Teaching Keynes' Business Cycle: An Extension of Paul Davidson's Capital Market Model

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Intermediate Macroeconomics is a key course in any economics curriculum. Not only does it offer a wider coverage of the topics already covered in the introductory course, but it is one of the first in which students get extensive practice using the formal tools of our discipline. In addition, because of the steady substitution of macroeconomics-oriented classes with applied micro and mathematics, it may be the only upper-level course in which students learn about important concepts like unemployment, inflation, and GDP growth. The knowledge they acquire in Intermediate Macroeconomics may become part of the student's basic set of assumptions about how macroeconomies operate and what methods are appropriate in understanding them.

It is also for these reasons that this course offers Post Keynesians the best, and sometimes only, chance to suggest an alternative to the general-equilibrium, Say's Law world of the Mainstream. Unfortunately, some instructors are reluctant to do this because they worry that they must prepare students for later Neoclassically-based courses. But, a) as suggested above, there are actually very few macro-oriented courses beyond Intermediate Macroeconomics and b) there is hardly unanimity within the Mainstream regarding the correct model of the macroeconomy. Given that, why not just teach them the approach we believe offers the best explanation of the real world?

One this decision is made, however, the problem of appropriate course materials remains. One possibility is to collect external and instructor-developed readings and weave them into a coherent explanation, and there is absolutely nothing wrong with this. But, an excellent alternative exists in Paul Davidson's textbook, *Post Keynesian Macroeconomic Theory: A Foundation for Successful Economic Policies for the Twenty-first Century*. It opens with a rejection of Say's Law, then works its way through the determinants and effects of consumption, investment, government spending, and trade. In addition, a great deal of time is spent discussing

financial markets (domestic and international) and the balance that must be found between the need to provide liquidity and the instability created by "a large number of ignorant individuals." By the end of the course, the student will understand that full employment is the exception rather than the rule and that regulation and government intervention are absolutely necessary for a civilized society.

There is also an important omission in Davidson's text, however, in that it lacks a clear explanation of the business cycle and the systemic tendency of the economy not just to less-than-full employment, but to significant short-term fluctuations in the degree thereof. This is very important as we do not want to leave students with the impression that, as argued in Neoclassicism, the economy could remain in perpetual expansion were it not for policy errors and external shocks. Quite the contrary, expansions contain the seeds of recession and recessions generate conditions conducive to expansion. Economies are dynamic and exist in time.

Fortunately, however, Davidson's text already includes tools that are well-suited to this task. In particular, the unique demand and supply diagram for capital developed in chapter 4 (originally introduced in *Money and the Real World*) is ideal. Not only can it be used to demonstrate the transition from boom to slump and back, but it shows students a tangible connection between the real and financial sides of the economy. It is the purpose of this paper to develop this supplementary lesson and thereby make *Post Keynesian Macroeconomic Theory* an even more attractive option to Post Keynesians teaching Intermediate Macroeconomics.

The paper is organized as follows. In the next section, the general structure of Post Keynesian Macroeconomic Theory is explained and then the capital market analysis is introduced. Over the next two sections, the business cycle extension is developed and empirical

evidence is offered. Conclusions follow.

Background

Post Keynesian Macroeconomic Theory is not an easy book. This is not to recommend against it, however, for difficult concepts require serious study. Furthermore, it is not altogether apparent that college textbooks written at an eighth-grade level and filled with pretty pictures do our students any favors. If necessary, the particularly complex issues addressed in the volume, such as the elasticities of production and substitutability related to liquid assets, can be supplemented by classroom lecture or clarified via exercises, homework, et cetera. One can teach successfully from the book, but it is helpful if students are told up front that Davidson does not spoon feed watered-down material in preparation for multiple-choice exams drawn from a publisher's test bank. They will have to read, contemplate, and then re-read. The payoff, however, is a far superior understanding of the real world.

Davidson's book begins by offering a broad review of the key issues to be addressed. In particular, he builds a case for the rejection of Say's Law on the basis that money matters. In the process, he introduces the financial sector as an essential source of liquidity and a potential source of instability. Keynes' Z-D diagram is offered a means of modeling the economy in a manner that assumes neither full employment nor that economic agents respond only to "real" values. A simplified version of his Figure 2.5 is reproduced below as Figure 1.

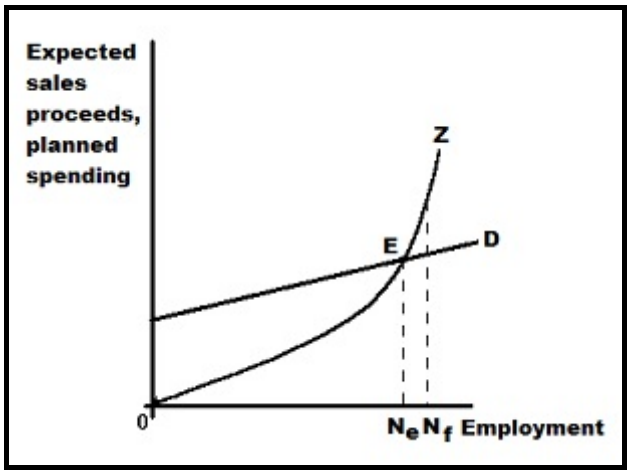

Figure 1: Davidson's Figure 2.5.

