BANKING, BUSINESS CYCLES, AND THE BASLE ACCORD: SOME EMPIRICAL EVIDENCE

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BANKING IN A THEORY OF THE BUSINESS CYCLE:
HAVE WE ALWAYS HAD THE BASLE REQUIREMENTS ON RISK-BASED CAPITAL?

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Banking, Business Cycles, and the Basle Accord: Some Empirical Evidence

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Abstract

This paper presents a theoretical and empirical analysis of the portfolio adjustments and financing adjustments of U.S. banks over the business cycle. The model describes a representative bank whose portfolio is financed with deposits and equity claims. At the core of the model is a moral hazard problem between relatively more risk averse depositors and relatively less risk averse equity investors. The solution to this moral hazard problem takes the form of shared management of the bank between depositors (or the deposit insuring agency) and equity investors. Towards this end portfolio decisions are made to conform to the risk aversion of equity investors, while financing decisions are made so as to offset any changes in portfolio risk caused by portfolio adjustments. Portfolio adjustments in turn are initiated by exogenous changes in the risk aversion of equity investors that are revealed to bank managers in equity share prices. The resulting portfolio adjustments and changes in portfolio risk then triggers financing adjustments that insulate depositors from any changes in portfolio risk. The model predicts that the loan component of a bank's portfolio is positively related to changes in bank stock prices, while the equity leverage ratio varies directly with the bank's loan to asset ratio. The regression evidence in this paper does not reject these two predictions. Finally the financing adjustments uncovered here were found to predate U.S. capital adequacy legislation for banks. This suggests that private arrangements may have achieved much the same qualitative results in the past as the Basle Accord now attempts to achieve with regulatory legislation.

JEL Classification E3, G2, L2

I. INTRODUCTION

The objective of this paper is to formulate and empirically test a model that describes the mechanisms by which external shocks to the risk aversion of equity investors are transmitted into rational production-asset allocation decisions and financing decisions for debt (including deposits) and equity financed enterprises. When the enterprises are nonfinancial the production-asset allocation or operating decisions generate some of the more interesting and important stylized facts of business cycles, facts that business cycle theories are supposed to explain. When the enterprises are financial these asset allocation or portfolio decisions also display business cycle regularities.[1] But what about financing decisions? How do nonfinancial and financial enterprises finance their real investments and portfolio investments over time? Until quite recently relatively little work has been done on measuring and interpreting the intertemporal financing decisions of financial and nonfinancial enterprises, and whether these financial decisions are systematically related to their asset allocation decisions.[2] In this connection it is interesting that one of the main objectives of the Basle Accord on capital requirements is to require banks to systematically link their financing decisions to their portfolio decisions so as to minimize the probability of default on their deposit liabilities. It will be shown below that the Basle Accord on risk-based capital requirements is the rational outcome of a contracting process between equity investors and depositors (or the government deposit insuring fund) in depository institutions. Moreover, the same contracting mechanisms should also govern the relationship between relatively less risk averse stockholders and more risk averse bondholders in nonfinancial enterprises.

In the next section we present a framework of analysis that describes the investment decisions and financing decisions for a representative nonfinancial or financial enterprise over the business cycle.[3] There are many ways in which a bank is different from a steel company, but in terms of asset adjustments and rational financing adjustments over the business cycle the two are remarkably similar. In previous work (Krainer; 1985, 1992, 1996, 2000, and 2003) we have described and measured these asset adjustments and financing adjustments for nonfinancial enterprises. This research indicates that shock-induced changes in equity valuations initiate asset adjustments. Rising (or falling) equity share valuations cause nonfinancial enterprises to increase (or decrease) their investments in speculative inventories and plant and equipment thus causing cyclical expansions (or contractions) in business activity. We also found that when nonfinancial enterprises move "down" (or "up") the asset side of their balance sheet by investing more (or less) in these risky assets, they match that investment strategy by moving "down" (or "up") the liabilities and equity side of the balance sheet. In other words, economic expansions are financed at the margin with equity while recessions are supported with debt. Long-term financial leverage is countercyclical. In Section III below we present similar empirical evidence on these asset or portfolio adjustments and financing adjustments for the U.S. banking sector over the period 1956-1999. We will see in this section that U.S. banks move down (or up) the asset side of their balance sheet in response to increases (or decreases) in bank share valuations. Moreover, when banks move down (or up) the asset side of their balance sheets by investing more (or less) in business and consumer loans, they finance more (or less) of their assets with equity compared to deposits. Furthermore, these asset adjustments and financing adjustments for U.S. banks are observed in the data long before the enactment of the FDIC Improvement Act of 1991 that implemented the Basle Accord on risk-based capital requirements for depository institutions. Finally, this paper concludes in Section IV with a short summary of the main results.

II. Investment Decisions and Financing Decisions for Nonfinancial and Financial Enterprises

This section presents an overview of a model of asset allocation and financial adjustments that will guide the empirical work on U.S. banks in the next section. The presentation of the model will be brief since it has been more fully described in our earlier work.

Towards this end consider an enterprise with total assets A—e.g., real productive assets such as inventories, plant, and equipment, or, financial investments such as government securities and private loans—generating expected nominal returns of $\overline{X}$. The rate of return R for this enterprise is defined as:

$$R = \overline{X} / A$$

If the assets of this enterprise are financed with equity A(E) and debt/deposits A(D), then the existence of risk aversion and the legal priority of debt/deposits over equity requires the existence of a positive risk premium; namely,

$$R(d) < R(e)$$

where

$R(d) = \overline{X}(d) / A(D)$ is the rate of return on debt/deposit type securities.

and

$R(e) = \overline{X}(e) / A(E)$ is the rate of return on levered equity securities.

Figure 1 presents a geometric description in the form of an Edgeworth-Bowley box diagram of this enterprise. The horizontal axis of this box diagram measures the total assets A invested in the enterprise, and the vertical axis measures the expected returns $\overline{X}$ generated on those assets. The point Z in the box represents a particular combination of equity finance A(E) on the upper horizontal axis and debt/deposit finance A(D) on the lower horizontal axis, along with their respective expected returns of $\overline{X}(e)$ and $\overline{X}(d)$ on the right and left vertical axis. Note also that in and around the small neighborhood of Z the rates of return R(d) along DD and R(e) along EE are assumed to be constant.

The sharing of finance and expected returns among debt/depositor investors and equity investors described in Figure 1 can be presented in a somewhat different way. To see this in the context of the box diagram in Figure 1 note that,

1. $\overline{X}(d) = R(d)A(D)$ is the required income for debt/depositor investors.

For the enterprise as a whole we have,

2. $\overline{X} = R[A(D) + A(E)]$

leaving

3. $\overline{X}(e) = \overline{X} - \overline{X}(d)$ or the expected income for the equity investors.

Substituting the rhs of (2) for $\overline{X}$ in (3) and then dividing the result into (1) and rearranging yields,

4. $$\frac{\overline{X}(d)}{\overline{X}(e)} = \frac{A(D)/A(E)}{\frac{R}{R(d)} + \left[\frac{R - R(d)}{R(d)}\right]\frac{A(D)}{A(E)}} \geq 0$$

a concave relationship between $\overline{X}(d)/\overline{X}(e)$ and A(D)/A(E). A linear approximation to (4) is presented in Figure 2 and labeled dd. The dd schedule presents the combinations of expected income sharing between debt/depositor investors and equity investors, and financial leverage for which the rate of return R(d) in the small neighborhood of Z in Figure 1 is a constant.

An equity market schedule based on the small neighborhood in and around point Z in Figure 1 can also be computed in the same way. In this connection note that

5. $\overline{X}(e) = R(e)A(E)$ is the required income for an investment of A(E) for equity investors. For the enterprise as a whole we again have,

2. $\overline{X} = R[A(D) + A(E)]$

leaving

6. $\overline{X}(d) = \overline{X} - \overline{X}(e)$ or the expected income for debt investors.

Substituting the rhs of (2) into (6), and then dividing (6) by (5) and rearranging yields

7. $$\frac{\overline{X}(d)}{\overline{X}(e)} = \frac{R - R(e)}{R(e)} + \frac{R}{R(e)}\left[\frac{A(D)}{A(E)}\right] \geq 0$$

a linear relationship between $\overline{X}(d)/\overline{X}(e)$ and A(D)/A(E). This linear relationship is also presented in Figure 2 and labeled the ee schedule. Everywhere along this ee schedule the rate of return on equity R(e) is the constant given by the slope of the EE schedule in and around point Z in Figure 1.

Equations (4) and (7) indicate that both the dd and ee schedules slope upward. It can be shown (Krainer; 2003, pp. 42-43) that when R(d) < R(e), the ee schedule intersects the dd schedule from below as drawn in Figure 3. The (+) and (–) around the dd and ee schedules in the figure indicate the direction of increasing and decreasing rates of return on debt securities and equity securities, and are the direct implication of equations (4) and (7).

Figure 2 describes an enterprise/economy of an explicitly fixed size in terms of A and $\overline{X}$ in Figure 1. It is also the case that the box diagram in Figure 1 implicitly incorporates risk and risk aversion since the taste for risk and the state of nature determine R, R(d), and R(e).[4] However, from the perspective of business cycle analysis the interesting question is what happens to the shape of the box in Figure 1 during cyclical expansions and recessions along with the embedded risk associated with various levels of investment. To begin answering this question it is necessary to understand how expected returns, $\overline{X}$, and a measure of risk, σ, vary with different levels of risky investments in the enterprise/economy. In this connection it will be assumed that the return generating process takes the following form.

8. $\overline{X} = f(I) \qquad f' \geq 0, \qquad f'' \leq 0$

and

9. $\sigma = g(I) \qquad g' > 0, \qquad g'' \geq 0$

where

I = Investments in risky assets.

Equation (8) indicates that expected income increases with investments in risky assets at a decreasing rate. Equation (9) indicates that risk is an increasingly convex function of investments in risky assets. This is a less common assumption than (8) although it is not without precedent.[5] Together equations (8) and (9) imply that the ratio of expected returns to risk, $\overline{X}/\sigma$, for the enterprise/economy declines (or increases) with increasing (or decreasing) levels of investment in risky assets as pictured in Figure 3. In other words the return to risk tradeoff generated by the investments of enterprises deteriorates during business cycle expansions and improves during recessions for the return generating process given in equations (8) and (9). This assumption on the technology suggests that in order for an enterprise/economy in this model to increase (or decrease) its investments in risky assets and thereby create cyclical expansions (or recessions), it is first necessary for investors to reduce (or increase) their required rates of return. For debt investors a reduction (or increase) in their required rate of return implies a downward (or upward) shift of the dd schedule in Figure 2, while for equity investors it would imply a leftward (or rightward) shift in the ee schedule in Figure 2. It will be assumed in this analysis that only equity investors change their required rate of return in response to some external taste shock; for example, a change in risk aversion. While this assumption is not necessary it will simplify the presentation particularly in subsequent figures. In addition to simplicity it is empirically the case that equity yields fluctuate more than debt yields. It is also empirically the case that equity yields and the risk premium follow a countercyclical path as implied in (8) and (9) and observed in the work of Fama and French (1989), Hardouvelis and Wizman (1992), Harrison and Zhang (1999), and Harvey (2001) among others.

