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MODELING STRUCTURE AND TEMPORAL VARIATION IN THE MARKET'S VALUATION OF BANKING FIRMS

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ABSTRACT

This paper decomposes both the market sensitivity and the interest-rate sensitivity of bank stock into on-balance-sheet and off-balance-sheet components. It derives these constituent and often-offsetting sensitivities from a nonstationary three-equation model that employs accounting and capital-market information to explain cross-sectional and temporal variation in the value of stockholder equity.

To control statistically for heteroskedasticity and intrasample differences in unbooked capital positions, the model is estimated separately for three size classes of large U.S. banks. Parameter estimates confirm the importance of "hidden" or unbooked capital at these banks. For the nation's very largest banks, shifts in the value of these parameters are consistent with the view that the capitalized value of federal deposit-insurance guarantees burgeoned in the 1980s with interest volatility, demonstrations of regulatory forbearance, and relaxation of deposit-rate ceilings.

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I. Introduction

This paper seeks to enrich the profession's interpretation of the market and interest-rate sensitivity of deposit-institution stock. Economists conventionally assess these sensitivities as the regression coefficients fitted to market returns and interest rates in an expanded market model. A market model uses capital-market data to estimate a usually stationary stochastic process presumed to generate periodic returns to stockholders. A stationary and nonstructural model seems poorly suited to analyzing a period when macroeconomic conditions, policy rules, financial technology, and regulatory freedoms change rapidly. We derive market and interest-rate sensitivities from a nonstationary model that uses accounting and capital-market information to explain the value of stockholder equity.

Our analysis develops two distinctions that partition the market value of a firm's stock (i.e., its market capitalization, MV) into three components. The first distinction decomposes MV into hidden and recorded capital reserves. The second distinction decomposes hidden capital reserves into values that are "unbooked but bookable" on a historical-cost basis under Generally Accepted Accounting Principles (GAAP) and those which are currently treated as unbookable off-balance-sheet items under GAAP.

Our statistical model develops explicit estimates of both components of hidden capital. We estimate the net unbooked value of bookable (or on-balance-sheet) positions by estimating an intermediate valuation ratio, k. This variable expresses the ratio of the market to book value of the collected components of a firm's bookable equity, B_e. Applying the valuation ratio to BV, the value of accounting or book net worth, assigns a market value to bookable assets and liabilities. Subtracting this estimate of B_e from market capitalization values off-balance-sheet items. This appraised value of unbookable equity, U_e, captures the net value of unbookable assets and liabilities.

We develop estimates of k and U_e for 43 quarters of 1975-85. We do this by regressing cross-sectionally the market value of banks' equity shares on the book value of their accounting net worth. We call this regression equation, the Statistical Market Value Accounting Model, SMVAM. We link this model to the market model by endogenizing changes in k and U_e as functions of ex post returns on stocks and bonds.

We envisage the parameters of these second-stage models as undergoing evolutionary change during 1975-85. Goldfeld and Quandt's [(1972), (1973), (1976)] switching regression method, GQSRM, is used to study the temporal variability of model parameters. GQSRM estimates three attributes of regime variation: specific shift dates, the gradualness of each shift, and the parameters of the stochastic process governing each regime.

Expanded market models make no direct use of accounting information on the bookable positions of a firm and make no effort to separate bookable and unbookable items. Rapid expansion in banks' fee-based service activity and in the policy problems that off-balance-sheet activities pose for deposit insurers (Kane, 1985) should create a demand for market-based measures of off-balance-sheet activities.

We interpret our model as a flexible functional form that incorporates structural detail aggregated away in a market model. It uses accounting data to focus structurally on market participants' ex ante and nonstationary valuation decisions rather than forcing ex post returns to fit a stationary process. Our analysis endogenizes temporal movements in the degree of market and interest sensitivity of capital positions that develop on and off a bank's conventional balance sheet. Specifying and estimating this additional structure generates evidence of disaggregated market and interest sensitivity that cannot be observed by directly fitting a two-index model of ex post equity returns. This additional evidence reconciles some conflicting findings in market-model studies of market and interest sensitivity.

II. The Statistical Market-Value Accounting Model

If markets are efficient, financial analysts see through smoke and mirrors raised by contemporary accounting rules. Our analysis develops separate estimates for bookable and unbookable elements of the market and interest sensitivity of a depository firm's generalized balance sheet.

At any time, a firm's market capitalization, MV, is the product of its share price and number of shares outstanding. Invoking the principle of value additivity, MV may also be expressed as the market value of bookable and unbookable assets, (A_m+A_m'), minus the market value of bookable and unbookable nonequity liabilities, (L_m+L_m'). Because deposit-insurance subsidies are widely believed to have surged during the 1980s and to vary with bank size, it is instructive to isolate from other unbookable assets the value of a deposit institution's explicit and conjectural federal guarantees net of discounted future costs, F_{CG} (cf. Benston _et_ _al_., 1986; Brickley and James, 1986; and Thomson, 1987). In symbols,

$$MV = [F_{CG} + (A_m' - L_m')] + (A_m - L_m). \qquad (1)$$

Since recorded assets and liabilities are carried at historical cost, even $(A_m - L_m)$ cannot be observed directly. A parsimonious way to proceed is to assume that market participants estimate the market value of elements of bookable equity by applying appropriate mark-up or mark-down ratios, k_a and k_l, to the accounting values reported by the institution. Adopting this approximation transforms equation (1) to:

$$MV = [F_{CG} + (A'_m - L'_m)] + k_a A_b - k_l L_b, \qquad (2)$$

where subscripts a, l, and b represent assets, liabilities, and booked values, respectively.

In principle, A_b and L_b are jointly determined variables, affected by many of the same unknown exogenous variables. Treating A_b and L_b as separate and exogenous regressors could introduce interpretive problems. Fortunately, our data give no evidence of these problems. At every date for every bank class, the coefficient constraint that $k_a = k_l$ proves impossible to reject. This justifies our applying a single valuation ratio k to the value of an institution's book equity, $BV = A_b - L_b$.

Expressing the market value of unbookable equity $[(F_{CG}+A'_m-L'_m)]$ as U_e and allowing for approximation error introduced in the model, we obtain equation (3):

$$MV = U_e + kBV + e \ . \qquad (3)$$

We term this equation, which can be estimated from time-series or cross-sectional data sets, the Statistical Market-Value Accounting Model, SMVAM.

As with many statistical models employed in finance, equation (3) can be justified most satisfactorily as a "flexible functional form." The specifications's virtues lie in having a small number of readily interpretable parameters and in incorporating several testable restrictions. Our specification treats e as an approximation error. Our goal is to show that (3) can be imbedded into a specification that uses more information than a market model, not that (3) completely represents the process determining MV.

