THE DEMAND FOR MONEY BY BUSINESS FIRMS:

A TEMPORAL CROSS-SECTIONAL INVESTIGATION

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ABSTRACT

The objective of this thesis is to develop and test demand for money models by business firms.

Because, it is argued, there are significant differences in the demand for money by industrial sectors, two sectors the retailing and distribution industry and the electrical engineering industry, were selected for empirical investigation. The firms in each sector were observed over the period from 1968 to 1971.

Specifically this thesis attempts to shed some light on whether demand for money models based on the wealth adjustment theories are superior to those based on the transactions theories. The wealth/transactions hypothesis is also investigated. In addition the existence of economies of scale and the degree of substitution between money and other assets is investigated.

Particular attention is paid to the limitations of the statistical techniques used by previous studies and different techniques are suggested in order to test the empirical validity of the theories in question. To this end an error components model and a two-stage least squares method is applied to combined cross-sectional and time-series data.

The empirical results obtained seem to indicate that monetary models based on the wealth adjustment theories provide a better description of the demand for money by the two industrial sectors than the models based on the transactions theories. Some evidence was found for the existence of both a wealth and transactions

demand for money. Economies of scale were evident for the electrical engineering sector but not for the retailing and distribution sector. There was no evidence of any important substitution between money and other assets.

PREFACE

The subject matter of this thesis is to develop and test demand for money functions for business firms. Because it is believed that there exist important differences in the demand for money of different industrial sectors, we have selected two industrial sectors for empirical investigation. These sectors, the retailing and distribution and the electrical engineering industries, were selected with the purpose of obtaining a reasonable degree of diversity regarding such factors as relative certainty of income streams, capital intensity, trade credit and business concentration. The monetary models are based on the basic principles of the transactions and wealth adjustment theories. The validity of the transactions-wealth hypothesis is also examined. We have questioned the appropriateness of applying ordinary regression analysis to single cross-sections, and applied an error components model to combined cross-sectional and time-series data. A two-stage least squares approach is developed for the wealth adjustment models in order to obtain unbiased results. This study is deemed desirable because of certain limitations of previous cross-sectional demand for money studies, and in particular because so far as the United Kingdom is concerned sectoral analyses of monetary behaviour have been a rather neglected field, whereas aggregate analyses have been quite numerous.

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CHAPTER 1

INTRODUCTION

The chief objective of this thesis is to examine the monetary behaviour of two industrial sectors. The monetary models will be based upon the main principles of the transactions and wealth adjustment theories. The validity of the transactions - wealth hypothesis will also be examined. Empirically our analysis will be conducted by application of an error components model to disaggregated cross-sectional and time series-data. This introductory chapter provides a general framework within which the demand for money by two industrial sectors will be examined. Section one (this chapter) covers some of the problems associated with monetary models tested with aggregate data. Section two attempts to justify our thoroughly disaggregated approach. In particular it advances the hypothesis that there are important differences in the demand for money by industrial sectors and selects two sectors for empirical investigation. Section three states the objectives of the thesis while section four summarises the contents of the subsequent chapters.

1. Some problems associated with aggregate demand for money functions.

Demand for money functions have been developed with assumptions concerning the behaviour of individual economic agents, but the theories have usually been tested with aggregate data. Aggregate data may be an appropriate source of data for testing monetary hypotheses, provided we can confidently expect individual economic agents to react identically to some economic stimuli. If however the behaviour of several economic sectors is different, aggregation over all economic individuals and firms may conceal important information and subsequently yield inaccurate results[1]. On the other hand disaggregated studies for all important economic sectors will yield useful information regarding the stability and relative importance of the determinants of separate functions, and thus enhance our understanding of the monetary and financial behaviour of the economy.

Furthermore in aggregate demand functions supply considerations may be important enough to call for model building in order to avoid identification problems, and simultaneous equation biases. In a thoroughly disaggregated study one can make the assumption that a specific sector is faced with a perfectly elastic supply curve, and can thus obtain as much money as it wishes at the current market interest rate.

2. Justification for our approach.

In this study we advance the hypothesis that there are important differences in the demand for money among industries, and have decided to select two different industrial sectors and examine their cash balance behaviour separately. One of these industrial sectors is the retailing and distribution industry whose income stream may be regarded as relatively stable, and which may be said to contain homogeneous firms. The other industrial sector is the electrical engineering industry, whose income stream may be regarded as relatively unstable in view of the cyclical nature of the industry. The firms included in this industry cannot be said to be as homogeneous as those of the first industry, but are relatively homogeneous as compared to the manufacturing sector as a whole.

1. Guy H. Orcutt, H.W. Watts and J.B. Edwards,
   Data Aggregation and Information Loss.
   American Economic Review, Sept. 1968, pp. 773-787.

The chief reason for our approach is that aggregate data for the corporate sector as a whole are not free of aggregation bias in the sense that either the same variables may affect money holdings of different sectors differently, or a specific set of variables may be appropriate for one sector, while the money holdings of another sector may be influenced by another set of variables. It follows that the magnitude of corporate cash balances may well be determined by the volume of transactions, but this relationship is likely to vary across industries depending on the degree of uncertainty of cash flows and outflows, the capital intensity of the industries, the pattern of trade credit and the degree of vertical and horizontal integration[2, 3, 4]. Of course the aforementioned variables cannot be said to remain constant within an industrial group, but we would however expect the effect of these variables to be mitigated if we select reasonably homogeneous groups of firms, which behave in a reasonably identical manner. If these variables can be measured they should of course be included into a demand for money function, for the corporate sector as a whole. If on the other hand, because of limitations in data, we cannot measure these variables we should select separate industrial sectors in such a way so that the effects of the excluded variables may be thought of as remaining reasonably constant over all firms in the same sector. On a priori grounds it is rather difficult to be

2. R.T. Selden, Cost-Push Versus Demand-Pull Inflation 1955-1957, Journal of Political Economy Feb. 1959, pp. 1-20.

3. R.T. Selden, The Postwar Rise in the Velocity of Money, a Sectoral Analysis, The Journal of Finance, Dec. 1961, pp. 483-545.

4. G. Garvy and M.R. Blyn, The Velocity of Money, Federal Reserve Bank of New York 1969.

precise on the net effect of these variables, on the demand for money for each separate sector. On the one hand it may be argued that the relative certainty of the cash flows and outflows of the retailing and distribution industry would tend to indicate that the average money holdings of this industry should be smaller than the average money holdings of the electrical engineering firms, which are characterised by less certain income streams. On the other hand the retailing industry's current expenses on labour costs, and the need to keep every day a significant amount of petty cash in order to finance a multitude of small cash transactions would imply a high ratio of cash to sales and/or total assets[5]. Increases in labour costs will have to be absorbed by the retailing industry, whereas the electrical engineering firms may be more able to substitute capital for labour, and will thus have a smaller ratio of cash to sales and/or total assets.

Different degrees of capital intensity (which is tantamount to different production functions) across industries, will have different impacts upon money holdings[6]. A capital intensive industry will have to invest in new plant in order to meet additional increases in its output, but also it may have to invest in new plant when technical

5. A.R. Koch, The Financing of Large Corporations, National Bureau of Economic Research 1943.

6. One cannot expect the effect of capital intensity on money holdings, to be constant across firms within an industry. It is obvious that electrical products of large firms are likely to be produced under different conditions than those of small firms. Firm heterogeneity, with respect to different production functions will affect the predictive power of regression equations. This is likely to be more important in the electrical engineering industry than in the retailing industry.

progress embodied in new capital goods promise productivity gains much higher than those associated with older plants[7]. Thus highly capital intensive industries for which the rate of growth in technical progress embodied in new plant is increasing rapidly, will require more funds for investment purposes, than labour intensive industries for which the rate of growth in technical progress is on the average very meagre. It follows therefore that for highly intensive capital firms there is a strong incentive to economise on their cash balances, because transmission of funds to cash account will reduce investable funds for additional investments, and may affect the capital intensity of the industry or firm[8, 9]. These points tend to indicate that the retailing industry may have to hold a relatively greater amount of cash than the electrical engineering industry. This last a priori conclusion may be reinforced by the fact that retailing and distribution firms have numerous branches throughout the country relative to electrical engineering firms, which makes cash optimisation techniques less efficient than in a centralised organisation[10].

Regarding the effect of trade credit on each industry's and/or firm's money holdings the following should be noted. On the whole,

7. Sir R. Shone, Problems of Investment, Blackwell 1971.

8. M.I. Nadiri, The Determinants of Real Cash Balances in the U.S. Total Manufacturing Sector, Quarterly Journal of Economics, May 1969, pp. 173-196.

9. M. Sidrauski, Inflation and Economic Growth, Journal of Political Economy, Dec. 1967, pp. 796-810.

10. See Chapter 2.

firms or industries which possess unutilised facilities of credit[11] will be able to synchronise their receipts and expenditures more efficiently than industries for which the amount of unused trade credit is negligible[13]. However, the net effect of trade credit on the demand for money depends on the cost of credit in relation to other sources of finance, and on whether use of trade credit enables firms to synchronise their receipts and expenditures efficiently, and thus reduce their money holdings. If the cost of trade credit is high in relation to the cost of holding money and other sources of finance, firms will be induced to hold more money relative to trade credit. On the other hand use of trade credit may shorten the payments interval, thereby reducing the demand for money. It follows therefore that if the money saved by reducing the payments interval and hence the average money holdings, is greater than the cost of trade credit, the net effect will be a reduction in the demand for money by firms. However even if the cost of trade credit is low in relation to other sources of finance, use of trade credit would not reduce the demand for money significantly, if the nature of business of an industry is such that there exists a high degree of coincidence between receipts and

11. Defined as the difference between the total amount of trade credit firms have been granted and the amount of credit already used. See footnote 12.

12. A.B. Laffer, Trade credit and the money market, Journal of Political Economy, March-April 1970, pp. 239-267.

13. The same argument holds true for firms or industries which have not utilised the amount of credit banks or other financial institutions are willing to grant them.

expenditures[14, 15]. It follows therefore that unless we know the cost of credit relevant to firms in an industry as well as the pattern of receipts and disbursements, we cannot offer any firm a priori conclusion, on the effect of trade credit on industry or firm demand for money.

The degree of business integration may or may not affect the average amount of cash balances relative to sales or final output[16]. Thus, horizontal integration may not significantly reduce cash balances relative to sales, if after integration each unit maintains its own cash account with a local bank and transmits the proceeds to a central account, thereby having two sets of money balances for a given amount of sales. Direct buying by the central offices of the organisation may or may not contribute towards cash economisation. Vertical integration may reduce the amount of cash balances relative to sales, if the number of payments associated with the production process is reduced as a result of such integration. On the other hand the number of payments associated with the production of output may be the same as that prevailing when the integrated firms were separate entities, if after integration cash holdings of previously separate firms are handled in such a way so that payments by cheque are made by one firm to another, in spite of the fact that all firms belong to the same group.

14. This of course means that firms in an industry will be able to hold smaller average money balances, even if they do not engage in cash economising techniques.

15. R.T. Selden, The Postwar Rise in the Velocity of Money .... p. 511.

16. C. Warburton, The Secular Trend in Monetary Velocity, Quarterly Journal of Economics, Feb. 1949, pp. 68-91.

If the effect of the aforementioned factors on the demand for cash balances is important and affect different industries differently, failure to account for it in an aggregate demand for money function will yield inaccurate information, and render the interpretation of statistical results difficult. Unless one can allow for these effects quantitatively, the best way to avoid biases of this kind is to examine the monetary behaviour of different industrial sectors separately. We have chosen two different industrial sectors which we think can be classified as belonging to a group of firms within which the excluded variables are approximately constant over all firms, but are likely to exert some influence of a different magnitude on each industry's money holdings. We cannot of course expect all the aforementioned variables to remain perfectly constant over all firms within an industry. For instance different production functions[17] across firms within an industry are likely to exist, and to affect the predictive power of regression equations. Firm heterogeneity will show up in our statistical results in the sense that the explanatory power of regression equations tested with heterogenous data will be low as opposed to the explanatory power of regression equations pertaining to homogeneous data.

2. Objectives of the thesis.

In the previous section we identified some of the problems associated with an empirical investigation of the demand for money by business firms. Within this particular framework this study will be concerned with examining the demand for money of the forementioned

17. It is possible that other variables like trade credit, the pattern of receipts and disbursements will vary across firms within an industry.

industrial sectors. The monetary models to be tested will be based upon the basic tenets of two monetary theories, namely the transactions and the wealth adjustment theories. We will also test the validity of the hypothesis that both the level of transactions and the level of net wealth determine the demand for money by business firms. We will apply regression analysis to combined cross-sectional and time series data, in contrast to the majority of previous studies which have used either cross-sectional or time-series data. Particular attention will be paid to the limitations of the statistical techniques used by previous studies and different techniques will be suggested in order to facilitate the interpretation of results and test the empirical validity of the monetary theories in question. To this end an error components model and a two-stage least squares method are employed in order to obtain unbiased results. Specifically we shall attempt to shed some light on whether monetary models based on the wealth adjustment theories are superior to those based on the transactions theories. The transactions-wealth hypothesis is also investigated. In addition we examine the existence of economies of scale and the degree of substitution between money and other assets.

3. Summary of the subsequent Chapters.

This thesis is divided into nine chapters. Chapter 2 of the thesis covers the theoretical literature of transactions models. The similarities and differences between these models are highlighted. At the end of the chapter two economic models are developed. Chapter 3 treats money as an asset and applies the basic principles of asset choice theory to money's use. The discussion includes an analysis of the indirect services that money provides. In addition some attention is paid to the scale variable which should constrain the money holdings by business firms. It is argued that the most appropriate budget constraint should be the net value of the firm. However because a current market determined equity value of the firm is likely to be affected by the amount of money holdings of the firm, a two-stage least squares approach is developed in order to avoid the effect of simultaneous equations biases. As a result it is suggested that in the first-stage we should utilise the relationship between share prices and certain variables suggested by valuation theory. On the basis of this relationship a new equity value for each firm will be constructed, which will be used in the second-stage least squares regression. Share valuation relationships are the subject matter of Chapter 4. Chapter 5 is concerned with surveying empirical monetary research based on aggregate time series data. Chapter 6 reviews the empirical evidence of monetary models for the corporate sector based on cross-sectional data. Chapter 7 questions the validity of applying ordinary regression to single cross-sections and suggests the application of an error components model to combined cross-sectional and time-series data. It also develops all the statistical models for all the economic relationships developed in the previous chapters. Chapter 8 presents, interprets and evaluates the empirical findings. The limitations of our approach and implications of our findings are highlighted. Finally Chapter 9 summarizes the objectives and conclusions of our empirical investigation.

CHAPTER 2

THEORETICAL TRANSACTIONS MODELS

1. Introduction.

Economic theory offers a number of hypotheses concerning the demand for money by individuals and business firms. The traditional monetary theory has maintained that the relationship between the demand for money and the volume of transactions is a proportional one determined in a rather mechanical way by the receipts and payments habits of the community, the developments and organisation of financial institutions, and other technological considerations[18]. The Keynesian approach to the demand for money has separated total money balances into the transactions precautionary and speculative motives[19]. Both the Classical Economists and Keynes regarded the effect of interest rates on the transactions demand for money as unimportant. Furthermore, the difficulty of separating empirically money holdings according to motives does not allow one to rely too heavily on these theories for the purpose of constructing monetary models for business firms. The wealth adjustment or portfolio theories (hereafter wealth adjustment theories) are based on economic reasoning, arising from the basic tenets of the asset choice theory. The proponents of these theories do not distinguish between the motives for holding money, but have instead postulated that an economic agent holds a certain amount of money simply because money

18. H. Barger, Money, Banking and Public Policy. Rand McNally and Co., Second edition 1968, Chapter 5.

19. J.M. Keynes, The General Theory of Employment Interest and Money, Macmillan 1963, Chapters 13, 15.

like any other asset yields a flow of services to its holder. The neo-transactions models on the other hand have likened money to inventories, and applied the basic tenets of inventory theory to money's use. The models which can be used to explain the demand for cash and other liquid assets by firms, can be classified into the transactions and wealth adjustment models. In this chapter we intend to survey and compare the basic transactions models which can be applied to both firms and individuals demand for money. In the following chapter we shall apply the asset choice theory to the demand for money by business firms in order to see whether on theoretical grounds the wealth models can usefully be employed in explaining the demand for money by business firms.

2. The transactions approach to the demand for money.

Baumol's classic article on cash management[20] stressed the macroeconomic implications for monetary theory, but it also recognised the importance of cash optimization for a single economic agent firm or individual. The similarities between inventories and money led Professor Baumol to utilise an inventory model[21] in order to determine rationally the minimum amount of cash balances an economic agent should hold, for effecting a given level of transactions at minimum cost. Both in the case of inventories and

20. W. Baumol, The Transactions Demand for Cash. An Inventory Theoretic Approach. Quarterly Journal of Economics, Nov. 1952. Reprinted in T. Archer and C.A. D'Ambrosio, The Theory of Business Finance: A Book of Readings, Macmillan 1970.
21. T.M. Whitin, Inventory Control in Theory and Practice, Quarterly Journal of Economics, Nov. 1952, pp. 505-508.

cash optimization policies two types of costs are involved, that is an opportunity cost and a transfer cost.

When an economic unit holds its wealth in assets not yielding an explicit return, it foregoes a certain amount of income on this form of wealth. Given that receipts do not always coincide with expenditures, a firm in order to increase its income may transfer its cash balances to an interest bearing account, and whenever money is needed a certain part of the income bearing asset may be liquidated. Every time a firm effects these financial transactions an expense is incurred. Since both opportunity and transfer costs are increasing functions of the amount of average cash balances, and the number of financial transfers respectively, the objective of a profit maximizing firm is to determine the level of average cash balances at which the total costs are at a minimum. Assuming either a certain lump-sum cash inflow and a steady stream of cash outflow, or a certain continuous cash inflow and a lump-sum cash outflow, the optimal amount of average cash balances is determined by the interest rate on income bearing assets, by the transfer costs, and the volume of expenditure. The decision variables facing a firm for a single period from t to tn can be illustrated as follows. At the beginning of the period t, the firm receives an amount of cash equal to T. Part of the initial cash R = T-I is kept for transactions required for the period from t to t1 and the remainder I is converted into short-term liquid assets at a rate of interest i. At time tl, the firm liquidates an additional amount of assets C in order to meet expenditures for the period from t1 to t2. The procedure of liquidating parts of the interest-bearing asset will continue until the end of the period under question. At time Tn new receipts of money will flow into the firm's cash account and the same process will be repeated in the following period. Assuming expenditures are continuous R = T-I will be sufficient to effect transactions during $\frac{T-I}{T}$ i.e., a fraction of the period between receipts. Since the withdrawn money is spent in a steady stream until it is gone, the average cash for $\frac{T-I}{T}$ will be $\frac{T-I}{2}$. It follows therefore that the opportunity cost of witholding $\frac{T-I}{2}$ pounds of money for a period of time equal to $\frac{T-I}{T}$ will be $\left(\frac{T-I}{2}\right) i \left(\frac{T-I}{T}\right)$ 1. A brokerage fee is incurred in order to invest I pounds and this is equal to bd + KdI 2, where bd and Kd are fixed and variable costs respectively. The cost of obtaining cash for the rest of the period is $\left(\frac{C}{2}\right) i \left(\frac{I}{T}\right) + (bw + KwC)\frac{I}{C}$ 3 where bw and Kw are fixed and variable costs respectively. That is, the first term represents the opportunity cost of holding an average amount of money during the subperiod, while the second term is the cost of effecting cash withdrawals from the investment account. The total cost function to the firm of holding cash is found by combining expressions 1, 2 and 3.

22. Tobin[23], arrived at equation 5, by maximizing a revenue function net of any transactions costs, and by proving what Baumol assumed to be true, namely that the conversion of securities into cash must be equal in size and equally spaced in time. Also in Tobin's application the number of sales of short-term securities must be a positive integer, while Baumol assumes continuity. - See page 15.

23. J. Tobin, The Interest-Elasticity of Transactions Demand for Money, Review of Economics and Statistics, August 1956, pp. 231-247.

$$X = \left(\frac{T-I}{2}\right) i \left(\frac{T-I}{T}\right) + \quad bd + KdI + \left(\frac{C}{2}\right) \; i \; \left(\frac{I}{T}\right) + (bw + KwC) \; \frac{I}{C} \qquad 4$$

Differentiating 4 with respect to C and setting the derivative equal to zero we find $C = \left(\frac{2bwT}{i}\right)^{\frac{1}{2}}$ 5 22. R, the optimal amount of money to be withheld from the initial receipts is found by differentiating equation 4 with respect to I and setting the derivative equal to zero i.e., $R = C + T\left(\frac{Kw + Kd}{i}\right)$ 6.

It should be noted that the simple square root formula i.e., equation 5 is a special case of the complete Baumol model, and is obtained when it is assumed that cash is obtained by borrowing or selling financial securities. When the firm is permitted to receive money from the sale of goods or accounts receivable the result is equation 6 which shows that the average amount of cash balances, partially follows a square root law, and partially a linear relationship with respect to T. To see the relationship between average cash balances, and transactions and interest rates, we denote the weighted average balance[24] as

$$M = \frac{R}{2} \cdot \frac{T-I}{T} + \frac{C}{2} \cdot \frac{I}{T} \qquad 7$$

In words the weighted average cash balance is equal to the average amount of money which firms withheld from investment and held during the period $\frac{T-I}{T}$ and to average amount of money held during the period $\frac{I}{T}$ during which there are no receipts from sales. Noting that R = T-I and substituting for R from equation 6 we obtain

24. K. Brunner and A.H. Meltzer, Economies of scale in cash balances reconsidered, Quarterly Journal of Economics, August 1967, pp. 422-436.

$M = \frac{C}{2} + \frac{R}{2i}\ (Kw + Kd)$ 8 . Again substituting for R from equation 6 and rearranging terms we obtain

$$M = \left(\frac{bwT}{2i}\right)^{\frac{1}{2}} \left(1 + \frac{Kw + Kd}{i}\right) + \frac{T}{2} \left(\frac{Kw + Kd}{i}\right)^{2} \qquad 9$$

As Brunner and Meltzer have pointed out[24], if the proportional costs Kw + Kd are equal to zero, equation 9 reduces to the well known square-root formula i.e., equation 5 . According to equation 5 the demand for money varies with the square of transactions. If a price increase also increases the cost of making financial transactions, then the demand for money is homogeneous of degree one with respect to the price level. According to equation 9 , however, if T is very large relative to bw, i.e., if fixed costs are of a negligible amount relative to transactions, the demand for money increases linearly with T while the interest elasticity equals -2[25]. Thus, we have seen that the precise estimates of elasticities derived from the square-root rule, are dependent upon the assumptions we make. When we include the assumption that receipts from sales and accounts receivable are permitted into the model, equation 9 shows that the demand for money is (a) proportional to the price level, and (b) if there are important fixed costs it will vary less than in proportion to real transactions, while for large T cash balances will be proportional

25. This can be found by putting bw = 0 and taking the logarithms of the remaining expression i.e., equation 9 .

to the level of transactions[26]. As regards the interest elasticity of the demand money it will range between -0.5 and -2 [27].

It is however possible to find a more than proportional relationship between money balances and transactions. Equation 5 is derived on the assumption that firms have complete centralization of their cash management. As Sprenkle[28], has argued the Baumol-Tobin formulation assumes that all cash flows and outflows are directed into one office which manages one account only. Following Sprenkle let us see the effect of some degree of decentralization on a firm's

26. Professors Brunner and Meltzer[24] show this by calculating the elasticity of money with respect to T from equation 9 .

$$\epsilon\,(M,\,T) = \frac{\left[1 + (Kw + Kd)/i\right](bwT/2i)^{\frac{1}{2}} + \left[(Kw + Kd)/i\right]^{2}\,T}{2\left[1 + (Kw + Kd)/i\right](bwT/2i)^{\frac{1}{2}} + \left[(Kw + Kd)/i\right]^{2}\,T}$$

They argue that as $T \rightarrow 0$ the elasticity approaches $\frac{1}{2}$, while as $T \longrightarrow \alpha$ the elasticity approaches 1.

27. That the transactions and interest elasticities can be different than those implied by the simple square-root formulation has also been shown by Sprenkle[29] on the assumptions that firms behave as in the Baumol model but in addition are allowed to earn a certain amount of interest income on their demand deposits as well as an array of services granted to them by banks.

28. C.M. Sprenkle, The Uselessness of Transactions Demand Models, Journal of Finance, Dec. 1969, pp. 835-847.

29. C.M. Sprenkle, Large Economic Units, Banks and the Transactions Demand for Money, Quarterly Journal of Economics, August 1966, pp. 436-442.

average cash holdings. Consider a large firm with J branches and J separate accounts. Let the J^{th} branch be responsible for X_J per cent of total receipts and disbursements. If each branch optimizes its cash holding, the optimal cash holdings of the J^{th} branch will be

$$M_J = \left(\frac{2X_J \, bwT}{i}\right)^{\frac{1}{2}} \qquad 10$$

The total mount of the optimal cash holdings of all branches will be

$$M_J = \sum_{J=1}^{J} \left(\frac{2X_J \, bwT}{i}\right)^{\frac{1}{2}} = \left(\frac{2bwT}{i}\right)^{\frac{1}{2}} \sum_{J=1}^{J} \left(X_J\right)^{\frac{1}{2}} =$$

$$= M \sum_{J=1}^{J} \left(X_j\right)^{\frac{1}{2}} \qquad 11$$

The difference between optimal cash balances under decentralization, M_J, and complete centralization of cash management is a function of the degree of cash management decentralization. In the case of complete centralization $M_J = M\,(1)^{\frac{1}{2}} M$. In the case of complete decentralization, where $X_J = \frac{1}{J}$ for all J,

$$M_J = M \sum_{J=1}^{J} \left(\frac{1}{J}\right)^{\frac{1}{2}} = M(J)^{\frac{1}{2}}$$

In words optimal cash balances on the assumption of complete decentralization will be greater than under complete centralization by a factor equal to the square-root of the number of separate branches or accounts. It follows therefore that the greater the need for separate branches and accounts, the greater the amount of cash the organization as a whole must hold. We must however note that the number of special branches and accounts is not necessarily a function of size. In fact it is both a function of size and the nature of the business of a particular organization. A retailing firm may have a greater number of branches around the country than an electrical engineering firm of the same size. Thus it is possible to find that average cash balances increase by more than in proportion to increases in transactions, not because firms treat money as a luxury good[30] but because as the size of firms grows the possible setting up of new branches may cause some degree of suboptimization of cash balances. Decentralization will lead to suboptimal cash balances for the organization as a whole if some smaller branches of the organization cannot engage in cash conserving practices. This may be attributed to the fact that the fixed and variable costs of maintaining a separate interest-bearing account are greater than the interest income earned on this account. On the other hand, it may be argued that increased operations may allow firms to introduce more sophisticated cash management techniques which may increase cash balances less than in proportion to sales. It follows that a priori it is very difficult to establish any specific cash balance behaviour.

