WHAT WENT WRONG WITH
IS-LM/AS-AD ANALYSIS — AND WHY?

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"... all novelty is but oblivion"
Francis Bacon

INTRODUCTION

The AS-AD approach used in macroeconomic textbooks to analyze the working of a market economy has come under increasing fire [Barro, 1994; Colander, 1986; 1992; 1993; 1994/1995; 1995; Clower, 1994; Nevile and Rao, 1996]. But these recent criticisms of the AS-AD approach, and especially of the conventional aggregate demand curve, are but the latest stage of an ongoing but largely overlooked debate, starting with Rabin and Birch [1982], that points out the inconsistency of determining the equilibrium price level with aggregate demand and aggregate supply curves while at the same time interpreting the IS curve as the equilibrium locus of the goods market.[1] This debate has now broadened into a discussion of various alternatives to the conventional aggregate demand and agregate supply curves.[2]

The pedagogical drawbacks of the conventional AS-AD analysis are succintly expressed by Geithman:

> As presented in most introductory and intermediate textbooks, the AS-AD framework offers textual neatness and expository convenience at the cost of impeding the development of student analytical abilities. Whenever key assumptions, equations, and conditions are hidden or inarticulated, essential parts of the reasoning chain are lost and students become unable to think the problem logically through for themselves to reach their own conclusions. Unable to follow the reasoning processes, they have little choice but to fall back on the authority of the textbook and instructor. [1994, 477]

> Accordingly, the AS-AD exercise amounts to a form of intellectual indoctrination that relies primarily on ... authority ... to gain student acceptance rather than the power of reason. [*ibid.*, 476][3]

In the light of this sad state of textbook macroeconomic models, the only way out would seem to be to abandon IS-LM/AS-AD analysis, as suggested in Barro [1994].[4] In the view of the present author, however, it would be premature to discard IS-LM analysis altogether. Confronted with the inconvenient alternative of carrying on with an inconsistent framework or starting again from scratch, it seems to be a good idea to get the questions right. It cannot be denied that *something* went wrong along the way from IS-LM to AS-AD; but one should ask *precisely what* went wrong and *why* it went wrong.

Considering the complexities of the debate, it seems best to start with the original IS-LM model of Hicks [1937], which he called the SI-LL "apparatus," and see what happened to IS-LM between 1937 and today. In what follows, I present a stylized account of the relationship between the IS curve and the conventional aggregate demand curve to throw some light on the problem of what went wrong (and why) with textbook IS-LM/AS-AD analysis. What emerges is that the conventional aggregate demand curve, the cause of so many methodological and analytical problems, is not really needed.

WHAT DID HICKS DO IN 1937?

In contrast to common macro textbooks, Hicks [1937] presented IS and LM curves in (interest (i), *nominal* income (Y_N)) space. He was forced to proceed in this manner because of the underlying macroeconomic model he used to compare the "classical" theory of the rate of interest to Keynes' theory.[5] This short-period model assumed two sectors of production (consumption and investment good(s) sectors), a *constant* money wage, *flexible* prices (or price levels) of consumption and investment goods (equal to their respective marginal costs of production) and a constant capital stock. Within this framework it is impossible to talk of "the" real income, measured in physical units, because real output consists of two distinct kinds of goods. Consequently, Hicks proceeded in terms of nominal income defined as the *money value of aggregate supply:*[6]

$$(1) \qquad\qquad Y_N = p_c C + p_I I$$

and presented the IS and LM curves in (i, Y_N) space.

As can be gathered from equation (1), the resulting IS and LM curves in (i, Y_N) space have characteristics that are of utmost relevance to the problem under consideration (i.e. the relationship between the IS curve and the aggregate demand curve):

— each point on these curves implies a specific combination of relative prices and relative quantities of consumption and investment goods,
— moving along these curves implies changes in quantities and relative prices and
— the point of intersection of the IS and the LM curve implicitly determines not only quantities (C, I) but also relative prices (p_C, p_I).

Thus Hicks [1937] had no need to construct an aggregate demand curve in order to determine relative prices or, for that matter, the price level.

