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Bank Asset-Liability Management Theory Revisited

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ABSTRACT

This paper seeks to build actively managed liabilities into the Kane-Malkiel model of bank portfolio allocation. The approach is to develop explicit channels for bank control of these liabilities in a way that lets managers use them reactively as a counterweight to exogenous disturbances elsewhere in the balance sheet. Our mechanism is to dichotomize managed liabilities into a planned and a reactive component. The reactive component is the counterweight of liability management. It enables bank managers to offset exogenous disturbances to maintain or increase bank utility. The proposed model is rich in its implications for public policy and managerial behavior. While not much has changed over the years, we feel that this new approach does offer a fresh theoretical look at asset-liability management.

INTRODUCTION

Even though the phenomenon of bank liability management saw rapid development during the 1970s and early 1980s, its full development within a portfolio-allocation model has yet to be accomplished. Reviewing the literature will show a paucity of work done over the decades, particularly on the theoretical side of asset-liability management. Further, the research done of the applied side has typically focused on mathematical models and methodologies such as goal programming, etc.

This paper will take an overdue look at the theoretical foundation of asset-liability management. It attempts to build actively managed liabilities into the classic Kane-Malkiel (1965) model of bank portfolio allocation. The approach is to develop explicit channels for bank control of these liabilities in a way that lets managers use them reactively as a counterweight to exogenous disturbances elsewhere in the balance sheet.

Our approach is to dichotomize managed liabilities into a planned and a reactive component. The reactive component is the counterweight of liability management. It enables bank managers to offset exogenous disturbances to maintain or increase bank utility. Since our model shows that liability management directly affects both expected bank profits and the variance of profits, its use involves a fundamental risk-return trade off. The proposed model is rich in its implications for public policy and managerial behavior.

The paper consists of four sections. In the next section, the concept of liability management as well as a brief literature review is introduced followed by the extension of the original Kane-Malkiel model in third section. The implications of the model are presented in section four and the paper ends with a summary-and-conclusions section. The detailed mathematics of the third section are contained in the paper's appendix.

THE CONCEPT OF LIABILITY MANAGEMENT& LITERATURE

Using Kane's (1979) terminology, liability management (LM) is defined as banks' efforts to develop nontraditional borrowing arrangements and to use them profitably, especially to meet loan demand. These nontraditional borrowing arrangements have interest, maturity, and service elements that differ in important ways from traditional deposits or non managed liabilities. The critical distinction is that liability managers are active and not passive participants in bank markets. They package customer services, deposit rates, and maturities on interest-sensitive funds to be competitive.

The concept of LM, as defined by Kane, involves two distinct aspects. First, there is the notion of supplementing asset management with only short-term borrowing, referred to as money-desk or reserve-position liability management and labeled LM-1. Second, there is the concept of closely managing all liabilities whatever their maturity, referred to as generalized or loan-position liability management and labeled LM-2. Both LM-1 and LM-2 focus upon an active rather than a passive approach toward the solicitation of funds. The time domain is the primary dimension for distinguishing between LM-1 and LM-2.

A bank's ability to issue new liabilities as a source of short-term liquidity describes the LM-1 process. Since banks regularly have been borrowing funds from each other or from the central bank for years, there is, of course, nothing new about LM-1. The major vehicle of LM-1 is the purchase of one-day federal funds and its main portfolio benefit is a compositional one. The latter is derived from the fact that a bank can hold a higher proportion of less-liquid, higher-yielding assets in its portfolio than it could without LM-1. The alternative to LM-1 is to store liquidity in cash and highly marketable securities such as Treasury bills.

The development of LM-2, which Kane regards as a series of regulation-induced innovations, is designed to facilitate permanent expansion of a bank's earning assets. The potential benefits of LM-2 are increased profitability and reduced deposit volatility. A bank's use of negotiable certificates of deposits (CDs) is a good example of LM-2.

This paper focuses upon-the impact of LM-2 upon bank risk exposure, credit rationing, bank-customer relationships, and monetary policy. The focal variables are changes in the levels of liabilities and assets. In contrast, other studies [See Aigner (1973), Buser, Chen and Kane (1981) and Hendershott and Winder (1979] have concentrated upon the pricing mechanism assuming funds are supplied perfectly elastically. This paper represents an addition to the theory of asset liability management.

