UNCERTAINTY, MARKET STRUCTURE, AND PERFORMANCE: THE GALBRAITH-CAVES HYPOTHESIS AND MANAGERIAL MOTIVES IN BANKING *

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I. THE MARKET STRUCTURE-UNCERTAINTY AVOIDANCE RELATIONSHIP

Although the theory of the firm under uncertainty has undergone rapid development in recent years, the idea that firm behavior with respect to "risk-taking" varies systematically with market structure has received little attention.

In his latest book *The New Industrial State*, however, Galbraith assigns an important role to the interrelationship between uncertainty and market organization.[1] Galbraith's thesis is that firm performance depends to a considerable extent upon how firms are organized and how they interrelate with each other. In a subsequent article Caves extends this thesis and attempts to determine its validity. Caves says: ". . . he [Galbraith] has touched upon an important and oft-ignored aspect of the large firm's behavior: that a significant portion of the potential profits latent in its position of market power is taken in the form of avoiding uncertainty, with important allocative effects on the economy." [2] In support of this idea Caves cites findings from several industrial oranizational studies. He concludes, however, that "probably no pattern of behavior described above can be defended as consistent with significant aversion of risk by large firms and with no other explanation. Nonetheless, the

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1. J. K. Galbraith, *The New Industrial State* (Boston: Houghton Mifflin, 1967), Chs. 3 and 7. See also R. E. Caves, "Uncertainty, Market Structure and Performance: Galbraith as Conventional Wisdom," in *Industrial Organization and Economic Development*, J. Markham and G. Papanek, eds. (Boston: Houghton Mifflin, 1970), p. 284.

2. Caves, *op. cit.*, p. 284.

range of behavior consistent with this hypothesis is impressive." [3]

The main objective of this study is to test what we shall refer to as the Galbraith-Caves hypothesis: that uncertainty avoidance by large firms varies directly with the degree of market power that these firms possess. Our second objective is to develop in a more rigorous fashion the theory underlying this hypothesis. Neither Galbraith nor Caves attempts to relate their thesis to the large body of uncertainty theory that already exists.

We have chosen to test their hypothesis in the context of the banking industry. This choice, however, is incidental to our main objectives. We chose the banking industry because it has several desirable characteristics. First, in banking there are many large firms that are to a great extent restricted to local markets. This characteristic enables us to observe large firms with varying degrees of market power in the same industry. Few other industries have this characteristic, and the alternative of studying firms operating in different industries clearly presents additional complexities. Second, data for banks are extraordinarily good because of systematic data collection by bank regulatory agencies. And, finally, the regulated character of banking markets with respect to new entry makes the measurement of a firm's market power somewhat easier than in industries where entry plays a more complex and subtle competitive role.

Testing the validity of the Galbraith-Caves hypothesis in banking is also interesting in its own right. Past studies of banking competition, for example, have assumed that banks behave as profit maximizers under conditions of complete certainty. If it is true, as Galbraith and Caves contend, that managerial objectives vary systematically with firm size and market power, the findings of past studies may be biased and may consequently fail to disclose the true performance-structure relationship. In addition, risk-avoidance behavior by banks may affect credit flows in a way that could have important implications for economic activity.

II. Rationale Behind the Galbraith-Caves Hypothesis

Caves's explanation of why large firms display greater uncertainty-avoidance behavior than small firms rests on two notions.[4] First, large firms more frequently occupy positions of greater market power so that they have the option of trading off excess profits for

3. *Ibid.*, p. 297.
4. *Ibid.*, pp. 284–85; and R. Caves and B. Yamey, "Risk and Corporate Rates of Return: Comment," *this Journal*, LXXXV (Aug. 1971), 513–17.

an increased amount of the "quiet life." Here "quiet life" is synonymous with less risk. Second, large firms may be run by more risk-averse managers, since "managerial personnel may distribute themselves between large and small firms on the basis of their differing marginal rates of substitution between the level of returns" and risk.[5] Implicit in this argument is the assumption that the managements of large firms are insulated from the kind of stockholder pressure that would prevent them from pursuing objectives other than the maximization of the value of the firm.

Thus, Caves's explanation of uncertainty-avoidance behavior by large firms is based upon two very different notions. On the one hand, it is postulated that managerial personnel have different utility functions. Managers of large firms are more risk-averse.[6] On the other hand, it is contended that large firms have market power and are therefore located on an "opportunity set," which allows them greater freedom to trade off profits for less risk.

Although these explanations are entirely different in substance, they cannot in practice be neatly separated and distinguished. In fact, the logic underlying them requires their interrelationship. It is precisely because large firms (with market power) are on a preferred opportunity set that more risk-averse managers will gravitate toward them. The greater the monopoly power possessed by a firm, the more attractive that firm should be to risk-averse managers. Thus, if uncertainty-avoidance behavior is characteristic of large firms, it is likely to be the result of both the above explanations working in tandem.