VARIANTS OF HICKSIAN IS-LM

In a two-sector model it is impossible to unambiguously separate price effects from aggregate output effects. But if the two-sector assumption is dropped, nominal income is equal to real income (Y) (quantity of the single produced good) multiplied by the price level (P), i.e. (i, $P \cdot Y$). At first sight, nothing much changes: as in Hicks' original model, points on the IS and LM curves imply specific values of price (level) and quantity (real income) variables. But now price (level) and quantity effects can be separated in a straightforward manner and, in principle, it becomes possible to geometrically represent IS and LM curves in various ways: they can be drawn (i) in (i, $P \cdot Y$) space, staying close to Hicks' original presentation of his model (as in Modigliani [1944]), (ii) in (i, Y) space and (iii) in (i, P) space.[7] For analytical reasons, alternative (iii) is to preferred.[8]

Let us look more closely at possibilities (ii) and (iii). Regardless of which is chosen, the resulting IS and LM curves always imply the "suppressed" variable. If IS and LM curves are drawn in (i, P) space, every point on them implies a specific value of Y, i.e. (i, $P[\cdot Y]$)., and if they are drawn in (i, Y) space every point implies a specific value of P, i.e. (i, $[P \cdot]Y$). Accordingly, the intersection of IS and LM curves drawn in (i, Y) space implicitly determines the equilibrium price level, while the intersection of IS and LM curves drawn in (i, P) space implicitly determines the equilibrium level of output (see Barens [1995] for the explicit geometrical determination of the equilibrium of price level and output, respectively).

Let us now turn to two extreme cases of this Hicksian one-sector IS-LM model. First, assume that not only the price level but the money wage as well is flexible [Hicks, 1950; 1957 and 1967]. In this case, the equilibrium level of output is determined by labor market equilibrium and production technology (the aggregate production function). Thus, concerning the analysis of IS and LM curves, the full employment level of output (Y_F) is exogenously fixed and the (i, $P \cdot Y$) space changes into (i, $P \cdot Y_F$) space. The rate of interest and the price level are the only variables free to vary and IS and LM curves have to be drawn either in (i, $P \cdot Y_F$) (as in Hicks [1957; 1967]) or in (i, P) space. I will refrain from discussing the shape of the resulting IS and LM curves (on this, see Hicks [1957; 1967], Meyer [1980, 126-8], Modigliani [1944, 59-60] and Barens [1995]), but one additional remark is in order at this stage: trying to draw the IS curve in (i, Y) space results in a *single point* ($i^* = i_F$, $Y^* = Y_F$) (assuming, as most textbooks do, $C = C(Y)$ and $I = I(i)$) [Hicks, 1957, 282; 1967, 149; Issing, 1973, 358].

The second extreme case assumes that the price level (and the money wage) is fixed at a given value, say P_0. The (i, $P \cdot Y$) space then changes into (i, $P_0 \cdot Y$) space. Now the rate of interest and the level of output are the only variables free to vary and IS and LM curves have to be drawn either in (i, $P_0 \cdot Y$) or in (i, Y) space. Here, at last, we have the IS and LM curves of the simple textbook IS-LM model (Hicks [1980-81] discusses this model).

FIGURE 1
Various IS Curves
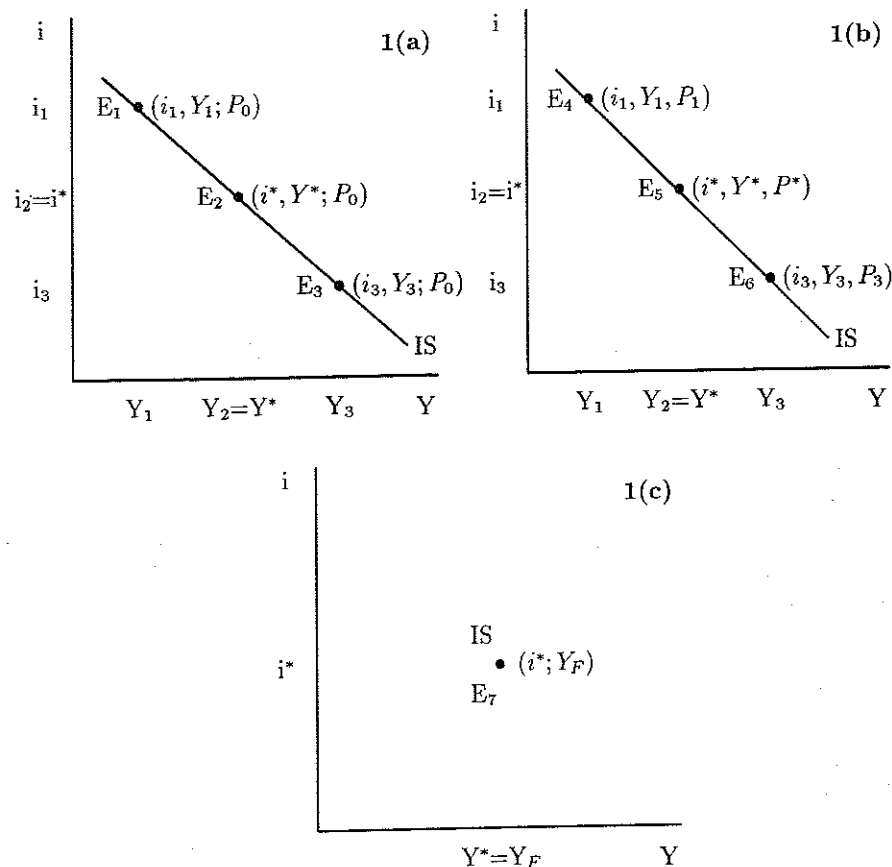
The IS and LM curves resulting from the full employment flexprice version and the fixprice version of IS-LM show a striking symmetry: while different points on the IS and LM curves derived from the former model imply the same level of output (i.e. Y_F), different points on the IS and LM curves resulting from the latter model imply the same price level (i.e. P_0)