Parameter Restrictions

In applying the model cross-sectionally, we restrict the valuation ratio k_{it} applicable to bank i at time t to have the same value k_t across each bank class. To lessen damage from this restriction, it is necessary to focus on relatively homogeneous subsamples of banks.

A set of what should be seen as identifying restrictions follow from reformulating (3) as a two-equation model of U_e and B_e:

$$U_e = a_u + b_u \ BV + e_1 \qquad (4)$$

$$B_e = a_e + b_e \ BV + e_2.$$

With only one instrumental variable, four coefficients cannot be identified. Equation (3) overcomes this problem by restricting b_u and a_e each to zero. To the extent that either U_e is not uncorrelated with book value or a_e is nonzero, the neglected coefficients bleed into our estimates of k and U_e. Although such bleeding limits our capacity to separate the components of hidden reserves, it does not invalidate (3) considered as a reduced form.

A third restriction is that (3) and (4) are linear. However, using a linear approximation to what is presumed to be a monotonically increasing function is less damaging when the range of upside and downside variation is controlled by outside forces. On the upside, takeover discipline limits large holdings of capital because high levels of capital reduce deposit-insurance subsidies. On the downside, the FDIC introduces increasing regulatory penalties whenever a bank's BV heads toward zero (Buser, Chen, and Kane, 1981). (Because the Federal Savings and Loan Insurance Corporation has in recent years virtually abandoned capital discipline, the model might work less well for S&Ls.)

A fourth restriction lies in treating BV_{it} as exogenous. Because GAAP gives bank managers options to realize unbooked gains and losses on bookable and unbookable positions and authorities penalize low BV_i, k_i and BV_i and tradable elements of U_e and BV_i may be negatively correlated. Our estimated rank orderings of k against bank size class vary over time.

Interpretability Issues

The model's coefficients describe the *de facto* deceptiveness of GAAP. Unless both $U_e=0$ and $k=1$, the accounting or book value of a bank's capital represents a biased estimate of the market value of stockholder equity. If the estimated intercept is significantly positive (negative), unbookable assets and liabilities serve as a net source of (drain on) institutional capital. Financial analysts know that problems exist in both directions. On the drain side, U.S. institutions habitually overstate the capital contribution derived from their loan-loss reserves by not deducting an allowance for anticipated loses that they have not yet formally realized. On the sources side, institutions do not book the value of the deposit-insurance guarantees they receive.

If only intercept bias were to exist, *changes* in accounting values would be unbiased estimates of changes in the market value of on-balance-sheet assets and liabilities. However, a slope bias may also exist. We interpret (1-k) as a premium when $k>1$ and as a discount factor when $k<1$.

Sampling Issues

It is difficult to develop a representative sample of data from which to estimate SMVAM. Stock in few U.S. deposit institutions trades directly or regularly in the market. Many thrift institutions are still mutual organizations, while small stockholder institutions are often privately held. For large institutions, to exploit regulatory and tax benefits, stock is typically owned indirectly through a holding company, HC. A bank (or a saving and loan) HC may own more than one depository and may own nondepository assets as well.

This leads us to reinterpret U_e. For an HC, U_e may capture activity that is on the HC's balance sheet but not on the balance sheet of the HC's principal bank. We view estimates of SMVAM parameters as if equity in a bank's affiliates were an off-balance-sheet position of the bank. We do this because data on subsidiaries are not available quarterly and to link the model with regulatory conceptions of affiliate activity.

Even if the market value of other HC subsidiaries and the unbookable equity of the bank were uncorrelated with the bank's book equity, the mean value of equity in HC affiliates would bleed into the measure of the bank's unbookable equity provided by the intercept term. The size of this intercept reflects the mean importance of all unbooked sources of value not correlated with BV. Similarly, $(1-R^2)$ tells us how much variation in these items is orthogonal to variation in BV.

If subsidiary values and unbookable equity correlate with book equity, regression estimates of the valuation ratio would be biased. Under these as-yet unknowable circumstances, deviations of k from unity could signal either the existence of capital gains and losses on bookable positions or size-based variation in the value of affiliate equity and unbookable positions.

III. Building Market and Interest-Rate Sensitivity into the SMVAM

The parameters of the SMVAM are U_e and k. When stock and bond returns change, these parameters must respond. To express the market and interest-rate sensitivity of a deposit institution's bookable and unbookable equity, we imbed this response in a triangular three-equation model.

This model portrays quarterly adjustments in each SMVAM parameter as a linear function of market returns and interest rates:

$$U_{et} - U_{e,t-1} = \beta^u + \beta^u_m R_{mt} + \beta^u_r R_t + v_t, \tag{5}$$

$$k_t - k_{t-1} = \beta^k + \beta^k_m R_{mt} + \beta^k_r R_t + w_t \;. \tag{6}$$

R_m and R represent a market return and an interest-rate proxy and the stochastic terms in each equation are conceived as approximation errors. The slope coefficients β^u_m and β^u_r in (6) and β^k_m and β^k_r in (7) measure the market sensitivity and interest-rate sensitivity of SMVAM's parameters.

As is equation (3), equations (5) and (6) are offered as flexible functional forms. This two-equation submodel is intended only to parameterize in an interpretable and parsimonious way revaluation decisions that take place continually. The true models that (5) and (6) -- and the two-index model -- merely approximate may be nonlinear in R_m and R and may include unspecified other variables as well. Because our equations are conceived as approximations, we subject parameter estimates to Goldfeld-Quandt tests for regime shifts. Especially in an era of rapid financial change, we think it important to allow the parameters of such approximations to be recalibrated whenever statistical evidence indicates that movements in omitted variables (such as authorities' closure rules) or nonlinearities might have degraded a previously relevant model's explanatory power.

Equations (5) and (6) have the same logical standing as the following two-index market model, which expresses the return on asset p as:

$$\tilde{R}_p = \beta_o + \beta_m\tilde{R}_m + \beta_r\tilde{R} + \tilde{e}_p. \qquad (7)$$

In (7), the betas measure the asset's systematic market and interest-rate sensitivity and $\tilde{e}_p$ is a stochastic disturbance. Except that $\tilde{R}$ may be interpreted as an "industry factor" (Lee and Brewer, 1985; Sweeney and Warga, 1987), the market model ignores the structural characteristics of individual institutions and the markets in which they operate. One source opines that "studies of bank stocks describe the pricing of steel industry stocks as well as they do the pricing of bank stocks" (Federal Reserve Bank of New York, 1986, p. 58).