In terms of relevant literature, there has been little theoretical work done over the years in this area with most work being done on specific modelling for asset liability management. Even that literature is somewhat dated. Most such work considers linear programming and goal programming models that have been around for many years. Some of the early works include Fortson and Dince (1977) who used the four goals of profit, loan to deposit ratios, capital adequacy and liquidity. Eatman and Sealey (1979) utilized three goals in their model. Korhonen (1987) utilized two-stage goal programming. Giokas and and Yassiloglou (1991) consider broader factors to include legal and bank specific policy factors. Tektas, Ozkan-Gunay and Gunay (2005) offer another look at goal programming for asset-liability management. They use goal programming during times of financial crisis for banks with differing risk taking behavior. They conclude that their model can help banks respond to a change in strategy as well as changes in scenarios the bank may face.

THE MODEL

To build actively managed liabilities into the Kane-Malkiel model (hereafter K&W), we proceed with the definition of the bank balance-sheet constraint:

$$A = G + L + D_1 + D_2 + \overline{NW}, \qquad (1)$$

where A = total assets.

G = government securities,

L = loans,

D_1= nonmanaged liabilities,

D_2 = managed liabilities, and

$\overline{NW}$ = net worth assumed to be zero. [1]

The analysis assumes a one-period planning horizon with the maturities' of earning assets greater than one period and equal. All balance-sheet items are as of time zero. (For convenience, the zero subscript is suppressed.) Any funds generated during the period are placed into government securities or loans. The one-period profit equation is:

$$\pi = g(D_1 + D_2) - C_1 D_1 - C_2 D_2 + (r - \tilde{d})L + \Delta\pi, \qquad (2)$$

Whereg = rate on government securities,

C_1 = average effective cost of nonmanaged liabilities[2],

C_2 = average effective cost of managed liabilities,

r = rate on loans,

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[1] Assuming NW = 0, as K&W did, only serves to simplify the mathematics and does not affect the results or our conclusions.

[2] The effective cost is the nominal rate (C*) adjusted for an implicit effective tax rate, i.e., Ci = Ci/(1-Ti), i = 1, 2, where T is a composite adjustment factor to account for deposit-insurance assessments and reserve requirements. Because of lower reserve requirements and fewer insured components in D2, T1 > T2.

$\tilde{d}$ = default rate on loans,

$\widetilde{\Delta L}$ = change in loans,

$\Delta\pi = \pi\left(\widetilde{\Delta D}_1 + \widetilde{\Delta D}_2\right)$= profit on the incremental funds,

$\widetilde{\Delta D}_1$ = change in nonmanaged liabilities during the period, and

$\widetilde{\Delta D}_2$ = change in managed-liabilities during the period,

A tilde (~) indicates a random variable. The expected relationship among the interest rates in equation (2) is: r > g >C_3> C_2>C_1. The fact that C_2 exceeds C_1 represents the discriminatory and regulation-avoiding elements in liability management. These elements serve to improve meanprofits, often at the expense of funding volatility.

To introduce the reactive mechanism of managed liabilities, we dichotomize $\widetilde{\Delta D}_2$into a planned component $\left(\Delta LM_p\right)$ and a reactive component$\left(\Delta\widetilde{LM}_R\right)$, that is,

$$\widetilde{\Delta D}_2 = \Delta LM_p + \Delta\widetilde{LM}_R \tag{3}$$

The planned component represents the systematic effort by bank management to expand its balance sheet profitably. The reactive component is an explicit counterweight used by manager to offset exogenous disturbances elsewhere in the balance sheet. The reactive element, which is a random variable, is a function of the uncertain changes in deposit supplies and loan demands. It is in this sense that managed liabilities are a random variable possessing a standard deviation. This dichotomization is a refinement of Kane's concept of LM-2.

