending ($-\Delta i_0$), then an increase in autonomous money demand ($+\Delta j_0$), and finally a sudden loss of capital stock ($-\Delta k_0$). These are important situations in their own right, but the main goal at this point is for you to learn the AD/AS model by using it rather than talking about it.
APPLICATION 1
A Decrease in Autonomous Real Investment Spending

Suppose there is a sudden drop in real private investment spending on plant and equipment by businesses, perhaps reflecting expectations of lower consumer demand and hence lower profits in the future. The expanded AD/AS model can help us trace the impact of this decline in investment spending on real output, the price level, and the real rate of interest, as well as on consumption, investment, net exports, tax revenues, and the size of the government deficit. More concisely, our model can reveal the effect of this $\Delta i_0$ on $y$, $P$, $r$, $c$, $i$, $x$, $t$, and $b=g-t$.

![Figure 4.4 Impact of a Decline in Autonomous Investment](image)

The $-\Delta i_0$ shifts IS to IS' moving the economy from points A to B in the short run. As market clearing results in $-\Delta P$ in the long run, LM($P_0$) shifts to LM($P_1$) and the economy adjusts to point C.

With the economy initially at the corresponding points A in the twin graphs of Figure 4.4, this fall in investment spending will show up as a decline in autonomous investment expenditures ($-\Delta i_0$). Remember that we represented the three variables $c_0+i_0+x_0$ by the single term $z_0$ in order to streamline the IS equation to $y=\mu(z_0+g_0-c_1t_0)-\mu(i_2+x_2)r$. So our $-\Delta i_0$ means a $-\Delta z_0$ and hence a leftward shift from IS to IS' by the distance $\mu\Delta z_0$.

Remember also that we added the money demand and supply relationships through the
LM equation which we wrote as \( y = \left[ (M_0/P_0) - j_0 \right] / j_1 + (j_2/j_1)r \). So as the inward shift in IS causes real output to fall it also decreases the demand for money and, finally, the real rate of interest as we slide down LM(P_0) to point B.

The top graph shows that the real demand for output has fallen from \( y^* \) to \( y_1 \). This appears in the bottom picture as the movement from A to B as aggregate demand shifts along the horizontal AS\textsuperscript{sr} curve. The full impact of this decrease in real investment spending on the economy is presented in the five steps below. This laborious and formal step-by-step analysis is used only in the three examples of this section. Once these basic mechanics are understood, most of the details can be dropped when using the model.

**STEP #1** Figure 4.4 shows that \(-\Delta i_0\) leads to \(-\Delta y\) and \(-\Delta r\) at the given price level, \( P_0 \) as the economy adjusts initially along AS\textsuperscript{sr} and LM(P_0) from points A to B.

**STEP #2** We now use the individual equations of the AD/AS model (restated below) to determine the short run change in all variables whose values depend upon \( y \) or \( r \).

\[
\begin{align*}
y &= c + i + x + g \quad (1) \\
c &= c_0 + c_1(y-t) \quad (2) \\
t &= t_0 + t_1y \quad (3) \\
i &= i_0 - i_2r \quad (4) \\
x &= x_0 - x_1y - x_2r \quad (5) \\
g &= g_0 \quad (6) \\
\end{align*}
\]

\[
\begin{align*}
L/P &= M/P \quad (7) \\
L/P &= j_0 + j_1y - j_2r \quad (8) \\
M &= M_0 \quad (9) \\
P &= P_0 \quad (10 \text{ sr}) \\
y^* &= F(n^*,k_0,\text{inst}) \quad (10 \text{ lr}) \\
\end{align*}
\]

a. \(+\Delta x\) **Net exports** (Equation 5) rise since both \( y \) and \( r \) fell in Step #1.

b. \(-\Delta t\) **Tax revenues** (Equation 3) decrease with the fall in income, even with no change in tax rates. The decrease in the tax base \(-\Delta y\) means a decline in tax revenues/payments.

c. \(-\Delta (y-t)\) **Income-after-taxes** falls with the \(-\Delta y\) but decreases with the \(-\Delta t\). But since the income tax rate is less than 1 (i.e., \(0<t_1<1\)), the fall in taxes is only a fraction of the drop in income. So the net effect must be to decrease \( y-t \).

d. \(-\Delta c\) The decrease in after-tax income, according to Equation 2, decreases consumption spending by the fraction \( c_1 \) times the \( \Delta (y-t) \).

e. \(+\Delta b\) Because of the decline in tax revenues, the **government deficit** \((b=g-t)\) will rise since government spending is assumed to be unchanged. This is called a "cyclical change" in the deficit and is discussed further in the next chapter.

f. \(\Delta i\) ? **Investment spending** (Equation 4) has two changes working in opposite directions. The initial fall in autonomous investment \((-\Delta i_0)\) is followed by a decline in the real rate of interest \((-\Delta r)\) which will induce additional investment spending of the amount \(-i_2\Delta r\). Without further information we can't say which of these two effects is largest, so the short run change in real investment is unknown.

**STEP #3** As "sticky" short run prices become flexible in the long run, the process of market clearing returns the economy to its vertical AS\textsuperscript{*} curve. This is shown in the bottom
graph of Figure 4.4 as the movement from B to C along the AD' curve. The **price level falls** (-\(\Delta P\)) and **output rises** (+\(\Delta y\)) until the overall excess supply—the gap between AD' and AS* at \(P_0\)—is eliminated at \(P_2\).

**STEP #4** Since these are two pictures of the same economy, we can't leave the top graph stranded at point B while the bottom has adjusted to C. We must include the impact of this falling price level (-\(\Delta P\)) in the IS-LM graph by **shifting the LM curve** to the right as the decrease in P increases the real value of the money supply (\(M_0/P\)). The LM curve continues to shift until P has reached its long run equilibrium (\(P_2\)), returning real output to its long run level (\(y^*\)). This shift from LM(\(P_0\)) to LM(\(P_2\)) causes the real interest rate to fall even further than it did in the short run. Thus Figure 4.4 reveals that the net long run impact of the initial decrease in real investment spending (-\(\Delta i_0\)) in a fully-employed economy is -\(\Delta P\), --\(\Delta r\), **but \(\Delta y=0\)** as the economy moves from points A to C.

