Faculty Working Papers

RISK, THE RATE OF RETURN AND THE PATTERN OF INVESTMENT IN NINETEENTH CENTURY AMERICAN INDUSTRIALIZATION

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Summary:

Economic theory predicts that market forces under conditions of uncertainty will work to equalize risk-adjusted rates of return across all activities by directing additional investment towards those activities with excess returns per unit of risk and away from those with lower returns per unit of risk borne. This adjustment process, however, appears to have operated only very weakly, if at all, in mid-nineteenth century manufacturing. Excess returns persisted over time and across industries and failed to attract the needed additional investment in any systematic manner. This market failure was apparently most complete in the South and may account for the slower pace of industrialization in America and the relatively backward position of the South.

RISK, THE RATE OF RETURN AND THE PATTERN OF INVESTMENT IN NINETEENTH CENTURY AMERICAN INDUSTRIALIZATION*

Long-run equilibrium under conditions of atomistic competition requires that all firms earn only normal profit. This condition comes about because excess profits attract additional investment while below normal profits lead to the reallocation of resources to other, more profitable, activities. In the former case, existing firms expand and new ones enter the more remunerative industry, increasing the supply of the product and, ceteris paribus, driving down price to equality with the minimum long-run average cost. In increasing cost industries, the adjustment process is hastened by rising costs due to the upward pressure on factor prices. There are circumstances, such as a pure monopoly with effective barriers to entry, in which a different theoretical result prevails, but these are viewed as exceptions. In reality, the many conditions subsumed under the ceteris paribus assumption do not hold long enough for equilibrium to be reached, but even so the expectation is that there would be a tendency towards equilibrium signalled by a flow of resources towards the industry with the super-normal profits.

This basic theory has prevailed from at least the time of the Wealth of Nations and underlies much empirical work such as that of Bain, his followers and his critics. Bain's entry inducing price, for example, (Bain, 1956) is the analog of profit induced investment. Moreover, these basic premises are at the heart of empirical work on investment behavior. Much of this work (Jorgensen, 1971; Kuh, 1963; Meyer and Kuh, 1957) has, however, rejected the profit adjustment hypothesis as a major determinant in investment decisions. These tests, however, cannot reject the classical hypothesis which states only that excess profits indicate where additional investment should go and should, eventually, induce sufficient new investment to eliminate the excess. Those empirical tests have been concerned with the volume of investment, and not simply its direction or efficacy in eliminating excess profits. The volume, of course, depends on a number of things, such as the physical production relationships for the firm, the price elasticity and growth of demand, technological change and on investor expectations. Further, the theory of investment is chiefly concerned with the explanation of capital accumulation along an equilibrium growth path, where profit differentials should theoretically be non-existent. Empirically, profit differentials did exist, but often the industries and firms under study were not far from the norm of profits. Overall, therefore it is not surprising that the profit thesis has not fared well. Hence it is of some interest that the one detailed study of nineteenth century investment found that profits were a significant explanatory variable in accounting for investment in the New England textile industry. (McGouldrick, 1968).

The major empirical studies of investment to date have not taken risk into account when formulating their profit tests. Differences in profits across firms and industries have been treated as being equally riskless, assuming, implicitly, that all above average profits are excessive and equally attractive to the investor with normal preferences. Very few studies have examined the economy's response to profit differentials after allowance has been made for the greater risks inherent in some activities, and none of the major studies of investment (e.g. Eisner (1964); Hickman (1965); Kuh (1963); Meyer and Kuh (1957)) allowed for risk, largely, it appears, because they treat profits as influencing investment through the supply of funds, not simply as an incentive.[1] Stigler (1963) did examine the relationship between risk and profit, but found it unimportant. However, he did not consider risk when testing the relationship between profit and investment. Two recent studies have tried to determine the extent to which risk explains persistently high rates of return in some industries. Joy and Litzenberger (1973) found that the rates of return in certain industries were higher than could be justified by the greater risk exposure, and that they persisted at that level. In their view, the inadequate investment response reflected the effect of barriers to entry. More recently, Bothwell and Keeler (1976) have considered the effects of market structure and risk on rates of return. Using their more precise measure of the impact of portfolio risk on return, they found that the risk variable did have the correct sign and was significant, but so too were the market structure variables. Both risk and market power served to raise returns. Their conclusion that "correctly adjusting profits for risk does not alter the basic relationship between market structure and market performance," corroborates the view of Joy and Litzenberger.