In spite of the elegance and simplicity of the forementioned models, their certainty assumptions about the behaviour of receipts and expenditures are unrealistic in certain cases. Instead changes in the cash balance may fluctuate in an irregular and rather unpredictable way. The uncertainty factor led Miller and Orr[31], to postulate that as in Baumol's model, cash balances held by firms

30. That is money has an income elasticity greater than one.

31. M.H. Miller and D. Orr, A Model of the Demand for Money by Firms, Quarterly Journal of Economics, August 1966, pp. 413-435.

still depend on the opportunity cost of holding money and the transfer costs, but unlike Baumol they add a third factor, namely the variance in a firm's net cash flow. In their model, net cash flows are assumed to be completely stochastic, and to follow the laws of the stationary random walk hypothesis. That is during a certain period of time the cash balance will either increase by a certain amount with probability p or decrease by the same amount with probability $q = 1-p$. The firm's objective of minimizing the average cost of money balances can be achieved by setting up a two-parameter control-limit cash policy. In other words cash balances are allowed to wander freely within the limits of an upper-bound, h, and a lower-bound which for simplicity[32] is assumed to be zero. Once the limit h is reached the treasurer will transfer an amount of cash h-Z to the investment portfolio where Z is the intermediate return point. Conversely, when cash balances reach the lower limit 0, there will be a transfer to cash of OZ pounds. The limits h and Z are calculated so as to minimize the following cost function

$$E(C) = bE(N)/T + iE(M) \qquad 12$$

where E(N) is the expected number of transfers between cash and securities during the period under question, b is the cost per transfer T the number of days in the planning period, E(M) the expected daily cash balance and i the daily rate of interest on securities.

32. It is recognised though that in reality Banks may require firms to hold some non-zero level of cash balances. See W.E. Gibson, Compensating balance requirements, National Banking Review, March 1965, pp. 387-395.

The solution derived by Miller and Orr is

$$Z = \left(\frac{3bS^2t}{4i}\right)^{\frac{1}{3}} \qquad 13$$

$$h = 3Z \qquad 14$$

The average cash holdings are shown to be

$$M = \frac{4}{3}\left(\frac{3bS^2}{4i}\right)^{\frac{1}{3}} \qquad 15$$

where S^2 is the variance of the daily demand for cash. Equation 15 shows that the demand for cash by firms is an increasing function of the cost per transfer and the variability[33] of the cash balance, and a decreasing function of the opportunity cost of holding cash. In contrast to Baumol's square-root formulation, nothing very precise can be said about the transactions elasticity of the demand for money, for it depends on the relationship between the variance of daily cash balances, and sales and can range from less than $\frac{1}{2}$ to greater than 1[34].

The distinctive aspect of the aforementioned models is that money has been assumed to possess the same attributes as ordinary inventories. But the rate of return on inventories is not necessarily zero. In the case of inventory shortages the firm incurs costs in

33. The same conclusion is reached by Flemming[35] and Friedman and Schwartz[36] for the aggregate demand for money, i.e., that the demand for money is an increasing function of the degree of uncertainty associated with future expected incomes or expenditure.

34. Miller and Orr, pp. 156-157.

terms of lost sales and lost goodwill. By the same token running out of cash may entail costs in terms of credit deterioration, loss of cash discounts, loss of production, labour and administrative costs.

W. Beranek[37] took these costs into account in his model of optimal cash determination. The distinctive aspect of this model lies in the occurence of short costs which manifest themselves when some critical level of minimum cash balances is violated. In this model the treasurer receives the production budget from other managers, and he is responsible for maximising interest returns from cash balances. The objective of the treasurer is to allocate his initial amount of money between cash and securities, so as to maximize interest income. Liquidation of securities is permitted at the end of the planning period. Cash expenditures are regarded as lumpy and controllable, while receipts are regarded as continuous and uncontrollable. Given a subjectively determined probability distribution of net cash flows, and a cost function consisting of the opportunity cost of holding cash and the cost of running short of cash, the optimal cash balance is found to be at a level where the probability of being caught short of cash equals the ratio of the net returns on the investment portfolio, and the

35. M. Flemming, The Timing of Payments and the Demand for Money, Economica, May 1964, pp. 132-157.

36. M. Friedman and A.J. Schwartz, A Monetary History of the United States 1867-1960, National Bureau of Economic Research, Princeton University Press 1963, pp. 673.

37. W. Beranek, Analysis for Financial Decisions, Richard D. Irwin, 1963, Chapter 11.

incremental cost of running short of cash[38].

3. Comparison of the models.

The theory of the transactions demand for money by business firms described in this chapter, is essentially based on models developed for inventory optimal decisions. All models are primarily concerned with minimizing some cost function. Their main differences lie in the importance given to certain costs, and in the time pattern of receipts and expenditures. The Baumol-Tobin and Miller-Orr models emphasize the costs of transfers between the cash account and the securities portfolio. The Beranek model emphasizes the importance of a short-cost function. In contrast to completely deterministic assumptions of the Baumol model, Miller and Orr have assumed a completely stochastic behaviour of net cash flows while Beranek has assumed controllable expenditures and stochastic receipts. In reality the treasurer will have to deal with the effect of uncertainty and he is thus forced to calculate the expected value of receipts and expenditures as well as the variances of these variables. Thus the minimum cash balance is bound to be above that indicated by models based on complete

38. In another model for an insurance company White and Norman[39], have developed a model similar to Beranek's designed to determine the optimal opening cash holdings that maximizes wealth at the end of the planning period. The solution depends upon the net incremental return per pound of investment and the interest rate on overdrafts.

39. D.J. White and J.M. Norman, Control of cash reserves, Operational Research Quarterly, Sept. 1965, pp. 309-328.

certainty. The treasurer may therefore allow for additional precautionary money balances, in order to cover the undesirable effects of expected expenditures being greater and expected receipts being less than the average values of these quantities.

One cannot accept unquestionably the Miller-Orr and Beranek assumptions regarding the behaviour of cash receipts and expenditures. In reality one would expect a portion of receipts and expenditures to be controlled by management, while the remainder would be expected to fluctuate randomly. It follows therefore that the applicability of the aforementioned models would depend on the nature of business of a particular firm. In spite of the deterministic character of the Sprenkle model its conclusion that firms with numerous branches will have to hold more money than firms with fewer branches, may be utilised in order to rationalize empirical results, which may be thought of as inappropriate on a priori grounds. In spite of the difficulties encountered when one attempts to estimate probabilities and parameters according to the letter and spirit of the aforementioned transactions models, the conclusions of these models may be usefully employed in order to facilitate the interpretation of our statistical results.

4. Development of transactions models.

The theoretical analysis of the transactions models and our comments on the comparison of these models suggest that the demand for real cash balances $\frac{M}{P}$ by business firms should be functionally related to the following variables as given by model 1 below.

$$\frac{M}{P} = f\left(r, \frac{S}{P}, \frac{b}{P}, S^2, C\right) \qquad 1$$

Where r is the yield on short-term Government securities. We are using a short-term interest rate, for all transactions models assume that cash not immediately needed for transactions should be invested in riskless short-term maturity debt instruments. $\frac{S}{P}$ is the current volume of real sales. Strictly speaking transactions should be represented by the expected volume of receipts and expenditures to and from the cash account. However because the debits and credits to the cash account cannot be derived from accounting data, we approximate this variable by the volume of sales[40]. b is the real brokerage cost, S represents the variability of real transactions and C are the costs of not holding a minimum amount of cash balances i.e., penalty costs.

It should be noted that model 1 is in fact a hybrid model based upon the variables advanced by the transactions models described in this chapter. However because of practical difficulties encountered in attempting to measure b, S, C[41] we shall assume them as being constant and consider

$$\frac{M}{P} = f\left(r, \frac{S}{P}\right) \qquad 2$$

40. E.L. Whalen, A Cross-Section Study of Business Demand for Cash, The Journal of Finance, Sept. 1965, pp. 434-439.

41. One may have argued that penalty costs could have been approximated by the interest rate paid on borrowed funds. It should however be noted that penalty costs incurred by firms when caught out of money are a far broader concept encompassing all costs associated with cash-out effects both tangible and intangible lossess i.e., credit deterioration, potential loss of sales, loss of machine, and man hours, and in extreme cases total loss of business.

However firms can and do borrow money to meet their transactions needs. A firm that borrows money will have to consider transactions costs, in the sense that the existence of these costs will encourage firms to borrow larger quantities of money less often, while interest rate costs will force them to borrow smaller amounts of money more frequently. We may therefore have to consider the effect on money of both interest rates i.e., lending and borrowing rates. For if we use one rate only, the effect of it on the demand for money may be negligible. As Selden[42] has argued, when interest rates rise, two things are likely to happen. As the lending rate rises firms are induced to transfer cash balances by moving into money substitutes. At the same time as the borrowing rate rises, firms may find it economical to increase their cash balances in view of the higher cost of borrowing. To the extent that these two opposite effects offset each other, the effect of a particular interest rate on money may be insignificant. Since it is reasonable to assume that interest rates move together over time we will not use both of them in a demand for money function, but instead use the difference between these rates. In this case the appropriate opportunity cost to use is the difference between the yield on long-term corporate bonds R and the yield on short-term Government securities[43]. Therefore the second economic model under examination

41. In Section 9 of Chapter 8 we consider the implications of omitting these variables from our models.

42. R.T. Selden, Monetary Velocity in the United States, In Milton Friedman, Studies in the Quantity Theory of Money, The University of Chicago Press 1967, pp. 208-210.

43. R.T. Selden, Monetary Velocity in the United States, pp. 209.

will be

$$\frac{M}{P} = f\left[(R-r),\ \frac{S}{P}\right] \qquad 3$$

Our models specify certain variables as being important determinants for the demand for cash balances by firms, and in addition they place certain restrictions on the relationships between the variables in question.

(a) $\frac{dM}{ds} > 0$ i.e., ceteris paribus the higher the level of real sales the higher the demand for real money balances.

(b) $\frac{dM}{dr} < 0$ i.e., ceteris paribus the higher the yield on short-term securities the smaller the demand for money.

(c) $\frac{\partial M}{dr} = 0$, to the extent that a change in the lending rate is completely offset by a corresponding change in the borrowing rate.

(d) $\frac{\partial M}{d(R-r)} > 0$ i.e., the greater the difference between these two rates the greater the demand for money.

That is so because the higher the borrowing rate on external funds, the more economical it will be for firms to hold more money balances. Given that R is greater than r, the greater the difference between these two rates the greater the demand for money.

We have simply specified the sign of the relationships between the demand for money and the variables, which according to our theories are likely to determine it. The magnitude and significance of the relevant parameters will be subject to empirical investigation.

CHAPTER 3

WEALTH ADJUSTMENT THEORIES

1. Introduction.

Interest in the demand for money by individuals and firms was revived after Friedman's publication of the Quantity Theory of Money[44]. Friedman and subsequently others[45-47], treated the demand for money like any other demand for assets.

Money is demanded for the services it yields its holders over time. Effecting transactions and being a hedge against uncertainty are but a few of the services that money provides. An individual's balance sheet is likely to contain money, bonds, equities and physical goods. Changes in the yields of one or more assets will induce an individual to adjust his holdings of assets according to the new yields, and in such a way as to enable him to maximize his wealth. The individual's wealth maximizing objective will be achieved as long as the last pound invested in monetary assets yields as much as the last pound invested in real assets. In making an investment

44. M. Friedman, The Quantity Theory of Money: a Restatement. In M. Friedman, Editor, The Optimum Quantity of Money, pp. 51-69.

45. Strictly speaking it was Professor Hicks who originally applied marginal analysis to money's use. J.R. Hicks, A Suggestion for Simplifying the Theory of Money, Economica, Jan.1935, pp. 1-19.

46. K. Brunner and A.H. Meltzer, The Place of Financial Intermediaries in the Transmission of Monetary Policy, American Economic Review, May 1963, pp. 372-412.

47. J. Tobin, Money, Capital and Other Stores of Value, American Economic Review, Feb. 1969, pp. 15-29.

decision an individual will be constrained by his net wealth as reflected by the sum of his net claims on real and financial assets, as well as his claims of future income from his labour. Thus the wealth constraint and indeed all other relevant variables are cast in terms of their long-term expected values. In other words under this theoretical framework, individuals are assumed to behave as if they adjust to expected variables rather than to current ones. Disregarding any expected capital gains or losses on the individual's portfolio of assets, a money demand function for an individual may be written as

$$M = f(r, Yp, u) \qquad 1$$

and assuming that money is homogeneous to degree one in prices and the value of financial and real assets we have

$$\frac{M}{P} = f\left(r, \frac{Yp}{P}, u\right) \qquad 2$$

where M is nominal money r is a vector of returns on financial and real assets, Yp is a weighted average of current and past values of incomes, P is a price index level which may be regarded as a weighted average of current and past values of prices and u stands for tastes and preferences.

Regarding the demand for money by business firms the same broad principles can be applied to it. Friedman[48], mentions that money should be treated as a productive asset which should be functionally related to the cost of money, cost of other productive services, the services yielded by money and the long-term production of the firm.

48. Friedman, The Quantity Theory of Money ...... pp. 52 and 58-59.

The same author[49], in his empirical work speculates whether money should be likened to inventories or to fixed assets. If money is treated like inventories, it should act as a shock absorber and increase by more than the amount corresponding to some normal level of production. If however cash is treated like fixed capital it should be related to normal level of production, and fluctuate by less than current production. Friedman asserts that firms treat money like fixed capital and hence some other assets or liabilities act as shock absorbers. However Friedman did not elaborate on the demand for money by business firms to the same extent as he did on the demand for money by persons. In the following section we view the firm as consisting of a portfolio of assets, and examine the major determinants of money holdings by business firms.

2. The firm as a portfolio of assets.

In this section we think of the firm as consisting of a portfolio of assets monetary and real[50]. Management will strive at allocating the firm's resources among all assets in order to

49. M. Friedman, The Demand for Money. Some Theoretical and Empirical Results, Journal of Political Economy, August 1959. Reprinted in M. Friedman, The Optimum Quantity of Money.

50. Real assets are assets whose nominal yields are affected by price level changes i.e., equities, real property etc., while monetary assets are claims to fixed number of pounds i.e., bank deposits, bonds, notes etc. See R.A. Kessel and A.A. Alchian, Effects of Inflation, Journal of Political Economy, Dec. 1962, pp. 522-537.

maximize shareholders wealth[51]. To the extent that management's investment decisions yield income returns at risk levels acceptable to the firm's ultimate owners, then management's investment policies will be in accordance with the objective of maximizing shareholders' wealth[52].

A firm's management having decided on how to raise the short and long-term financial resources for productive purposes, then has to allocate these resources among money, short-term securities, fixed capital etc. Each asset held in the firm's portfolio of monetary and real assets is likely to yield a certain amount of explicit or implicit income return. All assets enable firms to produce and distribute their products, and all contribute towards the achievement of wealth maximization. Although real assets may be said to be more closely related to the earnings capacity of a firm, investment decisions on other monetary assets do contribute towards the achievement of the wealth maximizing objective. A wealth maximizing firm will have maximized its wealth as long as the last pound invested in monetary assets yields as much as the last pound invested in real assets. Thus, in the case of firms, investing in money should be treated like any other investment decision, so that in equilibrium the marginal net return of a pound invested in the form of money is equal to that of a pound invested in any other asset. But in investment portfolios either personal or corporate, money has

51. E. Solomon, The Theory of Financial Management, Chapter 2, Columbia University Press 1969.

52. J. Hirshleifer, Investment Decisions Under Uncertainty: Choice-Theoretic Approach, The Quarterly Journal of Economics 1965, Reprinted in Archer and D'Ambrosio.

to compete with real assets which yield an explicit income return, and bear an explicit opportunity capital cost. An explicit net present value can thus be calculated for these assets. In the case of money neither its services nor its costs can be explicitly calculated. It is therefore important to be explicit about the implicit services that money provides.

The services that money yields are indirect[53]. These services can be conceived of, if we assume that a firm has decided not to hold money at all. The costs to a firm for doing so are: labour costs of investigating the possibilities of altering the time structure of receipts and payments, the labour costs of arranging several kinds of finance, costs of rendering labour and machinery idle, costs of managing an additional volume of inventories, deterioration of credit worthiness and loss of cash discounts.

On the other hand the holding of some resources in the form of money will reduce the aforementioned costs, by enabling management to free some labour resources engaged with altering the time pattern of receipts and expenditures, allow for efficient utilisation of existing labour and capital resources, decrease investment costs in inventories and reap the benefits of good credit rating and cost discounting.

Another feature of money is that it can act as a means of hedging against uncertainty. In a perfectly certain world in which financial transactions can be effected without incurring transactions costs, it would be unprofitable to hold money balances

53. J. Tobin, The Monetary Interpretation of History, A Review Article, American Economic Review, June 1965, pp. 464-485.

at all[53]. If all future transactions could be predicted with certainty money not required for immediate transactions needs could be lent at the market rate of interest. In such a world liquidity per se has no value. When uncertainty is present the holding of some money is needed for it can be used as a means of hedging against changes in the prices of capital, labour, commodities and the interest rate[54]. The other distinctive feature of money is the very low transactions costs associated with the exchange of money for other real or financial assets[55, 56].

All these services that money provides will enable a firm to reduce the unit cost of production. This suggests that using money results in certain cost advantages, and the ratio of money to other assets will change with changes in these costs[57]. Other things being equal, if the cost of human resources devoted to arranging a better and more efficient synchronization between receipts and expenditures increases the firm may increase its money holdings and decrease the demand for labour.

53. D. Bodenhorn, A Cash Flow-Concept of Profit, The Journal of Finance, March 1964, Reprinted in Archer and D'Ambrosio, The Theory of Business Finance, pp. 6-22.

54. M.I. Nadiri op cit.

55. K. Brunner, The Report on the Commission on Money and Credit, Journal of Political Economy, Dec. 1961, pp. 605-620.

56. P. Cagan, Why Do We Use Money in Open Market Operations, Journal of Political Economy, Feb. 1958, pp. 34-46.

57. Kessel and Alchian op. cit.

In the last analysis the expected returns that money provides must be discounted at an appropriate opportunity cost. This will probably consist of any charges of bank accounts, depreciation through inflation[57], and a capital cost reflecting the return on the best alternative that money may conceivably be invested in.

To recapitulate: We have postulated that a firm's objective is that of maximizing shareholders wealth. This objective can be achieved so long as all financing and investment decisions are based upon the basic tenets of wealth maximization. An asset will be worth holding if its net present value is equal to or greater than zero. It follows therefore that the management will have to ensure that the last pound invested in the form of money will have the same present value as the last pound invested in any other asset. In the case of money it is impossible to measure its present value in a concrete and meaningful way. This is so in view of the intangible returns that money provides. However, at least conceptually, investment in the form of money must be treated as any other investment decision. Thus the choice among different assets must depend upon their expected returns and costs. In theory therefore money holdings by firms should depend upon the net return on money, and the net return on other assets.

The other major determinant of money holdings is the budget constraint. In the case of an individual, if he were to sell all his holdings of real and financial assets as well as his claims for future income, and deduct from this total sum any liabilities both present and future, the remainder is what we call the individual's wealth or budget constraint. In other words, a budget constraint is the maximum amount of resources allowable for holding one's wealth in the form of a particular asset.

In fact the same principle can be applied to the wealth constraint for a business firm. If the management of a firm have decided for whatever "unrealistic" reason to hold the firm's wealth in the form of money, the management's action should be constrained by the amount of the firm's net wealth. We think that the best variable reflecting the net wealth of a firm is the capitalized value of its net expected earnings, that is the equity market value of shareholders wealth.

Perhaps the most appealing and commonly used variable expressing a firm's wealth should be the net book or current value of assets. Regarding the book value of assets the greatest part of it is expressed in historic prices, and only the current accumulation of assets is expressed in current prices. This and the different accounting techniques used by firms render the use of this variable as a proxy for the wealth constraint inappropriate. But even if we were to use some replacement value of total net assets this would still be an inappropriate wealth constraint. Attempts to use some replacement value of total net assets would be laborious and would not necessarily provide us with the maximum amount of money a firm is really worth. It may tell us what a firm is worth today, but it would fail to give us any realistic estimate about the firms expected wealth.

In the case of an individual, as Professor Friedman[58] has pointed out, an economic agent's money holdings are constrained not only by his current net worth, but also by the present value of his future net earnings including human earnings. What this means is that we must be concerned with a long-term concept of wealth or income, instead of a current one. The same principle can be applied

58. M. Friedman, The Optimum Quantity of Money ..... op. cit.

to a business firm. In fact in the case of firms we are not faced with the problem of having to calculate the present value of human expected earnings, for which no proper market exists. The net market value of the firm, apart from some problems connected with speculative forces, has capitalized all future earnings both tangible and intangible, is independent of different accounting techniques among firms, and may be said to represent the long-term expected net earnings of the firm, a concept which may be said to be analogous to permanent income[59]. To the extent that the current market value of a firm's shares reflect the expected earnings power of the firm's assets, it is this variable which should be employed as a wealth constraint in a demand for money function by firms.

Among other things, (mentioned above) direct inclusion of this wealth variable in a demand for money function by firms, is in accordance with the postulate of wealth maximization. In other words since our theory is based on the hypothesis that a firm's management aim at maximizing the market value of shareholders equity, it is important on theoretical grounds to utilise direct observations of this variable[60].

However the current market value of a firm's shares measured at a point in time is essentially a short-term concept in that it changes frequently and at times erratically. The effects of

59. Since permanent income has been defined - among other definitions - as the yield on wealth. See M. Friedman, The Optimum Quantity of Money, pp.52.

60. R. Marris and A. Singh, A Measure of a Firm's Average Share Price, Journal of the Royal Statistical Association, A 1966, pp. 74-97.

temporary disturbances may be avoided, if we use the yearly high-low average share prices which has been shown to be a good proxy for the average of share prices thoughout the year[60, 61]. This variable may reflect the market's evaluation of the expected net earnings of the firm. It is possible however that inclusion of the average share price in a demand for money function may produce biased results.

To see the problems involved let us put the cart before the horse and consider the following statistical model.

$$Mit = a + b1\ Pit + C1Rt + uit \qquad 3$$

Where Mit is the amount of money balances of firm i in year t, Rt is the yield on corporate bonds, Pit is the value of shares of firm i in time t, and uit is the disturbance term. It can be shown that ordinary least squares estimates of the parameters of equation 3 will be biased if the independent variables are correlated with the disturbance term[62]. We think that Pit is likely to be correlated with uit. We attribute this to the following reasons. It is possible that the level of money of firm i in year t, may affect the value of shares of firm i in year t. In other words we think that the particular level of money may affect investors' expectations regarding the ability of the management to finance short-term projects, or indeed its inability to invest liquid funds in real

61. C. Edwards and J.C. Hilton, A Note on the High-Low Price Average as an Estimator of Annual Average Stock Prices. The Journal of Finance, 1966, pp. 112-115.
62. J. Johnston, Econometric Methods, Ch. 13, Second Edition, McGraw-Hill.

assets. Money balances may also be an indicator of potential merger or takeover activities which may either increase or decrease the share value of the firm depending on the economic and financial characteristics of the firms involved. It is also possible that investment opportunities may affect the level of money holdings and subsequently the value of shares. For all these reasons Pit is likely to be correlated with uit and hence direct application of ordinary least squares is inappropriate. What we need is a new variable highly correlated with average share prices but uncorrelated with the disturbance term. This may be accomplished by the method of two-stage least squares[63]. That is, in the first stage we will use the relationship between the market price of shares and relevant variables. Regarding the specific exogenous variables to be used, we will rely on the basic tenets of valuation theory[64] so that we may find such variables which will be strongly correlated with share prices. Let this relationship be $Pit = a' + b'1Xit + eit$ 4 where Xit is the set of exogenous variables purporting to explain P. In equation 4 we assume that X is not correlated with the disturbance term. In the first stage we estimate a' and b' by the method of least squares[65]. Thus $\bar{P}it = \bar{a}' + \bar{b}'1Xit$ 5 . In the second stage $Mit = a + b1\ (\bar{P}it + eit) + C1Rt + uit$

$= a + b1\bar{P}it + b1eit + C1Rt + uit$ 6 . Since Pit is not correlated with (b1 eit + uit) the least squares method may be applied to estimate a, b1 and C1. Thus we will construct a new share price variable from the first-stage regression, while the second stage

63. Johnston, Chapter 12.

64. This is analysed in Chapter 4.

65. In fact will use a generalised least-squares approach namely an error components model.

regression will be conducted with the thus constructed variable as one of the independent variables. It is hoped that this approach will purge the explanatory variable of the stochastic elements associated with the disturbance term[66].

It must also be stressed that we expect this approach to pick up any systematic relationship between interest rates and share prices, or between interest rates and third variables. In other words it is quite possible that income conscious investors may be affected by the particular levels of interest rates, and hence move in or out of shares. Also changes in long-term corporate interest rates may affect the externally raised debt capital and hence the gearing ratio which in turn may affect share values. Since we will relate market share prices to such variables as dividends, capital gains etc., we may argue that our computed wealth variable may be closely related to the long-term or intrinsic value of shares. It is therefore hoped that a two-stage least squares approach will produce unbiased results.

66. We cannot of course be absolutely certain that the independence assumption of the disturbance term and the forecasted equity value will not be contradicted in reality. In our case though we can argue that observed values of money will not be related to short-term equity value, but to forecasted long-term value of shares. As a result observations of current money holdings will affect current share prices, but not observations of forecasted share prices. Hence the independence between the disturbance term and forecasted share prices is not contradicted.

