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A DISAGGREGATED STRUCTURAL MODEL OF THE TREASURY SECURITIES, CORPORATE BOND, AND EQUITY MARKETS: ESTIMATION AND SIMULATION RESULTS

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ABSTRACT

The estimation and simulation results of a disaggregated structural model of U.S. security markets are presented in this paper. The model consists of estimated demands for corporate bonds, equities, and four distinct maturity classes of Treasury securities by 11 categories of investors. The model is closed with the addition of six market-clearing identities equating market demands with exogenous supplies. The empirical results provide support to the model's specification and indicate that the "within-sample forecasts" of the six endogenous security yields closely track historical data.

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A DISAGGREGATED STRUCTURAL MODEL OF THE TREASURY SECURITIES, CORPORATE BOND, AND EQUITY MARKETS: ESTIMATION AND SIMULATION RESULTS

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The purpose of this paper is to present the estimation and simulation results of a disaggregated structural model of U.S. security markets. The model consists of estimated demands for corporate bonds, equities, and four distinct maturity classes of Treasury securities. Demands for these various types of securities are estimated for disaggregated categories of investors corresponding to the Federal Reserve's flow-of-funds accounts [2]. In total, 51 demand equations are estimated. Combining these 51 estimated demands with six market-clearing identities equating market demands with exogenous security supplies enables the model to determine six endogenous security yields.

Although the model presented in this paper is in many respects similar to other flow-of-funds models, it has several distinguishing features. In particular, the model differs from those constructed by Silber [19] and Bosworth and Duesenberry [3] in that these models do not use the market-clearing supply-demand framework to determine security yields. The model is also more highly disaggregated than the market-clearing supply-demand models presented by Hendershott [10] and Backus, Brainard, Smith, and Tobin [1], and it is more comprehensive than Friedman's [5] model which only includes corporate bonds.[1/]

In comparison to unrestricted reduced-form models of interest rate determination, disaggregated structural models in general have two principal advantages.[2/] First, portfolio behavior theories—such as the mean-variance approach advanced by Markowitz [12] and Tobin [21]—may be used to restrict the implied equations for interest rates. Second, various hypotheses concerning investors' portfolio behavior and the underlying determinants of interest rates may be directly examined thereby avoiding the problem of spurious correlation inherent in unrestricted reduced-form estimation. In this respect, various subsets of the complete model presented here have been used to examine a variety of hypotheses. In particular, previous papers have investigated the determinants of the Treasury security yield curve [15], the impact of interest rate variability on the level of interest rates [14], the impact of changes in commercial bank portfolio behavior on the Treasury security yield curve [17], the effectiveness of Federal debt management policy [13,18], and potential crowding-out effects associated with debt-financed Federal deficits [16].

Following this introductory section, the specification of the disaggregated structural model of U.S. security markets is presented in the first section of this paper. Estimation results along with discussions of data and estimation techniques are given in the second section. In the third section, market-clearing identities are combined with the estimated demands to solve for the six endogenous security yields. The within-sample fit of security yields are examined in both static and dynamic simulations. The estimation and simulation results are briefly summarized in the final section.

I. Specification of the Model

The methodology used to specify investors' security demands involves the familiar objective of considering the allocation of existing portfolio wealth and a given net wealth flow within a one-period investment horizon. This approach is implemented through the use of portfolio adjustment models that form short-run asset demands from expressions representing desired long-run proportional asset holdings. Derivations of desired proportional asset holdings are not dealt with at length here, but Friedman and Roley [8] have shown that linear homogeneous expressions for desired asset holdings are consistent with expected utility maximizing behavior. To operationally represent the effects of both means and variances of holding-period yields, expressions derived from expected utility maximization may be linearized as

$$\underline{\alpha}_t^* = \underline{A}_t^*/W_t = \underline{b} + B_1\underline{\mu}_t + B_2\underline{\sigma}_t, \tag{1}$$

where $\underline{\alpha}_t^*$ = Nx1 vector of the investor's desired proportional holdings of assets at time t($\underline{\alpha}_t^{*\prime}\underline{1} = 1$)

$\underline{A}_t^*$ = Nx1 vector of the investor's desired holdings of assets at time t ($\underline{A}_t^{*\prime}\underline{1} = W_t$)

W_t = the investor's total portfolio size (wealth) at the end of time t

$\underline{\mu}_t$ = Nx1 vector of expected holding-period yields at time t

$\underline{\sigma}_t$ = Nx1 vector of variances of holding-period yields at time t

$\underline{b},B_1,B_2$ = Nx1 vector and NxN matrices of coefficients, respectively.

The usual "adding-up" properties imply $\underline{1}'\underline{b} = 1$, $\underline{1}'B_1 = \underline{0}$, and $\underline{1}'B_2 = \underline{0}$. In addition, most derivations of desired asset holdings consistent with (1) imply non-negative coefficients on expected own-yields and coefficients on competing asset yields with signs that are unknown *a priori*.

Short-Run Portfolio Adjustment Models. The desired holdings of assets derived from portfolio theory may not fully describe the actual short-run demand for assets. The difference may result from the partial adjustment of asset holdings to desired levels due to transactions costs. Transactions costs may arise from brokerage fees and price effects resulting from asset illiquidities. Other transactions costs may take the form of indirect costs which could arise, for example, from the increased overhead costs associated with a greater level of activity in a specialized form of trading.

Because of the diverse institutional and behavioral characteristics of the categories of investors considered in this study, several different adjustment models are used to represent the effects of transactions costs on investors' short-run portfolio allocation. The most general form of the adjustment model includes five properties that are additional to the standard stock adjustment model: (i) new investable financial flows separately affect portfolio adjustment because of differential transactions costs; (ii) the allocation of new investable financial flows is dependent on the holding-period yields of the endogenous assets in the portfolio; (iii) new investable financial flows affect the reallocation of assets already in the portfolio; (iv) positive and negative new investable financial flows have asymmetric effects; and (v) different sources of funds comprising new investable financial flows are allocated differently. All of the adjustment models used for the individual investor categories may be classified by a subset of these properties. In addition, each adjustment model includes properties (i) and (ii).