The analysis so far suggests that economic fluctuations occur when enterprises change the level and structure of their assets. But in order for enterprises to change the level and structure of their assets, it is first necessary for the required rates of return of investors to change. To develop this idea further we define the nominal price of one debt security/deposit P(d) to be:

10. $$P(d) = \frac{\overline{X}(d)}{R(d, RR)} \bullet \frac{1}{N(d)}$$

where

$R(d, RR)$ = The required rate of return of debt/deposit investors.

$N(d)$ = Number of debt securities/deposits.

Multiplying the numerator of the rhs of (10) by A(D)/A(D) and defining

$R(d, ER) = \overline{X}(d)/A(D)$ to be the expected rate of return on debt securities enables us to rewrite (10) as:

11. $$P(d) = \frac{R(d, ER)}{R(d, RR)} \bullet \frac{A(D)}{N(d)}$$

Equation (11) says the market value of debt is the book value of one unit of debt scaled by the ratio R(d, ER)/R(d, RR). Similarly for equity we can write the market price of one share of stock P(e) as:

12. $$P(e) = \frac{\overline{X}(e)}{R(e, RR)} \bullet \frac{1}{N(e)}$$

where

$R(e, RR)$ = The required rate of return for equity investors.

$N(e)$ = Number of shares.

Again multiplying the numerator on the rhs of (12) by A(E)/A(E) and defining $R(e, ER) = \overline{X}(e)/A(E)$ to be the expected rate of return on equity shares enables us to rewrite (12) as:

13. $$P(e) = \frac{\overline{X}(e)/A(E)}{R(e, RR)} \bullet \frac{A(E)}{N(e)} = \frac{R(e, ER)}{R(e, RR)} \bullet \frac{A(E)}{N(e)}$$

The first term on the rhs of (13), R(e, ER)/R(e, RR), is a Q - ratio for equity, while the second term, A(E)/N(e), is the economic book value of one share of equity stock. In effect the market price of one share of stock is the economic book value (replacement cost of the assets minus the book value of debt) of one share of equity stock scaled by an equity Q-ratio.

To see the link between the capital market and general economic activity, consider some initial position where the market value of debt and equity securities equals their respective book values. Now suppose there is a positive external shock that reduces the risk aversion of equity investors that in turn reduces R(e, RR). (Suppose also there is no change in R(d, RR).) The reduction in R(e, RR) in equation (13) will drive up equity share prices above their economic book value. Managers in this model then respond to this stock market signal by increasing their investments in risky assets such as inventories, plant, and equipment. Since the expected returns of the firm/economy $\overline{X}$ are increasing at a decreasing rate by equation (8), eventually the expected rate of return on equity, $\overline{X}$(e)/A(E) = R(e, ER), is driven down to the shock-induced required rate of return on equity R(e, RR) at which point the equity Q-ratio in (13) is again unity and market valuations again equal economic book values for equity shares. For nonfinancial enterprises the resulting operating decisions to increase production and investment in risky assets—that in turn increases the operating risk of firms by equation (9)—causes a business cycle expansion. For financial enterprises such as a bank the resulting decision to shift their portfolios towards risky business loans—in response to the shock induced reduction in risk aversion that increases the market value of bank shares—helps finance the business cycle expansion caused by the increased production and risky investments of nonfinancial enterprises. The opposite sequence of events would result in an economic contraction. A negative external shock increases risk aversion and the required rate of return on equity driving share prices below economic book values. Mangers in this model respond to the decline in share prices by reducing production and their investments in risky assets, which in turn causes a recession. The reduction in bank share prices causes a "flight to safety" as banks reduce their loans to nonfinancial enterprises and shift their portfolios towards the safe securities issued by government.[6]

The discussion so far indicates that a business cycle expansion is characterized by an increase in the operating risk of nonfinancial enterprises and a shift towards more speculative business loans by financial enterprises. From the perspective of equity investors the resulting speculative asset adjustments by nonfinancial and financial enterprises that created (and enabled the creation of) the business cycle expansion are optimal since it was a reduction in their risk aversion and required rate of return that triggered these investment decisions. But what about the debt/depositor investors? They surely are worse off as a result of the production-investment-portfolio decisions of these nonfinancial and financial enterprises. All they can gain is their up-front promised payment on their debt/deposit investments in the firm if the speculative investments turn out to be successful, but potentially they could lose everything if the speculative investments turn out to be a complete failure.[7] This asymmetric result on the outcomes of the speculative investments is due to the limited liability of equity shares. Can anything be done for debt/depositor investors that ameliorates the effect of the speculative investment decisions that cause and enable business cycle expansions? It has been shown in Krainer (1985, 1992, 1996, 2000, and 2003) that if production-investment-portfolio decisions are made to conform to the risk aversion of equity investors in the firm, then the financing decisions should be made to preserve the valuation of the debt/deposit securities in the nonfinancial and financial enterprises. In other words, if managers make operating or portfolio decisions in the interest of their shareholders, then a rational debt/deposit contract would require managers to make financing decisions in the interest of their debt/depositor investors. In this way the welfare of both types of investors would be coalesced over the business cycle, and both types of investors would be more confident in investing in the firm. For a business cycle expansion resulting from the implementation of speculative investment decisions, the optimal financing decision from the perspective of debt/depositor investors is to increasingly finance the asset acquisitions of the nonfinancial and financial enterprises with equity. The end result is that debt/depositor investors offset increases in the operating risk of the enterprise with financing decisions that reduce the financial risk. In the case of a recession resulting from a flight to safety by both nonfinancial and financial enterprises, the financing constraint in the debt/deposit contract is relaxed and both types of enterprises can rely more heavily on debt and deposit finance. For banks it will be immediately recognized that this model contract between depositors and equity investors takes the form of the Basle Accord regulations on risk-based capital requirements.

A geometric description of a business cycle expansion is presented in Figure 4. The intersection of the dd schedule and the ee schedule at point z represents some initial product market and capital market equilibrium where R(d, ER) = R(d, RR) and R(e, ER) = R(e, RR) and the capital market value of the firm/economy equals the economic book value of the assets employed by the firm/economy. Now suppose an external taste shock reduces the risk aversion of equity investors which in turn reduces R(e, RR) and increases equity share prices. As mentioned before, we assume for simplicity the shock has no effect on R(d, RR). The reduction in the required yield on equity shifts the ee schedule to e″e″ and a new equilibrium emerges at z″ in the figure. When the firm/economy is at point z in terms of generating the expected rate of return R(e, ER) but at point z″ in terms of the investor's required yield R″(e, RR), the capital market value of the firm/economy by equation 13 rises above the book value of its productive resources. Managers of enterprises react to this arbitrage opportunity by increasing production and investments in risky assets. These decisions increase the level of productive assets in the economy but at the same time change the composition of assets with more being invested in the risky category. These decisions by nonfinancial enterprises also cause an expansion in economic activity, which in part is financed by banks that at the same time are shifting the composition of their portfolios towards risky loans to nonfinancial enterprises. The increased investment in risky assets increase expected returns but at a decreasing rate by equation (8). Eventually these decisions deliver the expected rate of return R″(e, RR) now required by equity investors as a result of the taste shock that reduced risk aversion. When that occurs the market value of equity shares equals the economic book value of shares. In the new equilibrium at z″ in Figure 4 the firm/economy generates more expected income $\overline{X}$, but also (by equation 9) generates more operating risk σ. To offset the negative effect this would have on debt valuations, the optimal contract that brings debt investors and equity investors together in the same enterprise requires managers to finance the economic expansion with equity. The same is true with banks. The shift in their portfolios towards risky business loans, which helped finance the economic expansion, must now by negotiated contract or Basle-like regulation be followed up with a safe and conservative financial strategy that reduces financial leverage. This can be seen in the figure as a leftward movement in financial leverage A(D)/A(E). In the expansion equilibrium at z″ both debt investors and equity investors earn their required rate of return and no further arbitrage opportunities between the capital market and product market exist. While there is more operating risk in the expansion equilibrium at z″, it has been offset with the contract/regulation decision to lower financial risk. A recession induced by an increase in the risk aversion and required yield of equity investors could also be described with a similar geometry but is omitted here in the interest of conserving space.

III. Asset Allocation Decisions and Financing Decisions for U.S. Banks: Some Empirical Evidence

A. Introduction

The model in Section II argues that shock-induced changes in equity valuations causes the managers of enterprises to change the allocation of their assets between those that are relatively risky and those that are relatively safe. According to the model these asset allocation decisions are made to conform to the risk aversion of the equity investors in the firm. However, the asset allocation decisions implemented on behalf of the equity investors are not necessarily the same decisions that would be made by debt/depositor investors. The quid pro quo for debt/depositor investors then requires managers to make financing decisions so as to offset changes in operating/portfolio risk resulting from asset adjustment decisions. The main objective of this section will be to test these two relationships between: 1) asset allocation decisions and equity share valuations; and 2) financing decisions and asset allocation decisions implied by the model in Section II for U.S. banks over the business cycle.

B. Data

The data that will be used to measure the portfolio adjustments and matched financing adjustments of U.S. banks comes from the balance sheets and income statements of all FDIC insured commercial banks. The FDIC makes this data available on the Web under the heading of Historical Statistics on Banking.[8] The sample time period covered is 1956-1999. Since the focus in this study is on the portfolio adjustments and financing adjustments of banks, the balance sheet variables will be measured as ratios of year to year changes in various balance sheet items. The specific balance sheet variables representing portfolio allocation decisions that will be used in various figures and regressions presented below are as follows.

$\left(\frac{\Delta \text{Loans}}{\Delta \text{A}}\right)$ = The ratio of the change in Net Loans and Leases (net of allowance for losses in loans and leases) to the change in Total Assets. *A proxy for risky investments.*

$\frac{\Delta(\text{Cash} + \text{Securities})}{\Delta \text{A}}$ = The ratio of the change in the sum of Cash and Investment Securities to the change in Total Assets. *A proxy for safe investments.*

The financing decisions are measured in the following way.