As is well-known, Z represents the demand for labor (horizontal axis) as a direct function of expected nominal sales (vertical axis). Meanwhile, D is the aggregate demand (measured on the vertical axis) generated by a particular level of employment (horizontal axis) and given autonomous spending (intercept of D). Equilibrium (E) occurs when firms' expectations of sales are not disappointed, i.e, at the intersection. Key, of course, is the fact that there is no reason to expect equilibrium (N_e) and full employment (N_f) to coincide.

They can do so, however, if the vertical intercept of D is high enough, and this possibility is not denied. In an economy with no government or foreign sector, this essentially means that full employment can be achieved if and only if investment spending is sufficient to cause $N_e = N_f$.[1] For this reason, the chapter on investment spending (chapter 4) is key and it is there that his

[1]Note that Davidson is careful to point out that, contrary to popular belief, Keynes' analysis *does not* assume that D's slope is determined solely by consumption and it's position in space by investment. Rather, there are components of each kind of spending that are determined by and independent of the current level of employment. But, as it is autonomous investment that is ultimately the most volatile and important factor, I will assume for simplicity that it is the only factor determining the vertical intercept.

capital market diagram is introduced.

The Demand for and Supply of Capital

In chapter 4, it is made clear that the object of investment is the accumulation of physical capital on the part of entrepreneurs who hope to earn profits from the services of these extremely illiquid goods over a relatively long period of time. This is a weighty and largely irreversible decision, something to which I shall return later. In the meantime, Davidson's demand for physical capital function is set out in his equation 4.2:

(1) $$D_k = f_1(\underset{-}{p_k}, \underset{-}{i}, \underset{+}{\Phi}, \underset{+}{E})$$

where D_k is the quantity of capital demanded, p_k is the price of capital goods, i is the rate of discount used by entrepreneurs in considering the present value of expected future profits, Φ is the expected growth in demand for the products produced by the capital in question, and E is the number of investors able to obtain finance for their projects. The signs under each variable represent those of the relevant partial derivatives. As shown, a rise in the price of capital reduces quantity demanded, as does an increase in the rate of discount of future profits. The quantity of capital demanded rises when agents expect to earn more from future sales of the goods and services produced and if prospective investors can get the necessary funding. Note how the latter immediately creates a tangible connection between the real and financial sides of the economy. This stands in stark contrast to the typical Neoclassical approach which portrays the latter as passively accommodating the needs of the real side. As Keynes said:

> ...banks hold the key position in the transition from a lower to a higher scale of activity. If they refuse to relax, the growing congestion of the short-term loan

market or of the new issue market, as the case may be, will inhibit the improvement, no matter how thrifty the public purpose to be out of their future incomes (Keynes 1937, pp.668-9).

Students in this Intermediate Macroeconomics course will come to regard the financial sector as an integral part of the process and not a subject for a chapter at the back of the book.[2]

This function, when placed in p_k and quantity of capital space, yields a negatively-sloped line (see Figure 2). Changes in i, Φ, or E will cause shifts in the directions implied by the signs of their partial derivatives. The first step in adding the supply side involves marking the current stock of capital. This is shown in Figure 3 where S_k is drawn above k_1. The intersection of S_k and D_k yields the spot market price, p_s, or that "necessary to allocate the stock without remainder among demanders" (Davidson 2011, p.68).

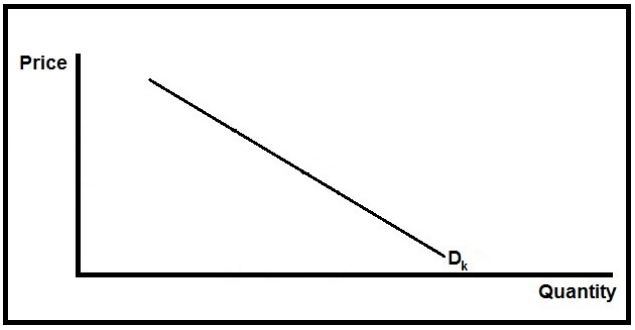

Figure 2: Demand for capital curve.

[2]The financial sector also makes itself felt via i, the rate of discount, as it is heavily influenced by the rate of interest.

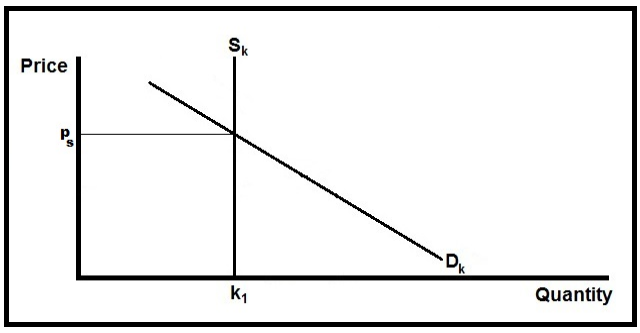

Figure 3: The determination of the spot market price.