The rate of profit earned by manufacturers during the period 1850 through 1870 appears to have been quite high (Bateman, Foust and Weiss, 1975; Bateman and Weiss, 1976 and 1977). The most recent estimates for a number of industries for the nation as a whole are give in Table 1.[2] Rates of return clearly varied among industries and over time. They also varied between areas, although the latter are not shown here. In this paper we propose to examine the economy's response to these profit differentials in about 60 industries at the national level and a somewhat smaller number at the regional level.

Our standard economic theory has traditionally ignored the element of risk, prefering to deal instead with a world of certainty. Risk, however, was certainly present in nineteenth century manufacturing and neither the would-be impartial investor nor the manufacturer could have been ignorant of it. Market forces, to the extent that they worked in the manner traditionally assumed, and to the extent that they recognized and measured risk, should work to equalize the risk-adjusted rates of return, rather than the nominal ones. The risk came from many sources, such as uncertain machine or labor performance, entrepreneurial failure and market uncertainties. Moreover, some risk was industry specific, while other risks were more general. To the extent that our data represent random samples of firms, we assume that the variability of industry rates of return about their means reflect the degrees of risk in those industries. Risk averse investors would only be willing to assume greater risks if rewarded by higher returns. That is, given two choices A and B which offer the same expected rate of return, the risk averse investor would prefer the one with lower variability. The degree of

TABLE 1

RATE OF PROFIT IN MANUFACTURING IN THE UNITED STATES
1850-1870 BY MAJOR INDUSTRIES

INDUSTRY	1850 μ	1850 σ	1860 μ	1860 σ	1870 μ	1870 σ
Agricultural Implements	.230	.436	.213	.421	.124	.395
Blacksmithing	.395	.737	.302	.499	.552	.490
Books and Shoes	.318	.514	.341	.508	.620	.648
Brick Making	.008	.540	.135	.723	.206	.724
Clothing	.129	.352	.211	.363	.270	.369
Cooperage	.142	.478	.191	.469	.218	.438
Flour Milling	.221	.526	.233	.422	.193	.841
Furniture	.251	.436	.211	.415	.310	.373
Iron, Bar	.008	.308	.210	.253	.051	.219
Iron, Cast	.218	.291	.242	.386	.180	.335
Iron, Pig	.220	.559	.092	.304	-.016	.118
Leather	.227	.402	.234	.522	.213	.365
Lumber Milling	.224	.392	.233	.402	.173	.434
Machinery	.168	.361	.310	.430	.185	.274
Meat Packing	.290	.546	.427	.586	.631	.510
Printing	.331	.396	.313	.403	.322	.378
Saddlery	.335	.591	.397	.672	.385	.588
Textiles, Cotton	.002	.160	.136	.205	.185	.303
Textiles, Woolen	.100	.233	.206	.388	.140	.281
Tin, Copper and Sheet Iron	.354	.493	.228	.392	.284	.382
Wagons and Carriages	.216	.354	.238	.358	.257	.360
All Industries	.261	.529	.259	.475	.293	.568

Source: Computed from the Bateman-Weiss Manuscript Census Samples.

risk aversion depends upon the shape of the individual's utility function and, hence, the extent to which rates of return have to be adjusted so that an individual would be indifferent between two opportunities bearing different risks varies from person to person.

One way to assess the importance of risk is to try to measure how much of a given rate of return represents a premium for bearing risk and how much represents a "riskless" rate of return. This may be done by estimating the simple OLS equation:

$$E(R) = R_f + b \cdot \sigma$$

where E(R) is the mean rate of return in an industry and σ is the standard deviation of individual firm rates of return about the mean (Stigler, 1963; Fisher and Hall, 1969; Cootner and Holland, 1979). This equation defines what has been called the Capital Market Line in the theory of Finance (Sharpe, 1964). The coefficient of σ indicates the importance of the risk premium and represents the increase in the mean rate of return necessary to compensate the investor for a unit increase in the risk. The constant term in the equation, R_f, represents the "riskless" rate of return.[3]

Table 2 presents the regional and national estimates of this equation for the three census years, 1850, 1860 and 1870. The results provide very strong support for the notion of risk aversion.[4] Investors demanded and received quite high risk premiums for bearing additional risk. In 1850, the risk premium was highest in the West, somewhat lower in the South and lowest in the North. To the extent that investor-appraisals of risk are in part conditioned by experience

TABLE 2

THE RELATIONSHIP BETWEEN RISK AND THE RATE OF RETURN IN MANUFACURING INDUSTRY BY REGION, 1850-1870[a]

(Standard Errors in Parentheses)

YEAR/REGION[b]	CONSTANT (=Riskless Rate of Return)	b (=Risk Premium)	NUMBER OF INDUSTRIES	$\bar{R}^2$
1850				
North	-.040 (.057)	.620** (.162)	47	.228
South	-.092 (.074)	.872** (.155)	43	.421
West	-.170† (.080)	.992** (.140)	42	.546
U.S.	-.119† (.041)	.803** (.086)	66	.570
1860				
North	.022 (.041)	.593** (.106)	53	.367
South	-.153† (.056)	1.108** (.115)	38	.715
West	-.013 (.056)	.568** (.110)	41	.393
U.S.	.068 (.039)	.472** (.090)	66	.288
1870				
North	.086 (.049)	.554** (.126)	38	.330
South	.005 (.048)	.714** (.071)	34	.752
West	.059 (.082)	.546** (.188)	39	.164
U.S.	.097 (.052)	.401** (.110)	57	.181

Table 2 Continued.