$\left(\frac{\Delta \text{Equity}}{\Delta \text{A}}\right)$ = The ratio of the change in Total Equity Capital to the change in Total Assets. *This is a proxy for the change in Tier 1 Capital relative to the change in bank assets.*

$\left(\frac{\Delta(\text{Tier}\,1 + \text{Tier}\,2)}{\Delta \text{A}}\right)$ = The ratio of the change in the sum of Total Equity Capital, the Allowance for Losses in Loans and Leases, and Subordinated Notes to the Change in Total Assets. *The latter two items are a proxy for Tier 2 capital.*

Bank share valuations play a key role in the model presented in Section II. They are an advanced signal for a change in the portfolios of banks. The share valuation measures used in this study are based on the Standard & Poor index of 26 major regional banks.[9] Specific bank share price variables used in the regressions presented below are as follows.

ΔSP = The Change in real (i.e., nominal share prices deflated by the consumer price index) Share Prices of banks.

$\Delta\left[\frac{SP_t}{(\text{Div} + \text{RE})_t}\right]$ = The change in the ratio of real bank share prices to the sum of cash dividends declared and retained earnings. Retained earnings is the difference between net income and total cash dividends declared. This variable is one measure of a price-earnings ratio.

SP^{Cyc} = The deviation in actual real bank share prices from their computed Hodrick-Prescott trend.

C. Results

The presentation of the empirical results begins in Figure 5 with a time series plot of the risky loan variable, (ΔLoans/ΔA). As can be seen there are three large spikes for this portfolio allocation variable over the sample time period. One positive spike occurs in 1959 when loans grew more than twice as much as the total assets of U.S. banks. In this year the variable (ΔLoans/ΔA) took on its highest value (more than three standard deviations above the mean) over the sample time period. According to the Federal Reserve this sharp increase in bank loans was the result of an attempt by nonfinancial enterprises (particularly metal fabricating companies) to build up their inventories of steel in anticipation of a well-publicized steel strike scheduled for mid-1959.[10] Much of this speculative inventory accumulation was financed with bank loans. The Federal Reserve also noted that there was a sharp increase in charge card and credit card debt by consumers in response to a heavy promotional campaign by the card companies in this relatively new financial service business.[11]

The second and third large spikes in (ΔLoans/ΔA) were negative and occurred in 1991 and 1992. These are the only two years in the entire sample for which the change in bank loans is negative, namely, –$57 billion in 1991 and –$20.1 billion in 1992. What were the reasons for this sharp decline in bank loans for these two years? One reason is that in 1991 there was a relatively mild recession (GDP growth was -.002) and that contributed to some of the decline in bank loans. However it is doubtful that the recession of 1991 was the only reason for the sharp decline in bank loans in 1991 and 1992. A recession of the same magnitude occurred in 1980, and in that year bank loans grew $70.9 billion. Perhaps a more important reason for the decline in bank loans was the implementation of the Basle Accord on risk-based capital requirements. The FDIC Improvement Act of 1991 with its "prompt corrective action" linked the financing of a bank's portfolio to the risk classification of various categories of assets within the portfolio.[12] The more (or less) risky the asset category, the more (or less) bank equity capital was required by the FDIC Improvement Act to finance the portfolio. Loans were classified in the most risky categories and therefore required the largest amount of equity finance. Cash and government securities were classified in the least risky category and required the least amount of equity finance. Thus a bank in 1991 and 1992 not in compliance with the new capital requirements—and many were not—could achieve compliance in one or both of two ways. One way is that it could raise more equity capital through earnings retention and/or by issuing new shares on the capital market. The second way would be for banks to reduce their investments in loans that carry a higher equity capital requirement, and increase their investments in cash and government securities that carry a relatively low equity capital requirement. Figures 6 and 7 indicate that U.S. banks adjusted to the new Basle/FDIC capital standards in the early 1990's in both ways. Figure 6 presents time series plots for both (ΔLoans/ΔA) and Δ(Cash + Securities)/ΔA. As can be seen in the figure there is a strong negative relationship between these two components of bank portfolios over the entire sample period. For the years 1991 and 1992 U.S. banks sharply reduced the loan component of their portfolios and correspondingly increased the cash and securities component. On balance this portfolio adjustment reduces the required equity finance mandated by the FDIC.[13] But this was not the only adjustment U.S. banks made to meet the new equity capital standard. Figure 7 indicates that U.S. banks also sharply increased their equity finance in 1991 and 1992.

To summarize, Figures 5 and 6 indicate that the years 1959, 1991, and 1992 were unusual for the portfolio allocation variable (ΔLoans/ΔA)—and Δ(Cash + Securities)/ΔA—while Figure 7 shows that the years 1991 and 1992 were unusual for the financing variable (ΔEquity/ΔA). The steel strike in 1959 and the implementation of the Basle Accord via the FDIC Improvement Act of 1991 were argued to be contributing factors to the unusually large changes in these asset allocation and financing variables for these three years. To account for these external factors two dummy variables (one each for the years 1959, and 1991 and 1992) that take on the value of unity in the year(s) in which the event occurred and zero elsewhere will be used in the regression tests presented below.

With this brief description of the relevant data over the sample time period of 1956-99, we now move on to test some of the predictions of the model presented in Section II. That model implies that shock-induced changes in bank share valuations are a signal for bank managers to change their portfolio strategy so as to conform to the risk aversion of their equity shareholders. Thus a rise (or fall) in share valuations is the signal for bank managers to invest more (or less) heavily in risky loans. Moreover, when banks change the risk structure of their portfolios, a rational contract between shareholders and depositors (or their delegated monitors the regulators) requires them to change their financing. For example, a relative increase (or decrease) in risky loan investments requires banks to rely more (or less) heavily on equity finance. This is exactly what the Basle Accord on capital standards attempts to achieve. This is also what a rational agreement between depositors and shareholders would want to achieve in the absence of deposit insurance. These predictions on balance sheet adjustments of U.S. banks will now be tested in Tables 1 and 2. Table 1 presents the results of the regression experiment on asset adjustments by U.S. commercial banks over various sample time periods. Column (1) presents the three different stock market variables used in the regressions. Column (2) presents the three different sample times periods for each of the stock market variables used in the regression tests. Column (3) presents the estimated coefficients on the three stock market variables over the three different sample times periods. Columns (4) and (5) present the Newey-West corrected t-scores and P-values. Column (6) presents the partial correlation coefficient between (ΔLoan/ΔA) and the three different stock market variables over the three different sample time periods. Finally, Column (7) presents the various dummy variables used in each of the nine regressions. In parts A, B, and C of the table the change in the risky loan component of bank portfolios, (ΔLoans/ΔA), is regressed on three different measures of bank share valuations and various dummy variables. The different share valuation measures—Δ(SP), $\Delta[SP_t/(Div + RE)_t]$, and SP_t^{Cyc}—were described in Part B on Data. The regressions are carried out over three different sample time periods: 1) 1956-99, the entire sample period; 2) 1956-90, the sample period before the enactment of the FDIC Improvement Act of 1991; and 3) 1991-99, the time period after the enactment of the FDIC Improvement Act. The reason for carrying out the regressions over these three time periods is to see whether the capital requirements imposed by Basle/FDIC altered the relationship between the three stock market variables and the bank portfolio allocation variable (ΔLoans/ΔA). The model presented in Section II above predicts that in the absence of bank capital regulations the risky loan component of bank portfolios is positively related to the stock market valuations of banks.

As can be seen from Table 1 the regression evidence is consistent with this prediction from the model. To begin with, the estimated coefficients on the three stock market variables in part A, B, and C are all positive and statistically significant for the two sample periods of

1956-99 and 1956-90. In addition, it is generally the case that the estimated coefficients (and their associated t-scores) on the stock market variables are larger for the 1956-90 period compared to 1956-99.[14] This is what would be expected in the absence of regulation. The one exception occurs in part B where the stock market variable is the change in the price-earnings ratio for bank stocks, $\Delta[SP_t /(Div + RE)_t]$. In this case the estimated coefficient and the t-score/P-value are essentially the same between the two samples time periods. The regression evidence so far for both time periods is consistent with the view that positive (or negative) changes in bank share valuations signal an increase (or decrease) in the risky loan component of bank portfolios as bank managers adjust their portfolios to reflect changes in the risk aversion of their shareholders. On the other hand, the results for the three regressions for the time period 1991-99—when the Basle/FDIC capital requirements were in effect—are very different. The estimated coefficients on two of the three stock market variables fall drastically, and none are statistically significant. In these regressions and for this time period there is no evidence that bank portfolio management was governed by the risk aversion of shareholders as reflected in share valuations. Instead, during this time period banks were using all possible means to achieve compliance with the Basle/FDIC capital requirements.[15] Inspection of Figures 6 and 7 indicates that compliance was achieved by a combination of reducing the loan component and increasing the cash and securities component of bank portfolios, along with increasing equity finance.

So far in this section we have empirically examined the link between stock market fluctuations and the portfolio adjustments of U.S. banks, a link predicted by the model in Section II.[16] A second prediction of this model is that rational contracting between shareholders and depositors (or the deposit insuring agency) requires banks to adjust their financing to any change in the risk of their portfolios induced by changes in bank share valuations. Thus when banks increase (or decrease) the risk of their portfolios—in response to rising (or falling) share prices—by investing more heavily in risky loans (or by investing more heavily in cash and securities), a rational contract requires them to increase (or decrease) their reliance on equity finance. This is what the Basle Accord attempts to achieve through the regulation of bank capital. However, would private arrangements between shareholders and depositors more or less achieve the same result? Table 2 will provide some evidence on this question.

Towards this end Table 2 presents some regression evidence on how financing decisions adjust at the margin to the portfolio decisions of U.S. banks. Column (1) presents two popular measures of adjustment to bank capital. The first is the marginal change in total equity capital relative to the change in total assets of the U.S. banking system, (ΔEquity/ΔA). Total equity includes both common equity and perpetual preferred stock, and is a fairly close proxy for what the Basle Accord defines as Tier 1 capital. The second measure of bank capital adds the loan loss reserve and subordinated notes of U.S. banks to total equity capital. In the U.S. the sum of the loan loss reserve and subordinated notes is a close proxy for what the Basle Accord defines as Tier 2 capital. The second measure of financial adjustment is defined to be the sum of the change in Tier 1 and Tier 2 capital relative to the change in total assets, Δ(Tier 1 + Tier 2)/ΔA. Column (2) presents four time period samples. The first three are the same that were used in Table 1, namely: 1) 1956-99, 2) 1956-90, and 3) 1991-99. Note that there are two regressions for the two sample periods of 1956-99 and 1956-90. The difference in these two regressions for both sample periods is that the second (i.e., 1b and 2b) includes a dummy variable for the year 1987. The reason for this is that the loan loss reserve for that year had its largest year to year increase ($21 billion) in the sample period as U.S. banks were coming under market and regulatory pressure to recognize the losses on risky loans made in the earlier years of the 1980's. This increase in the loan loss reserves of banks helped to reduce equity finance, or, Tier 1 capital by a record-$1.4 billion but at the same time helped to increase Tier 2 capital by a record $22 billion. The fourth time period is 1956-79. This is the time period in which neither the Basle/FDIC regulations nor its predecessor the so-called CAMEL rating system were in existence. This was the period of time in our sample in which there was the least regulation on the adequacy of bank capital. Column (3) presents the estimated regression coefficient on the risky loan variable, (ΔLoans/ΔA). Column (4) and (5) present the Newey-West computed t-scores and P-values on the estimated regression coefficients in Column (3). Column (6) presents the partial correlation (and in some cases the simple correlation) coefficient between the marginal change in the two measures of bank capital and the marginal change in risky loans. Finally, Column (7) present the various dummy variables used in the individual regressions over the various sample time periods.