**STEP #5** The long run story is completed by returning to the underlying equations as we did for the short run in step #2, above. The long run impact (from start to finish, ignoring the temporary short run adjustments) of the -\(\Delta i_0\) on the underlying variables is:

a. +\(\Delta x\)  **Net exports** (Equation 5) have risen in the long run because of the fall in r.

b. \(\Delta t=0\)  **Tax revenues** (Equation 3) have remained unchanged since real income has not changed in the long run.

c. \(\Delta(y-t)=0\)  Since neither income nor taxes has changed, real **after-tax income** is unchanged.

d. \(\Delta c=0\)  With no change in y-t, **consumption spending** (Equation 2) is unchanged.

e. \(\Delta b=0\)  The **government deficit** (b=g-t) is unaffected in the long run since neither public spending nor taxes have changed.

f. -\(\Delta i\)  This is a slightly tricky one because real **investment spending** (Equation 4) has two factors working in opposite directions—the initial decrease in \(i_0\) and the subsequent long run decrease in the real rate of interest to \(r_2\) which increases investment spending. How can we say that the net effect is an increase in investment spending? We know that \(y=c+i+x+g\) and also \(\Delta y=\Delta c=\Delta g=0\) in the long run. The long run drop in r has caused a +\(\Delta x\), so it must be true that the net effect on real investment is negative and equal, in absolute value, to the increase in net exports. If it weren't, Equation 1 wouldn't hold true.\(^6\)

\(^6\) Note also that since the real interest rate has fallen even more than it did in the short run and \(\Delta i\) still ends up negative, then it must also be true that the short run \(\Delta i\), which we called indeterminate back in #2f, was actually negative.
So the answer to the question "What macroeconomic impact will a decrease in autonomous real investment spending have in a fully employed economy?" is as follows.

<table>
<thead>
<tr>
<th>Impact of (-\Delta i_a) on</th>
<th>Short Run ((A \rightarrow B))</th>
<th>Long Run ((A \rightarrow C))</th>
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<tbody>
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<td>(y)</td>
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<td>(x)</td>
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<td>(b)</td>
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If autonomous investment were to rise instead of fall, the reasoning would be identical and the answer would be everything in reverse. IS and AD would shift to the right, all the +’s would change to -’s and vice versa. Since \(\Delta c_0\) and \(\Delta x_0\) work the same as \(\Delta i_0\) (remember they all shift IS through the \(z_0\) term), those changes would be similar in their impact on the economy. Moreover, since public spending works with the same multiplier as private spending, as we saw in the previous chapter, the results would be basically the same for \(\Delta g_0\) as for \(\Delta z_0\). Learning the mechanics of the analysis (not just the "right" answers) for this single example will therefore enable you to understand the short and long run impacts of any event that shifts the IS curve. The next example presents a similar analysis for shifts in the other segment of aggregate demand, the LM curve.

**APPLICATION 2**

*An Increase in Autonomous Real Money Demand*

Suppose there’s a sudden increase in the demand for money, perhaps reflecting fears of a coming financial crisis and plummeting stock and bond prices. What will be the impact of this increase in *autonomous* money demand—\(+\Delta j_0\) in Equation 7, the part that’s independent of current levels of income and interest rates—on the variables in our model of the macroeconomy, \(y\), \(P\), \(r\), \(c\), \(i\), \(x\), \(t\), and \(b\)?

Starting at points A in the twin graphs of Figure 4.5, the \(+\Delta j_0\) *reduces* the horizontal intercept of the LM curve, \(y\downarrow=[(M_0/P_0)-\tau j_0]/j_1+(j_2/j_1)r\), shifting it to the left to \(LM'(P_0)\) in Figure 4.5. Equilibrium on the demand side has moved from point A to B in the top graph as the increased money demand raises the real interest rate and lowers aggregate demand. This drop in demand shows up in the bottom graph as the shift from AD to AD’ and the movement from A to B along the short run aggregate supply curve, AS<sub>sr</sub>. So the short run impact of this increase in real money demand can be summarized as:

**STEP #1** Figure 4.5 shows that the \(+\Delta j_0\) leads to \(+\Delta r\) and \(-\Delta y\) at the initial price level, \(P_0\), as the economy adjusts from points A to B.

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7 However, public spending is a little more involved since the government has three options for financing an increase in spending—an increase in taxes \(+\Delta t\), deficit spending \(+\Delta b\), or simply printing more money \(\Delta M\). This is covered in Section 4.6 below.
Figure 4.5 Impact of an Increase in Autonomous Money Demand
The $+\Delta j_0$ shifts $LM(P_0)$ to $LM(P_0)'$, moving the economy from points A to B in the short run. As market clearing results in $-\Delta P$ in the long run, $LM(P_0)'$ shifts to $LM(P_2)'$ as the economy adjusts to point C. Note that the real rate of interest returns to its original level.

**STEP #2** We now use the individual relationships in the underlying equations of the AD/AS model to determine the short run changes of the remaining variables.

\[ y = c + i + x + g \quad (1) \]
\[ c = c_0 + c_1(y-t) \quad (2) \]
\[ t = t_0 + t_1y \quad (3) \]
\[ i = i_0 - i_2r \quad (4) \]
\[ x = x_0 - x_1y - x_2r \quad (5) \]
\[ g = g_0 \quad (6) \]
\[ \frac{L}{P} = \frac{M}{P} \quad (7) \]
\[ \frac{L}{P} = j_0 + j_1y - j_2r \quad (8) \]
\[ M = M_0 \quad (9) \]
\[ P = P_0 \quad (10 \text{ sr}) \]
\[ y^* = F(n^*,k_0,\text{i}^{\text{nat}}) \quad (10 \text{ lr}) \]

a. $-\Delta i$ **Investment spending** (Equation 4) declines with the rise in the real interest rate.

