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*The Journal of Economic Perspectives*, Vol. 9, No. 3. (Summer, 1995), pp. 169-188.

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*The Journal of Economic Perspectives* is currently published by American Economic Association.

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## **The Stories We Tell: A Reconsideration of AS / AD Analysis**

David Colander

**T**he economics we teach undergraduates is a combination of simple models with highly limiting assumptions and storytelling that relates the simple model to the economy. The models are comparative static; the stories generally fill in the missing dynamic analysis. At the introductory economics level, where the models are highly simplified, the storytelling grows in relative importance. A good principles of economics teacher is a good storyteller.

In introductory microeconomics, the central model we teach is a variant of Marshall's partial equilibrium analysis. The dynamic disequilibrium story we tell to accompany it involves opportunity cost and substitution: if the quantity supplied exceeds the quantity demanded, suppliers find that they cannot sell all their goods and find it in their interest to lower prices, and so on . . . . It's an appealing intuitive story that the majority of economists are reasonably comfortable with. It also meets an important teaching criterion: the majority of students can relate to it and say, "Yeah, it makes sense."

In the 1950s and 1960s, introductory macroeconomics had such a simple model: the Keynesian cross. The model came with an intuitively appealing dynamic disequilibrium adjustment story—the multiplier story. If aggregate expenditures exceed aggregate production, then production increases, which causes income to increase, which causes expenditures to increase, and so on . . . . This chase between expenditures and production occurs in declining amounts (since the marginal propensity to consume is less than one), which means that, eventually, an aggregate expenditures/production equilibrium is reached. This dynamic adjustment story may or may not be true; in its simple form, it is

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believed by only a few economists. We taught it nonetheless because, given the assumptions, it is a logically consistent story, and for most students, it meets the “Yeah, it makes sense” criterion.

In the 1990s, the Keynesian cross has been supplanted by the AS/AD model. Unfortunately, that model as currently presented is seriously flawed. First, it does not fulfill the minimum requirement of a model: logical consistency. Its component parts are derived from models that reflect different, and inconsistent, models of the economy. Second, the appropriate disequilibrium adjustment story with which it is consistent—one in which short-run aggregate adjustment occurs because of price level flexibility—is consistent neither with observed reality nor with the disequilibrium adjustment story that most macroeconomists accept.

The problems with the dynamic disequilibrium story are often not apparent, since telling this AS/AD dynamic disequilibrium story properly requires such high-level mental gymnastics that the proper story is not discussed in intro texts, and is not seriously considered in most intermediate macro texts. Instead, the background dynamic story that gives the model intuitive meaning to the student is typically glossed over, or told in a way that is inconsistent with the model. The result is a model of the worst type—a model that obscures, rather than clarifies, that invites students to make the incorrect logical jump that AS/AD analysis is similar to partial equilibrium supply demand analysis, and that discourages thinking deeply about the inner workings of the model.

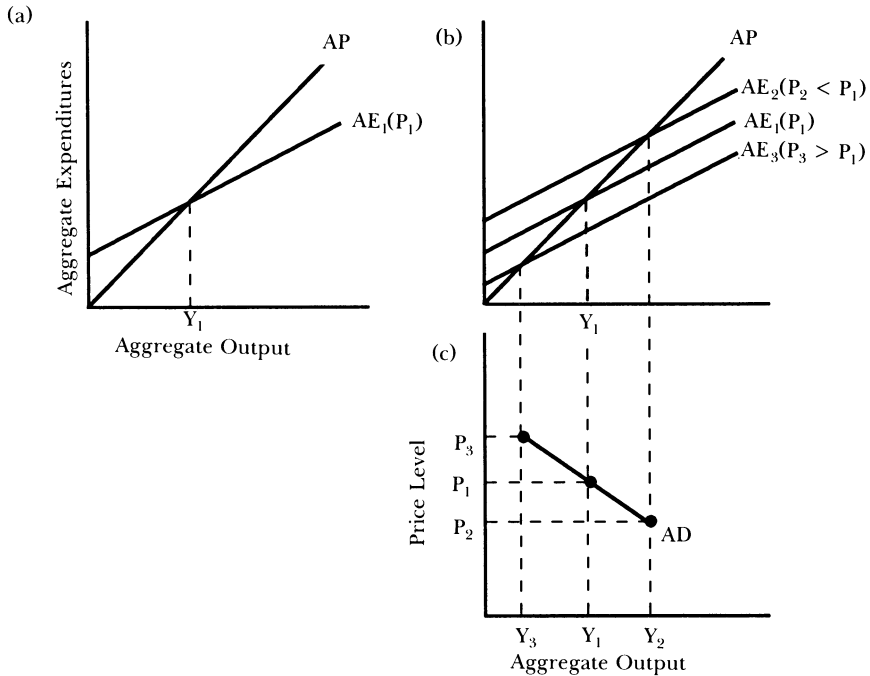
These problems are not unknown to textbook authors. Their attempts to contort the AS/AD model into a coherent pedagogical tool has led to inconsistencies and confusions in the standard exposition. In this paper I try to make those inconsistencies and confusions clear, and discuss alternatives.