The regression/correlation evidence in Column (3)-(6) of Table 2 is broadly consistent with the financing prediction of the model in Section II. For the sample periods of 1956-99, 1956-90, and 1956-79 (i.e., regressions 1a, 1b, 2a, 2b, and 4) there is a statistically significant relationship between the marginal change in the two measures of bank capital in Parts A and B, and the marginal change in the risky loan component of U.S. bank portfolios (ΔLoans/ΔA). When banks increase the risky loan component of their portfolios, they match that portfolio adjustment with a financial adjustment that increases their Tier 1 and Tier 2 capital.[17] Moreover, regressions 2a and 2b in Parts A and B indicate that they have matched financing adjustments to portfolio adjustments before the Basle/FDIC regulation on capital adequacy.

Finally, regression 4 reinforces this matching result for the period 1956-79 which in turn is prior to both the Basle/FDIC capital requirements and the CAMEL rating system. This is the time period of least government regulation for bank capital, and yet we see that banks adjusted their capital to changes in their investment portfolio in much the same way as they did in the 1956-99 and 1956-90 periods. This is indicated by the fact that the estimated coefficients on (ΔLoans/ΔA) are not too different between the three sample time periods of 1956-99, 1956-90, and 1956-79 for which there were varying degrees of government regulation on the adequacy of bank capital. Another interesting comparison centers around the inclusion of DV^{87} in regressions 1 and 2 of Parts A and B. In part A when (ΔEquity/ΔA) is the measure of bank capital the inclusion of DV^{87} in regressions 1b and 2b slightly increases the estimated coefficient on (ΔLoans/ΔA) for both time periods; namely 10 percent for 1956-99, and 12.3 percent for 1956-90. On the other hand, in part B when Δ(Tier 1 + Tier 2)/ΔA is the measure of bank capital including DV^{87} as a regressor in 1b and 2b reduces the estimated coefficient on (ΔLoans/ΔA) for both periods; namely by 10.5 percent for 1956-99, and by 7.7 percent for 1956-90. This was to be expected since in the year 1987 U.S. banks took a change of $50 billion in their loan loss reserve, a record increase of $21 billion from the previous year of 1986. This charge had the effect of sharply reducing earnings, retained earnings, and consequently the equity finance variable in Part A of the table. However, the increase of $21 billion in the loan loss reserve directly increases the Tier 2 capital of banks. Consequently the change in the sum of Tier 1 + Tier 2 capital relative to the change in total assets, Δ(Tier 1 $^{-}$+ Tier 2)/ΔA, in part B of the table is governed by the change in subordinated notes and the change in total assets. Both were relatively small (compared to the mean) and for that reason Δ(Tier 1 + Tier 2)/ΔA was relatively large in

1987. Since (ΔLoans/ΔA) was about average in 1987 while Δ(Tier 1 + Tier 2)/ΔA was very large and above average, including DV^{87} in regressions 1b and 2b tended to push down the estimated coefficient in Column (3).

Another difference in the financing adjustment across time periods in both parts A and B of Table 2 occurs in regression (3) for the time period 1991-99. This was the time period when U.S. banks were adjusting to the new Basle/FDIC capital requirements, particularly in the early years.[18] In the early years of this period the adjustment took the form of shifting the composition of bank portfolios away from loans and into cash and securities, and raising both Tier 1 and Tier 2 capital. As can be seen in the table, the estimated coefficients on (ΔLoans/ΔA) are positive (although not statistically significant) in regression (3) in Parts A and B. Moreover, the estimated coefficient in part B is larger than estimates for earlier periods. In the future it will be interesting to see whether the Basle/FDIC capital regulations match financing to the change in portfolio composition of banks in the way private arrangements did before the enactment of these regulations.

IV. SUMMARY AND CONCLUSIONS

This paper proposes and empirically tests a partial equilibrium model describing the cyclical portfolio adjustments and financing adjustments of U.S. banks over the 1956-99 period. These portfolio adjustments facilitate and amplify business cycles. In this model the adjustments are triggered by an external shock (e.g., a change in risk aversion) that in turn changes the required yield of investors in bank shares. When required yields change, stock prices change. In this model changes in stock prices are a signal for managers to change the portfolio strategy of their banks to conform more closely to the risk aversion of their shareholders. Thus when stock prices are rising, bank mangers in this model shift the composition of their portfolios towards risky investments like loans. On the other hand when stock prices fall, there is a flight to safety as managers increase their investments in relatively safe assets like cash and securities. Of course, any portfolio adjustment will have differential effects on depositors (and/or the deposit insuring agency) and shareholders. A risky investment strategy that increasingly conforms to the falling risk aversion of shareholders increases the probability of bank failure with potential losses for depositors and the deposit insurance fund. For this reason, rational depositors and the deposit-insuring agency will require that banks do something that offsets any change in portfolio risk. That something in this model and the Basle Accord is some form of a required adjustment in the bank's financial strategy. More specifically, when banks increase portfolio risk by investing more heavily in increasingly risky loans that finances a speculative business cycle expansion, they match that portfolio strategy with a financial strategy that infuses more equity capital into banks. Conversely when banks reduce portfolio risk by reducing their investments in risky loans—thereby tightening the budget constraint of nonfinancial companies and causing a recession—and increasing their investments in relatively safe cash and government securities, the offsetting financial strategy is to rely more heavily on deposit finance. In this way financial adjustments are linked to portfolio adjustments and the business cycle.

Section III presented the results of a number of regression/correlation tests for the two main predictions of the model. The first prediction concerned the link between changes in bank share prices and the risk of bank portfolios. This prediction was tested in Table 1 using three different measures of bank share valuations and conducting the tests over three different sample time periods to account for possible regime shifts. The results of the regression tests in Table 1 did not reject this prediction of the model. Increases (or decreases) in bank share valuations are followed by marginal increases (or decreases) in the risky loan component of bank portfolios. Bank managers act as if they change bank portfolios in response to changes in investor risk aversion as reflected in movements in share prices. The only exception occurred in the short sample period of 1991-99 when banks were adjusting their portfolios and their financing to meet the Basle/FDIC capital standards. The second prediction concerned the financing of bank portfolios. This prediction was tested in Table 2 using two measures of bank capital and four different sample time periods. The results of the regression tests in Table 2 did not reject the prediction of the theory that banks rely more (or less) heavily on equity finance when they take on more (or less) portfolio risk. Furthermore banks adjusted the financing of their portfolios in this way long before the Basle/FDIC capital requirements and the CAMEL rating system were part of the regulatory architecture. Again the only exception occurred over the 1991-99 time period when U.S. banks were in the process of adjusting to the Basle/FDIC capital standards.

The results of this paper for the U.S. banking sector parallel earlier work we have done on nonfinancial enterprises in the G-7 countries. In that work (Krainer, 1985, 1992, 1996, and 2003) it was observed that nonfinancial enterprises in many (but not all) G-7 countries adjusted the risk of their investment strategies to lagged changes in their share prices. These changes in the risk structure of investment cause business cycles. At the same time these companies were adjusting their investment strategies, they were also adjusting their financial strategies so as to coalesce the welfare of their bondholder and stockholder investors over the business cycle. High and rising share prices were followed by increases in inventory accumulation, board of director approval for major capital projects, and the ordering of new capital equipment. These increasingly risky (from equation (9) and Figure 3) investments cause business cycle expansions. The financial response of these firms was to rely more heavily on equity finance. The increased operating risk associated with the production-investment decision is offset with a reduction in financial risk associated with the matching financing decision. Conversely low and falling share prices induce the opposite set of business decisions with firms reducing their risky investments in inventories and new capital projects. While reducing the operating risk of the firm these investment decisions also cause business cycle recessions. The financial response in this case is for firms to rely more heavily on debt finance.

Financial enterprises like banks can easily be fit into this theoretical framework of the business cycle. The same outside shock that increases stock prices for nonfinancial enterprises also increases stock prices of banks. Both types of enterprises respond to rising share prices by investing in relatively risky assets; inventories and major capital projects for nonfinancial enterprises that in turn cause economic expansions, and loans for banks that help finance the expansion. Large nonfinancial enterprises finance the expansion with retained earnings and new equity issues on the stock market. Small nonfinancial enterprises finance the expansion with retained earnings, some IPO's, and short-term bank loans. Banks, on the other hand, finance their portfolio adjustment towards risky loans with increasing amounts of Tier 1 and Tier 2 capital. In the end society ends up with a riskier stock of real capital as described in Figure 3 and equation (9). This riskier stock of real capital is increasingly financed by relatively less risk adverse equity investors in both nonfinancial and financial enterprises. The reverse sequence of events would follow a negative external shock that resulted in falling share prices followed by a recession financed with debt and deposits. In both cases equity and debt/depositor investors finance the investments they want to finance consistent with their risk aversion, and this is how a financial system should work.

ENDNOTES

1. For example, Lang and Nakamura (1992), Stanton (1998), and Krainer (2003) among many others find that bank loans and short-term debt of nonfinancial enterprises are strongly procyclical in the G-7 countries. For a descriptive review of the procyclicality of the financial system in general—and banks in particular—see Borio, Furfine, and Lowe (2001).

2. An excellent exception is the study by Brewer, Genay, Jackson, and Worthington (1996) of project finance of small companies by Small Business Investment Companies or SBIC's. They found evidence that risky projects were financed with equity while safe projects with high collateral value of assets were financed with debt.

3. For other work in this area see Bernanke and Gertler (1989) and Kiyotaki and Moore (19970). Bernanke, Gertler, and Gilchrist (1996) provide a mid-1990's review of this strand of research on the link between finance and the real production/investment side of the economy.

4. In other words, for the investment opportunity described by the box in Figure 1 to be created in the first place, it is necessary that it provide investors their required rate of return which in turn includes compensation in the form of a yield for bearing risk.