This price is a key benchmark even if there is not a single, solitary unit of existing capital actually for sale. Comparing what entrepreneurs would be *willing* to pay if all capital put on the market all at once (the demand price) to what they must actually pay to build new capital (the supply price) determines the current level of investment. For example, say agents, taking into account the rate of discount of future sales, expected future sales of goods produced by the capital in question, the availability of finance, and the existing quantity of capital, were willing to pay $1 million for a representative extant restaurant. Say at the same time that it costs only $500,000 to build a new one. Whether or not there are any establishments for sale is not the issue; the fact that the demand price exceeds the supply price is. This means that new restaurants will be constructed and net investment will be positive. But, if a unit of existing capital is valued at $250,000 while building one costs $500,000, then there is a glut of restaurants and net investment will be negative. Davidson argues that the Marshallian practice of comparing demand and supply prices (also used by Keynes) is superior to that typically employed by Keynesians wherein the analysis focuses on the marginal efficiency of capital. Indeed, it is one of the main reasons it is possible to use Davidson's model to explain the business cycle.

To determine the price at which new capital can be produced (Davidson's flow price, p_f), both depreciation and the quantities offered for sale at each price by the capital-goods producing industry must be added. The former is relevant because the existing stock of capital is not a static number. Unless repairs and additions are undertaken, it will diminish in value. Davidson's d_k shows what demand must be simply to replace depreciation and it appears as the gap between (D_k+d_k) and D_k. How much depreciation is truly replaced is a function of the difference between p_s and p_f, as will be seen below.[3]

The capital-goods producing industry is represented by s_k. The function begins at p_m, or the minimum price at which they are willing to contract to build a new unit. Above that point, the curve is positively sloped on the assumption that the costs of construction will increase. Since k_1 units of capital already exist, the s_k curve is added to the S_k one as shown in Figure 4. In other words, (S_k+s_k) represents existing stock supply (S_k) plus the flow resulting from building (s_k).

The complete apparatus, including both (D_k+d_k) and (S_k+s_k), is shown in Figure 4. Recall that k_1 is the current stock of capital and p_s is entrepreneurs' subjective valuation thereof. The latter is what demanders would pay to obtain a unit of existing capital. What they must actually pay to produce a new one, however, is lower, at p_f, meaning that net investment will take place. This is shown by $k_2 - k_1$. Gross investment is $k_3 - k_1$ and that just to replace depreciation is $k_3 - k_2$ (equal to the distance between D_k and d_k).

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[3]The functions are drawn parallel on the assumption that their price sensitivities are identical.

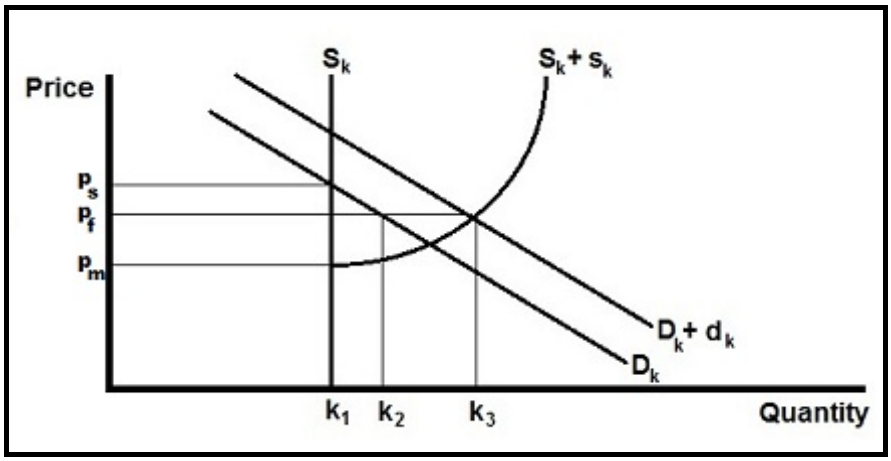

Figure 4: Complete demand for and supply of capital diagram.

On the surface of it, this appears to an be equilibrium model typical of the Mainstream. It goes deeper than that, however. Not only is Davidson careful to stress the possibility of interactions among functions throughout the text, but notice what Figure 4 implies about the future: the new stock of capital will be at k_2. Ceteris paribus (leaving the demand curves in place and shifting the supply curves to the right), in the next time period the economy will appear as in Figure 5 below, with the new current stock of capital at k_2 (k_1 remains for reference), gross investment at $k_5 - k_2$, and net investment at $k_4 - k_2$. And in time period three, the stock of capital will be k_4.