Similar to K&W, it is assumed that bank managers seek to maximize a two-parameter utility function consisting of expected profits, $E(\pi)$, and the variance of expected profits, σ_π^2. Risk-averse behavior is postulated and thus utility varies directly with $E(\pi)$ and inversely with σ_π^2. Given these assumptions, it can be shown (see the appendix) that

$$E(\pi) = g_0(D_1 + D_2 + L) - C_1D_1 - C_2D_2 + \left(r + \bar{d}\right)L + \Delta LM_pX_3 - \Delta LM_pX_2 \tag{4}$$

and

$$\begin{aligned}\sigma_\pi^2 = {}& \sigma_d^2L^2 + \sigma_{\Delta D_1}^2(X_3 - X_1)^2 + \sigma_{\Delta LM_R}^2(X_3 - X_2)^2 + \sigma_{\Delta L}^2(X_3^2 + X_4^2) + \\ & 2\rho_{\Delta D_1\Delta LM_R}\sigma_{\Delta D_1}\sigma_{\Delta LM_R}(X_3^2 + X_3X_2 - X_3X_1) - 2\rho_{\Delta D_1\Delta L}\sigma_{\Delta D_1}\sigma_{\Delta L}(X_3^2 - X_3X_4) - \\ & 2\rho_{\Delta LM_R\Delta L}\sigma_{\Delta LM_R}\sigma_{\Delta L}(X_3^2 - X_3X_2) + 2\rho_{\Delta D_1 d}\sigma_{\Delta D_1}\sigma_d LX_3 + \\ & 2\rho_{\Delta LM_R d}\sigma_{\Delta LM_R}\sigma_d LM_3\end{aligned} \tag{5}$$

In equation (5), the ρ_{ij} represent correlation coefficient and the X_i are simplifications for

$$X_1 = \int e^{\beta(1-t)}dt = e^{\beta}\left(-\frac{e^{-\beta}}{\beta} + \frac{1}{\beta}\right),$$

$$X_2 = \int e^{\psi(1-t)}dt = e^{\psi}\left(-\frac{e^{-\psi}}{\psi} + \frac{1}{\psi}\right),$$

$$X_3 = \int e^{\gamma(1-t)}dt = e^{\gamma}\left(-\frac{e^{-\gamma}}{\gamma} + \frac{1}{\gamma}\right),$$

and

$$X_4 = \int e^{\alpha(1-t)}dt = e^{\alpha}\left(-\frac{e^{-\alpha}}{\alpha} + \frac{1}{\alpha}\right),$$

with γ = continuous rate on government securities acquired during the period corresponding to g,

α = continuous rate on loans acquired during the period corresponding to r,

β=continuous effective rate on non managed liabilities acquired during the period corresponding to C_l, and

ψ = continuous effective rate on managed liabilities acquired during the period corresponding

Corresponding to r > g > C_2> C_l, we have α>γ>ψ>β and X_4> X_3> X_2> X_1. Taking the derivative of (4) with respect toLM_p, the impact of planned LM upon bank profits is:

$$\frac{\partial E(\pi)}{\partial \Delta LM_P} = X_3 - X_2. \tag{6}$$

Equation (6) says that planned LM has a positive effect on bank profits as long as X_3> X_2, that is, as long as the yield on government securities is greater than the marginal cost of managed liabilities. For distressed banks that are forced to pay a high-risk premium for managed liabilities, X_2 may exceed X_3 and the impact upon bank profits would be negative. However, if the purchased funds were used to meet loan demand with X_4 > X_2, the effect would be favorable. Of course, if X_2> X_4, the effect on expected profit is unfavorable.

Although reactive liabilities do not enter the expected profit equation explicitly, they do enter the equation for profit variance. The relationship between the reactive component and profit variance can be seen by taking the derivative of (5) with respect to ΔLM_R:

$$\frac{\partial\sigma^2\pi}{\partial\sigma\Delta LM_R} = 2\sigma_{\Delta LM_R}(X_3 - X_2)^2 + 2\rho_{\Delta D_1\Delta LM_R}\sigma_{\Delta D_1}(X_3^2 - X_3X_2 - X_3X_1) - 2\rho_{\Delta LM_R\Delta L}\sigma_{\Delta L}(X_3^2 - X_3X_2) + 2\rho_{\Delta LM_R d}\sigma_d LX_3 \qquad (7)$$

