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by

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Investigations of market structure have sometimes incorporated various measures of disequilibrium but the validity of these measures has not undergone a thorough testing.[1] Statements justifying the use of these measures are usually ad hoc in nature with little empirical precedence. The incidence and duration of industry disequilibria have received scant attention in the past.

Our purpose in this paper is to construct a measure of disequilibrium which can be used by investigators of industry behavior and to examine some empirical magnitudes regarding the phenomenon of disequilibrium. This paper is composed of six parts. The first section is concerned with the definition of disequilibrium and a model of the processes involved. In the next section we construct various measures of disequilibrium used in the literature and test their performance. In the third section we examine the time path of disequilibrium. Section 4 looks at other evidence. Section 5 is concerned with the influence of disequilibrium on profit rates. Section 6 uses the methodology developed in the earlier parts of the paper to test a Marshallian hypothesis regarding the effect of fixed assets on industry response to shocks. It is hoped that the framework provided by this paper will engender more coherent discussions of these matters than has previously existed.

I. The Disequilibrium Process

We are concerned with market disequilibria caused by shocks in the economy. It is important to realize that incorrect anticipations of these shocks are at the core of disequilibrium. The actual mechanisms which determine

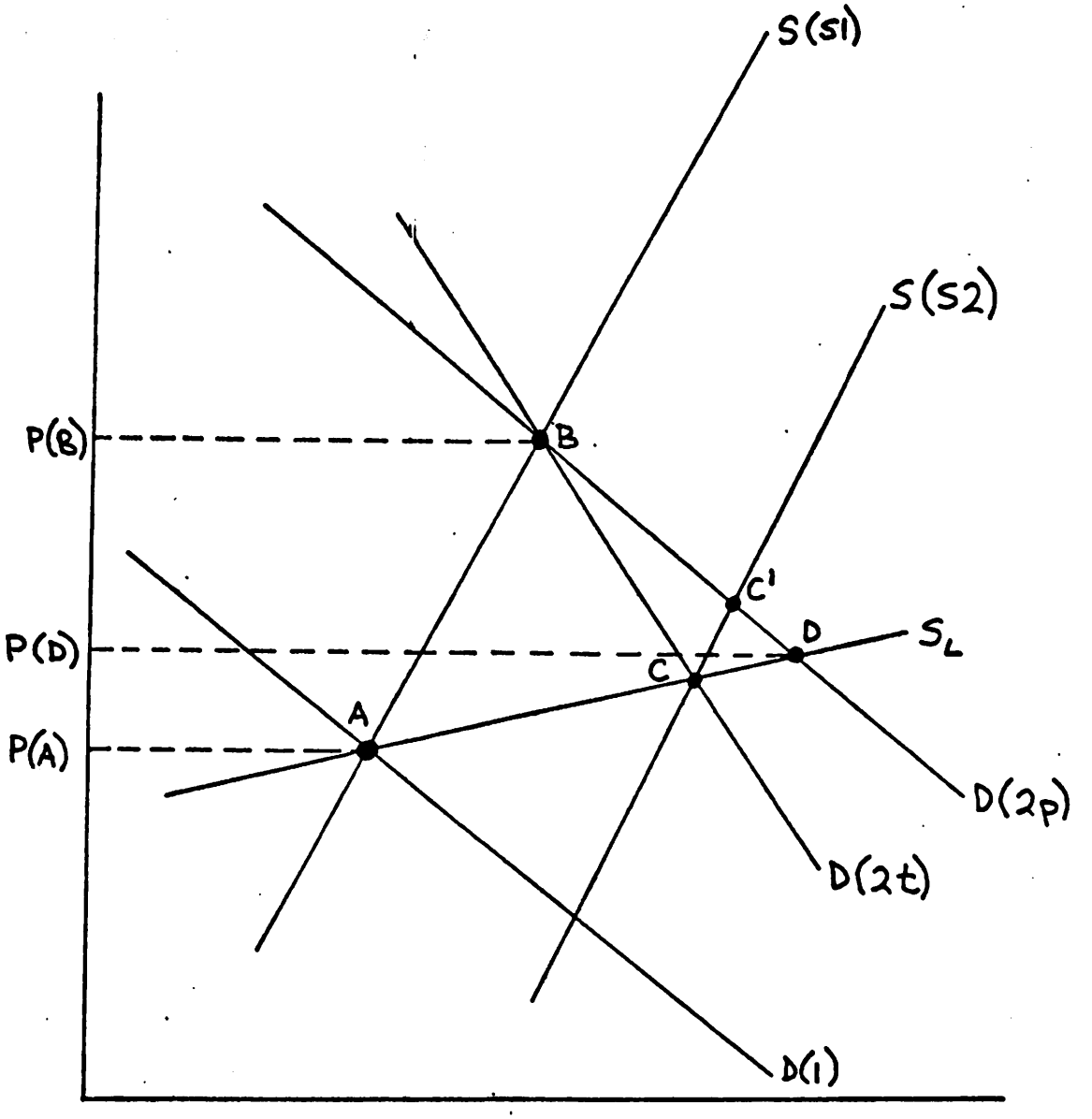
anticipations are not well defined. There are difficulties in attempting to analyze this process which we can illustrate with the aid of Figure 1. Let us assume the industry is producing at point A with demand represented by D(1). We shall take this to be an initial state of equilibrium. Now let demand rise on a permanent basis to D(2p). When firms in the industry regard the demand change as permanent they will move the industry to point D on its 'long-run' supply curve. If firms anticipated the demand shift the movement from A to D could occur instantaneously. There need be no disequilibrium or economic profits.

If firms are surprised by the demand shift they will act differently. If they regard the unanticipated demand shift as temporary, they will move to point B on their less elastic 'short-run' supply curve. Economic profits will be earned as each firm moves up along its marginal cost curve. New firms are not likely to take up the slack since the change was not anticipated and is thought to be temporary.[2] At point B the industry will begin to realize that the demand shift is permanent. It will make its way to point D, possibly through points such as C and C′. Although D(2p) is the long-run consumer demand, when price is lowered from P(B) not all consumers can adjust their buying habits instantaneously. The short-run demand is less elastic and cuts through point C. As demand adjusts to D(2p), it is possible that the industry moves on its new short-run supply S(s2) to point C′. This chain of events is only one of several which are possible.

Empirical verification of disequilibrium is a difficult task. In the example we have illustrated, we would expect prices to rise from P(A) to P(B) and then fall (not necessarily monotonically) to P(D). We would expect industry economic profits to be above normal during the adjustment from A to D. This is due to the fact that total revenue rises more rapidly

FIGURE 1

REACTION TO DEMAND SHIFT



than total cost as demand increases. Our empirical tests will focus on the change in profits.