Our equations condition market participants' revaluation decisions on the same variables that are taken as exogenous in the two-index model. In a reduced-form sense, then, (5) and (6) must explain the overall market sensitivity, β_m, and the interest sensitivity, β_r, of equity returns in model (7). These market-model betas may be deemed to be monotonically increasing in the respective slopes of (5) and (6):

$$\beta_{mt} = f_t\ (\overset{(+)}{\beta^{u}_{mt}},\ (\overset{(+)}{\beta^{k}_{mt}})\ , \tag{8}$$

$$\beta_{rt} = g_t\ (\overset{(+)}{\beta^{u}_{rt}}\ ,\ \overset{(+)}{\beta^{k}_{rt}}). \tag{9}$$

Linking the SMVAM to the two-index model in this way takes all partial derivatives as positive and allows the righthand-side betas and the weighting functions f(...) and g(...) to vary over time with market and interest volatility and with the balance-sheet structure of sample institutions.

IV. Data Set Used

End-of-quarter share prices, number of shares, and book values for a set of large commercial banks are obtained from BANK COMPUSTAT, 1986. This data set includes about 150 NYSE, AMEX and over-the-counter issues. Market values are determined as the product of end-of-quarter share price and number of shares outstanding. BANK COMPUSTAT provides data on the book values of the principal bank subsidiary, defined as the total equity of the common stockholders in the capital of the bank which includes the par value of common stock, surplus, undivided profits, reserves for contingencies and other capital reserves.

Our market proxy is the CRSP equal-weighted NYSE and AMEX monthly stock index adjusted for dividends. Because empirical research shows no reliable role for short-term rates in the two-index model (Kane and Unal, 1987), the interest-rate index used is the monthly holding-period return on long-term government bonds constructed by Ibbotson Associates, 1986. Monthly returns are compounded to produce quarterly returns.

We interpret movements in holding-period yields as dominated by what rational-expectations models term "interest-rate surprises." Although the construction of holding-period returns parallels the CRSP proxy, such returns reverse the economic interpretation of the sign of an interest-rate coefficient. Bond-price reductions induced by interest-rate increases decrease holding-period returns. Hence, a rise in holding-period returns corresponds to a fall in interest rates, an event widely believed to benefit the stock of a typical bank.

V. Parameter Estimates for SMVAM

Estimation proceeds stepwise. From a time series of cross-sectional values for the MV and BV of individual banks, U_e and k are estimated by ordinary least squares for each of 43 1975-1985 quarters. Then, to estimate (5) and (6), the quarterly changes in k and U_e are regressed on stock and bond returns.

To control statistically for heteroskedasticity and intrasample differences in k and U_e, we classify sample banks into three asset-size classes. For each class, the SMVAM is estimated separately. The three size groups consist of the largest 25 banks, the smallest 25 sample banks, and 54 to 97 other banks that we term medium-size banks. Banks of similar size may be presumed to operate in broadly similar ways and to be disciplined or assisted by deposit-insurance authorities in similar fashion.

For SMVAM, Table 1 reports quarterly cross-sectional regressions for each size class. For the largest banks, t-tests reject (albeit with low power) the combined U_e=0 and k=1 condition necessary for recorded equity to be an unbiased estimate of market value except in nine quarters (for medium-size banks, eighteen quarters). Accounting representations of the economic performance of major banks are deceptive. Moreover, our data indicate that the larger a bank becomes, the less reliably book values track the market value of underlying stockholder claims.

It is also useful to examine the two prongs of the unbiasedness condition separately. Deviations of U_e from zero show a definite time pattern. Before 1980, the market value of unbookable equity is negative for every bank group in every quarter. This means that off-balance-sheet items serve as a drain on capital values before 1980. At the largest banks, this drain remains statistically significant until mid-1979, but becomes insignificant thereafter. A broadly similar pattern holds for the other two bank groups: U_e remains negative throughout 1975-79, while its sign becomes less regular during 1980-85.

The ratio of mean U_e to mean MV varies sharply between the 1975-79 and 1980-85 subperiods. During the first subperiod, this ratio is -31 percent for the largest banks, -15 percent for medium banks and -25 percent for small banks. During the 1980-85 period, the ratio shrinks dramatically, becoming -1 percent for the largest and smallest banks, and -9 percent for medium-size banks. After 1980, unbookable equity seldom acts as significant reservoir of hidden losses. This observation is consistent with the hypothesis that after 1980, the value of federal deposit-insurance guarantees increased with: interest volatility; demonstrations of regulatory forbearance for large banks; and the relaxation of deposit-rate ceilings (Kane, 1985). Of course, the precise effect of these forces at an individual bank should vary with the bank's leverage and other portfolio riskiness. Largest banks' dramatic improvement in the U_e/MV ratio may reflect different economic forces from those operative at other banks. The upward surge of U_e

at very large institutions may be driven by administrative and political difficulties that persuade regulatory authorities to overlook a capital deficiency (caused, for example, by unrealized losses on LDC loans) and to regard these institutions as "too big to fail" (Seidman, 1986). For other banks, the major influences may be the opening up of extralocal sources of retail deposits and a broader range of potential acquirers, acquisitions, and future activities.

Turning to k, the largest banks usually show a significant premium (k>1) for recorded equity before 1980. However, k drops significantly below unity in 1980 and in most quarters thereafter. For other size classes, patterns differ. At medium-size banks, except for two scattered observations, k stays below one until 1983. From then on, k lies above unity most of the time. The smallest banks' pattern resembles that of medium-size banks, but the turn comes later, in 84/4 when the departure from unity becomes significant.

VI. Digression on Switching Regression

We investigate the temporal variability of the parameters of the second-stage equations (5) and (6) by Goldfeld and Quandt's switching regression method (GQSRM). This section illustrates the method for an n-regime specification of equation (5):

$$\Delta\tilde{U}_{et} = \beta_{j}^{u} + \beta_{mj}^{u}\tilde{R}_{mt} + \beta_{rj}^{u}\tilde{R}_{t} + v_{tj} \quad , \ j = 1,\ldots,n; t = 1,\ldots,T. \quad (10)$$

In (10), $\Delta\tilde{U}_{et}$ is $U_{et} - U_{e,t-1}$, j indexes the n regimes and v_{jt} is a disturbance term assumed to be distributed $N(0, \sigma_{vt}^{2})$. The likelihood function that applies when the data set is conceived as a combination of n regimes would employ more parameters than we have observations. To develop positive degrees of freedom, GQSRM uses transition-smoothing dummy variables, D_{tj}. If the observations come from n regimes, (n-1) switch dates Z_j^* and (n-1) gradualness parameters σ_j^* exist. The n-1 sets of variables D_{tj} are approximated as:

$$D_{tj} = \int_{-\infty}^{t} [(2\pi)^{1/2} \sigma_j^*]^{-1} \exp \{- 1/2 \, [(\xi - Z_j^*)/\sigma_j^*]^2\} \, d\xi \quad , \qquad (11)$$

where j now runs from 1 to n–1 and the endpoint values are $D_{tn}= 0$ and $D_{t0}= 1$ by definition. In (11) the value of σ_j^* gives information about the smoothness of the structural change. The smaller σ_j^* is, the more sudden the transition between the regimes. If σ_j^* is significantly different from zero, the hypothesis that the structural change is abrupt in the vicinity of Z_j^* should be rejected in favor of a hypothesis of gradual change.