[a]The estimating equation was $E(R) = R_f + b\sigma$, where $E(R)$ is the mean industry rate of return and σ is the standard deviation of that return. All estimates are OLS.

[b]Regions as follows:

North: CT, DE, DC, ME, MD, MA, NH, NJ, NY, PA, VT
South: AL, AR, FL, KY, MS, NC, SC, TN, TX, VA, WV
West: CA, IL, IN, IA, KS, MI, MN, MO, OH, OR, WI

**Significantly greater than zero at the one percent level.

†Significantly different from zero at the five percent level.

(i.e. adaptive expectations), this pattern is consistent with the pattern of regional manufacturing development. By 1860, the risk premiums fell in both the North and West and fell again between 1860 and 1870 which would be consistent with the accumulation of knowledge and experience and the flow of investment between the Atlantic and New England states and the mid-West. Indeed by 1860 the risk premium in the West was virtually identical with that demanded by investors in the north-eastern states.

While the risk premium demanded in the South also fell between 1860 and 1870, the trend between 1850 and 1860 runs opposite to that in the other regions. Before the Civil War, the southern investor apparently became much more risk averse so that in 1860 the southern investor demanded almost double the incremental return per unit of risk required by other investors. Although, the risk premium fell between 1860 and 1870, the risk premium of the southern investor in 1870 was still 30 percent above that of the typical northern or western investor. This behavior is consistent with the "safety-first" behavior of the southern agriculturalists at this time who preferred a more diversified, and hence, less risky, mix of agricultural crops before the Civil War (Wright and Kunreuther, 1975).

The differential levels of risk aversion across regions and over time suggest that investor responses to a market investment stimulus were also likely to have varied. The traditional view has been that in the Northeast and Midwest the response was generally in the right direction while in the South it called forth a totally inappropriate response; inadequate not only in size but even in direction. Thus, for example, the southern planter continued to invest in more land, more slaves and more cotton despite the publicity accorded manufacturing by champions of industrialism such as William Gregg or James Hammond and by newspaper and magazine accounts of successful enterprises and the various Commercial Conventions (Mitchell, 1928; Wender, 1930; Genovese, 1965; Lander, 1969). Even more recent work has suggested that the competitive predictions of a flow of investment into those fields with the highest excess return per unit of risk were not fully met during this period in terms of equalizing risk-adjusted returns (Bateman and Weiss, 1976 and 1977). We propose to examine this further in the light of more complete data.

Excess return per unit of risk is defined as:

$$\frac{E(R)_j - R_f}{\sigma_{E(R)_j}}$$

where $E(R)_j$ is the mean rate of return in industry j,

R_f is the riskless rate of return,

and $\sigma_{E(R)_j}$ is the standard deviation of the industry mean rate of return.

In modern studies of capital markets, the "riskless" rate of return is usually thought of as the rate of return on short-dated Treasury bonds, while in the nineteenth century, the <u>numeraire</u> most frequently used by modern researchers has been the rate of return on railroad bonds, namely 6 percent. It is doubtful, however, whether the 1850 investor would have felt very secure with any then existing interest paying asset. The 1840s had witnessed, for example, default on state bonds and drastic declines in the prices of railroad stocks (Taylor, 1951).

Indeed, our estimates of the "riskless" rate of return in 1850 were not significantly different from zero in the North and South (which had the most developed capital markets and lowest risk aversion) and were significantly less than zero in the West and for the nation as a whole in 1850. That is, in the West and in the United States, the 1850 investor in manufacturing was willing to pay for certainty. Thus, for example, the investor in the West in 1850 was willing to pay 17 cents for the privilege of receiving a dollar with certainty a year hence. The "riskless" rate of return rose slightly in 1860 and 1870 to 6.8 percent in 1860 and 9.7 percent by 1870 for the nation, however, it was never significantly greater than zero and the western rate was below the eastern rate. In the South in 1860, the "riskless" rate of return was estimated to be significantly negative reinforcing the risk-averse, "safety-first" behavior which we have already mentioned. The "appropriate" value for R_f is therefore not self-evident.