## The Standard Exposition of the AD Curve

There are various ways of introducing the AS/AD model. Here, I will focus on the typical derivation of the AD curve from the Keynesian aggregate expenditure/aggregate production (AE/AP) model. Let us assume that the students have learned the Keynesian AE/AP model (or at least have had it presented to them) and are now being taught AS/AD analysis. Typically, the presentation goes as follows:

“Last class, I presented the Keynesian AE/AP analysis. Any question? Good; I will assume that you all understand it. In this class I will show how we can get an AD curve from that analysis. Consider Figure 1a. What is this graph? Right: it’s the Keynesian AE/AP model with equilibrium at income  $Y_1$ . We didn’t discuss price in that analysis, but we can assume that the price level was at some level, say  $P_1$ . The AE curve,  $AE_1$ , is the relevant curve for price level  $P_1$ . Let’s now go through a thought experiment, specifying the effect of a change in

Figure 1  
From Keynesian Cross to Aggregate Demand Curve



the price level on aggregate expenditures.<sup>1</sup> What effect will a change in the price level have on aggregate expenditures?" The typical silence from the class ensues. "Well, then, let me help you."

The professor then explains that the quantity of aggregate expenditures will increase with a fall in price level and decrease with a rise in the price: "In Figure 1b I show how a fall in the price level from  $P_1$  to  $P_2$  shifts the AE curve up to  $AE_2$ , thereby giving a new higher  $AE_2$  curve at lower price level,  $P_2$ . Similarly, a rise in the price level lowers aggregate expenditures, giving us a new lower  $AE_3$  curve at higher price level  $P_3$  ( $P_3 > P_1 > P_2$ ). So we now have three different AE curves, each associated with a different price level."

The professor usually offers some subset of four effects as intuitive justification for these movements: the wealth or Pigou effect (a fall in the price level makes the holders of money richer, which leads them to increase expenditures), the international price level effect (a fall in the price level, given fixed exchange rates, decreases imports and increases exports), the Keynes effect (a fall in the price level increases the real money supply, lowering interest rates, increasing expenditures), and the intertemporal price level effect (a fall in the price level, expectations of future price level constant, causes people to switch from future to present consumption).

<sup>1</sup>The same derivation can be done from an IS/LM model in an intermediate macro course.

The professor then proceeds to derive an AD curve from the AE/AP model. “Notice that we have three price levels and three different levels of aggregate output. Consider Figure 1c. It has price level on the vertical axis and aggregate output on the horizontal axis. So, let us now plot the price/output points from the top graph on to this bottom graph.”

The professor then draws a curve in the price level/output space underneath the AE curve. It is a downward sloping curve, which is presented to the class as the AD curve. At this point, the professor may show how expansionary monetary and fiscal policy will shift the AD curve to the right, and contractionary monetary and fiscal policy will shift it to the left.

## The Standard Exposition of the AS Curve

The professor now switches gears and presents the aggregate supply curve. Here, generally, there is somewhat less consistency in the presentation. In a typical presentation, both a long-run and a short-run AS curve are discussed.

The long-run AS curve is usually presented as a perfectly inelastic curve at the economy’s potential output level. Its shape is generally justified by reference to the neutrality of money in the long run. Since a price level change—in which all relative prices move in tandem—makes no difference to anyone, it is reasonable to assume that aggregate output is unaffected by changes in the price level. Often, the long-run AS curve is related to the “natural rate” equilibrium of the economy, and the argument is made that if the wage rate is flexible in the long run, the economy will always be at “full employment.”

The short-run aggregate supply curve is presented as upward sloping for one of two reasons: fixed nominal input prices (perhaps due to explicit or implicit contracts) or misperceptions of workers or firms. For example, the sort of heuristic presentations generally found in intro texts might hold that when faced with higher prices for their output caused by an increase in the money supply, firms incorrectly think the price level would remain constant, their relative price had increased, and they can make higher profits by increasing production. They consequently increase production only to discover that the price level (including input prices) has risen and, had they had full information, they would not have chosen to increase output. Thus, after some unspecified time period the short-run AS curve shifts back to the long-run supply curve. In more formal models it is generally the fixed nominal wage that leads to the short-run increase in output (implicitly assuming money illusion on the part of the workers) but the general reasoning is the same. The underlying dynamics of that shift are often left undiscussed; however, since, in the long run, the AS curve is assumed to be perfectly inelastic at full employment, the shift must take place.

Both the short-run and the long-run aggregate supply curve come from a fundamentally different conception of the economy than did the AD curve.

Neither the long- nor the short-run supply curves fit the Keynesian model, so the above presentation of the shape of the AS curve is often supplemented in intro texts by what might be called a “pure Keynesian” case. In this pure Keynesian case, the supply curve is presented as perfectly elastic. This is generally not derived: it is simply presented as an assumption of the Keynesian model.

Often the three cases are combined together into an AS curve, which has three ranges: a Keynesian range in which the AS curve is perfectly horizontal, a classical range in which the AS curve is perfectly vertical, and an intermediate range in which the AS curve is upward-sloping. In this combination AS curve, the long-run/short-run distinction is generally dropped, and the potential instability of the intermediate range is not discussed.

### **Policy Analysis with the Standard AS/AD Curves**

The above aggregate supply-curve is then combined with the AD curve derived from the Keynesian model to arrive at the standard textbook AS/AD model. Let me briefly specify the typical analysis presented. Expansionary fiscal and monetary policy shifts the AD curve out, with the effect on real output and price level dependent on the elasticity of the AS curve. In the Keynesian range, expansionary policy affects only real output. In the classical range, it affects only the price level. In the intermediate range, the effect of monetary and fiscal policy is split between price level changes and real income changes, with the relative division being determined by the elasticity of the AS curve. A price supply shock will shift the AS curve up, causing real output to decrease and the price level to rise. A negative supply shock will shift the AS curve back, causing price level to rise and real output to decrease.