WHAT WENT WRONG WITH IS-LM/AS-AD ANALYSIS?

We are now in a position to answer the question of *what* went wrong in the development of textbook IS-LM/AS-AD analysis. Above it was pointed out that in IS-LM models with flexible price level, IS and LM curves should be drawn in (i, P) space. But in what follows, they will be drawn in (i, Y) space in order to accomplish a simple way of comparing the IS and LM curves resulting from the basic model and its two extreme cases.

Figure 1(a) shows the IS curve resulting from the IS-LM model with a given price (level) $(P = P_0)$ and a given money-wage $(W = W_0)$. Because P is assumed to be exogenously given, every point on the IS curve implies the same price level (P_0). Let us assume that the LM curve (not drawn) passes through point E_2, determining the equilibrium levels of the rate of interest (i^*) and real income (Y^*).

Figure 1(b) shows the IS curve resulting from the IS-LM model with a flexible price (level) and a given money-wage. As was shown above, every point on it implies a different price level with $(P_1 < P^* < P_3)$. Let us assume that the LM curve (again not drawn) passes through point E_5, again determining Y^* and i^*. But at E_5 the price level P^* is also determined, even if only implicitly!

Figure 1(c) shows the IS curve resulting from the IS-LM model with both price (level) and money-wage flexible. As was mentioned above, it degenerates into the single point E_7 (implying nothing about the price level) if drawn in (i, Y) space. As the LM curve (again not drawn) passes through E_7 the price level P^* is again implicitly determined.

Two things can be seen from Figure 1. *First,* if drawn in (i, Y) space, the IS curve changes its characteristics when moving from the simple IS-LM model to the full employment IS-LM model: it changes from a *curve* implying a single price level to a *curve* implying different price levels, to a single *point* implying no particular price level. *Second,* in both IS-LM models with a flexible price level the conventional textbook aggregate demand curve is not needed to determine the equilibrium price level!

In addition, it emerges that the textbook aggregate demand curve cannot be derived from Figures 1(b) and 1(c): changes in the price level *do not* result in shifts of the LM curve because the endogenous price level — in contrast to the LM curve in the simple IS-LM model — is not a shift parameter of the LM curve.[9] Finally, even if the LM curve could be shifted by assuming alternative price levels, in Figure 1(c) there is no IS *curve* it could shift along.

As can be seen from Figures 1(a)-(c), the fundamental fallacy in textbook IS-LM/AS-AD models, especially in the construction of the conventional aggregate demand curve, is that an IS curve — implying $(i_i, Y_i; P_0)$ — that only exists under the assumption of a given price level and a given money wage is carried over into models that contradict this assumption and in which IS curves exist that imply either (i_i, P_i, Y_i) or $(i^*; Y_F)$.[10] This erroneous procedure can only result in the self-contradictory and incompatible model components pointed out by Barro [1994] (in addition see Colander [1995, 176]).

So what went wrong with textbook IS-LM/AS-AD analysis is that in the attempt to endogenously determine the price level an aggregate demand curve is used that cannot be constructed and that, in addition, is unnecessary. This is, in a nutshell, the "tragedy" of common textbook IS-LM/AS-AD analysis.

WHY DID IS-LM/AS-AD ANALYSIS GO ASTRAY?