The model in its most general form, incorporating all five of the properties listed above, may be written as 3/

$$\Delta A_{it} = \sum_{k}^{N} \Theta_{ik}(\alpha^*_{kt}W_{t-1} - A_{k,t-1}) + \sum_{kj'}^{NJ}\sum \psi^{j'}_{ik}(\Delta A^{j'}_{t}/W_{t-1})(\alpha^*_{kt}W_{t-1} - A_{k,t-1})$$

$$+ \sum_{kj''}^{NJ}\sum \psi^{j''}_{ik}(\Delta A^{j''}_{t}/W_{t-1})(\gamma^*_{kt}W_{t-1} - A_{k,t-1}) + \sum_{j'}^{J} \pi^{j'}_{i}\Delta A^{j'}_{t}$$

$$+ \sum_{j''}^{J} \pi^{j''}_{i}\Delta A^{j''}_{t}, \qquad i = 1,\ldots,N. \qquad (2)$$

where ΔA_{it} represents net purchases of the i^{th} asset; the indices i and k ($i, k=1,\ldots,N$) are associated with endogenous assets; the indices j' and j'' ($j', j''= 1,\ldots,J$) are associated with exogenous assets and liabilities; the Θ_{ik}, ψ'_{ik}, ψ''_{ik}, $\pi^{j'}_{i}$, and $\pi^{j''}_{i}$ are fixed coefficients of adjustment; the $\Delta A^{j'}_{t}$ and $\Delta A^{j''}_{t}$ are flows of exogenous assets and liabilities such that the sum of these flows equals the flow of the total value of endogenous assets; and the α^*_{kt} and γ^*_{kt} are desired proportional holdings of assets conditional on positive and negative financial flows, respectively. The exogenous portion of the balance sheet is disaggregated to capture the possibly different short-run portfolio adjustments that may result from different sources of new investable funds. In addition, the positive and negative flows, with respect to the endogenous portion of the portfolio, are written as

$$\Delta A_t^{j'} = \begin{cases} \Delta A_t^j, \text{ if } A_t^j \text{ is a liability and } \Delta A_t^j > 0, \\ -\Delta A_t^j, \text{ if } A_t^j \text{ is an asset and } \Delta A_t^j < 0, \\ 0, \text{ otherwise,} \end{cases}$$

$$\Delta A_t^{j''} = \begin{cases} \Delta A_t^j, \text{ if } A_t^j \text{ is a liability and } \Delta A_t^j < 0, \\ -\Delta A_t^j, \text{ if } A_t^j \text{ is an asset and } \Delta A_t^j > 0, \\ 0, \text{ otherwise.} \end{cases}$$

The portfolio wealth constraint implies that the parameters of the adjustment model are subject to the following constraints: $\sum_i^N \Theta_{ik} = \overline{\Theta}$, for all k, $\sum_i^N \psi_{ik}^{j'} = \overline{\psi}^{j'}$, for all k and j′, $\sum_i^N \psi_{ik}^{j''} = \overline{\psi}^{j''}$, for all k and j′′, $\sum_i^N \pi_i^{j'} = 1$, for all j′, and $\sum_i^N \pi_i^{j''} = 1$, for all j′′.

The α^*_{kt} represent the desired proportional holdings of assets given previously in (1). They are, however, only applied to the positive financial flows (i.e., positive with respect to the endogenous portion of the portfolio) and the portfolio adjustment corresponding to the standard stock adjustment model (i.e., terms involving Θ_{ik}). The γ^*_{kt} differ from the α^*_{kt} in that the former explicitly represent desired short-run portfolio holdings conditional on negative financial flows.

That is, the γ^*_{kt} are included to allow for possible asymmetric effects of expected holding-period yields and variances of holding-period yields associated with positive and negative financial flows.[4/] These asymmetric effects may result from different transactions costs for purchasing and selling assets, and from different behavior regarding unrealized capital gains and losses on existing assets in the portfolio.

An adjustment model similar to (2)—except that new investable flows are not disaggregated—is a general model from which all others considered are special cases. This model incorporates properties (i) through (iv), and may be written as

$$\Delta A_{it} = \sum_k^N \Theta_{ik}(\alpha^*_{kt}W_{t-1} - A_{k,t-1}) + \sum_k^N \psi'_{ik}(\Delta W'_t/W_{t-1})(\alpha^*_{kt}W_{t-1} - A_{k,t-1})$$
$$+ \sum_k^N \psi''_{ik}(\Delta W''_t/W_{t-1})(\gamma^*_{kt}W_{t-1} - A_{k,t-1}) + \alpha^*_{it}\Delta W'_t + \gamma^*_{it}\Delta W''_t,$$
$$i = 1\ldots,N, \qquad (3)$$

where

$$\Delta W'_t = \begin{cases} \Delta W_t, \text{ if } \Delta W_t > 0, \\ 0, \text{ otherwise,} \end{cases}$$

$$\Delta W''_t = \begin{cases} \Delta W_t, \text{ if } \Delta W_t < 0, \\ 0, \text{ otherwise.} \end{cases}$$

The portfolio wealth constraint implies: $\sum_i^N \Theta_{ik} = \overline{\Theta}$, for all k, $\sum_i^N \psi'_{ik} = \overline{\psi}'$, for all k, and $\sum_i^N \psi''_{ik} = \overline{\psi}''$, for all k.

The terms in (3) relate to various sources of portfolio adjustment. The first terms describes standard stock adjustment. The second and third terms include the effects of financial flows on the reallocation of assets already in the portfolio dependent on the sign and magnitude of the financial flows. The final two terms involve the marginal allocation of investable financial flows according to desired proportional asset holdings, with the inclusion of asymmetric effects from positive and negative flows. The terms in (3) additional to the standard stock adjustment model may be statistically tested to determine the appropriateness of their inclusion. In fact, the remaining adjustment models considered are formed by constraining certain parameters in this model.