Most professors know this drill well, and it is to get to that policy drill that most professors put up with the AS/AD analysis. After all, the general effect of monetary and fiscal policy and of supply shocks in the standard AS/AD model are those that the majority of economists believe will occur. Moreover, significant room is left for differences of opinion about the short run, depending on what portion of the composite AS curve the economy is in.

### **Problems with the Standard Exposition**

The above presentation seems relatively straightforward. The problems arise when the veneer of the model is scraped off, either because one is forced to scrape it off due to a question of a precocious student, because one is trying to carefully spell out the underlying logic specification of the model, or because one is carefully going through the dynamics accompanying it.

### An Incorrectly Specified AD Curve

The logical specification problem concerns defining the AD curve that was derived from the Keynesian model. An appropriate definition of the AD curve derived from the Keynesian model would be as follows: *The AD curve is the combination of points at which the Keynesian model is in equilibrium, given the relationship between price level and real output specified in the price-level thought experiment.* The standard intro book does not give this definition; instead it gives a definition that parallels the definition of the partial equilibrium demand curve. A typical definition of an AD curve presented in an intro text is the following: *Aggregate demand is a schedule, graphically represented as a curve, which shows the various amounts of goods and services that society as a whole will desire to purchase at various price levels, other things being equal.* Notice that this definition parallels the definitions of the partial equilibrium demand curve, making appropriate distinctions between relative price and price level and quantity of a good and real output.

This textbook definition is a reasonable one of what the AD curve should be, although it is somewhat vague about what other things are being held constant. Typically, the explanation of what determines the slope of the AD curve, which focuses on the four effects discussed above, clarifies that everything except the direct effect of changes in the price level on output is being held constant.

The problem with this definition and delineation of what determines the slope of the AD curve is that it *is not consistent with the derivation of the AD curve from the Keynesian model*, because that Keynesian model-derived AD curve does not hold other things constant.<sup>2</sup> The Keynesian model is quite explicitly a model of *expenditures and production*; it does not hold other things, specifically supply, constant. Listing factors like the Pigou effect and the Keynes effect as the determinants of the slope of the AD curve does not include the multiplier effects, which are central to the Keynesian model. Thus, the standard presentation of the AD curve misses the point that in the AD curve derived from the Keynesian model, all these effects of price level on output are multiplied by some amount before one derives an AD curve. The two approaches are equivalent only if the multiplier is zero.

To see how this inconsistency can get a professor into trouble, let's introduce a precocious student. We all know the type: the one who asks the simple

<sup>2</sup>In this article I concentrate on what might be called the Keynesian aggregate demand curve—so-called because it is derived from a Keynesian IS/LM or AE/AP model or is developed using reasoning (such as the Pigou or Keynes effect) that developed after the Keynesian revolution. I do not discuss what might be called a classical aggregate demand curve, which is derived from the quantity theory and which assumes velocity constant. This rectangular hyperbola aggregate demand curve follows from the assumptions of the quantity theory and is not derived from any other analysis. As such, it avoids the criticism of being logically inconsistent; it is, simply, arbitrary and, given the real world fluctuations in short-run velocity, hardly supportable as an empirically relevant curve. What is not pedagogically defensible is to present the classical AD curve in one part of the book and, without discussion, present a Keynesian AD curve in another part of the book.

but difficult questions. This student asks, “Professor, I’m trying to draw the AD curve, and I want to make sure that I have it right. Say the price level falls by 2 and the real output caused by that fall in the price level, other things constant, is 2. Does this mean that the AD curve will have a slope of  $-1$ ?”

If the professor isn’t paying too much attention when asked this question, he or she responds, “Yes, that sounds right.”

“But professor,” the student responds, “that isn’t what I got when I did my derivation of the AD curve. Specifically, when I shifted up my AE curve by 2, real output increased by 6 because I had a multiplier of 3. So the slope of the AD curve I got was  $-3$ , not  $-1$ .”

“Oh,” the professor responds, trying to regroup as we all have a tendency to do in such cases. “The definition isn’t quite the definition we meant; we also want to take into account the multiplier effect. So you are quite right, the slope of the AD curve is indeed  $-3$  when the multiplier is 3, and the initial response of real output to price level is in a one to one ratio.”

“But professor,” responds the student, “now I’m even more confused. Didn’t you tell me before when you were explaining the Keynesian disequilibrium process that the multiplier was an interaction of production and expenditures—that when aggregate expenditures increased, it brought about a supply response from firms who increased output? Didn’t you also say that this increase in income would cause income to increase even more, which would cause firms to increase output, which would cause income to increase, which would cause expenditures to increase, and that this process continues until the iterations ground to zero? Or have I misunderstood the multiplier? But, now you’re telling me that the AD curve holds other things constant, and that must mean that supply is being held constant, right? Is supply or quantity supplied being held constant in the Keynesian model? Or are they not? And if they are not being held constant, how can we derive an aggregate demand curve from the model that does not hold other things constant?”

At this point the professor, if he or she is like me, gives the “retreat and regroup” response: “You raise some very interesting issues, but they are difficult ones; let’s discuss it after class.”