To test the validity of the Galbraith-Caves thesis, we argue in this paper that the degree of uncertainty avoidance by firms can be represented by their respective ratios of profit variance to profit level. This measure is commonly used in uncertainty literature to indicate the degree of risk.[7] In the following section, therefore, the

5. Caves, *op. cit.*, p. 285.

6. One reason that managerial personnel in large corporations may be more risk-averse is that they are not rewarded commensurate to the firm's profits. For a detailed justification of this contention, see R. Marris, *The Economic Theory of Managerial Capitalism* (Glencoe, Ill.: Free Press, 1964). It is also important to note that in banking, where regulation insulates firms from intensive competitive pressure from either existing or potential rivals (as well as from the take-over raid), management may be relatively free to pursue its own risk preferences. For an estimate of the importance of entry protection in banking, see S. Peltzman, "Entry in Commercial Banking," *The Journal of Law and Economics*, VIII (Oct. 1965), 11–50.

7. See, for example, the well-known texts: D. Vickers, *The Theory of the Firm: Production, Capital, and Finance* (New York: McGraw-Hill, Inc., 1968), pp. 59–69 and 101–02; and W. Sharpe, *Portfolio Theory and Capital Markets* (New York: McGraw-Hill, Inc., 1970), pp. 85 and 154. Sharpe calls

Galbraith-Caves hypothesis is developed within the context of conventional uncertainty theory in order to make clear its relationship to this profit variance-profit level measure.

III. A Measure of Uncertainty Avoidance and the Theory of the Firm Under Uncertainty

In order to formulate the Galbraith-Caves hypothesis in the rigorous context of the theory of the firm under uncertainty, we make extensive use of a model developed recently by John Lintner.[8] Lintner's model is ideally suited to our purpose. It pertains to decision making under uncertainty where firms have substantial degrees of market power, and it requires assumptions that correspond closely to the characteristics of banking markets. In addition, it implies a concrete measure of risk avoidance.

The assumptions underlying Lintner's model are the following: (1) firms are price-setters and price-leaders as distinct from price-takers and price-followers; (2) at the time prices (or interest rates) are determined, the quantities of output (or loans) that can be sold at any one of the possible prices during the price-planning period are highly uncertain; (3) marginal production costs are essentially constant with respect to output over the relevant range; (4) questions of optimal carry-over stocks (or inventories) have relatively little bearing upon the selection of a price to be quoted at the beginning of the pricing period; (5) uncertainty with respect to both realized average unit revenues and the level of unit variable costs is minor compared to the uncertainty regarding sales at any given price; and (6) firms make pricing decisions on a fully rational profit-maximizing basis subject to risk aversion with respect to the uncertain profits involved.[9]

These assumptions fit the banking industry as well as or better than most industries. Large banks operate in oligopolistic markets and clearly do act as price-setters and price-leaders. The well-known "prime rate convention" is indicative of this behavior. At the same time loan demand is decidedly volatile due to fluctuations in busi-

this ratio (or its reciprocal) the "reward-to-variability ratio," while Vickers calls this ratio the "coefficient of variation of net income." Both authors use a version of this ratio "as a measure of the degree of risk in the owners' economic position." Vickers, p. 59.

8. J. Lintner, "The Impact of Uncertainty on the 'Traditional' Theory of the Firm: Price-Setting and Tax Shifting," in *Industrial Organization and Economic Development*, J. Markham and G. Papanek, eds. (Boston: Houghton Mifflin, 1970), pp. 238–65.

9. For a more detailed discussion of these assumptions, see *ibid.*, pp 239–41.

ness conditions. The assumption of essentially constant marginal production costs for large banks has also been verified by several studies.[1] Finally, both the inventory problem and the problem of fluctuations in realized prices and costs are minor for banks compared to other industries. To the extent that banks hold "inventories" of credit, these inventories are neither perishable nor beset with problems of obsolescence, such as model changes. Large fluctuations in realized prices and costs are also unlikely because of the oligopolistic and regulated character of banking (Regulation Q, for example). Thus, the assumptions underlying Lintner's model seem quite reasonable in the context of banking markets.

Lintner also uses the traditional behavioral assumptions of uncertainty theory (Ramsey-de Finetti-Savage axioms, etc.), to adopt as the firm's utility function the following exponential function:

$$U(W''_1) = a - b\, e^{-2rW''_1},$$

where W''_1 = uncertain end-of-period wealth in period 1, and a, b, and r are constants, and the degree of risk aversion is equal to $-\frac{U''}{U'} = 2r$ where $r > 0$.[2] This utility function assumes constant risk aversion with respect to wealth and allows any degree of risk aversion to be built into the model by simply changing the value of r.[3]

If it is assumed that the distributions of the uncertain outcomes associated with any action taken by the firm can be approximated by a normal probability distribution, or $f\ (W'') = N[W^*, s_W{}^2]$, it can be shown that

$$E[U(W'')] = a - b[\exp.\ (-2r[W^* - r\, s_W{}^2])].$$

Since expected utility varies directly with the value of the interior bracket, it follows that the decisions which maximize the certainty equivalent, defined as $CE(W) = W^* - r\, s_W{}^2$, will also maximize expected utility. By further assuming that a firm's uncertain end-of-period wealth W''_1 is equal to its initial wealth plus its uncertain profits during the price-planning period, we have

$$W''_1 = W_0 + \Pi''_1.$$

1. For a recent study see F. Bell and N. Murphy, "Costs in Commercial Banking: A Quantitative Analysis of Bank Behavior and Its Relation to Bank Regulation," Research Report No. 41, Federal Reserve Bank of Boston, April 1968.