The subcases of (3) used in the empirical work may be classified according to their constraints. A model which includes properties (i) through (iii) may be derived from (3) by imposing the constraints

$$\psi''_{ik} = \psi'_{ik}, \text{ for all i and k,} \qquad \gamma^*_{kt} = \alpha^*_{kt}, \text{ for all k.} \tag{3a}$$

These are straightforward constraints for categories of investors with strictly positive new investable financial flows throughout a given sample period. The interpretation of this model follows from the discussion concerning (3).

An adjustment model including properties (i), (ii), and (iv) may be derived from (3) by imposing the constraint

$$\psi''_{ik} = \psi'_{ik} = 0, \text{ for all i and k.} \tag{3b}$$

The application of (3b) implies that positive and negative financial flows are allocated asymmetrically. The model does not include the possibility that new investable financial flows affect the portfolio reallocation of previously held assets. This model does, however, have the distinct advantage of allowing the identification of the α^*_{it} and γ^*_{it} terms from the estimated coefficients on the flow terms in any single asset demand equation. In contrast, when the adjustment model given by (3) is applied to a single asset demand, the coefficients on the flow terms are not directly interpretable in terms of the structural parameters of the underlying models.

The final subcase of (3) used in the empirical work is the "optimal marginal adjustment" model devised by Friedman [5]. This model includes properties (i) and (ii), and may be derived from (3) by imposing the constraints

$$\psi''_{ik} = \psi'_{ik} = 0, \text{ for all i and k,}$$
$$\gamma^*_{kt} = \alpha^*_{ki}, \text{ for all k.} \tag{3c}$$

It is apparent that the "optimal marginal adjustment" model is also a special case of the adjustment models in (3a) and (3b). Thus, the corresponding constraints are testable in each case.

II. Estimation Results

The investor categories included in the disaggregated structural model are indicated in Table 1. The investor categories with endogenous demands hold 95 percent of the total amount of outstanding Treasury securities net of Federal Reserve System and foreign holdings, 96 percent of the total supply of corporate bonds, and 97 percent of the total supply of equities.5/ Following preliminary discussions concerning data and estimation techniques, the estimated structural demand equations are presented.

Data. The primary data source for the financial stock and flow variables is the Federal Reserve System's flow-of-funds accounts [2]. Quarterly observations are used, with the sample period beginning in 1960:I and ending in 1975:IV.

The data for Treasury securities consist of four weighted maturity classes of Federal debt that are consistent with the flow-of-funds accounts. (See Taylor and Wood [20].) The data are defined in terms of four "definite" areas and three "borderline" areas. The definite areas include the following maturities: (1) within 1 year (short-term), (2) 2 to 4 years (short-intermediate-term), (3) 6 to 8 years (long-intermediate-term), and (4) over 12 years (long-term). Treasury securities with maturities in the borderline areas are allocated to the definite classifications according to a weighting scheme. In particular, if n is the number of months in a borderline area, then the securities are allocated to the immediately preceding and successive definite maturity classes according to the following pairs of weights:

$$\left[\frac{n}{n+1}, \frac{1}{n+1}\right], \left[\frac{n-1}{n+1}, \frac{2}{n+1}\right], \ldots, \left[\frac{1}{n+1}, \frac{n}{n+1}\right],$$

where maturity is increasing from left to right.[6/] The principal advantage of this procedure is that it avoids the otherwise perverse effects that occur when large debt issues cross fixed maturity boundaries.

Each financial flow variable, corresponding to the individual assets of the 10 investor categories, is defined in terms of seasonally adjusted net changes during the quarter. The variables representing wealth flows correspond to the division of the investors' portfolios into endogenous and exogenous parts. For households, other insurance companies, state and local government general funds, and state and local government retirement funds, the wealth flow variables are defined as quarterly net acquisitions of financial assets, seasonally adjusted. For nonfinancial corporate businesses, the wealth flow is defined as the quarterly net change of liquid assets, seasonally adjusted. For life insurance companies, the wealth flow is defined as the quarterly net acquisition of financial assets, seasonally adjusted, minus the similarly defined measure for the net change in policy loans. The wealth flow variables for mutual savings banks and savings and loan associations are quarterly net acquisitions of financial assets, seasonally adjusted, minus the corresponding measures for net changes in mortgages.[7/] The wealth flow variable for commercial banks is disaggregated in terms of the exogenous variables that form its aggregative value.[8/] The aggregative value equals the quarterly net acquisition of financial assets, seasonally adjusted, minus similarly defined measures for mortgages, bank loans, consumer credit, security credit, and required reserves.[9/]

Financial stock variables, including individual asset stocks and total portfolio wealth, are formed by decrementing seasonally adjusted quarterly flows from the value of yearend outstandings in 1975:IV. This procedure serves to guarantee the mutual consistency of the asset stock and flow data throughout the sample period. When asset stock data contain market valuation changes, these components are included without seasonal adjustment.

The endogenous yields correspond to the published series for the 3-month Treasury bill yield, the 3-5 year Treasury security yield, the long-term (10 year and over) Treasury security yield, the yield on new issues of corporate bonds (Aa utilities), Standard and Poor's dividend-price ratio, and a weighted average of yields on Treasury securities maturing in 6, 7, and 8 years for the long-intermediate-term yield. When statistically significant, distributed lags on the percentage change of the Standard and Poor's composite common stock price index are also included to represent expected capital gains or losses on equities.[10/] The descriptions of other variables—such as other security yields, variances, and measures of inflation—are given in the summary of variable symbols following the estimated equations.

Estimation Techniques. The individual asset demand equations for each investor category are formed by substituting (1) into the relevant adjustment model. It is impossible to estimate equations in this form, however, because both lagged wealth and the lagged stocks of assets that comprise it are included as right-hand side variables. This problem may be alleviated by a prior zero constraint on at least one of the coefficients of these variables, or by substituting either for the lagged wealth variable or any lagged asset stock according to the expression for the wealth identity. Prior to either of these latter substitutions, the adjustment model parameters corresponding to the simple stock adjustment model (Θ_{ik}, for all k) are identified. However, after either of these substitutions, the coefficients on lagged asset stocks are linear combinations of the parameters of the adjustment model. Therefore, these parameters are in general no longer identified.