5. See Stiglitz (1972, p. 39) for an example of this kind of technology.

6. For evidence on this see Kashyap, Stein, and Wilcox (1993), Gertler and Gilchrist (1993), Berger and Udell (1990), Corcoran (1992), and Peek, Rosengren, and Tootell (2000).

7. For an analysis of the effect of changes in business risk on the price of risky corporate debt in the option pricing model see Merton (1974) and the numerical example in Krainer (1992, pp. 82-86).

8. The Website is: http://www2.fdic.gov/hsob/hsobRpt.asp

9. See Standard & Poor's Statistical Service, Security Price Index Record 2000 Edition, p. 285. In the year 2000 these 26 banks accounted for 35 percent of the total assets of all FDIC insured depository institutions and 33 percent of their deposits. Moreover in terms of market traded equity capitalization these 26 depository institutions would probably constitute a much larger share of the total than their share in total assets or deposits by virtue of the fact that most depository institutions are not publicly owned. In this connection it is important to note that on June 30, 2000 approximately 85 percent of the depository institutions in the U.S. had deposits of less than $300 million. Most of these small depository institutions do not have stock that is traded on the stock exchanges.

10. See the Federal Reserve Bulletin, February 1960, Vol. 46, Number 2, p. 121.

11. See the Federal Reserve Bulletin, April 1960, Vol. 46, Number 2, p. 360.

12. The Basle Accord/FDIC Improvement Act was among other things an attempt to solve the moral hazard problem in banking where government subsidized deposit insurance and limited liability on equity provided inducements for banks to make speculative high yielding loans to the private sector. Under the original 1988 Basle Accord, bank assets were assigned to one of four categories for purposes of assigning risk weights and minimum required capital. The first category includes nominally risk-free assets such as

cash, claims on the central bank, and government securities. This category has a zero risk weight. The fourth and most risky category includes claims on the private sector and non-OECD governments, and fixed assets including real estate. This category has a risk weight of 100 percent. The middle two categories have risk weights of 20 percent and 50 percent. Assets in these two categories include cash items in the process of collection and loans fully secured by mortgage on residential property. For a complete description of all the assets in the four categories see *Annex 2 of the Basle Committee on Banking Supervision, International Convergence of Capital Measurement and Capital Standards*, Basle, July 1988.

The Basle Accord is in the process of being revised. One proposal for the new version is to increase the number of risk categories within which bank assets can be classified. Another main proposal relates to just how bank assets will be classified within the expanded risk categories. One proposal is to use the quality ratings provided by debt rating services such as Moody's and Standard & Poor. Still another proposal is to eventually use the bank's own model of risk assessment. One thing is certain. The new proposals if accepted will be more complicated to implement and perhaps more difficult to monitor by the regulatory authorities. For a detailed discussion of the issues and problems associated with the new Basle proposals see the Special Issue on "Credit Ratings and the Proposed New BIS Guidelines on Capital Adequacy for Bank Credit Assets" in the *Journal of Banking & Finance*, Vol. 25, No. 1, 2001 pp. 1-270.

13. The FDIC data referenced in footnote 8 does not differentiate between government securities and private securities such as commercial paper. Under the present Basle regulation commercial paper is a private claim and therefore classified as a category Four

asset with a risk weight of 100 percent. If the new proposals are adopted much of the commercial paper will be in a lower risk classification requiring less equity capital. Even so under the present regulation the Securities component of Cash and Securities is subject to a lower equity capital requirement since government securities are included in this category.

14. It is possible that factors reflecting the demand for loans by bank loan customers (e.g., industrial enterprises) might also influence the marginal change in the loan component of bank portfolios. To test for this possibility in the context of the model in Section II, we include the change in real industrial share prices (the S&P 380 stock index of industrial companies), ΔSP^{Ind}, in regressions A1 and A2 of Table 1. The estimated coefficient on this variable is predicted to be positive since a change in industrial share prices signals a change in the demand for and composition of industrial firm assets along with the financing of those assets. The results are as follows.

1956-99

$$\left(\frac{\Delta \text{Loans}}{\Delta A}\right)_t = \underset{(16.83)}{.6129} + \underset{(2.33)}{.3576}\,(\Delta SP)_t + \underset{(41.47)}{1.4883}\,(DV)_t^{59} - \underset{(-7.44)}{1.4107}\,(DV)^{91,92} - \underset{(-.43)}{.0254}\,(\Delta SP)_t^{Ind}$$

$\bar{R}^2 = .723$ DW = 2.03

and

1956-90

$$\left(\frac{\Delta \text{Loans}}{\Delta A}\right)_t = \underset{(16.81)}{.6150} + \underset{(2.59)}{.4130}\,(\Delta SP)_t + \underset{(25.12)}{1.4290}\,(DV)_t^{59} + \underset{(1.13)}{.0992}\,(\Delta SP)_t^{Ind}$$

$\bar{R}^2 = .604$ DW = 1.88

where the numbers in the parentheses are the Newey-West adjusted t-scores.

$\overline{R}^2$ = Adjusted coefficient of determination.

DW = Durbin-Watson Statistic.

As can be seen in the above two regressions the estimated coefficient on $(\Delta SP)^{Ind}$ is not significantly different from zero indicating that this measure of loan demand from bank customers has no effect on the marginal change in the loan component of bank portfolios.

We also carried out the non-nested hypothesis test proposed by Davidson and MacKinnon (1981) for an alternative specification of the loan regressions in Table 1. In this connection suppose alternatively that (Δ Loans/ΔA) depends positively on the change in the rate of interest on prime bank loans, ΔPR. Thus higher (or lower) yields on loans induce banks to make more (or fewer) loans. The two specifications then take the following form.

H1: $(\Delta \text{ Loans}/\Delta A)_t\, 1 = k_0 + k_1(\Delta SP) + k_2(DV)^{59} + k_3(DV)^{91, 92} + e_1$

and

H2: $(\Delta \text{ Loans}/\Delta A)_t\, 2 = f_0 + f_1(\Delta PR) + f_2(DV)^{59} + f_3(DV)^{91, 92} + e_2$

To carry out the Davidson-MacKinnon J-test, we take the fitted values from regression H2 and include them as a regressor in regression H1. If the estimated coefficient on the fitted values variable from H2 is statistically significant, we reject the specification in H1. This procedure is then repeated for H2; namely, take the fitted values from regression H1 and include them as a regressor in regression H2. If the estimated coefficient on this fitted variable is statistically significant, reject the specification in H2. The results for the two sample time periods 1956-99 and 1956-90 are as follows.

1956-99

i. $$\left(\frac{\Delta \text{Loans}}{\Delta A}\right) = \underset{(.19)}{.0913} + \underset{(2.31)}{.3311(\Delta SP)} + \underset{(.20)}{.2242(DV)^{59}} - \underset{(-.19)}{.2093(DV)_t^{91,92}} + \underset{(1.10)}{8.29}\left(\frac{\Delta \text{Loans}}{\Delta A}\right)2$$

and

ii. $$\left(\frac{\Delta \text{Loans}}{\Delta A}\right) = \underset{(.03)}{.0076} + \underset{(1.10)}{1.4499(\Delta PR)} + \underset{(.14)}{.0884(DV)^{59}} + \underset{(.0054)}{.0035(DV)^{91,92}} + \underset{(2.31)}{.9809}\left(\frac{\Delta \text{Loans}}{\Delta A}\right)1$$

1956-90

iii. $$\left(\frac{\Delta \text{Loans}}{\Delta A}\right) = \underset{(.31)}{.1806} + \underset{(2.35)}{.3895(\Delta SP)} + \underset{(.29)}{.4070(DV)^{59}} + \underset{(.76)}{.7021}\left(\frac{\Delta \text{Loans}}{\Delta A}\right)2$$

iv. $$\left(\frac{\Delta \text{Loans}}{\Delta A}\right) = \underset{(-.70)}{-.2573} + \underset{(.76)}{1.4192(\Delta PR)} - \underset{(-.62)}{.5925(DV)^{59}} + \underset{(2.35)}{1.4232}\left(\frac{\Delta \text{Loans}}{\Delta A}\right)1$$

As can be seen for both time periods the estimated coefficient on (Δ Loans/ΔA)2 in (i) and (iii) is not significantly different from zero, while the estimated coefficient on (Δ Loans/ΔA)1 in (ii) and (iv) is statistically significant. Consequently, we reject the specification in H2 and fail to reject the specification in H1.

15. In the U.S. banks that did not meet or exceed the Basle capital requirement were precluded from entering new (i.e., for the U.S.) financial services businesses such as insurance and investment banking. In addition if banks did not meet the so-called “well-capitalized” standard — a slightly higher capital standard than the “adequately capitalized” standard that satisfied the Basle requirement — they required permission to issue brokered certificates of deposits from the FDIC. Finally, if banks were undercapitalized or significantly undercapitalized the U.S. regulatory authorities could restrict the amount of cash dividends that banks could pay to their shareholders as well as

restrict the salaries of managers. Thus under the "prompt corrective action" feature of the FDIC Improvement Act of 1991 there were great incentives for U.S. banks to meet and surpass the Basle capital requirements.

16. It might be thought that there is a simultaneous relationship between bank share valuations and the proportion of bank assets invested in loans. In other words, besides the hypothesized relationship predicted by the theory in Section II that goes from (ΔSP) to (ΔLoans/ΔA), the relationship might go in the opposite direction from (ΔLoans/ΔA) to (ΔSP). If this is the case then OLS estimates of k1 in Table 1 are inconsistent and inefficient. To test for the existence of a simultaneous relationship between (ΔSP) and (ΔLoans/ΔA) we implement the Hausman procedure. To do this we run an auxiliary regression of (ΔSP) on the exogeneous variables in regression A1 in Table 1 and certain instrument variables that are correlated with (ΔSP) but not with the error term U_t in A1. The exogeneous variables from A1 are DV^{59} and $DV^{91, 92}$, while the instrument variables are the current dividends paid on bank stocks and the rate of change in the consumer price index. The rationale for the choice of these instruments is that dividends reflect the permanent earnings of banks while the inflation rate (through its well known effect on the variability of relative prices) reflects the quality of those earnings. Both of these variables will then affect banks share valuations. Collecting the residuals V_t from this auxiliary regression and including them as a regressor in A1 of Table 1 yields the following result.

1956-99

i. $$\left(\frac{\Delta \text{Loans}}{\Delta A}\right) = \underset{(18.86)}{.6072} + \underset{(2.10)}{.3902}\,\Delta(SP)_t \underset{(36.97)}{+1.4797}(DV)^{59} \underset{(-7.28)}{-1.4095}(DV)^{91,92} - \underset{(-.43)}{.0770}\,\hat{V}_t$$

$$\bar{R}^2 = .723 \qquad DW = 2.04$$

As can be seen the residual from the auxiliary regression $\hat{V}_t$ when inserted as a regressor in A1 of Table 1 is not significantly different from zero. Hence, we cannot reject the null hypothesis of no simultaneity between (ΔSP) and (Δ Loans/ΔA). The OLS estimate of k1 in regression A1 of Table 1 is consistent and efficient.