After class, the professor tells the student something like this: “The problem here is that the AD curve derived from the Keynesian model is not really an AD curve.<sup>3</sup> The AD curve defined in the book would only include the initial effects, not any multiplied effects of that initial effect. As you quite rightly recognized, the Keynesian model defines equilibrium points, and thus the curve we derive from it would better be called an ‘aggregate equilibrium curve,’ not an AD curve. For some reason it wasn’t, and the book and I are simply following standard nomenclature and definition, which are, I agree, inconsistent.

<sup>3</sup>Variations of this criticism of the AD curve have been made by a variety of economists. Besides myself, they include Robert Clower (1994), Robert Barro (1994), Fields and Hart (1990, 1994), and, I’m sure, many others. But nonetheless the presentations described here are standard in many texts.



“The reason we accept this inconsistency is that in the 1990s we don’t really believe that the Keynesian model defines long-run equilibrium; instead we believe that the long-run equilibrium is determined by aggregate supply considerations and that, at best, the Keynesian model describes a temporary and fleeting aggregate equilibrium. To get into these issues would totally confuse the class, so, to be honest, we fudged a bit and talked about the AD curve we defined and the aggregate equilibrium curve we derived as if they were the same curve, so as not to confuse students. This allows us to avoid some complicated dynamic issues that the profession has not fully resolved. You understand, right?”

The precocious student nods and decides to switch to another major.

In short, the logical problem here is that one cannot derive an AD curve from the Keynesian model, because the Keynesian model includes a dynamic interactive effect between supply and demand in the form of the multiplier. The Keynesian model has embodied in it what Robert Clower (1994) calls Hansen’s Law—the proposition that demand creates its own supply. This analysis of supply might be totally wrong, but there is no denying that the Keynesian model has assumptions of supply responses in it. As you move along the 45-degree line, supply is changing independently of any change in the wage/price ratio.

Given that the Keynesian model includes assumptions about supply, one cannot logically add another supply analysis to the model unless that other supply analysis is consistent with the Keynesian model assumption about supply. *The AS curve used in the standard AS / AD model is not; thus the model is logically inconsistent.* It has two inconsistent supply analyses: one implicitly built into the slope of the AD curve, the other explicitly behind the AS curve.

### **AS / AD Disequilibrium Dynamics**

The second problem with the AS/AD model is that the implicit dynamic adjustment story that lies behind it is not consistent with observed reality and is not a story most economists accept. To understand this problem, consider the situation where both wages and prices are perfectly flexible, so the AS curve is perfectly vertical. Say that the economy is initially in equilibrium and that it suddenly experiences a negative demand shock. What is the underlying dynamic adjustment story?

Most intro books are good at pointing out that the necessary adjustment is not a micro-style partial equilibrium story. But most do not delve into the appropriate adjustment story, which would be complicated because an autonomous shift of expenditures of say, 10, will cause a shift of the standard AD curve by  $(1/1 - MPC) 10$ . Pointing this out would lead students to see what a strange type of demand curve the standard AD curve is, so the books simply don’t point it out. Instead, when discussing dynamic adjustment most books

simply switch and implicitly use a more reasonable aggregate demand curve that corresponds to their definition, not their deviation.

Say that there is a negative real demand shock that causes excess supply in the goods market. (Here, to simplify the presentation, I describe only the dynamics behind the Pigou and Keynes effect; the intertemporal price level effect and the international effect have different dynamics and different problems.) The appropriate dynamic adjustment story is the following: The price level falls, increasing the real money supply. This lowers interest rates, stimulating investment- and interest-related consumption expenditures (the Keynes effect). The fall in the price level also makes the holders of real money balances richer, increasing their expenditures (the Pigou effect). The combination of these two effects moves us along the defined AD curve (including no multiplier effects since this is not the derived AD curve) until, finally, equilibrium is reached at the starting point—the natural rate of output.

The problems with the above dynamics are fourfold. First, they don't correspond to observed reality. The last time the U.S. price level fell was back in the 1930s, yet the economy has experienced many adjustments to negative demand shocks. Second, these effects are simply too weak to be the driving forces in the aggregate adjustment process. Pigou, when he first presented the wealth effect, agreed that it was only a debating point, unimportant on the checkerboard of real life. Similarly, falls in the price level of a magnitude large enough for the Keynes effect to be significant simply are not observed. And, as Keynes pointed out in *The General Theory*, if this were a sensible adjustment mechanism to follow, increasing the nominal money supply would achieve the same end.

A third problem is that if the above two effects are the entire dynamic story, then the story assumes that a falling price level will affect the goods market only indirectly through its effect on the money supply. But if you ask any business economist to predict the effect of an unexpected 10 percent fall in the price level, you are likely to hear that it would tear the economy apart through its effect on financial obligations specified in nominal terms. Such an unexpected fall in the price level would transfer significant wealth from debtors to creditors, and since many entrepreneurs are debtors, it would significantly disrupt the economy, reducing both aggregate supply and aggregate demand.

A fourth problem is that the dynamics assume that as all this indirect dynamic adjustment is taking place, *the participants in the goods market are assumed to be making no adjustments of their own*. Firms and individuals facing excess supply are sitting around, waiting for equilibrium to be brought about by the falling price level's effect on the money supply, even though firms cannot sell all their goods. Any student who looks at the real economy knows that isn't what happens. It is intuitively much more plausible to assume (as Keynes did) that faced with excess supply, firms will, to some degree, decrease real output supplied. As they do that, they will decrease aggregate income. Put simply: in the aggregate economy it is almost inconceivable that supply and

demand are not interdependent in some way. Any dynamic adjustment story that does not take account of that interconnection, or at least explain why such an intuitively obvious interconnection is not present, is simply unbelievable.