In (10) the equation representing the s-th regime is then multiplied by $\gamma_{ts}= \prod_{j=0}^{s-1} D_{tj} \prod_{w=s}^{n} (1 - D_{tw})$. The resulting equations for n regimes are added together to obtain the composite equation that we estimate:

$$\sum_{s=1}^{n} \Delta\tilde{U}_{et}\gamma_{ts}= \sum_{s=1}^{n} \{ (\beta_s+\beta_{ms}\tilde{R}_{mt}+\beta_{rs}\tilde{R}_{it}+ v_{ts}) \, (\gamma_{ts})\} \quad . \qquad (12)$$

Assuming $\Delta\tilde{U}_{et}\gamma_{ts}$ to be normally distributed with mean $\sum_{s=1}^{n} \{(\beta_s+\beta_{ms}\tilde{R}_{mt}+\beta_{rs}\tilde{R}_{it}) \, (\gamma_{ts})\}$, and variance $\sigma_{vt}^2= \sum_{s=1}^{n} (\sigma_{vs}^2) \, (\gamma_{ts})$, the log-likelihood function for an n-regime specification then becomes:

$$\log L = -T/2 \log 2\pi - 1/2 \sum_{t=1}^{T} \log \sigma^2_{vt} - 1/2 \sum_{t=1}^{T} [\sum_{s=1}^{n} v_{ts}\gamma_{ts}]^2/\sigma^2_{vt}. \quad (13)$$

Maximizing (13) with respect to the unknown parameters generates maximum-likelihood estimates of: the parameters of equation (10), the mean switch dates Z^*_j, and the gradualness parameters σ^*_j which characterize the nonabruptness of the associated structural change.

Maximizing the likelihood functions developed in this paper requires numerical optimization. GRADX (an algorithm using the quadratic hill-climbing method) in Princeton University's GQOPT package is used.

VII. Changes in the Market and Interest-Rate Sensitivity of k and U_e

Substantive interest focuses on the market sensitivity (β^u_{mj} and β^k_{mj}), interest-rate sensitivity (β^u_{rj} and β^k_{rj}), and residual variance (σ^u_{vj} and σ^k_{wj}) of unbookable equity and the valuation ratio. Tables 2 to 5 summarize GQSRM results. Table 6 sorts out the individual significance of the many individual coefficient shifts allowed.

Table 2 reports two regimes for the market and interest sensitivity of unbookable equity for the largest and the smallest 25 banks. Medium-size banks experience three regimes. In all three size classes, the market and interest sensitivities of the valuation ratio show the same number of regimes (although not always the same shift dates) as unbookable equity.

Table 3 reports the dates and gradualness of the shifts. Panel A focuses on the market and interest sensitivity of unbookable equity. For the largest banks, the only switch occurs at 78/3. This switch point estimate has a standard error of 2.07 quarters. This means that the two-standard-error confidence interval for this switch date runs from roughly 77/3 to

79/3. The estimated associated gradualness parameter is 4.33 quarters meaning the switch is gradual. Approximating the length of the transition by twice the gradualness parameter implies this gradual switch (given an estimated starting point) completes itself in nine quarters.

Medium and small banks' first switch is estimated at 77/2; medium banks' second switch at 81/1. GQRSM cannot reject the hypotheses that these switches are abrupt.

Panel B of Table 3 develops parallel results for the valuation ratio. Large and small banks show one switch, while medium banks experience two. The largest banks experience a gradual shift: the mean date is 77/3 and the associated gradualness parameter is 3.47 quarters. The drift in the market and interest sensitivity of the largest banks' valuation ratio takes 7 quarters. Medium banks' first and second switches occur abruptly at 77/2 and 80/4. Small banks' second regime starts at 77/1.

For all banks, GQRSM labels mid-1977 as a time of sea change. Around this date, sample banks experience structural changes in their sensitivities to stock returns and bond yields. This dating pattern supports the political-economy view that the Fed's October 1979 change in operating procedures is better conceived as an endogenous response to changes in the economic and political environment affecting the stock of its client firms rather than as an exogenous event. For the largest banks, the structural drift tails off precisely when the Federal Reserve's regime change was announced. Medium-size banks differ in experiencing a second structural change at the end of 1980.

Table 4 reports sensitivities for unbookable equity in each regime. For the largest banks, the market sensitivity of unbookable equity (β_m^u) proves negative and significant early in its 75/2-78/3 drift. But over time this sensitivity becomes positive and loses its significance by 78/4. This indicates that largest banks' off-balance-sheet positions hedge market variation only during the 1975-78 period. After 1978, off-balance-sheet positions lose their relation to market returns on stock. Table 6 confirms that the shift in market beta is significant.

In both regimes largest banks' unbookable equity proves negatively correlated with bond returns. This implies that the value of unbookable equity at large banks increases when ex post bond returns fall (i.e., when interest rates rise). This is consistent with Kane's (1985) hypothesis that increases in FDIC guarantees offset much of interest-induced losses on net bookable assets at banks the FDIC deems infeasible to liquidate. Although we observe no significant shift between regimes, β_r^u remains negative taken by itself but loses significance during the second regime.

For medium banks, the market sensitivity of unbookable equity is negative and significant in all three regimes. Compared to large banks, medium-size banks' off-balance-sheet positions better hedge market variations after 77/3. Medium banks parallel large banks in having unbookable equity relate negatively to holding-period yields prior to 1977. However, the relation becomes insignificantly positive in the two regimes operative after 77/3.

The specification for unbookable equity works poorly for the smallest banks. R^2 values prove much lower and slope coefficients are insignificant in both regimes. This may trace to greater diversity in the way members of this class operate or to the FDIC's willingness to enforce capital requirements closely enough to keep the capitalized value of FDIC guarantees close to zero for this size class. Table 6 clarifies that the 77/2 shift is best viewed as a significant increase in residual variance.

Market and interest sensitivites for the valuation ratio are found in Table 5. For the largest banks, β_m^k is positive and significant in both regimes. This positive sign indicates that when stock returns increase, so does the valuation ratio for book equity. For fixed interest rates, this means that in a bull market book values increasingly underestimate the market value of net bookable assets. The market and interest-rate sensitivities of the valuation ratio for the largest banks decline after the 77/3 shift, but only the decline in market beta proves significant. During both regimes, the relation between k and holding-period returns on bonds is positive. This indicates that the institution's bookable assets are more interest-sensitive than its bookable liabilities. This is not evidence that the Macauley duration (as opposed to the "effective duration") of its bookable assets exceeds the duration of its bookable liabilities. Such an implication would hold only for infinitesimal movements in r (Kaufman, 1984). The robustness of the coefficient restraint k_a-k_1-k suggests instead that interest-rate variation affects the repayment capacities of banks and borrowers.