One approach would be to use the estimates in Table 2 of the riskless rate of return in each region and year but those estimates are based upon a portfolio containing only investment opportunities in manufacturing. The traditional, approach has been to specify some market return as a proxy for the riskless rate. While this rate may be somewhat appropriate for New England and the Middle Atlantic states in 1860 it is doubtful whether it is a good estimate in other years and for other regions. We have nevertheless used such estimates of R_f but have compromised by not using a straight 6 percent.[5]

Risk-adjusted profitability assumes that the investor can borrow and lend at the "riskless" rate. However, the entrepreneur-investor is unable to engage in any further investment diversification. That is, he can choose only investment combinations involving a single, risky manufacturing enterprise and lending or borrowing at the riskless rate. He cannot try to maximize his expected return by investing in several different risky ventures. Today, with the sophisticated investment analysis, the rise of corporate ownership and the complex and smooth working capital markets available, such an assumption is unreasonable. For the mid-nineteenth century investor this is not the case. The typical industrialist of this era invested in a single firm, one which could be supervised personally. The major investment decisions were constrained by the inability to divide one's entrepreneurial talent. Our assumption, then, does not grossly misrepresent the situation of that time.

The first test applied to the risk-adjusted data was to determine whether the persistence of high profits was due to chance or whether it was systematically related to industrial classification and time. The null hypothesis in each case was that the excess returns per unit of risk were due solely to chance against the alternative hypothesis that there was some non-random pattern to the high return which persisted across industries or across time. The form of the test was a fixed effects, completely randomized, 2-way analysis of variance with one observation per cell which is the same as the fixed effects, randomized block, one-way ANOVA model except for its interpretation (Yamane, 1973). The results are summarized in Table 3. As can be seen, the null hypothesis, that persistently

TABLE 3

PERSISTENCE OF EXCESS RETURNS PER RISK UNIT

1850-1870

(Summary of 2-way ANOVA model, fixed effects, one observation per cell[a])

Source of Variation	F-Values			
	North	South	West	U.S.
Industry	1.920* (31,64)	.939 (27,56)	1.064 (32,66)	1.691* (50,102)
Time	2.723† (2,93)	4.132* (2.81)	17.649** (2,96)	16.946** (2,150)

Figures in parentheses are degrees of freedom

[a]See Yamane (1973).

†Significant at the 10% level.

*Significant at the 5% level.

**Significant at the 1% level.

high excess returns per unit of risk were due to chance, is rejected in five of the cases considered.[6] In the South, West and for the nation, chance is rejected because the time effect is significant. Indeed, at the ten percent level of significance, the null hypothesis is rejected in each case because of the persistance of excess returns per unit of risk over time. In two instances, the North and the U.S., the industry effect also proved significant. As the North was the most heavily industrialized region and often characterized as the most market oriented, this former result is particularly noteworthy and the significance at the national level probably reflect the dominance of manufacturing in the North.

In all regions, but particularly in the West, these results point to substantial time lags in the adjustment to profit differentials. Moreover, investors in the North were also apparently reluctant to take advantage of profit differentials between industries. In short, this test indicates that the market system failed in its task of equalizing risk adjusted rates of return and this market failure was more general rather than specific to a particular region (i.e. the South) as often assumed.

The failure of the market to eliminate profit differentials does not necessarily imply that the market had ceased working to reduce or eliminate them. In reality, adjustments are not instantaneous. There are lags and delays in all stages of the process from the perception of these differentials, to the spread of knowledge about them and investor response to them. Equilibrium conditions, too, posit that other things have not changed. Yet, in this tumultuous period of industrialization other things were continually changing. Thus, we need to determine whether the investment response, which was clearly inadequate to the task of substantially reducing profit differences (much less equalizing them), might have been correct to some degree. We have attempted to do this in several quite simple ways, performing tests that are much less complex than the equations and models used in recent studies of investment demands. This greater simplicity reflects the nature of the data available to us rather than a conscious decision that the more sophisticated approach is inappropriate.

Given the nature of these data, our formulation of the test was severely restricted. For one thing, the lack of data on capacity, utilization rates and annual sales precluded consideration of any accelerator effects. In our view this was not a severe handicap. Our purpose was not to predict precisely the pattern and timing of investment demand, but rather to test the proposition that investment responded to excess profits. Simple correlations between profit and investment have proven positive in some studies of the twentieth century (Meyer and Kuh (1957); Eisner (1960)) even though more complex models have predicted investment better and have minimized the role of profits as an explanatory variable (Eisner, (1960) Kuh, (1971)). Further, most studies show that profits are correlated with these other variables (viz. sales or sales/capacity) which better explain investment demand. Thus, the exclusion of these other variables served to increase the expectations of a positive relation between profits and investment.