2. See J. Pratt, "Risk Aversion in the Small and the Large," *Econometrica*, XXXII (Jan.–April 1964), 122–36; and K. Arrow, *Aspects of the Theory of Risk Bearing* (Helsinki, Finland: Yrjo Jahnssonin Saatio, 1965).

3. For a discussion of the appropriateness of using this utility function, see Lintner, *op. cit.*, pp. 242–43 and note 9 on p. 242. Lintner argues that an exponential utility function is reasonable for "intermediate" decisions, as opposed to decisions that may result in either very small or very large changes in a firm's wealth.

If expected end-of-period wealth (W^*_1) is now taken to be equal to a constant plus expected profit, and s_W^2 is set equal to s_π^2, we have the firm maximizing the certainty equivalent of profits by maximizing the following expression: [4]

$$CE(\pi) = \pi^* - r s_\pi^2.$$

Since the model assumes that firms are price-setters and quantity-takers, price is the relevant decision variable. Consequently, to maximize the certainty equivalent of profits, firms adjust their prices until [5]

$$\frac{\partial CE(\pi)}{\partial(-P)} = \frac{\partial \pi^*}{\partial(-P)} - r\frac{\partial s_\pi^2}{\partial(-P)} = 0.$$

This model leads directly to a concrete measure of a firm's degree of risk aversion. In particular, the last equation above shows that the degree of risk aversion can be measured by the rate at which the firm trades a unit of expected profits for a unit of profit variance, or by [6]

$$r = \frac{\partial \pi^* / \partial(-P)}{\partial s_\pi^2 / \partial(-P)}.$$

In other words, for a given price change the higher the degree of risk aversion (r), the greater the increase in expected profits a firm will require to induce it to accept greater profit variability (and vice versa).

IV. The Galbraith-Caves Thesis in the Context of the Firm Under Uncertainty

The foregoing model can now be used to give more specific analytic context to the Galbraith-Caves thesis. In Figure I a set of a particular firm's indifference curves in profit level-profit variance space is depicted by lines 1 through 4. A firm will desire to attain the indifference curve that yields the highest possible expected profit for a given level of profit variance. In other words, in Figure I indifference curve 2 is preferred to 1, 3 is preferred to 2, and so forth. Further, given that all firms have exponential utility functions, the slope of any firm's indifference curves will be a constant and, as

4. See Lintner, *op. cit.*, pp. 244–47, for a fuller discussion of this derivation.

5. Prices are written with a negative sign to indicate that firms initially announce a high price and then progressively reduce it so long as the benefits of price reduction outweigh the costs of the reduction. *Ibid.*, pp. 246–47.

6. Hereafter we shall simply use r to indicate the degree of risk aversion. Strictly speaking, r is equal to one half of the degree of risk aversion, which equals $2r$.

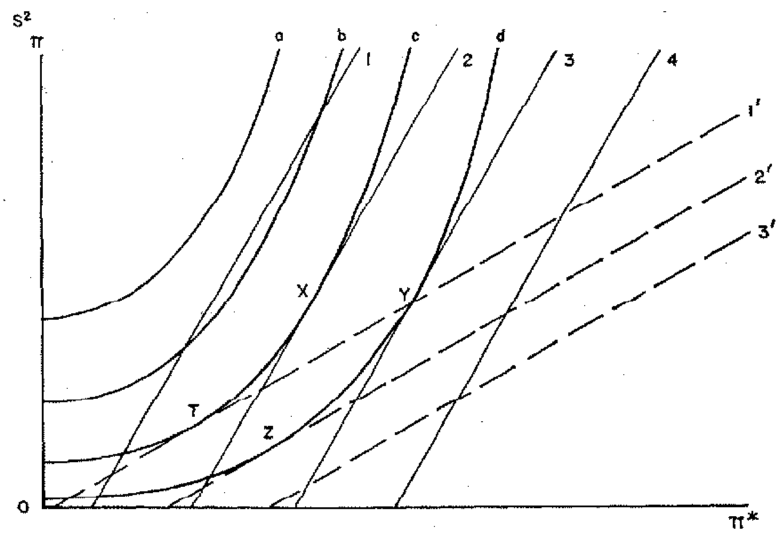

FIGURE I

depicted in Figure I, will be equal to the reciprocal of the firm's degree of risk aversion $\left(\frac{1}{r}\right)$. Different firms, of course, may have different degrees of risk aversion, so that each firm's indifference curve set may differ with respect to slope. An alternative set of indifference curves showing greater risk aversion, for example, is depicted by lines 1′ through 3′ in Figure I. Superimposed on these two sets of indifference curves are the different efficient opportunity sets that may confront particular firms. Those are curves *a* through *d* in Figure I. It is obvious that an opportunity set that lies to the right of another is superior, since it enables a firm to obtain a higher expected profit for every level of profit variance. Thus, in Figure I, *d* is the most favorable efficient opportunity set. The convex shape of the opportunity sets is well established in the theory of uncertainty.[7]

Using Figure I, we can depict in terms of our model the Galbraith-Caves thesis of the behavior of a profit-maximizing firm under uncertainty. First, the argument that large firms with market power have the option of trading off excess profits for less risk implies that the efficient opportunity set of a firm with monopoly power lies to the right of that of a comparable firm in a more competitive market. In other words, it implies that a monopolistic firm can obtain a higher profit for every level of profit variance. In Figure I this argument can be depicted by assigning the efficient

7. For a detailed explanation, see Sharpe, *op cit.*, Ch. 4, pp. 45–73.

opportunity set "*d*" to the firm with greater market power, while assigning the opportunity set "*c*" to a more competitive firm. If both firms have identical degrees of risk aversion and therefore identical indifference maps, the firm with greater market power will maximize utility by choosing the portfolio represented by point *Y*, whereas the competitive firm will choose portfolio *X*. Second, the argument that the managements of large firms with market power will have a higher degree of risk aversion implies that the indifference curve map associated with these firms will be more like those portrayed by curves 1′ through 3′ in Figure I. Consequently, monopolistic firms will choose portfolio *Z* rather than portfolio *Y*. (Competitive firms with greater risk aversion would choose portfolio *T* rather than portfolio *X*.)