The structure of a supply-demand market-clearing model necessitates the use of simultaneous equations estimation techniques. This is the case because yields on securities are jointly dependent variables along with investors' demands. Thus, ordinary least squares estimation results in inconsistent estimates. Because the direct application of 2SLS is not possible due to the undersized sample problem—i.e., more predetermined variables than sample observations—the application of an instrumental variables technique described by Brundy and Jorgenson [4] is used to gain consistent estimates for the structural equations.

The particular instrumental variables procedure used involves replacing current values of dependent variables appearing in the right-hand side of the structural equations with fitted values obtained from a first-stage regression. The first-stage regression for an individual structural equation has right-hand side variables consisting of a subset of the principal components of the entire set of predetermined variables in the system of equations, augmented by the set of predetermined variables appearing in the individual structural equation. In addition, since the dependent variables being instrumented appear as products with either wealth flows or stocks, the proper procedure is to instrument the entire multiplicative term.

Due to the approximations utilized in the modeling of commercial banks, mutual savings banks, and savings and loan associations, several variables were included as exogenous while they may properly be viewed as endogenous in an implicit formulation of a larger model. Thus, instruments were also formed, by the procedure outlined immediately above, for terms involving contemporaneous values of assets appearing in the equations for these investor categories. For commercial banks, these consist of variables for current values of mortgages, loans, consumer credit, security credit, and adjusted wealth flows. For mutual savings banks and savings and loan associations, these consist of current adjusted wealth flows.

Estimation Results for the Structural Equations. The security demand equations are estimated over 64 quarterly observations beginning in 1960:I and ending in 1975:IV using the instrumental variables procedure.[11] The short-run demands are specified by applying one of the adjustment models (2), (3), (3a), (3b), or (3c) to the expression for desired long-run portfolio composition (1). The most general adjustment model (2) is applied to commercial banks. Nonfinancial corporate businesses are specified with (3). Households and state and local government general funds use adjustment model (3a). Adjustment model (3b) is applied to mutual savings banks and savings and loan associations. The "optimal marginal adjustment" model (3c) is used for life insurance companies, other insurance companies, private pension funds, and state and local government retirement funds. The choice for each investor category is based on preliminary tests using ordinary least squares estimation. In particular, in each case the general adjustment models (2) and (3) were tried, and successively more restrictive models were adopted until an additional constraint could be rejected statistically. The different adjustment models found applicable to the various investor categories accentuate the importance of disaggregation.

The complete set of estimated equations are presented by investor category in Tables 2 through 12. The dependent variables are net purchases of short-term Treasury securities (ΔUS1), short-intermediate-term Treasury securities (ΔUS2), long-intermediate-term Treasury securities (ΔUS3), long-term Treasury securities (ΔUS4), corporate bonds (ΔCB), and equities (ΔEQ). Based on the summary statistics presented in each table, the short-run portfolio adjustment models capture much of the variation in the net purchases of these securities. Individual coefficient estimates also provide support to the specification of the model. For example, all own-yields and own-stock adjustment parameters have the anticipated signs, and virtually all are highly statistically significant. Other properties of the estimated security demands are discussed in detail elsewhere. (See Roley [15,17,18].)

III. Simulation Results

The 51 estimated equations are combined with six market-clearing identities equating market demands with exogenous supplies to simultaneously determine the six endogenous yields and 51 endogenous security demands.[12/] The endogenous variables are determined in this framework using both static and dynamic simulations beginning in 1960:I and ending in 1975:IV. The dynamic simulation differs from the static (or one-period) simulation in that the former uses simulated values for all lagged endogenous variables. In addition to the complete-model simulations, the individual sub-markets are simulated separately.

The results from these simulations are summarized in Table 13. In particular, the mean errors (ME) and root-mean-square errors (RMSE) are reported for security yields. Several aspects of these results are of interest.

TABLE 1

TREASURY SECURITIES, CORPORATE BONDS, AND EQUITIES OUTSTANDING AS OF YEAREND 1975

	Treasury Securities[1]		Corporate Bonds		Equities	
	Amount	Percent	Amount	Percent	Amount	Percent
Federal Reserve System	$ 87.9 b	23.5 %	--	--	--	--
Commercial Banks	84.6	22.6	8.6	2.7	0.9	0.1
Foreign	66.5	17.8	2.6	0.8	26.7	3.1
Households*	49.0	13.1	65.9	20.8	630.5	73.8
State-Local General Funds†	30.6	8.2	--	--	--	--
Nonfinancial Corporate Businesses†	14.3	3.8	--	--	--	--
Private Pension Funds*	7.9	2.1	37.8	11.9	88.6	10.4
Savings and Loan Associations†	5.4	1.4	--	--	--	--
Credit Unions	5.0	1.3	--	--	--	--
Life Insurance Companies*	4.7	1.3	105.5	33.3	28.1	3.3
Mutual Savings Banks*	4.7	1.3	17.5	5.5	4.4	0.5
Other Insurance Companies*	4.7	1.3	12.2	3.8	14.3	1.7
Sponsored Credit Agencies	3.4	1.0	--	--	--	--
State-Local Retirement Funds*	2.2	0.6	60.9	19.2	25.8	3.0
Security Brokers and Dealers	2.1	0.6	1.4	0.4	1.7	0.2
Investment Companies‡	1.1	0.3	4.8	1.5	33.7	3.9
Total	374.1	100.0	317.2	100.0	854.7	100.0

Notes:

Source: Board of Governors of the Federal Reserve System [2].
Amounts are in billions of dollars.
Detail may not add to total because of rounding.
[1]Agency issues and non-negotiable savings bonds are excluded.
*Endogenous demands for all three types of securities.
†Endogenous demands only for Treasury securities.
‡Endogenous demands only for equities.