I suspect that it was to capture that interdependency that most books chose to focus on the aggregate demand curve (really an aggregate equilibrium curve) derived from the Keynesian model rather than on the appropriately defined AD curve. But they can't have it both ways. If that goods market adjustment eliminates some portion of the goods market disequilibrium, the effects of the money market dynamics on the goods market will be changed. If interdependent shifting of aggregate supply and aggregate demand brings the goods market closer to equilibrium, as the Keynesian model assumes it does, what is the dynamic adjustment mechanism that leads the economy back to the original supply curve? It isn't to be found in the texts. It simply is assumed to happen.

The above dynamic disequilibrium problem is central to macroeconomics. If aggregate supply and demand are interdependent, *the standard disequilibrium dynamics do not lead to a unique equilibrium with anything less than instantaneous price level adjustment*. That story is vacuous; it works only if there is never disequilibrium. This was the essence of the Keynesian revolution spelled out by Keynes in his one paragraph Chapter 1 of *The General Theory*. The standard AS/AD analysis emasculates both Keynes and common sense.<sup>4</sup>

I think most economists would agree that the underlying disequilibrium adjustment story that appropriately accompanies the AS/AD model is not descriptive of the real world, but is simply a defensive story to maintain the logic of the AS/AD model of the economy. If we honestly told students that these are the underlying stories behind the analysis, most of them would ask, "Why are you teaching us this? This is not the way the economy works."

## Proposed Solutions

There are three alternative ways of dealing with the problems with AS/AD described above: the "pedagogy is dirty" solution; the "banishment" solution; and the "coordination augmented production function" solution. Although I am biased toward the third of these, I will try to give a fair presentation of each.

### The Pedagogy is Dirty Solution

The first solution is practical. It is implicitly the solution we are currently using. It views the AS/AD model as a rough and dirty policy model and holds

<sup>4</sup>I am not arguing here that Keynes was right that the economy has multiple equilibria. I am only arguing that the standard disequilibrium stories are insufficient to justify assuming a unique equilibrium.

that what we should be doing in the principles course is simplifying the essence of the macro policy problem to something that is understandable. The standard AS/AD analysis does that. It captures certain tendencies in the economy—for aggregate demand to affect both real output and the price level in the short run and for the economy to be limited by a supply constraint in the long run. If we can get into students to understand that, we're lucky; and all this other stuff is theoretically nice but pedagogically quite irrelevant.

After all, the reality is that most students retain only a small amount of what we teach them. If, in our teaching, we focus on analytic distinctions that only macro specialists understand or care about, students will get all involved in these distinctions and will not learn the important policy lessons of the model.

Many professors must find this viewpoint reasonable. If they didn't, the inconsistencies and sloppiness currently found in the standard presentation of AS/AD analysis would have been removed long ago. But while I understand the reasoning behind this view, I am not convinced by it, and I find it pedagogically troubling. Even "dirty pedagogy" should be internally consistent. It can be exceedingly vague, but it should not be logically wrong as the standard AS/AD model is. Teaching the standard inconsistent model discourages students from questioning the workings of the model. That may not bother those students who are interested in getting their grade and getting out of the course. But it decidedly turns off the good students, the ones we all want to encourage.

If one wants a quick and dirty analysis, why not present to students a quick and dirty analysis, with no pretensions of it being anything else? We could simply tell students that in the short run when expenditures increase, generally output increases, often by a bit more than the initial increase, but that in the longer run, that increase often results in an increase in the price level. Similar descriptions of the other normal effects of policy could easily be given—without any formal AS/AD model that seems to give the analysis rigor when actually none is there. Why use a logically inconsistent model to explain what can be far more simply explained?

### **The Banishment Solution**

The second solution is what might be called the banishment solution. In it one would simply do away with aggregate supply and demand analysis. New classicals who advocate this approach argue next for a focus on micro issues, leaving macro issues for later courses. Old-time Keynesians who support the banishment solution often recommend teaching the Keynesian model as most descriptive of the real-world adjustment process; in other words, return to the way macro was taught before AS/AD analysis became popular. Thus, we have the wonderful irony of a coalition between new classicals and old-time Keynesians arguing for banishment of AS/AD analysis, although their alternatives are polar opposites.

In the “micro only” view, we would explain to students that aggregate disequilibrium analysis is complicated, and quite likely chaotic, and that economists have little to say explicitly about such complicated dynamics, especially at the introductory level. This alternative is a return to pre-Keynesian days when macro issues were not part of the principles course.

Given the chaotic state of macro theorizing today, this solution is logical enough. But it has problems. Students want to know what economists have to say about the aggregate economy, and if an interest is there, it seems a pity not to meet it. In the 1930s, it was precisely that lack of discussion of the issues that made the younger students ripe for joining the Keynesian revolution. Moreover, this solution would eliminate one-half of the intro courses, although probably a third to a half of that half could be saved by expanding what we teach in micro. But intro courses are the bread-and-butter courses of most departments, which would consequently recoil at a solution that so reduced the demand for economists.