3. <u>Development of the wealth adjustment model.</u>

The forementioned analysis suggests that not only money's indirect services but also the returns on real and financial assets should be included in a demand for money function. Since money should in fact compete with all assets in a firm's portfolio and indeed with rates on its short and long-term liabilities, all relevant rates of return should be included. Because however, meaningful measures of money's own return and of returns on each asset contained in a firm's balance sheet are not easily measurable we are compelled to make severe approximations.

The internal rate of return on the firm's assets could have been used, but inclusion of such a rate in a demand for money function would have raised serious problems of multicolinearity in view of the close relationship between the internal rate of return and the firm's net market value. We think that a good proxy for the internal rate of return is the yield on long-term corporate bonds. This measure of opportunity costs may be thought of as the rate which a firm pays for raising external capital. In equilibrium it may also be viewed as the average cost of capital in a Modigliani and Miller[67] theoretical framework. In other words we are not just considering the nominal interest paid for external capital, but the real costs to a firm consisting of both the nominal interest charges and the additional equity costs resulting from the introduction of debt into the firm's financial structure.

We are therefore led to consider the following model

$$\frac{M}{P} = f\left(R, \frac{W}{P}\right) \qquad 6$$

67. See Chapter 4.

Where $\frac{M}{P}$ is real money, R is the yield on corporate bonds i.e., the yield on corporate debentures and loans and $\frac{W}{P}$ is the product of the number of shares per firm at time t multiplied by the computed real value of its shares.

The following restrictions can be put on the relationship between the variables under consideration.

$\frac{dM}{dR} < 0$ i.e., other things being equal the higher the yield on long-term corporate bonds the smaller the demand for real money.

$\frac{dM}{dW} > 0$ i.e., other things being equal the higher the level of a firm's net real value the higher the demand for real money.

4. A transactions-wealth hypothesis.

Lastly we will briefly consider the transactions-wealth hypothesis originally advanced by Marshall[68] and later completed by Hansen[69]. This hypothesis suggests that as far as an individual's demand for money is concerned both income and wealth should be included in a demand for money function, as both are likely to exert an independent influence on money.

We will apply this hypothesis to a firm's demand for money in order to see whether both transactions and wealth exert an independent positive influence on a firm's money holdings. The transactions-wealth aspect of money from a firm's point of view can be rationalized on the grounds that business firms in an attempt to

68. A. Marshall, Money Credit and Commerce, Book 1, Chapter IV, Macmillan, London 1983.

69. A.H. Hansen, Monetary Theory and Fiscal Policy. McGraw Hill New York, 1949, pp. 66-67.

increase their wealth will invest in securities and equities, so long as the return on them is higher than the return on additional investment projects. Following Tobin[70] we should expect firms to hold in addition to their real portfolio, a diversified financial portfolio as well. It follows therefore that firms may have to hold money both for their transactions and portfolio purposes. Thus if there is both an asset and a transactions demand for money, both variables must be considered as potential determinants of the demand for money by business firms. On the basis of the above discussion we can formulate the following economic model.

$$\frac{M}{P} = f\left(R, \frac{S}{P}, \frac{W}{P}\right) \qquad 7$$

where all variables have been defined before. The signs of the relationships predicted by this hypothesis are as follows.

$\frac{dM}{dR} < 0$ i.e., ceteris paribus the higher the yield on long-term corporate bonds the smaller the demand for real money.

$\frac{dM}{dS} > 0$ i.e., ceteris paribus the higher the level of real sales the higher the demand for real money

and

$\frac{dM}{dW} > 0$ i.e., ceteris paribus the higher the net real wealth of the firm higher the demand for real money.

70. J. Tobin, Liquidity Preference as Behaviour Towards Risk, Review of Economic Studies, Feb. 1968, Reprinted in Archer and D'Ambrosio.

5. Comparison between transactions and wealth adjustment theories.

Basically both approaches are quite similar mainly because they are based on rational behaviour on the part of the management. Both are dexterous modifications of the asset choice theory, but emphasise different variables as being potentially important determinants in a corporate demand function for money.

The portfolio or wealth adjustment models emphasise some permanent income or wealth concept, the services provided by holding money and the services of other assets as the most relevant arguments in a demand for money function. The transactions models concentrate on a transactions variable, net returns on short-term securities, and the services[71] that money provides as the variables influencing the demand for money by firms.

Thus although these theories do not necessarily contradict one another, they nevertheless employ different theoretical variables which may affect money holdings in a different way. To the extent that we are able to employ the empirical counterparts of the theoretical variables we may be able to test which one of these models is superior on empirical grounds. Since these theories do not contradict each other we have a third alternative model that of the transactions-wealth model.

71. Here we think in terms of costs incurred by not holding a minimum amount of cash balances.

CHAPTER 4

SHARE VALUATION MODELS, THEORY AND EVIDENCE

1. Introduction.

We said in Chapter 3 that biased results would have been obtained if we had tested a demand for money model in which the wealth variable was represented by the current market value of equity. In addition, the speculative elements inherent in share prices ruling at a moment in time, suggested that our objective should be to determine the value of shares based on such real variables as dividends, capital gains etc.

Although this thesis is not primarily concerned with share value theory, we need nevertheless to survey the theoretical and empirical literature on share valuation models and also to develop a proper valuation model. Our reasons for devoting a whole chapter on share valuation are as follows. As is well known a two-stage least squares approach, requires one in the first stage, to find variables highly correlated with the endogenous variable considered to be dependent on the disturbance term. One could approach this matter in an ad-hoc way in that a host of variables could be tested and the ones highly correlated with the variable under question would be selected for predictive purposes. However the variables thus selected may not necessarily reveal any fundamental relationship if the correlations are of a spurious nature. If on the other hand we attempt to test a relationship based on the basic tenets of a specific theory we can then feel confident that our statistical results are in accordance not only with the usual statistical tests, but also with our theoretical constructs.

Thus although our basic objective will be to develop a two-stage least squares model in order to purge the explanatory variable of the stochastic elements associated with the disturbance term, this approach will also enable us to obtain an estimate of wealth which may be regarded as a long-term expected concept.

During the theoretical development of our economic models it was made clear that realistically both the transactions[72] and wealth models were in fact concerned with expected transactions and wealth concepts, and not with current measured ones. Since our data does not allow us to develop an expected transactions concept, our forecasted wealth variable may enable us to shed some light on the empirical superiority of a wealth model containing an expected wealth variable vis-as-vis a transactions model containing current measured sales as one of the independent variables affecting the demand for money by firms. We hope this digression has been sufficient to justify our reasons for having included a relatively long chapter on share valuation to which we now turn.

2. Theoretical valuation models.

In this chapter we will attempt to highlight the most salient points of valuation theory, and offer a brief critical survey of a number of empirical papers. As is well known there exists a great deal of controversy regarding the effect of earnings and dividends on share prices. The effect of financial structure on share prices is just as controversial. Given the present state of knowledge of valuation theory, and the formidable problems encountered in

72. Although the Baumol model is deterministic, Miller and Orr have made it clear that a firm in planning its holdings of money balances works from expected receipts and disbursements. See Chapter 2, Section 1.

measuring empirically the variables suggested by the theory, the construction of a perfect valuation model is impossible. Nevertheless we think that given our objectives the best way to develop a valuation model should be to rely upon the basic tenets of valuation theory. Before we do so, we think it appropriate to discuss briefly the most popular valuation models, and refer to earlier empirical work on this subject.

Although the reader may be familiar with what follows we think that a brief critical review of the most salient points of valuation theory will enable us to construct a consistent valuation model and help us in interpreting and analysing our statistical results.

Financial theory suggests that the value of a share at a point in time is determined by appropriate discounting of expected returns. In spite of B. Williams'[73] well accepted proposition that the intrinsic value of a firm's stock is the appropriately discounted stream of expected returns, there is a considerable degree of controversy and debate regarding the nature of these returns, and the discount factor to be applied to these returns. In general there are two schools of thought, one associated with the irrelevance of dividends while the other attributes great importance to it as being the chief factor determining share valuation. Both are based on the present value theory.

The first school associated with Miller and Modigliani[74] assumes an entirely perfect capital market with perfectly rational

73. J.B. Williams, The Theory of Investment Value, Part 2, Harvard University Press 1938.

74. M.H. Miller and F. Modigliani, Dividend Policy, Growth and the Valuation of Shares. The Journal of Business of the University of Chicago, Oct. 1961. Reprinted in Archer and D'Ambrosio.

and omniscient economic agents, and shows that the value of any share for a given time must be

$$Po = \frac{1}{1+k}\left[D1 + P1\right] \qquad 1$$

Where Po is the market price of a share of any firm at time o, k is the market rate of interest, D1 represents dividends at the end of period 1 and P1 is the market price at the end of the first period. Under the given assumptions any share or indeed any asset will yield the same amount of interest and sell at the same price. The equality of yields and thus prices is a result of the way economic agents bid up or down the market price of assets[75]. To see the effect of dividend policy on valuation let us restate equation 1 in terms of the total value of the firm and assume that the number of shares recorded at time o is n and that there has been an issue of new shares m sold at price P1. The value of the firm as a whole is

$$nPo = \frac{1}{1+k}\left[nD1 + (n + m)P1 - mP1\right] \qquad 2$$

In words the total value of all shares recorded at time o, is the discounted value of total dividends paid on n shares at time 1 minus the total value of the newly issued number of shares. The total amount of the newly issued shares is

$$mP1 = I-(X-nD1) \qquad 3$$

where I = total amount of investments during period 1 and X = total net profit of firm for the period. Substituting 3 into 2 we

75. P.A. Samuelson, Economics, An Introductory Analysis, McGraw Hill 1970.

obtain

$$nPo = \frac{1}{1+k}\left[(n + m)P1 - I + X \right] \qquad 4$$

Since D1 is not included in equation 4 and since X, I, (n + m)P1 and P are assumed to be independent of D1 it is concluded that the current value of the firm does not depend on the current dividend decision. What shareholders gain by increased dividends is exactly offset by the decline in the terminal value of their stock. The same rationale is employed in order to show that all Pt are independent of dividend policies in period t. Thus Po is independent of all current and future dividend decisions. Nor will any decisions to finance investment projects with debt affect the above conclusions, for in a certain and perfect world the cost of capital concept is an unambiguous concept[76], and is the same regardless of the method of financing.

It follows that in a world of perfect capital markets and perfect certainty, the Miller and Modigliani conclusions follow as a corollary. In such a world rational economic agents will act according to the basic principles of the present value theory. Given the firm's optimal investment plans its management will act in such a way which will ensure that the last pound paid in dividends will have the same present value as the last pound of capital gains. In our idealised world the time pattern of dividend distribution will not matter, for all economic agents can borrow or lend as much as they desire at the market determined rate of interest.

Even under uncertainty and in spite of the fact that the variables in equation 2 must now be thought of as random ones and

76. Which of course equals the market rate of interest.

that asset yields must now vary in proportion to their risks, Miller and Modigliani still hold that dividend policy is a mere detail. Arbitrage and the assumptions of symmetric market rationality will ensure that market values of a group of firms belonging to the same risk class must be the same. This is so as long as all shareholders hold identical expectations regarding the average earnings stream, and the investment plans of a group of firms, and believe that everybody else shares their expectations, any temporary disequilibrium being restored through the process of arbitrage. Arbitrage will occur because the general condition for equilibrium is that assets whose returns have the same risk level must sell at market prices, such that their expected rates of returns are equal. Again, the shareholder is assumed to be indifferent to the time pattern of dividends. He can lend his dividends at k or he can sell part of his shareholdings at a price reflecting the expected earnings power of his shares. Alternatively he can borrow against his shareholdings, provided the risk attached to borrowing is the same for firms and individuals. It follows therefore that according to this school of thought, in a share valuation model earnings per share must feature prominently and predominently.

Needless to say all dissenting views regarding the validity of the irrelevance of dividends hypothesis have been based on the effect on share valuation exerted by uncertainty, and market imperfections. That is if given the investment decision of a firm, present and prospective shareholders fail to arrive at an identical expected earnings stream, the firm's management may have to offer more than the minimum required by the original shareholders. In this case the original shareholders cannot be said to be indifferent between different forms of financing[77]. Also, to the extent that market imperfections exist, the size of the dividend payout may have an important impact upon share values. For instance borrowing against capital gains will reduce shareholders wealth if the borrowing rate is greater than k. On the other hand if there exists a tax system favourable to retentions, shareholders may prefer a pound's worth of retentions to a pound's worth of dividends. Nor can we safely assume that investors can always invest their dividends at a rate of return equal to k. Transactions costs such as brokers fees of investing funds may lower their expected rate of return.[78]

The main argument against the irrelevance of dividends theory is that advanced by the second school of thought associated with M. Gordon and others[79-82]. That is assuming risk aversion on the part of shareholders, near dividends may be valued more favourably

77. A.A. Robichek and S.M. Myers, Optimal Financial Decisions, Prentice-Hall 1965, Chapter 4.

78. B.G. Malkiel and W.J. Baumol, The Firm's Optimal Debt-Equity Combination and the Cost of Capital, The Quarterly Journal of Economics, Nov. 1967, pp. 547-578.

79. M.J. Gordon and E. Shapiro, Capital Equipment Analysis, The Required Rate of Profit Management Science, Oct. 1956, pp. 102-110.

80. M.J. Gordon, Optimal Investment and Financial Policy, Journal of Finance, May 1963, pp. 254-272.

81. M.J. Gordon, Financing and Valuation of the Corporation, Homewood Ill, R.D. Irwin 1962.

82. J.E. Walter, Dividend Policy and Enterprise Valuation, Wardsworth Publishing Co., 1967.

than distant dividends. In other words it is not clear whether k, the capitalisation rate, remains constant over time. Gordon has developed a dynamic valuation model in which current dividends feature predominantly and prominently. Gordon assumes a self-financed company that retains and reinvests a constant proportion of total net earnings Yo in all future periods. Further it is assumed that all future investments yield a constant rate of return r, and that expected dividends are discounted at a constant minimum rate of return k. It can be shown that reinvestment dividends and earnings will grow continually at a rate br = g[83]. Under these assumptions it can be shown that the price of a share is given by the following formula[83].

$$Po = \frac{D\,o}{k-g} = \frac{(1-b)Y\,o}{k-br} \qquad 5$$

This formula tells us that the price of a share is equal to its current dividend, divided by the rate of return required by shareholders minus the growth rate. Whether dividend policies affect share values can be seen by differentiating 5 with respect to b and setting the result equal to zero[84], i.e.,

$$\frac{dP}{db} = \left[\frac{Y\,o}{(k-br)^2}\right] r-k \qquad 6$$

It should be noted that if r = k the dividend rate does not affect the value of a share. If r< k, equation 6 shows that the firm should pay out all of its earnings in dividends, while if r> k the

83. M.J. Gordon, Financing and Valuation of the Corporation, Chapter 4.

84. Provided k and r are independent of b.

firm should reinvest all earnings. These predictions are at variance with corporate practices. Firms generally neither reinvest nor retain all of their earnings. In addition equation 5 predicts a price equal to infinity if $k < rb$. Since it is impossible for a share to sell at an infinite price one may be inclined to reject the operational ability of equation 5 . The usefulness of equation 5 can be preserved if we can assume that k is an increasing function of b. In other words the issue is whether under uncertainty the actual behaviour of investors can be adequately represented by a valuation model, in which the appropriate discount rate is a function of the dividend or retention rate[85]. As Gordon has argued in an uncertain world k is likely to be an increasing function of time. He supports this on the assumption that investors are risk averters and thus value current dividends more highly than distant ones. This assumption implies that when b increases since k is likely to increase over time the average discount rate increases. Ceteris paribus the increase in the discount rate depresses the value of a share. It follows therefore that according to this school of thought current dividends should be valued more highly than uncertain capital gains. In a valuation model one would expect dividends to play a far more significant role than earnings, retained earnings or capital gains. These two models based on earnings and dividends respectively provide the necessary background for constructing empirical models.

Another important issue however is whether or not changes in a firm's financial structure affect its average cost of capital, and hence the total value of the firm. Briefly, the effect of debt on a

85. M.J. Gordon, Optimal Investment and Financial Policy, p. 267.

value depends upon shareholders' responsiveness, with respect to the risk premium portion of their expected equity yields[86]. On the one hand if the amount of net incremental returns resulting from introducing debt capital into the firm's financial structure is greater (smaller) than the incremental equity yields demanded by shareholders, then debt financing will increase (decrease) the value of the firm. On the other hand if the increase in yield demanded by shareholders completely offsets the advantages of incremental returns derived from additional debt-financing, then financial structure is a mere detail not affecting the value of the firm. The so called traditional view maintains that there is an optimum combination of debt and equity at which the overall cost of capital is at a minimum, and hence at that point the value of the firm is at a maximum[87-88]. The logic behind this theory is that the introduction of reasonable amounts of debt capital into the firm's capital structure will reduce the average cost of capital, because the additional yield shareholders demand is likely to be less than the incremental returns derived from this form of financing. However as the firm increases the amount of debt capital relative to equity capital, shareholders may be suspicious about the quality

86. R.F. Wippern, Financial Structure and the Value of the Firm, The Journal of Finance, Dec. 1966, pp. 615-633.

87. D. Durand, The Cost of Debt and Equity Funds for Business: Trends, Problems of Measurement, In Conference on Research in Business Finance New York, National Bureau of Economic Research, 1952.

88. E. Solomon, Leverage and the Cost of Capital, Journal of Finance, May 1963, pp. 273-279.

of potential income returns, and hence may demand a far greater amount of yield in order to compensate them for the additional variability to which their expected returns will be subjected. According to this theory it is quite possible for the firm to combine different forms of financing in such a way so that its average cost of capital will be at a minimum. Solomon[89] while agreeing with the basic premises of this theory, has argued that an optimal mix of debt and equity can be found not at a single point, but over reasonable ranges of values of debt and equity.

On the other hand Modigliani and Miller[90] dismissed these views, and showed that provided there is perfect substitutability of personal and corporate leverage, no taxes[91] or transactions costs, the average cost of capital of a group of firms in the same risk class is independent of the firms financial mix. This is so because investors are supposed to be able and willing to create their own leverage to offset any particular financial mix a firm has chosen.

89. E. Solomon, The Theory of Financial Management, pp. 93-98.

90. F. Modigliani and M.H. Miller, The Cost of Capital Corporation Finance and the Theory of Investment, American Economic Review, June 1958, Reprinted in Archer and D'Ambrosio, The Theory of Business Finance.

91. It must however be stated that in Miller and Modigliani's 1963 article[92] as well as in their empirical work[93], Miller and Modigliani admitted that leverage can reduce the average cost of capital through tax advantages on debt financing. In particular in their 1966 empirical work[93] they suggested that there is some optimum financial structure merely by virtue of tax advantages on debt financing.

In effect the aforementioned theory suggests that the incremental returns from debt financing are exactly offset by an equal increase in equity costs. Needless to say the theoretical conclusion of the aforementioned views are critically dependent upon shareholders responses to changes in firms' capital structures and the conditions of capital markets.

Thus far we have discussed two competing theories regarding the importance of earnings and dividends on share values. We have also touched upon the effect of debt on valuation. Do dividends affect share values? or is it only earnings that determine share values? Is debt an advantage or a disadvantage? How do investors behave in practice? Are there any other determinants of share prices? To answer these and other related questions we must resort to empirical evidence which is the subject matter of the following section.

3. Empirical evidence.

A number of empirical studies employing cross-sectional data have attempted to discover the effect of leverage, on the average cost of capital, or the value of the firm. In their first empirical study Modigliani and Miller[90] provided evidence supporting their

92. F. Modigliani and M.F. Miller, Corporate Income Taxes and the Cost of Capital, a Correction. American Economic Review, June 1963, Reprinted in Archer and D'Ambrosio, The Theory of Business Finance.

93. M.H. Miller and F. Modigliani, Some Estimates of the Cost of Capital to the Electrical Utility Industry, 1954-57, American Economic Review, June 1966, pp. 333-391, esp. footnote 12, pp. 342-343.

theoretical conclusions. They regressed the ratio of total earnings after taxes to total market value of the firm against gearing defined as the ratio of the market value of senior securities to the total market value of the firm for a cross-section of electric utility companies. Their results showed no significant relationship between the variables in question. Barges[94] after a critical evaluation[95] of Miller and Modigliani's statistical tests, emphasised that the regression coefficients of the above study were biased, in view of the fact that the total market value variable appeared in the denominator of both the dependent and independent variables. He attempted to remove these biases, by expressing the gearing variable as the ratio of senior securities to book, rather than total market value of the firm. His regression results showed some support for the traditional cost of capital theory. Weston[96] criticized the functional specification of the above models, and regressed the after-tax cost of capital on leverage, total assets and rate of growth in per share earnings. His results suggested that leverage has had a favourable effect on the cost of capital.

In their second empirical study Miller and Modigliani[93] attempted to estimate the relationship between firm value and other variables, suggested by their valuation theory. Their independence hypothesis was supported again in that the inclusion of debt and

94. A. Barges, The effect of capital structure on the cost of capital, Prentice-Hall 1963.

95. A. Barges, pp. 24-26.

96. J.F. Weston, A Test of Cost of Capital Propositions, Southern Economic Journal, Oct. 1963, pp. 105-112.

preference stock ratios in their valuation model did not improve significantly the explanatory power of the valuation model. Weston's empirical approach of using more than one independent variable in order to test the cost of capital theorems was modified, and extended further by other researchers. Their main objective was to test the effect on earnings yield[97], or dividends yield[98] and growth in dividends[99] of such variables as debt-equity or total assets ratio, business risk, normalized growth rates and firm size. None of these empirical studies have supported Modigliani and Miller's theoretical conclusions. The empirical evidence seems to support the view that the relationship between cost of capital and leverage ratios is a U-shaped one, and to the extent that firms were operating below some critical financial mix, judicious use of debt could increase shareholders wealth. If we could ignore the difficulties of selecting and measuring the variables advanced by the cost of capital theories, we would be bound to conclude that on the basis of the results of the majority of empirical studies, changes in a firm's financial structure do have some influence upon its average cost of capital. There is no conclusive evidence

97. H. Benishay, Variability in Earnings-Price Ratios of Corporate Equities, American Economic Review, March 1961, pp. 81-94. See also R.F. Whippern 86.

98. E.F. Brigham and M.J. Gordon, Leverage, Dividend Policy and the Cost of Capital, Journal of Finance, March 1968, pp. 85-103.

99. M. Davenport, Leverage and the Cost of Capital, Some Tests using British Data, Economica, May 1971, pp. 136-162.

however as to whether the favourable effects of debt on market value stem from tax savings, or from the cheapness of the interest component in the average cost of capital.

Regarding the relative importance of dividends and earnings on a firm's value Modigliani and Miller[93] presented statistical evidence favourable to their valuation theory. A two-stage least squares[100] regression procedure was used to develop a model including the following variables.

$$V = f\,(t, K, L, \bar{E}, A, G) \qquad 1$$

$$E = f'(t, L, A, G, P, DIV) \qquad 2$$

where:

V = the sum of the market values of stock, debt and preferred stock

t = income tax rate

K = risk class index

L = debt

$\bar{E}$ = forecasted earnings

E = current earnings

A = total capital

G = rate of growth in assets

P = preferred stock

DIV = dividends

100. A two-stage least-squares approach was used in order to overcome the problem of measurement errors in the observed earnings variable.

The second stage results for a sample of 63 electric utility companies showed that, as expected by far the largest component of market value is the capitalized earnings power of the assets currently held.[101] It must however be said that Modigliani and Miller were led to the above conclusion mainly because the dividend coefficient obtained by their second-stage least squares regression was negative, and statistically insignificant. If one looks at their statistical results[102] of the first-stage least squares regression of earnings on the instrumental variables, one would see that the explanatory power of the dividends variable is by far the most important compared with the joint explanatory power of the other exogenous variables included in the equation. This observation has led Crockett and Friend[103] to argue that the main reason why the coefficient of dividends appeared to be unimportant in the second stage regression could be accounted for by the fact that the explanatory power of dividends was already included in the first-stage computed earnings coefficient. Other papers also criticized the unreliability of Miller and Modigliani's conclusions mainly on the grounds of misspecification of the earnings and growth variables[104,5].

101. Miller and Modigliani, Some Estimates of the Cost of Capital ..... pp. 373.

102. Miller and Modigliani ..... pp. 361, table 2.

103. J. Crockett and I. Friend, Some Estimates of the Cost of Capital to the Electric Utility Industry 1954-1957. Comment, American Economic Review, Dec. 1967, pp. 1258-1266.

104. M. Gordon, Some Estimates of the Cost of Capital to the Electric Utility Industry, 1954-1957, Comment, American Economic Review, Dec. 1967, pp. 1267-1277.

In our opinion Miller and Modigliani should not have attempted to test the relative importance of dividends by including this variable in a valuation model including among other variables the level of earnings either current or forecasted, and growth in assets as a proxy of growth in earnings. The value of a firm must be either a function of earnings expected from existing assets as well as the net stream of earnings expected from additional investment or a function of the level of dividends plus the gross stream of earnings expected from new investments[106]. Now to include the level of earnings and the growth in earnings plus the level of dividends, one is committing the error of double-counting. Thus although the basic valuation model[107] was properly specified the model used to test the relative superiority of earnings vis-a-vis dividends was clearly misspecified[108].

The dividends versus earnings controversy has also been studied empirically by use of less sophisticated models. Cross-sectional data were used in order to test several variations of the following model.

105. A.A. Robichek, J.G. Mcdonald and R.C. Higgins, Some Estimates of the Cost of Capital to the Electric Utility Industry 1954-57, American Economic Review, Dec. 1967, pp. 1278-88.

106. See section 4, this Chapter.

107. That is model 1 above.

108. Here we are considering the valuation model which included both earnings, growth in assets as well as dividends which led Miller and Modigliani to conclude on the superiority of earnings as a variable determining value, see pp. 367-370.

$$P = f(D, E, RE, VAR, L, SIZE, BR, SR, GR) \qquad 3$$

Where:

P the dependent variable was cast in terms of share prices[109] or in terms of earnings[110] or dividend yield[111].

D = current or normalized dividends.

E = current or normalized earnings.

RG = current or normalized retained earnings.