17. On the other hand, when they increase their investments in relatively safe assets like cash and securities they reduce their Tier 1 and Tier 2 capital as the following two regressions for the 1956-99 period indicates.

1956-99

$$\left(\frac{\Delta \text{Equity}}{\Delta A}\right)_t = \underset{(12.10)}{.0921} - \underset{(-4.80)}{.0604}\left[\frac{\Delta(\text{Cash} + \text{Securities})}{\Delta A}\right]_t + \underset{(20.12)}{.3623}(DV)_t^{91,92}$$

$$\bar{R}^2 = .726 \qquad DW = 1.99$$

and

1956-99

$$\left[\frac{\Delta(\text{Tier 1} + \text{Tier 2})}{\Delta A}\right]_t = \underset{(11.43)}{.1236} - \underset{(-4.94)}{.0803}\left[\frac{\Delta(\text{Cash} + \text{Securities})}{\Delta A}\right]_t + \underset{(13.19)}{.4204}(DV)_t^{91,92}$$

$$\bar{R}^2 = .612 \qquad DW = 1.95$$

The Newey-West corrected t-scores are given beneath the estimated coefficients.

We also carried out a Hausman type test for simultaneity between (ΔLoans/ΔA) and (ΔEquity/ΔA) by taking the residuals from regression 1 in part A of Table 1 and including them as regressors in regressions 1a in Parts A and B of Table 2. The results are as follows.

1956-99

$$\left(\frac{\Delta \text{Equity}}{\Delta A}\right)_t = \underset{(3.67)}{.0375} + \underset{(8.14)}{.0636}\left[\frac{\Delta \text{Loans}}{\Delta A}\right]_t + \underset{(20.23)}{.3854}(DV)^{91,92} - \underset{(-.92)}{.0229}\hat{U}_t$$

$$\overline{R}^2 = .703 \qquad DW = 1.94$$

and

1956-99

$$\left[\frac{\Delta(\text{Tier 1} + \text{Tier 2})}{\Delta A}\right]_t = \underset{(3.46)}{.0558} + \underset{(5.29)}{.0774}\left(\frac{\Delta \text{Loans}}{\Delta A}\right)_t + \underset{(14.31)}{.4404}(DV)^{91,92} + \underset{(.92)}{.0328}\hat{U}_t$$

$$\overline{R}^2 = .636 \qquad DW = 1.93$$

Since the estimated coefficients on $\hat{U}_t$ in both regressions are not significantly different from zero, we cannot reject the null hypothesis of no simultaneity between the two measures of bank capital and (ΔLoans/ΔA) and OLS estimation is efficient and consistent.

18. Aggarwal and Jacques (2001) also come to this same conclusion in their recent empirical study of 1685 FDIC insured banks with assets of at least $100 million. They attribute this portfolio and capital adjustment of U.S. banks in the early and mid-1990's to the Prompt Corrective Action feature of the FDIC Improvement Act of 1991 pointing out the dire consequences for banks of not meeting the adequate capital standard. They found (as we found in Figures 6 and 7) that both adequately capitalized and undercapitalized

banks increased their equity and reduced the risk of their portfolios during this period. Our research would seem to indicate that these kinds of capital and portfolio adjustments in the early and mid-1990's are only the temporary response of U.S. banks to this regulatory change.

Table 1

$$\left(\frac{\Delta \text{Loans}}{\Delta A}\right)_t = k_o + k_1(\text{StockMarketVariable}) + \Sigma_i\, k_i\ (\text{DummyVariable})_t + U_t$$

(1) Stock Market Variable	(2) Time Period	(3) Estimated Coefficient	(4) t-score[1]	(5) P-Value	(6) Partial[2] Correlation Coefficient	(7) Dummy Variables	
A. **ΔSP**	1. 1956-99	.3375	2.27	.029	.3494[b]	DV^{59}	$DV^{91,\ 92}$
	2. 1956-90	.4068	2.49	.018	.4041[a]	DV^{59}	
	3. 1991-99	.2476	.42	.687	.1877		$DV^{91,\ 92}$
B. $\Delta\left[\frac{SP_t}{(Div+RE)_t}\right]$	1. 1956-99	.7527	2.13	.040	.3177[b]	DV^{59}	$DV^{91,\ 92}$
	2. 1956-90	.7325	2.12	.042	.3607[b]	DV^{59}	
	3. 1991-99	11.1074	.33	.749	.1454		$DV^{91,\ 92}$
C. $(SP)_t^{Cyc}$	1. 1956-99	.4763	3.02	.004	.3859[a]	DV^{59}	$DV^{91,\ 92}$
	2. 1956-90	.7059	4.78	.000	.5371[a]	DV^{59}	
	3. 1991-99	.1320	.75	.480	.1210		$DV^{91,\ 92}$

1. The t-scores on the estimated coefficients are computed using the Newey-West heteroskedastic and autocorrelation correction for calculating standard errors.

2. The partial correlation coefficient between the stock market variable and $\left(\frac{\Delta \text{Loans}}{\Delta A}\right)$.

a. Indicates that the partial correlation coefficient is significantly different from zero at the 1 percent level.

b. Indicates that the partial correlation coefficient is significantly different from zero at the 2½ percent level.

DV^{59} = Dummy variable taking on the value of one in 1959 and zero elsewhere.

$DV^{91,\ 92}$ = Dummy variable taking on the value of one in 1991 and 1992, and zero elsewhere.

Table 2

$$(\textbf{Banking Capital})_t = k_o + k_1\left(\frac{\Delta \text{Loans}}{\Delta A}\right)_t + \Sigma_i\, k_i\ (\textbf{DummyVariable})_t + V_t$$

(1) Bank Capital		(2) Time Period	(3) Estimated Coefficient	(4) t-score[1]	(5) P-Value	(6) Partial[2] Correlation Coefficient	(7) Dummy Variables
A. $\left(\frac{\Delta \text{Equity}}{\Delta A}\right)$	1a.	1956-99	.0529	4.78	.000	.4076[a]	$DV^{91,92}$
	1b.	1956-99	.0582	6.59	.000	.4793[a]	DV^{87} $DV^{91,92}$
	2a.	1956-90	.0505	3.71	.008	.4027[a]	
	2b.	1956-90	.0567	5.53	.000	.4899[a]	DV^{87}
	3.	1991-99	.0618	2.00	.093	.4608	$DV^{91,92}$
	4.	1956-79	.0603	5.86	.000	.5473[a]	
B. $\frac{\Delta(\text{Tier 1} + \text{Tier 2})}{\Delta A}$	1a.	1956-99	.0929	5.07	.000	.4966[a]	$DV^{91,92}$
	1b.	1956-99	.0830	5.78	.000	.5418[a]	DV^{87} $DV^{91,92}$
	2a.	1956-90	.0866	5.23	.000	.4663[a]	
	2b.	1956-90	.0799	6.85	.000	.5207[a]	DV^{87}
	3.	1991-99	.1234	2.26	.065	.6529	$DV^{91,92}$
	4.	1956-79	.0799	6.61	.000	.6061[a]	

1. The t-scores on the estimated coefficients are computed using the Newey-West heteroskedastic and autocorrelation correction for calculating standard errors.
2. The partial correlation coefficient between the bank capital variable and $\left(\frac{\Delta \text{Loans}}{\Delta A}\right)$.

a. Significance level of .01.
b. Significance level of .025.

DV^{87} = Dummy variable; 1 in 1987, 0 elsewhere.

$DV^{91,92}$ = Dummy variable; 1 in 1991 and 1992, 0 elsewhere.