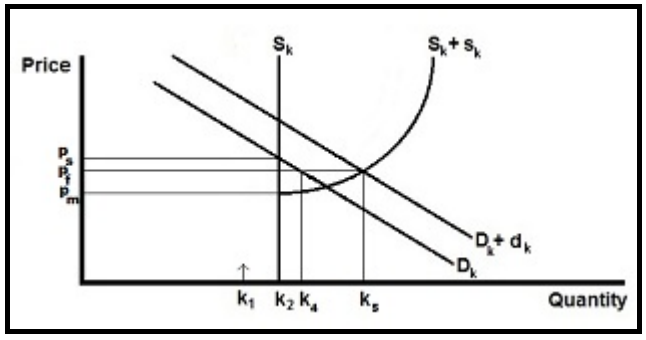

Figure 5: Rising stock of capital in a booming economy.

Thus Figures 4 and 5 are therefore merely snapshots of a dynamic economy. Unlike in IS-LM curve analysis, there is no assumption that the economy is rushing to a resting point where it will remain until external forces cause a disturbance. Instead, there is implicit movement even on an otherwise static diagram. This is an important lesson for students in and of itself. But note, too, how the gap between p_s and p_f is closing. This makes sense since the former is moving very quickly down the vertical S_k while the latter is dropping more slowly along the much flatter s_k. In terms of the underlying behavior, rising supply is driving down both prices. But while there is no limit to how far p_s could fall (negative prices are theoretically possible in the sense that entrepreneurs could be so pessimistic that they would have to be paid to take over existing capital), p_f will only fall as far as the minimum supply price, p_m. Thus, as S_k and $(S_k + s_k)$ continue to shift rightward, p_s approaches p_f. In fact, whenever we start where $p_s > p_f$, the rightward shift in $(S_k + s_k)$ will lead to $p_s = p_f$, zero net investment, and a stationary state; and if we start during a slump, where $p_s < p_f$ and net investment is negative (see $k_2 - k_1$ on Figure 6), the leftward shift in $(S_k + s_k)$ will lead to $p_s = p_f$, zero net investment, and a stationary state.

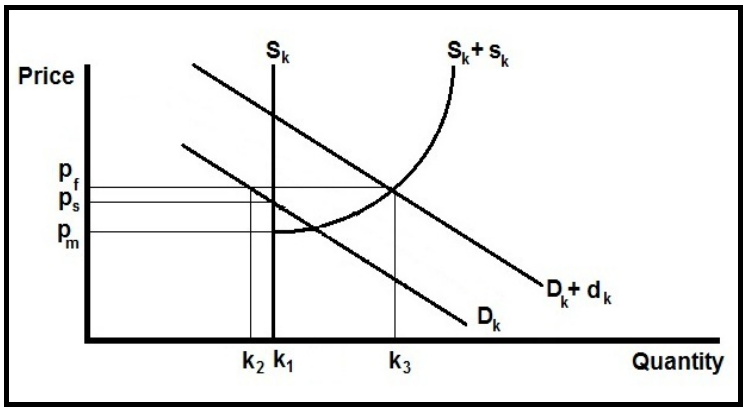

Figure 6: Negative net investment.

Thus far, everything described here is already in *Post Keynesian Macroeconomic Theory*. But, despite the very useful story told so far, a gap remains. Why, a student may ask, do expansions and recessions occur if situations of either positive or negative net investment inevitably lead to $p_s = p_f$? Are these simply a result of the same external forces that shift IS and LM in Neoclassicism? The short answer is no. While Post Keynesians do not deny the existence of exogenous shocks, there are also important systemic forces at work creating short-run fluctuations in output and employment, i.e., creating the business cycle. Fortunately, the demand for and supply of capital diagram can be employed to take these into account. In fact, it is a natural extension.

Explaining the Business Cycle: Integrating Demand

The first step is showing how the changing levels of investment are simultaneously affecting entrepreneurial expectations. Consider the conditions under which the investment decision is made. Keynes believed that we live in a world of uncertainty wherein one cannot make objective mathematical forecasts of the future. Doing so would require us to know both all the possible future states of the world and the probability of each. We do not know either. Given this and given the weighty and irreversible nature of capital formation, one is left to wonder why anyone would undertake investment. Keynes said no rational person would, except for the existence of animal spirits. The latter means that, even lacking an objective forecast, we are willing to risk fortunes because we each think we can do better than the average person. Very little investment would take place in the absence of this spontaneous optimism and confidence.

At the opening stages of an expansion, when agents are still relatively pessimistic,

realized profits often exceed those that were expected. This stokes animal spirits and (D_k+d_k) shifts to the right as Φ in equation (1) increases. The rate of discount (i) may also fall as liquidity preference declines and bankers may be more willing to loan, raising E. This takes the expansion from its sputtering beginnings to full strength and represents a situation like that illustrated in Figure 4.