Our reliance on benchmark data on profits and decadal changes in capital poses a different problem, but again one which does not seem intolerable. These data may not reflect accurately the behavior of the profit and investment variables during intervals between census dates, but this is not really necessary. Studies of investment stress the time lags involved in the process, with lags of up to two or three years having been used successfully. Bain (1956) argues for the use of a five to ten year period to represent the long run adjustment to equilibrium. In earlier times the lags were almost certainly this long. On the profit side, the question is twofold, does the point estimate of profit reflect the profit experience of subsequent years, and does it reflect investors' expectations about profits.[7]

We have performed three tests designed to measure whether or not market forces were working according to competitive predictions, despite their failure to eliminate the excess returns per unit of risk across time and industries. These tests vary in their statistical power and in the strength of their fundamental assumptions. For each, the null hypothesis of the competitive prediction is that an excess rate of return per unit of risk led to additional investment in that activity, while a low return per unit of risk, discouraged investment.

However, these tests also require judgment as to whether or not the observed increase in the capital stock was consistent with the equilibrating adjustment process. This depends upon a variety of factors about which we have very limited information. But on the production side we do have evidence indicating that almost all manufacturing industries were operating in the range of constant returns to scale, so that whatever increases in output were necessary to make price equal to average cost would have given rise to proportionate increases in capital (Atack, 1976). Similarly, increases in demand would also be accompanied by proportionate increases in capital. What remains then is whether some industries experienced a more rapid rate of technical change and/or more rapid growth of demand over the subsequent decade. The former, if neutral in nature, would mean a less than proportionate increase in capital for each increase in demand. The latter would mean above average increases in capital.

We know little about the pace of technical progress in a quantitative sense and less about its differential advance across industries during the nineteenth century. The estimates of Gallman (1960) suggest that in the aggregate the pace of technological change was not of great importance in accounting statistically for the growth of output during the nineteenth century and others agree with this at least until the 1870's (Davis, 1971). Estimates of industrial production functions where a technological change variable is included, are consistent with these historical claims. Of the twenty-three industries for which such functions were fitted, the coefficient of technological change is significantly positive in only eight cases.[8] Of these eight, only two (boots and shoes, and saddlery) are industries of major importance. Of course, in some industries the technical change which did occur has been seen as labor-saving, so its impact on the growth of capital could influence some industries more than others (Uselding and Juba, 1973).

On the demand side we know only that, in general, one would expect manufacturing to experience greater increases than farm products during this period because of its greater income elasticity of demand. However, we do not know how large the difference would be. For 1875, Williamson (1967) found that manufactured products, such as clothing, dry goods and sundries had higher expenditure elasticities than did food items. Since food products are also manufactured items and non-food items create a demand for farm products such as cotton and wool, the differences in the growth of demand between agricultural and manufactured goods may not have been very great. But in the aggregate, the evidence on value-added shows that manufacturing grew by 338 per cent between 1849 and 1879, somewhat faster than the 213 per cent figure achieved by agriculture (Gallman, 1960). In constant prices, the percentage increases were 302 and 162 per cent. Of course, within the manufacturing sector the differences in income elasticity of demand could have produced substantially different rates of growth of demand. This should not influence our sign test of the relationship between profit and investment, but could distort the other tests where greater precision would be necessary to obtain unambiguous results and may explain some of the results reported below.

The strongest test we have used, both in terms of its assumptions and its potential results, is a simple linear regression asserting that the level of excess returns in the base year determined the percentage increase in investment in the industry during the course of the ensuing decade. The results, as shown in Table 4, offer no support for such a strong hypothesis. Excess returns per unit of risk explain virtually none (less than ten percent, at least) of the variability in the changes in the level of investment by industry. In no case is the regression coefficient of excess returns significantly different from zero, let alone greater than zero as implicit in our formulation of the test. Indeed in a number of instances the coefficient had a negative sign attached to it though no weight was given such results.

The failure of the data to pass the test of market responsiveness led to our applying a weaker test, namely a rank correlation test. Once again our null hypothesis that markets worked in the manner described by our economic theory required merely that higher excess returns be associated with greater percentage increases in investment during the following decade. This hypothesis was rejected in every case at the 5 percent level. The results are shown in Table 5.