As has been shown, Hicks' original IS-LM model already was able to determine the prices of produced commodities. Furthermore, the IS-LM model used in Modigliani [1944] is a simplified version of Hicks' original model and can determine the price level without an aggregate demand curve (it is basically identical to the one-sector IS-LM model underlying the comparison of IS curves presented above).[11] So why did Hicks' IS-LM model, or Modigliani's simplified version, have no influence when macroeconomic textbooks started to address the endogenous determination of the price level? At this stage, some remarks on the history of the evolution of IS-LM and AS-AD analysis are in order.

The first author to turn to, of course, is Alvin Hansen. Hansen [1953, 41 and 144-51] presented IS and LM curves in terms of nominal income. On the other hand, Hansen [1949] had proceeded in terms of nominal income until IS and LM curves were introduced. At this point, without any explanation, his analysis switched to real income [Hansen, 1949, 72n2, 73n2 and 78n1].

As was shown above, representing IS and LM curves in (i, Y) space *as such* raises no problem as long as the "suppressed" price level is not forgotten. It is not easy to find an answer to the question of whether Hansen did forget the "suppressed" variable, because he did not emphasize the connection between changes in output and changes in the price level. One reason for this may have been that he considered constant (marginal) costs of production (a horizontal aggregate supply curve) to be a reliable approximation of supply conditions in the presence of unemployment.[12] So, even if Hansen did not misinterpret Hicks' IS-LM model by forgetting the "suppressed" price level, he did pave the way for the neglect of the price level in later IS-LM analysis.

McKenna [1955] seems to have been the first macroeconomic textbook that used an aggregate demand curve derived from IS-LM. As McKenna [1955, 197] notes, his exposition is based on Brownlee [1948]. But the analysis in Brownlee [1948] is not based on IS-LM and is carried out on the assumption of an exogenously fixed rate of interest. Therefore, it seems more appropriate to say that McKenna's exposition is based on Brownlee [1950]. In this paper, Brownlee derived the aggregate demand curve by shifting the LM curve (equilibrium curve of the money market) along the IS curve.[13] The IS curve was the equilibrium locus of the commodity market [*ibid.*, 413]. But the meaning of this equilibrium, defined as "...the equality between real income (or output) and real expenditures on goods and services..." [*ibid.*], is ambiguous, because it is not clear whether real income referred to is meant to be realized output (with equilibrium implying equality between real aggregate demand and realized output) or output supplied by firms (with equilibrium implying equality between real aggregate demand and real aggregate supply).[14]

So either Brownlee's AS-AD analysis was inconsistent, because the aggregate demand curve cannot be constructed if the IS curve shows combinations of real income and the rate of interest compatible with equality between aggregate supply and

aggregate demand in the commodity market, or his IS-LM model was decisively different from Hicks' IS-LM. [15]

It is interesting to note that Brownlee considered the aggregate demand curve (his ZZ curve) as the "distinguishing feature of the 'Keynesian' theory" [1950, 414] . If this were true, neither Hicks' nor Modigliani's IS-LM analysis would qualify as expositions of Keynesian theory.

McKenna [1955] adopted this derivation of the aggregate demand curve, but, in contrast to Brownlee [1950], introduced a horizontal aggregate supply curve. The IS and LM curves were constructed assuming a constant price level and the horizontal aggregate supply curve served as a rationale for this assumption [McKenna, 1955, 171-2].[16] This procedure runs into two interrelated problems. First, if the aggregate supply curve is horizontal, the price level is *endogenous* and the LM curve cannot be shifted by parametrical changes of the price level. If the LM curve is shifted to the right (left), the horizontal aggregate supply curve must be shifted downwards (upwards). Hence, *every* point on the aggregate demand curve will be intersected by a horizontal aggregate supply curve and it is misleading, and maybe even inconsistent, to combine this aggregate demand curve with a single horizontal aggregate supply curve.[17] Second, combining this aggregate demand curve with a non-horizontal aggregate supply curve results in a diagram comprising contradictory assumptions about aggregate supply. [18]

To sum up: whereas Hansen may not have misunderstood Hicks' IS-LM model, two early, maybe even the earliest[19] expositions of the AS-AD approach did not build upon Modigliani [1944] and either used IS-LM models different from Hicks' original model or were marred by serious inconsistencies. In particular, all the problems that still haunt present-day AS-AD analysis were already present in these two early contributions.