TABLE 2

COMMERCIAL BANKS

Equation	Lagged Stocks: $US1_{-1}$	$US2_{-1}$	$US3_{-1}$	$US4_{-1}$	CB_{-1}	SL_{-1}	CP_{-1}	USA_{-1}
ΔUS1	-.1558 (-4.3)	.2284 (6.0)			1.699 (7.5)	-.3214 (-6.8)	2.363 (5.1)	
ΔUS2	.1598 (3.5)	-.1987 (-5.8)				.2650 (4.3)	-2.347 (-3.9)	
ΔUS3(60:I-65:I)			-.2136 (-1.7)					.6576 (1.8)
ΔUS3(65:II-75:IV)	.3126 (7.3)		-.7541 (-10.1)			.3406 (11.6)	-2.691 (-7.7)	
ΔUS4(60:I-65:I)				-.6691 (-6.6)				
ΔUS4(65:II-75:IV)		.01089 (1.7)		-.2558 (-3.8)				

	$(\Delta DD/W_{-1})\cdot$Lagged Stocks	$(\Delta DD/W_{-1})\cdot$Lagged Stocks			$(\Delta TD/W_{-1})\cdot$Lagged Stocks				
	USA_{-1}	$US2_{-1}$	$US3_{-1}$	SL_{-1}	$US1_{-1}$	$US2_{-1}$	$US3_{-1}$	CP_{-1}	USA_{-1}
ΔUS1			5.967 (2.0)	5.312 (2.6)			7.607 (4.8)		
ΔUS2	-4.384 (-1.7)		-2.563 (-1.2)	-1.966 (-1.7)	-3.044 (-2.8)			22.14 (4.1)	
ΔUS3(60:I-65:I)									
ΔUS3(65:II-75:IV)		-1.604 (-2.9)				2.174 (3.5)			-3.822 (-3.8)
ΔUS4(60:I-65:I)									
ΔUS4(65:II-75:IV)								-.7028 (-1.0)	

TABLE 2

(Continued)

	$(\Delta CD/W_{-1})$·Lagged Stocks		$(\Delta BL/W_{-1})$·Lagged Stocks		$(\Delta CC/W_{-1})$·Lagged Stocks				$(\Delta SC/W_{-1})$·Lagged Stocks
	$US1_{-1}$	USA_{-1}	$US2_{-1}$	$US4_{-1}$	$US3_{-1}$	$US4_{-1}$	SL_{-1}	CP_{-1}	$US4_{-1}$
ΔUS1						-104.4 (-3.4)	23.25 (4.6)	-251.4 (-4.4)	
ΔUS2	3.141 (3.3)	-5.740 (-3.5)			-66.20 (-4.6)	201.3 (4.8)	-19.18 (-3.4)	232.3 (3.6)	
ΔUS3(60:I-65:I)									
ΔUS3(65:II-75:IV)			-3.971 (-4.2)	82.52 (3.9)		335.7 (5.4)	-19.77 (-6.9)	156.3 (4.6)	
ΔUS4(60:I-65:I)									
ΔUS4(65:II-75:IV)			-.1325 (-1.5)						5.282 (1.5)

	$(\Delta MT/W_{-1})$·Lagged Stocks				R1·Flow					
	$US2_{-1}$	$US3_{-1}$	$US4_{-1}$	CP_{-1}	ΔDDP	ΔGDP	ΔTDP	ΔCDP	ΔBLN	ΔSCN
ΔUS1					.08893 (4.4)					-.2226 (-3.8)
ΔUS2		47.73 (4.0)				-.6708 (-2.7)	-.09387 (-3.3)		1.417 (2.2)	.1176 (1.9)
ΔUS3(60:I-65:I)										
ΔUS3(65:II-75:IV)	13.27 (3.5)		-387.9 (-4.3)							
ΔUS4(60:I-65:I)										
ΔUS4(65:II-75:IV)				.8819 (1.1)				-.01095 (-1.1)		

TABLE 2

(Continued)

	R2·Flow			R3·Flow				
	ΔDDP	ΔGDP	ΔBLN	ΔDDP	ΔGDP	ΔBLN	ΔSCN	ΔWP
ΔUS1								
ΔUS2	.07751 (1.8)	.9037 (3.9)	-1.082 (-2.1)					
ΔUS3(60:I-65:I)								.2310 (4.5)
ΔUS3(65:II-75:IV)				.01155 (1.8)	.1047 (4.2)	-.08696 (-6.2)	-1.879 (-2.6)	
ΔUS4(60:I-65:I)								
ΔUS4(65:II-75:IV)								

	R4·Flow					RS·Flow			Flow/R1	
	ΔDDP	ΔTDP	ΔCDP	ΔSCN	ΔWP	ΔGDP	ΔSCN	ΔWP	ΔCDN	ΔBLP
ΔUS1						-.3379 (-1.7)			1.953 (1.9)	-1.407 (-3.0)
ΔUS2										
ΔUS3(60:I-65:I)										
ΔUS3(65:II-75:IV)							2.515 (2.6)			
ΔUS4(60:I-65:I)					.2312 (2.6)			-.3004 (-2.8)		
ΔUS4(65:II-75:IV)	.00365 (2.2)	.00488 (0.9)	.01411 (1.3)	-.01145 (-1.1)						

TABLE 2

(Continued)

	Flow/R2					Flow/R3		Flow/R4		
	ΔDDN	ΔGDN	ΔSCP	ΔMTP	ΔWN	ΔDDN	ΔWN	ΔGDN	ΔTDN	ΔWN
ΔUS1								-7.833 (-1.7)		
ΔUS2	6.333 (1.5)	3.992 (1.8)	-3.217 (-1.6)	-13.29 (-3.7)						
ΔUS3(60:I-65:I)					-1175 (-6.1)		2087 (5.7)			-902.7 (-5.3)
ΔUS3(65:II-75:IV)						2.026 (2.8)			-11.15 (-4.3)	
ΔUS4(60:I-65:I)										37.24 (3.6)
ΔUS4(65:II-75:IV)										