From, this equation, it is clear that, as$\sigma_{\Delta LM_R}$ changes, profit variance changes by a constant amount $2(X_3 - X_2)^2$times $\sigma_{\Delta LM_R}$plus the sum of the other three terms, the signs of which depend upon the correlation coefficients. To clarify this complex relationship, consider the following partial derivatives of profit variance with respect to the correlation coefficients that incorporate reactive managed liabilities:

$$\frac{\partial\sigma_\pi^2}{\partial\rho_{\Delta D_1\Delta LM_R}} = 2\sigma_{\Delta D_1}\sigma_{\Delta LM_R}(X_3^2 + X_3X_2 - X_3X_1)0 \quad (8)$$

and

$$\frac{\partial\sigma_\pi^2}{\partial\rho_{\Delta LM_R\Delta L}} = -2\sigma_{\Delta LM_R}\sigma_{\Delta L}(X_3^2 - X_3X_2) < 0 \qquad (9)$$

Under normal spread conditions, the partial derivative in (8) will be greater than zero and the partial in (9) less than zero. In words, the greater the correlation between changes in reactive liabilities and changes in nonmanaged liabilities, the greater will be profit variance and the greater the correlation between changes in reactive liabilities and changes in loan demand, the lower will be profit variance. Both of these relationships capture the essense of liability management because they show the use of reactive liabilities to offset deposit outflows and/or increased loan demand.

Managed Liabilities in a Friedmanesque Framework.

For expositional purposes, the model is simplified and restated as:

$$M = D + Z, \qquad (10)$$

where D = nonmanaged liabilities,

Z = managed liabilities (both planned and reactive), and

M = total investible funds.

The change in the level of investible funds is given by:

$$\Delta M = \Delta D + \Delta Z. \qquad (11)$$

Using standard statistical notation, the variance of the change in investible funds can be written as:[3]

$$\sigma_{\Delta M}^2 = \sigma_{\Delta D}^2 + \sigma_{\Delta Z}^2 + 2\rho_{\Delta D\Delta Z}\sigma_{\Delta D}\sigma_{\Delta Z}. \qquad (12)$$

The conditions for a reduction in funds variability can been seen from equation (12). If the correlation coefficient between flows of nonmanaged and managed liabilities ($\rho_{\Delta D\Delta Z}$) is perfectly negative (i.e., -1), the optimum use of managed liabilities in reducing the variability of funds flows can be achieved. At the other extreme, a perfect positive correlation (i.e., +1) would increase the variability of funds to the maximum. If the correlation between the flows of funds is zero, the variability of investible funds still would be increased by an amount equal to the variance of managed liabilities. According to the Diversification Theorem, the upper bound is the ratio of the smaller to the larger standard deviation, which is less than unity.

Rewriting equation (12), provides additional insight regarding the use of managed liabilities. That is,

$$\frac{\sigma_{\Delta M}^2}{\sigma_{\Delta D}^2} = 1 + \frac{\sigma_{\Delta Z}^2}{\sigma_{\Delta D}^2} + 2\rho_{\Delta D\Delta Z}\frac{\sigma_{\Delta Z}}{\sigma_{\Delta D}} \qquad (13)$$

The left-hand side of equation (13) is the ratio of the variance of the change in total investible funds to the variance of the change in nonmanaged liabilities. When this ratio is equal to one, all stochastic variation in investible funds occurs completely through the vehicle of nonmanaged liabilities. This is the special case of no liability management. If the ratio is less than one, the variance of total investible funds is reduced. If the ratio is greater than one, greater variability has resulted. This Friedmanesque [6] framework suggests that:

$$\frac{\sigma_{\Delta M}^2}{\sigma_{\Delta D}^2} \lesseqgtr 1, \qquad (14)$$

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[3] Recalling that the variance of the planned component of managed liabilities is zero, aA2z reflects only the variance of the reactive component.

as

$$\frac{\sigma_{\Delta Z}^2}{\sigma_{\Delta D}^2} + 2\rho_{\Delta D \Delta Z}\frac{\sigma_{\Delta Z}}{\sigma_{\Delta D}} \lesseqgtr 0\,, \tag{15}$$

or

$$\rho_{\Delta D \Delta Z} \lesseqgtr -\frac{1}{2}\frac{\sigma_{\Delta Z}}{\sigma_{\Delta D}}\,, \tag{16}$$

Equation (16) describes the effects of LM on the stability of a bank's investible funds. If $\rho_{\Delta D \Delta Z}$ is between -1 and $-\frac{1}{2}\sigma_{\Delta Z}/\sigma_{\Delta D}$,LM will be stabilizing; if it is between $-\frac{1}{2}\sigma_{\Delta Z}/\sigma_{\Delta D}$, and +1, the technique will be destabilizing. In this context, destabilizing means an increase in the variability of bank profits and hence, ceteris paribus, a decrease in utility. Of course, risk-averse bank managers require compensation in the form of higher expected profits for this additional risk. Recall that the focus of LM is to develop nontraditional borrowing arrangements and to use them profitably. Our model shows that LM affects both expected profit and profit variance. In banking, as in any other business, the essence of good financial management hinges upon the critical risk-return decisions made by top management.