VAR = variability in dividends, earnings or retained earnings.

L = financial risk, defined as the ratio of senior securities to equity of total assets.

SIZE = total or net assets.

BR = business risk i.e., variability in net profits.

SR = systematic risk i.e., the relationship between a share's return and the overall market return.

GR = growth in earnings, dividends, retained earnings, assets or the product of a normalised rate of return and growth in assets.

109a. M.J. Gordon, Dividends, Earnings and Stock Prices Review of Economics and Statistics, May 1959, pp. 99-105.

109b. G.R. Fisher, Some Factors Influencing Share prices, Economic Journal, March 1961, pp. 121-141.

109c. I. Friend and M. Puckett, Dividends and Stock Prices, American Economic Review, Sept. 1964, pp. 656-682.

111. D. Weaver and M.G. Hall, The Evaluation of Ordinary Shares using a Computer, Journal of Institute of Actuaries 1967. Additional references can be found in our bibliography.

Several combinations of the above variables were fitted with cross-sectional data. In most cases, where dividends and retained earnings or dividends and earnings were the main independent variables the results showed that the dividend coefficient were (a) more stable (b) numerically greater and (c) more significant than the coefficients of retained earnings. As regards the importance of the other variables no precise conclusions were reached, except for the size variable which had an important influence upon share prices. All empirical studies can be criticized on the grounds that the estimated parameters did not show a high degree of stability over time, and may be biased because of measurement errors, omitted variables, and model misspecification[112]. Presumably the most difficult problem is our inability to measure precisely the variables suggested by valuation theory, especially risk variables and expectations.

The statistical findings that dividends are valued more highly than retained earnings have been rationalized on the grounds that distant dividends (represented by retained earnings) are riskier than current dividends, and that firms display a stable dividend policy. Descriptive and statistical studies on dividend policies have shown that dividend decisions feature prominently when management decide on their net income appropriations[113, 114]. The most common practice

112. M. Keenan, Models of Equity Valuation: The Great Germ Bubble, Journal of Finance, May 1970, pp. 243-273.

113. J. Linther, Distributions of Incomes of Corporations Among Dividends Retained Earnings and Taxes. American Economic Review, May 1956, pp. 97-113.

114. P.I. Darling, The Influence of Expectations and Liquidity on Dividend Policy. Journal of Political Economy, June, 1957, pp. 204-224.

is for corporations to base their dividend payments not on their current income, but on what they believe to be their long-term sustainable level of income. In fact, for the United States, corporations have been found to aim at a target payout ratio which they change according to permanent income changes. For the United Kingdom, the statistical work of Professor Hart and his associates[115] was not very conclusive as to whether the majority of British firms based their dividends policies on their long-term income. However the evidence as a whole seems to indicate that dividend payout changes may provide investors with valuable information regarding future earnings, or that dividend changes act as leading indicators for changes in expected earnings. This may well explain the statistical insignificance and instability of risk variables in valuation models containing a dividend variable alongside with some variable purporting to represent risk. The main feature of the above models is that investors are assumed to capitalize either dividends and earnings, or dividends and retained earnings. When dividends alone are included the effect of the expected dividend growth is lost. When earnings alone are included the procedure involves double counting, for net earnings can grow through the reinvestment of earnings. When retained earnings are included along with dividends it may be questionable whether current measured retained earnings do in fact represent growth in earnings. The reason is that a firm may have decided to retain a certain portion of its net earnings for reasons not necessarily connected with investment in new plant and equipment. Retained earnings may for instance be used for repaying

115. P. Hart, Studies in Profit, Busines Saving and Investment in the U.K. 1920-1962, Volume 2.

debts, or may act as a hedge against expected monetary stringency. In other words we cannot be certain as to whether retained earnings will actually be used for future investment opportunities. Nor can we be certain about the profitability of new investments. It follows therefore that retained earnings cannot always be expected to reflect future growth in earnings or dividends. If retained earnings are indeed invested in new investment projects expected to yield high returns one would expect these returns to be reflected in share price appreciation. If on the other hand retained earnings are invested in unsuccessful investment projects, share prices will be depressed. One way to approximate for expected growth in earnings is to take a pragmatic view, and assume that share price appreciation acts as a leading indicator for expected growth in earnings. Regardless of the variable reflecting future growth in earnings, the fact remains that neither dividends nor earnings alone can provide a good basis for drawing conclusions regarding the relative importance of earnings or dividends. Inclusion of both earnings and dividends makes matters worse both on theoretical and econometric grounds. Nor can retained earnings provide an adequate basis for future capital gains. A proper model should take into account what kind of returns on theoretical grounds a shareholder is supposed to capitalize, a theme which we turn to in the following section.

4. An investment opportunities valuation model.

"A correct model must take into account the anticipated flow of net earnings and the reinvestment of such earnings as is required to achieve the anticipated flow, as well as the benefits from this reinvestment." [116]

Following Solomon[116] and Miller and Modigliani[117], let us examine what sort of variables should be included in a correct valuation model. Assuming a debt-free self-financed firm whose expected returns from existing assets are identical to those expected from incremental investment, we postulate that the share value P of such a company is functionally related to the present value of three types of returns discounted at k the appropriate capitalization rate.

(a) The per share level of net earnings E, expected to be received from the firm's existing assets[118].

(b) The per share level of additional earnings DE expected as a result of investing a constant amount of money each year which is equal to the proportion b of this year's net earnings.

(c) The per share amount of investment bE required to achieve the incremental earnings DE.

Assuming no diminishing returns on the additional investment projects undertaken over time, let r be the rate of return on these projects and let k be the appropriate capitalization rate. Assume further that investments in new projects yield a rate of return which

116. E. Solomon, The Theory of Financial Management, p.58

117. Miller and Modigliani, Dividend Policy .... pp. 345-348.
See also J.C.T. Mao, The Valuation of Growth Stocks: The Investment Opportunities Approach, The Journal of Finance 1966, pp. 95-130.

118. We assume that funds from depreciation are sufficient to maintain the firm's net earnings at current levels without any additional investment.

is greater than k. The gross present value of all future investment projects[119] as of today is $(bEr/k)/k$ or bEr/k^2 1, since $r > k$ we can write $r = mk$ where $m > 1$. Substituting mk for r we have:

$$\frac{bEm}{k} \qquad 2$$

Since, in order to secure $\frac{bEm}{k}$ we must invest $\frac{bE}{k}$, the net present value of the additional investment opportunities is:

$$\frac{bEm}{k} - \frac{bE}{k} \qquad 3$$

Therefore the value of a share is equal to:

$$P = \frac{E}{k} + \frac{bEm}{k} - \frac{bE}{k} \qquad 4$$

or $$P = \frac{E}{k} + \frac{bE(m-1)}{k} \qquad 5$$

In words, the value of a share at time 0 is the capitalized value of the expected constant earnings resulting from existing assets, plus the net capitalized value of the expected stream from the additional investment opportunities. Equation 4 can be rewritten as:

$$P = \frac{E(1-b)}{k} + \frac{bEm}{k} \qquad 6$$

Noting that $E(1-b)$ equals the dividend payout from the constant earnings stream, 5 can be stated as:

$$P = \frac{D}{k} + \frac{bEm}{k} \qquad 7$$

The above alternative formulations demonstrate that neither earnings

119. See Solomon, pp. 59.

per se nor dividends per se is the basis for share valuation." The answer to the controversy about whether dividends or earnings determine value is that neither does. When each approach is correctly restated so that it does provide a defensible model the two models come to exactly the same thing[120]." According to equation 5 share values should be functionally related to earnings and net growth in earnings while equation 7 provides us with a dividend and capital gains valuation model. Since both equations give exactly the same answer both approaches are identical. In spite of the great similarities between this valuation model and the valuation models described in section 2, we felt that reliance on this approach to valuation is important, because it shows clearly the variables affecting share valuation, and avoids the old controversy regarding the importance of dividends or earnings in a valuation model. This approach to valuation divides the value of shares into two parts. These two parts of value are either the value of current earnings, and the value of net incremental earnings expected in the future or the value of current dividends and capital gains. In spite of certain limitations of the above approach[121], a regression model based upon such a valuation model is consistent with the basic tenets of valuation theory, and avoids biases stemming from double-counting or from omission of important variables.

Our chief purpose is to derive an economic model which may be used to explain differences in share prices among firms and over

120. Solomon, pp. 60.

121. The assumptions behind this model may be untenable. See for instance our criticisms of the Gordon valuation formula.

time. Our basis for such a model will be equation 7 that is a dividend and capital gains formulation[122]. A model of this kind is reasonably consistent with reality, for although some growth companies may follow an active investment policy with a residual dividend policy[123], the general practice of firms has been to treat dividends as an active decision variable while investments are being financed with retained earnings or other means of financing.

5. <u>The economic model.</u>

By using equation 7 we assume that the main variables affecting share values are expected dividends and growth in expected earnings. If current dividends are preferred because of their information content regarding long-term earnings and/or because of risk aversion on the part of the shareholders we would expect investors to give primary importance to dividends, and secondary importance to riskier expected growth in earnings. Accordingly in a regression valuation equation we should expect the dividends coefficients to be numerically greater and statistically more significant than the growth in earnings coefficient. In other words if investors attitudes towards share valuation correspond to those advanced by Gordon we should expect the relatively more certain dividends to be capitalized by a lower discount rate, than the riskier expected growth in earnings. If on the other hand there is a

122. Equation 5 could have been used as a basis for formulating a model. However theoretically both equations i.e. 5 and 7 yield the same answer. For a rather similar model see Keennan op. cit.

123. The investment opportunities approach implies of course an active investment policy and a residual dividend policy.

perfect capital market and the assumption of symmetric market rationality[124] holds true, both components of return should bear the same discount factor. Accordingly both components of returns must be of equal relative importance in a valuation model. Our discussion of the appropriateness of using retained earnings as a variable reflecting future growth in earnings suggested that we should look for another variable to represent expected growth in earnings. For the purposes of constructing a valuation model we will consider two alternative variables. One is the growth in earnings over some past period. This is quite reasonable for it is possible that the growth in earnings per share may provide shareholders with valuable information regarding the future course of dividends or earnings. The main disadvantage of this variable is that accounting differences among firms may raise doubts as to whether reported earnings are true representatives of the real earnings of firms. Perhaps a better way of representing expectations regarding the earnings or dividends growth is the growth in share prices over some past period. As it was stated earlier retained earnings cannot always be expected to reflect future growth in earnings or dividends. If shareholders believe that retained earnings will be invested profitably this will be reflected in share price appreciation. Conversely if shareholders believe that retained earnings are likely to be invested in unsuccessful investment projects share prices will be depressed. As a result of the above discussion growth in earnings per share will be represented by the growth in share prices and growth in earnings per share.

124. That is if shareholders behave in accordance with the Miller and Modigliani posulates.

Of course there are other variables which investors are likely to take into consideration in evaluating the worth of their shares. Our discussion of the effect of leverage on share values suggests that leverage may (a) not affect the value of a share or (b) increase or decrease its value. The size of the firm may affect share evaluation because (a) larger firms are better known than smaller firms and hence the demand for their shares may be higher than that of smaller firms, (b) shares of larger firms may be traded in a near perfect market and (c) larger firms may be considered relatively safer than smaller ones, in that larger firms may represent a smaller probability of failure[125]. Another variable affecting the value of a share is business risk, which may be defined as variability in a firm's profits. This variable reflects management's inability to secure perfect sales, costs and profits. On the basis of the above discussion our valuation model will include the following variables:

$$P = f(D, GE, L, S, BR) \qquad 8$$

Where, P is the price per share, D expected dividends per share, GE growth in expected earnings, L leverage, S size of the firm, and BR business risk.

On the basis of the above analysis we would expect the following relationships between the variables in question.

125. H. Benishay, Variability in Earnings-Price Ratios of Corporate Equities, American Economic Review, Mar. 1961, pp. 81-94.

1. $\frac{dP}{dD} > 0$, i.e., the greater the dividend rate the greater the value of a share. If for instance we had two shares of two different companies identical with respect to other variables but the dividend rate, we would expect to find the one with the greater expected dividend rate being valued more highly than the one with a smaller dividend rate.

2. $\frac{dP}{dGE} > 0$, i.e., the greater the growth in expected earnings the greater the value of a share. That is to say, if we had two shares of two different companies identical with respect to other variables but the growth in earnings we would expect the share bearing a greater growth in earnings, to be valued more highly than the share with a smaller growth in earnings.

3a. $\frac{dP}{dL} = 0$, i.e., changes in a firm's financial structure have an insignificant influence upon share valuation.

3b. $\frac{dP}{dL} > 0$, i.e., the greater the value of debt the greater the value of a share provided a firm was operating below some optimal capital structure.

3c. $\frac{dP}{dL} < 0$, i.e., the greater the value of debt the smaller the value of a share provided a firm was already operating above some optimal capital structure.

4. $\frac{dP}{dS} < 0$, i.e., the greater the size of a firm the greater the value of its shares.

5. $\frac{dP}{dBR} < 0$, i.e., the greater the variability of profits the smaller the value of its shares.

Thus our approach specifies a certain number of variables as being important determinants of share valuation, and in addition it specifies the sign of relationships that share prices may be expected to bear towards the variables affecting them. What we have is a testable hypothesis, and only by resorting to empirical evidence will we be able to say something concrete about the relative importance of the variables affecting share prices.

CHAPTER 5

A SURVEY OF EMPIRICAL MONETARY RESEARCH.

AGGREGATE TIME SERIES

Introduction.

A detailed and lengthy survey of empirical research based on aggregate time series is probably unnecessary in view of the objectives of this thesis, and the fact that excellent surveys on this subject already exist[126]. Nevertheless we feel that a brief critical survey of a number of empirical papers is required, in that it will assist us in interpreting and analysing our own statistical results. As a result we intend to comment on a number of empirical

126a. G. Fisher and D. Sheppard, Effects of Monetary Policy on the United States Economy, OECD Economic Outlook, Occasional Studies, 1972.

126b. D. Laidler, The Influence of Money on Economic Activity, A Survey of Some Current Problems. In G. Clayton, J.C. Gilbert, R. Sedwick, Monetary Theory and Monetary Policy in the 1970's, Oxford University Press 1971.

126c. A.A. Walters, The Radliffe Report, Ten Years After. A Survey of Empirical Evidence. In D.R. Groome and H.J. Johnson, Money in Britain.

126d. C.A.E. Goodhart and A.D. Crockett, The Importance of Money, Bank of England Quarterly Bulletin, June 1970, pp. 159-198.

126c. D.M. Jones, Demand for Money, a Review of Empirical Literature, Staff Economic Studies Board of Governors of the Federal Reserve System 1965, pp. 1-22.

papers dealing with aggregate demand for money functions, and with the effect of money on economic activity.

If one were asked to specify the most important factor responsible for the phenomenal growth of empirical monetary research one would unhesitatingly single out Friedman's theoretical and empirical research. Virtually all researchers either explicitly or implicitly have endeavoured to shed some light on the chief substantive issues of monetary theory as articulated by Johnson[127] in his oft-cited survey of monetary theory and policy. In effect in his survey Johnson asked all prospective researchers to pay particular attention to how they define money and to attempt to discover (a) whether there is a stable and predictable relationship between money and its main determinants (b) the relative importance of these determinants and (c) whether monetary variables are more important than real variables in determining national expenditure.

Following this survey, interest has been concentrated on the above issues. Important problems like the most appropriate definition of money, the most representative variable for the opportunity cost of holding money, and the most appropriate budget constraint, have been solved either on a priori or empirical grounds. Thus in spite of great difficulties in defining the money concept in a widely acceptable manner, theorists[128] stressing the transactions motive for holding money, emphasize that money should

127. H.G. Johnson, Monetary Theory and Policy, American Economic Review, June 1962, pp. 335-84.

128. H.R. Heller, The Demand for Money: The Evidence from the Short-Run Data, Quarterly Journal of Economics, May 1965, pp. 291-303.

be defined as the sum of currency and demand deposits at commercial banks, while time deposits are identified with idle balances[129]. Others do not distinguish between the motives for holding money, but treat money as an asset held for the services it provides. In particular Friedman and his associates[132] regard money as a "temporary abobe of purchasing power", rather than as fulfilling several motives that can be distinguished easily for analytical purposes. But by the same token the liabilities of other financial institutions may in fact be considered as temporary abobes of purchasing power in view of their close substitutability with money[133]. It follows that a specific a priori definition cannot be accepted unquestionably.

129. Others, e.g. Tobin[130] and Kisselgoff[131], have attempted to distinguish between active and speculative balances. The latter were estimated by substracting an estimate of active balances, corresponding to the year with the highest velocity from the total demand deposits.

130. J. Tobin, Liquidity Preference and Monetary Policy, Review of Economics and Statistics, May 1947, pp. 124-131.

131. A. Kisselgoff, Liquidity Preference of Large Manufacturing Corporations, Econometrica, Oct. 1945, pp. 334-344.

132. M. Friedman and A.J. Schwartz, A Monetary History of the United States, 1867-1960, Princeton, New Jersey, 1963, pp. 649-50.

133a. H.F. Lydall, Income, Assets and the Demand for Money, Review of Economics and Statistics, Feb. 1958, pp. 1-14.

133b. J.G. Gurley and E.S. Shaw, Money in a Theory of Finance, The Brookings Institution, Washington, D.C. 1970.

Some authors attempted to settle the issue empirically. Because income and money broadly defined yielded the best correlation than any other formulation, it is better to treat time deposits as perfect substitutes than to exclude them[134, 135]. However as Feige[136] and Brunner, and Meltzer[137] have argued, inclusion of time deposits in a demand for money function blurs the substitutional effects between money thus defined, and interest rates. This is so, because money narrowly defined is a decreasing function of the opportunity cost of holding money, while time deposits are an increasing function of it. Thus the two effects on the broadly defined demand for money tend to move in opposite directions. Others have argued that it is better to estimate either separate demand functions for demand deposits, time deposits and other liquid assets[136], or demand functions both for the narrow and broad money concepts, and select the one that performs better according to

134. M. Friedmand and D. Meiselman, The Relative Stability of Monetary Velocity and the Investment Multiplier pp. 180-183 in the United States 1897-1958, Stabilisation Policies, C.M.C. Research Papers, Prentice-Hall 1964.

135. By a broad definition of money we mean the sum of currency, demand deposits and time deposits.

136. E.L. Feige, The Demand for Liquid Assets, Prentice-Hall, 1964, pp. 5.

137. K. Brunner and A.H. Meltzer, Predicting Velocity, Implications for Theory and Policy. Journal of Finance, pp. 319-354.

standard statistical tests[138].

One is also faced with the same kind of difficulties in attempting to define the most appropriate opportunity cost of holding money. If one takes a Keynesian or portfolio adjustment view one may argue that the long rate of interest is more appropriate than the short-rate, because it represents the average rate of return of capital in the economy. On the other hand those emphasising transactions models prefer a short-term interest rate on the grounds that short-term securities are better substitutes for money than long-term debt instruments. In inflationary periods price changes should be taken into consideration for a proper representation of the opportunity cost of money[139].

Finally, if one views money as a medium of exchange one would be inclined to use current income as a budget constraint, while if money is viewed as an asset one would use expected income or wealth.

Researchers attempted to resolve the main issues of monetary theory by using three broad models[140].

138. D.E. Laidler, The Definition of Money: Theoretical and Empirical Problems, Journal of Money Credit and Banking, August 1969, pp. 508-525.

139. P. Cagan, The Monetary Dynamics of Hyperinflation. In M. Friedman, The Quantity Theory of Money.

140a. The usual procedure has been to test a demand function either directly or in terms of the ratio of money to income or its reciprocal.

For the latter approach see:

140b. H.A. Latane, Cash Balances and the Interest Rate a Pragmatic Approach, Review of Economics and Statistics, Nov. 1954, pp. 456-460.

When it was thought reasonable to believe that the money market was in equilibrium a long-term model was employed i.e.,

$$Mt = f(Yt,Rt) \qquad 1$$

Where Mt denotes the equilibrium demand for money, Y is the relevant constraint and R represents some measure of the opportunity cost of holding money and t is a time subscript[141]. When however it was thought that the money market was in disequilibrium i.e., the adjustment to new equilibrium as a result of changes in income and/or interest rates was gradual and not sudden and instantaneous, a partial adjustment model of the following form or variations of it was employed.

$$Mt = kMt - 1 + (1-k)bXt \qquad 2$$

140c. D. Sheppard, The Growth and Role of U.K. Financial Institutions 1880-1962, Methuen 1971.

140d. N.J. Cavanagh and A.A. Walters, Demand for Money in the U.K. 1877-1961, "Some Preliminary Findings" Journal of Political Economy, Dec. 1966, pp. 543-555.

141a. D. Laidler, The Rate of Interest and the Demand for Money, Some Empirical Evidence, Journal of Political Economy, Feb. 1966.

141b. D. Laidler, Some Evidence on the Demand for Money, Journal of Political Economy, Feb. 1966, pp. 55-58.

141c. A.H. Meltzer, The Demand for Money, The Evidence from the Times Series, Journal of Political Economy, June 1963, pp. 219-247.

Where k is a measure of the speed of adjustment to equilibrium and X stands for income and interest rates[142]. Finally when it was thought that the assumption of a purely exogenous money supply was unrealistic some authors, in order to avoid simultaneous equation biases in the coefficients of single equations resorted to simultaneous estimations of supply and demand functions by using the method of two-stage least squares[143].

142a. C.A.E. Goodhard and A.D. Crockett, The Importance of Money, Bank of England Quarterly Bulletin, June 1970, pp. 159-198.

142b. D. Fisher, The Demand for Money in Britain, Quarterly Results 1951-1967, The Manchester School of Economics and Social Studies, Dec. 1968, pp. 329-344.

142c. L.D. Price, The Demand for Money in the U.K., a Further Investigation, Bank of England Quarterly Bulletin, Mar. 1971, pp. 43-55.

142d. D. Laidler and M. Parkin, The Demand for Money in the United Kingdom 1956-1967, Preliminary Estimates. The Manchester School of Economics and Social Studies, Sept. 1970, pp. 187-208.

142e. M. Bronfenbrenner and J. Mayer, Liquidity Functions in the American Economy, Econometrica, Oct. 1960, pp. 810-834.

142f. G.C. Chow, On the Long-Run and Short-Run Demand for Money, Journal of Political Economy, April 1966, pp. 111-131.

142g. M.J. Hamburger, The Demand for Money by Households, Money Substitutes and Monetary Policy, Journal of Political Economy, Dec. 1966.

142h. F. Deleeuw, The Demand for Money, Speed of Adjustment Interest Rates and Wealth, in G. Horwich, Monetary Process and Policy, A Symposium, Homewood Illinois, 1967.

Apart from the difficulties in estimating a universally accepted lag structure, the overwhelming majority of empirical studies found that neither the extreme Keynesian nor the extreme Monetarist views regarding the interest elasticity of money demand were substantiated. In general the predictions of monetary theories that the demand for money is an increasing function of income or wealth, and a decreasing function of the opportunity cost of money, stood up to empirical testing. It has been established that over long periods both in the United Kingdom and United States there has been a very close association between money and its main determinants, and that the relationship has been reasonably stable[144]. We should however stress that the relationships have been influenced by strong trends, as it is shown by the low coefficients of determinations which were obtained when first differences of the data were used. The use of partial adjustment models help to mitigate the effect of time trends on the regression coefficients, but one should interpret the implied elasticities with special circumspection in view of the positive existence of serial correlation in the residuals. It should be noted that the existence of positive autocorrelation in the disturbance term, biases the sampling variance downwards when ordinary least

143a. R. Teigen, Demand and Supply Functions for Money in the United States, Econometrica, Oct. 1964, pp. 477-509.

143b. K. Brunner and A.H. Meltzer, Some Further Evidence on Supply and Demand Functions for Money. Journal of Finance, May 1964, pp. 240-283.

144. By stability we mean that regression coefficient for different periods are not statistically different.

squares techniques are used[145]. Hence it is dangerous to rely on 't' tests in order to test for the stability and superiority of alternative demand for money functions.[146] Whether or not short-term interest rates are better representatives of the opportunity cost of holding money, some empirical studies which have tested both variables suggest that short-term rates[147] show a more stable relation to the demand for money in different periods, than do long-term interest rates. On the other hand other studies have shown a preference for long-term interest[148] rates, or did not indicate any preference between different interest rates[149]. Regarding the relative importance of different constraint variables, long-term equilibrium models showed that either nonhuman wealth or permanent income were the best proxies for the budget constraint variable. On the other hand adjustment models suggest a preference for current

145. J. Johnston, Econometric Methods, Chapter 8.

146a. J.J. Courchene and H.T. Shapiro, The Demand for Money, A Note from the Time Series, Journal of Political Economy, Oct. 1964.

146b. A.H. Meltzer, A Little More Evidence from the Time Series, Journal of Political Economy, Oct. 1964, pp. 506-7.

147. See for instance Laidler, Teigen, Heller and Sheppard op. cit. In fact Sheppard's velocity model shows that claims on tangible assets proxied by the price index, and claims on financial assets proxied by the yield on treasury bills and the standard rate of income tax were the most important variables affecting velocity.

148. See J. Tobin, The Monetary Interpretation of History opt.cit.

149. See Deleeuw, Goodhard and Crockett, Fisher and Price opt. cit.

income while the implied long-term elasticities are closely in agreement with those expected from long-term expected variables[150]. As far as the most appropriate definition of money is concerned there seems to be some preference for the broad definition of money. Finally it cannot be said that simultaneous estimation of supply and demand functions resulted in empirical results significantly different than those obtained by single equation procedures.

Regarding the empirical results of the demand for money by business firms Price's[151] partial adjustment model revealed that firms responded faster than persons to income and interest rate changes, and that the rate of interest most appropriate to the company sector was the short-term rate. Both sectors treated money as a luxury good, but for persons the income elasticity of demand for money was greater than that of the company sector. In contrast Nadiri's[152] partial adjustment study for the U.S. corporate sector suggested that it was both the level and changes in long-term rates which performed best as proxies for the opportunity cost of money. In addition important economies of scale were found regardless of whether the scale variable was measured by total assets or output. Furthermore firms reached their equilibrium cash balances very rapidly, and responded to general price changes.

The relationship between money holdings and interest rates for the corporate sector has by no means been established conclusively.