	Flow/RS		Yields·W_{-1}		Other Non-Yield Variables					
	ΔDDN	ΔWN	R4·W_{-1}	RS·W_{-1}	Const.	%ΔP_{-1}·ΔGDP	V2·ΔDDP	V3·ΔWP	VP·ΔCDP	ΔDDN/V4
ΔUS1	-3.693 (-2.6)					-1.350 (-2.8)				
ΔUS2							-1.254 (-3.0)		1.020 (1.3)	
ΔUS3(60:I-65:I)					-1637 (-2.1)			-.00139 (-3.5)		
ΔUS3(65:II-75:IV)				-.00806 (-5.4)						
ΔUS4(60:I-65:I)		-30.56 (-3.7)		-.01284 (-5.5)	5488 (5.9)					
ΔUS4(65:II-75:IV)			.0008010 (1.4)	-.00108 (-1.8)						-3.643 (-0.8)

TABLE 2

(Continued)

	(continued)							
	ΔDDN/VP	$V3 \cdot W_{-1}$	D602	D623	D643	D644	D672	D724
ΔUS1			-2217 (-1.6)	-3192 (-2.4)		2321 (1.8)	-4107 (-3.0)	
ΔUS2	-.01143 (-1.3)							
ΔUS3(60:I-65:I)		.00003815 (2.4)	909.4 (1.6)		1202 (2.3)			
ΔUS3(65:II-75:IV)								-1715 (-3.5)
ΔUS4(60:I-65:I)								
ΔUS4(65:II-75:IV)								

	Summary Statistics		
	$\bar{R}^2$	SE	DW
ΔUS1	.75	1190	1.79
ΔUS2	.57	841	2.01
ΔUS3	.87	366	2.32
ΔUS4	.64	136	2.68

TABLE 3

HOUSEHOLDS

Equation	Lagged Stocks										
	$US1_{-1}$	$US2_{-1}$	$US3_{-1}$	$US4_{-1}$	CB_{-1}	EQ_{-1}	SL_{-1}	CP_{-1}	MT_{-1}	TS_{-1}	W_{-1}
ΔUS1	-.3111 (-4.6)	-1.002 (-3.0)							.3795 (3.1)	-.05822 (-4.0)	
ΔUS2		-.3335 (-6.0)			-.1919 (-6.7)			.4401 (3.8)	-.3025 (-4.8)		-.00300 (-3.5)
ΔUS3		-.1035 (-3.4)	-.3600 (-4.8)				-.4231 (-5.0)	.3550 (3.5)	.4302 (5.4)		
ΔUS4	.06856 (5.3)			-.6459 (-8.8)	.2634 (6.6)			.3248 (6.1)	.1409 (3.9)		
ΔCB					-.1004 (-2.8)						
ΔEQ	-.04315 (-1.7)			-2.116 (-3.0)		-.06931 (-4.4)				-.05311 (-4.8)	.06294 (4.3)

	$(\Delta W/W_{-1})$·Lagged Stocks									
	$US2_{-1}$	$US3_{-1}$	$US4_{-1}$	CB_{-1}	EQ_{-1}	SL_{-1}	CP_{-1}	MT_{-1}	TS_{-1}	DDC_{-1}
ΔUS1	74.15 (2.2)	-64.90 (-3.5)	168.8 (5.1)	-39.52 (-5.2)	2.553 (2.2)		-25.54 (-2.6)		11.19 (5.7)	
ΔUS2							-42.85 (-4.9)			
ΔUS3			28.56 (3.7)			32.60 (5.2)	-35.79 (-4.6)	-24.50 (-4.6)		
ΔUS4	-4.329 (-2.4)			-13.46 (-4.4)		-3.538 (-2.6)	-19.89 (-5.1)	-19.85 (-7.5)	2.364 (6.4)	2.929 (2.4)
ΔCB	-12.74 (-1.7)	-19.90 (-1.5)						12.51 (2.6)		
ΔEQ	-10.96 (-1.5)		199.2 (2.8)					-23.54 (-3.8)		

TABLE 3

(Continued)

	Yields									
	$R1\cdot\Delta W$	$R2\cdot\Delta W$	$R3\cdot\Delta W$	$R4\cdot\Delta W$	$RC\cdot\Delta W$	$RE\cdot\Delta W$	$RP\cdot\Delta W$	$RC\cdot W_{-1}$	$RS\cdot W_{-1}$	$RP\cdot W_{-1}$
ΔUS1	.09277 (3.1)						-.1654 (-4.9)			.00152 (3.9)
ΔUS2		.01826 (3.5)								-.0002134 (-5.9)
ΔUS3			.05776 (4.0)	-.09772 (-5.1)						
ΔUS4				.05013 (5.1)			-.01877 (-3.4)		-.0005085 (-5.1)	.0002091 (2.8)
ΔCB				-.1195 (-4.5)	.05791 (2.6)			.0004476 (4.1)		-.0001053 (-1.6)
ΔEQ						.06329 (2.0)				

	Other Non-Yield Variables										
	Const.	ΔW	CE	$ECG''\cdot\Delta W$	$\%\Delta P_{-1}\cdot\Delta W$	$V4'\cdot\Delta W$	$VP\cdot\Delta W$	$V4'\cdot W_{-1}$	$VC''\cdot W_{-1}$	$VE\cdot W_{-1}$	$VP\cdot W_{-1}$
ΔUS1		-2.805 (-2.8)								.0000006783 (3.2)	
ΔUS2	4506 (4.4)		.03685 (6.5)				-1.254 (-5.2)	.000001978 (3.4)			.02034 (5.6)
ΔUS3						.0003432 (2.2)		-.000004676 (-2.7)			
ΔUS4	7198 (7.3)		-.03144 (-6.7)		-.01459 (-3.3)				.0007809 (5.3)		
ΔCB	-1186 (-1.3)										
ΔEQ			-.05968 (-2.6)	.01666 (2.7)		.0007206 (2.0)		-.000007134 (-1.9)		-.0000005232 (-2.6)	

TABLE 3

(Continued)

(Continued)

	D611	D612	D643	D693	D701	D711	D723	D734	D743
ΔUS1									
ΔUS2	-2206 (-4.7)				1708 (3.6)		-1835 (-3.8)		
ΔUS3	2357 (6.4)	-957.1 (-2.8)	956.9 (2.9)						
ΔUS4			484.4 (3.0)						
ΔCB									-4117 (-4.0)
ΔEQ				1459 (2.1)		-2913 (-4.0)	1990 (2.8)		-3122 (-4.2)