b. $-\Delta t$ **Tax revenues** (Equation 3) will also decline as the tax base, $y$, falls.
c. \(-\Delta(y-t)\) After-tax income has fallen because of the \(-\Delta y\), but has risen because of the \(-\Delta t\). Since the decline in taxes is a fraction \((t_1)\) of the fall in \(y\), the net effect must be a decrease in \((y-t)\).

d. \(-\Delta c\) The drop in after-tax income leads households to lower consumption spending (Equation 2).

e. \(+\Delta b\) Because of the drop in tax revenues, the government deficit \((b=g-t)\) will increase as the economy slips below full employment. This is called a cyclical rise in the deficit since it's the result of a "cyclical" departure from full employment, i.e., \(y \neq y^*\).

f. \(\Delta x\) Net exports (Equation 5) have two changes working in opposite directions. The rise in the interest rate \((+\Delta r)\) lowers net exports while the decline in income works to increase them. Without further information about the magnitudes of the \(+\Delta y\), \(+\Delta r\), \(x_1\), and \(x_2\), we can't determine the final impact on net exports. So \(\Delta x\) is unknown.

STEP #3 In the long run, price flexibility and market clearing return the economy to full employment \((y')\) and we move to point C in the bottom graph of Figure 4.5. As the price level falls to \(P_2\), the overall excess supply (the gap between \(AD'\) and \(AS'\) at the initial price level) is eliminated.

STEP #4 This drop in the price level \((-\Delta P)\) feeds back to the top graph by shifting the LM curve to the right as the real value of the money supply \((M/P)\) rises. The LM curve continues to shift until \(P\) has reached its long run equilibrium \((P_2)\), returning demand for output to its long run level \((y')\). This shift from \(LM'(P_0)\) to \(LM'(P_2)\) lowers the real interest rate back to its initial level. Thus Figure 4.5 reveals that the net long run impact of the autonomous increase in money demand in a fully-employed economy is \(-\Delta P\), with \(\Delta y=\Delta r=0\).

STEP #5 The story is then completed by returning to the underlying equations as we did for the short run in #2, above. The long run impact (from start to finish, A to C) of an increased autonomous demand for money is:

a. \(\Delta i=0\) Investment spending (Equation 4) is unchanged because \(\Delta r=0\) in the long run.

b. \(\Delta t=0\) Tax revenues (Equation 3) have remained unchanged since real income has not changed in the long run.

c. \(\Delta(y-t)=0\) Since neither \(y\) nor \(t\) has changed, there is no change in after-tax income.

d. \(\Delta c=0\) With no change in \(y-t\), consumption spending (Equation 2) is unchanged.
e. $\Delta b=0$ The government deficit is unaffected in the long run since neither $g$ nor $t$ have changed.

f. $\Delta x=0$ Net exports (Equation 5) are also unchanged since neither $y$ nor $r$ has changed in the long run.

So the answer to the question "What impact will an increase in autonomous money demand have in a fully employed economy?" is as follows.

<table>
<thead>
<tr>
<th>Impact of $+\Delta j_0$ ON</th>
<th>Short Run (A→B)</th>
<th>Long Run (A→C)</th>
</tr>
</thead>
<tbody>
<tr>
<td>$y$</td>
<td>-</td>
<td>0</td>
</tr>
<tr>
<td>$r$</td>
<td>+</td>
<td>0</td>
</tr>
<tr>
<td>$P$</td>
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<tr>
<td>$c$</td>
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<td>0</td>
</tr>
<tr>
<td>$i$</td>
<td>-</td>
<td>0</td>
</tr>
<tr>
<td>$x$</td>
<td>?</td>
<td>0</td>
</tr>
<tr>
<td>$b$</td>
<td>+</td>
<td>0</td>
</tr>
</tbody>
</table>

A fall in autonomous money demand would be the mirror image of this. LM and AD would shift to the right, all the +’s would change to -’s and vice versa. Since a change in the money supply ($\Delta M$) also changes the intercept of the LM curve, monetary policy will have similar effects as we’ll see in Chapter 6.

**APPLICATION 3**  
A Negative Supply Shock

The first two applications looked at events that originated on the demand or spending side and then spread their short and long run effects throughout the economy. Let’s now turn to the supply side of our model, represented in the long run by the production function in Equation 10 [$y^*=F(n^*,k_0,\text{inst}_0)$]. Suppose there’s a sudden loss or destruction of our capital stock ($-\Delta k_0$), perhaps from an economic embargo (e.g., oil), a war, or a natural disaster. Unlike the two applications above, the initial impact of this negative supply shock begins on the supply side of our model.

Figure 4.6 illustrates this loss of capital with the leftward shift of aggregate supply to $\text{AS}^*$, creating a situation at point A in which aggregate demand now exceeds the newly-reduced level of supply, putting upward pressure on the price level. The short run "price stickiness" assumption, embodied in the horizontal $\text{AS}^\text{hr}$ curve, tells us that the economy remains at point A in the short run, in spite of the fact that the full employment level of output has fallen. But as price rigidity loosens and the market clearing process gets underway, the macroeconomy will adjust to the now lower full employment level of output ($y^*$) at a higher price level ($P_1$) as it moves from point A to B in the graphs. The rising price level reduces the real value of the money supply, shifting $\text{LM}(P_0)$ to $\text{LM}(P_1)$ and results in a rise in the real rate of interest.
Figure 4.6 Negative Supply Shock
The impact of a loss of capital stock (-Δk₀) shows up initially as a leftward shift of AS* to AS**, reducing the long-run full employment level of real output accordingly (-Δy*). As the price level rises, the real value of the money supply diminishes, and the economy moves to a new equilibrium (point B) with a higher interest rate and price level, and lower output.

This example raises an important question. Is it realistic to assume that the degree of price stickiness following a shift in aggregate supply is the same as for a demand shift? Sources of price rigidity will be examined more carefully in our later discussion of business cycles. But let's suppose that while prices adjust sluggishly to demand shocks, they react much more quickly to supply shocks. Our present rule of thumb will be that for supply shocks the short run price rigidity is generally so brief that we can safely ignore it and focus on the long run impact.