Disequilibrium can also be caused by unanticipated supply shifts. This analysis is equally complex and will not be dealt with in detail. One important distinction must be made regarding the behavior of profits. Because price and quantity move in opposite directions during a supply shift, it is not possible to know whether profits rise or fall without specifying specific data on demand and supply other than the sign of their slopes.

The point of this simple exposition of the difficulties inherent in analyzing disequilibrium is merely to draw attention to possible pitfalls inherent in such analysis. Any construction of a measure of disequilibrium must be crude. We will have difficulty measuring the degree to which permanent or temporary demand or cost changes are correctly anticipated as such. More importantly, it is difficult to determine the magnitude of demand or supply shifts, if one can determine that they occurred at all. Knowledge of profits, prices and quantities would only be of limited use as we have seen because the movement of these variables is not unambiguously related to disequilibrium.

We shall make some simplifying assumptions about the industries covered by our data which will enable us to derive workable proxies for measuring disequilibrium. We shall concern ourselves with demand shifts to the exclusion of supply shifts. We shall use changes in total revenue as a proxy for changes in demand. These two variables tend to move together. When demand increases for an industry with a horizontal supply curve the percentage increase in revenue and quantity demanded is the same. With an upward sloping supply curve the quantity demanded and total revenue move in the same direction. With a downward sloping supply curve the relationship between total revenue and quantity demanded would be determined by the elasticity of supply. In this

case, since not even the sign of the correlation between revenues and quantity demanded would be known, a priori, we would have a difficult time justifying the use of total revenue as a proxy for demand shifts. However, a downward sloping supply curve seems to be unrealistic and we will disregard this possibility.[3] Another point worth taking note of is the impact of inflation on total revenue. We will be using a cross-section of industries over a given time period, therefore inflationary effects on total revenue will not appear as changes in demand.[4]

Another potential empirical problem concerns the duration of disequilibrium. We do not know the length of time required for industries to fully respond to shifts in demand. For example, if it takes more than ten years for industries to respond to shifts in demand and our data cover a period of ten years we would find that those industries which had increases in demand immediately prior to the period covered by our data would have above normal rates of return without any apparent disequilibrium, and industries which are in disequilibrium during the period will not have fully worked it out when our measurements end. If disequilibrium works itself out in a period that is shorter than ten years but longer than a year we would find that most of its influence would be washed out if we used a ten year period as our basic unit of temporal measurement[5] although if we used yearly data over the period we might get reasonable results.

Measures of disequilibrium that have been suggested are (1) sales growth, [3,6,9,10], (2) asset growth, [18], (3) sales growth minus asset growth [7] and (4) movement in profit rates [14].[6] Each of these measures will be discussed below.

We have stated that disequilibrium is due to incorrect anticipations and for this reason would like to be able to measure the divergence of actual from anticipated market conditions. The relationship between demand shifts and anticipated demand shifts is the primary element in our analysis.

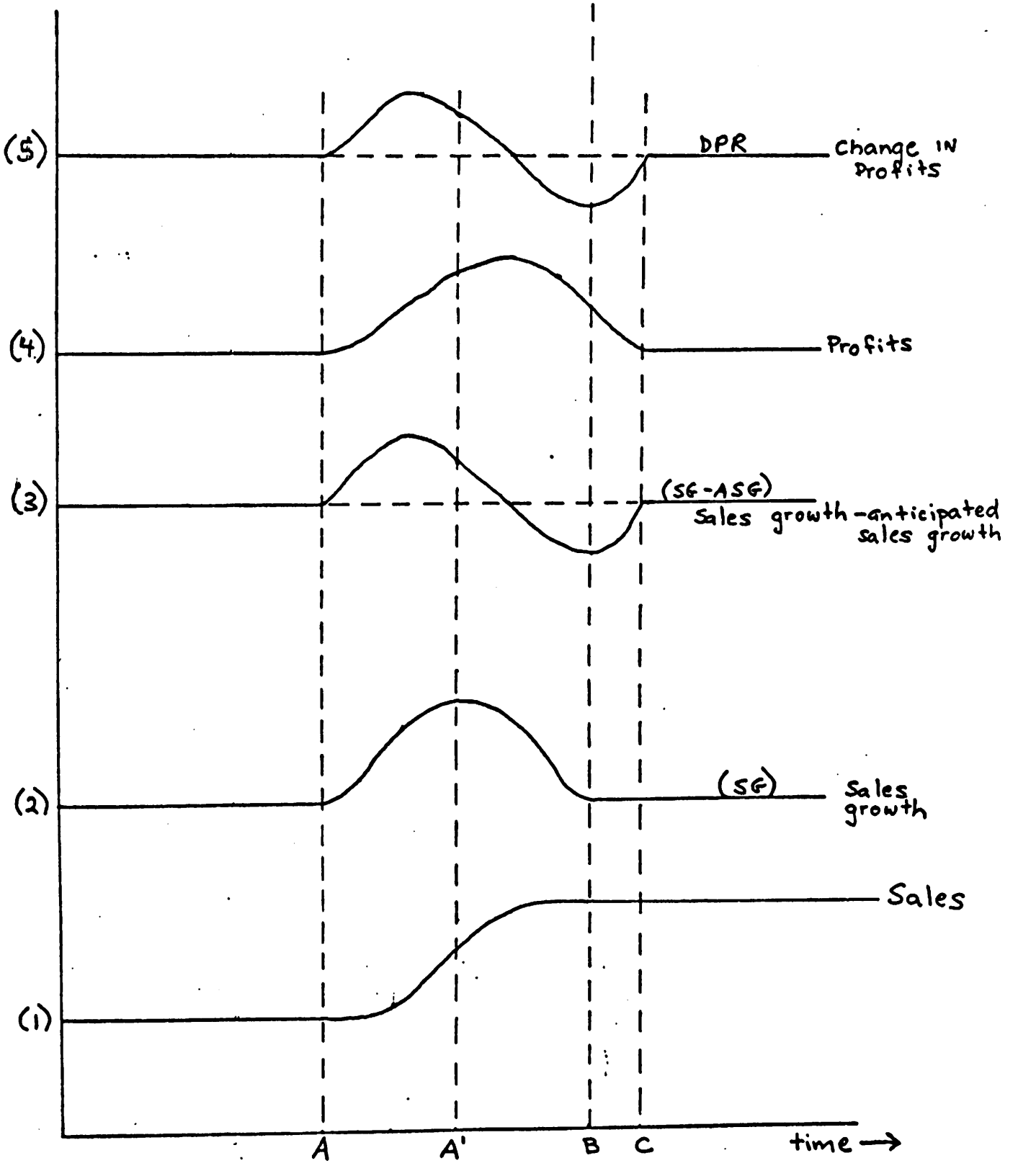
To better understand how different variables will react over time observe Figure 2. This diagram has been drawn with five panels, each of which shows how a variable changes over time. All trends not having to do with disequilibrium have been removed from the time path of these variables. Sales and demand are equivalent in this scenario.