Summary Statistics

	$\bar{R}^2$	SE	DW
ΔUS1	.76	978	2.26
ΔUS2	.76	426	2.20
ΔUS3	.66	318	2.44
ΔUS4	.71	154	2.16
ΔCB	.69	660	2.16
ΔEQ	.61	637	1.99

TABLE 4

INVESTMENT COMPANIES

Equation	Lagged Stocks			Yields			Other Non-Yield Variables	
	US_{-1}	EQ_{-1}	CP_{-1}	$RE \cdot \Delta WP$	$\Delta WN/RE$	$RP \cdot W_{-1}$	$\%\Delta P' \cdot WP$	$\Delta WN/ECG$
ΔEQ	.4871 (3.2)	-.00519 (-1.1)	.6232 (4.7)	.3086 (3.0)	2.453 (3.0)	-.00724 (-4.0)	-.7763 (-2.8)	.3635 (1.8)

	Summary Statistics		
	$\bar{R}^2$	SE	DW
ΔEQ	.53	325	2.09

TABLE 5

LIFE INSURANCE COMPANIES

Equation	Lagged Stocks									
	$US1_{-1}$	$US2_{-1}$	$US3_{-1}$	$US4_{-1}$	CB_{-1}	EQ_{-1}	SL_{-1}	CP_{-1}	CM_{-1}	W_{-1}
ΔUS1	-.6492 (-5.8)	.2118 (2.4)					.06615 (3.4)			
ΔUS2		-.1430 (-2.4)			.00149 (2.5)	-.00787 (-3.5)				
ΔUS3		-.2213 (-3.2)	-.06698 (-2.6)	-.1660 (-10.6)	-.00354 (-1.9)					
ΔUS4		-.2220 (-2.6)	-.3145 (-5.9)	-.2067 (-4.1)			.2089 (6.8)	-.05355 (-4.1)		
ΔCB					-.1184 (-3.3)	-.05768 (-2.6)		.5984 (7.5)		.07114 (4.3)
ΔEQ		-1.362 (-4.5)	-.6893 (-4.1)	-.6712 (-5.1)	-.1051 (-4.0)	-.04510 (-2.5)			-.1343 (-4.6)	.09895 (5.5)
	Yields									
	R1·ΔW	R2·ΔW	R3·ΔW	R4·ΔW	RC·ΔW	RE·ΔW	RP·ΔW	$RC \cdot W_{-1}$	$RP \cdot W_{-1}$	$RM \cdot W_{-1}$
ΔUS1	.01102 (2.4)								-.0001283 (-3.2)	
ΔUS2		.02741 (4.7)		-.01872 (-3.9)			-.00497 (-3.1)			
ΔUS3		-.02011 (-2.5)	.01436 (2.0)							
ΔUS4				.01451 (4.3)				-.0002160 (-4.2)		
ΔCB					.08615 (3.1)		-.08968 (-2.2)		.00121 (2.4)	-.00334 (-6.1)
ΔEQ						.02451 (1.5)	-.01358 (-2.0)			

TABLE 5
(Continued)

	Other Non-Yield Variables									
	Const.	ΔW	V2·ΔW	V4′·ΔW	VC·ΔW	VE′′·ΔW	$V4'\cdot W_{-1}$	$VC\cdot W_{-1}$	$VE''\cdot W_{-1}$	D604
ΔUS1		-.07020 (-2.8)					.000002015 (3.8)			
ΔUS2			-.01608 (-2.2)			.01923 (2.3)			-.0003012 (-2.0)	
ΔUS3	971.5 (6.4)									-788.9 (-22.8)
ΔUS4	373.2 (1.8)			-.0001874 (-3.9)	.00002190 (3.1)					791.7 (17.2)
ΔCB							.00001057 (3.6)	-.000001320 (-1.6)		
ΔEQ										

	(continued)				Summary Statistics		
	D613	D614	D723	D754	$\bar{R}^2$	SE	DW
ΔUS1				765.1 (12.8)	.85	45	1.95
ΔUS2		129.5 (5.9)			.83	21	2.24
ΔUS3	-983.3 (-27.7)				.96	30	1.64
ΔUS4	758.4 (17.6)				.93	39	2.36
ΔCB					.87	238	1.36
ΔEQ			-459.1 (-3.5)		.88	120	1.73

TABLE 6

MUTUAL SAVINGS BANKS

Equation	Lagged Stocks									
	$US1_{-1}$	$US2_{-1}$	$US3_{-1}$	$US4_{-1}$	CB_{-1}	EQ_{-1}	SL_{-1}	CP_{-1}	USA_{-1}	TD_{-1}
ΔUS1	-.3082		-.1668		-.02273		.5148	.3616		
	(-3.6)		(-2.7)		(-2.1)		(4.4)	(3.1)		
ΔUS2	-.9050	-.2408			-.00969					
	(-1.8)	(-5.2)			(-4.9)					
ΔUS3	.1006		-.2219	.5108		.08970				
	(1.8)		(-5.5)	(7.9)		(5.0)				
ΔUS4		-.1022	.1729	-.4210		-.2225				
		(-2.2)	(5.0)	(-6.3)		(-3.6)				
ΔCB		.4185			-.07399					
		(5.9)			(-2.6)					
ΔEQ		-.05471				-.1780	-.1041	.1011	.1407	.05876
		(-2.3)				(-4.5)	(-3.0)	(3.1)	(5.6)	(1.6)

Equation	(Continued)		Yields						
	DDC_{-1}	FF_{-1}	R1·ΔWP	R2·ΔWP	R3·ΔWP	R4·ΔWP	RC·ΔWP	RE·ΔWP	RP·ΔWP
ΔUS1	-.6354		.2615						-.2359
	(-4.1)		(4.1)						(-4.2)
ΔUS2				.08203		-.04122			-.03882
				(2.7)		(-1.7)			(-3.2)
ΔUS3			-.02169		.02519				
			(-1.7)		(2.7)				
ΔUS4						.00416			
						(1.7)			
ΔCB				-.2124			.2528		
				(-2.0)			(3.1)		
ΔEQ		.1210						.01023	
		(6.4)						(4.4)	