For medium banks, the valuation ratio also shows a consistently positive market-sensitivity. During the first two regimes, β_m^k is unchanged, while the increase observed after 1981 is insignificant. The valuation ratio correlates positively with holding-period yields during each regime, but after the first switch on 77/2, the coefficient shifts significantly downward. In the last 7.5 years of the sample, the effective durations of bookable assets and liabilities appear to be nearly matched.

For the smallest banks, the valuation-ratio model works only a little better than the unbookable-equity model. Prior to the 76/4 switch, market sensitivity is significant and positive. Once the switch occurs, the model deteriorates, with no beta remaining significant. Once again, Table 6 portrays the shift as an increase in residual variance.

Comparison with Related Studies

Our results help to explain the diversity of interest-sensitivity estimates reported in previous studies (Lloyd and Shick, 1977; Lynge and Zumwalt, 1980; Chance and Lane, 1980; Flannery and James, 1984; Kane and Unal, 1988). Market models estimated from CRSP and DRI data show bank equity returns becoming interest-rate sensitive only after 1979. Prior to 1979, market-model evidence indicates insensitivity to interest rates. Tables 4 and 5 show that, for all but the smallest banks in our sample, ΔU_e is negatively and Δk is positively correlated with ex post bond returns prior to the first switch and that both coefficients (β_r^u and β_r^k) are significant. During the 1975-79 period, the impact of the separately significant β_r^u and β_r^k are therefore offsetting. The resulting "tendency to cancel out" clarifies how researchers could estimate an insignificant interest-rate beta (β_r) for the two-index model with data drawn from this interval. For the largest and medium-size banks that the cited authors studied, U_e loses its significant link to bond returns during 1979-85. Deleting this offsetting force permits movements in β_r to be dominated by movements in β_r^k. Eliminating this category of revaluation ought to increase the significance of β_r's in a two-index market model.

Even though both interest-sensitivity terms decline in magnitude during the late 1970s, the overall interest sensitivity of bank stock need not decline. A stock's overall interest sensitivity reflects the net contribution of both interest-rate betas. For the largest and medium-size banks, the interest-sensitivity of off-balance-sheet items not only declines in magnitude but begins a drift to insignificance in 1977. Hence, one cannot reject the hypothesis that once the shifts complete themselves, the interest sensitivity of bank stock in these size classes depended entirely on the interest sensitivity of the valuation ratio.

VIII. Diagnostic Regression Experiments

Table 7 reports a series of regressions that investigate for the SMVAM how well our three-way size partition controls for heteroskedasticity and intrasample differences in k and U_e. The first panel estimates k and U_e for the country's nine largest banks. These money-center banks consist of Citibank and the eight banks that Sinkey (1986, p. 249) reports that its staff labels as close competitors. Without exception, estimates of k lie above and estimates of U_e lie below parallel estimates for the 25 largest banks reported in Table 1 (often substantially so). The magnitude of these differences suggests that these giant banks deserve a class of their own and leads us to ask whether the 16 other large banks might be reclassified into the medium group. Moreover, the very high k values assigned money-center banks in the early quarters of our sample are inconsistent with a zero correlation at these dates between book value and unbookable equity (which for these giant banks includes the value of numerous affiliates).

As an alternative to reclassification, the second panel of the table examines what happens when for the largest 25 banks the flexible form (3) is respecified as a quadratic equation:

$$MV = U_e + (k_o + k_1 BV) BV + e_Q. \qquad (14)$$

(14) models the valuation ratio k as a function of BV. Table 7 tells us that for large banks k generally increases with bank size; but after 1980 never significantly so. Substantial bleeding of unbookable equity into k seems to be limited primarily to money-center banks during 1975-79. Parallel but unreported runs for medium and small banks reveal different patterns. Medium banks generally show a negative k_1; this coefficient proves significant two-thirds of the time before 1980 but only one-third of the time thereafter. At small banks, k_1 varies in sign and is almost never significant.

The third panel of Table 7 estimates the SMVAM for the 25 largest banks after deflating all variables in equation (3) by BV. This deflation would correct exactly for heteroskedasticity if e in (3) were to equal the product of a random error e_D and BV. In any case, the indicated transformation reweights individual observations, raising the weight of observations drawn from smaller members of the large-bank sample relative to money-center banks. Before 1980, deflated estimates of U_e and k for large banks lie closer to the undeflated estimates for medium than for large banks. From 1981 on, the deflated estimates for large banks look much like the undeflated ones. This supports the view that before 1980 the SMVAM should be estimated separately for money-center banks. Results from fitting the deflated model to money-center banks (not presented here) confirm this. In the money-center subsample, pre-1980 estimates of k and U_e are broadly similar to those of the undeflated model. The main difference is that three-fourths of the U_e estimates become significant at 5 percent. Using this information to interpret the third panel of Table 7 assures us that deflated pre-1980 estimates of unbookable equity at the next 16-largest banks would be positive, with valuation ratios much more like those shown for medium-size banks in Table 1. Taken together, these sensitivity tests underscore the value of undertaking pooling tests to partition sample banks optimally.

We also tested the unit constraint on the lagged coefficients for U_e and k built into the first-difference specifications (5) and (6). To do this, we ran unconstrained regressions of U_{et} and k_t on their respective (t-1)-values, R_{mt}, and R_t over the time span of each regime identified in Table 2. Only one of the 14 lagged coefficients differs significantly from unity at 5 percent.

IX. Directions for Further Research

The reconceptualization established in this paper offers four directions for future research: sequential estimation, model respecification, sample selection, and data partition. Under the identifying restrictions and recursive structure employed here, sequential estimators of U_e, k and the various betas can be regarded as consistent instrumental-variable or method-of-moment estimators (Kmenta, 1971, pp. 559-567; Newey, 1984). To the extent that the recursive model is only an approximation or U_e and k are improperly identified, the estimates of k and U_e employed as input into second-round regressions add a measurement error to the model-approximation errors envisaged in (5) and (6). Although this complication could be addressed by estimating k, U_e, and the betas simultaneously, this would greatly expand the parameter space over which costly Goldfeld-Quandt search routines would have to operate. In our judgment,a more promising approach is to await the development of attractive instrumental-variable equations for the bookable and unbookable components of MV. Given a specification with less-oppressive identifying restrictions than our own, the GQRSM procedure could be adapted to explaining time-series observations for individual banks.