At time A, an unanticipated increase in demand occurs. In panel 2 we see sales growth becoming positive at A and returning to zero (normal growth) at B when sales reach their new higher level. By assumption, anticipated sales growth lags behind actual sales growth so that in panel 3 we see sg-asg (where sg stands for sales growth and asg stands for anticipated sales growth) becoming positive at A but decreasing before sales growth decreases and then becoming negative as sales growth becomes smaller than anticipated sales growth. The particular relation between sales growth and anticipated sales growth is itself a possible topic for study, but will not be investigated here. We assume in this diagram that anticipations are duplications of actual sales growth with an unspecified lag. The actual process of expectation formation will not affect our primary results. At time C the industry capacity has fully caught up with demand, and profits (rates) have returned to normal as shown in panel 4. In panel 5 the change in profits mirrors the difference between sales and anticipated sales growth shown in panel 3 if the change in profits is a function of excess demand (for which sg-asg is a proxy).[7]

Observation of Figure 2 reveals that variations in sg-asg should predict change in profit rates very well but the variations in sg-asg will not predict the level of profit rates as well. Sales growth will be related to the change in profits but this relationship will depend on the length of

FIGURE 2

RELATION BETWEEN DISEQUILIBRIUM AND PROFITS



the lag between sales growth and anticipations of sales growth. The longer the lag the better the correlation between sg and change in profits (dpr). Sales growth looks as though it should be highly related to the level of profit rates although they are somewhat out of phase.

If we mentally flip Figure 2 over the horizontal axis but have time still go from left to right we would be looking at a disequilibrium caused by a reduction in demand. Both types of disequilibrium will be occurring at the same time for different industries in the economy. Sg-asg will be positive in both the early stages of a disequilibrium caused by an increase in demand and in the later stages of a disequilibrium caused by a reduction in demand. In the former case profits would be above normal whereas in the latter case the opposite would be true. Thus we should not expect profit rates to be closely related to measures of disequilibrium which do not distinguish between increases or decreases in demand if both occur simultaneously in the economy. However, as we have seen, such a measure of disequilibrium would predict changes in profits quite well.

II. Testing Measures of Disequilibrium

Our first task will be to discover the power of our measures of disequilibrium in explaining changes in profits. Our procedure will be to regress an equation of the form:

$$Dpr(t) = A+b\ D(t)+c\ D(t-1) + d\ D(t-2) + e\ D(t-3) + u$$

where dpr(t) is the change in profit rates from year t-1 to year t, D(t) is our measure of disequilibrium for year t and u is an error term. Our first year of observation on these variables is 1959. Our last year is 1967. Observations are based on IRS industries.

The different measures of disequilibrium we will test are listed below:

1) Sales growth (sg); defined as business receipts in year t less those of year t-1 divided by those of t-1.
2) Sales growth less (net depreciable) asset growth (sg-ag); asset growth is defined similarly to sales growth.[8]
3) Sales growth less past sales growth; past sales growth defined in various ways--average of last three years, average of past two years and simply the past year.
4) Asset growth (ag).

In our construction of variables 2 and 3 we have used asset growth and past sales growth respectively as measures of anticipated demand shifts.

With our dependent variable in the form of a first difference accounting bias should have little affect on our results since this bias should vary little from year to year.[9]

Table 1a-1e show the results of these regressions. The most important feature that emerges upon inspection of these results is that some of our independent variables can significantly explain changes in profit rates. Our results are quite robust for cross-section studies of this genre.

Interpretation of the coefficients is not straightforward. The fact that the explanatory variables are not independent of each other makes interpretation of individual coefficients difficult. These regressions are run primarily to determine the overall strength of the explanatory variables.

In Table 1a we see the results of change in profits regressed on growth in sales for each year. Figure 2 implies little relationship between sales and profit changes if our measurements are fine enough. If however, the period of disequilibrium is short relative to our periods of measurement (one year), it is possible that a relationship might show up. In terms of Figure 2, if

TABLE 1a

D = sales growth

Change in profit rates is dependent variable

Year	D(t)	D(t-1)	D(t-2)	D(t-3)	R^2
1967	-.15 (1.9)	-.05 (.2)	-.18 (2.3)	.03 (.1)	.04
1966	.32 (9.7)	.06 (.4)	-.11 (1.4)	-.19 (3.7)	.17
1965	.21 (5.0)	-.02 (.09)	.11 (1.5)	.17 (3.3)	.10
1964	.05 (.29)	-.07 (.53)	-.10 (1.1)	.15 (2.4)	.09
1963	.39 (14.19)	.05 (.36)	-.26 (6.3)	-.15 (2.3)	.22
1962	.26 (8.2)	.24 (5.37)	-0.0 (0)	.17 (2.64)	.14
1961	-.20 (3.24)	-.19 (4.0)	-.15 (1.85)		.06
1960	.23 (5.90)	-.10 (1.29)			.07

Values represent (beta) coefficients from the regression:

$$Dpr(t) = a + b\,D(t) + c\,D(t-1) + d\,D(t-2) + e\,D(t-3)$$

where Dpr is change in profit rate and D is the measure of disequilibrium.

F-statistics are in parentheses

Values of F greater than 4 are significantly different from zero at a 95% level of confidence. This will be true for all tables with F statistics

Sources: Internal Revenue Service

OA is year t and AB is year t+1 our data would show a rise in profits from year t to year t+1 and an increase in sales also. In year t+2 profits would fall by a small amount although there would still appear to be an increase in sales.[10] Unless the period of disequilibrium is much longer than one year we are liable to find a positive relationship between growth in sales and changes in profits.

This is generally the type of result we find in Table 1a. Five out of eight unlagged coefficients are positive and significant. Of the three insignificant coefficients, two are negative. A negative coefficient would occur if many industries were in the t+2 year of the disequilibrium.

Growth in sales during the preceding year has a significant effect on the change in profits in only two out of eight regressions and the coefficient is negative in five out of eight years. We conclude that sales growth in previous years has no systematic effect on profit rate changes in a given year.