Figure 1

Input and Expected Output Sharing in an Debt and Equity Economy

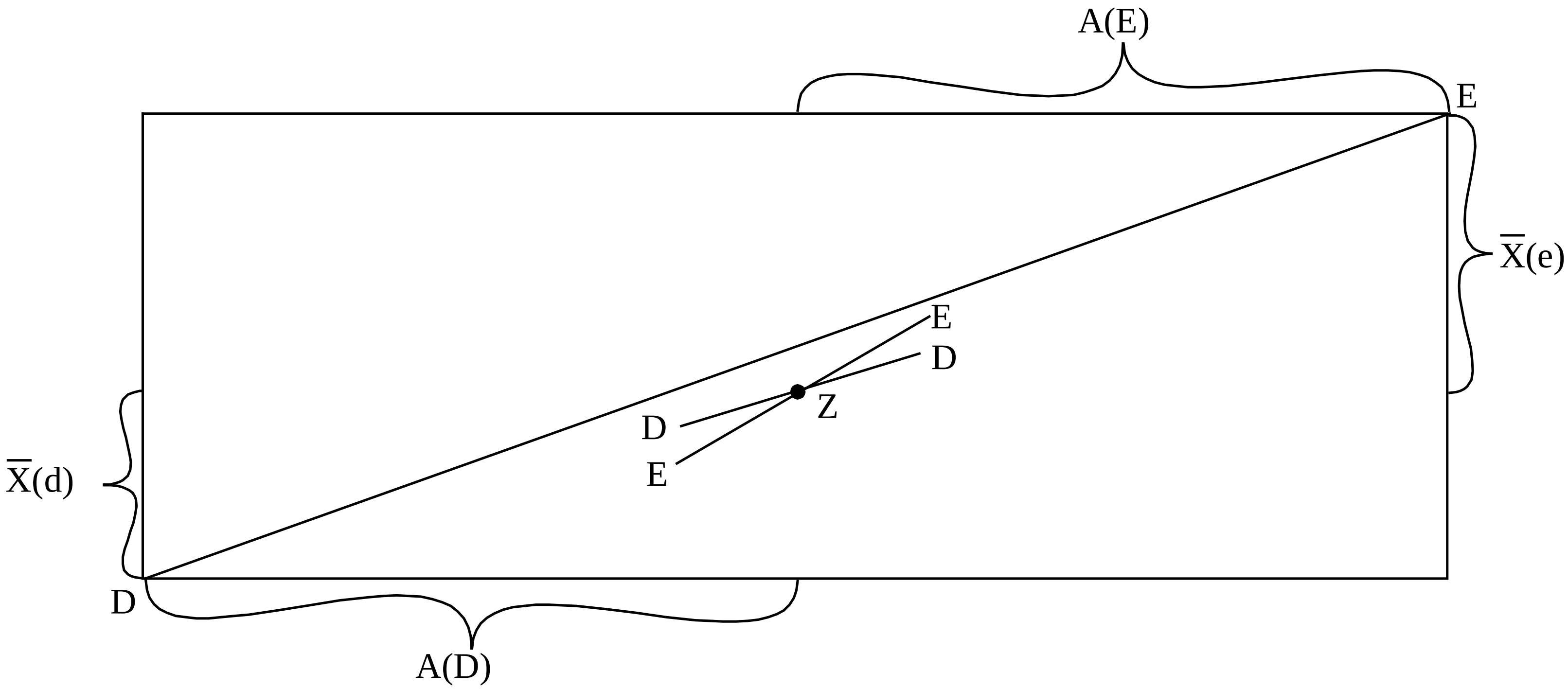


Figure 2

Financial Markets and Equilibrium

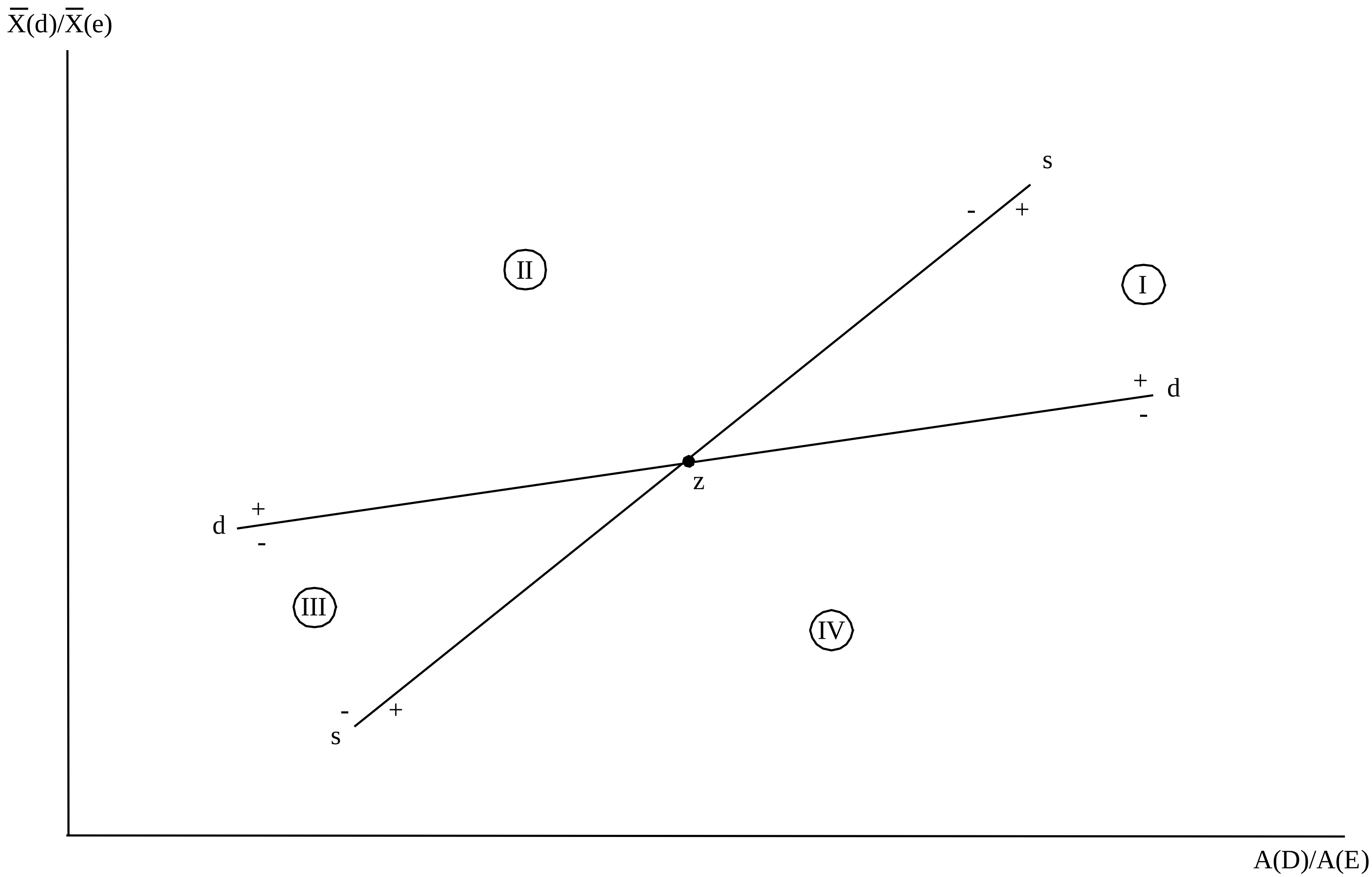


Figure 3

Risk and Return Trade-off forCapital Investment

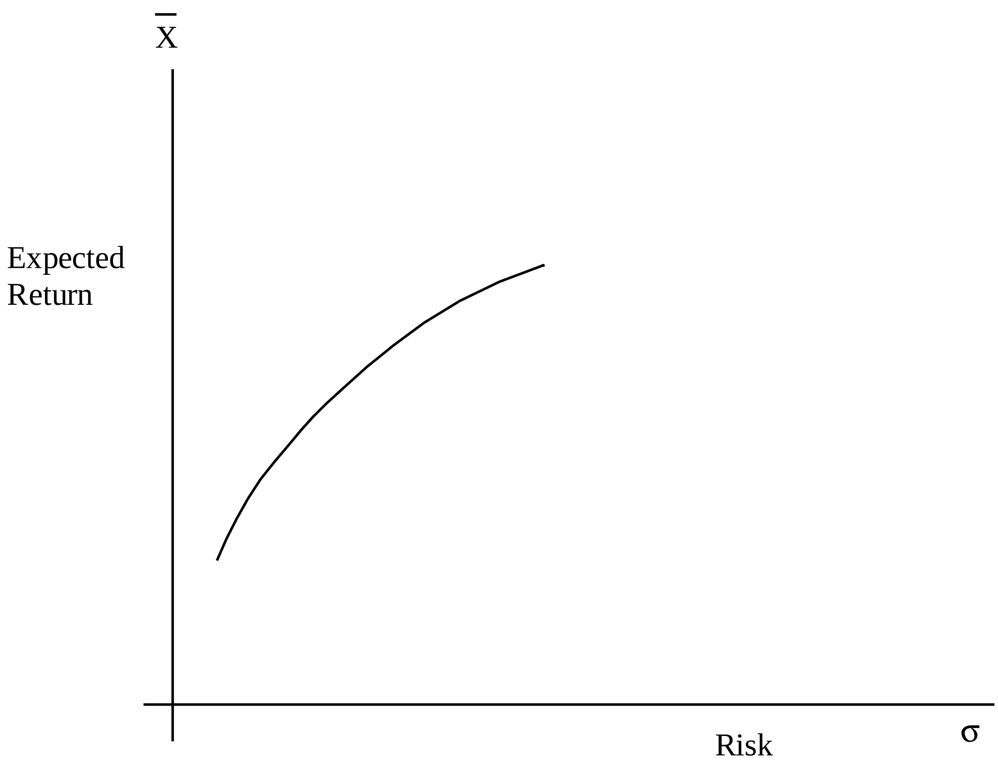


Figure 4

A Business Cycle Expansion in a Debt and Equity Financed Economy