Portraying the Galbraith-Caves hypothesis in this manner reveals how the $s^2\pi/_{\pi^*}$ ratio can be used to test their thesis. Although, as we previously noted, this ratio is commonly used "as a measure of the degree of risk in the owners' economic position," [8] Figure I also demonstrates precisely how this measure reflects the reasoning underlying the Galbraith-Caves thesis. In particular, Figure I shows that a firm's $\frac{s_\pi{}^2}{\pi^*}$ ratio will be lower when either or both of the following are true: the managers of the firm are more risk-averse (point *T* versus point *X*), or the firm faces a more favorable efficient opportunity set (point *Y* versus point *X*).[9] Thus, if either or both of the economic arguments underlying the Galbraith-Caves hypothesis are valid, we would expect to find a negative relationship

8. See note 7, p. 457.

9. If the efficient opportunity sets assume a shape similar to that shown in Figure I (parabolic), it is a simple exercise to prove that a firm's $\frac{s_\pi{}^2}{\pi^*}$ ratio will fall for either of the reasons discussed above. For example, the family of efficient opportunity sets depicted in Figure I can be described by the general functional form $s_\pi{}^2=b+a\pi^{*2}$, where $a>0$ and $b<0$. An opportunity set with a positive intercept ($b>0$) is not feasible, as it implies that firms will accept positive risk for zero expected profits. Since in equilibrium the slopes of the opportunity set and the indifference curves are equal, we have $2a\pi^*=\frac{1}{r}$ or $\pi^*=\frac{1}{2ar}$.

$$\frac{\partial\left(\frac{s_\pi{}^2}{\pi^*}\right)}{\partial\, b}=\frac{\partial\left(\frac{a\pi^{*2}+b}{\pi^*}\right)}{\partial\, b}=\frac{\partial\left(\frac{a\frac{1}{(2ar)^2}+b}{\frac{1}{2ar}}\right)}{\partial\, b}=2ar>0$$

$$\frac{\partial\left(\frac{s_\pi{}^2}{\pi^*}\right)}{\partial\, r}=-\frac{1}{2r^2}+2ab<0.$$

between large firms' $\frac{s_{\pi}^2}{\pi^*}$ ratios and the degree of market power that these firms possess.

V. Testing the Relationship Between Market Power and Uncertainty-Avoidance Behavior

In order to test the validity of the hypothesized negative relationship between market power and uncertainty-avoidance behavior, it is necessary to hold constant additional variables that, together with market power, determine the risk taken by firms. To do this, we utilize two procedures. First, we choose an intraindustry sample of firms to standardize for factors that would otherwise cause differences in risk taking among firms in different industries.[1] Second, we explicitly incorporate variables in the estimating equations to account for those important differences among firms that still remain.

A. The Sample

Our sample consists of sixty-six of the largest hundred banks in 1960.[2] Of the hundred largest banks, nineteen had to be excluded from our sample because comparable profit data over time were not available. An additional fifteen were excluded because of inadequate market data, such as retail sales. The remaining sixty-six sample banks range in size from $315 million to over $10 billion in total 1960 deposits and have an average size of $940 million in total deposits. These banks are located in thirty-three of the largest Standard Metropolitan Statistical Areas (SMSA's). Thus, we are using an industry sample of firms, all of which are very large and located in widely diversified, extensive banking markets.

Thus, as the efficient opportunity curve shifts to the right (b decreases), or as the degree of risk aversion increases (r increases), the ratio $\frac{s_{\pi}^2}{\pi^*}$ decreases. Since the curvature of the efficient opportunity set depends only on the extent to which securities in the portfolio are correlated, the assumption that the efficient opportunity set of a monopolist will have a shape identical to that of a competitor seems quite reasonable.

1. See, for example, G. Hall and I. Fisher, "Risk and Corporate Rates of Return," this *Journal*, LXXXIII (Feb., 1969), 79–92; and F. Scherer's comment on their study in his *Industrial Market Structure and Economic Performance* (Chicago: Rand McNally & Co., 1970), p. 205, n. 79.

2. See Paine, Webber, Jackson and Curtis, *A Comparative Analysis of the 100 Largest Banks and Other Representative Banking Institutions*, 1961 edition. The yearly editions of this publication are our primary source for bank financial data. Other data come from FDIC and Federal Reserve publications, with the exception of our proxy for demand, retail sales, which is taken from annual editions of *Retail Sales*, Almanac Issues.