In Table 1b we present results using sales growth minus asset growth (sg-ag) as our measure of disequilibrium. Our previous analysis has indicated that this variable should be highly correlated with changes in profits if our yearly measurements are fine enough to pick up the patterns of these variables in disequilibrium.

In this table the measure of disequilibrium in year t gives the correct sign (+) in every year and is significant in every year. Of equal interest is the fact that the coefficient for year t-1 is negative in all years and significantly so in two of the seven. The effect of this lagged term is much weaker than is the unlagged term. Sg-ag lagged two years does not show much of a pattern.

There are reasons why we do not expect the lagged coefficient to be as strong as the unlagged coefficient. In any year t some industries will be in the first year of the disequilibrium and other industries will be in their second year. For those industries in the second year D(t-1) will be related

TABLE 1b

D = sg - ag

Year	D(T)	D(t-1)	D(t-2)	D(t-3)	R**2
1967	.42 (29.35)	-.52 (38.07)	-.02 (.04)	.08 (.95)	.40
1966	.64 (65.14)	-.05 (.52)	.09 (1.29)	0.0 (0.0)	.49
1965	.48 (28.37)	-.07 (.055)	.18 (1.44)	.06 (.42)	.24
1964	.37 (16.77)	-.02 (.09)	.18 (3.97)	.26 (7.78)	.27
1963	.57 (54.86)	-.02 (.04)	-.21 (6.86)	-.14 (3.59)	.45
1962	.48 (27.03)	-.01 (0.0)	.16 (3.59)	.09 (1.17)	.25
1961	.29 (10.42)	-.19 (4.81)	-.17 (3.62)		.15
1960	.36 (17.11)	-.17 (3.67)			.17

Interpretation is the same as Table 1a except that sales growth minus asset growth is the measure of disequilibrium.

to year t profit changes in our model. For those industries which are in the first year of disequilibrium in year t, D(t-1) will be unrelated to profit changes in year t. To the extent that industries in our sample are in the first year of disequilibrium in year t we would expect the coefficient of D(t-1) to weaken.

In Table 1c we have the results for growth in sales minus the average growth in sales for the preceding three years. In Table 1d we have growth in assets as our independent variable. As expected, growth in assets individually gives no consistent pattern of coefficients and explains little of the variance of the change in profits. Growth in sales above the normal growth of sales as measured by the previous three years also does poorly in explaining variations in profits. This indicates that expectation of demand growth is not based on past demand growth as measured by the average of the last three years. To see if it was the length of time which caused this variable to do so poorly we redefined past sales growth as the average of the last two years and then as the last year.

The results for the former definition of sales growth were extremely weak and can be dismissed. The same cannot be done for the latter and they are presented in Table 1e. These results are as strong as Table 1b and are quite impressive. The unlagged coefficients are similar to those for sg-ag (positive and significant). This lends support to the contention that planned asset growth in year t is based on past sales growth from the previous year alone. It would appear that both asset growth and the previous year's sales growth are good indicators of anticipated sales growth.

There is a possibility that our specification of sg-ag is not accurate so we ran them as separate variables and give the results in Table 2.

TABLE 1c

$$d = sg(t) - [sg(t-1) + sg(t-2) + sg(t-3)]/3$$

Year	d(t)	d(t-1)	d(t-2)	d(t-3)	r**2
1967	-.09 (.76)	-.01 (.01)	-.11 (.83)	.03 (.07)	.03
1966	.41 (14.03)	.20 (3.49)	.06 (.31)	-.09 (.59)	.19
1965	.16 (2.28)	-.08 (.47)	.08 (.58)	.13 (1.46)	.04
1964	.06 (.36)	-.09 (.76)	-.19 (3.27)		.10
1963	.40 (18.75)	.07 (.52)			.20
1962	.03 (.088)				.0009

Interpretation is the same as Table 1a except that the measure of of disequilibrium is sales growth minus the average of the prior three years sales growth.

TABLE 1d

d = growth in total assets

Year	D(t)	D(t-1)	D(t-2)	D(t-3)	R^2
1967	-,37 (11.96)	.15 (2.23)	-.06 (.29)	-.19 (3.86)	.16
1966	.03 (.12)	-.05 (.37)	-.02 (.04)	-.31 (10.02)	.12
1965	.09 (.99)	.02 (.03)	.14 (2.12)	.21 (4.40)	.10
1963	.31 (10.0)	.11 (1.44)	.17 (2.52)	-.20 (3.1)	.18
1962	-.12 (1.37)	-.12 (.92)	.04 (.11)	.05 (.25)	.03
1961	.20 (3.13)	-.17 (2.29)	.08 (.89)		.11

1964 is unavailable.

Interpretation is the same as Table 1a except that the measure of disequilibrium is growth in total assets.

TABLE 1e

$D = sg(t) - sg(t-1)$

Year	D(t)	D(t-1)	D(t-2)	D(t-3)	R^2
1967	.210 (4.36)	-.357 (8.14)	-.167 (1.85)	.016 (.025)	.18
1966	.815 (62.73)	.367 (8.34)	.317 (5.03)	.190 (2.16)	.47
1965	.550 (19.97)	.092 (.30)	.052 (.14)	.064 (.48)	.25
1964	.560 (23.75)	.140 (.88)	.112 (.11)	.327 (.85)	.36
1963	.752 (63.07)	.862 (9.44)	.685 (5.29)		.50
1962	1.05 (13.90)	.827 (8.53)			.14
1961	.267 (8.49)				.07

Interpretation is the same as Table 1a except that the measure of disequilibrium is sales growth minus the prior year's sales growth.

TABLE 2

Values are coefficients from regression:

$$Dpr(t) = a + b\ Sg(t) + c\ Ag(t)$$

Year	sg	ag	R^2
1967	.064	-.086	.25
	(34.33)	(36.96)	
1966	.077	-.062	.50
	(75.57)	(19.79)	
1965	.052	-.029	.26
	(37.99)	(6.84)	
1964	.038	-.032	.21
	(24.69)	(18.38)	
1963	.060	-.027	.46
	(62.43)	(4.79)	
1962	.056	-.030	.27
	(38.94)	(11.92)	
1961	.030	-.043	.13
	(14.43)	(10.88)	

F Statistics in parentheses.

Dpr = Change in profit rates

sg = sales growth

ag = asset growth

Sources: Internal Revenue Service

Sales growth is positive and significant in every year and asset growth is negative and significant in every year. The coefficients are quite close in absolute value although sales is slightly stronger. These results lend support to our specification of sg-ag which gives equal but opposite weight to sg and ag.

III. The Time Path of Disequilibrium

We have previously noted the difficulty in interpreting these coefficients. In this section we shall present our results in a way which will clarify the pattern of adjustment to disequilibrium.