Without going through all the step-by-step detail, we see that the long run impact of a sizable loss of capital on the macroeconomy is to reduce real output (-Δy) and raise both the real interest rate (+Δr) and the price level (+ΔP). Investment spending (Equation 4) will then decline (-Δi) because of the higher rate of interest. Tax revenues (Equation 3)
will fall because of the lower tax base (-Δy'), leading to a rise in the government deficit [+Δb=+Δ(g-t)]. Both income and taxes have fallen, but since taxes are a fraction (t₁) of the change in income (Equation 3), after-tax income will fall and so will consumption spending (-Dc, from equation 2). The impact on net exports (Equation 6) is uncertain without further information on the actual magnitude of the changes in y and r as well as the size of the parameters x₁ and x₂.

<table>
<thead>
<tr>
<th>Impact of -Δk on</th>
<th>Short Run (A→B)</th>
<th>Long Run (A→C)</th>
</tr>
</thead>
<tbody>
<tr>
<td>y</td>
<td>0</td>
<td>-</td>
</tr>
<tr>
<td>r</td>
<td>0</td>
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<td>x</td>
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<td>?</td>
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<tr>
<td>b</td>
<td>0</td>
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</table>
A WORD ABOUT MODELS & REALITY

These equations and graphs are a simplified (abstract) representation of the macroeconomy, to which we apply deductive logic to derive implications. A model can never be the "true" picture of the "real world" that we would like. It is just a window through which we hope to catch a partial glimpse of a complex and changing reality. When you begin to wonder whether such a quick peek is worth all this trouble, keep in mind the alternatives. How else can we get at the connections between choices and consequences? Other approaches involve rules of thumb and slogans that are often just thinly-disguised versions of wishful thinking or narrow self-interest.

It's not surprising that these less analytical approaches are far more prevalent than economic analysis. They offer quick, easy answers without requiring us to gather many facts or do much, if any, thinking. They fit nicely into media "sound bites" used by political candidates who have learned that a memorable phrase ("Read my lips, no new taxes."); "The loud sucking sound you'll hear is our jobs headed South to Mexico.") gets much more political mileage than a careful, responsible explanation of the various alternatives confronting economic policy.

Such shortcuts have their place, but so does a more painstaking and responsible attempt to understand how economic events and policy changes will affect our overall economy and our individual lives. We'll see many examples of popular economic programs, marketed through slogans, appeals to the crudest "common sense", patriotism, and so on, that turned out badly. We will also see how a little careful thought and enlightened common sense, guided by an analytical framework (model), can do dramatically better.
4.5 STABILIZATION POLICY -- A FIRST LOOK

Let's take the three examples of the previous section a step further to get a first look at macroeconomic stabilization policy. The notion of using fiscal and monetary policies to counteract unwelcome shocks to the economy, so widely accepted today, is a legacy of the "Activist" policy stance of Keynes and his followers. Simply put, the idea is to quicken the return to full employment with "countercyclical" policy stimulus rather than relying solely on the market-clearing process.

![Graph showing IS and LM curves]

**Figure 4.7(a) A Drop in Autonomous Investment**

(IS → IS' and AD → AD') could be offset by expansionary fiscal policy (+Δg₀ or -Δt₀), returning the economy to point A instead of relying on the market-clearing process to move the economy to point C.

Viewed through the lens of our AD/AS model it's easy to see both the logic and appeal of such an approach. In the first example above, a decline in autonomous investment spending (-Δi₀) set off a contraction of aggregate demand that pushed the economy into recession. This is reproduced in Figure 4.7(a) as the movement from A to B. But rather than waiting for price level adjustments to slide us down to point C, suppose we ran an expansionary fiscal policy (+Δg₀ or -Δt₀). This could shift IS' and hence AD' back to their initial levels and return the economy to its original position at A. In the same way, the contraction triggered by increased autonomous money demand (+Δj₀), as illustrate in Figure 4.7(b), could be counteracted by an expansionary monetary policy (+ΔM₀) that shifts both the LM and AD curves back to their...
original positions.

Figure 4.7(b) Increased Autonomous Money Demand

$(LM(P_0) \rightarrow LM(P_0)' \text{ and } AD \rightarrow AD')$ could be offset by expansionary monetary policy $(\pm \Delta M_0)$, returning the economy to point $A$ instead of relying on the market-clearing process to move the economy to point $C$.

In either case, the allure of using fiscal and monetary policy to stabilize the economy around full employment is obvious. Its potential to moderate if not eliminate the periodic ups and downs of economic activity that characterize the business cycle is just as appealing today as it was in the Great Depression. The difference between a mild and a severe recession in the U.S. in the Nineties can be measured in millions of workers who don’t experience joblessness and in output and income differentials in the hundreds of billions of dollars.

Our AD/AS framework makes stabilization policy look easy. We apparently need only keep a close watch on current economic performance and at the first sign of trouble respond appropriately. In reality, of course, things are never so simple and it's important to remind ourselves of the limitations of this first view of stabilization policy. While the model now incorporates a short run response that was missing in the classical analysis, it does so in a very primitive way. In particular, there is no explanation of how long this "short run" lasts before price flexibility returns us to "long run" full employment. Nor is there any analysis of how long it takes for a policy response to be implemented and then to have its desired impact on aggregate demand. As it now stands, this model holds out the promise of effective countercyclical policy but withholds the details about timing that are crucial to an "appropriate" policy response.
When an economy has fallen into a very deep and prolonged recession, popularly called an economic "depression", the timing of a policy response is of little practical significance. This, of course, was the backdrop against which Keynes's policy views in the 1930s were set. But the post-WWII period is one in which departures from full employment have been comparatively small and short-lived, making issues of timing and policy lags more important. We will have much more to say about this in later chapters. You may already know that the economics profession is divided over whether aggressive policy responses can or cannot moderate economic fluctuations. One view, associated with the so-called Keynesian and New Keynesian schools, is convinced that careful countercyclical policy actions can greatly reduce the inherent instability of the macroeconomy. They advocate what is usually termed an Activist approach to macroeconomic fluctuations. At the other end of the spectrum we find the Non-Activist views of the New Classical and Monetarist schools who contend that attempts to reduce fluctuations in output and employment, however well-intended, are doomed to failure. Either they will have minimal impact on real output and employment (New Classical) or they may actually turn out to destabilize overall economic activity and prices (Monetarist).