This sample permits us to make several assumptions that are necessary to test the Galbraith-Caves hypothesis. First, since all sample banks are large in size, we assume that these firms are managerial- rather than owner-controlled. As a test of the validity of this assumption, we used Vernon's procedure to classify banks.[3] He classifies banks as owner-controlled if 10 percent or more of their voting stock is concentrated in a single party. Under this criterion only nine banks in our sample qualify as owner-controlled. Further, when a dummy variable is introduced in the estimating equation to distinguish these nine banks from the others, its coefficient is never significantly different from zero. Thus, the assumption that all sample banks are managerial-controlled seems reasonable.

Second, we assume that all of the sample banks are located in markets that allow bank managers wide scope for choosing their desired portfolios. Since the sample banks are located in large, widely diversified metropolitan areas, it seems reasonable to assume that they also face highly diversified demand conditions. Consequently, their managers should be free to select the portfolio they desire. (Such freedom would not be likely in the case of a small bank restricted to a small local market where the range of potential customers is greatly restricted.)

Despite its restrictiveness, however, the sample does allow for extensive variation in market structure. Although no SMSA banking market can be regarded as being highly competitive, there is a considerable range in the degree of its oligopolistic structure.[4] The three-firm concentration ratio of total deposits in these markets ranges from a minimum value of 45 percent to a high of 96 percent. The average three-firm concentration ratio is 74 percent. Using an alternative measure, a three-firm concentration ratio calculated with only deposits of less than $100,000 ranges from a low of 22 percent to a high of 93 percent and has an average value of 55 percent. The latter measure may better approximate the actual market structure in SMSA's because it excludes customers who are not restricted to SMSA banking markets.

3. See J. R. Vernon, "Ownership and Control Among Large Member Banks," *Journal of Finance*, XXV (June 1970), 651–57, and "Separation of Ownership and Control and Profit Rates, the Evidence from Banking: Comment," *Journal of Financial and Quantitative Analysis*, VI (Jan. 1971), 615–25. An unpublished listing of banks classified according to his criteria was furnished to us by Professor Vernon.

4. For a rationale for using SMSA's as meaningful banking markets, see F. Edwards, "The Banking Competition Controversy," in *Studies in Banking Competition and the Banking Structure* (Washington, D.C.: Administrator of National Banks, 1966), pp. 310–12.

B. Additional Variables Used in the Estimating Equation

Notwithstanding our highly stratified sample, there may still remain important variations in factors that affect a firm's risk taking. For example, there is still a wide range in the size disparity of firms, in the extent of their geographic diversification, and in the stability of demand conditions that confront them.

With respect to firm size, profit variability should decrease as the size of firm increases (for a given level of expected profits). This effect is well-known and has been substantiated by several empirical studies.[5]

Greater geographic diversification (or branching) may also lower the variability of profits. The extent of branching by our sample banks differs considerably, depending on state regulations. Some banks have many branch offices scattered throughout an entire state, others have offices only in counties contiguous with their home office (such as the SMSA), and still others have no branches at all.[6] Since the variability of profits may differ with the extent of geographic diversification through branching,[7] we include in the estimating equation dummy variables to represent the state branching laws that confront each of the sample banks. These dummy variables are obviously crude measures of a bank's actual geographic diversification, since they do not allow for the possibility of differences in the amount of diversification among banks within a given branching classification.

Finally, profit variability may be affected by the variability of market demand. In Lintner's model of the firm, profit variability is equal to the product of the firm's profit margin squared times the variability of its demand.[8] For a given profit margin, therefore, we would anticipate a positive relationship between profit varia-

5. See H. J. Sherman, *Profits in the United States* (Ithaca: Cornell University Press, 1968), pp. 101–20. See also S. Alexander, "The Effect of Size of Manufacturing Corporation on the Distribution of the Rate of Return," *Review of Economics and Statistics*, XXXI (Aug. 1949), 229–35; J. Samuels and D. Smyth, "Profits, Variability of Profits, and Firm Size," *Economica* XXXV (May 1968), 127–39; and H. Stekler, "The Variability of Profitability with Size of Firm, 1947–1958," *Journal of the American Statistical Association*, LIX (Dec. 1964), 1183–93.

6. Of our sixty-six sample banks, fifteen are located in states that allow statewide branching, thirty-one in states that allow some form of limited branching, and twenty in states that do not allow branching.

7. See, for example, R. Wacht, "Branch Banking and Risk," *Journal of Financial and Quantitative Analysis*, III (March 1968), 97–107; and L. Lauch and N. Murphy, "A Test of the Impact of Branching on Deposit Variability," Working paper No. 69-5, Banking and Economic Research Section, Division of Research, Federal Deposit Insurance Corporation (1970).

8. Lintner, *op. cit.*, p. 246, Equation (8b).

bility and demand variability. But the profit margin chosen by the firm is not independent of the variability of demand. Consequently, profit variability might either increase or decrease with demand variability, depending on the specific parameters in the underlying demand and utility functions.[9] Thus, although a variable to represent the variability of demand is included in our estimating equation, its directional effect is ambiguous.

C. The Estimating Equation

To test the Galbraith-Caves hypothesis, the following equation is estimated using a cross-section sample of banks for the year 1960:

Risk avoidance $= F$ (market structure, size of bank, geographic diversification, variance of demand, random error).