Model respecifications ought to focus on the possibility of finding omitted variables and the desirability of disaggregating accounting net worth into detailed asset and liability components. In principle, one could expand either stage of the model. Following the lead of arbitrage-pricing theory, one could expand the set of macroeconomic risk factors employed as regressors in the second-stage equations. In (3), one might also estimate distinctive valuation ratios for different classes of assets and liabilities. Our own preliminary attempts to make these extensions failed to improve upon the specifications reported here. It is difficult to expand the specification without developing a simultaneous-equations model of a bank's asset and liability decisions. Because existing bank portfolio models treat banks as enjoying monopoly power in at least some deposit and loan markets, they are ill-suited to representing the operations of large banks in 1975-1985. However, one might adapt Goldfeld's (1966) empirical model of bank behavior to serve this end.

At least three sample-selection issues merit attention. First, this study includes no observations on either mutual institutions or stock savings-and-loan associations and savings banks. Second, introducing data on the value of individual HCs' nonbank subsidiaries would sharpen the interpretation of U_e. Third, survivorship bias could be studied by applying the model to a set of institutions that went out of business between 1975 and 1985.

Finally, repartitioning our data would let us reinterpret our quarter-by-quarter models in at least two ways. One is to test and correct our regressions for richer forms of heteroskedasticity. A second is to use pooling tests for parameter variation to isolate the nature of meaningful differences in bank behavior. The size breakdown we employ represents a preliminary attempt at developing interpretable patterns of parameter similarities and differences, in which the partition itself is not tested for significance. Investigations aimed at finding optimal pooling procedures would also track changes over time in the composition of relevant classes.

X. Summary

This paper combines accounting estimates of a bank's net worth with capital-market information to estimate a well-interpreted flexible-form model of the values of the firm's net bookable and unbookable assets. By permitting regime changes in the valuation models that reset market values each quarter, our methods provide new insight into changes in: (1) the market and interest sensitivity of a bank's stock and (2) the impact of off-balance-sheet positions on bank stock prices.

Our results show that the interest and market sensitivities of bookable and unbookable values often prove offsetting in sign. In particular, the evolution of the value and sensitivity of hidden capital at the nation's very largest banks after 1978 is consistent with the hypothesis (Kane, 1985) that during this period increases in the unbookable value of FDIC guarantees offset the bulk of market-induced and interest-induced losses on net bookable assets.

TABLE 1
Estimates of the Statistical Market-Value Accounting Model

MODEL: $MV = U_e + kBV + e$

Year.Qtr.	Largest 25 Banks			Medium-Size Banks				Smallest 25 Banks		
	U_e	k	R^2	U_e	k	R^2	N	U_e	k	R^2
1975.1	-365*	1.59**	.80	-9	0.77**	.70	54	-2	0.78	.60
.2	-420*	1.83**	.80	-18	0.90	.76	54	-4	0.86	.63
.3	-266*	1.28**	.82	-6	0.69**	.75	54	-9	0.82	.69
.4	-329*	1.42**	.82	-13	0.74**	.74	55	-11	0.85	.75
1976.1	-402*	1.66**	.84	-19	0.89	.75	54	-13	0.93	.70
.2	-422*	1.73**	.84	-25	0.93	.70	55	-18	0.99	.75
.3	-334*	1.46**	.86	-25*	0.91	.76	55	-22*	1.03	.76
.4	-372*	1.60**	.87	-29*	1.03	.75	55	-22*	1.17	.80
1977.1	-267*	1.32**	.89	-23	0.93	.75	55	-17	1.00	.81
.2	-246*	1.28**	.91	-27*	0.97	.78	55	-19	1.02	.80
.3	-225*	1.20**	.90	-20	0.88	.73	56	-10	0.90	.80
.4	-162	1.07	.90	-17	0.88	.72	56	-28*	1.10	.70
1978.1	-132	0.98	.89	-10	0.84**	.74	67	-7	0.92	.57
.2	-128	1.01	.92	-15	0.90	.75	67	-8	0.95	.56
.3	-191*	1.15**	.91	-16	0.93	.75	67	-10	1.01	.65
.4	-198*	1.04	.89	-13	0.80**	.76	67	-22	1.06	.67
1979.1	-167	0.98	.90	-15	0.83**	.77	67	-29*	1.14	.72
.2	-184*	1.05	.92	-17	0.84**	.76	67	-21	1.02	.66
.3	-146	1.01	.90	-22	0.90	.74	67	-26	1.13	.70
.4	-173	0.97	.89	-16	0.80**	.69	67	-34*	1.11	.67
1980.1	-123	0.79**	.88	-10	0.64**	.66	67	-19	0.82	.67
.2	-94	0.87**	.89	-10	0.75**	.63	67	-18	0.86	.69
.3	-23	0.76**	.88	-12	0.78**	.57	66	-1	0.76	.46
.4	-108	0.92	.87	-11	0.80**	.49	67	20	0.58**	.25
1981.1	31	0.81**	.86	-20	0.90	.45	67	-10	0.91	.40
.2	72	0.85**	.88	-41	1.06	.46	67	9	0.77	.28
.3	74	0.75**	.86	-9	0.78**	.44	67	-1	0.77	.34
.4	140	0.70**	.87	-4	0.81	.41	67	25	0.61	.17
1982.1	40	0.68**	.90	-7	0.74**	.56	89	8	0.69**	.55
.2	-19	0.64**	.88	-22	0.76**	.59	89	6	0.72	.53
.3	-31	0.68**	.89	-16	0.79**	.60	89	6	0.74**	.76
.4	-83	0.79**	.90	-31	0.95	.61	89	-3	0.90	.69
1983.1	-177	0.92	.90	-31	1.02	.66	97	-1	0.94	.89
.2	-33	0.87**	.90	-37	1.13**	.68	97	3	0.99	.85
.3	80	0.75**	.87	-45*	1.20**	.74	97	-1	1.20	.69
.4	36	0.77**	.89	-29	1.11	.78	97	1	1.11	.80
1984.1	46	0.71**	.90	-11	0.99	.70	97	7	1.00	.75
.2	74	0.60**	.84	-7	0.92	.71	97	1	1.01	.76
.3	95	0.70**	.85	-25	1.08	.79	97	-3	1.07	.85
.4	-13	0.76**	.89	-19	1.11	.81	97	-9	1.21	.85
1985.1	-68	0.83**	.88	-46*	1.28**	.83	97	-11	1.27**	.85
.2	-134	0.95	.88	-35	1.39**	.82	97	-24	1.47**	.76
.3	75	0.72**	.82	65*	0.97	.70	97	-28	1.50**	.73

NOTES: (*) indicates an estimate of k that differs significantly from zero at 5 percent.
(**) indicates an estimate of U_e that differs significantly from unity at 5 percent.