To illustrate equation (16) more fully, consider the situation where $\sigma_{\Delta D} = \sigma_{\Delta Z}$, that is, where the variability of managed liabilities exactly offsets the variability of nonmanaged liabilities. In this case, LM is stabilizing if ρ is between -.5 and -1. If ρ is -1, LM is ideal because the variance of ΔM is zero. The requirement that ρ exceed .5 in absolute value is a rather stringent one; however, unless it is, LM has a destabilizing effect on bank profits. Given a one-parameter utility function with σ_π^2 as the only argument, LM becomes a less-desirable technique. To look at risk, however, without considering expected return is financial myopia. Thus, value judgments regarding LM must focus upon both the expected risk and expected return associated with the phenomenon.

The optimum value of LM as measured by $\sigma_{\Delta Z}$ can be established by differentiating the right-hand side of equation (9) with respect to$\sigma_{\Delta Z}$, setting the result equal to zero, and solving for $\sigma_{\Delta Z}$. The solution is

$$\sigma_{\Delta Z}^{*} = -\rho_{\Delta D \Delta Z}\sigma_{\Delta D}\,, \tag{17}$$

where $\sigma_{\Delta Z}^{*}$ represents the optimum value of$\sigma_{\Delta Z}$. Equation (17) provides a general optimization rule and checks the above statement for ρ = -1. For ρ = 0, the optimum value of $\sigma_{\Delta Z}$ is zero. For ρ> 0, equation (17) yields a negative value for $\sigma_{\Delta Z}^{*}$, which, of course, is impossible since σ is nonnegative. Thus, the best attainable value for $\sigma_{\Delta Z}$ is zero. This analysis implicitly recognizes that the ρ and σ on the right-hand side of (17) may in part be choice variables, not exogenously fixed parameters. The subsequent discussion of cyclical changes in ρ incorporates this implication.

Since the impact of LM on the variability of bank profits (or risk) critically depends upon the sign and magnitude of $\rho_{\Delta D \Delta Z}$,what are reasonable expectations regarding these factors? First, we anticipate these factors to be cyclical ones, that is, both the sign and magnitude of ρ should vary with the business cycle. Second, beginning with the early stages of an economic recovery, we present the following scenario. With deposits flowing back into banks (disintermediation is not a problem now) and slack loan demand, there is little need for banks to manage their liabilities aggressively. In this stage of the cycle, ρ is expected to be close to zero. As the economy expands and banks are faced with larger relative inflows and stronger loan demand, ρ should be positive and increasing in magnitude as banks begin to aggressively compete for funds. As the cycle peaks with a credit crunch and disintermediation, ρ should change sign but maintain roughly the same absolute magnitude as banks attempt to offset deposit outflows with inflows of managed liabilities. As the economy moves into the recessionary phase of the cycle characterized by increased loan losses, reduced loan demand, and reduced deposit outflows, ρ should still be negative but headed toward zero as the pressure for banks to offset deposit outflows to meet loan demand is abated. During the trough of the cycle, ρ is most likely to be close to zero and remain there until the recovery begins. If the recession is a severe one, bank balances probably would be reduced for transactions purposes. While banks might like to offset these deposit withdrawals with inflows of managed liabilities, it is unlikely that they could sell such instruments in depressed money and capital markets.

To summarize, our scenario suggests that the existence of LM will lead to greater variability of bank profits during economic upswings and to less variation in profits during economic downswings. To complete the analysis, we note that bank profitability varies directly with the business cycle but with a slight lag (e.g., loan charge offs, which reduce profits and which are heaviest during a recession, usually occur only after customers have been "carried" for a while). Thus, over the business cycle, LM tends to lead to increased (decreased) variability of bank profits at a time when bank profits are increasing (decreasing). This risk-return trade off is, after all, the essence of bank financial management.