However, (D_k+d_k) will not shift rightward indefinitely. Indeed, data on US business cycles since 1950 suggest that entrepreneurial forecasts moderate, while remaining positive, as expansions mature.[4] Meanwhile, as already shown, investment will inevitably decline because of the continuous additions to the capital stock. But this would induce a stationary state only if a steadily rising $(S_k + s_k)$ approached a stationary (D_k+d_k). This will not be the case because falling investment will have shifted D in Figure 7 down to D', *disappointing the expectations represented by Φ*. Agents had undertaken the investment decisions represented by the intercept of D on the assumption that the economy would at least remain at N_1; but, it has fallen to N_2. Entrepreneurs are rudely reminded that never had a firm basis for their expectations in the first place and their error of optimism "is replaced by a contrary 'error of pessimism'" (Keynes 1964, p.322). This manifests itself in a rapid fall in Φ in equation (1), causing a sudden leftward shift in (D_k+d_k). What had been slowing but positive net investment now becomes negative net investment. Banks, stung by defaults and frightened by the sudden downturn, will likely ration credit more carefully, lowering E. With rising liquidity preference, the rate of discount may also increase (raising i). The capital market, having already moved from Figure 4 to Figure 5, reaches Figure 6 and demand collapses from D to D' to D" (see Figure 8). It may be some time before

[4]Supporting evidence will be provided later in the paper.

the negative net investment associated with Figure 6 creates sufficient scarcity in the capital market for investment to rise again. It is for this reason that Keynes feared that slumps would be more protracted than booms.

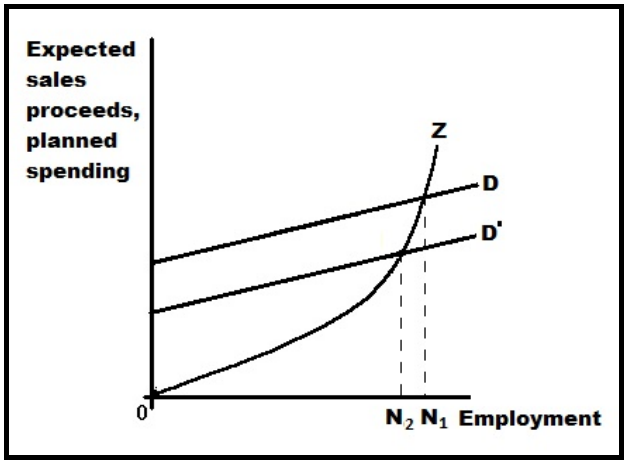

Figure 7: Effects of falling investment (D to D').

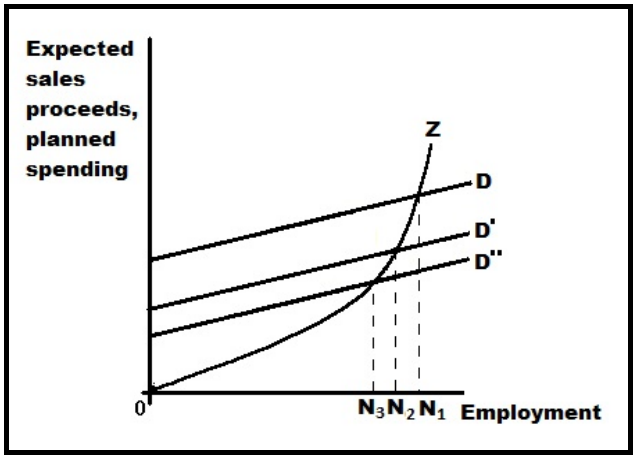

Figure 8: Collapsing investment and demand (to D'') after expectations are disappointed.

To reiterate, while Davidson's discussion of the possibility of a stationary state is relevant to a longer-run analysis, the short run–that in which we all live–looks more the graphs above. Expansion and positive net investment lay the foundation for recession because they are associated with rightward shifts in (S_k+s_k) that eventually create disappointment.[5] Recovery occurs only after the stock of capital shrinks and hope recovers. This is the essential nature of the business cycle upon which other exogenous forces may be superimposed.

Explaining the Business Cycle: Distinct Stages and the Real World

The above may suffice for many instructors, but those wishing to devote more time to the subject can delve deeper by defining distinct stages of the business cycle and offering empirical evidence in support of the theory. The latter might not only serve to solidify the role of the capital market in the business cycle in the student's mind, but drive home the "real world" emphasis of Post Keynesian economics.

Just as economies exist in historical time, so the typical business cycle passes through distinct stages. These are summarized in Table 1. In stage one, early expansion, entrepreneurs are just emerging from the recession and their expectations are, though no longer depressed, tentative. That said, because (S_k+s_k) is relatively as the economy emerges from recession, investment is rising and actual sales and profits may exceed expectations. This is illustrated in

[5]Keynes is careful to point out that he does not view this as a process of overinvestment in the sense that entrepreneurs have built more capital than the economy would use at full employment. Rather, the problem is that the level of economic activity that led entrepreneurs to undertake the investment shown in Figure 4 no longer exists when the capital comes online in Figure 5. Thus, profits that might otherwise have been acceptable are in this case a disappointment.