N is the number of banks in the medium-size bank group in a given quarter.

TABLE 2
Likelihood-Ratio Tests to Determine the Number of Regimes in Effect for the Market and Interest-Rate Sensitivity of Unbookable Equity and The Valuation Ratio For the Three Bank Groups.

	Market and Interest Sensitivity of Unbookable Equity $-2 \log(L^*/L)^1$	Market and Interest Sensitivity of Valuation Ratio For Bookable Equity $-2 \log(L^*/L)^1$
I. Largest 25 Banks		
Test of one vs. two regimes	18.94	25.12
Test of two vs. three regimes	8.92*	6.44*
II. Medium Banks		
Test of one vs. two regimes	49.62	26.86
Test of two vs. three regimes	15.34	14.32
Test of three vs. four regimes	5.90*	8.70*
III. Small Banks		
Test of one vs. two regimes	17.36	17.14
Test of two vs. three regimes	4.78*	8.10*

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(1) Critical value for 6 d.f. at 5 percent significance is 12.592.

(*) The hypothesis that an additional regime exists is rejected at 5 percent significance.

TABLE 3
Outcomes of Goldfeld-Quandt Tests Identifying Most Likely Switch Dates and Gradualness of Switches in the Market and Interest-Rate Sensitivity of Unbookable Equity and the Valuation Ratio

Panel A: Market and Interest-Rate Sensitivity of Unbookable Equity

	First Switch	Second Switch
Largest 25 Banks		
Implied Date (Z^*)	78/3 (2.07)	
Gradualness parameter (σ^*)	4.33 (2.56)	
Medium Banks		
Implied Date (Z^*)	77/2 (1.23)	81/1 (2.30)
Gradualness parameter (σ^*)	0.08 (1.00)	0.56 (1.06)
Small Banks		
Implied Date (Z^*)	77/2 (0.72)	
Gradualness parameter (σ^*)	0.34 (0.48)	

Panel B: Market and Interest-Rate Sensitivity of the Valuation Ratio

	First Switch	Second Switch
Largest 25 Banks		
Implied Date (Z^*)	77/3 (2.25)	
Gradualness parameter (σ^*)	3.47 (1.96)	
Medium Banks		
Implied Date (Z^*)	77/2 (1.09)	80/4 (1.87)
Gradualness parameter (σ^*)	1.19 (1.47)	0.59 (0.41)
Smallest 25 Banks		
Implied Date (Z^*)	76/4 (3.04)	
Gradualness parameter (σ^*)	0.20 (4.00)	

Standard errors in parentheses.

TABLE 4

Maximum-Likelihood Estimates of Regime Parameters for the Second-Stage Model for the Market and Interest-Rate sensitivity of Unbookable Equity.

Model: $U_{et} - U_{e,t-1} = \beta^{u}_{k} + \beta^{u}_{mk} R_{mt} + \beta^{u}_{rk} R_{t} + V_{tk}$

	Largest 25 Banks	Medium Banks	Smallest 25 Banks
Starting Year/Qtr	75/2	75/2	75/2
β^{u}_{1}	58.54*	2.00	-1.59
	(3.95)	(1.28)	(-1.36)
β^{u}_{m1}	-432.04*	-28.12*	6.91
	(3.71)	(-2.27)	(0.73)
β^{u}_{r1}	-795.46*	-81.85*	-26.60
	(2.32)	(-2.17)	(0.93)
σ^{u}_{v1}	35.20	3.61	2.74
R^2	0.76	0.69	0.10
Ending Year/Qtr.	78/3	77/2	77/2
Starting Year/Qtr.	78/4	77/3	77/3
β^{u}_{2}	-1.28	3.13*	-0.71
	(-0.07)	(3.09)	(0.29)
β^{u}_{m2}	185.60	-34.68*	15.29
	(1.00)	(3.43)	(0.59)
β^{u}_{r2}	-220.36	9.57	-14.15
	(1.11)	(0.88)	(0.49)
σ^{u}_{v2}	77.74	3.04	11.97
R^2	0.06	0.42	0.01
Ending Year/Qtr.		81/1	
Starting Year/Qtr.		81/2	
β^{u}_{3}		7.84	
		(1.17)	
β^{u}_{m3}		-160.33*	
		(2.23)	
β^{u}_{r3}		52.58	
		(0.58)	
σ^{u}_{v3}		24.44	
R^2		0.20	
Ending Year/Qtr.	85/3	85/3	85/3

t values in parentheses; (*) significant at 5 percent.

TABLE 5

Maximum-Likelihood Estimates of Regime Parameters for the Second-Stage Model for the Market and Interest-Rate sensitivity of the Valuation Ratio.

Model: $k_t - k_{t-1} = \beta_j^k + B_{mj}^k R_{mt} + B_{rj}^k R_t + W_{tj}$

	Largest 25 Banks	Medium Banks	Smallest 25 Banks
Starting Year/Qtr	75/2	75/2	75/2
β_1^k	-0.23*	-0.06*	0.02
	(3.52)	(3.21)	(1.61)
β_{m1}^k	1.67*	0.71*	0.23*
	(3.71)	(5.41)	(3.05)
β_{r1}^k	2.60*	1.17*	0.26
	(1.91)	(2.47)	(0.92)
σ_{w1}^k	0.12	0.04	0.02
R^2	0.81	0.90	0.69
Ending Year/Qtr.	77/3	77/2	76/4
Starting Year/Qtr.	77/4	77/3	77/1
β_2^k	-0.04*	-0.05*	-0.01
	(2.18)	(7.24)	(0.37)
β_{m2}^k	0.33*	0.72*	0.28
	(1.94)	(10.15)	(1.05)
β_{r2}^k	0.49*	0.16*	0.30
	(2.60)	(2.11)	(1.01)
σ_{w2}^k	0.08	0.02	0.12
R^2	0.40	0.92	0.10
Ending Year/Qtr.		80/4	
Starting Year/Qtr.		81/1	
β_3^k		-0.04	
		(1.38)	
β_{m3}^k		1.18*	
		(3.70)	
β_{r3}^k		0.08*	
		(1.93)	
σ_{w3}^k		0.11	
R^2		0.50	
Ending Year/Qtr.	85/3	85/3	85/3

t values in parentheses; (*) significant at 5 percent.