In later chapters, we'll look carefully at the reasons behind such widely differing views. There's clearly no simple right or wrong answer revealed by past experience. We can find episodes in which Activist policies clearly prevented lost jobs and lost output. We can also find situations in which the impact of a policy change was felt only after economic recovery was substantially complete, causing overshooting and further macroeconomic instability. The key question, of course, is whether we can determine in advance whether an intended countercyclical policy is likely to be effective, inconsequential, or procyclical. This will be the focus of Part III (Chapters 8-11) "Smoothing Business Cycles & Controlling Inflation."

So far our discussion of stabilization policy has considered only situations in which the initial disturbance came from the demand side of the economy. What about our third example in which the decline in output came from a negative supply shock? Figure 4.8 shows how a loss in capital stock shifts aggregate supply to the left, eventually causing output to fall and both the price level and real interest rates to rise. Suppose policy-makers attempt to counter this falling output by increasing the money supply. At first glance such an expansionary response to a contractionary event may seem beneficial. As the negative supply shock shifts AS to AS', moving the economy from A to B in Figure 4.8, the increase in the money supply shifts LM and AD to the right along AS'sr, pushing the macroeconomy to point C. This combination of negative supply shock (-\(\Delta k_0\)) and expansionary monetary policy (+\(\Delta M_0\)) has increased the price level but prevented output from falling.

Unfortunately, however, this is not the end of the story. The situation at point C is not sustainable. The leftward shift to AS' means that long run output must end up at the lower level, \(y^*\). You should not be surprised that the attempt to offset a loss in productive inputs (-\(\Delta k_0\)) with more "green" pieces of paper (+\(\Delta M_0\)) is doomed to failure as market clearing pushes the economy to a lower level of output and an even higher price level as shown at point D. Repeated attempts to use monetary policy to offset a negative supply shock and return the economy to its initial level of real output (\(y^*\)) can only lead to continued increases in the price level. This last example is a useful reminder that our policy instruments work predominantly from the demand side and that no matter how ingenious or well-meaning their use, they are no match for supply-side problems.
Figure 4.8 Negative Supply Shock with Expansionary Monetary Policy
The initial \( \Delta k \) would move the economy from points A to B. But a prompt \( +\Delta M_0 \) might move it to point C. However because this lies above the new full-employment level of output, \( y^* \), it is not sustainable. The rising price level and interest rate will move the economy up and back to point D.

The possibility that at least some of the ups and downs of the macroeconomy originate on the supply side certainly complicates the use of stabilization policy. Implementation of an Activist approach to the business cycle requires prompt responses to changing circumstances. But we may not be able to see at the outset whether a downturn in economic activity is coming from a negative demand shock, a negative supply shock, or some combination of the two. The likelihood that economic instability might originate on the supply side was given little attention until the OPEC oil embargo and subsequent price shocks of the 1970s. Since then, even the more Activist-oriented economists have become more hesitant to recommend aggressive monetary or fiscal responses at the first sign of a downturn. Moreover, another school of Non-Activists has arisen to argue that supply fluctuations are actually the primary source of the business cycle. This so-called Real Business Cycle view, though certainly in the minority among economists, has been an important challenge to the earlier presumption of both Activists and Non-Activists that macroeconomic instability is inevitably a demand-side phenomenon.
4.6 A QUICK SKETCH OF THE GREAT DEPRESSION

The most costly economic lesson in U.S. history was undoubtedly the decade-long economic crisis known as the Great Depression. Between 1929 and 1933, for example, the price level fell by more than 20%, yet real output in 1933 was almost one-third below its 1929 level. Even the most rapid price and wage declines of the century were unable to bring about the market-clearing return to full employment predicted by the Classical model.

There were many events that influenced economic performance in the Thirties and there is still disagreement about their relative importance. But we need not go beyond a few basic events to understand a good part of why the U.S. economy suffered such devastation. There is general agreement that an initial recessionary decline in autonomous consumption and investment spending in 1929 and 1930 was then turned into a depressionary collapse by a powerful accomplice -- the government. A rough characterization of the decisive years 1929-1933 would be a period of major declines in autonomous private spending (-Δz₀) followed by both contractionary fiscal policy in an attempt to balance the Federal budget (-Δg₀ & +Δt₀) and severely contractionary monetary policy (-ΔM₀) as the Federal Reserve stood by while bank closings and other monetary events resulted in almost a 33% drop in the nation's supply of money.

Putting all this together in Figure 4.9 paints a somber portrait of a deep and partly self-inflicted economic wound. After the initial drop in autonomous spending (-Δz₀) shifted IS to IS', subsequent attempts at budget-balancing caused a further drop in aggregate demand as higher taxes (+Δt₀) and reduced government spending (-Δg₀) shifted IS' to IS", moving the economy from points B to C. Monetary contraction then reduced demand still further as the -ΔM caused LM(P₀) to shift to LM'(P₀). The combined effect is to shift aggregate demand all the way to AD''', moving the economy finally to point D in the graphs. Whatever decline in the price level was occurring (not shown in the graph) was obliterated by the continuing leftward shift of aggregate demand.

In hindsight, viewed through the lens of our Expanded AD/AS model, it's hard to resist the conclusion that a significant recession was prolonged and deepened by the actions of bewildered policy-makers following the advice of a confused economics profession. The orthodox Classical analysis at the time, which could do little more than proclaim a continuing "temporary disequilibrium in the economy" and prescribe "patience" as the treatment, became increasingly ridiculed. Market clearing was supposed to insure that such "temporary" events would not continue year-after-year-after-year. In the absence of an alternative analysis, policy was guided by slogans and wishful thinking. Tragically, but not surprisingly, this only deepened and extended the crisis.