To accurately determine the pattern of coefficients would require the use of time series analysis. Since our data consist of only nine years (industry definitions changed at the beginning and end of this period) and the number of coefficients to be estimated is at least three, this approach does not appear to be very rewarding due to the limited number of degress of freedom which would be available.[11]

To determine the effects of our disequilibrium variables unhindered by the presence of the other disequilibrium variables we ran separate regressions of the form

$$dpr(t) = a + b\ dis(t-i) \quad i=0,1,2...$$

for each year.

Table 3 gives the results for sg-ag. Taking any particular coefficient and going up diagonally to the right shows the effect of that variable on future changes in profits.[12]

We find that a pattern emerges out of these coefficients. During the first year there is a positive effect on profits, as would be expected. In

TABLE 3

D = sg-ag

coefficients are from the regression:

$$dpr(t) = a+b\ D(t-i)(t-i)\quad i=0,1,2,\ldots$$

Year	D(t)	D(t-1)	D(t-2)	D(t-3)	D(t-4)
1967	.051	-.053	.029	-.009	-.021
	(22.12)	(31.36)	(4.77)	(.59)	(1.78)
1966	.084	-.04	.052	-.032	.003
	(103.8)	(8.33)	(18.11)	(3.99)	(.02)
1965	.046	-.019	.006	-.005	.006
	(31.08)	(5.0)	(.36)	(.27)	(.67)
1964	.035	-.028	-.006	.019	.009
	(28.08)	(9.62)	(.52)	(10.7)	(.55)
1963	.066	.001	-.026	-.02	.006
	(70.09)	(.01)	(18.45)	(2.29)	(.29)
1962	.042	-.01	.006	.021	
	(31.05)	(3.58)	(.03)	(4.2)	
1961	.016	-.015	-.021		
	(11.27)	(2.13)	(5.64)		
1960	.056	-.026			
	(18.27)	(4.60)			

dpr = Change in profit rates
D = Sales growth minus asset growth
F Statistics in parentheses

This table is best understood by looking at the coefficients along the diagonals. E.g., in 1963 those industries with positive values of sg-ag on average had increases in Dpr and those with negative values of sg-ag had decreases in Dpr. In 1964 however, those industries with positive values of sg-ag had decreases in Dpr and vice-versa. The slope relating sg-ag in 1963 and Dpr in 1964 is -.028 (column 2, 1964).

the second year profits generally reverse and significantly so. The coefficient lagged a year is negative in six out of seven years and significantly so in five. The one positive coefficient (1963) is followed by a significant negative coefficient the next year indicating a somewhat lengthier adjustment period. Regressions using sg(t)-sg(t-1) as our measure of disequilibrium (not shown) confirm the results of Table 3.

The coefficients lagged more than a year are similar in their lack of a significant pattern. Coefficients lagged two years are often significant but of varying signs while coefficients lagged more than two years are generally insignificant. The evidence causes us to reach two conclusions--1) disequilibrium is adjusted to within two or three years; 2) both change in sales growth and sales minus asset growth are effective and similar indicators of unanticipated growth in sales.

IV. Additional Evidence

Our interpretation of the results in the previous sections have contained references to periods of adjustment. We have shown how the length of this period plays a critical role in interpreting our results.

Our evidence indicates that the effects of disequilibrium seem to diminish to insignificance by the third or fourth year, implying that a year is not extremely short relative to the duration of disequilibrium. By the second year industries have reacted to bring profits closer to normal and the effects of disequilibrium during the third and fourth year are usually rather weak. This implies that an adequate supply of capital has moved into the industry within two or three years.

To bolster this finding we have calculated simple correlations for several variables. First we find that increases in demand are, on

TABLE 4

Simple correlations between:

Year	(1) ASG(T) ASG(T-1)	(2) SG(T) AG(T+1)	(3) SG(T) SG(T-1)	(4) SG(T) AG(T)	(5) SG(T) AG(T-1)	(6)* SG(T) AG(T+1)	(7) DPR(T) DPR(T-1)	(8) DPR(T) DPR(T-2)	(9) SG(t)-AG(t) SG(T)-SG(T-1)	(10) SG(T) AG(T+2)
1967	.11		.03	.91	-.11	-.11	-.57	-.12	.59	
1966	.38	.10	-.44	.86	-.20	-.43	-.17	-.08	.84	
1965	.20	-.19	-.01	.55	.21	.19	-.14	.03	.86	-.35
1964	.20	.60	.21	.51	.24	.43	-.28	.10	.84	.32
1963	.26	.77	-.08	.76	-0.0	-.01	-.35	.25	.86	.45
1962	.16	.32	.07	.39	.11	-.07	-.14	-.08	.56	.03
1961	-0.0	.53	.04	.97	-.32	.08	-.52		.95	-.29
1960	-.06	.21	-.05	.56	.14	.14			.83	.25
1959		.53		.60						-.52

This table gives the Pearson correlations between the variables listed at the top of each column for each year shown. SG = Sales Growth; AG = Asset Growth; DPR = Change in Profits; ASG = Absolute Sales Growth.

*Before Asset Accounting Adjustment.

average, of short duration.[13] In fact, they last less than a year. Looking at column 3 of Table 4 we find the cross sectional correlations of sales growth in year t with sales growth in year t+1 are centered closely around zero and, if anything, tend toward being negative. This is encouraging, for if the correlations had been strongly positive, it would have been difficult to accept the negative coefficient of the one year lagged term in our previous regressions.

These correlations do not rule out other possibilities. If sales return to their previous level for half the industries which had sales increases in year t and continue to grow for the other industries then the correlations would still be near zero but our conclusions about the duration of sales increases would no longer hold. Although this possibility seems unlikely we can test it by looking at the absolute value of sales changes. If this hypothesis were true the correlations between absolute sales changes should be high even though it was found to be low for arithmetic changes. Column 1, Table 4 gives these correlations. The mean is .16 which shows that demand shifts have some tendency to be followed by other demand shifts (although the direction of the latter shift is random), but that this tendency is too weak to affect our primary conclusions.

If demand increases endure for less than a year, then our next question concerns the length of time needed for assets to 'catch up' with sales. Our regressions indicated that assets had caught up by the second or third year for those industries which had fallen behind (as measured by profit levels). Columns 2, 4 and 6 give evidence indicating that this may understate the speed of adjustment of industries to a change in sales.