TABLE 6

Likelihood-Ratio Tests of Shifts in Second-Stage Model Parameters for Market and Interest-Rate Sensitivity of Unbookable Equity and Valuation Ratio.(1)

I. Unbookable Equity

Parameter Restriction	Largest 25 Banks	Medium Banks	Smallest 25 Banks
$\beta_1^u = \beta_2^u$	6.08*	0.38	0.12
$\beta_2^u = \beta_3^u$	-	1.82	-
$\beta_{m1}^u = \beta_{m2}^u$	7.36*	1.44	0.10
$\beta_{m2}^u = \beta_{m3}^u$	-	2.88	-
$\beta_{r1}^u = \beta_{r2}^u$	1.88	5.58*	0.10
$\beta_{r2}^u = \beta_{r3}^u$	-	0.24	-
$\sigma_{v1}^u = \sigma_{v2}^u$	7.92*	1.70	17.02*
$\sigma_{w2}^u = \sigma_{w3}^u$	-	41.26*	-
II. Valuation Ratio for Bookable Equity			
$\beta_1^k = \beta_2^k$	9.30*	0.02	1.12
$\beta_2^k = \beta_3^k$	-	0.00	-
$\beta_{m1}^k = \beta_{m2}^k$	6.92*	0.00	0.04
$\beta_{m2}^k = \beta_{m3}^k$	-	1.94	-
$\beta_{r1}^k = \beta_{r2}^k$	2.64	4.76*	0.02
$\beta_{r2}^k = \beta_{r3}^k$	-	-0.04	-
$\sigma_{w1}^k = \sigma_{w2}^k$	3.34	3.54	16.84
$\sigma_{w2}^k = \sigma_{w3}^k$	-	29.80*	-

(1) The test statistic is -2log(L*/L), where L* and L are restricted and unrestricted maximum-likelihood values. Critical value for one d.f. at 5 percent is 3.84.

(*) significant at 5 percent.

Table 7: Diagnostic Regressions

	SMVAM for 9 Money Center Banks			Quadratic Specification of SMVAM for 25 largest Banks				Deflated SMVAM for 25 Largest Banks		
	$MV = U_e + kBV + e$			$MV = U_e + k_o BV + k_1 BV^2 + e_Q$				$MV/BV = U_e\left(\frac{1}{BV}\right) + k + e_D$		
	U_e	k	R^2	U_e	k_o	k_1	R^2	U_e	k	R^2
75/1	-1005	2.05**	0.80	312	-0.31**	0.0009*	0.88	-6	0.96	0.00
2	-1098	2.31**	0.79	310	-0.17	0.0009*	0.87	-4	1.12	0.00
3	- 779	1.63	0.83	234	-0.06**	0.0006*	0.88	19	0.81	0.00
4	- 933	1.82**	0.83	265	-0.14**	0.0007*	0.89	10	0.86	0.00
76/1	-1109	2.12**	0.85	295	-0.13**	0.0007*	0.91	-10	1.03	0.00
2	-1128	2.17**	0.85	271	-0.01	0.0007*	0.90	-22	1.09	0.00
3	- 928*	1.82**	0.87	243	0.06**	0.0005*	0.92	-20	0.98	0.00
4	-1017	1.96**	0.87	267	0.10**	0.0006*	0.92	-28	1.08	0.01
77/1	- 746	1.59**	0.89	202	0.24**	0.0004*	0.93	-3	0.94	0.00
2	- 655	1.50**	0.91	140	0.41	0.0003*	0.94	-28	0.96	0.01
3	- 615	1.41	0.89	116	0.45	0.0003*	0.92	-33	0.93	0.01
4	- 524	1.25	0.90	150	0.40**	0.0002*	0.93	-1	0.85	0.00
78/1	- 487	1.16	0.88	143	0.41**	0.0002*	0.91	12	0.79**	0.00
2	- 463	1.17	0.92	146	0.45**	0.0002*	0.93	12	0.83	0.00
3	- 630	1.35	0.91	146	0.49	0.0002*	0.93	-28	0.95	0.01
4	- 651	1.24	0.89	162	0.35**	0.0002*	0.92	-31	0.84	0.01
79/1	- 585	1.17	0.90	132	0.43**	0.0002*	0.92	-28	0.82	0.01
2	- 602	1.22	0.92	99	0.54	0.0001*	0.93	-62	0.91	0.04
3	- 592	1.19	0.90	141	0.51	0.0001	0.91	-24	0.88	0.00
4	- 638	1.15	0.90	147	0.42**	0.0001*	0.91	-38	0.83	0.01
80/1	- 422	0.91	0.87	82	0.45**	0.0001	0.90	-32	0.70**	0.04
2	- 456	1.00	0.91	145	0.48**	0.0001	0.96	41	0.73**	0.01
3	- 362	0.88	0.90	227	0.37**	0.0001	0.90	66	0.67**	0.03
4	- 593	1.09	0.90	268	0.36**	0.0001	0.89	38	0.79	0.01
81/1	- 357	0.94	0.91	310	0.40**	0.0001	0.87	104	0.75	0.04
2	- 220	0.94	0.95	159	0.72	0.0000	0.88	49	0.88	0.01
3	- 237	0.85	0.94	221	0.55	0.0000	0.86	161	0.67**	0.06
4	- 133	0.79**	0.97	271	0.53	0.0000	0.87	209	0.64**	0.10
82/1	- 176	0.76**	0.96	162	0.53**	0.0000	0.90	114	0.62**	0.05
2	- 303	0.73**	0.94	172	0.39**	0.0001	0.89	89	0.55**	0.06
3	- 300	0.76**	0.90	180	0.42**	0.0001	0.90	63	0.60**	0.02
4	- 405	0.89	0.91	155	0.51**	0.0001	0.91	8	0.73**	0.00
83/1	- 631	1.06	0.88	261	0.41**	0.0001*	0.92	-25	0.81**	0.00
2	- 599	1.02	0.92	311	0.48**	0.0001	0.91	25	0.83	0.00
3	- 377	0.87	0.89	310	0.49**	0.0001	0.88	94	0.75**	0.03
4	- 482	0.90	0.90	373	0.39**	0.0001	0.90	105	0.72**	0.05
84/1	- 426	0.83	0.92	337	0.40**	0.0001	0.91	130	0.66**	0.06
2	- 273	0.68**	0.87	341	0.31**	0.0001	0.85	59	0.62**	0.01
3	- 216	0.77	0.85	377	0.40**	0.0001	0.86	47	0.74**	0.01
4	- 298	0.82	0.88	199	0.54**	0.0000	0.89	-15	0.76**	0.00
85/1	- 348	0.89	0.84	187	0.58	0.0000	0.89	-105	0.86	0.04
2	- 613	1.06	0.87	228	0.60	0.0001	0.89	-91	0.93	0.01
3	- 428	0.83	0.83	482	0.33**	0.0001	0.84	119	0.70**	0.02

Notes: (*) indicates an estimate of U_e or k_1 that is significantly different from zero at 5 percent.

(**) indicates an estimate of k or k_o that is significantly different from unity at 5 percent.

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