Figure 9. Note that a scale has been added to make the comparison of successive levels of investment easier.

Table 1: Stages of the Business Cycle.			
Stage	**Investment Spending**	**Investor Expectations**	**Realized Profits**
Early Expansion	Moderate	Tentative	Better than Expected
Mid Expansion	Booming	Optimistic	As Expected
Late Expansion	Slowing but Strong	Moderating but Optimistic	Disappointing
Recession	Collapse	Pessimistic	As Expected

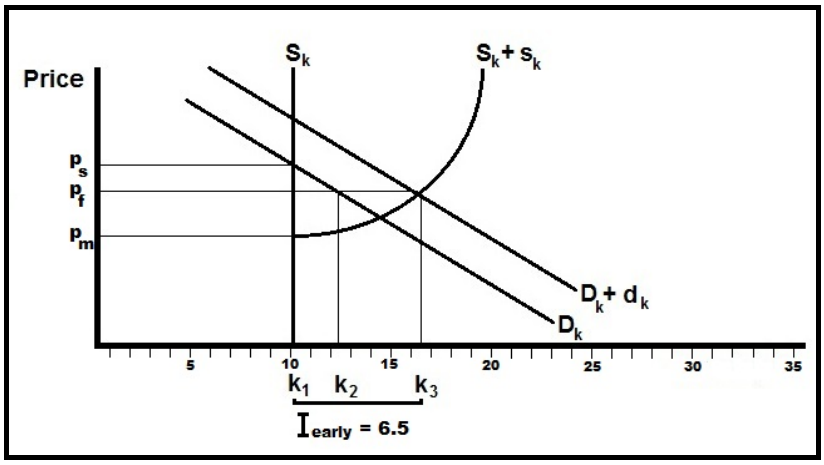

Figure 9: Early Expansion.

In mid expansion (illustrated in Figure 10), the stock of capital has risen from k_1 to k_2, thus potentially depressing investment spending. But, the pleasant surprise experienced in early expansion boosts both Φ and E and causes (D_k+d_k) to jump from their previous position marked by the dashed lines to the current one shown on Figure 10. Hence, during this boom period, gross investment rises again (to 8.5 units in the example) and expectations are not disappointed. This means that the D curve on the Z-D diagram is continuing to shift up in both early and mid

expansion.

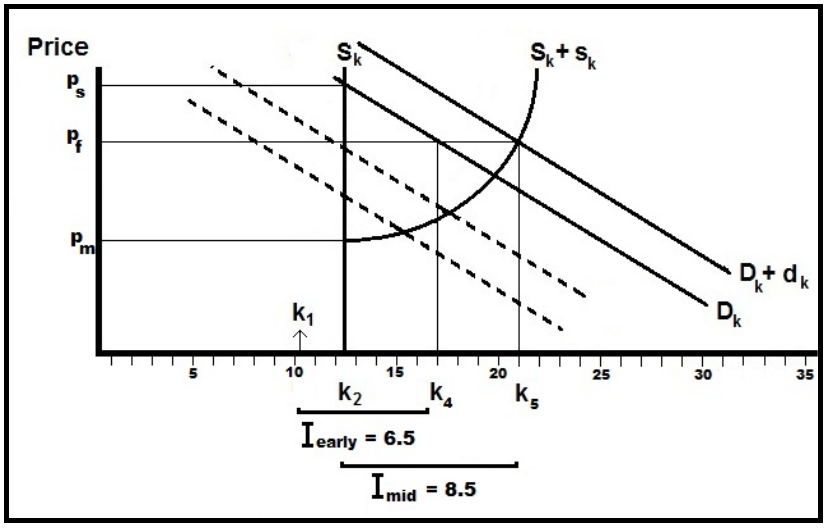

Figure 10: Mid Expansion.

It is in late expansion that problems begin to arise, for the inexorable rightward shifts in (S_k+s_k) will inevitably catch up with even optimistic (D_k+d_k) curves. Those entrepreneurs whose on line capital is represented by k_4 in Figure 11 were expecting overall demand to be that associated with investment of 8.5 as shown in Figure 10 because that is what prevailed when they made their decision. But, in contrast, p_s and p_f will have moved closer together and investment will have declined (in this particular example to 7) by the time their restaurants, factories, and office buildings are open for business. Under other circumstances, the profits generated might have been acceptable. Indeed, in early expansion, investment had only been 6.5 and yet this had been met with enthusiasm. But, relative to expectations, 7.0 is a disappointment. Because investment is a weighty and non-reversible decision made in an environment of uncertainty, agents panic and we witness the collapse in demand shown on Figure 12 (from the dashed to the solid lines). Net investment becomes negative during the recession, the gross level of 4.5 is the

lowest of any of the four periods, and the economy flounders until entrepreneurs and bankers regain confidence and the stock of capital falls sufficiently to generate new profit opportunities. Until p_s is no longer below p_f, as shown in Figure 12, the stock of capital will continue to contract.