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8 If you're wondering how far to shift the IS and LM curves, don't worry about it. Without specific values for this model all we can know is the direction of the changes, not their magnitude. This is sometimes called a "qualitative" as opposed to "quantitative" analysis. Of course, if we had chosen a larger shift in LM, the real interest rate would have risen further. So this qualitative analysis does have its limitations. But for the present case our concern is with the change in real output from all these shifts. It is unambiguously negative!
Figure 4.9 Scenario for the Great Depression
An initial drop in autonomous consumption and investment spending moved the economy from points A to B. This was then followed by contractionary fiscal and monetary policies that continued the contraction to points C and D.

The Great Depression was a watershed event not only in the lives of hundreds of millions of people across the world, but also in the study of macroeconomics and the practice of economic policy-making. It led Keynes and a flood of followers to the kind of short run analysis now embodied in our AD/AS framework. This model reveals that contractionary aggregate demand policies are powerful enough to plunge a nation into an extended period of stagnation. But it also implies that such policies in reverse can be used to hoist it out. This lesson is now fully incorporated into the mainstream of economic science.
Policy-making in the 1930s was guided by a model that focused on relatively distant, long run outcomes by assuming both market clearing and constant velocity of money. It was unable to assess the tragic short term consequences of the contractionary events and policies of the early Thirties. How might things have been different if the Expanded AD/AS model had been available to policy-makers?

Returning in a time machine, suppose we convince President Hoover and Congress that however laudable their "balance the budget" program might sound, a recession is not the time for contractionary policies. We caution them that their hopeful "Prosperity is just around the corner" campaign is little more than empty propaganda.

Suppose they're persuaded by our arguments and agree to run a neutral fiscal policy that is neither contractionary nor expansionary. Equally important, suppose we convince decision-makers at the Federal Reserve to offset the rapid decline in the money supply with an unprecedented infusion of funds into the banking system so that they will at least be running a neutral monetary policy.

In the absence of sharply contractionary fiscal and monetary policies, our Expanded AD/AS model predicts that the Great Depression would not have occurred. Economic history would instead tell a story of a serious downturn that might have been called the "Long Recession". But it would not have produced the deep economic devastation that was actually experienced.

Unshackled from the Great Depression, what directions the energy and creativity of that decade might have taken can never be known. For most people, the struggle with a falling and then stagnant standard of living was at the center of their lives, every day, month-after-month, year-after-year. For those not directly affected, the uncertainty as to how long it would last and how far it would spread meant endless anxiety. If macroeconomics does no more than keep us alert to the kinds of policy mistakes made in the 1930s, it can prevent a fall in living standards that would reach well into the trillions of dollars. Try to keep this in mind the next time you become frustrated with the conflicting advice of distinguished economists on how to cope with the latest economic "crisis". As serious as many of our current economic issues may seem, they pale in comparison with the reality of the Great Depression.

### 4.7 A COMPARISON OF TWO MODELS

A useful way to reinforce the main results of these last three chapters is to contrast the major implications of this Keynesian-inspired expansion of the AD/AS model with those of the classical model of Chapter Two.

#### 1. FULL EMPLOYMENT

**Classical Model: Full Employment Prevails**

The market-clearing process keeps the "Classical thermostat" set at full employment. Deviations from full employment are assumed
to be relatively short-lived, provided that price flexibility is not limited by monopoly power or governmental policies.

**Keynesian Model: Full Employment is a Long Run Outcome**
Markets don't clear instantly. Short run price "stickiness" following demand shifts can explain the departures of actual from full employment output that define the "business cycle".

### 2. IMPORTANCE OF AGGREGATE DEMAND

**Classical Model: Aggregate Demand has No "Real" Effects**

*Money is a “veil.”* Changes in the money supply alter the price level but leave real output, employment, and the real rate of interest unchanged.

*Only Money Matters.* Under the assumption that the velocity of money is constant over time, only \( \Delta M \) can shift aggregate demand.

*Fiscal policy is “powerless.”* Changes in government spending and taxes don't alter aggregate demand, hence have no impact on real output or the price level.

**Keynesian Model: AD has "Real" Effects in the SR but not in the LR**

Since price rigidity permits real output to deviate from full employment, shifts in aggregate demand cause short run changes in output (and employment). Moreover, since the velocity of money can vary, aggregate demand can be shifted by fiscal policy or by changes in private spending, as well as by monetary policy. Hence fiscal policy is not powerless to shift aggregate demand and money is not all that matters. Money is still a "veil", but only in the long run.

### 3. IMPORTANCE OF AGGREGATE SUPPLY

**Classical Model: Supply is the Key to Economic Growth**

Output is determined solely by the vertical \( AS^* \) curve. It can increase only with growth in the inputs—with increases in labor or capital or improvements in the institutional structure.

**Keynesian Model: Supply Remains the Key to Growth**

In the short run the economy can deviate from its long run \( AS^* \) curve, moving along the horizontal short run supply curve. But ultimately, real output is determined by the vertical aggregate supply curve, just as in the Classical world.

### 4. INFLATION

**Classical Model: Inflation Comes From "Too Much" Money**
Continued increases in the price level are typically the result of a too rapid growth of aggregate demand, specifically $%\Delta M > %\Delta y^\prime$. With velocity assumed constant, it is only continued increases in the money supply that can cause demand to grow. In other words, the central bank is the only possible source of inflation and, therefore, its only cure.

**Keynesian Model: Inflation Can Come From Anything that Keeps Aggregate Demand Growing More Rapidly Than Aggregate Supply**

Whether or not the central bank is the culprit becomes an empirical question (a matter for statistical testing), rather than a foregone conclusion based on the logic of the model.

These last two chapters have introduced the basic analytical framework underlying macroeconomic thinking since Keynes's *General Theory*. Developments in macroeconomic theory and policy-making since that time can be usefully viewed as either extensions of this model or as reactions to its perceived limitations. Coming chapters will continue to apply the expanded (Keynesian) AD/AS model to major policy issues. Let's reiterate some important policy insights already uncovered.

1. An **economic depression** is not something that happens frequently or easily. In the 1930s, a recession was turned into prolonged decline and stagnation by contractionary actions of both the fiscal and monetary authorities.