POLICY IMPLICATIONS

Our model has implications for both public policy makers and bank managers. The public-policy inferences focus upon issues of regulation-induced innovation, bank supervision, and monetary policy; the managerial, implications deal with risk exposure, credit rationing, and customer relation-ships.

Discrimination and Regulation-Induced Liability Management

The effective cost rates of the profit equation in our model are determined, in part at least, by such regulatory factors as deposit-insurance assessments, interest-rate ceilings, and reserve requirements (see footnote 2). Banks' desire to offset the regulatory burdens imposed by these factors lead to the discriminatory and regulation-avoiding elements of liability management.Since these burdens act as an implicit tax on bank profits, managers attempt to circumvent these restrictions by developing nontraditional borrowing arrangements. Naturally, there is an inverse relationship between the implicit tax rate and expected profit. The ugliest part of LM has been the discrimination against the small saver. The way to avoid the discrimination and regulation-induced innovation associated with LM is to eliminate the restrictions. The schizophrenic Depository Institutions Deregulation and Monetary Control Act of 1980 gives us both deregulation (e.g., phase out of Reg Q) and control (e.g., universal reserve requirements for all depository institutions).

Bank Risk Exposure

Both bank managers and bank supervisors (e.g., the FDIC) are concerned about bank risk or, to use the jargon of the banking authorities, "safety and soundness." In the short run, managers (and shareholders) mainly are concerned about the risk of profit variance; in the long run, they are concerned about "risk of ruin" or insolvency. To the FDIC, risk of ruin is more relevant than profit variance[4]. Of course, the two risks are not unrelated. Over the long run, profit variance can eat away a bank's equity capital and lead to insolvency. Our model implies that liability management does not always lead to greater profit variance and hence it may help to reduce risk of ruin.[5]

The theory of finance and banking practice suggests that bank managers consider both risk and return in making decisions. In contrast, bank supervisors tend to have a one-parameter utility function focusing upon risk of ruin as measured by such nebulous concepts as "capital adequacy" and "liquidity." It is not surprising, therefore, to find the banking authorities and Congressional oversight committees expressing dissatisfaction with declining capital and liquidity ratios. To finance asset growth and the changing composition of their assets, banks have relied, in part, upon the tool of LM. According to Schweitzer [], some critics contend that "… many banks have grown too reliant on the practice (of LM) and do not maintain sufficient liquid assets to meet unforeseen cash needs" (p. 118, parentheses added). Our model shows that LM involves a fundamental risk-return trade off. Moreover, a modern-day bank failure has yet to have been described as due solely to LM.[6]

We suggest that the U.S. Congress and bank supervisors set broad guidelines for appropriate bank behavior and conduct and leave the risk-return decision-making to bank managers. Such change is now being realized as some of the more stringent provisions of the 2010 Dodd-Frank Act are being relaxed or dropped entirely. It is interesting to note that such discussions have continued for decades. For example, , we support the atypical regulatory words of former Federal Reserve Governor Jackson [11] who said in a speech in 1978 to bankers in Alabama

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[4] See Ho and Saunders (1980) and Buser, Chen, and Kane (1981)) for publications dealing with a catastrophe model of bank failure and the pricing of FDIC insurance, respectively.

[5] Because liability management can be used to reduce the variability of profits does not mean that it must be used in this way. In principle, given the structure of FDIC insurance assessments, the trade off between expected profit and increased risk (see Buser, Chen, and Kane (1981)) could (without FDIC portfolio restrictions) lead banks to a risky corner solution.

[6] See Sinkey [1979, pp. 268-269] and Pettway and Sinkey (1981).

"I think the industry as a whole has become overregulated by the way its supervisors set standards for a bank's capital and assets. We need to stop treating banks like public utilities and allow the market place by its own risk analysis to make a determination between the successful and the unsuccessful bank. No government official, regardless of how competent or well intentioned, can manage an individual bank or the industry as a whole as well as the collective efforts of bank stockholders, directors and officers."