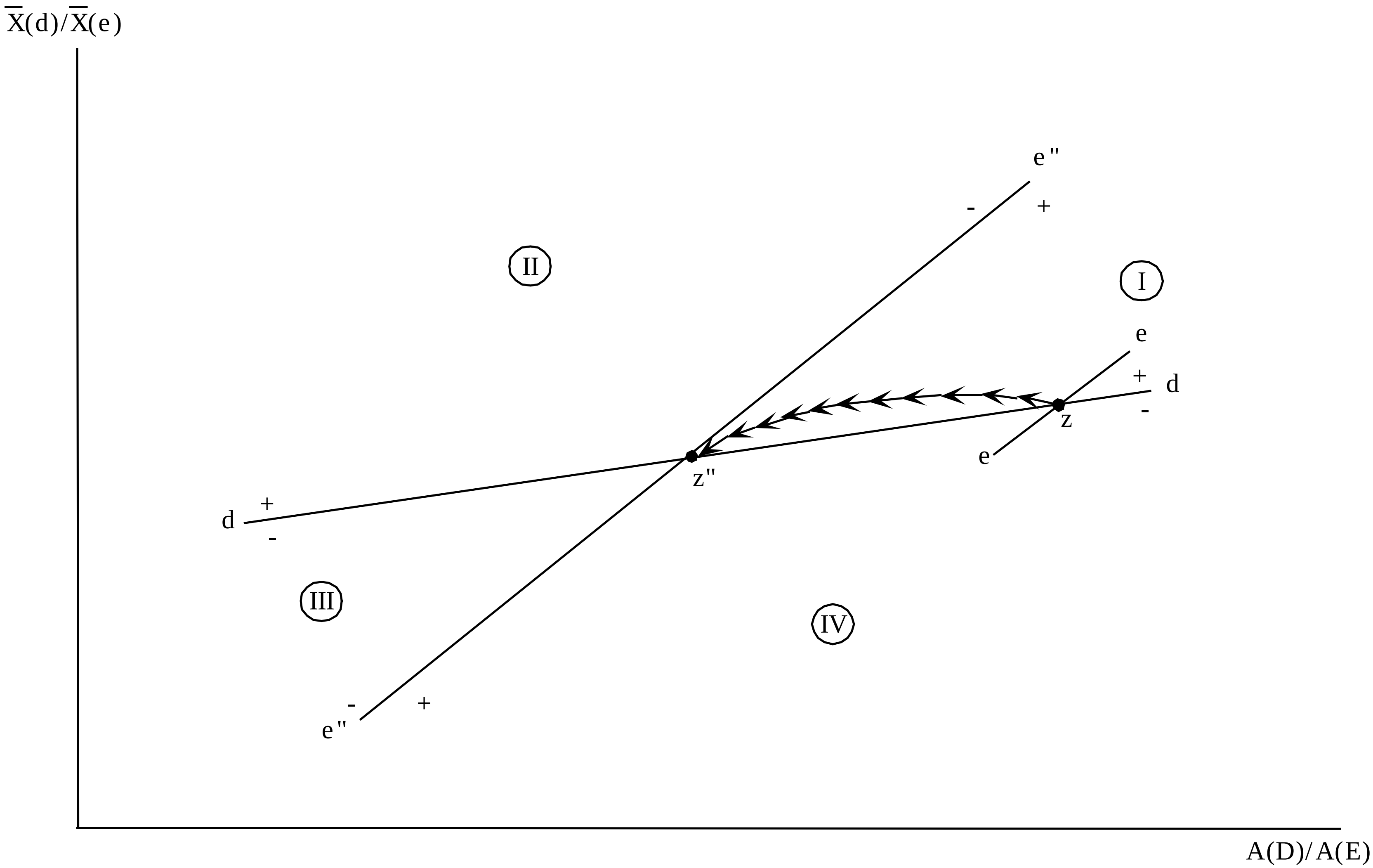


Figure 5
Δ(loans)/ΔA
1956-1999

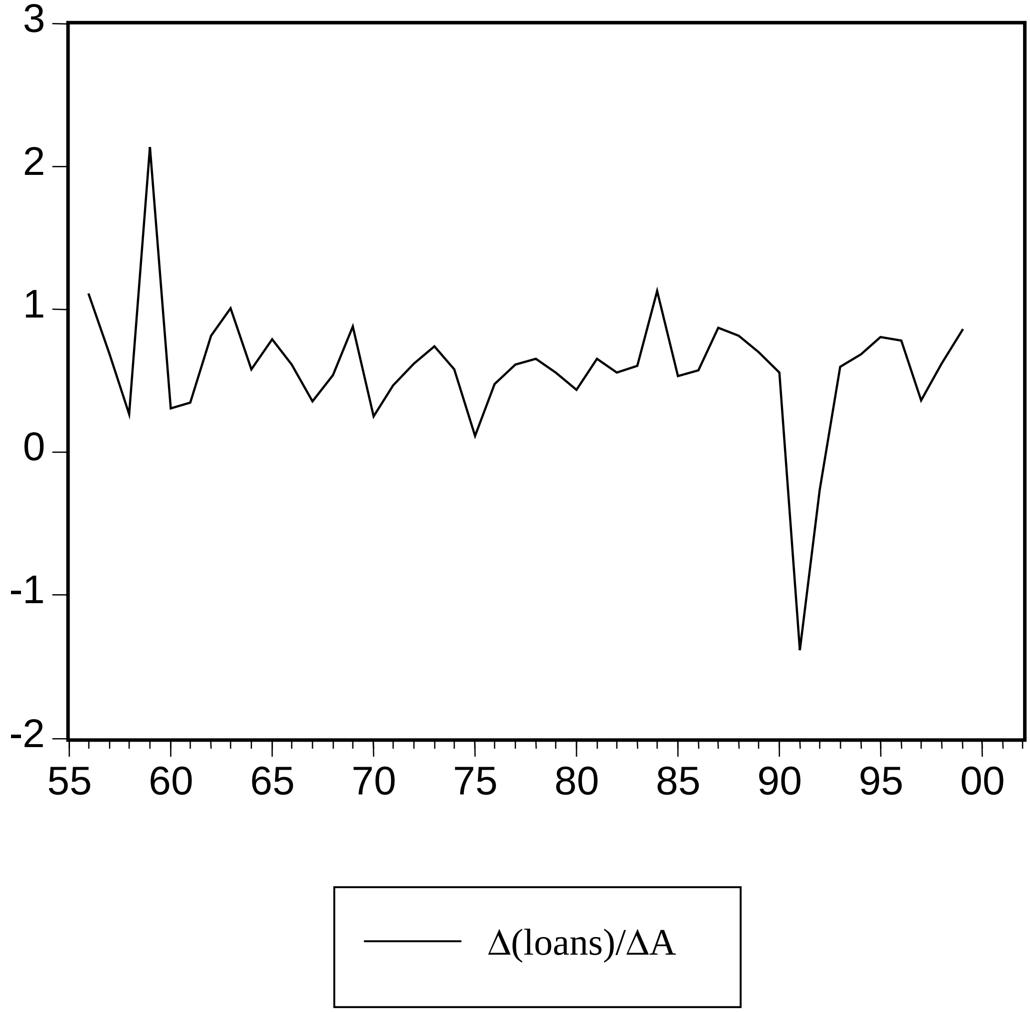


Figure 6
Δ(loans)/ΔA and Δ(cash + securities)/ΔA
1956-1999

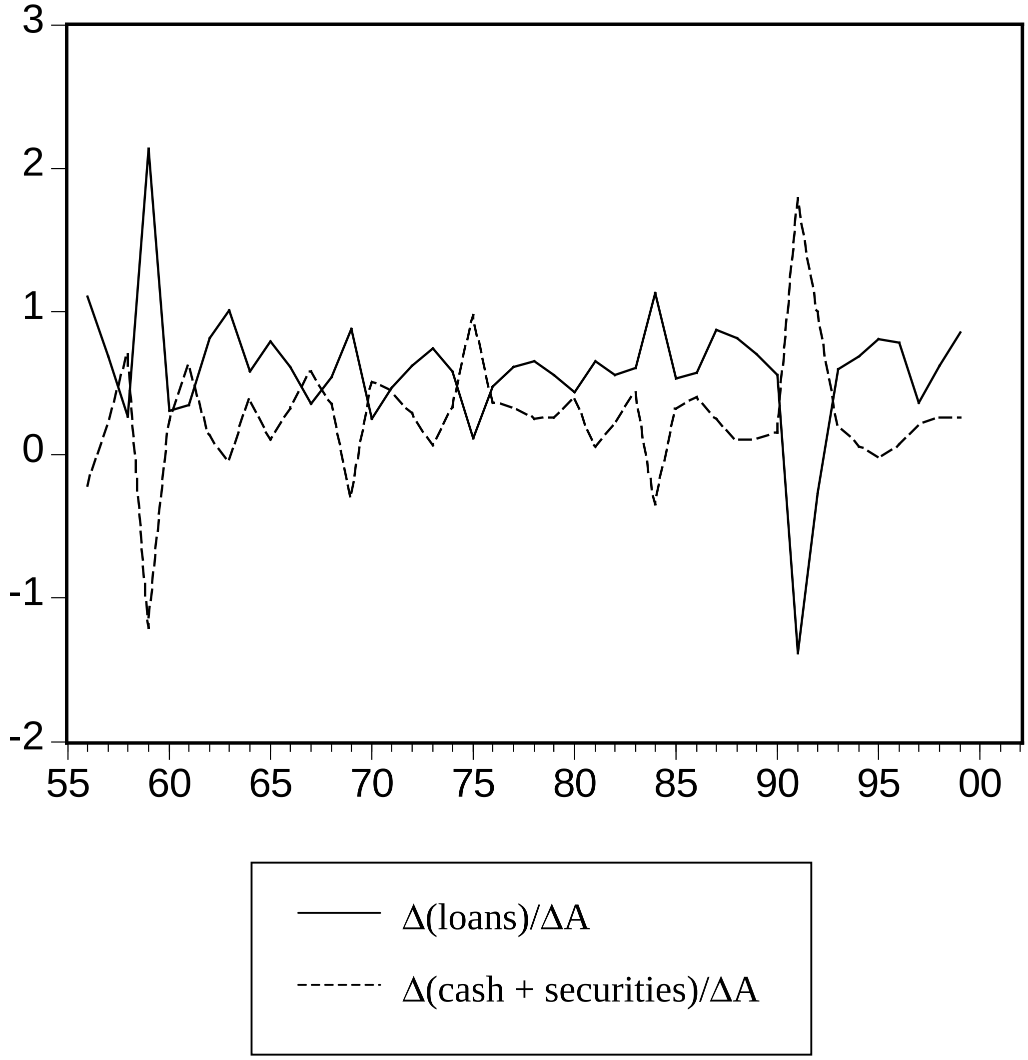
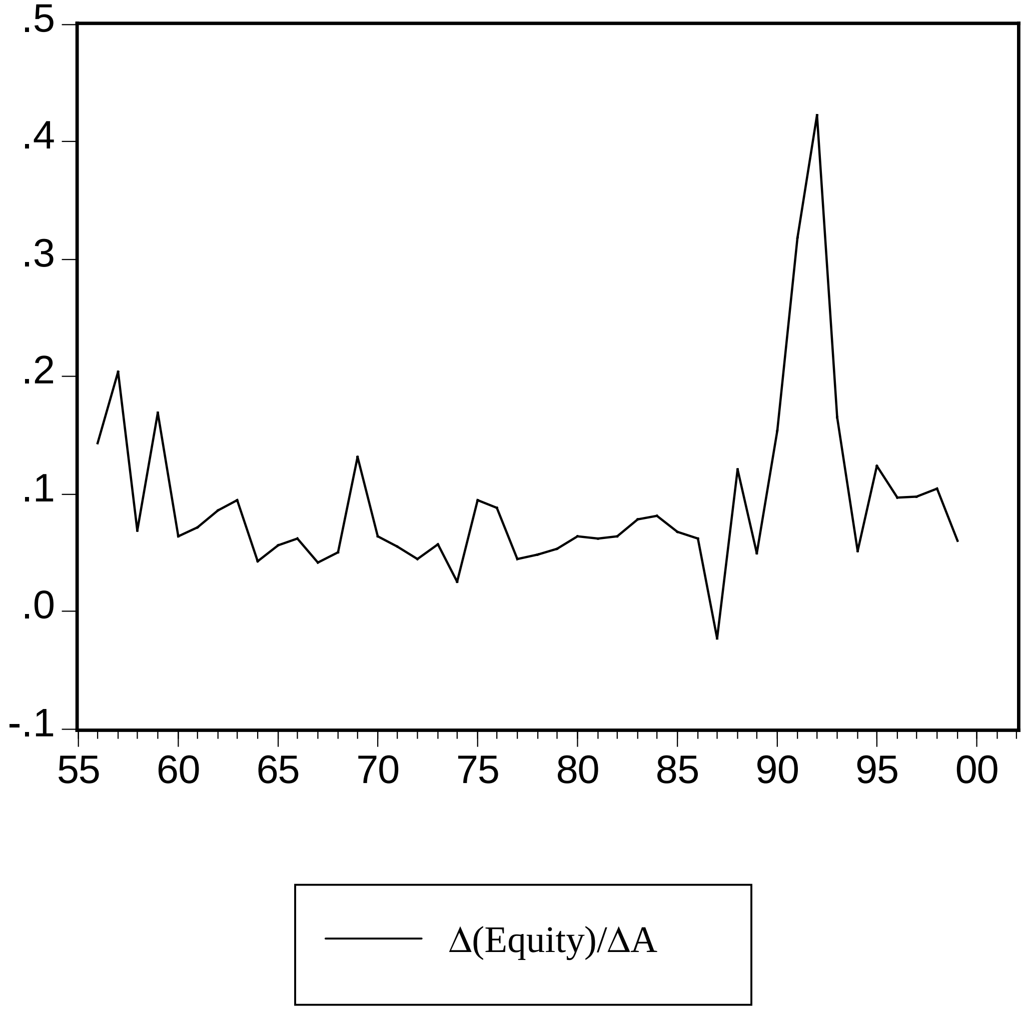


Figure 7
Δ(Equity)/ΔA
1956-1999



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