2. The AD/AS model provides a framework for understanding **cyclical fluctuations** in output, but can sometimes prove to be an unreliable guide to stabilization policy unless analysis of the time dimension—that is, time lags in policy formulation as well as in the multiplier and market-clearing processes—is carefully included.

3. **Supply shocks** create a special situation in which prices adjust more rapidly than with demand shifts. Hence a negative supply shock quickly leads to falling output and rising prices. Attempts to offset it with demand stimulus may temporarily prevent output from falling, but will cause lasting price level increases.
4.8 OVERVIEW

1. This chapter began by translating the information from the IS-LM model of aggregate demand into an explicit relationship between total real output (\(y\)) and the overall price level (\(P\)), called the aggregate demand curve (AD). Using this 10 equation model, we found that a change in the price level alters the real value of the money supply (\(M_0/P\)) changing the intercept of the LM curve. This shift in LM means a movement along the IS curve until new equilibrium levels of \(y\) and \(r\) are established for the new level of \(P\). The result is that an increase in \(P\) sets off the following process:

\[
\Delta P \rightarrow -\Delta(M_0/P) \rightarrow +\Delta r \rightarrow -\Delta i \& \Delta x \rightarrow -\Delta y \rightarrow -\Delta c.
\]

This inverse relationship between the price level and real output (\(\Delta P \rightarrow -\Delta y\)) is contained in the downward slope of the AD curve.

2. Changes in the price level, which shift LM along IS, are therefore built into the slope of AD. Anything else that shifts either LM or IS will shift the entire AD curve. For example, expansionary fiscal policy (+\(\Delta g_0\) or -\(\Delta t_0\)) shifts both IS and AD to the right. So does any increase in the components of private autonomous spending (+\(\Delta z_0\)). Expansionary monetary policy (+\(\Delta M_0\)) shifts LM and AD to the right. So does a decrease in autonomous money demand (-\(\Delta j_0\)).

3. Intricate as the twin IS-LM & AD graphs may seem, they only address half the issue—demand, not supply. They reveal nothing about the production process, nothing about how many goods will actually be supplied in the economy. In other words, the central frustration that defines economics—scarcity—has been left out. This is easily amended by adding a familiar relationship, the production function \([y^*=F(n^*,k_0,\tau_n,\text{inst})]\). This now defines a vertical aggregate supply curve at full employment, AS*. This curve represents essentially the same boundary that we encountered with the PPF and is identical to the supply curve of the Classical model.

4. But to capture the Keynesian belief that shifts in aggregate demand cause short run changes in real output, the Classical aggregate supply curve must somehow be relaxed. An easy way to do this is with the subsidiary assumption that the price level is fixed ("sticky prices") in the short run. The resulting horizontal short run aggregate supply curve, AS\(_{sr}\), allows this model to explain short run deviations of output from its full employment level. As time passes and markets clear, we return to the long run, vertical aggregate supply curve and full employment (\(y^*\)).

5. With all this apparatus in place—IS-LM as the foundation for AD and price stickiness underlying short run deviations from AS—substantive economic analysis of short run events is finally available to us. We applied this expanded Keynesian AD/AS model to some basic situations and saw that it could be used to address a number of important questions, including the following.

a. A decrease in investment spending contracts output in the short run. But a decrease in money demand would work in the opposite direction to expand the economy. Precisely why is this?

b. Countercyclical policy is designed to "calm the waters" of the business cycle. What insights does the Classical framework yield on such a plan? How does the expanded AD/AS model differ on this issue?
c. In what ways might the expanded AD/AS model not be a reliable guide to smoothing the business cycle? What implications do you think this would have for the Activist policy position associated with the Keynesian tradition?

d. Why may an anti-recession policy that makes sense for a negative demand shock not be appropriate if the downturn is due to a negative supply shock?

e. The Classical model predicts that extended periods of high unemployment are prevented by the process of market clearing. But it could not offer a convincing explanation of the economic crisis of the 1930’s. How can the expanded AD/AS model explain the Great Depression?

f. If we could go back to the early days of the Great Depression, taking this new and improved AD/AS model with us, what policy recommendations are we likely to make? How does this compare with the actual policy choices made at the time?

g. Why did the U.S. economy spring back to life so buoyantly with the coming of World War II?

6. The questions above might seem to have been mistakenly put in the Overview section instead of with the Review Questions. Actually, they belong in both. The reason for putting questions here is to encourage you to learn to derive your own answers to whatever issues may arise. Rather than memorizing answers to many hundreds of potential questions, it is more sensible as well as much simpler (with a little practice) to use the mechanics of the model to generate your own answers. As the parable says: *Give me a fish and I will eat for a day. Teach me to fish and I shall eat for a lifetime.*

4.9 Review Questions

1. Define the following basic concepts or terms:

<table>
<thead>
<tr>
<th>Aggregate Demand Curve</th>
<th>Gross Domestic Product</th>
<th>Monetarist</th>
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</thead>
<tbody>
<tr>
<td>Short Run Aggregate</td>
<td>Negative Supply Shock</td>
<td>Non-Activist</td>
</tr>
<tr>
<td>Supply</td>
<td>Stabilization Policy</td>
<td>Recession</td>
</tr>
<tr>
<td>Short Run Price Rigidity</td>
<td>Keynesian</td>
<td>Economic Depression</td>
</tr>
<tr>
<td>Long Run Market Clearing</td>
<td>Activist</td>
<td>Cyclical Fluctuations</td>
</tr>
<tr>
<td>Keynesian (Expanded) AD/AS Model</td>
<td>Classical</td>
<td></td>
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</table>

2. In the Classical tradition, the direct economic role of government is highly circumscribed and the conclusion that this does not hinder economic performance is embodied in the Classical macroeconomic model. In the Keynesian tradition, government action is viewed as a response to the supposed failure of actual economies to achieve the optimal results of the Classical model.

a. What are the alleged shortcomings of the Classical analytics and how does the
Keynesian model "correct" these?
b. Discuss the similarities and differences in the policy predictions of the Classical and Keynesian models.