Column 4 gives the correlations of sales growth in time t with growth in assets also in time t. In two of the nine years the correlation is above .9 and the nine year average is .68. In column two we show the correlations between sales growth in year t with asset growth in year t+1. If asset growth was not completed within the year then this correlation coefficient should be positive. We find that it is positive with the mean being .36 which is considerably lower than those values in column four. Before the asset accounting adjustment (given in the appendix) this correlation was essentially zero as shown in column six. Apparently the six month difference in asset measurement caused this change. This implies that the majority of asset growth is accomplished with 18 months of the increase in sales. Final evidence is garnered from column 10 where sales growth in year t is correlated with asset growth in year t+2. The average correlation is -.02 thus indicating that assets have caught up within two years.

A potential objection to our regression results is that sg-ag may merely reflect changes in capacity utilization and have nothing to do with disequilibrium. For example, when demand increases and capacity utilization goes up, profits would be above that level which would prevail at lower capacity levels. When demand returned back to a lower level, profits would return to a lower level. This might be expected for industries with cyclical demand. A high value for sg-ag would be associated with increasing profit levels. One implication of this hypothesis is that sg should then predict profit changes as well as sg-ag does. In addition, the negative coefficients of sg-ag lagged one year would imply that sales increases tended to be followed by sales decreases. Since this is not the case (compare column 1 or 3 with 7) we reject this alternative explanation.

Other results can be gleaned from this table:

1) Columns 7 and 8 indicate that changes in profits are followed the next year by changes in the opposite direction but by the second year (t+2) profits do not change in any particular pattern. This reinforces our conclusion that adjustments require less than two years.

2) Comparison of columns 2 and 5 clearly shows that asset growth follows sales growth and not vice-versa. Column 5 gives the correlation between asset growth in a given year and sales growth in the next year. The average correlation is .01 whereas column 2 which correlates sales growth and asset growth for the next year shows strong positive correlations.

3) The strong correlation between our two main measures of disequilibrium is given in column 9 . The mean correlation is .79 which should explain the general consistency between these two measures.

V. Disequilibrium and the Level of Profits

We have shown how disequilibrium affects changes in profit rates. We now wish to determine the effect of disequilibrium on the level of profit rates. In particular we wish to know the degree to which interindustry variation in profit rates is due to disequilibrium.

In theory, disequilibrium has a clearcut influence on profit rates. When disequilibrium is caused by demand outstripping productive capacity, profit rates will be above normal for the industry. A disequilibrium caused by lack of demand will lead to below normal rates. Unfortunately, the variables which perform best as indicators of disequilibrium do not distinguish between these two cases. It is readily apparent that if both types of disequilibrium (excess demand and excess supply) occur with equal frequency and intensity and have identical adjustments then our best measures of disequilibrium (sg-ag and sg(t) - sg(t-1)) should have no relationship to profit rates.

Sales growth, which was found to be a weak measure of disequilibrium per se, does not suffer from this drawback. Based on Figure 2 it should be a good predictor of the type of disequilibrium which is occurring, if one is occurring at all. When industry sales growth is above normal (the average of all industries), it is likely that industry profits will be above normal. The opposite is true for below normal sales growth.[14] We may expect that sales growth will have a more powerful effect on profit rates than our superior measures of disequilibrium unless there is a great preponderance of either excess demand or supply disequilibrium in a given year. This was diagrammed in Figure 2. We now put this expectation to the test.

In Tables 5a and 5b, we regress equations of the form:

$$PR = a+b\ D(T) +c\ D(t-1) +d\ D(t-2) +e\ d(t-3)$$

where Pr is the rate of profit and D stands for our various measures of disequilibrium, as before. We have previously taken note that sg-ag and sg(t) - sg(t-1) should have no effect on profits if there are an equivalent amount of excess demand and excess supply disequilibria. We would not expect this to be the case due to the cyclical nature of the economy, however.

Comparing the power of these results for our different measures in Tables 5a and 5b we find our general expectations upheld. Growth in sales is more powerful in predicting profit rates than the other measures which proved superior in predicting disequilibrium.[15] In every year, it explains more of the variance of profit levels than our other measures. Our other measures give significant results for many individual years implying that excess demand and excess supply disequilibrium are not symmetrical with regards to their frequency or that the disequilibrium response is not symmetrical over its life. Interpretation of these coefficients is difficult for the same reasons as set forth previously in our discussion of Tables 1a-1e.

It is clear that sales growth does have an influence on profit rates. From Table 5a it appears to be able to explain about 15% of profit variation. Thus past studies which have used sales growth as a measure of disequilibrium in an attempt to explain profit rates have not been off base. Some studies have used sales growth over five or ten year periods of time, however, and based on our results of the last section such a procedure is incorrect.[16]

TABLE 5a

Profit rate regressed on growth in sales

Year	D(t)	D(t-1)	D(t-2)	D(t-3)	R**2
1967	.011 (3.73)	.025 (14.41)	.050 (13.92)	.007 (.309)	.16
1966	.054 (40.12)	.060 (14.25)	-0.0 (0)	-.003 (.04)	.31
1965	.062 (26.52)	.014 (1.17)	.008 (.51)	.025 (2.11)	.26
1964	.035 (7.44)	.013 (1.36)	.018 (1.07)	.004 (.66)	.11
1963	.037 (11.03)	.018 (1.36)	-.002 (.26)	.013 (.53)	.17
1962	.032 (3.51)	.005 (1.17)	.024 (1.96)	.010 (.31)	.08
1961	.008 (2.55)	.021 (1.59)	-.005 (.089)		.05
1960	.046 (6.22)	-.001 (.005)			.05

F Statistics in parentheses
Source: Internal Revenue Service

TABLE 5b

Profit Rate regressed on sales growth minus asset growth

Year	D(t)	D(t-1)	D(t-2)	D(t-3)	R^2
1967	.006 (.25)	.008 (.40)	.030 (4.42)	.037 (7.28)	.12
1966	.070 (20.12)	.032 (2.91)	.032 (2.92)	.046 (4.04)	.22
1965	.048 (9.12)	.020 (1.67)	.054 (7.59)	.022 (1.70)	.11
1964	.026 (3.54)	.042 (5.36)	.018 (1.08)	.002 (.06)	.06
1963	.046 (8.76)	.003 (.03)	-.15 (2.10)	.020 (1.06)	.13
1962	.008 (.23)	.003 (.09)	.040 (3.55)	.005 (.06)	.03
1961	.011 (1.14)	.027 (1.62)	-.012 (.44)		.04
1960	.047 (4.44)	.006 (.11)			.04
1959	.029 (2.69)				.02

F Statistics in parentheses.
Source: Internal Revenue Service

VI. Testing a Marshallian Hypothesis

In this section we use our measure of disequilibrium to test a hypothesis, proposed by Marshall. The results are indicative of the potential of our methodology in testing various hypotheses. It is possible that macro uses exist as well as micro uses.