The alternative banishment solution—going back to teaching the Keynesian model—is essentially a “return to the ’60s” solution. The problem here is even if the simple Keynesian model ever was a reasonably good description of the determination of aggregate income, it certainly isn’t now in the 1990s. Few macroeconomists today believe that fine-tuning will work; that expansionary fiscal policy is called for in such cases as western Europe in the 1990s where the unemployment exceeds 10 percent; or that we can talk about macro policy without directly incorporating inflation, or at least a changing price level, into the analysis. The policy debates in the 1990s are not about fiscal policy—which the AE/AP model was designed to highlight. They are about monetary policy that can fit into the AE/AP model, but that doesn’t fit directly into it, or about policies that directly affect supply. The movement away from the Keynesian model occurred precisely because it often didn’t fit observed reality and because we needed a model that did not assume the price level constant.

Consider the policy discussion when President Bill Clinton came into office bringing with him liberal, generally Keynesian, economic advisers. He wanted to expand the economy—and he advocated *reducing* the deficit to do it. It requires a big stretch to explain Clinton’s policy with the old-time Keynesian model. Thus, while I am sympathetic to certain Keynesian insights, I am not sanguine about a return to the old-time Keynesian model.

A final argument against the banishment solution is that it would lead to a bifurcation of the teaching of macro. In the principles course, Keynesians would teach Keynesian macroeconomics, and classical economists would simply ignore macro issues. Intermediate courses could no longer assume a common base. Neither of the polar solutions would prepare students to deal with the views of modern macro theorists who approach macro from a dynamic perspective that is neither pure Keynesian nor pure classical. The reality is that few macro theorists accept a simplistic, mechanistic Keynesian view. Similarly, fewer and fewer modern classical economists are telling strong, efficient market

stories of the aggregate economy where partial equilibrium micro explains all macro issues. Instead, they are considering the dynamic issues, and telling stories of potential “sunspot” and “bootstrap” equilibria in which expectations can influence the final equilibrium—stories in which there are path dependencies, and in which there is no unique equilibrium. In short, in abstract theory the Keynesian/classical theoretical distinction is breaking down, as both camps more carefully investigate complex dynamic adjustment models of how the economy might respond to real shocks and monetary shocks.

### **The Coordination Augmented Production Function Solution**

I call the third solution the “coordination augmented production function” solution. This solution continues to use the AS/AD model, but offers a different specification of the AS and AD curves, and thus an alternative interpretation of the model—one that is consistent with modern debates.

In this approach, the definition of the AD curve would be changed so that the AD curve would no longer be derived from the Keynesian AE/AP model. The shape of the AD curve would reflect only the direct effect of any combination of the Pigou effect, the Keynes effect, the international effect, and the intertemporal price level effect that one believes makes logical sense. It would not include the multiplied effects of those initial effects. If none is very large, the AD curve would be nearly vertical.<sup>5</sup> What this redefinition buys is logical consistency. Since Keynesian dynamics involving the multiplier effect and assumed interactions of aggregate supply and demand are not incorporated into the shape of the AD curve, the AD curve can logically be incorporated with alternative AS curves.<sup>6</sup>

Having specified the AD curve so that it fits the definition of an AD curve, one must then make explicit that for this AD curve, aggregate supply is being held constant and that if a change in aggregate supply has an effect on aggregate demand, it must be explicitly accounted for. As output changes for any reason other than the direct effects of a change in the price level on the quantity of aggregate demand, the AD curve shifts.

On the aggregate supply side, this solution involves a respecification of the AS curve to accommodate the dynamics implicit in the Keynesian model, and more complicated dynamics as well. At a root level, this change involves modifying the specification of the underlying aggregate production function. One way to incorporate complicated dynamics into the production function that is consistent with recent developments in macro theory is to separate out

<sup>5</sup>If one assumes falling price levels disrupt production, it is even possible to have an AD curve that looks like an AS curve.

<sup>6</sup>If the multiplier is zero—that is, the marginal propensity to consume is zero—because expenditures and income are unrelated, then the two demand curves become one, but for the Keynesian AE/AP model, that would imply a horizontal aggregate expenditures curve. This would deny the essence of the Keynesian model, that autonomous expenditures have induced effects on other expenditures.

the coordination function needed in the economy from the production process and to specify it directly in the production function. Aggregate output depends on production technology, inputs, and “coordination technology”—the institutions that coordinate individuals’ actions. Thus the aggregate production function would be  $X = f(K, L, C(K_c, L_c))$ . Coordination shocks or changes in coordination technology (such as a change in policy regimes) could cause shifts in the production function. This specification allows for the possibility of the economy moving from one aggregate equilibrium to another even if the wage price ratio is constant. If people suddenly have a wave of pessimism, so that expectations of output fall, and firms decrease supply, output does fall. The pessimism is a self-fulfilling coordination shock, and the economy falls to an alternative equilibrium.

Using such a production function, aggregate supply is no longer a simple function of capital and labor used in production, but also depends on the coordination function—how well current institutions in the economy coordinate individual’s actions. One portion of the macro course would involve teaching about how markets coordinate, or fail to coordinate, in the aggregate. It would deal with topics such as interdependent expectations, real-world institutions’ role in the coordination, the public good aspect of coordination, and the difficulty of any coordination solution that involves political processes.

This change looks small, but it is not. It opens up the analysis to new, complicated transmission mechanisms through which policies could affect the economy. Specifically, policies could work through this coordination factor without affecting relative prices. In such a specification there would be no general presumption that policies work, as there is in the Keynesian model, or do not work, as there is in the current classical model. Such discussions would be institutionally specific and open to discussion.