150. See in particular, G.C. Chow, On the Long-Run and Short-Run for Money op. cit.

151. L.D. Price, The Demand for Money in the U.K. op. cit.

152. M.I. Nadiri, The Determinants of Real Cash Balances in the U.S. op. cit.

A number of empirical papers[153] in the U.S. reported that their results failed to show any significant relationship between money holdings and interest rates. This has been attributed to the cyclical nature of money and interest rates. That is during recessions firms build up their liquid assets, mainly as a result of greater relative reduction in spending than in cash receipts. Liquidity is also increased because of the ensuing liquidation of inventories and reductions in capital expenditures and tax payments. The overall result may be an increase in the cash to sales ratio and depending on expectations regarding the future course of interest rates, the ratio of securities to sales increases as well. During recovery the ratio of cash to sales begins to fall, while the ratio of short-term securities to sales continues to rise and begins to fall when expansion is well under way. The main reason why the short-term securities to sales ratio continues to increase is attributed to the funding of tax liabilities. When however expenditure in plant and equipment is increasing, firms liquidate their securities in order to finance these expenditures. It follows that under this analysis

153a. J.S. Duesenberry, The Portfolio Approach to the Demand for Money and other Assets. Review of Economics and Statistics, Feb. 1963, pp. 9-24.

153b. L.E. Thomson, Income Velocity, Liquid Assets of Households and Nonfinancial Corporations and Monetary Policy. Stabilization Policies, Commission on Money and Credit, 1963.

154c. E. Bloch, Short-Cycles in Corporate Demand for Government Securities and Cash. American Economic Review, Dec. 1963, pp. 1058-1077.

money substitutes can be thought of as a means of investing excessive liquidity built up in recession or early recovery period. Hence a regression analysis between money and interest rates is likely to show a positive relationship between these two variables, and not the negative relationship predicted by all monetary theories. However the above analysis does not really explain the observed decline in money balances over time. The gradual decline in cash balances can be explained by the cash economizing practices of corporate management, and not necessarily by rising interest rates or the cyclical nature of business activity. In other words firms, especially the large ones, may not be sensitive to interest rate changes because the most important costs of managing their portfolios of securities are of a fixed nature. Over short-periods of time firms will attempt to maintain a minimum level of money consistent with their cash management techniques, irrespective of the level of interest rates[154]. That is, once corporate managers have learned the favourable effects of investing excess cash in securities the familiar ratchet effect insures that investments in these securities do not fall in the event of lower interest rates[155].

154a. G. Garvy and M.R. Blyn, The Velocity of Money, Federal Reserve Bank of New York 1969.

154b. J. Duesenberry, The Portfolio Approach to the Demand for Money op. cit.

154c. P.F. McGoudrick, A Sectoral Analysis of Velocity Federal Reserve Bulletin, Dec. 1962, pp. 1557-1569.

155. Unless of course interest rates in depression periods are very low and expected to remain low for long periods, the familiar liquidity impasse effect may induce firms to hold their liquid assets in money form.

Of course over long periods of time higher interest rates may induce firms to be more economical in the use of their cash balances, and attempt to coordinate their receipts and payments more efficiently.

As regards the relative stability of the investment and monetary multipliers examined by constructing simple models of income determination, the evidence based on simple single equation models cannot be said to be very conclusive. To be sure Friedman and Meiselman[134] find impressive correlations between income and money which hold true irrespective of whether one is looking at levels or changes in levels of data, or whether one uses nominal or real variables. However the results of this study were attacked because (a) the definition of autonomous expenditure was not appropriate (b) some of the elements in the Friedman and Meiselman definition of autonomous expenditures were not purely exogenous and (c) the specified equations were simple and naive versions of two alternative complicated theories[156]. Using a more complex model and a different definition of autonomous expenditure, the results showed that both autonomous expenditures and the money stock affected the dependent variable i.e., consumption, but the former's explanatory power was greater than the latter's.

156a. A. Audo and F. Modigliani, The Relative Stability of Monetary Velocity and the Investment Multiplier, American Economic Review. Sept. 1965, pp. 693-728.

156b. M. Depramo and T. Mayer, Tests of Relative Importance of Autonomous Expenditure and Money, American Economic Review 1965, pp. 129-144.

Still another study[157] attempted to show the supremacy of money over fiscal policies, by regressing changes in income to both changes in the money stock, and to various alternative fiscal measures. It was found that money exerted a larger influence on income was more predictable and acted faster than any of the alternative fiscal policies i.e., high employment budget surplus, expenditure and receipts.

For the U.K., similar work[158] suggests that both money and autonomous expenditure were important in determining aggregate expenditure. In particular Sheppard[159] sought to put the Keynesian and Monetary theories on a comparable basis. He argued that in order to compare like with like one should cast the Keynesian and Monetary theories of income or consumption determination, both in nominal and real terms. The results suggested that as far as real quantities are concerned, real money and real encashable assets were more important than real autonomous expenditure in determining either real consumption or real total expenditure. In money terms however autonomous expenditure was more important than money in determining consumption or total expenditure, but that the effect of money either

157. L.C. Andersen and J.L. Jordan, Monetary and Fiscal Actions, a Test of their Relative Importance in Economic Stabilisation, Federal Bank of St. Louis Monthly Review, Nov. 1968, Reprinted in H. Kohler Readings in Economics, pp. 220-235.

158. C.R. Barret and A.A. Walters, The Stability of Keynesian and Monetary Multipliers in the U.K., Review of Economics and Statistics, Nov. 1966, pp. 395-405.

159. D. Sheppard, The Growth and Role of the U.K. Financial Institutions, Chapter 5.

the synchronous or the lagged - 6 months - had an appreciable effect on economic activity. Finally Artis and Nobay[160] duplicated the work of Anderson and Jordan[159], but their results were the opposite of those found by their American colleagues.

But although the predictions of the monetary theories regarding the signs of the relationships between money and the relevant explanatory variables have been vindicated, nothing precise and conclusive can be said about the magnitude of the effects. There is considerable divergence of the magnitudes among different empirical studies probably reflecting the impacts of different models, different data or different time periods. Perhaps the proxies for the opportunity cost of holding money, and the budget constraint, have not been appropriately measured. Perhaps our data are subject to errors, or the functions used were inappropriate. It goes without saying that confidence on the part of the policy makers on the stability and precision of a particular economic function is of paramount importance for policy making purposes. To simply say that empirical study X has established that money is a luxury good and that economic agents were mainly concerned with income effects, while study Y has discovered important economies of scale and substitutional effects, it does not help matters greatly from a practical point of view. Clearly, in unemployment situations, it will make a great deal of difference in the economy, if the monetary authorities aiming at achieving certain objectives acted on the belief that the forementioned hypothetical study X was true, where in fact they should have relied on the results of study Y.

160. M.J. Artis and A.R. Nobay, Two Aspects of the Monetary Debate, N.I.E.R., August 1969, 3, pp. 3-51.

We should note in particular that aggregate time series demand for money analyses ignore the separate responses of different sectors of the economy. In effect they assume that the relevant elasticities and speed of adjustment to some economic stimuli are the same, regardless of whether we are dealing with wealthy or of moderate income individuals, with the corporate or personal sector. They also assume that the pattern of receipts and expenditures of all economic sectors is identical and that there prevails certainty. Income redistribution and the relative economic importance of different economic sectors is not taken into consideration. Clearly the importance of disaggregated demand for money functions cannot be stressed too strongly. If the behaviour of several economic groups is different, aggregation over all economic agents will conceal important information and subsequently yield inaccurate results. Unless we can safely assume that all economic sectors behave identically one should attempt to disaggregate the economy into fairly homogeneous sectors, otherwise wrong conclusions may be reached.

Nor can we be very confident about estimates of the money multipliers based on single equations. Apart from the aggregative character of these models, they may be said to be useful for predictive purposes if the money supply is purely exogenous. This in turn implies that the monetary authorities have been able to control the amount of money supplied. This is possible except for countries like the U.K. where the monetary authorities have largely been concerned with controlling the level of interest rates. In this case the money stock cannot be said to be exogenous[161]. Under these circumstances the question is whether single equation models can be used for predictive purposes. The main problem is the causal interpretation of the regression results. If we assume no time lags in the supply of money we may as well use the same sample data and try to predict money for a given value of income. Thus both equations are econometrically identical, and unless we know which of the variables is truly independent we cannot really have much faith in the coefficients of an equation of this kind. One may argue that if the money supply variable was found to be sufficiently lagged then it could be thought of as an exogenous variable whose fixed past value could be used to predict the income variable[162]. But even if we assume that we have been able to find appropriate time lags this would not necessarily prove anything about causality. Lags may not prove anything about causality because anticipation of future economic activity may bring about a lag, not necessarily attributed to true causality between income and money. Indeed Friedman has stated that in order to attribute true causality to money we must show that the money stock has really been imposed on the economy by central authorities, quite independently of any current or expected fluctuations in economic activity[163]. In any case it is clear from the way the

161a. A.D. Bain, The Control of the Money Supply, Penguin Modern Economics 1970.

161b. A.B. Cramp, Does Money Matter? Lloyds Bank Review, Oct. 1970, pp. 23-37.

161c. N. Kaldor, The New Moneturiam, Lloyds Bank Review, July 1970, pp. 1-19.

162. A.A. Walters, Money in Boom and Slump, Hobart Papers No. 44, Jan. 1969.

163. M. Friedman, The Monetary Studies of the National Bureau, in M. Friedman, The Optimum Quantity of Money.

monetary mechanism is described that it is only the money stock in nominal terms which could be defined as exogenous, and not the real money stock which is determined endogenously[164].

Another important problem is whether a simple econometric model could really supply the necessary confidence for predictive purposes. Of course there have been high correlations between money and income but this statistic does not tell us much about the transmission mechanism by which exogenous changes in the money supply influence the level of economic activity. Thus important questions of how money comes into circulation, how it is distributed, whether additional money is spent on current goods and services, or whether it is treated as an addition to wealth by those who receive it, cannot be answered by the mere fact of the close statistical association of the variables in question[165]. For in the last analysis it is not only money that correlates with income, but other economic variables as well like exports, money wages, etc. It follows that for policy purposes we must be able to convince the authorities as well as ourselves that high values of coefficients of determination are the result of a causal relationship between income and money, and the influence runs from money to income. There is no question that the stock of money however determined has exerted important influences on economic activity. On the other hand economic conditions have also exerted important influences on the money stock. It follows therefore that we should not expect a simple static

164a. A.J. Schwartz, Why Money Matters, Lloyds Bank Review, Oct. 1970, pp. 1-15.

164b. Friedmand and Meiselman, pp. 179.

165. N. Kaldor op. cit.

regression equation to shed much light onto the complex process of income determination. Presumably what is needed is the construction of extensive structural equations based on disaggregated data, where the exogenous and endogenous variables are properly defined and identified, and in which estimates of the exogenous variables are derived in terms of the purely exogenous variables[166].

This thesis is not concerned with the costs and benefits of monetary research. It is certainly true that monetary research has enhanced our knowledge about the determinants of the demand for money, and the effect of money on economic activity. There still however remains a great deal of controversy as to whether the results of monetary research have vindicated those who believe that only money matters. What we need to show is that we have a well defined and stable demand for money function, and a purely exogenous supply of money. When these two conditions are satisfactorily met we may be able to show whether the demand for money in conjunction with the supply of money provides a better explanation of observed money income movements, than models based on income-expenditure relationships.

The statistical findings based on time series data cannot be said to have demonstrated the superiority of one of the alternative theories unequivocally. An implication of the findings of the aggregate monetary studies is that the level of aggregation used in

166. For a critical and highly illuminating discussion of reduced form equations and large scale econometric models containing money and real variables see Fisher and Sheppard, Chapters 3 and 4.

these studies may be rather high. The majority of empirical papers has found either unity or greater than unity elasticities of money with respect to the constraint i.e., permanent income, wealth or current income. In contrast to these findings, corporate demand for money studies utilising cross-sectional data (see next Chapter) have consistently found unity or less than unity elasticities of money with respect to the constraint. These findings would suggest that money demand analyses should be approached by disaggregating the household and corporate sectors. Further disaggregation of the corporate sector may be necessary if our hypothesis that there exist significant differences in the monetary behaviour of different industrial sectors is substantiated by our data. However, as we will see in the following Chapter it is not entirely legitimate to compare findings based on aggregate monetary data with those based on cross-sectional data.

CHAPTER 6

A SURVEY OF CROSS-SECTIONAL CORPORATE DEMAND FOR MONEY STUDIES[167].

Introduction.

The purpose of this chapter is to offer a critical survey of demand for money empirical studies based on cross-section regression techniques[168]. The majority of these studies has concentrated their attention on whether on empirical grounds it is possible to discriminate between alternative monetary hypotheses. Attention has also been given to the existence of economies of scale, and the substitutional pattern between money and securities. The first of these studies employs a partial adjustment model in an attempt to discover both short and long term relationships. The following three studies apply ordinary cross-section regression techniques. The last two studies utilise the techniques of covariance analysis in an attempt to capture the effects of cross-sectional and time-series constant variables.

167. Attempts have also been made to discover the relative importance of income and wealth on the demand for liquid assets for the household sector by using cross-section data. For U.K[172] and Czeckoslovak[173] data the evidence suggests that wealth is more important than income, in explaining liquid assets. On the other hand cross-sectional evidence for the U.S.[174] suggests that both income and wealth are of approximately equal importance in explaining the demand for liquid assets by households. Another very notable study[174a], has utilised data for the North American States and used a cross-sectional-

Heston's[169] partial adjustment model recognizes the relationship between money and other current assets. As an initial step a canonical correlation analysis was employed in order to discover interrelationships of changes in cash, securities, short-term bank financing, net receivables, inventories and unanticipated receipts i.e., retained earnings minus accounts payable. On the basis of the relationships suggested by his canonical correlation analysis Heston postulated the following model.

$$C^{*}t = ao + a1Tt + a2Bt + a3It + a4(R-D)t + ut \quad 1$$ [170]

where $C^{x}t$ = desired cash holdings at time t

Tt = the level of sales

Bt = the 91 day treasury bill rate

It = level of inventories

(R-D) = net receivables

ut = the random error term

t = a time subscript

167 continued...

temporal analysis, in an effort to test separate functions for demand deposits, time deposits and savings and loans shares. The main independent variables were per capita permanent income and returns on relevant assets. The principal conclusion was that demand deposits were not close substitutes for time deposits. This conclusion is clearly against Friedman's contention and evidence that operationally money should be defined to include not only currency and demand deposits but time deposits as well.

However, because firms will attempt to adjust firstly their inventories and net receivables, and then the desired level of their cash balances, it is not expected that actual money holdings will equal desired money holdings at time t. Instead it is postulated that,

$$DCt = DC^{p}t + DC^{u}t \qquad 2$$

where the supersubscripts denote planned and unplanned changes respectively. Further it was postulated that changes in cash may result from unexpected changes in receipts. This would mean that the firm finds itself unable to adjust the stock of money to its equilibrium level within a given period. The volume of unexpected

168. Another study, that of Selden[175], not directly concerned with the transactions demand for cash, contains some observations on firm financial behaviour based on cross-sectional data. Selden observes that as firms increase in size there is a decline in the velocity of money and an increase in the amount of short-term securities relative to cash and total assets. Selden's observations indicate that investment cash holdings increase more than in proportion to sales offsetting, therefore any economies in the transactions demand for money. Similar conclusions were reached by Lutz[176].

169. A.W. Heston. An Empirical Study of Cash, Securities and Other Current Accounts of Large Corporations, Yale Economic Essays, Spring 1968, pp. 116-168.

170. The functional relationship as outlined above was also tested for all fixed claims securities, pp. 139.

receipts may be approximated with changes in tax liabilities[171] i.e.,

$$DC^{u}t = DNt + u't \qquad 3$$

where DNt is changes in taxes. Finally the effect of unexpected receipts on desired cash balances, as well as the assumption that in the short-term firms adjust their inventories and net receivables prior to adjusting their cash balances, led Heston to introduce the following partial adjustment mechanism.

$$DC^{p}t = \beta(C^{x}t - Ct - 1) \qquad 4$$

Substituting equation 1 into 4 and 4 and 3 into equation 2 we obtain a short-run function for the demand for cash balances by firms.

171. In fact Heston considered several variables purporting to explain unanticipated receipts. He decided to use only changes in taxes because preliminary investigation showed that all considered variables performed equally well, pp. 146-7.

172. H.F. Lydall, Income, Assets and The Demand for Money, Review of Economics and Statistics, Feb. 1958, pp. 1-14.

173. B.P. Pesek, Determinants of the Demand for Money, Review of Economics and Statistics, Nov. 1963, pp. 419-424.

174. T.H. Lee, Income, Wealth and the Demand for Money. Some Evidence from Cross-Section Data. The American Statistical Association, Sept. 1964, pp. 746-762.

174a. E.L. Feige, The Demand for Liquid Assets, opt.cit.

175. R.T. Selden, The Postwar Rise in the Velocity of Money pp. 500-504.

176. F.A. Lutz, Corporate Cash Balances 1914-1943, N.B.E.R., New York 1945.

$$C_t = \beta a_0 + \beta a_1 T_t + \beta a_2 B_t + \beta a_3 I_t + \beta a_4 (R-D)_t + \beta u_t - \beta C_{t-1} + DN_t + u'_t \qquad 5$$

The above model was fitted with data of 209 large firms for the years 1946 to 1956, with separate intercepts for each firm. All coefficients had the expected sign and were statistically significant, except for the coefficient of net receivables[177]. The long-term sales elasticity was estimated to be 0.885[178], which suggests that economies of scale are possible as sales increase. The partial adjustment coefficient showed that less than 2/3 of the adjustment towards equilibrium is achieved within a year. This suggests a long period for adjusting cash balances, which may limit the importance of a partial adjustment model based on yearly data. For instance Nadiri's[179] quarterly time series investigation for the demand for money by business firms indicated that about 80% of the adjustment towards equilibrium is achieved within 4 quarters. Heston's results of the short-term securities model were in accordance with expectations, but suggested that securities adjust to their desired levels more slowly than cash. This may be explained on the grounds that securities relative to money, act as shock absorbers for short-

177. This is attributable either to the high correlation between inventories and net receivables or that cash and securities are used to finance inventories to a greater degree than receivables. In fact one would expect high correlations between all explanatory variables, because all these variables increase with the size of the firm.

178. Heston, pp. 181.

179. M.J. Nadiri, The Determinants of Real Cash Balances op. cit.

term adjustments of the firm. It appears to us, that Heston's results justify Friedman's contention that money in the short-term is like fixed capital while securities play the role of a buffer asset. Although Heston took into consideration the effect of firm constant variables by fitting separate intercepts, his omission to account for time invariant variables may have biased his results. General economic conditions, new financial developments which affect all firms equally over time, may have injected some biases into the estimated coefficients. The application of regression analysis to combined cross-sections and time-series data may be a legitimate procedure provided it is conducted in a proper way[180].

The following cross-sectional models are basically similar in that the researchers concerned tested the same basic equations. In his cross-section study of the demand for money by corporations Meltzer[181] tested a model similar to that used in his series analysis[182] i.e.,

$$Mij = Kr^{a}Wij \qquad 6$$

where M is the demand for money, W the amount of wealth, r is a market rate of interest, K reflects cyclical changes in business

180. More comments on the statistical procedures used by all studies mentioned in this chapter, can be found in Chapter 8 of this thesis.

181. A.H. Meltzer, The Demand for Money: A Cross-Section Study of Business Firms, Quarterly Journal of Economics, August 1963, pp. 405-422.

182. A.H. Meltzer, The Demand for Money, The Evidence from the Time Series .....

activity and intensity in capital use, and i, j denote firm and industry subscripts respectively. In order to express the demand for money in terms of sales Sij by the ith firm it was assumed that sales and wealth were related by the following relationship,

$$Sij = KijpjWij \qquad 7$$

where pj is the internal rate of return on assets. Solving equation 7 for Wij and substituting the resulting expression into equation 6 we obtain

$$Mij = \frac{K.r^{a}}{(Kijpj)^{b}} Sij^{b} \qquad 8$$

Meltzér argues that although this implies a rather complicated relationship over time, we can assume that in any industry in a given year the variables r, Kij and pj are constant, and hence the demand for money by firms can be explained by sales in a cross-section regression. Using this relation in logarithmic terms Meltzer obtained 126 separate regressions.(14 industries on 9 different years) The results suggested that Meltzer's contention regarding the unitary elasticity of demand with respect to sales was vindicated empirically. In addition in an attempt to discover whether the square-root formulation suggested by Baumol improved the explanatory power of equation 8 above, Meltzer combined equation 8 with Baumol's square-root formulation to obtain

$$M = a + c\sqrt{S} + dS \qquad 9$$

As one might expect the explanatory power of equation 9 was greater than that of equation 8, chiefly because $\sqrt{S}$ is correlated both with M and S. Thus, it is not appropriate to assess the relative importance of c and d.

Another very similar model but with U.K. data was that of DeAllessi[183]. DeAllessi used Meltzer's basic equation i.e. 8 in an attempt to discriminate between alternative monetary theories. To this end he drew two samples of firms, one from the Breweries and Distribution industry and the other from the Industrial Section of the London stock exchange list. All firms were observed over ten years, i.e., from 1948 to 1957. Two relationships were tested. One with money narrowly defined, and the other with money broadly defined[184]. The budget constraint was represented by the market value of equity capital. The results suggested that as far as the samples under question were concerned, the wealth elasticity of the demand for money was equal to one, while the wealth elasticity of money broadly defined was greater than one. In addition DeAllessi attempted to provide support for Tobin's assertion[185] that the ratio of money to income, in this case wealth, varies inversely with income. The results suggested that on the whole Tobin's contention was not empirically justified.

Both Meltzer and DeAllessi argued that their results implied some influence of interest rates on the demand for money. In addition they argued that their cross-sectional results were in accordance with those obtained by Meltzer's time series analysis. Furthermore both authors maintained that other monetary hypotheses should be rejected. However it is difficult to see how Meltzer's

183. L. DeAllessi, The Demand for Money: A Cross-Section Study of British Firms, Economica, August 1966, pp. 288-302.

184. i.e., the sum of currency, demand and time deposits and short-term securities and tax saving certificates.

185. J. Tobin, The Interest Elasticity of Transactions Demand for Money, pp. 246.

sales variable could be said to represent the wealth level of firms, since sales constitute only a current addition to wealth, while wealth is a far broader concept. DeAllessi's market value of equity capital does not necessarily represent the intrinsic value of the firm in view of the speculative elements inherent in share prices at a moment of time. As we showed earlier, his results may be biased because the disturbance term in his monetary equation is not independent of the explanatory variable wealth. It may not be proper to draw conclusions of the empirical validity of a specific theory, based on the apparent similarity of results obtained from cross-section and time-series data, especially when the samples chosen do not represent the population as a whole. Results derived from time-series data for the economy as a whole may suffer from aggregation biases, while results derived from partly disaggregated data may disclose more information than the former. In general, when interpreting cross-section regression estimates the chief question is whether cross-section estimates can be said to reflect the proper behaviour of firms, in view of the fact that the underlying relationships may include dynamic adjustments[186, 187]. Kuh[186] has argued that the variance of an array of data may be attributed both to differences among economic agents, and to time variability. Hence

186. E. Kuh, The Validity of Cross-Sectionally Estimated Behaviour Equations in Time Series Application, Econometrica, 1959, pp. 197-214.

187. R.C. Vogel and G.S. Maddala, Cross-Section Estimates of Liquid Asset Demand by Manufacturing Corporations, The Journal of Finance, Dec. 1967, pp. 557-575.

from a dynamic point of view specific biases may blur the underlying relationships. Kuh[186], Vogel and Maddala[187] suggest that under these circumstances the most appropriate procedure is to use a rectangular array of data consisting of several cross-sections extending over some period of time, which should be analysed by means of individual and pooled regressions with dummy variables. As we will argue in Chapter 8, results derived from cross-sections regressions may be said to be biased. Thus, although one may have obtained high coefficients of determination and a unitary elasticity of sales or wealth it cannot be claimed that there are neither economies nor diseconomies of scale.

In another study Whalen[188], attempted to discriminate between the traditional monetary theory and the Baumol-Tobin formulation. To this end he employed equations 8 and 9 stated above, and deflated the dependent and independent variables by the sum of Government securities and money. He obtained regressions for each industry and for aggregate data for the year 1958-1959. His findings suggested that there were no significant economies of scale for the separate industrial sectors, but there were some indications of economies of scale for the aggregate data. He[189] does however note that economies of scale may exist, but are obscured by data limitations and statistical techniques. Our comments on the previous cross-sectional studies are applicable to this study as well. In addition Whalen's idea to divide both the dependent and independent variables by the same variable in order to mitigate the effects of scale, may

188. E.L. Whalen, A Cross-Section Study of Business Demand for Cash, The Journal of Finance, Sept. 1965, pp. 434-439.

189. Whalen, pp. 439.

have biased his results ever further[190].

A notable study is that of Yogel and Maddala[191]. They were concerned with the same issues as those of the previous researchers, namely the superiority of wealth over the sales variable, the existence of economies of scale, and the substitutional pattern between money and short-term securities. To this end they employed a rectangular array of data composed of several cross-sections which were analysed by means of pooled regressions with and without dummy variables. Their estimates were obtained by employing two sets of matrices. The first contained 224 observations for the year 1960-61 for 16 industries. The second matrix contained 140 observations for the total manufacturing industry from 1947-48 to 1960-61. Their basic equation was the same as Meltzer's equation 8 . The dependent variables cash and government securities were regressed against sales. Their preliminary investigation showed that results would not have been affected had they used total assets instead of sales in their regression equations. The results were very revealing. Without dummy variables the numerical values of elasticities were similar to those obtained by Meltzer. The introduction of industry asset size and time dummy variables reduced the elasticity of sales significantly. The Kuh[192] covariance test for data homogenetty was employed in an attempt to see whether cross-

190. E. Kuh and J.R. Meyer, Correlation and Regression Estimates When the Data are Ratios, Econometrica, Oct. 1955, pp. 400-416.