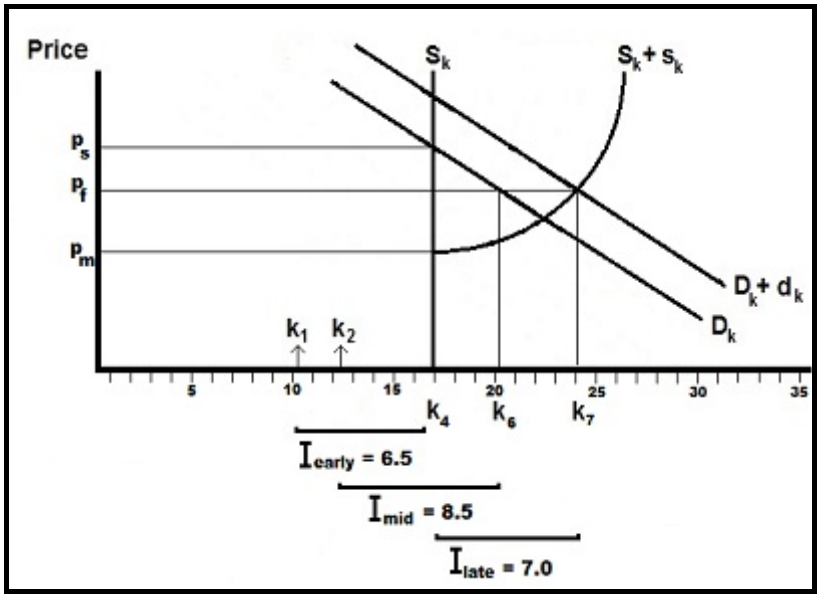

Figure 11: Late Expansion.

This tells an internally consistent story, but how does it stack up against experience? Unfortunately, in the real world, everything else is never constant. External shocks and unique historical forces make themselves felt whether we want them to or not. But, if we take a long enough period, it is possible underlying systemic factors may stand out. To this end, Table 2 offers a summary of data from all US business cycles since 1950.

According to Table 1, three variables are key: gross investment, entrepreneurial expectations, and realized profits. Also according to Table 1, we should expect to see investment rising in early expansion, leading still-cautious agents to be pleasantly surprised by realized profits; rising again in mid expansion, further encouraging agents as profits meet expectations;

moderating in late expansion as profits fall, causing disappointment; and falling significantly in recession as optimism and realized profits collapse.

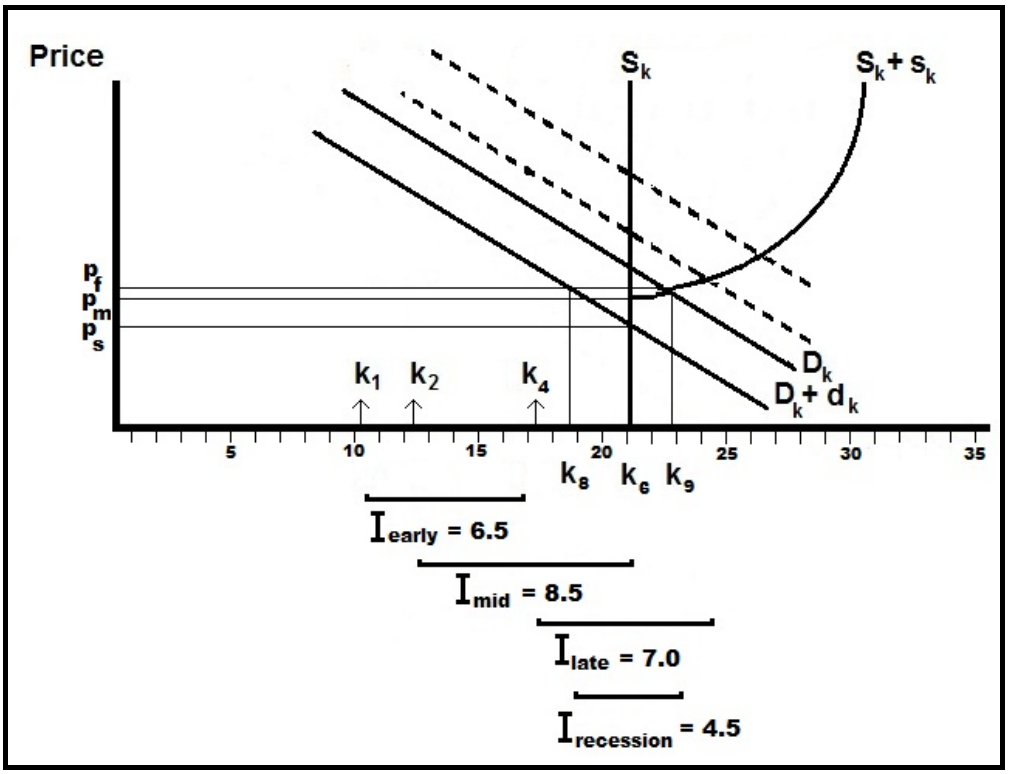

Figure 12: Recession.