Let me give an example of how this expanded production function could avoid the current problems with AS/AD analysis. Since the Keynesian model assumes aggregate supply depends on aggregate demand, or at least on expected demand, the revised production function behind the AS curve must have expected demand as a component. The Keynesian model becomes a supply model in which aggregate demand, or more specifically expectations of aggregate demand, influences aggregate supply. In this Keynesian model expected demand must be coordinated since there is no market in expectations to keep them optimal. The micro foundation for Keynesian stabilization policy is the missing market in expectations; it has nothing to do with fixed nominal wages.

The Keynesian multiplier model shows one way in which expectations can go wrong and be self-fulfilling, leading the economy to an undesirable equilibrium. In my view, the simple Keynesian model is far too simple; our economy has many institutions and standard operating features that tend to stabilize expectations, and thus, there is a stability of expectations given to the system by institutions. Are these ideal? That’s debatable, and that is precisely where the high-level debate is.

An economy with this coordination augmented aggregate production function is far more complicated than those presented in the standard textbook models. Aggregate results cannot necessarily be deduced from individual maximization analysis. The self-equilibrating tendency of the aggregate economy cannot be asserted in a classroom setting without explanation. If one believes the economy arrives at the desirable aggregate equilibrium despite no market in expectations, the explanation of how it does so will be part of the story about the determinants of coordination variable. Nor is there a presumption that any type of intervention into the economy will improve it, as there is in the standard Keynesian models. Those positions must be argued on their merits; they are no longer implicitly built into the specification of aggregate supply.

The coordination augmented production function is general; it is simply a framework within which various alternative explanations of how the economy works can be given algebraic and graphical presentations. It allows the telling of complex dynamic stories about aggregate adjustment.

In this paper I am not arguing for the “coordination solution” as a theoretical advance, although I believe addressing macro problems within this framework would be far more fruitful than our current approaches.<sup>7</sup> My focus here is on pedagogy, and I am arguing for this approach as the solution to a sticky pedagogical problem. It is quite true that the coordination variable is simply a fudge factor that allows us to express our lack of knowledge of aggregate dynamics. It would be nice if such fudge factor were not necessary, but given the state of macro dynamic theorizing today, it is necessary to tell a reasonable story. At the textbook level, there is nothing wrong with that.

The coordination solution allows a fundamentally different interpretation of the Keynesian/classical debate than is currently presented in most standard textbooks. The debate will shift from comparative statics to dynamics and the implications of path dependency of dynamic adjustment on aggregate equilibrium.

To illustrate this point, let me describe the analysis of expansionary aggregate fiscal policy from both a simple Keynesian and a simple classical perspective. To keep the analysis simple, let us assume in both cases that the AS curve is perfectly vertical. One can be so cavalier about the shape of the supply curve in the Keynesian exposition since in this explanation of the Keynesian model, adjustment does not occur through movements along the supply curve, but instead through interdependent shifts of the supply and demand curve.

A Keynesian dynamic adjustment process holds the price level fixed, and a boost in aggregate demand triggers the multiplier: aggregate supply depends on aggregate demand, and aggregate demand depends on aggregate supply, and so on. This interdependency makes it almost impossible for the individuals to

<sup>7</sup>It can accommodate support and bootstrap equilibria models whereas the standard production function cannot. For an early presentation of this, see Colander (1986); and for a discussion of how this fits modern theories and a stronger argument concerning the theoretical issues, see Bryant (1994) and Colander (1994).



coordinate their production and spending decisions and leads one to expect significant fluctuations in aggregate output—sometimes it would be too high; sometimes it would be too low. If aggregate output is too low; government can use expansionary fiscal policy to shift AD curve to the right. Given the Keynesian coordination assumptions, that shift in aggregate demand causes the AS curve to shift out by an equal amount. However, this shift in AS increases income and thus induces a further outward shift in AD by an amount determined by the marginal propensity to consume. The multiplier interaction continues until a new equilibrium is arrived at, at a constant price level. Notice that this answer is totally consistent with the Keynesian AE/AP model, since it uses the same goods market dynamic adjustment explanation. Notice also that the shape of the AS curve is of secondary importance, since the economy is not adjusting through price level fluctuations.

In the simplest classical model, disequilibrium is impossible since the price level is perfectly flexible. Thus, the expansionary fiscal policy in the previous example would shift out the AD curve. But as it did so the price level would instantaneously adjust before any other dynamic adjustment process could occur. The result is a rise in the price level, real output remaining constant.

In this explanation, the key difference between Keynesian and classical models does not focus on the real wage or the issue of nominal wage rigidity. It, instead, focuses on the self-adjusting properties of the aggregate equilibrium. The classical model assumes the long-run equilibrium is unaffected by dynamic adjustment. That assumption leads to the natural rate equilibrium result. The standard Keynesian model assumes the dynamic adjustment process can affect the long-run equilibrium; it incorporates short-run path dependency, multiple equilibria, and no natural rate.

These simplistic Keynesian and classical views can also be combined into a more realistic story that parallels what is currently being told in the textbooks. In this case, one must specify the relative degree of price level and output sensitivity, as well as the shapes of the AS and AD curves. Figure 2 shows an example. AS is vertical. AD has a slope of  $-1$ . The new ingredient is a “price level flexibility curve”—a curve that reflects the institutionally imposed degree of price level flexibility on individuals and firms. A flat curve would illustrate inflexible prices, while a vertical curve would show perfect flexibility. As drawn in the figure, the price flexibility curve describes an economy that has a 50–50 split between price level and real output flexibility.