Pursuant to section IV above, risk avoidance is measured as the ratio of the variance of profits to expected profits. The profit concept we use is the rate of return on total assets, which is measured by the ratio of net operating earnings after taxes to total bank assets.[1] The expected rate of return for each bank in 1960 is estimated as the bank's average annual rate of return over the period 1954–1966. Since 1960 is the middle year of this period, use of the simple average is an unbiased estimate of the expected value whether or not there exists a time trend in the profit rate.[2]

We use two measures of the variability of a bank's rate of return. The first is simply the variance of the bank's yearly profit rates about the mean value of the profit rate for the years 1954–1966. The second is the sum of squared deviations from the trend line of the equation: Net Earnings/Assets $= a + b$ (time) $+ \epsilon$, where time runs from 1954 to 1966. If there is a time trend in a bank's earnings, the latter measure allows us to obtain pure fluctuations in its rate of return. If no trend exists, this estimate of the variance will be slightly higher than the simple variance about the mean.[3] In test-

9. This can be seen by substituting equation (11b) into equation (8b) in Lintner's paper and differentiating with respect to the variability of demand.

1. Net operating earnings include gains and losses on securities and provisions for loan losses, as defined by Paine, Webber, Jackson and Curtis. See note 2, p. 463.

2. With a time trend, expected profit rate in any year (t) is $\pi_t = a' + b't$, where $t = 1, 2, \ldots, T$ and T equals number of years. Since the least squares estimate of a line passes through the means of both variables, we have $\pi^* = a' + b't^*$.

3. Variance about the mean is defined as $\frac{1}{n-1}\Sigma(y_t - y^*)^2$.

Variance about the trend line is defined as ing the Galbraith-Caves hypothesis, we experiment with both of these because some banks have time trends in their earnings while others do not.[4]

In using a rate of return on assets rather than some other rate of return, such as a rate of return on capital, we do not profess to answer the controversial question of what rate of return the managements of managerial-controlled firms attempt to maximize. Our choice of rate of return on assets is dictated by two factors. First, we believe this measure of profitability is intrinsically reasonable. Freed from the necessity of maximizing stockholder welfare, management may quite reasonably act to maximize the return on all productive resources available to the firm. We are not, of course, alone in this belief. Many studies that examine the relationship of firm performance to market structure use a rate of return on assets.[5] The second reason for our choice of rate of return is that we encountered severe measurement problems in attempting to develop a rate of return on capital. In many cases the year-end capital accounts reported by our data source included additions to capital made after the end of the year. In addition, in some cases the capital accounts included reserves for possible loan losses, while in others it did not.[6] Since measurement errors of this nature would have introduced a serious error in our dependent variable if rate of return on capital were used, we considered the rate of return on assets to be preferable.[7]

The independent variables in the estimating equation are measured as follows. Market structure is represented alternatively

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$$\frac{1}{n-2}\left[\sum_i (y_i-y^*)^2-\beta\sum_i (x_i-x^*)(y_i-y^*)\right].$$

When β is zero, the squared deviations from the trend line minus the variance about the mean equals $\frac{1}{(n-1)(n-2)}\Sigma(y_i-y^*)^2$.

4. The average estimate of the time trend for all banks is 0.016 and is significant for 60 percent of the sample banks. The average R^2 of the trend equation is 0.39.

5. See, for example, G. Stigler, *Capital and Rates of Return in Manufacturing Industries* (Princeton: Princeton University Press, 1963); V. Fuchs, "Integration, Concentration, and Profits in Manufacturing Industries," this *Journal*, LXXV (May, 1961), 278–91; M. Hall and L. Weiss, "Firm Size and Profitability," *Review of Economics and Statistics*, XLIX (Aug. 1967), 319–31; J. Samuels and D. Smyth, *op. cit.*; and R. Miller, "Marginal Concentration Ratios and Industrial Profit Rates: Some Empirical Results of Oligopoly Behavior," *Southern Economic Journal*, XXXIV (Oct. 1967), 259–67.

6. See note 2, p. 463.

7. In a recent statement on this issue, Caves and Yamey say: "An investigation concerned primarily with risk aversion should look at the variance of the variable of greatest concern to shareholders or to corporate management. Our view, briefly, is that there is no reason to suppose that the recorded rate of return on net worth qualifies as such a variable." *Op. cit.*, p. 517.

by three concentration variables: the first is the percentage of total SMSA deposits held by the largest three banks; the second is similar but uses only SMSA deposits of less than $100,000 to calculate the ratio; and the third is a dichotomous variable that distinguishes highly concentrated from less concentrated markets. Size of firm is measured as a three-year average of total deposits for each bank over the years 1954, 1960, and 1966. As a proxy for the demand variability, which banks confront in their local SMSA markets, we use the R^2 of the following equation: $(\text{Retail Sales})_t = a + b(t) + e$, where $t = 1954, \ldots, 1966$. A higher R^2 indicates lower variability of demand around the trend.[8] Finally, the variation in banks' geographic diversification is represented by dummy variables that classify SMSA's into one of three groups: no branching allowed; limited branching allowed; or statewide branching allowed.[9]

In summary, the variables in the estimating equation are

R_1 = Variance of the net earnings to assets ratio divided by the expected net earnings to assets ratio, 1960;

R_2 = Sum of squared deviations of the net earnings to assets ratio about its trend line divided by the expected net earnings to assets ratio, 1960;

C_1 = Three-firm concentration ratio of total deposits in SMSA, 1962–1964;

C_2 = Three-firm concentration ratio calculated using only deposits less than $100,000 in SMSA, 1970; [1]

C_3 = A dummy variable, which takes the value of 1 if C_1 is greater than 50 percent, but zero otherwise;

S = Average total deposits of the bank, 1954-1966;

U = R^2 of the equation $(\text{Retail Sales})_t = a + b$ (time), estimated for each SMSA for the period 1954 to 1966;

B_1 = Dummy variable, which equals 1 if statewide branching allowed, but zero otherwise;

B_2 = Dummy variable, which equals 1 if no branching is allowed, but zero otherwise.