191. Yogel and Maddala op. cit.

192. E. Kuh, Capital Stock Growth, A Micro-Economic Approach, Amsterdam 1963, Chapter 5.

sectional results excluded dynamic variables. The test showed that there were important differences both among industries and asset sizes, and over-time. Thus the main reason why earlier cross-section regressions of money balances and sales or wealth yielded unitary elasticities, was that the effect of time invariant[193] and firm constant[194] variables had not been taken into account. The major conclusions of this study were that

(a) both industry and asset size class dummies are significant with the latter being more important than the former,

(b) time dummy variables were important but not as important as either industry or asset size dummy variables,

(c) the introduction of asset size class dummy variables reduces the coefficient of sales with the magnitude of dummy variables being an increasing function of size,

(d) securities are an increasing function of firm size and

(e) the magnitude of the time dummy variable is reduced over time which may be attributed to rising interest rates and better cast management techniques.

This statistical analysis is superior to all others, in that it deals explicitly with the effect of time and firm invariant variables. However their data may have obscured the existence of economies or diseconomies of scale, because firms in every industry have been classified into 14 asset size classes. Unless we can safely assume that in every class the included firms are homogeneous in every respect,

193. e.g. new financial or cash management techniques being developed over time etc.

194. e.g. managerial efficiency, technical efficiency, size etc.

the average firm data may suffer from aggregate effects. Thus pre-firm data may be more appropriate than partly aggregative data. Their interpretation of the nature of the effect of the excluded firm variables is not altogether clear. It is not clear why these dummy variables should in fact account for the effect of differences between size variables. The reason being that according to their preliminary investigations sales and total assets were of equal importance in explaining cash balances. Since these two variables were almost perfectly correlated, sales the independent variable in their regressions must be a good proxy for firm size. In addition since their data were classified by asset size classes the effect of size differences on money is already introduced directly into the regression analysis. It seems to us that it would have been more rational to attribute the effect of firm or asset size dummy variables to the quality of management, and superior technological efficiency which may be unique to each firm or to a group of firms within a size class. We do of course accept that bigger firms do in fact employ better managers, are more efficient, and can utilise new cash management techniques far better than smaller firms. We have offered these comments for the sake of clarity and consistency. One may also question whether their dummy variable analysis is an appropriate statistical technique for testing alternative theories. The reasons are that (a) dummy variables may in fact reflect ignorance[195] regarding the excluded variables (b) their interpretation is not always meaningful and (c) utilisation of covariate analysis may eliminate a major portion of the variation

195. In other words there is no reason why we should not treat the effect of excluded variables as random.

between both the dependent and independent variables, if the between firm and between time period variation is large[196]. It follows therefore that another statistical technique which avoids these problems must be utilised.

Finally another study similar to the above but with Canadian data is that of Shapiro's. Shapiro followed Kuh's suggestion in that he used a rectangular array of data of 21 industries over 15 years. The data were classified by industry as opposed to asset-size classification. The dependent and independent variables, cash and sales or total assets respectively, were industrial averages. He thus assumed homogeneity among firms and heterogeneity among industries. The analysis of covariance for the underlying structure over time, suggested that an interest rate variable should have been included. However inclusion of an interest rate variable in a pooled regression did not appear to produce better results than those obtained by a pooled regression with time dummy variables. Economies of scale were apparent when the independent variable in the regression was total assets. With sales as the dependent variable there were neither economies nor diseconomies of scale. It should be noted that the relationship between money and total assets may be spurious in view of the fact that money, the dependence variable, is included in total assets the independent variable. In addition the aggregative character of Shapiro's data may have biased his results.

196. G.S. Maddala, The Use of Variance Components Models in Pooling Cross-Section and Time Series Data, Econometrica, March 1971, pp. 341-357.

The main conclusions of the empirical literature are (a) that the choice of the scale variable does not significantly affect the magnitude of elasticities (b) that the choice of statistical techniques may be crucial in the discovery of economies of scale, and (c) as the size of firms increases, firms tend to substitute short-term securities for cash.

CHAPTER 7

DEVELOPMENT OF STATISTICAL METHODS AND MODELS

1. Introduction.

The first objective of this chapter is an attempt to justify the statistical techniques and estimation procedures employed by this thesis. Our empirical surveys suggested that the methods used to investigate the firm's demand for cash were mainly three. These are time-series, cross-sectional and temporal-cross-sectional analysis. The main advantage of using time-series analysis is that it enables one to discover dynamic factors affecting the dependent variable under consideration. The main disadvantage of this analysis is that time-series data may pose autocorrelation and multicollinearity problems[197]. Cross-sectional data do not pose serious problems of autocorrelation and multicollinearity, but suffer from problems of heteroscedacity and may not enable one to detect dynamic factors which may affect the dependent variable[198]. Temporal-cross-sectional analysis is an appropriate method provided the combination of time-series and cross-sectional data is conducted in an efficient statistical technique. In the following section we will question the validity of applying regression analysis to single cross-sectional data and suggest an efficient statistical technique for investigating

197. L.R. Klein, An Introduction to Econometrics, Prentice-Hall, 1962, Chapter 2.

198. It should be noted that it may be possible to apply dynamic regression analysis to cross-sectional data. See the studies by R.L. Alpine and A.B. Jack published in P.E. Hart, editor, Studies in Profit, Business Saving and Investment, Volume two.

the validity of our theories. The second objective of this chapter is to set out algebraically and statistically the economic models developed in earlier chapters. Some attention will be paid to model specification and to the definition of the variables of our statistical models.

2. Choice between cross-sectional and temporal-cross sectional analysis.

Given the nature of our data - i.e., 40 electrical engineering firms, and 45 retailing and distribution firms over a 4-year period - we have two choices. We can either conduct a purely cross-sectional or a temporal-cross-sectional analysis. In a cross-sectional analysis we are concerned with deriving information based on differences between quantifiable dependent and independent variables at a point in time. Non-quantifiable variables, that is intra-firm variation, cannot be ascertained. Firms may have the same broad objectives but may act differently in achieving their objectives because of differences in managerial behaviour. Thus we may observe two firms with identical sales, but with different cash balances. This may be due to the fact that expectations and information are construed differently by these firms. As another example we may have two firms having the same reported earnings but different share prices. This may depend on how investors interpret reported earnings, on the amount of information obtained, on investors' faith in management's ability etc. Age and experience may be important factors which cannot be taken into account by ordinary cross-sectional analysis. Dynamic or old established firms may be able to invent new technological, financial and organisational techniques, or to learn and apply similar techniques developed by others. Size of course is another factor in that big firms may be able to utilise new techniques which may increase the efficiency of asset utilisation. Now if all these effects unique to each firm are relevant, but cannot be quantified we must allow for them statistically otherwise we will reach wrong conclusions. As far as simple cross-sections are concerned, when a regression model is applied we assume that slopes and intercepts for all firms are constant over all firms. However if firm constant effects are relevant, failure to account for them will bias our results. To see the problems involved consider the following hypothetical model

$$Yi = ao + bXi + ui \qquad 1$$

where i refers to cross-section units. In this situation we are concerned with the relationship between Y and X. However there may be other types of differences between firms which may affect the true relationship between Y and X. For instance there may be variables which vary across firms but which are invariant through time[199]. These section or firm effects may reflect differences in technological, managerial or financial efficiency among firms. For instance if equation 1 represents a demand for money equation the magnitude of cash balances may well be determined by say sales, but this relationship is likely to vary across firms depending on such section variables as technical and financial efficiency and managerial quality[200]. To the extent that these attributes are to be found in large firms then the size of a firm is another factor which

199. E. Kuh, Capital Stock Growth: A Micro-Economic Approach, Amsterdam 1963, Chapter 5.

200. The same section variables are applicable in a share valuation model.

may affect the cash position of a particular firm. If this is true we should expect efficient firms to utilise their cash balances more efficiently than inefficient firms. In other words we should expect efficient firms to be able to effect a given volume of transactions with a smaller amount of money relative to inefficient firms. If these variables cannot be quantified, their effect must be allowed for statistically. Equation 1 may be modified to reflect these differences, i.e.,

$$Yi = ao + Ui + bXi + ui \qquad 2$$

In this specification Ui reflects firm effects which are unique to a firm, but reasonably constant over time. Our analysis has suggested that Yi depends not only on Xi but also on Ui. In fact observed values of X are affected by Ui as well. This means that if the effects of Ui on Yi and Xi are not taken into account equation 2 is mis-specified, in the sense that section differences will be incorrectly attributed to variable X. To the extent that these sort of differences enter observed values of both Yi and Xi the disturbance term will be correlated with both Xi and Yi. It follows that the independence assumption between Ui i.e., the disturbance term, and the dependent and independent variables is contradicted, and hence application of ordinary least squares is inappropriate. This sort of bias may be termed simultaneous equation bias[201]. The same sort of bias will occur if time variables (that is variables which are the same for all firms in a cross-section but vary over time) are

201. I. Hoch, Estimation of Production Function Parameters Combining Time Series and Cross-Section Data, Econometrica, Jan. 1962, pp. 34-53.

important determinants for the dependent variable. In this category we include changes in productivity over time, the development of new cash management techniques etc. We have therefore shown that if the excluded firm and time variables are important, application of ordinary least squares to cross-sectional data will yield biased results. Attempts to account for firm constant effects in a single cross-section by introducing firm dummy variables are futile, because the number of coefficients will be greater than the number of observations.

A way of overcoming these problems is to combine our cross-section and time-series data. One advantage of combining our observations is the larger number of degrees of freedom available for the estimation of the proposed relationships. Another additional advantage in utilising such a method is that individual firm data in a particular year may contain some short-term disturbances, in the sense that in any one year, it is conceivable that part of our dependent and independent variables may be transitory. The transient character of part of our variables may result from short-term influences, or lags in adjustment to equilibrium[202]. By pooling our data we may be able to remove the influences of transitory effects from our relationships. Also certain time variables which remain constant in a cross-sectional analysis can now be explicitly introduced into our relationships. It must however be stressed that the combination of cross-section and time-series data should be conducted in an efficient statistical technique, otherwise the

202. E. Kuh and J.R. Meyer, How Extraneous Are Extraneous Estimates, Review of Economic and Statistics, Nov. 1957, pp. 380-393.

estimation of coefficients will be biased[203].

There have been developed two methods with the purpose of combining cross-sectional and time-series data in an efficient way. The first method involves the use of the analysis of covariance techniques[204]. Equation 2 can be expressed as

$$Yit = ao + Ui + Vt + bXit + uit \qquad 3$$

where i refers to cross-section units, i = 1 ...... N, t refers to time periods, t = 1 ...... T, ao is an overall constant, Ui is the dummy variable associated with cross-sections, Vt is the dummy variable associated with time, and uit is a purely random term. Under this method the dummy variables are assumed to represent constant shifts between firms and time periods. The analysis of covariance provides us with estimates of ao, Ui, Vt and b of equation 3 . Economically equation 3 can be interpreted as follows. We assume that there is say a linear relationship between Y and X which is the same for all firms and constant over time with slope b. There is a constant term Ui specific to a firm and invariant over time, and that there is a constant verm Vt for each year but invariant among firms. If specification 3 and the ordinary least squares assumptions are true the estimated function will display the following features:

203. E. Kuh, The Validity of Cross-Sectionally Estimated Equations <u>op. cit.</u>

204. H. Clifford, Combining Cross-Section Data and Time-Series, Cowles Commission Discussion Paper, No. 347, May 1950.

(a) deviations from the true relationship unique to a specific firm that are invariant over time will be removed from the overall function.

(b) deviations from the true relationship common to all firms but specific to each time period will be removed from the overall function[205].

Hence the aforementioned biases do not occur in equation 3 since firm constant and time invariant effects influencing the relationship are accounted for by the U_i and V_t terms.

The second method is to treat the terms U_i and V_t as random variables rather than as fixed parameters. This is the components of error model[206] which can be written as follows

$$Y_{it} = a + bX_{it} + \epsilon_{it} \qquad 4$$

We assume that

$$\epsilon_{it} = u_i + v_t + w_{it} \qquad 5$$

205. P.R. Johnson, Some Aspects of Estimating Statistical Cost Functions, Journal of Farm Economics, Feb. 1964, pp. 179-187.

206a. T.D. Wallace and A. Hussain, The Use of Error Components Models in Combining Cross Section with Times Series Data, Econometrica, Jan. 1969, pp. 55-72.

206b. P. Balestra and M. Nerlove, Pooling Cross Section and Time Series Data in the Estimation of a Dynamic Model, The Demand for Natural Gas, Econometrica, July 1966, pp. 585-612.

206c. M. Nerlove, Experimental Evidence on the Estimation of Dynamic Economic Relations from a Time Series of Cross-Sections, Economic Studies Quarterly, Dec. 1967, pp. 42-74.

that is the random error ϵit, consists of three parts, all random, the first accounting for firm effects, the second for time effects, while the third is an overall variable both in time and cross-sections dimensions. Further we assume that:

$$E(ui) = 0 \qquad E(vt) = 0 \qquad E(wit) = 0$$

$$\begin{aligned} E(uiu'i) &= \sigma^2 u \quad \text{for } i = i' \\ &= 0 \quad \text{for } i \neq i \end{aligned}$$

$$\begin{aligned} E(vtv't) &= \sigma^2 v \quad \text{for } t = t' \\ &= 0 \quad \text{for } t \neq t' \end{aligned}$$

$$\begin{aligned} E(witw'it') &= \sigma^2 w \text{ for } i = i' \text{ and } t = t' \\ &= 0 \quad \text{for } i \neq i \text{ and } t \neq t' \end{aligned}$$

The (NTXNT) variance-covariance matrix of the random ϵit is constructed as follows:

$$\Sigma = \sigma^2 wINT + \sigma^2 uA + \sigma^2 vB \qquad 6$$

where INT is an NTXNT identity matrix and A and B are NTXNT matrices defined as

$$A = \begin{bmatrix} Jt' & 0 \; \ldots\ldots \; 0 \\ 0, & JT \; \ldots\ldots \; 0 \\ 0 & 0 \; \ldots\ldots \; JT \end{bmatrix}$$

where JT is a TXT matrix of ones and there N rows and columns of the TXT block matrices.

$$B = \begin{bmatrix} IT' & IT \; \ldots\ldots \; IT \\ IT' & IT \; \ldots\ldots \; IT \\ IT' & IT \; \ldots\ldots \; IT \end{bmatrix}$$

where IT is an identity matrix of order T and there are N rows and columns of the block matrices. In addition we assume that the X's are non-stochastic but not repeated, and that the errors are normally distributed. The estimation procedure consists of two steps. Firstly, ordinary least squares are applied to equation 4 and the resulting estimated residuals $\hat{\varepsilon}it$ are used to estimate the variances $\hat{\sigma}^2 w$, $\hat{\sigma}^2 u$ and $\hat{\sigma}^2 v$ as follows.

$$\tilde{\sigma}^2 w = \frac{1}{(N-1)(T-1)}\left[\Sigma i \Sigma t(\hat{\varepsilon}it - \Sigma t\, \hat{\varepsilon}it/T - \Sigma i \hat{\varepsilon}it/N)^2\right]$$

$$\tilde{\sigma}^2 u = \frac{1}{T}\left[\Sigma i \ \frac{(\Sigma t \hat{\varepsilon}it)^2}{T(N-1)} - \tilde{\sigma}^2 w\right]$$

$$\tilde{\sigma}^2 v = \frac{1}{N}\left[\Sigma t \ \frac{(\Sigma i \hat{\varepsilon}it)^2}{N(T-1)} - \tilde{\sigma}^2 w\right]$$

By using $\tilde{\sigma}^2 w$, $\tilde{\sigma}^2 u$, $\tilde{\sigma}^2 v$, we can obtain an estimate of Σ. In the second step we incorporate the estimated Σ in a generalised least squares estimation procedure, giving the following estimation of the coefficients.

$$\tilde{b} = (X' \tilde{\Sigma}^{-1} X)^{-1} X' \tilde{\Sigma}^{-1} Y$$

and

$$V(\tilde{b}i) = (X' \tilde{\Sigma}^{-1} X)^{-1}$$

Footnote 206 continued.

206d. M. Nerlove, Further Evidence on the Estimation of Dynamic Economic Relations from a Time Series of Cross-Sections, Econometrica, March 1971, pp. 359-383.

206e. M. Nerlove, A Note on Error Components Models, Econometrica, March 1971, pp. 383-401.

In using this model it is assumed that our relationships are basically the same for all firms, but are affected by random effects i.e., the influence of excluded variables. The properties of the error components model have been analysed in comparison with the covariance techniques[207]. It is shown that both models produce unbiased estimators when the variance components are known, and the samples are finite. Under these circumstances the Aitken type generalised least squares based on the error components is assymptotically more efficient. However in the realistic case in which the X's are weakly nonstochastic i.e., do not repeat but are bounded, and where the variances of the error components are unknown, the Aitken generalised least squares procedure for estimating the coefficients should be modified according to the procedures suggested by Professor Zellner[208]. When the variances of the errors are unknown, but the X's are strongly non-stochastic, both the Zellner-type and the covariance estimators are assymptotically unbiased, but the former have smaller assymptotic variances. It should however be pointed out that the results from the various analyses of the sampling properties of these alternative models i.e., covariance and error components techniques, do not provide a clear-cut conclusion in favour of one model or the other. However it has been pointed out[209] that the utilisation of covariance techniques

207. See for instance Wallace and Hussain op. cit.

208. A. Zellner, An Efficient Method of Estimating Seemingly Unrelated Regressions and Tests for Aggregation Bias, Journal of the American Statistical Association, June 1962, pp. 348-368.

209. G.S. Maddala op.cit.

eliminates a major portion of the variation between both the dependent and independent variables, if the between firm and between time period variation is large. In addition treating ui and vt as random can be rationalised on the grounds that the dummy variables represent some ignorance, like the residual term in a regression model. In other words we are treating this kind of specific ignorance in the same way as that of our overall ignorance. For all these reasons we think that an error components model can be used in the estimation of both our demand for money and share valuation models. Having described the statistical technique and estimation procedures to be used for investigative purposes we can now set out the statistical models. Before we do so we like to comment upon the sources of our data.

3. Sources of data.

Two industrial sectors, the retailing distribution and the electrical engineering were selected from the Board of Trade 1969 list of quoted companies. All firms were included in that list regardless of size. For the purpose of estimating the necessary growth variables (see section 4.5 of this chapter) for the share valuation models, firms in the two industries were observed from December 1965 to January 1972. Firms whose shares ceased to be traded on the London stock exchange between December 1965 and January 1972 were excluded from the final test[210]. In addition, a few firms whose financial years changed in such a way so that a year's accounts were missing, were also excluded. The final samples consisted of 40

210. It is possible that the elimination of unsuccessful firms may introduce some biases into our results in that our samples will consist of successful firms only.

firms in the electrical engineering industry, and 45 firms in the retailing distribution industry. The data of the remaining firms will be arranged into rectangular arrays consisting of four cross-sections extending over four years. Our time-series data both for the valuation and monetary models cover four years only i.e., 1968 to 1971, mainly because some firms did not report sales figures before the year 1968. All relevant industrial data was extracted from Moodies services[211], whilst interest rates and the retailing price index were obtained from publications of the Bank of England Quarterly Bulletin and National Institute of Economic Review respectively.

Two points should be borne in mind when interpreting our statistical findings. First, some firms especially in the retailing industry have included in their cash accounts some money substitutes[211a]. Secondly it is conceivable that some firms may have been practicing window dressing techniques, in order to enhance their

211. It should be noted that Moodies company data are reported on a fiscal year basis. Although the fiscal year ends for the Companies in our samples differ, the majority of the companies' fiscal years end on December 31 or between January and March. In order to adjust fiscal year data to a calendar year basis we treated all fiscal years ending between January and August as if they occurred in the previous year. Fiscal years ending between August and September were treated as if they occurred in the reference year.

211a. We are commenting upon this point because, as we have already mentioned, our concern is with a narrow definition of money.

liquid position at the end of their financial year. To the extent that these two problems are important we should expect our sales and wealth coefficients to be biased upwards. There are of course additional criticisms regarding the nature of balance sheet data. We cannot for instance regard stock variables as representing conditions which will prevail at other times. Different accounting practices among firms may distort the real performance of firms. In spite of these criticisms one may argue that on the whole there are no significant heterogeneous factors which may lead to large systematic biases.

4. Specification of the functions to be estimated.

4.1. Demand for money models based on the transactions theories.

Our relationships under examination specify that differences in real money[213] across firms and over time are functionally related (a) to differences over time in the short-term interest and differences across firms and over time in real sales and (b) to the difference over time between the long-term corporate interest rate and the short-term interest rate and differences across firms and over time in real sales:

212. We do of course realise that the length of time-series observations may be brief enough for any significant relationship to emerge between money and interest rates. In spite of this, we feel that it might be possible to derive some information, on how a group of firms reacts to the same interest rate which varies over time.

213. The proportionality of money with respect to price level will not be taken for granted. Instead our monetary functions will be cast both in nominal and real terms.

$$\frac{Mit}{Pt} = ao + a1rt + a2\frac{Sit}{Pt} + uit \qquad 1$$

$$\frac{Mit}{Pt} = bo + b1(Rt-rt) + b2\frac{Sit}{Pt} + u'it \qquad 2$$

where i refers to cross-sectional units i = 1 ..... N and t to time period t = 1 ..... T

Definition of variables

M = nominal cash in hand and current accounts per firm expressed in millions of pounds. We have used a narrow definition of money because we are mainly interested in the degree of substitution between money thus defined, and money substitutes and other assets. It may be questionable as to whether money balances reported in firms' balance sheets represents the theoretical variable advanced by the transactions theories. As we stated in Chapter 2 the transactions models are mainly concerned with the amount of money firms need in order to effect their transactions needs. It is quite possible however that firms use reported money balances for transactions, precautionary, speculative, and asset purposes. Since it is not possible to segregate reported money into its constituent parts we are compelled to use the reported cash balances as a whole for investigative purposes. This should be born in mind when we compare the empirical ability of monetary models based on the transactions approach to the demand for money, and on the wealth adjustment theories. As we have stated in Chapter 3 the wealth adjustment theories do not distinguish between the motives for holding money. These theories postulate that money is demanded for the services it yields its holders over time. Effecting transactions and being a hedge against uncertainty are some of the services that money provides. It follows therefore, that reported cash balances may be said to represent reasonably well the theoretical money variable advanced by the wealth adjustment theories.

Pt = the retailing price index. Perhaps the wholesale price index may have been a better deflator for the electrical engineering industry. However for the sake of obtaining comparable results we will use the retailing price index for deflating the relevant nominal variables of both industries. The possibility of biases is remote in view of the strong correlation between these two indices.

r = the yearly average yield on treasury bills. This variable is the one implied by transactions theories, in the sense that money not needed for immediate transactions should be invested in risk-free financial securities. Although using this interest rate is in accordance with the theoretical opportunity cost implied by the transactions theories, it may be questionable whether in practice firms face the same opportunity cost of holding money. Large firms may be able to lend money at a relatively higher interest rate than smaller firms. Also the cost of borrowing to larger firms may be smaller than that of the smaller firms.

S = the level of sales per firm expressed in ten millions of pounds. We have used this variable because of its proximity with the theoretical level of transactions. Strictly speaking transactions should be represented by the expected volume of receipts or expenditures to and from the cash account. Because of limitations in balance sheet data we will approximate this variable by the volume of sales.

(R-r) = the difference between the yearly average yield on long term corporate debenture and loan stocks R and the yield on treasury bills r. We use this opportunity cost of holding money in order to capture the effect of borrowing and lending rates on the demand for money. Again we do not expect this opportunity cost of holding money to be a good representative of the actual opportunity cost in view of the fact that different firms may face different borrowing and lending rates. The implications of our inability to measure in a proper way the variables included in our monetary models will be discussed in section 9 of Chapter 8.

4.2. A demand for money function based on the wealth adjustment theories.

Our relationship under examination specifies that differences in real money across firms and over time are functionally related to differences over time in the yield on corporate debenture and loan stocks and differences across firms and over time in real net wealth.

$$\frac{Mit}{Pt} = C + C1Rt + \frac{C2\widehat{W}it}{Pt} + vit \qquad 3$$

Definition of Variables

Rt = the yearly average yield on corporate debenture and loan stocks. This cost of external funds would be the same as the rate of return of an industry in equilibrium[214]. In other words we are not just considering the nominal interest paid for external capital, but the real cost to a firm consisting of both the nominal interest charges and the additional interest charges resulting from the introduction of debt into the firms' financial structures.

214. The internal rate of return on assets for an industrial sector or class of firms used here is similar to that used in the theoretical discussion of the cost of capital by Modigliani and Miller. See their paper, The Cost of Capital, Corporation Finance and the Theory of Investment op. cit.

$\hat{W}$ = the level of the net wealth position of the firm expressed in ten millions of pounds. It is defined as the product of the number of shares outstanding at the end of the financial year, multiplied by the estimated share price variable. It may be recalled (see Chapter 3) that for reasons connected with simultaneous equation biases which might have occurred had we used market determined share prices, we decided to employ a two-stage least squares regression for the wealth models. As a result we will construct a new share price variable from the first-stage regression of share prices on dividends etc., while the second stage regression will be conducted with the thus constructed variable, multiplied by the number of shares outstanding at the end of the financial year.

4.3. A transactions-wealth model.

Our last model refers to the relationship between real cash balances, the yield on corporate bonds, real sales and real net wealth.

$$\frac{Mit}{Pt} = d + d1Rt + \frac{d2S}{Pt} + \frac{d3\hat{W}}{Pt} + v'it \qquad 4$$

where all variables have been defined before.

4.4. Functional forms of the monetary equations.

Regarding the functional form of monetary equations, it is well known that in monetary economics, researchers faced with the problem of specifying the functional form of equations have used either a linear formulation, a logarithmic formulation or both[215]. Because

215. P. Zarembka, Functional Form in the Demand for Money, Journal of American Association, June 1958, pp. 502-511.

there is no conclusive a priori reasoning for the choice of a specific functional form, we have experimented with both formulations, and have also conducted graphic tests in an attempt to discover which of these alternative relationships is appropriate on empirical grounds. Our preliminary graphic tests of the functional forms and experimentations with alternative formulations suggested that as a first rough approximation our relationships were linear in absolute terms. Accordingly only results of linear functions will be reported in this paper[216].