A variety of explanations for the failure of the data to pass our simple market tests are possible. The most controversial is, of course, that markets did not work, thereby assuming that our tests are appropriate and our data accurate. While we believe that our data accurately measure the levels and variabilities of profitability during the census years we are less willing to defend strongly our claim that the measured profitability can serve as a proxy for investor expectations during the following decade or for a period equal to a decade minus the gestation period of the investment although we do not consider that claim to be implausible. We have therefore formulated a third test which is biased

TABLE 4

OLS Estimates of the Relationship Between the Increase in Industry Investment Over the Course of a Decade and the Excess Return Per Unit of Risk in That Industry in the Base Period, 1850-1870

Dependent Variable	Coefficient of the Excess Return Per Unit of Risk in:			
	U.S.	North	South	West
Percentage Increase in Investment Between:				
1850-60	-.252 (.637)	.064 (.465)	.020 (.466)	.447 (.595)
1860-70	-.271 (.196)	.008 (.265)	.343 (.413)	1.373 (.760)
1870-80	.046 (.176)	.184 (.282)	-.305 (.238)	.186 (.232)

Standard errors are given in parentheses.

TABLE 5

Spearman's Rank Correlation Coefficients Between the Level of Excess Returns and the Increase in Investment Over the Following Decade

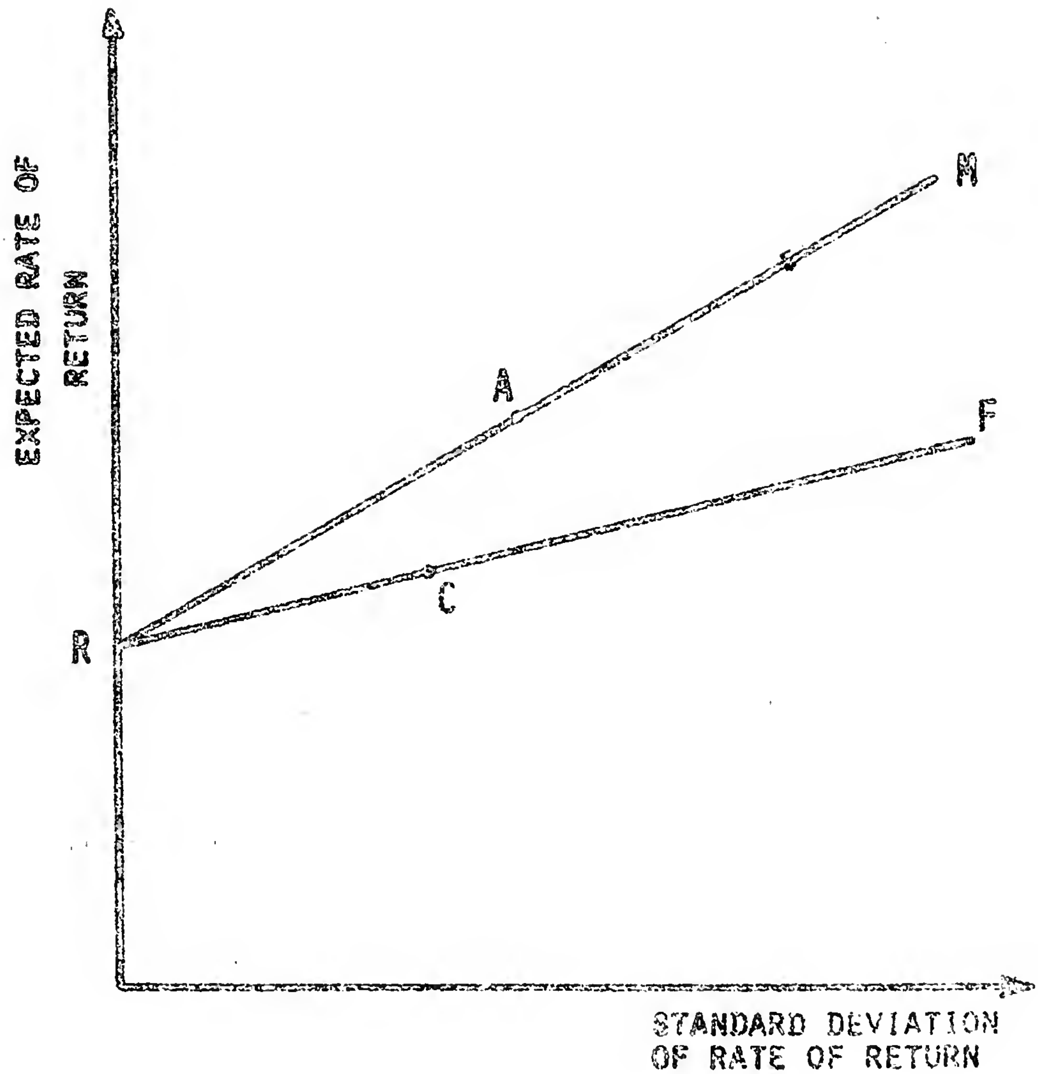
Ranking of Excess Returns Against the Increase in Investment in:	U.S.	North	South	West
1850-60	.071 (.316)	.006 (.481)	-.091 (.302)	-.019 (.459)
1860-70	-.231 (.052)	-.113 (.254)	.053 (.396)	.135 (.232)
1870-80	.032 (.417)	.113 (.284)	-.323 (.054)	.163 (.162)

Significance levels are given in parentheses.

in favor of accepting the null hypothesis that markets did indeed work and which draws heavily upon the theory of finance.