The functional form of the estimating equation is specified as log-linear. Although it is not possible to specify a priori the exact functional form, theory clearly suggests that it should be nonlinear.

8. For a discussion of the factors that affect retail sales in SMSA's, see B. Liu, "Determinants of Retail Sales in Large Metropolitan Areas, 1954 and 1963," *Journal of the American Statistical Association*, LXV (Dec. 1970), 1460–73.

9. See *Federal Reserve Bulletin* (March 1970), p. 210.

1. This ratio is only available for 1970. Since concentration in banking changes very slowly over time, this ratio should be a good proxy for the level of concentration in 1960 as well.

For example, general research in industrial organization indicates that some critical level of concentration is necessary before firms sufficiently recognize their mutual interdependence to extract monopoly profits. Consequently, until a certain minimum level of concentration is reached, market structure may have little effect on firms' risk-avoidance behavior. In addition, both theory and prior empirical findings suggest the existence of a nonlinear relationship between profit variability and both firm size and the extent of its branching.[2] Finally, our earlier discussion implied the existence of a nonlinear relationship between profit variability and demand variability.[3] Consequently, we estimate a log-linear equation on the theory that this functional form best approximates the true nonlinear relationship.[4]

VI. Empirical Results

Table I presents the estimated log-linear equations, using two alternative measures of risk avoidance and three alternative measures of market concentration. In all equations the concentration variable has the predicted negative effect on firms' profit-variance-to-profit-level ratios. The coefficients on all three concentration variables are always negative and significant. Thus, we reject the null hypothesis that there is either no relationship or a positive relationship between market power and risk avoidance. Our findings, therefore, are consistent with the Galbraith-Caves hypothesis.

Bank size also has the anticipated effect. Its coefficient is always negative and significant, indicating that a bank's exposure to risk decreases as its size increases. The coefficients of the proxy variables for demand variability and geographic diversification, on the other hand, are never significant. These results are not surprising. As we indicated earlier, the directional effect of demand variability is ambiguous a priori. Its zero coefficient, therefore, may be the result of its having different (and conflicting) effects on the firm. With respect to the insignificance of the branching dummy variables, it is possible that these variables are too crude to capture the true effects of geographic diversification. Even when a simpler, two-category

2. See S. Alexander, *op. cit.*; and Lauch and Murphy, *op. cit.*

3. See note 9, p. 466.

4. Because there is still room for controversy over the appropriate functional form, we also estimated linear equations. The estimated coefficients for the concentration variables were quite similar to those in the log-linear equations. They were negative and significant. The chief difference between the estimates was with respect to the size (S) variable. These coefficients were not significant in the linear equations. The linear results are available upon request.

TABLE I

LOG-LINEAR EQUATIONS

Dependent variable	C_1	C_2	C_3	S	U	B_1	B_2	Constant	R^2	F
R_1	−1.163 (−2.40) [a]							0.750 (0.359)	0.07	5.75 [b]
R_1		−0.593 (−2.80) [a]						−1.92 (−2.27) [b]	0.10	7.84 [a]
R_1			−0.428 (−2.37) [a]					−4.01 (−29.29) [a]	0.07	5.60 [b]
R_1	−1.279 (2.74) [a]			−0.305 (2.74) [a]				3.26 (1.46) [c]	0.14	6.44 [a]
R_1		−0.618 (−3.03) [a]		−0.291 (−2.49) [a]				0.095 (0.083)	0.16	7.33 [a]
R_1			−0.444 (−2.54) [a]	−0.286 (−2.40) [a]				−2.12 (−2.66) [a]	0.13	5.89 [a]
R_1	−1.256 (−2.68) [a]			−0.322 (−2.67) [a]	−0.457 (−0.804)			3.23 (1.44) [c]	0.14	4.48 [a]
R_1		−0.611 (−2.99) [a]		−0.309 (−2.60) [a]	−0.490 (−0.874)			0.15 (0.13)	0.16	5.12 [a]
R_1			−0.445 (−2.33) [a]	−0.285 (−2.34) [a]	0.007 (0.011)			−2.12 (−2.63) [a]	0.12	3.85 [b]
R_1	−1.510 (−2.79) [a]			−0.280 (−2.23) [b]	−0.173 (−0.288)	−0.269 (−1.15)	−0.297 (−1.27)	4.23 (1.66) [b]	0.14	3.13 [b]
R_1		−0.822 (−3.14) [a]		−0.291 (−2.34) [a]	−0.275 (−0.47)	−0.078 (−0.328)	−0.370 (−1.56) [c]	1.01 (0.730)	0.17	3.59 [a]
R_1			−0.473 (−2.43) [a]	−0.236 (−1.84) [b]	0.259 (0.39)	−0.333 (−1.40) [c]	−0.095 (−0.445)	−2.31 (−2.82) [a]	0.12	2.70 [b]