In this case, expansionary fiscal policy first shifts the AD curve out. Aggregate supply starts responding (the Keynesian view) but so does the price level (the classical view). If the original outward shift in aggregate demand is 10, the 50–50 price level flexibility curve means that aggregate supply initially increases by only 5. With a marginal propensity to consume of, say, .6, this leads to a second shift in aggregate demand of 3, half of which is reflected in a boost to aggregate supply, and so on. Given these illustrative numbers, the original increase of 10 in aggregate demand leads to an increase in real output of 7. This



dard ways, arriving at almost identical results as the standard AS/AD model while avoiding the logical inconsistencies found in the standard model. It is, however, an integration of views that, I believe, is unfair to both Keynesian and classical views. The reality is that when one gets into dynamics, so many things can be changing that any simplistic explanation of the dynamic adjustment processes will necessarily be unfair. The policy effects of monetary and fiscal policy that sophisticated Keynesians and classicals believe occur are much more complicated and subtle than is allowed for in the above combination model. That's what is nice about the coordination variable in the production function approach. With it one can tell an almost infinite number of stories, including ones that fit far more sophisticated interpretations than the above graphical model allowed.

The dynamic story I find reasonably convincing is one in which policy affects expectations, expectations affect coordination, and coordination affects real output in a multitude of ways. In this story, existing institutions play an important role in determining which of the multitude of possibilities will actually occur. (Somehow, I've always had the belief that one cannot discuss the real-world economy without discussing the real-world institutions that shape it.) This dynamic story gives a reasonable (to me) presentation of the views of both sophisticated Keynesians and sophisticated classicals.

The sophisticated classical view accepts the possibility of muted multiplier effects and hence fluctuations in real output in the economy that are not reflective of individuals' decisions. However, it denies that, practically, there is anything the government can do about it. Thus, for practical purposes, it holds that business cycles can be considered real business cycles. As a practical matter, the economy will be best left alone. This is not, however, a theoretically deduced view; it is an argument based on political economy. One reason is that differences between aggregate supply and demand will be minimal since the financial markets will operate relatively efficiently, eliminating the need for price level fluctuations. In addition, this view generally sees the workings of government as too slow and too politically influenced to warrant policy action.

The sophisticated Keynesian view accepts that the actual adjustment process is far more complicated than the simple Keynesian multiplier allows. It also accepts that, as a practical matter, government policy, whether fiscal or monetary, is far from a perfect coordinating factor and that often one is better off leaving the economy to fend for itself, rather than trying to adjust a dynamic system that is so complex that actions and consequences cannot be easily connected. However, as a judgment call, it sees some relevance for government policy action in specific circumstances. That government action need not only

<sup>8</sup>One can add differential wage price flexibility to the model and hence have an upward sloping AS curve. As I discuss in "Keynes and the Classics: An Alternative Interpretation," (Colander, 1992a) doing so can increase the degree of fluctuations in the economy rather than decrease it. In this model there is no presumption of any relationship between the real wage and output without a full specification of the dynamics.

be monetary and fiscal policy. It is any government action that will help coordinate aggregate supply and demand decisions in a cost-effective way.

In these sophisticated stories, often the real policy action is not in the policy itself, but is in the expectations of policy, and in the expectations of expectations of policy. In a world where expectations influence real variables, policy is not, and cannot be, mechanical; it is an art to be studied in a game theoretic setting. Thus, macroeconomics becomes a study of the aggregate coordination problem in a realistic setting. The coordination approach automatically leads to a discussion of policy that reflects the real-world policy discussions that occur, not the simplistic mechanistic effects of policy that follow from the standard models.

In this interpretation, there is little theoretical difference between sophisticated classicals and Keynesians. Their differences lie in judgments about politics and about interconnections in the economy that are beyond empirical verification, and hence they are differences that reasonable people can have.

## Conclusion

The problem of the AS/AD presentation of macro to students reflects larger problems in macro. It is not just a pedagogical problem; it is a problem of the way economists think about the macroeconomy and the way we treat textbook models.

There is, and there must be, a fundamental difference between textbook models we present students and the models we develop to extend theory. When there is such a difference, textbook models should not be taught as definitive models of the economy; because of the limitations on exposition, they must necessarily be far too simple for that. Textbook models are exercises of the mind that give one a sense of how economic variables may interact. Such exercises are absolutely necessary if one is to deal with the far more complicated real-world interactions. These exercises are a tool for helping one understand some of the interconnections in the economy and can be useful only in conjunction with a broader knowledge of the institutions in the economy. As Keynes argued, “The theory of economics . . . is a method rather than a doctrine, an apparatus of the mind, a technique of thinking which helps its possessor to draw correct conclusions.” To put it another way, textbook models illustrate a way of thinking; they are not the replacement for thinking.

All too often, economists try to draw logical links between textbook models and the broad theoretical models that seek to describe how the economy actually works. Unless the standard textbook models are broad enough to incorporate reasonable dynamics in the accompanying dynamic adjustment story, making that link hurts both theoretical work and teaching. In theoretical work, they limit the development and extension of new insights, as people’s imaginations are limited by their textbook conception of issues. In teaching, it forces us into

the inconsistencies and gerrymandered dynamics illustrated by the standard AS/AD exposition. By broadening the textbook model to allow for dynamics to affect statics, as is done in the coordination approach, we can use textbook models to sharpen students analytic skills. Then, through the stories we tell to accompany those models, we can convey to students the complexity of the economy and the insightfulness of economists thinking about that economy.

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