Customer Relationships and Credit Rationing

There exists a certain class of bank customers, called L* customers by K&M,[7] whose loan requests during periods of tight money present bankers with a dilemma. Assuming a bank's portfolio mix is an optimal one, the decision to grant the L* customer's request disturbs that equilibrium and reduces utility. However, the decision to reject the request also reduces utility by jeopardizing the customer relationship. Based upon their analysis, K&M argue that bankers will continue to grant loans to L* customers despite the resulting disutility. In our model of LM, the tendency for bankers to accommodate L* customers is even greater because they have greater flexibility in meeting loan demand. Thus, bankers who practice LM should be able to establish better customer relationships than non-LM bankers and they should not have to resort to credit rationing as frequently or intensely as non-LM bankers.[8] In a world of managed liabilities, banks are capable of providing a higher degree of intermediation and thus greater service to the economy.

Why do bankers choose to accommodate L* customers? Accommodation decisions indicate a preference for nonalienation of L* customers over an optimal portfolio mix. Thus, stronger L* customer relationships, which enhance a bank's long-run profitability, are gained at the expense of a riskier portfolio. If, as a result of the portfolio shift, the bank is viewed as being "illiquid" and/or "inadequately capitalized," the bank may be subject to supervisory discipline (e.g., moral suasion, a cease-and-desist order, etc.).

Monetary Policy

Does the existence of LM permit banks to frustrate a restrictive monetary policy? A restrictive monetary policy is one in which the central bank (the Federal Reserve in the U.S.) attempts to withdraw reserves from the banking system to reduce the supply of money and credit. If banks can obtain funds from outside the banking system or cause funds to be shifted from a high-reserve source to a low-reserve source to replace lost reserves, then clearly the process will be frustrated to some extent. In this context, an "outside" source of funds is any newly-acquired bank liability that was not 'previously subject to Fed reserve requirement or part of the currency component of the money supply. With the recent introduction of expanded reserve requirements via the Monetary Control Act of 1980, there are few major bank liabilities that would qualify as "outside" sources. One of those few exceptions would be foreign deposits, an important source of funds for the billion-dollar sizeU. S. banks. Another example would be excess reserves that are coaxed out of "country" banks and into "city" ones.

It is clear that LM does not make the task of-restricting the supply of money and credit any easier. The important question; which only can be answered empirically, deals with the magnitude of this impact. Certainly, LM has facilitated the expansion of bank credit, but has it affected the total supply of credit? For those who believe that bank business loans are the driving force in the monetary-transmission mechanism, the rapid growth of these loans would appear to be prima facie evidence in favor of reduced monetary control, regardless of what has happened to the total supply of credit. A parallel interpretation in terms of monetary-aggregate or interest-rate objectives would focus upon the Fed's inability to hit its money-supply and federal-funds targets as evidence of the disruptive effects of LM. Thus, the impact of LM on the effectiveness of monetary policy is not only an empirical question but also one that

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[7] The quality of a customer relationship is determined by such factors as deposit size and stability, borrowing patterns, and length of the relationship. An L* customer would be one with a large and stable deposit base, a regular borrowing pattern, and a long relationship with the bank. See K&M [12, pp. 122-123].

[8] Not all bankers practice LM. Garino [7] reports: "Small banks...are ill-equipped to compete for high-cost funds; they can't, for example, easily sell certificates of deposit or raise money in other sophisticated ways. And they apparently would rather ration credit to their customers than rile them by raising interest rates to big-city levels" (p. 1).

depends upon one's view of the monetary-transmission process.

SUMMARY AND CONCLUSIONS.

This paper seeks to build actively managed liabilities into the Kane-Malkiel model of bank portfolio allocation. The approach is to develop explicit channels for bank control of these liabilities in a way that lets managers use them reactively as a counterweight to exogenous disturbances elsewhere in the balance sheet. Our mechanism is to dichotomize managed liabilities into a planned and a reactive component. The reactive component is the counterweight of liability .management. It enables bank managers to offset deposit outflows and/or increased loan demand to maintain or increase bank utility. Since our model shows that liability management directly affects both expected bank profits and the variance of profits, its use involves a fundamental risk-return trade off.

The policy and behavioral implications of the model are: (1) liability management is promoted by restrictive regulations, which if removed would eliminate such inefficiencies as nonprice competition and the payment of implicit interest on deposits; (2) liability management involves a risk-return trade off and use of the technique should not be a matter of-regulatory or shareholder concern as long as rational, risk-averse managers control banks; (3) liability management can be used to strengthen the bonds of customer relationships and can reduce the frequency and timing of credit rationing; and (4) liability management reduces the effectiveness of a restrictive monetary policy but the magnitude of this impact depends upon one’s view of the monetary-transmission mechanism and is an empirical question which goes beyond the scope of this paper. In summary, the literature shows that this debate over asset-liability management has continued for decades and will likely continue as the banking environment changes with increased competition from nonbank competitors. Hopefully, future research will again address the theoretical foundation of an approach to asset-liability management. This aspect of the theoretical research has been sorely neglected really since the late 1970s and very early 1980s.