Another problem is associated with the possibilities that large size differences among firms may invalidate one of the assumptions of the Gaus-Markov theorem of least squares, namely that the error variance must be constant overall observations[217]. In order to avoid the effects of such a problem i.e., heteroscedasticity, we experimented with the appropriateness of dividing our variables by a suitable deflator e.g. total assets. However our results suggested that linear homogeneity and certain correlational conditions suggested by Kuh and Meyer[218] did not hold for our equations. Hence this approach

216. It should be mentioned that our preliminary investigations of the form of functional relationships indicated that non linear forms might have been more appropriate than either linear or log-linear forms. An additional reason for our preference of linear models over logarithmic models is that we expect the relevant elasticities to be variable and not constant over all observations.

217. J. Johnston, Chapter 2.

218. E. Kuh and J.R. Meyer, Correlation and Regression Estimates When the Data Are Ratios. Econometrica, Oct. 1955, pp. 400-416.

was abandoned, and our data were left untransformed. It should be noted that if the assumption of homoscedastic variances does not hold our regression estimates will not be best linear unbiased estimates. However they will remain unbiased estimates[219].

Another important problem is whether the regression coefficients of the monetary equations would reflect short or long-term effects. Firstly, we should note that we have specified our monetary models as long-term ones in the sense that observed values of the variables are supposed to equal their planned or equilibrium values[220]. Secondly, regression parameters derived from cross-section data may be regarded as measuring long-term effects[221]. On the other hand regression parameters derived from time-series data are usually regarded as measuring short-term adjustments. Since we are pooling cross-section and time-series data it would appear better, to consider the tested relationships to be those of an intermediate run[222].

219. J. Johnston, Chapter 7. It should be noted that examination of the residual variance of the monetary equations indicated that it was not completely homoscedastic.

220. Strictly speaking, the best way to derive short-term and long-term coefficients is to use a partial adjustment model. See for instance, G.C. Chow, On the Long-Run and Short-Run Demand for Money op. cit. However one's ability to do so is limited because of one's yearly data, and also because one would like to avoid adjustment models containing both current and lagged values of the dependent variables.

221. L.R. Klein, Chapter 2.

222. P.R. Johnson, Some Aspects of Estimating Statistical Cost Functions op. cit.

The advantages of using an error components model although important cannot be readily identified. If say without the effects of firm and time variables being removed from the demand for money functions, the estimated sales and wealth elasticities appear to be one, the removal of these effects if significant will reduce the sales and wealth elasticities. It should be noted though, that our theoretical analysis does not provide us with conclusive a priori numerical estimates of the relevant elasticities. As a result we cannot really identify the degree of biases existing in the estimation of the relevant parameters.

4.5. Share valuation models.

Our relationship under examination[223] specifies that differences in the yearly average prices across firms and over time are functionally related to differences across firms and over time in dividends, growth in earnings or growth in share prices, size of the firm, business risk and leverage. We stated in Chapter 4 that one way to approximate expected growth in earnings per share may be to use growth in share prices themselves. Alternatively one may use the growth in earnings per share. Accordingly we will test two models. The first will comprise growth in share prices as well as the other prime variables, while the second will comprise growth in earnings per share along with the other variables.

$$Pit = e + e1DIVit + e2GPit + e3\ln SIZit + e4BRit + e5Lit + wit \qquad 1$$

$$Pit = e' + e'1DIVit + e'2GEit + e'3\ln SIZit + e'4BRit + e'5Lit + w'it \qquad 2$$

Definition of variables

P = the arithmetic average of the high and low share price recorded each calendar year expressed in new pence. Some authors have used share prices prevailing on the day immediately following the

223. See Chapter 4, section 4.

cross-section year. It has however been argued[224] that share prices prevailing at any one day contain random or temporary disturbances. On the other hand an average of the low and high values of share prices over a year, may be relatively free of temporary disturbances.

DIV = gross dividends per share in new pence. We do not really know how shareholders utilise the information contained in current dividends when buying shares. We will assume that shareholders take into account not current dividends, but a four year moving average of dividends. A moving average of dividends as opposed to current values of dividends in conjunction with the pooling of time-series and cross-section data may purge the transitory values of this variable, which may still exist in any single cross-section.

GP = growth in share prices.

GE = growth in gross earnings per share expressed in new pence. According to our theory shareholders are assumed to be purchasing a stream of income consisting of distributed earnings and growth in earnings. However, because future earnings are not easily observable we postulate that shareholders rely on past data for the formulation of their expectations. One may argue that it may not be appropriate to rely on past growth performance as a means of predicting future growth, for it is not always true that growth breeds growth[225].

What matters however is whether investors behave as if past growth

224a. Marris and Singh op. cit.

224b. Edwards and Hilton op. cit.

225. A.M.D. Little, Higgledy Piggledy Growth Bulletin of the Oxford Institute of Statistics. For a different point of view see W.B. Reddaway, Higgledy Piggledy Growth Economic Journal, Sept. 1967.

achievements affect share prices, and not "how the future profits of a company are affected by past growth[226]". Growth in per share earnings is represented by the slope coefficient obtained from a linear trend equation of earnings per share over time. In fact our growth in earnings variable is represented by a four-year moving trend of earnings on time. As we argued in Chapter 4, investors may be formulating their growth expectations on the basis of their share price appreciation, or share depreciation. Accordingly an alternative variable for growth in expected earnings per share will be represented by a four-year moving trend of average share prices over time. We will use the trend in share prices in spite of the fact that use of this variable may introduce some bias in the regression coefficients, since this variable will consist of lagged values of the dependent variable. We hope however that in our case this problem is not very important in view of the large size of our observations.

SIZ = firm size measured by total assets. Since a size variable expressed in absolute terms does not lend itself to comparability among firms we will use the natural log of size. It should be noted that size is here represented not by net assets because a net asset size variable does not lend itself to comparability between large and small firms within an industry and across industries. As is well known small firms or firms in certain industries tend to have high percentage level of liabilities. It follows that the netting out of liabilities implicit in the construction of net assets value necessarily reduces the size of small firms relative to large firms.

226. J.M. Samuels and J. Tzoannos, Takeovers and Share Price Valuation, Business Ratios 1969, pp. 5-16.

BR = business risk. Since we will apply our valuation models to two separate industries we may argue that a business risk variable is unnecessary. We have however included in our models a risk variable associated with the business nature of each firm. We have done so because work on the subject of the nature of the risk class assumptions suggests that unless it can be shown that firms in the same industry are of the same risk category, a business risk variable should be introduced in a model of share valuation. Risk is measured as the coefficient of variation of the rate of return on capital employed over four years. Again risk is represented as a four-year moving coefficient of variation.

L = the gearing ratio, that is the ratio of the book value of long-term debt and preference shares to total net assets[227]. We include this variable because our theoretical constructs have indicated that the amount of earnings available to common shareholders may be influenced by the amount of payments to senior security holders. Gearing is a four-year moving average of gearing.

4.6. Functional forms of the share valuation equations.

Regarding the functional form of the equations, we have followed previous studies and have assumed that share prices vary linearly with the natural logarithmic of size, and linearly with all other variables expressed on a per share or per pound basis[227]. Since our variables are expressed either on a per share and per pound of capital employed basis, we can assume that all observations have a constant variance.[228]

227. See for instance M. Davenport op. cit.

228. In fact examination of the residual terms of the share valuation models failed to show that the residual variance was heteroscedastic.

Although we have not used any sophisticated technique in order to normalize our variables, we feel that our approach may enable us to derive relationships free of transitory effects. We attribute this to our using averages and trends for all the variables except the size variable, as opposed to the current values of the variables. In addition our statistical technique of combining cross-sectional and time series data may be said to purge the transitory effects from our relationships[229]. Since we are combining our time series and cross-sectional data we are able to use a moving growth variable, and moving averages of all variables except the size variable. This is a departure from all previous cross-section valuation models whose growth variables were represented by a constant growth variable. We have taken the view that since the trend of earnings or indeed any other variable is likely to change with the passage of time, it may be more realistic to assume that shareholders in evaluating their shares do not look at some constant growth variable over the last four, five or ten years but instead assume a changing growth variable or indeed changing values of other variables. It should be noted that in order to pursue the objective of deriving moving trend and moving average variables our firm data were observed from 1965 to 1971.

It is worth noting that although the effects of firm and time variables have not really been dealt with explicitly and systematically by previous valuation models, some authors have expressed concern over the effect of certain unmeasurable variables on share valuation. Thus Gordon has suggested that "when such firm effects are present, there is the possibility that inclusion in the model of an additional variable or that a different method of estimation will

229. Kuh and Meyer op. cit.

improve the reliability of the parameter estimates[230]." Friend and Puckett have been more emphatic on the use of an appropriate statistical technique in a situation when "Measurement of such slippery concepts as subjective risk evaluation, profitability of investment opportunities, sources of expected future financing, and accounting differences is both difficult and subject to large error. Indirect approaches thus seem particularly attractive"[231].

Thus although the direction and extent of biases is difficult to identify in view of the effects of so many omitted variables, our analysis of the importance of combining our cross-section and time-series data, suggest that using such a technique is desirable in a valuation model. The importance of such a technique is further reinforced by the suggestions and comments of the aforementioned economists.

230. M. Gordon, Financing and Valuation of the Corporation, pp. 153.

231. Friend and Puckett, Dividends and Stock Prices, pp. 665-666.

CHAPTER 8

PRESENTATION AND INTERPRETATION OF RESULTS

1. Introduction.

In this chapter we present and interpret the statistical findings derived from the empirical models developed in the previous chapter. All the statistical results are obtained by application of an error components model to combined cross-section and time-series data. As we have already stated, in order to obtain unbiased results for the monetary empirical models with net wealth as one of the independent variables, we will estimate this relationship in two stages. In the first stage we will measure the relationship between share prices across firm and over time and the variables which determine their value. On the basis of this relationship we will construct a new share price variable for each firm which (multiplied by the number of shares of each firm) will be used for the second stage regressions. Consequently the presentation and interpretation of share valuation results will precede those of the demand for money results.

2. Statistical findings of valuation models.

We have tested two similar valuation models. In the first model expected earnings per share are proxied by growth in past share prices, while in the second model growth is represented by growth in earnings per share. In statistical form the empirical models are:

(1) $P_{it} = e + e_1 DIV_{it} + e_2 GP_{it} + e_3 \ln SIZE_{it} + e_4 BR_{it} + e_5 L_{it} + w_{it}$

(2) $P_{it} = e' + e'_1 DIV_{it} + e'_2 GE_{it} + e'_3 \ln SIZE_{it} + e'_4 BR_{it} + e'_5 L_{it} + w'_{it}$

where i = 1 .... N (cross sectional observations), t = 1 .... T (time-series observations), P is the yearly average share price, DIV is a four-year moving average of dividends per share, GP is a four-year moving trend of past average share prices, lnSIZ is the natural log of total assets, BR a four-year coefficient of variation of the rate of return on capital employed, L is a four year moving average of the ratio of senior securities to capital employed[232], and GE is a four year moving trend of past earnings per share. As an initial step we tested jointly all the five prime variables in each model. Variables which had the wrong sign or were statistically insignificant at the five per cent level, were omitted one at a time and the remaining variables were tested anew. The results for the electrical engineering and retailing and distribution industries are given below. The standard errors are shown in brackets below the parameters. A computed 't'[233] value above two is significant at the five per cent level.

<u>Electrical engineering, empirical model 1.</u>

Number of observations 160 i.e., 40 firms over 4 years, from 1968 to 1971

1. $$P = -91.60324 + 14.97860DIV + 1.64398GP + 14.58030\ln SIZ + 0.01262BR - 0.42278L$$

$$(37.34970) \quad (1.34875) \quad (0.30504) \quad (3.35956) \quad (0.01612) \quad (0.33194)$$

$\bar{R} = 0.761$[234].

232. For a full definition of variables see Chapter 7.

233. That is the ratio of the regression coefficient to its standard error.

234. All coefficients of determination are adjusted for degrees of freedom.

2. $P = -85.75247+14.97860DIV+1.67538GP+13.39225\ln SIZ+0.00924BR$

$$(38.58756) \quad (1.38342) \quad (0.27500) \quad (3.34281) \quad (0.01549)$$

$\bar{R}^2 = 0.758$

3. $P = -83.94593+14.87270DIV+1.64873GP+13.77800\ln SIZ-0.362719L$

$$(37.40321) \quad (1.35441) \quad (0.27500) \quad (3.38317) \quad (0.32825)$$

$\bar{R}^2 = 0.753$

4. $P = -84.56600+14.8860DIV+1.67436GP+13.34210\ln SIZ$

$$(38.58756) \quad (1.37497) \quad (0.27500) \quad (3.34288)$$

$\bar{R}^2 = 0.758$

<u>Model 2</u>

5. $P = -128.68500+15.39140DIV+5.52280GE+20.74220\ln SIZ+0.02631BR-1.49552L$

$$(47.40253) \quad (1.76892) \quad (1.550357) \quad (4.22499) \quad (0.02583) \quad (1.48031)$$

$\bar{R}^2 = 0.705$

6. $P = -106.26400+15.36470DIV+6.75085GE+16.18780\ln SIZ+0.01676BR$

$$(49.58830) \quad (1.85358) \quad (1.52893) \quad (4.16922) \quad (0.02626)$$

$\bar{R}^2 = 0.695$

7. $P = -121.46700+15.32090DIV+5.42921GE+19.87200SIZ-1.35546L$

$$(49.58300) \quad (1.76534) \quad (1.544837) \quad (4.17473) \quad (1.47260)$$

$\bar{R}^2 = 0.701$

8. $P = -104.49300+15.231800DIV+6.61864GE+16.10260\ln SIZ$

$$(47.40242) \quad (1.84883) \quad (1.51341) \quad (4.16712)$$

$\bar{R}^2 = 0.683$

Retailing and distribution industry, model 1.

Number of observations 180 i.e., 45 firms over 4 years from 1968 to 1971

1'. $P = -68.10777 + 13.16010DIV + 2.00360GP + 9.72178 \ln SIZ + 0.06250BR + 0.331253L$

$(26.07681) \quad (0.89678) \quad (0.15735) \quad (2.18908) \quad (0.05059) \quad (0.21927)$

$\bar{R}^2 = 0.799$

2'. $P = -63.66752 + 13.06400DIV + 1.97799GP + 9.96417 \ln SIZ + 0.06438BR$

$(26.43861) \quad (0.90983) \quad (0.15814) \quad (2.22323) \quad (0.05089)$

$\bar{R}^2 = 0.796$

3'. $P = -62.47133 + 12.93430DIV + 2.00065GP + 9.31719 \ln SIZ + 0.33127L$

$(26.58947) \quad (0.88687) \quad (0.16164) \quad (2.19403) \quad (0.33273)$

$\bar{R}^2 = 0.793$

4'. $P = -58.22100 + 12.50510DIV + 1.96361GP + 9.60256 \ln SIZ$

$(26.60827) \quad (0.89269) \quad (0.15738) \quad (2.21882)$

$\bar{R}^2 = 0.859$

Model 2

5'. $P = -72.00886 + 13.85340DIV + 15.57830GE + 11.08960 \ln SIZ + 0.073433BR - 0.07589L$

$(32.96968) \quad (1.16403) \quad (2.44665) \quad (2.83900) \quad (0.062760) \quad (0.28252)$

$\bar{R}^2 = 0.725$

6'. $P = -73.19516 + 13.88720DIV + 15.55170GE + 11.05600 \ln SIZ + 0.0713BR$

$(33.03029) \quad (1.15979) \quad (2.44232) \quad (2.84116) \quad (0.06276)$

$\bar{R}^2 = 0.728$

7'. $P = -64.99500 + 13.09300DIV + 15.60500GE + 10.81300 \ln SIZ - 0.09094L$

$(33.06055) \quad (1.13963) \quad (2.4447) \quad (2.83056) \quad (0.28321)$

$\bar{R}^2 = 0.700$

8'. $P = -67.26666 + 13.58820 DIV + 15.32300 GI + 10.675201\ SIZ$

$$(33.12099) \quad (1.13561) \quad (2.43822) \quad (2.83424)$$

$$\bar{R}^2 = 0.719$$

The final model to be selected for the estimation of share prices will be based upon the magnitude of the coefficients of determination $\bar{R}^2$, standard errors of the regression coefficients, and the a priori versus the observed signs. As we have stated in Chapter 3 the main reason why we have decided to construct valuation models is that we want to avoid simultaneous equation biases which would have existed had we used a market determined net wealth as one of the independent variables in a demand for money model. As a result we have employed a two-stage least squares method. What we need are variables highly correlated with P, otherwise the regression coefficient of net wealth in the second stage regression will have a large sampling variance[235].

Accordingly, for the purpose of estimating a new wealth variable for the second stage regressions, we must select those regression equations which have the highest coefficients of determination. Bearing these points in mind we have selected equation 4 for the electrical engineering industry and equation 4' for the retailing industry in order to construct new share prices for the firms in question. As can be seen by looking at the equations presented above, that is by comparing their coefficients of determination, neither the gearing nor the risk variables contribute significantly towards the reduction of the variance of the dependent variable.

235. J. Johnston, Chapter 9.

3. A brief interpretation of results.

According to the theoretical relationships predicted by our valuation theory[236] we should expect both dividends and growth in earnings to be positively related with share prices. Our empirical findings are in accordance with the theoretical predictions. Both coefficients have the right sign and in addition are highly significant. Thus our theoretical predictions are empirically validated, for both components of return exert a positive and significant influence on share prices. We argued in Chapter 4 that future growth in earnings may be reflected better in a growth variable represented by growth in share prices, than by retained earnings or growth in earnings per share. This seems to be borne out in our statistical results at least as far as our two industries are concerned[237]. Given the sign magnitude and statistical significance of the dividend coefficient we can say that dividends play a great role in determining share prices. In both industries dividends are the most superior variable explaining about 50% of the variance of the dependent variable[238]. The importance of dividends, vis-a-vis growth in earnings however measured may be indicative of the investors' preference for dividends over uncertain future earnings. Alternatively this relationship may indicate that dividends act as a vehicle in conveying information about future earnings. The fact remains however that shareholders are interested

236. See Chapter 4, Section 4.

237. In the sense that growth in share prices explains a greater proportion of the variance of the dependent variable than growth in earnings per share.

238. In fact our findings are in line with the findings of another valuation study using British data. See G.R. Fisher, Some factors Influencing Share Prices op. cit.

in both components of returns, that is dividends and expected growth in earnings, but that the more certain dividends are much preferred to uncertain expected incremental earnings.

According to our valuation model the size of the firm should be positively related with share prices. Our results for both industries support our expectations in that the size variable exerts a positive, independent influence on share prices. This variable may act as a proxy for business risk, in the sense that the market may be more confident in the future earnings of a large firm's assets than in a small firm's assets.

Our theoretical constructs suggested a negative relationship between the business risk variable and share prices. Our empirical findings however show a positive but statistically insignificant relationship. To the extent that our risk variable has been measured appropriately we can attribute our results to the fact, that given the objective of stabilizing dividend distributions, shareholders are not particularly concerned with the overall risk. On the other hand this variable may be redundant in the sense that, within a group of firms belonging to the same risk class the risk variable is a constant across firms. Alternatively if we assume that the risk variable is purely random both across firms and over time, we would expect its effect to have been picked up by the cross-sectional and time-series error components.

Our theoretical discussion on the effects of gearing on value suggested three theoretical predictions. First, a not significantly different from zero gearing regression coefficient would tend to support the Miller and Modigliani[239] view that changes in the

239. See Chapter 4.

financial structure of a firm do not have any significant effect on the value of shares. Second, positive and statistically significant regression coefficient would tend to support the traditional view that judicious use of gearing has a favourable impact upon share values if the firm or a group of firms were operating below some optimal capital structure. Third, a negative and statistically significant gearing coefficient would tend to support the traditional view in that firms were heavily geared, and hence additional debt has an unfavourable influence on share values. Since our gearing regression coefficients are all statistically insignificant we are forced to say that our empirical results tend to provide some support for the Miller and Modigliani thesis. This finding may of course be consistent with the traditional view in that a firm or a group of firms were operating at an optimal range of financial mix over which reasonable changes in debt do not have any significant influence on share value[240]. Our interpretation of the gearing coefficients must

240. A more careful look at the regression coefficients reveals a small but unfavourable effect of debt on share values, for the electrical engineering industry. The opposite results have been obtained for the retailing industry. Although the latter is highly geared (average gearing ratio 18.4) in comparison to the former (average gearing ratio 11.7) the fact that the income stream of the retailing firms is less volatile than that of the electrical engineering firms may explain the small but favourable effect of debt on share values for the retailing firms. This rationalization of our results is based on the grounds that the effect of debt on shareholders' wealth depends on the degree of risk associated with income returns. The lower the business risk in a particular industry the higher the allowable level of senior securities in the industry's capital structure.

be treated with special circumspection. Apart from measurement and statistical difficulties[240a] we do not really know whether the favourable effect of debt on share values stems from tax savings, or from the cheapness of the interest component in the average cost of capital.

In general we can attribute the relatively better results for the retailing industry to the fact that during the period examined the market was more optimistic about the performance of the retailing than of the electrical engineering industry. It seems as though shareholders conceived of the retailing industry as a more homogeneous sector, whose dividends were more stable and whose expected earnings were more certain, than those of the electrical engineering group. As we have already mentioned, the electrical engineering industry consists of firms vulnerable to the business cycle, and thus with a relatively unstable income stream. It may be recalled that the years 1968-1971 were characterised by economic stagnation and uncertainty, which was largely a result of the balance of payments deficit and the subsequent severe monetary and fiscal policies. One may therefore expect that under these circumstances, shareholders expectations regarding the future of these otherwise dynamic companies were bleak. This may presumably be the reason why the growth variable was far more important in the retailing than in the electrical engineering group. In fact one would have expected the opposite results for an industry which under normal circumstances should have had good growth prospects. In fact uncertainty in future income returns may have contributed to the great importance of dividends as opposed to the

240a. See for instance: Barges, Weston and Wippern op. cit.

growth in earnings per share[241].

We think that we have good methodological points which enable us to rely on our models in order to compute share values for the second stage monetary regressions. These are the large size of observations, our reliance upon theory in formulating the valuation models, the use of a rectangular array of data and the utilization of an error components model in order to take into account the effects of excluded variables, the high statistical significance of our regression coefficients and the high value of the coefficients of determination. Furthermore our interpretation of results indicated that most of the a priori predictions have been vindicated empirically. These points indicate that we can be reasonably confident that our computed measure of net wealth is reasonably free of short-term randomness. We cannot of course be absolutely certain that in the second stage regression of money balances and computed net wealth and the opportunity cost of holding money, the independence assumption of the disturbance term and the computed equity value will not be contradicted in reality. In our case though we may argue that observed values of money will not be related to short-term equity value, but to the expected, normal value of shares. As a result observations of current money holdings will affect current share prices but not observations of computed share prices. Hence the independence between the disturbance term and computed share prices is not contradicted.

241. One may have expected the growth variables to have been more important, in view of their preferential tax treatment of capital gains vis-a-vis dividend distributions.

4. Presentation of statistical findings for the monetary empirical models.

Our basic hypotheses under examination specified that differences across firms and over time in nominal (M) or real money balances $\frac{M}{P}$ are functionally related to differences in

(a) the yield on treasury bills (r) and nominal (S) or real sales $\frac{S}{P}$

(b) the difference between the yield on long-term corporate debentures and loans (R) and the yield on treasury bills (r) and $\frac{S}{P}$

(c) the yield on long-term corporate debentures and loans (R) and computed nominal $(\hat{W})$ or real equity capital $\frac{\hat{W}}{P}$ and (d), (R), $\frac{S}{P}$ and $\frac{\hat{W}}{P}$

Below we present the statistical findings for the monetary equations. The standard errors[242] are shown in brackets below the regression coefficients. A computed 't' value above 2 is significant at the five per cent level. All coefficients of determination have been adjusted for degrees of freedom.

242. Standard errors of the constant terms are all statistically insignificant and have thus been omitted.

Electrical engineering

(1) $$M = 2.97661 + \underset{(0.87387)}{0.66366}\, r + \underset{(0.32945)}{1.36538}\, S$$

$$\bar{R}^2 = 0.250$$

(2) $$\frac{M}{P} = 1.41727 + \underset{(0.75466)}{0.77676}\, r + \underset{(0.37190)}{1.58895}\, \frac{S}{P}$$

$$\bar{R}^2 = 0.270$$

(3) $$\frac{M}{P} = 8.13831 - \underset{(0.54588)}{1.03068}\, (R-r) + \underset{(0.37294)}{1.62860}\, \frac{S}{P}$$

$$\bar{R}^2 = 0.278$$

(4) $$M = 14.86657 - \underset{(1.18303)}{0.97928}\, R + \underset{(0.42313)}{2.70364}\, \widehat{W}$$

$$\bar{R}^2 = 0.400$$

(5) $$\frac{M}{P} = 12.89137 - \underset{(0.96260)}{0.97609}\, R + \underset{(0.42455)}{2.98538}\, \widehat{\frac{W}{P}}$$

$$\bar{R}^2 = 0.431$$

(6) $$\frac{M}{P} = 13.77135 - \underset{(0.97752)}{1.10131}\, R + \underset{(0.46980)}{0.38448}\, \frac{S}{P} + \underset{(0.63907)}{2.56617}\, \widehat{\frac{W}{P}}$$

$$\bar{R}^2 = 0.433$$

Retailing and distribution

(7) $$M = -7.37521 + 1.26006\ r + 2.22997\ S$$
$$\qquad (0.54234) \qquad (0.29306)$$
$$\bar{R}^2 = 0.428$$

(8) $$\frac{M}{P} = -7.84781 + 0.97321\ r + 2.82193\ \frac{S}{P}$$
$$\qquad (0.39024) \qquad (0.33481)$$
$$\bar{R}^2 = 0.530$$

(9) $$\frac{M}{P} = 1.19374 - 0.85858\ (R-r) + 2.84758\ \frac{S}{P}$$
$$\qquad (0.30924) \qquad (0.33554)$$
$$\bar{R}^2 = 0.542$$

(10) $$M = 3.80952 - 0.30090\ R + 3.20667\ \hat{W}$$
$$\qquad (1.40719) \qquad (0.17366)$$
$$\bar{R}^2 = 0.713$$

(11) $$\frac{M}{P} = 3.19394 - 0.29131\ R + 3.34861\ \frac{\hat{W}}{P}$$
$$\qquad (0.97533) \qquad (0.18077)$$
$$\bar{R}^2 = 0.730$$

(12) $$\frac{M}{P} = 2.83437 - 0.49052\ R + 1.37744\ \frac{S}{P} + 2.25017\ \frac{\hat{W}}{P}$$
$$\qquad (0.96261) \qquad (0.33420) \qquad (0.31231)$$
$$\bar{R}^2 = 0.753$$

5. Interpretation of results.

Although the explanatory power of the electrical engineering equations is rather low, the level of the explained variance in all equations is sufficient to yield significant relationships at the five per cent level. The explanatory power of the retailing equations is quite satisfactory. On the basis of the coefficients of determination statistical significance of regression coefficients, and the a priori versus observed signs, our results indicate that the wealth adjustment models provide a better explanation of the demand for money by both industries, than do the transactions models. The wealth models appear to perform better not only in terms of the coefficients of determination, but also in terms of the interest rate which has the right sign. As we can see the similarity of the parameters between the equations expressed in nominal and real terms suggest that the demand for money is homogeneous of degree one in prices[243]. In other words a one per cent increase in the retailing price index increases the demand for nominal balances by one per cent, but leaves real balances unaffected. This finding is of course in accordance with the a priori expectations. We will now attempt to interpret our statistical findings for the interest rates and the scale variables separately.