This is precisely what we see in Table 2. The recessions are as defined by the *National Bureau of Economic Research* and all data are quarterly. Early expansion is defined as the first year of an upturn, late expansion as the last year, and mid expansion as the remainder. When an expansion lasted for fewer than nine quarters, the length of each of the three periods was determined by dividing it into thirds. If not evenly divisible by three, the remaining quarter was added first to early expansion and then, if necessary, to late expansion. Data in each cell are averages across all ten such cycles and are not weighted by the numbers of quarters in each recession or expansionary period.

The variables were defined as follows. So as to make it possible to compare levels across the almost sixty-year period covered, investment is measured relative to the overall size of the economy. Modeling investor expectations was more challenging. The Purchasing Managers' Index (PMI) is a widely regarded indicator collected by the *Institute for Supply Management*. Purchasing managers at various manufacturing firms are asked a short list of very simple questions that amount to, was business this month better than last month? The choices are yes, no, or no change and these are aggregated and weighted. When the resulting index is above 50, this indicates improvement; below 50 indicates deterioration. While these are not forecasts, per se, they are thought to be directly reflective of the forecasts of the businesses who are the customers of the manufacturing firms queried.

But, this is a relative scale when an absolute one is needed. In other words, saying that you expect things to get better the day after your dog got hit by a car is not to say that you think things will go well, just not as bad as yesterday. Hence, it was necessary to "deflate" the PMI by comparing it to the period preceding that forecast. As early and late expansion were each defined as four quarters and the average recession over the period studied was 4.7 quarters, the benchmark was one year. In other words, each PMI was considered in light of the state of the economy over the previous year. Real GDP growth rates were used for the latter.

To accomplish this, the averages and standard deviations for quarterly observations of PMI and real GDP growth from 1950:1 through 2009:2 were calculated and each data point was converted to the number of standard deviations above or below the mean. This had the advantage of creating a common scale. The numbers on Table 2 are the sum of each standardized PMI plus the average of the previous four standardized growth rates. In this way, if

growth over the previous year had been one standard deviation below its mean while PMI was one standard deviation above, the resulting number was a very neutral zero. Yes, agents expected improvement, but then the economy had been underperforming anyway. However, if both the standardized growth and PMI had been one standard deviation above their means, the investor expectations number was an enthusiastic +2.

Table 2: US Business Cycle since 1950.

Period	Investment as % of GDP	Investor Expectations	Realized Profits
Early Expansion	15.55%	+0.08	0.20%
Mid Expansion	16.86%	+0.81	0.10%
Late Expansion	16.70%	+0.20	-0.02%
Recession	15.16%	-1.72	-0.05%

Business cycle dates are from the *National Bureau of Economic Research*; all data from the *Federal Reserve Bank of St. Louis* except the Purchasing Managers' Index, which is from the *Institute for Supply Management*; data are averages of quarterly observations; and rates of change are annualized.

The last column shows realized profits. While, strictly speaking, we would like to know the specific profit rates from the new investments, these data do not exist. Proxying this is the quarter-to-quarter rate of change of after-tax corporate profits (deflated by the GDP deflator).

As suggested above, *every number moves just as the theory predicts*. Investment levels in early expansion are moderate but still higher than recession and expectations are only slightly above neutral. Meanwhile, profits show the largest increase of any period. This has the effect of driving expectations to their highest point during mid expansion and investment follows suit.

Profits continue to rise, albeit at a slower rate. However, problems arise in late expansion. Investment is still relatively high, but slowing, and expectations, though moderated, continue to be optimistic–but profits are falling! Disappointment leads to recession, when investment falls to the lowest level of the four periods, profits continue to decline, and investor expectations absolutely collapse.

Conclusion

Post Keynesian economists should not be afraid to teach what they believe offers the best explanation of macroeconomic fluctuations. Our colleagues in the mainstream certainly are not. And realistically speaking, it is hard to imagine that any student would be handicapped by not having had a full dose of IS-LM, the accelerationist hypothesis, Phillips Curves, et cetera. After all, many Neoclassicals do not endorse one or more of these. Why not therefore teach something useful.

But the problem of finding appropriate materials remains. However, those not inclined to build a course from scratch may find Paul Davidson's book useful. I have done so, despite initial trepidation regarding the apparent complexity of the capital market diagram. In retrospect, however, it is certainly no more challenging than anything covered in a traditional course, it is just unfamiliar. Furthermore, it can be used effectively in combination with the Z-D diagram to talk about broader issues, it conveys to the student a sense of the dynamic nature of the economy, and it includes the impact of the banking sector. And, as demonstrated above, it can be used to build a convincing story of the business cycle and one that is supported by the experience of the US over the past sixty years.

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