It is well known that firms with durable or specialized assets will react to demand fluctuations with short term adjustments. Having durable or specialized assets tends to increase the divergence between short run and long run supply curves (as do long term contracts). We would thus expect these firms (industries) to be the most strongly affected and to have the strongest reaction to disequilibrium. This proposition was tested by Stigler (1963) who constructed a measure of disequilibrium adjustment speed based on the movement of an industry's profits toward its average from peaks and troughs. The ratio of fixed to total assets was used as a proxy for the degree of durable and/or specialized resources. When Stigler correlated disequilibrium adjustment speed with the degree of durable assets the coefficient was insignificant and of the wrong sign.

It is unclear whether the ratio of fixed to total assets is the appropriate measure of a firm's inertia to new market conditions. The relative importance of assets in the production process is a parameter which also needs to be taken into account but is neglected in Stigler's measure. One possible way to take this parameter into account is to calculate the capital-output ratio.

We are now in a position to further test this hypothesis. We use both the capital-labor ratio and the ratio of depreciable assets to total

assets as proxies for durability. We can then examine the effect of sg - sg(t-1) on Dpr for those industries with higher degrees of specialized resources and those industries with low degrees of specialized resources. The results are portrayed in Table 6.

From the results it appears that the capital-output ratio is a superior measure of the inertia of various industries to demand shifts than is the ratio of depreciable to total assets. The former variable shows a much stronger dichotomy in behavior between industries with high and low values. Low valued industries (column 3) show almost no measurable disequilibrium whereas high valued industries (column 4) show the normal strong positive association between change in profits and sales growth minus asset growth. The coefficients in column 4 are higher in all but one instance than the coefficients in column 3 which is indicative of a more pronounced disequilibrium.

The latter variable (used by Stigler) gives much weaker results. The coefficients in column 2 are on average slightly higher than those in column 1. Both groups appear to react to disequilibrium with similar adjustments.

Columns 5-8 give the relation between the change in profits in year t with the disequilibrium measure from year t-1. In other words, if sales unexpectedly increase in 1964 what happens to profits in 1965? It is not clear what kind of behavior we would expect in industries with high degrees of inertia. On the one hand, we would expect industries with a high degree of inertia to have the strongest disequilibrium, as already confirmed. On the other hand we would expect these industries to react most slowly to the disequilibrium. The first effect should make the coefficient of D(t-1) negative but the second effect would tend to make it positive. For these reasons no conclusion can be drawn regarding the pattern of coefficients expected in columns 5-8. These coefficients are included merely for the sake completeness.

TABLE 6

Behavior of high and low inertia industries

	D(t)				D(t-1)			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Year	Low f/t	High f/t	Low K/0	High K/0	Low f/t	High f/t	Low K/0	High K/0
1967	.020	.049	-.006	.035	-.029	-.014	-.01	-.037
	(2.01)	(21.6)	(.1)	(3.2)	(5.9)	(.6)	(.2)	(4.1)
1966	.022	.061	.025	.105	-.020	.001	-.003	-.090
	(2.97)	(15.5)	(1.0)	(58.6)	(2.9)	(.0)	(.01)	(3.4)
1965	.044	.014	-.01	0	-.027	.005	-.048	-.009
	(17.38)	(1.0)	(.1)	(0)	(2.3)	(.2)	(4.4)	(.5)
1964	.033	.050	.018	.032	-.028	-.24	-.017	-.043
	(6.83)	(27.2)	(1.1)	(8.3)	(4.0)	(1.4)	(1.1)	(4.6)
1963	.028	.044	.038	.124	-.028	-.003	.018	.019
	(12.5)	(13.1)	(4.1)	(69.9)	(6.3)	(.03)	(.6)	(.4)
1962	.015	.023	.076	.046	-.018	-.021	-.064	.006
	(.8)	(2.8)	(8.6)	(14.0)	(.9)	(2.0)	(5.0)	(0)
1961	.040	.009	-.047	.013	-.01	.005	-.027	.045
	(14.2)	((.2)	(2.9)	(9.8)	(.7)	(.1)	(1)	(7.6)
			.003	.063			.016	-.049
			(0)	(14.7)			(.1)	(6.8)

Columns 1-4 give disequilibrium coefficients (F-statistics in parenthesis) of regression Dpr = a + b D(t).

Columns 5-8 give coefficients for Dpr = a + b D(t-1).

f/t = ratio of fixed to total assets
K/0 = capital output ratio
N_1 = 23
N_2 = 25
N_3 = 18
N_4 = 20

} number of industries in each column

F Statistics in parentheses
Source: Internal Revenue Service

There are several other factors influencing this particular test which could work to weaken or alter the results; 1) the relative specialization of fixed and total assets; 2) the relative degree with which demand shifts are anticipated by the two groups of industries; 3) the relative degree of long term contracts in two groups. It is hoped that future research will look into these problems.