Specifically, that theory describes a locus of efficient portfolios, showing the various combinations of return and risk that are equal in terms of their risk-adjusted value. The estimated locus can also represent, <u>ceteris paribus</u>, the equilibrium value toward which individual opportunities will converge. In a world where investors can engage in unlimited diversification the construction of this locus becomes complex and involves the covariation between individual returns and the market average return. However, where diversification, other than "risk-free" lending, is either not possible or not practiced, the estimation of the locus is more direct involving only a linear relation between two points. One of these points is the risk-free, market rate of interest, (point R in diagram 1) the other is the combination of return-risk available in some risky endeavor. For an individual investor, that latter point would be the alternative with the highest return per unit of risk, but to determine the norm we need some risky alternative that yields a value reflecting long term equilibrium. We could choose the mean for all manufacturing (point A in Figure 1) and then classify all industries with risk-return combinations above line RM as earning excess profits. Alternatively, we could have chosen a more conservative measure, namely the risk-return combination for farming (point C in Figure 1) and considered industries with combinations above RF as earning excess profits. In fact we have used both of these measures in our test. In those industries with excess profits (those with risk-return combinations above RM) the norm of capital growth has been taken to be that of farm

FIGURE 1


EXPECTED RATE OF RETURN
M
A
F
C
R
STANDARD DEVIATION OF RATE OF RETURN

capital, which, because its return was below that for all manufacturing, should be relatively slow growing. For industries earning below average risk-return combinations, those lying below RF, which itself lies below the average manufacturing return, the norm of capital growth is that of manufacturing capital.[9] Those earning excess profits according to this definition should exhibit subsequent capital increases more rapid than the less attractive farm sector. Those earning low risk adjusted rates of return should exhibit capital increases slower than that which prevailed in the more rapidly growing manufacturing sector. Thus we are neglecting some industries whose returns are too close to the norm, and simultaneously selecting investment norms that should be biased in favor of the hypothesis.

A pattern consistent with the null hypothesis occurred if (a) an industry with a net return per unit of risk in excess of the mean for all manufacturing in the region experienced a larger percentage increase in its capital stock than for farming in the region, or (b) an industry with a net return per unit of risk below that for agriculture in the region experienced a increase in its capital stock below that for all manufacturing in the region. The resultant statistic follows the binomial distribution and permitted us to test whether the percentage of industries passing the test was greater than could be expected by chance alone. The results, as shown in Table 6, are that the markets were functioning, albeit weakly (despite the bias of the test in this direction) and that, with the exception of the South, the significance of this relationship increased over time. Thus, except for the South, the market of the 1870s worked better than the market of the 1850s in

TABLE [illegible]

Relative Frequencies of Industries Passing the "Sign"
Test by Regions and Years

Test Group	Region U.S.	North	South	West
1850 Excess Profits with 1850-60 Investment	.64	.64	.34	.53
1860 Excess Profits with 1860-70 Investment	.69*	.73*	.68	.75*
1870 Excess Profits with 1870-80 Investment	.73*	.79*	.62	.77*

*Significantly greater than expected (.50) at better than the five percent level.

terms of allocating investment funds to those areas with excess returns per unit of risk. In the South, market failure appears to have been much more complete. The reasons for this failure are, however, another story (Bateman and Weiss, 1979).

Although our conclusion is not likely to be a popular one, particularly amongst those of the "Chicago School," it is that market forces in the mid-nineteenth century were slow to act and weak when they did so. To anyone familiar with Davis' work on nineteenth century markets this should not be an entirely novel idea.[10] Thus investment funds only flowed into those activities characterized by high excess returns per unit of risk after a substantial time lag and to a degree insufficient to equalize returns over the time period which we consider. Investors were risk averse and while the extent of risk aversion declined over time in line with increasing information experience and opportunites for diversification, investment in many manufacturing activities must have appeared unduly risky for the returns offered, particularly if diversification could not be practiced. Within this framework, the behavior of southern investors differs from that of investors elsewhere. Southern risk aversion increased markedly during the decade of the 1850s and southern market failure appears more complete than that in any other region. Investment funds in the South just did not flow towards those activities with excess returns per unit of risk any more than would be expected from an entirely random distribution to the industries.