From the arguments presented in this paper, the answer to *why* conventional IS-LM/AS-AD analysis went astray seems to be straightforward: it is a case of "collective amnesia." When, after having initially presented only the simple IS-LM model with constant money wage and price level in textbooks, the need was felt to discuss price level determination, the relevant features of Hicks' ingenious approach apparently were forgotten. Therefore, it was also forgotten that the IS and LM curves of the simple IS-LM model are only special cases that cannot be transposed into more general IS-LM variants.[20] This in turn led to the methodological blunder of constructing the conventional aggregate demand curve on the basis of IS and LM curves incompatible with the underlying model.

CONCLUDING REMARKS

The stylized account of the origin and development of textbook IS-LM/AS-AD analysis presented in this note has shown that

1. beyond the superficial similarity of using IS and LM curves, textbook IS-LM/AS-AD analysis bears very little resemblance to its alleged Hicksian origin;

2. severing the links to its origin results in the inconsistent use of an IS curve derived under the assumption of price (level) and money wage inflexibility in IS-LM models that contradict precisely this assumption, which, in turn, is the ultimate cause of the problems raised by the attempt to determine the equilibrium price level in textbook IS-LM models; and

3. by, at last, adopting the Hicksian approach, we could do without this methodological and analytical monstrosity, the conventional aggregate demand curve.[21]

Even if conventional AS-AD analysis should be discarded, there is, contrary to Barro's [1994] suggestion, no need to abandon a properly understood IS LM apparatus. Following Hicks' lead, we can construct an IS-LM model that does not fall victim to the inconsistencies of conventional IS-LM/AS AD models and that may enable us to deal with questions of the implications of different assumptions about price (level) and wage flexibility for the working of a market economy.[22]

This raises two important questions: What is the conceptual structure of Hicks' original IS-LM model and its variants that results in IS and LM curves so different from their textbook counterpart?[23] Can the Hicksian approach to macroeconomic modelling serve as an alternative to conventional textbook IS-LM/AS-AD analysis or will we be forced to abandon his approach as well after careful scrutiny?

Whatever the answers to these questions eventually turn out to be, considering the present debates about alternatives to the conventional aggregate demand and aggregate supply curves of macroeconomic textbooks, the following reminder seems appropriate. Before modifying curves or shifting them around or even discarding them, one should be clear about what these curves are (or what they were meant to be), how they are (or have to be) constructed and what their implications are, because, as the saying goes: you must learn to walk before you run...

NOTES

1. Benassy [1983; 1986] mentioned this inconsistency as well; the first author to point it out seems to have been Perry [1981] in an unpublished paper.
2. See the literature referred to in Dalziel [1993]. In dealing with the AS-AD approach, this discussion tends to lose sight of the IS-LM model. In addition, some participants view Hicks' original IS-LM as a fixprice model [Rao, 1991; Nevile and Rao, 1996]. In the present paper, AS-AD analysis is compared to Hicks' IS-LM model in order to put the aggregate demand curve into proper perspective.
3. See, as well, Colander [1995], which presents a stylized classroom dialogue between teacher and alert student that illustrates the problems pointed out in these quotes.
4. Introductory textbooks typically derive the aggregate demand curve not from IS-LM but from the Keynesian cross; but this approach is haunted by exactly the same, and additional, problems as the IS-LM/AS-AD approach.
5. See Barens and Caspari [forthcoming] for a discussion of Hicks' comparison of "classical" theory of the rate of interest and Keynes' theory.
6. Because p_c and p_I are equal to marginal costs of production, $p_c C$ is the money value of the supply of consumption goods and $p_I I$ is the money value of the supply of investment goods.
7. The equilibrium solution of the model may be presented geometrically in (P, Y) space as well, but in this case IS and LM curves cannot be used.
8. With a constant money wage, aggregate supply Y is a function of P and, therefore, strictly speaking, the IS and LM equations are functions in i and P; see Barens [1995].
9. In textbook IS-LM, the LM equation is considered to be a function with three independent arguments (price level, rate of interest and level of output). Therefore, for any given P, it is possible to draw a specific LM curve showing those alternative combinations of i and Y that are solutions of the LM equation. Consequently, changes in P "shift" the LM curve.