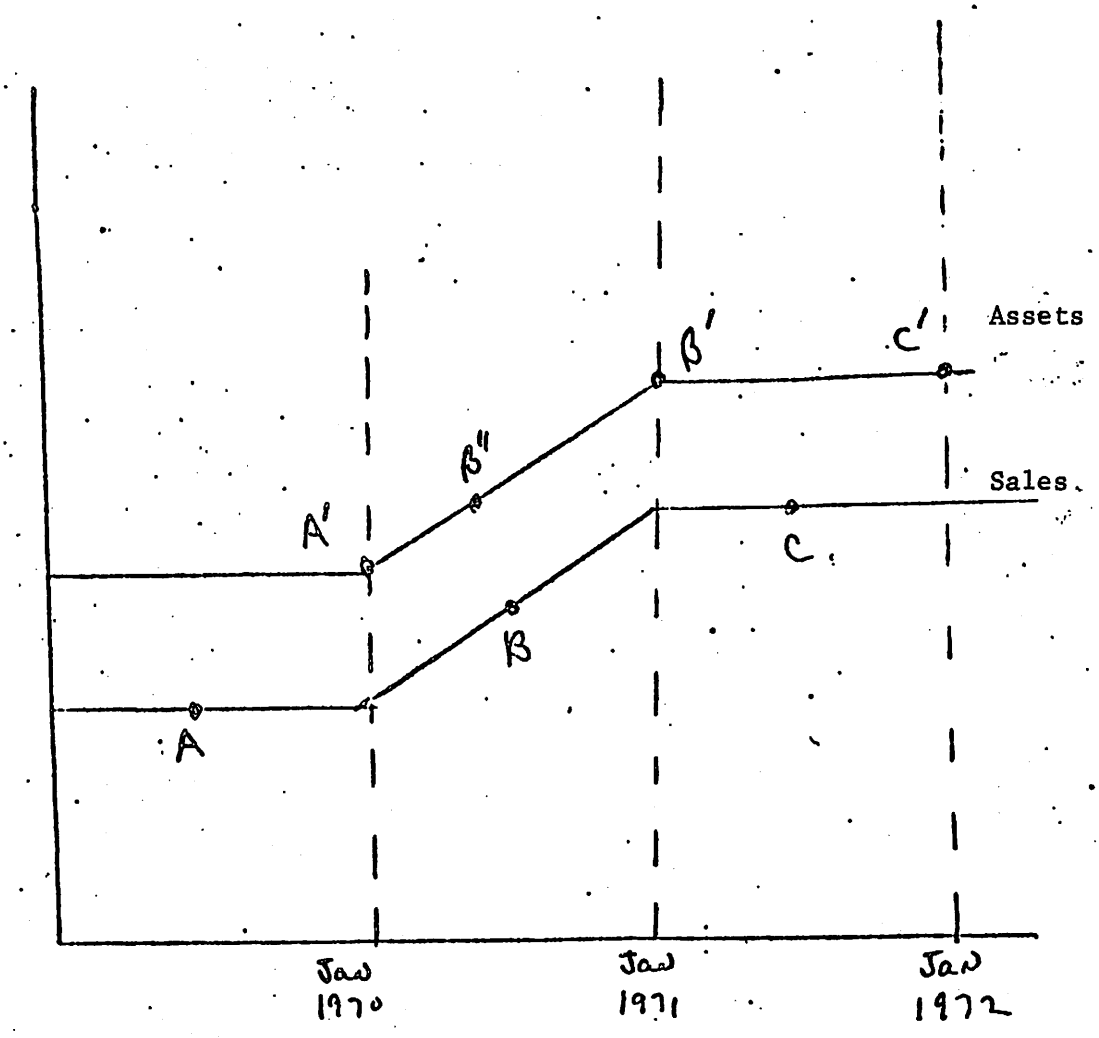
APPENDIX

A problem with yearly data concerns the reporting period. We make use of a measure which consists of sales growth minus asset growth. IRS data is based on annual income statements of firms. Sales are given as a flow for the year. Assets, on the other hand, are measured as an end of year stock. If we assume smooth changes in both sales flows and asset stocks then asset growth and sales growth as measured by IRS data will be six months out of phase. This can be better understood with the help of Figure 3.

We have drawn our diagram such that there is no disequilibrium since asset growth exactly matches sales growth. Both sales and assets are twice their January 1970 level in January 1972. With yearly IRS data we would measure sales growth as 50% from A to B (1969 to 1970) and then 33% from B to C (1970 to 1971). Asset growth would be measures as 100% from 1969 to 1970 (A' to B') and 0 from 1970 to 1971. Asset growth appears to grow faster than sales growth from 1969 to 1970 and then slower from 1970 to 1971. Since profits don't change in any of these years, such a system of measurement will weaken any measured relationship between profit changes and sg-ag. Additionally, we would expect certain biases to exist in our previous results. Our theory of disequilibrium assumes that asset changes lag behind sales changes. Our measurement of these variables tends to move asset changes 6 months forward, thus possibly underestimating the lag of response.

We can attempt to circumvent this problem by bringing our measurements back into phase. This is done by taking the surrounding year-end measurement of assets and averaging these quantities to get a middle of the year measure. In Figure 3 this would consist of averaging A' and B' to get average assets for 1970 giving us point B''. B'' is not exactly in phase with B but it is much closer. Using this improved data we expected our regressions to give a better fit which they did.

FIGURE 3



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FOOTNOTES

[1]Various measures were used with differing results in each of the following studies: Brozen, 1971; Comanor and Wilson, 1967; Hall and Weiss, 1967; Leabo and Winn, 1974; Ornstein, 1973; Rhoades, 1973; Stigler, 1963; and Wenders, 1971.

[2]This is to be distinguished from an anticipated temporary demand shift. In this case, firms will move along their 'short-run' supply curve. However, this will be a different 'short-run' curve than the one in the text because the firms are able to change their capacity in order to take advantage of the anticipated temporary demand shift. The industry earns no long-run economic profits although accounting rules might make it seem as if it does.

[3]None of the industries in our sample is thought to be a 'natural monopoly'.

[4]Except as certain industries are hit harder by inflation than others. The variance of this effect will probably still be smaller than yearly fluctuations in inflation rates.

[5]That is, if we had data based on end of decade observations, we would not be able to observe most disequilibriums that occurred within the decade and which had already been fully adjusted to.

[6]Other possible measures of disequilibrium can be constructed. Any variable which indicates that a firm has been caught off guard (changes in overtime pay, changes in inventories, etc.) is a potential candidate although these other measures are not further examined in this paper.

[7]In the scenario presented above profit changes were the result of disequilibrium, not a cause of it. For this reason it plays a different role than the other variables in the empirical testing to follow.

[8]Assets are adjusted six months to be in phase with sales. Our results would hold even without this adjustment. See appendix.

[9]See Solomon, 1970 for an articulation of this problem.

[10]Sales do not increase during year t+2 but the average level of sales is higher than the level in year t+1. From year t+1 to t+2 we find a negative relationship between profit changes and sales changes but this relationship is not as strong as the positive one between years t and t+1.

[11]In addition, time series would give us a different pattern for each industry. Running a cross section as we do enables us to judge whether there is a pattern of adjustment across industries. At the moment, it is the similarities of the adjustments which interest us.

[12]For example in column 1 for year 1963 a very significant positive coefficient of .066 was found. This means that industries with large values of sg-ag had large values of dpr and those with small values of sg-ag had small values of dpr. The second column in year 1964 shows a significant negative coefficient of -.028, implying that those industries with large values of sg-ag in 1963 had small values of dpr in 1964.

[13]This means that demand increases are not followed by other demand increases. It does not mean that the demand increases are temporary.

[14]We assume that most industries have similar growth rates and that when one industry registers an above normal growth rate it will be indicative of a short-run unanticipated phenomenon. To the extent that industry growth rates differ in an anticipated fashion, sales growth will be unable to predict disequilibrium.

[15]Results using change in sales growth are not shown because of a similarity to Table 5b.

[16]Comanor and Wilson use a ten year period to measure sales growth and then try to explain profit rates over a four year period. With such an inappropriate procedure it is not surprising that they obtained insignificant results.