TABLE I (*continued*)

Dependent variable	C_1	C_2	C_3	S	U	B_1	B_2	Constant	R^2	F
R_2	−1.098							2.48	0.19	15.9 a
	(−3.99) a							(2.10) b		
R_2		−0.297						−1.08	0.06	5.1 b
		(−2.26) b						(−2.07) b		
R_2			−0.293					−2.08	0.09	7.3 a
			(−2.70) a					(−25.31) a		
R_2	−1.144			−0.120				3.47	0.21	9.7 a
	(−4.20) a			(−1.74) b				(2.67) a		
R_2		−0.306		−0.101				−0.38	0.07	3.5 b
		(−2.34) a		(−1.35) c				(−0.52)		
R_2			−0.298	−0.100				−1.42	0.10	4.6 a
			(−2.77) a	(−1.36) c				(−2.87) a		
R_2	−1.130			−0.130	−0.263			3.45	0.21	6.6 a
	(−4.13) a			(−1.85) b	(−0.790)			(2.55) a		
R_2		−0.301		−0.113	−0.317			−0.35	0.07	2.6 c
		(−2.30) b		(−1.48) c	(−0.88)			(−0.47)		
R_2			−0.302	−0.099	0.032			−1.42	0.09	3.0 b
			(−2.57) a	(−1.31) c	(0.082)			(−2.85) a		
R_2	−1.259			−0.148	−0.296	0.127	−0.059	4.11	0.20	4.3 a
	(−3.97) a			(−2.01) b	(−0.842)	(0.93)	(−0.43)	(2.75) a		
R_2		−0.377		−0.145	−0.434	0.218	0.022	0.10	0.07	2.0 c
		(−2.24) b		(−1.83) b	(−1.15)	(1.43) c	(0.144)	(0.11)		
R_2			−0.276	−0.117	−0.105	0.092	0.135	−1.39	0.07	2.0 c
			(−2.28) b	(−1.47) c	(−0.25)	(0.62)	(1.01)	(−2.73) a		

"t" values are below coefficients and R^2's are corrected R^2's.
a. significant at the 1 percent level, one-tailed test.
b. significant at the 5 percent level, one-tailed test.
c. significant at the 10 percent level, one-tailed test.

dummy variable approach is used to distinguish some branching from no branching, or to distinguish statewide branching from both limited and no branching, the coefficients are still insignificant. Moreover, their signs continue to be the opposite of the signs that our diversification rationale implies.[5]

VII. Conclusion

This paper analyzes and tests the thesis advanced by Galbraith and Caves that a firm's risk-avoidance behavior varies directly with its degree of market power. We begin by analyzing this thesis within the context of a theoretical model of firm behavior under uncertainty. The analysis suggests that a measure of risk-avoidance behavior, which is consistent with the logic of the Galbraith-Caves thesis, is the ratio of a firm's profit variability to its expected level of profits. Using this measure, we test their hypothesis on a sample of large banks and find a statistically significant inverse relationship between a firm's market power and its ratio of profit variability to profit level. These findings, therefore, are consistent with the Galbraith-Caves theory of risk avoidance.

Our theoretical analysis reveals, however, that the hypothesized risk-avoidance behavior may be the result of either or both of the following: managers of firms with market power may be more risk-averse, or these firms may simply be able to take advantage of more favorable market opportunities. Thus, although our statistical evidence provides impressive support for the Galbraith-Caves hypothesis, the implications of their thesis are not clear, since such implications depend upon the reasons underlying risk-avoidance behavior.[6]

If the reason for this behavior is that managers of monopolistic firms are more risk-averse, rather than that they face more favorable market opportunities, the Galbraith-Caves thesis has important implications. It implies, for example, that the innumerable empirical studies that relate firm or industry performance (e.g.,

5. A possible explanation of this result is that the branching dummy variables may also represent the difficulty or ease with which existing banks enter SMSA banking markets. Statewide branching, for example, may result in lower entry barriers and therefore greater competition. If so, statewide branching would be associated with higher rather than lower profit variability. Our insignificant results, therefore, may be due to this "competition" effect working against the hypothesized "diversification" effect.

6. In his brief, exploratory discussion of the welfare effects of uncertainty-avoidance behavior, Caves does not make clear what assumptions he is making about the underlying causes of this behavior. See Caves, *op. cit.*, pp. 298–300.

prices, profits, advertising) to market structure are misspecified in that they implicitly assume that all firms have identical risk preferences.[7] In addition, studies of the relationship between risk and rates of return in different industries are also biased, since they too fail to account for the effects of differing industry structure on firm's risk behavior.[8]

Thus, the results of this study suggest that further work in clarifying and identifying firms' risk preferences may help to understand more fully the intricacies of the relationship between market structure and firm performance.

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7. Lintner's model demonstrates that more risk-averse firms will have lower "optimal" prices and profit margins. See Lintner, *op. cit.*, p. 247. In addition, building on the findings of this paper, one of the authors has recently shown that the effect of monopoly power on bank profitability is significantly underestimated in studies that ignore differing risk preferences. See A. Heggestad, "Market Structure, Profitability, and Risk in the Commercial Banking Industry," Ph.D. thesis, Michigan State University, 1973.

8. See, for example, G. Hall and I. Fisher, *op. cit.*