   Because in the simplified Hicksian IS-LM model the LM equation is a function with only two independent variables (price level and rate of interest), see above footnote 8, it determines a unique value of i for any given P: any given P implies a specific level of aggregate supply Y and, therefore, only one value of i will satisfy the LM equation. There is only one LM curve, not a family of LM curves, and changes in P result in *movements along* this unique LM curve. Because the nominal quantity of money is a shift parameter of the LM curve, whereas the price level is not, a change in the real quantity of money has asymmetrical effects, depending on how it is brought about.
10. Issing [1973] has been the only author who did recognize that *specific* IS and LM curves have to be constructed for each different IS LM variant.
11. Modigliani [1944, 57-60, 65] was very careful in his treatment of nominal vs. real income and even anticipated some results of Hicks [1957;1967] concerning the shape of the IS curve in conditions of flexible money wages that are important in the context of the present discussion.
12. See Hansen [1949, 99-110; 1938, 321]; see Clower [1994, 381-2] for a critical discussion of "Hansen's Law".
13. Brownlee did not use the now common nomenclature for his curves.
14. In Brownlee [1948, 260], nominal income is defined as the money value of aggregate supply and saving and investment are equal when (the money value of) aggregate demand is equal to (the money value of) aggregate supply, just as in Hicks [1937].
15. Brownlee [1950] did not refer to Hicks [1937] and mentioned Modigliani [1944] only in an unrelated context.
16. The use of a horizontal aggregate supply curve may be due to Hansen's influence. Be that as it may, McKenna dedicated the third edition of his textbook [McKenna, 1969] to Alvin Hansen, "the father of us all".
17. A given horizontal aggregate supply curve implies certain assumptions concerning the exogenous money wage, exogenous (marginal) labor productivity and, maybe, exogenous mark-up. In this case,

only one price level is relevant and hence only one point on the aggregate demand curve, the one that lies on the horizontal aggregate supply curve. Therefore, it is misleading to suggest that the entire aggregate demand curve is relevant. The argument becomes inconsistent as soon as a different point on the aggregate demand curve is considered (and interpreted as a disequilibrium situation), because such a different point corresponds to a *different* set of assumptions about the three exogenous determinants of the price level; see Nevile and Rao [1996].

18. This supply inconsistency (as it may be called) of IS-LM/AS-AD has been pointed out by Colander [1995, 1761, Fields and Hart [1996] and Nevile and Rao [1996, 198 and 203]. It may be avoided by dropping the assumption of a horizontal aggregate supply curve. But in this case, the move away from the IS-LM model with a constant price level not only entails a change in the assumption concerning price level flexibility but also a change in aggregate supply conditions and, more importantly, in the character of the IS-LM model and, hence, of the aggregate demand curve. So, just like Brownlee's AS-AD analysis, McKenna's exposition either is inconsistent or his IS-LM model is decisively different from Hicks' IS-LM.

19. The AS-AD approach may have a different origin in the theory of inflation; see, for example, Hansen [1951] and Bronfenbrenner and Holzman [1963].

20. An anonymous referee has suggested that maybe the relevant features of Hicks' IS-LM model have not been forgotten but just not understood. This would be "collective unawareness" instead of "collective amnesia."

21. Concerning the problem raised by Rabin and Birch [1982], it may be pointed out that in the Hicksian one-sector IS-LM model the IS curve indeed is the equilibrium locus of the commodity market.

22. It may be argued that textbook IS-LM/AS-AD is more concerned with portraying the short-run adjustment to a long-run equilibrium of prices and money wages that are neither perfectly flexible nor perfectly inflexible.

In this interpretation, a vertical aggregate supply curve does not necessarily assume price flexibility (and certainly does not imply that firms can actually sell their desired output [Barro, 1993, 561]). Instead, it is a labor market equilibrium curve drawn in (P, Y) space showing constant full employment aggregate supply at alternative rigid price levels if the rigid money wage moves "in tandem" [Stiglitz, 1993, 435] with any change in the rigid price level. This "tandem assumption" may be artificial, but the components of AS-AD are no longer contradictory as both aggregate demand curve and aggregate supply curve refer to "sticky" prices and money wages. From this perspective, Barro's [1994] critique of AS-AD seems to be excessive. What, of course, remains valid is that a IS-LM model resting on the assumption of excess supply of goods must not be applied to situations that contradict this assumption (i.e. IS, LM and aggregate demand curves must not be drawn to the right of full employment output).

But even leaving aside the problem of whether this application of conventional IS-LM/AS-AD can avoid the inconsistencies discussed in the present paper, it must be emphasized that IS-LM is a short-period model assuming, *inter alia*, a constant capital stock. If one takes into account empirical findings on the frequency of changes in rigid prices [Ball and Mankiw, 1994, 131], the short run may easily be longer, so to speak, than the short period, with sluggishly adjusting prices and money wages chasing after a shifting vertical aggregate supply curve. This would be a misuse of the IS-LM model [Bliss, 1987, 644].

23. On this see Barens [1995].

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