3. Following many long years of happiness and prosperity in her Kingdom, the Queen responds quickly to the first rumors of a coming economic downturn by asking the three wisest persons in the Land for their diagnoses and remedies. Evaluate each of their responses in terms of the AD/AS model.

a. "The problem is that we have become too used to prosperity and it has led us to borrow and spend too freely for our own good. Right now the Kingdom is borrowing beyond what it is investing, and the result must be economic stagnation, falling incomes and a declining standard of living. An end to the Royal Deficit will restore prosperity."

b. "The problem is a temporary supply shock, caused by events beyond our control. They will end eventually. In the meantime we should contract our money supply a bit to be sure that we don't end up with both a recession (unavoidable) and inflation (avoidable)."

c. "Periodically the Animal Spirits of our citizens combine with the alignment of the Heavens and lead to feelings of anxiety and pessimism. This, in turn, causes them to reduce investment spending, and thus begins the cyclical downturn. A slight fiscal or monetary "goose" will provide the necessary economic stimulation to restore our Fabled Prosperity."

4. Suppose that rising fears of a coming inflation lead many people to decrease their money holdings and that this results in a significant decrease in autonomous money demand (-\( \Delta j_0 \)) for the whole economy.

a. What short run impact will this event have on P, y, and r? Explain.
b. According to the Activist view, what sort of monetary policy change, if any, would be appropriate? Explain.
c. What is the long run impact of -\( \Delta j_0 \) on the economy? Explain.
d. Suppose the Federal Reserve responds by adjusting M so as to keep the real value or purchasing power of money (M/P) at its original (pre-shock) level. What impact would such a policy have on the economy? Explain.

5. Suppose a statistical analysis finds that money demand does not depend on the real rate of interest and that the \( j_2 \) coefficient equals zero. Explain why this economy would be better described by the Classical Macro model than by the expanded Keynesian model. Explain your reasoning.

6.

a. Suppose the economy is in short run equilibrium well-below full employment. If no policy changes whatsoever are made, what is the cause-and-effect process that is alleged to bring the economy back to full employment in the long run? Be specific and explain.
b. What information would you need before you could conclude that changes in fiscal or in monetary policy would return the economy to full employment more rapidly than market clearing? Explain.

7. "In the long run, assuming flexible wages and prices, real output/income is determined entirely by factors on the supply side. Similarly, the real interest rate is determined entirely by factors on the demand side." Do you agree or disagree with this statement? Explain your reasoning.

8. John Maynard Keynes argued that fiscal policy could alter aggregate demand with a multiplier effect and that the remedy for the devastating unemployment of the Great Depression was expansionary fiscal policy. His critics asserted that this expansionary policy would have no impact whatsoever on aggregate demand, income, or employment. Which of these two diametrically opposed views is embodied in the AD/AS model that we've been using? Explain.

9. In terms of the Expanded AD/AS model, what is the short and long run impact of an increase in the money supply on y, P, r, c, i, and x? Explain your reasoning.

10. Suppose a careful statistical study shows that the real interest rate does not influence either investment or net exports at all.

   a. How would this change the IS equation, the IS curve, and the AD curve? Explain.

   b. Would this new information alter our conclusions about the impact of fiscal and monetary policy on aggregate demand? Explain.

11. "For all its sounds of revolution, the Keynesian model is really quite tame and ultimately very much like the Classical model of the macroeconomy. It retains the basic Classical insights that "We can't spend our way to prosperity," "We can't print our way to prosperity", "Economic growth depends on the supply side", and "Inflation is everywhere and always a monetary phenomenon."
Do you agree with this statement? Explain why or why not.

12. Suppose we increase government spending but refuse to raise taxes to pay for it.

   a. According to the Classical model of the overall economy, what consequences, if any, would this have for the economy.

   b. According to the Keynesian or Expanded AD/AS model, what SR and LR consequences, if any, would this have for the economy.
USE THE FOLLOWING MODEL TO ANSWER THE QUESTIONS BELOW.

\[ y = c + i + x + g \]
\[ c = 50 + 0.9(y - t) \]
\[ t = 200 + 0.2y \]
\[ g = 730 \]
\[ i = 300 - 1000r \]
\[ x = 100 - 12y - 500r \]
\[ L/P = M/P = 387.5 + 0.1y - 1000r \]

13. a. What is the equation for the IS Curve for this economy? Put it in terms of the specific quantitative values that describe this economy.

b. Calculate the value of the expenditure multiplier, \( \mu = 1/(1-c_1+c_1t_1+x_1) \).

c. If government spending rises by $100 (billion), what will happen to this equation and to the IS Curve? Be specific. (Suggestion: Use the multiplier from above instead of resolving the entire set of equations.)

d. Calculate the value of the tax multiplier, \( -c_1\mu \).

e. If taxes (\( t_0 \) for simplicity) fall by $100 billion, what happens to this equation and to the IS Curve? (Suggestion: Use the tax multiplier instead of re-solving the equations.)

f. If both public spending and taxes rise by $100 billion, what happens to this equation and to the curve?

14. a. What is the equation for the LM Curve, again with specific values?

b. If the money supply rises by $100 billion, what happens to this equation and to the LM Curve? Be specific.

c. With the money supply still at this higher value, suppose the price level rises to 1.20. What happens to this equation and the LM Curve?

15. Suppose this economy is initially in both short run and long run equilibrium in terms of the complete AD/AS model. Find the specific equilibrium values of \( r, y, c, i, x, \) and \( b = g - t \).

16. What happens to equilibrium \( r, y, \) and \( b \) if government spending rises by $110 (billion)?

17. Several former Presidents optimistically predicted that we could "grow" our way out of the deficit without raising tax rates or cutting spending. Without any change in tax rates or government spending, how high would real output (and income) have to grow in this economy to bring about a balanced government budget?

18. In order to stimulate economic growth, we need to get resources out of consumption and into saving. To help this along, suppose that we eliminate taxes on income earned from saving accounts, and that the effect of this is to increase saving hence decrease autonomous
consumption by $110 \text{ (billion)}. \text{ What will be the short and long run impacts of this policy on } r, y, c, i, x, \text{ and } b \text{ in this model?}