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MATHEMATICAL APPENDIX

The distributional assumptions for the normally distributed random variables are given by:[9]

$$E(\Delta \mathrm{D}_1) = 0 \quad E(\Delta \mathrm{D}_2) = \Delta LM_P \quad E(\Delta LM_R) = 0 \quad E(\Delta \mathrm{D}_1) = 0 \quad E(d) = \bar{d}$$

$$E(\Delta \mathrm{D}_1^2) = \sigma^2_{\Delta D_1} \quad E(\Delta \mathrm{D}_2^2) = \sigma^2_{\Delta D_2} \quad E\left(\Delta \mathrm{LM}_\mathrm{R}^2\right) = \sigma^2_{\Delta LM_R} E(\Delta \mathrm{L}^2) = \sigma^2_{\Delta L} \quad E\left(\bar{d} - d\right)^2 = \sigma^2_d$$

Given the additional assumptions presented in the text, we begin with the derivation of text equations (4) and (5). Profit on the incremental funds is given by:

$$\begin{aligned}\pi(\Delta D_1 + \Delta D_2) = &\int_0^1 (\Delta D_1 + \Delta D_2 - \Delta L)\left(e^{\gamma(1-t)} - 1\right)dt \\ &+ \int_0^1 \Delta L\left(e^{\alpha(1-t)} - 1\right)dt - \int_0^1 \Delta D_1\left(e^{\beta(1-t)} - 1\right)dt \\ &- \int_0^1 \Delta LM_P\left(e^{\psi(1-t)} - 1\right)dt \qquad (A.1)\end{aligned}$$

The first term in (A.1) represents the return on government securities, the second the return on loans, the third the cost of nonmanaged funds and the fourth the cost of managed funds. From the distributional assumptions, equation (A.1) can be simplified to:

$$\begin{aligned}\pi(\Delta D_1 + \Delta D_2) = &\int_0^1 (\Delta D_1 + \Delta D_2)\left(e^{\gamma(1-t)} - 1\right)dt \\ &- \int_0^1 \Delta L\left(e^{\gamma(1-t)} - 1\right)dt + \int_0^1 \Delta \mathrm{L}e^{\alpha(1-t)}dt - \int_0^1 \Delta L dt - \int_0^1 \Delta \mathrm{D}_1 e^{\beta(1-t)}dt \\ &+ \int_0^1 \Delta D_1 dt - \int_0^1 \Delta D_2 e^{\psi(1-t)}dt + \int_0^1 \Delta D_2 dt. \qquad (A.2)\end{aligned}$$

Suppressing the limits of integration and expanding gives:

$$\begin{aligned}\pi(\Delta D_1 + \Delta D_2) = &\int \Delta D_1 e^{\gamma(1-t)}dt - \int \Delta D_1 dt + \int \Delta D_2 e^{\gamma(1-t)}dt - \int \Delta D_2 dt - \int \Delta L e^{\gamma(1-t)}dt \\ &+ \int \Delta L dt + \int \Delta L e^{\alpha(1-t)}dt - \int \Delta L dt - \int \Delta D_1 e^{\beta(1-t)}dt + \int \Delta D_1 dt \\ &- \int \Delta D_2 e^{\psi(1-t)}dt + \int \Delta D_2 dt.\end{aligned}$$

Collecting terms yields:

$$\begin{aligned}\pi(\Delta D_1 + \Delta D_2) = &\int \Delta D_1 e^{\gamma(1-t)}dt + \int \Delta D_2 e^{\gamma(1-t)}dt - \int \Delta L e^{\gamma(1-t)}dt + \int \Delta L e^{\alpha(1-t)}dt \\ &- \int \Delta D_1 e^{\beta(1-t)}dt - \int \Delta D_2 e^{\psi(1-t)}dt \qquad (A.3)\end{aligned}$$

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[9] The tilde used in the text to denote a random variable is suppressed in this appendix.