243. In fact a 't' statistical test showed that there is no significant difference between nominal and real cash balances.

6. Interest rates[244].

All interest rates coefficients have either the wrong sign or are statistically insignificant when they bear the right sign. Firstly, in all wealth models, the yield on corporate bonds varies negatively with money as predicted by our theory, but its coefficient is insignificant at the five per cent level. In the case of transactions models our empirical results are at variance with the a priori expectations. Since our empirical results are not in accordance with the a priori predictions of the transactions theory we will attempt to rationalize our findings by resorting to alternative hypotheses. In the first instance Duesenberry's[245] theoretical conclusions regarding the effect of short-term rate fluctuations on business money holdings seem to have been validated by our results. As we stated in our survey of monetary research based on aggregate time-series data, firms may be insensitive to short-term interest rate changes because the costs of managing their portfolio of securities are of a fixed nature. It follows therefore that in the short-term firms will attempt to

244. The reader is requested to bear in mind that our comments on the interest rate coefficients hold true if the length of our time-series is sufficient for the proper relationship between money and interest rate to emerge. As we argued earlier it may be necessary to have long-time series data in order to allow the interest rate coefficients to capture the long-term effects of rising interest rates i.e., new cash management techniques, the effects of learning by doing, adjustments of payments and receipts etc.

245. Duesenberry op. cit. See also, Garvy and Blyn and McGoudrick op. cit.

maintain a certain amount of money consistent with their cash management techniques. Temporary changes in interest rates may not induce firms to change their short-term financial investments significantly. Conversely over long periods of time permanent changes in interest rates may induce firms to be more economical in the use of their cash balances and thus reduce their demand for money. On the basis of this analysis we should expect a negative and significant relationship between money balances and interest rates averaged over long periods. As a matter of fact our results are in accordance with this hypothesis in the sense that interest rates during the time period under examination i.e., 1968-1971 had not changed significantly. Secondly, a perverse sign between money holdings and short-term interest rates, or the difference between long and short-term interest rates[246], may be expected if money

246. We would like to mention in passing that although we had expected a positive sign between money balances and the difference between the yield in long-term corporate bonds and the yield on Treasury bills, it might have been possible to have expected a negative sign. This may be rationalized on the grounds that the yield on long-term corporate debentures and loans may reflect the average cost of capital for the sectors in question. (See Chapter 3, section 3). If this is so, the greater the average cost of capital the smaller the demand for money by business firms. Given that the yield on long-term corporate debentures is greater than the yield on Treasury bills, then the greater the difference between these two rates the lower the demand for money. It follows therefore that the results of equations (3) and (9) presented earlier are in accordance with the predictions of this alternative hypothesis.

holdings adjustments are of a cyclical nature. Thirdly, a non significant relationship of the money holdings and the lending or borrowing rate may be expected if the effect of higher lending rates is completely offset by higher borrowing rates. Finally, insignificant relationships between money holdings and interest rates may be rationalized on the grounds that the effect of interest rates is a random time effect, which has been accounted for by the time-series error component. In fact omission of the interest variables from the regressions did not appear to produce significantly different results than those reported here. Thus, given both the nature of our data and the conclusions of alternative hypotheses it is not suprising we have been unable to find any appreciable effects between money holdings and interest rates.

7. Sales and net wealth coefficients.

The sales and net wealth coefficients for both industrial sectors in all equations are highly significant. For the electrical engineering sector, the computed sales and net wealth elasticities[247] are 0.47 and 0.62 respectively. For the retailing and distribution sector, the computed sales and net wealth elasticities are both 0.93 These estimated elasticities tell us the percentage change in money balances for a 1% change in the independent variable, (in our case

247. It should be noted that elasticities of linear relationships are not always useful because they depend on the initial position we choose. The initial values chosen here, are the means of the variables (expressed in nominal terms) of the samples which may provide a reasonable initial position from which we may consider small departures. See for instance, A.W. Heston, pp. 150.

sales and net wealth) given that the other independent variables[248] remain constant. It would appear that for the electrical engineering firms the estimated elasticities are less than one, while for the retailing and distribution firms are approximately equal to 1[249]. These results would suggest that cash balances for the electrical engineering firms may grow less than in proportion to sales and net wealth. The results for the retailing and distribution firms would suggest that cash balances may grow in proportion to sales and net wealth. Within the context of the transactions approach to the demand for money, rational cash management behaviour implies a less than proportional relationship between money holdings and transactions[250].

248. We have not calculated the interest elasticities of money in view of the insignificance and wrong signs of the interest coefficients.

249. This is confirmed by 't' statistical tests. In order to carry out these tests, we calculated what values the regression coefficients would have assumed if the elasticities were equal to one.

250. Of course the precise assumptions upon which the simple square-root Baumol-Tobin model is based, provides us with precise estimates of the relevant parameters. For instance, if we take the logarithms of equation 5 in Chapter 2 i.e., $C = \left(\frac{2bwT}{i}\right)^{\frac{1}{2}}$, the coefficients of transactions and interest will be, $\frac{1}{2}$ and $-\frac{1}{2}$ respectively. However, given the restrictive assumptions of this model in conjunction with the different conclusions of other transactions models (see Chapter 2), it is rather improbable that empirical results will be precisely equal to these two numbers. However for the purpose of testing for econmies of scale, economies of scale could exist as long

A proportional or more than proportional relationship between these variables is possible if firms are unable to practice systematically and consistently cash-conserving financial transactions, because of the existence of certain adverse factors.

As we argued in Chapter 1, one would have expected the relative certainty of income streams of the retailing and distribution firms to enable them to synchronise their receipts and expenditures closely, and to engage in cash-conserving financial transactions. Conversely the relatively less certain income streams of the electrical engineering engineering firms should have made it difficult for these firms to engage in cash optimisation techniques. If that was so we would have expected our regression results to show a less than proportional relationship between money holdings and transactions (represented here by sales or net wealth), for the retailing and distribution firms and a proportional or more than proportional relationship for the electrical engineering firms. We have instead found a proportional relationship between money and the constraint variables for the retailing and distribution firms, and a less than proportional relationship for the electrical engineering firms. It would seem as though the favourable effect of relative certainty of cash receipts on the demand for money by the retailing and distribution firms, may have been offset by the unfavourable effect of cash decentralization on optimal cash balances. In Chapter 2 on discussing the effect of decentralization on the demand for money by business firms, we concluded that the greater the need for branches and thus separate cash accounts, the greater the amount of money the organisation as a

Footnote 250 continued...

as the elasticity of money with respect to the constraint is significantly less than one.

whole must hold. In particular we showed that it may be possible to find that average cash balances increase by more than in proportion to increases in transactions, because as the size of firms grows the possible setting up of new branches may cause some degree of suboptimisation of cash balances. We also noted that the number of branches is a function both of the size and the nature of the business of an organisation. A retailing firm may have a greater number of branches and thus separate cash accounts than an electrical engineering firm of the same size. In addition the need by retailing firms to keep a sizable amount of money for their daily numerous transactions as well as their expenses on labour may explain the proportional relationship between money and the constraint variables. On the other hand, electrical engineering firms, being highly capital intensive have a strong incentive to economize on cash balances in order to invest funds in capital projects.

The transactions-wealth hypothesis states that both transactions and net wealth have an independent positive effect on money balances. Our statistical findings equations 6 and 12 seem to substantiate the theoretical conclusions. For the electrical engineering equations real sales have a positive but insignificant effect on real cash balances, when real net wealth appears in the equation. For the retailing firms real sales has a positive and significant effect on real cash balances, when real net wealth appears in the equation. Although it is difficult to interpret these findings meaningfully in view of the high correlation between real sales and net wealth it should be noted that the real wealth coefficients in equations 4 and 11 are not very much different from those estimated in equations 6 and 12. From this it would appear that real net wealth has a far more powerful effect on real money balances, than has real sales.

We may therefore argue that there is some tentative evidence that firms hold money in order to meet not only their transactions needs but also their portfolio needs.

The poor results for the electrical engineering industry are probably due to firm homogeneity especially with respect to the pattern of receipts and expenditures and capital intensity. In all probability inclusion of a variable reflecting variability in transactions would have improved the explanatory power of our equations, especially those of the electrical engineering industry. Also a variable reflecting differences in capital intensity across firms would have improved our results[251]. The more satisfactory results provided by the wealth adjustment models may be attributed to the use of an expected net wealth variable. As is well known both in theory and practice firms are faced with expected transactions and wealth positions. It follows therefore that two variables are required in order to capture the proper effect of the scale variable on the demand for money by firms and indeed by households. These are expected transactions or wealth as well as variability in these

251. One cannot expect the effect of capital intensity on money balances to be constant across firms within such an industry as the electrical engineering. It is obvious that electrical products of large firms are likely to be produced and sold under different conditions. Firm heterogeneity, with respect to different capital intensities or production functions, will affect the predictive power of the equations. This is likely to be more important in the electrical engineering industry than in the retailing and distribution industry.

variables. Although we have not been able to utilize these variables it should be noted that since our wealth variable is an estimated one it could be regarded as an expected variable. Thus by utilizing a two-stage least squares method we have been able to obtain some measure of an expected wealth variable which although not completely identical with its theoretical counterpart, it is nevertheless better than the current measured sales variable.

8. Implications of our results and comparison with other studies[252].

Our results imply that the amount of aggregation used for most demand functions may be rather high. The greater than unity money elasticity with respect to the constraint found by Price's[253] aggregate time series model and the different results found by us in conjunction with DeAlessi's[254] cross-sectional findings of approximately unitary elasticities for two industrial sectors, suggests that the demand for money by firms should be approached by dissagregating the corporate sector. The suspected differences

252. It should be noted that comparison between our work and previous cross-sectional studies and time-series studies is not entirely legitimate. Our data, model specification, statistical methods and estimation procedures are different than those of earlier studies. In addition the majority of empirical studies has used American data. In spite of these differences comparison of our study with other studies will assist us in evaluating our results more efficiently.

253. L.D. Price, op. cit.

254. L. DeAlessi op. cit.

affecting money holdings between our two industrial sectors would tend to suggest important bias in aggregation. DeAllessi's study also provides tenuous support for our approach. The results of his relatively homogeneous group of firms i.e., breweries and distillers, were more reliable than those of the group of firms containing more than one industry classification i.e., the industrial section of the London Stock Exchange lists.

The choice of statistical methods may be crucial for the discovery of economies of scale in the corporate sector. As we argued in Chapter 7, cash balances across firms may be determined by say sales, but this relationship is likely to vary across firms and over time, depending on firm constant and time invariant variables. If these usually non-quantifiable variables are not taken into account, a regression equation of money on sales will be misspecified in the sense that the effects of these variables will incorrectly be attributed to the sales variable or indeed any other constraint variable. These problems may be overcome if we combine the cross-sectional and time series data, and apply an appropriate statistical technique and estimation procedure. Although we are not able to identify completely the degree and direction of biases which would have occurred had we applied ordinary regression analysis to single cross-sections, ordinary regression applied to the whole matrix of data[255] showed lower effects of scale vis-a-vis those obtained by applying the error components model. All studies whose statistical models allowed them to take into account the effect of excluded variables were able to report the existence of economies of scale[256].

255. i.e., combined cross-section and time series data.

256. e.g., Yogel and Maddala, Shapiro, Heston op. cit.

On the other hand all those who applied ordinary regression techniques to single cross-sections, found in general unitary elasticities[257].

Our results also suggest that the choice of the scale variable does not significantly affect the magnitude of elasticities. This conclusion seems to be in line with the conclusions of several writers who considered several proxies for the scale variable[258]. This is not a surprising result since the variables chosen (mainly sales and assets) are highly correlated. However we like to offer an alternative explanation which may be relevant to our own approach. As we have argued in Chapter 3 both theories i.e., transactions and wealth adjustment, are quite similar in view of the fact that both are dexterous modifications of the central choice theory. Although they emphasize different constraint variables[259], there is no compelling reason why a demand for money model constrained by wealth should not reveal economies of scale. As we have seen the Baumol simple square formulation implies important economies of scale in the demand for money by business firms. But findings of economies of scale do not necessarily mean that the Baumol transactions model performs better than the wealth adjustment models. Such behaviour is also consistent with Friedman's conclusions that in the short-run,

257. e.g., Meltzer, D'Allessi, Whalen op. cit.

258. e.g., Yogel, Maddala, Nadiri, Heston, Whalen op. cit.

259. Strictly speaking the main difference between these theories lies with the definition of the constraint variable. Transactions models usually emphasize current transactions, while wealth adjustment models emphasize a long-term concept i.e., expected wealth or permanent income.

cash balances of firms vary less than proportionally to wealth or permanent income. The rationale of this conclusion is based on Friedman's contention, that firms do not regard money as a shock absorber. If money acted as a shock absorber, we should expect unexpected receipts to be kept in the form of money and thus find higher sales or wealth elasticities than those reported here. If on the other hand unexpected receipts are kept in the form of short-term securities, or used in order to adjust inventories, trade credit or liabilities, we should expect these assets or liabilities to act as a means of absorbing unexpected receipts. Of course Friedman's[260] long-term results for the aggregate demand for money led him to conclude that in the long-term, money changes by more than in proportion to permanent income. But as Meltzer[261] has pointed out this finding is chiefly a result of the broad definition of money that Friedman employed which raises the permanent income elasticity. Using the same data, but a narrow definition of money Meltzer found that the elasticity of money with respect to permanent income or wealth was equal to one. It must of course be stressed that neither our data nor our model specification enable us to derive purely short-term and long-term elasticities. As we argued during the development of our empirical models, our estimated relationships would tend to produce intermediate run coefficients. Presumably long-term elasticities would have been higher than those reported here. Strictly speaking short-term and long-term elasticities can only be estimated with the

260. M. Friedman. The Demand for Money, Some Theoretical and Empirical results, op. cit.

261. A.H. Meltzer. The Demand for Money, The Evidence From Time Series op. cit.

use of data based on relatively long-time series and a partial adjustment model. However if we accept that our coefficients tend to reflect intermediate term adjustments then our results are consistent with both the transactions and wealth adjustment theories. The relatively higher wealth elasticity vis-a-vis the sales elasticity for the electrical engineering firms may be rationalised on the grounds that our computed wealth variable is a long-term variable reflecting expected normal income of each firm as opposed to the current sales variable. The higher elasticity for net wealth is to be expected, since substitution of a long-term wealth variable for a current measured one raises the value of the relevant elasticity. As regards the similarity in the magnitude of the sales and net wealth elasticities for the retailing firms, it can be explained on the grounds that for firms whose sales follow a smooth trend, changes in net wealth are proportional to short-term changes in current measured sales.

Our results hold important implications for monetary policy. Firstly our findings for individual sectors reveal that there exist distributional effects in the aggregate demand for money. Thus a given change in sales or net wealth position of the electrical engineering sector will have a smaller impact on the demand for money than a change of equal magnitude in the sales or net wealth position of the retailing sector. It follows therefore that the greater is a given real level of production, concentrated in economic sectors with inelastic demands for money, the lower will be the demand for real money for that particular level of income. Secondly the existence of economies of scale in the demand for money by important economic sectors, indicates that monetary policy may be more powerful than if the demand for money varies in proportion, or more than in proportion to the level of income. With a given distribution of income and at a given interest rate, changes in the aggregate supply of money will have, in conditions of unemployment, a far more powerful effect on income than if the demand for money was proportional or more than proportional to the level of income.

9. Limitations of our study and implications for further research.

Among other things, we were chiefly concerned with the ability of the transactions and wealth adjustment models in explaining the demand for money by business firms. However, if one wants to observe the relationships postulated by our theories one must be able to measure all the variables suggested by these theories. We have in effect assumed that all firms within an industry are identical in every respect except in sales and wealth. As we have stated during the theoretical development of our models, both the hybrid transactions model and the wealth adjustment model suggested more variables than those we have experimented with, as being potentially important in determining the demand for money by business firms. Because of data limitations we were not able to measure transactions costs, nor were we able to introduce a variable representing variability in transactions. Also, as we argued in Chapter 8, section 4, it may be questionable whether balance sheet cash holdings represent the theoretical variable advanced by transactions models. This may be so because reported cash holdings are used not only for effecting transactions but also for other purposes[262]. The

262. Nor can we be certain that our sales variable is identical to its theoretical counterpart. Strictly speaking transactions should be approximated by the volume of receipts to the cash account. See for instance E.L. Whalen, pp. 432.

opportunity cost of holding money has been assumed to be the same for all firms in the same industry. This is clearly in accordance with the Baumol formulation which is really applicable if the opportunity cost of holding money is constant over all firms. However it may be questionable whether the same interest rate should affect all firms in a similar manner. One may argue that large firms are able to hold a relatively larger amount of money, because the cost of borrowing to them is less than that of a smaller firm. This would call for the construction of own rates of opportunity costs as opposed to external rates which are the same for all firms. By the same token we should, if we could, construct own variables reflecting penalty costs. The cash account should not include income earnings short-term assets. As we have already stated some firms in the retailing industry have included some short-term securities in their cash accounts. To the extent that the amount of short-term securities included in the cash account was important the proper relationship between narrow money and sales or wealth has been obscured. In the wealth adjustment models we had to proxy rates of return on balance sheet assets with the yield on long-term corporate bonds. We did not use internal rates of return for each firm, because across firms, internal rates of return must be correlated with net worth. It follows that even if we were able to derive meaningful measures of returns on assets included in a firm's balance sheet, single equation models would have been inappropriate in view of the simultaneous relationships prevailing among the different assets and liabilities included in firms' balance sheets. This would certainly call for extensive model building in order to take into account the simultaneous relationships among various balance sheet assets and liabilities. Our time series should have been longer if we had wanted to capture the effects of interest rates on money holdings. In addition it should be said that interest rates during our period i.e., 1968-1971 did not change significantly. It follows therefore that if our analysis is undertaken again with quarterly time series and cross-sectional data covering the recent important increases in interest rates i.e., 1972-1974, we may be able to discover the proper theoretical relationship between interest rates and money holdings. Given these limitations we cannot really maintain with great confidence that the wealth models are superior to transactions models, nor can we say that neither of the theories is capable in explaining the demand for money by business firms. Although we were able to theorise at a firm level, it must be stated that because of data limitations the arguments contained in our functions resembled those used by aggregate studies. It seems to us that if we were able to utilize all the variables advanced by our theories and use an approach to account for possible simultaneous relationship between the independent variables of the regression equations, we may have been able to obtain better results than those obtained in this thesis.

CHAPTER 9

CONCLUSIONS

Introduction.

The purpose of this final Chapter is two-fold. Section one is concerned with a brief overview of the thesis, while section two summarizes the results of our investigation.

1. A brief overview of the thesis.

We have attempted to shed some light on the ability of two alternative monetary theories in explaining the demand for money by business firms. We have also paid attention to the possible existence of economies of scale in the demand for holding cash balances, the substitutability between money and other assets and to whether there exists a transactions-wealth demand for money by business firms. In addition we hypothesized that cash balances vary not only across firms but also across industries. To this end we selected two industrial sectors with the objective of obtaining a reasonable degree of diversity regarding such factors as certainty of income streams, capital intensity, trade credit and business concentration. Our economic models were based upon the basic principles of the transactions, the wealth adjustment and the transactions-wealth adjustment theories.

For reasons connected with simultaneous equation biases, we decided to employ a two-stage least squares approach for the wealth adjustment models. As a result we constructed a new wealth variable for each firm from the first-stage regressions of share prices and other variables. The thus constructed new wealth variable was used for the second stage regressions. Our share valuation models were based on the basic principles of valuation theory. Our statistical findings enabled us to rely on our valuation models in order to compute new share values for the second stage wealth adjustment monetary regressions.

Having questioned the validity of using single cross-section regression techniques in both share valuation and demand for money studies, we applied an error components model to disaggregated temporal-cross-sectional data, in contrast to all previous studies which used different statistical methods and estimation procedures.

Because of data limitations certain important variables had to be omitted. In addition our brief time-series data and the relative stability of interest rates during the time period under investigation may have obscured the proper relationship between money holdings and interest rates. We should also bear in mind that our preliminary investigations of the functional form of monetary equations showed that non-linear relationships might have been more appropriate than either linear or logarithmic relationships. With these limitations in mind we can now proceed to summarise the conclusions of our empirical investigation.

2. Summary of conclusions and implications.

The empirical findings of this study are based on combined time-series and cross-sectional data of two industrial sectors. Given our initial hypothesis that cash balances vary across industrial sectors and the fact that it has been justified empirically, it is unlikely that our results will have applicability to all industrial sectors. Since our results suggest the existence of industrial differences in cash holdings our approach of examining the demand for money for each industrial sector separately has been empirically justified. Unless we can allow for the effect of industrial differences quantitatively, the most effective approach to avoid biases in our results is to disaggregate the corporate sector, and examine sectoral demand for money functions. The suspected industrial differences in conjunction with our statistical findings and the different results obtained by others using aggregate data tend to suggest important bias in aggregation. It follows therefore that if the behaviour of separate sectors is different, aggregation over all industrial and household sectors will conceal important information, and yield inaccurate results. In addition our findings imply important distributional effects with important impacts on the effectiveness of monetary policy.

The poor results[263] for the electrical engineering sector are probably due to some degree of firm heterogeneity. The wealth models provide a better description of the demand for money[263] by our two sectors than the transactions models. We cannot of course reject the ability of the transactions models to explain the monetary behaviour of business firms in view of our inability to examine the effects of certain variables suggested by these theories, as being important determinants of the demand for money by business firms.

The better performance of the wealth functions can probably be attributed to the fact that wealth in our case is an expected variable as opposed to current measured or observed sales variables. Since almost all theories speak in terms of an expected constraint variable[264], a model whose empirical variables are good representatives of the theoretical variables is likely to perform better than a model whose empirical variables cannot be said to represent the theoretical

263. In terms of the explanatory power of the equations.

264. Except the Baumol-Tobin theories.

variables adequately. It follows therefore that our two-stage least squares approach has been well justified. Firstly since net wealth is an expected variable the independence between the disturbance term and net wealth is likely to have been sustained. Secondly since forecasted net wealth may be regarded as an expected long-term variable it may be said to represent reasonably well its theoretical counterpart. We have some evidence that there is both a transactions and wealth demand for money by our two industrial sectors. No strong conclusions can be offered in view of the high degree of correlation between sales and net wealth.

We were not able to discover any important substitutional effects between money holdings, and short-term interest rates or the difference between the long and short-term rates. We have attempted to rationalize these results by resorting to theoretical predictions offered by some other alternative hypotheses. In particular we must remember that cash optimizing practices are not necessarily affected by short-term interest rate changes unless these are of a permanent nature. This seems to be in line with the nature of our data in that interest rates did not change significantly over the time period considered i.e. 1968-1971. Our results may have been different had we extended our time series data to include the recent drastic interest rate changes. The fact that the yield on corporate bonds (although insignificant) had always the right sign, tenuously supports our theory's prediction that money holdings and this opportunity cost of holding money vary inversely. Alternatively this may be attributed to the observed fact that not all firms in our two industries held short-term securities, but instead relied on borrowing in order to meet their cash requirements.

The choice of statistical methods and estimation procedures may be very important for the discovery of the appropriate relationships. Allowance must be made for firm constant and time invariant effects, otherwise any statistical findings will be unreliable. On the basis of our results there is no evidence that firms in either sector treated money as a luxury good.

The results for the electrical engineering firms suggest that these firms have utilized their cash balances intensively and invested the excess cash in money substitutes and real assets. Thus as sales, size and net wealth tend to increase there is a tendency to substitute money for money substitutes and/or real assets. The results for the retailing and distribution industry imply neither economies nor diseconomies or scale[265]. This is probably due to the nature of the business of these firms which makes cash optimizing techniques difficult. These results also suggest that the choice of the scale variable does not significantly affect the magnitude of elasticities.

On the basis of our results it would appear that further research, preferably based on quarterly data, should concentrate on developing and testing demand for money models for each corporate sector. Attempts should be made to develop variables reflecting expectations in transactions and net wealth levels. Particular attention should be paid to constructing variables reflecting variability in the above mentioned variables. Some attention should be paid in constructing opportunity costs specific to each firm but at the same time the interrelationships between independent variables should be taken into account. A variable reflecting differences in capital intensity across firms would in all probability improve the explanatory power of the equations.

With these limitations in mind, we can claim to have shown that demand for money functions constrained by an expected net wealth variable provided a better description of cash-management behaviour than did demand for money functions constrained by a current measured sales variable. We have also shown the importance of sectoral as opposed to aggregate demand for money functions. In addition, our analysis has shown that the choice of statistical methods and estimation procedures may be crucial for the discovery of economies of scale.

265. These conclusions must be treated with some caution. As we reported in Chapter 7, the underlying data are not linearly related over all ranges. It is therefore possible that calculation of elasticities for individual firms or groups of firms classified by size will not indicate a clear variation in the elasticities over all ranges of data.

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