FOOTNOTES

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[1]Jorgensen (1971) surveys the various profit variables used.

[2]These estimates differ somewhat from those given elsewhere (such at Bateman and Weiss, 1976) in so far as the number of sample states has been increased and minor changes have also been made in some of the parameter values underlying the profit estimates.

[3]"Riskless" is something of a misnomer. The constant term here represents not the rate of return which could be earned with certainty, but rather the rate of return which could be earned after abstracting from the random risk element in manufacturing. It does not take account of the systematic risk common to all manufacturing enterprise.

[4]These results are similar to those given in Bateman and Weiss (1976 and 1977). However, they are based on larger sample sizes and are statistically much stronger.

[5]In order to have a consistently determined series we have used the average interest rate over the census year paid on prime (i.e., at least two name) commercial paper as given by Macaulay (1938). For 1850 this rate was 8.7 percent, for 1860, 6.7 percent and for 1870, 8.8 percent. This rate is clearly a feasible one at which the manufacturer could borrow or lend.

[6]At the five percent level of significance. At the ten percent level, the null hypothesis would be rejected in six cases.

[7]We cannot know the answer to either of these questions, but with a few assumptions we can use evidence on wholesale prices to surmise the relationship between the benchmark estimates and the longer term situation. Consider first that the calculated benchmark returns reflect the fact that output prices were above average costs. This situation should induce investment so long as investors expect that the output price will remain above average cost. The two major cost items were wages and raw materials, but it seems likely that investors would form expectations about the price-cost relationship on the basis of prices and wage protion of costs. If we use wholesale prices as an index of the prices manufacturers received (U.S. Bureau of the Census, 1975), and assume that changes in wages lagged behind changes in wholesale prices (i.e., real wages vary inversely to the price index), we can use wholesale prices to indicate the annual flow of information that conditioned the response of investors to the benchmark excess returns. Specifically, if wholesale prices rose in subsequent years, our benchmark estimate would understate investors' expectations; if prices fell

the benchmark data would exceed expectations; while stability of prices would mean that the benchmark data and long run expectations were comparable. Unfortunately, the Civil War clouded the pattern noticeably, by causing rapid price increases and interfering with the smooth flow of investment. Nonetheless, during the 1850s, wholesale prices rose steadily through 1857 from an index of 82 in 1849 to 111, and then declined to 95 in 1859. For this period, investors favorable expectations about excess profits should have been continually reinforced for the bulk of the decade. During the 1860s, prices rose rapidly through 1864, then declined from an index value of 193 to 151. The effect on expectations is hard to surmise since the initial rise was war induced, and during the post-war years investors may have attempted to make investments they had been unable to during the war, and in spite of the prospect of declining prices. In the 1870s, the wholesale index declined through 1878 and then rose, so here 1870 benchmark data may overpredict the investment response that could have been expected.

[8]The function estimated was of the form:

$$\log V^{\lambda} = \log A + \xi \cdot T + \mu \cdot \log L + \beta \cdot \log\left[\frac{K}{L}\right]$$

where $\log V_i^{\lambda} = \log V_i + \theta V_i$ and was solved using Box-Cox. non-linear maximum likelihood method. This function has variable scale elasticity which depends upon the level of value-added, V and is defined by $\varepsilon = \mu/(1 + \theta V)$. See Zellner and Revankar (1969). T is the time variable used as a proxy for technological progress.

[9]The excess returns per unit of risk for all manufacturing and the ratio of capital investment at (t + 1) to capital investment at time t were:

	Excess Returns			Change in Investment		
	1850	1860	1870	1850-60	1860-70	1870-80
United States	.330	.404	.361	1.895	2.097	1.317
North	.315	.409	.494	1.726	2.015	1.289
South	.32[illegible]	.444	.322	1.734	1.086	1.504
West	.367	.371	.370	2.734	3.192	1.377

while the excess returns per unit of risk in agriculture and the ratio of capital investment at time (t + 1) to capital investment at time t were:

	Excess Returns			Change in Investment		
	1850	1860	1870	1850-60	1860-70	1870-80
United States	.681	.958	.667	2.013	1.393	1.105
North	.696	1.054	.679	1.470	1.469	0.881
South	.165	.418	.152	2.257	0.689	1.222
West	.696	.949	.684	2.353	2.032	1.199

Investment in agriculture was measured by the value of farm and the value of farm implements. Profit and variability estimates in agriculture are all for 1860 and were taken from Bateman and Atack (1969), Table 14.

[10]See particularly, Davis (1963, 1965 and 1971).

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