TABLE 6

(Continued)

	ΔWN/RL	ΔWN/RC	ΔWN/RE	ΔWN/RP	$R4 \cdot W_{-1}$	$RC \cdot W_{-1}$	$RE_{-1} \cdot W_{-1}$	$RP \cdot W_{-1}$
ΔUS1	34.69 (2.5)			-40.01 (-2.4)				-.0007541 (-2.1)
ΔUS2								
ΔUS3								
ΔUS4					.00221 (2.6)			
ΔCB						.00611 (3.2)	-.01458 (-4.4)	
ΔEQ		-3.354 (-2.8)	2.413 (4.6)				-.00211 (-6.1)	

	Other Non-Yield Variables									
	Const.	VP·ΔWP	$ECG^2 \cdot W_{-1}$	$V3 \cdot W_{-1}$	$VC \cdot W_{-1}$	D604	D612	D633	D661	D691
ΔUS1	854.2 (4.6)	.3506 (3.5)								248.5 (3.1)
ΔUS2	409.2 (4.8)	.3506 (3.5)						-173.7 (-3.3)	144.9 (2.8)	
ΔUS3	-722.4 (-7.2)					-363.4 (-5.6)				
ΔUS4	638.0 (4.9)	-.1882 (-1.9)				398.2 (6.7)	-172.0 (-3.2)			
ΔCB			-.00105 (-2.3)	.000008502 (2.7)	-.000007425 (-1.5)					
ΔEQ	302.0 (6.0)	-.2224 (-5.9)								

	Summary Statistics		
	$\bar{R}^2$	SE	DW
ΔUS1	.55	74	2.07
ΔUS2	.67	50	1.82
ΔUS3	.72	57	2.07
ΔUS4	.71	52	1.79
ΔCB	.82	187	1.93
ΔEQ	.84	21	1.78

TABLE 7

NONFINANCIAL CORPORATE BUSINESS

	Lagged Stocks					$(\Delta WP/W_{-1}) \cdot$ Lagged Stocks			
	$US1_{-1}$	$US2_{-1}$	SL_{-1}	TD_{-1}	DDC_{-1}	$US2_{-1}$	$US3_{-1}$	SL_{-1}	CP_{-1}
ΔUS1	-.03062 (-1.3)		.4352 (2.7)	-.1647 (-3.9)	-.03339 (-2.2)				
ΔUS2		-.1927 (-4.1)		-.02901 (-3.0)		-7.518 (-3.1)	41.46 (2.7)	-9.255 (-4.1)	-1.759 (-2.5)

	Yields			
	R1·ΔWP	R2·ΔWP	ΔWN/R2	$RP \cdot W_{-1}$
ΔUS1	.08978 (2.8)			
ΔUS2		.1153 (3.8)	12.16 (5.1)	-.0002107 (-1.3)

	Other Non-Yield Variables								
	Const.	%ΔP´·ΔWP	V2·ΔWP	ΔWN	$\%\Delta P' \cdot W_{-1}$	D602	D703	D711	D754
ΔUS1		-.2014 (-1.8)	.5959 (2.5)		.01127 (3.5)	-1570 (-2.2)			4870 (4.3)
ΔUS2	685.0 (5.8)			-2.269 (-4.9)		1328 (6.6)	635.6 (2.9)	-878.7 (-4.7)	

	Summary Statistics		
	$\bar{R}^2$	SE	DW
ΔUS1	.65	665	1.82
ΔUS2	.77	169	2.21

TABLE 8

OTHER INSURANCE COMPANIES

Equation	Lagged Stocks									
	$US1_{-1}$	$US2_{-1}$	$US3_{-1}$	$US4_{-1}$	CB_{-1}	EQ_{-1}	SL_{-1}	CN_{-1}	DDC_{-1}	W_{-1}
ΔUS1	-.1175 (-3.0)			.2070 (2.3)		.05094 (2.0)	.08965 (3.2)	2.392 (2.8)		-.07359 (-3.3)
ΔUS2		-.1880 (-4.8)	.1554 (4.1)			-.04807 (-3.7)	-.04544 (-2.6)			.03004 (2.6)
ΔUS3	.2664 (9.1)		-.1205 (-6.9)	.3410 (4.9)					.4258 (4.6)	
ΔUS4		.09423 (3.4)	.05409 (3.2)	-.3157 (-4.5)	.01182 (2.1)					-.00282 (-1.9)
ΔCB				-.9711 (-4.8)	-.04380 (-1.9)	-.0615 (-4.9)			-2.501 (-8.3)	.02247 (3.8)
ΔEQ		-.2022 (-1.7)	-.5776 (-4.8)		-.2265 (-3.1)	-.2153 (-2.9)	-.3047 (-3.0)	-5.284 (-3.1)		.2521 (3.3)

Equation	Yields									
	R1·ΔW	R2·ΔW	R3·ΔW	R4·ΔW	RC·ΔW	RE·ΔW	$R3 \cdot W_{-1}$	$RC \cdot W_{-1}$	$RE \cdot W_{-1}$	$RP \cdot W_{-1}$
ΔUS1	.05696 (2.0)					-.2248 (-1.4)			.00643 (1.7)	-.0009429 (-1.8)
ΔUS2		.09644 (3.7)			-.07701 (-3.2)					
ΔUS3		-.08267 (-3.8)	.06257 (3.0)				.0005234 (5.2)			
ΔUS4				.01615 (1.6)						
ΔCB					.08976 (3.0)					
ΔEQ						.1051 (2.7)		-.00210 (-2.1)		

TABLE 8

(Continued)

	Other Non-Yield Variables									
	Const.	ΔW	$ECG' \cdot \Delta W$	$\%\Delta P' \cdot \Delta W$	$ECG \cdot W_{-1}$	$\%\Delta P' \cdot W_{-1}$	$V4' \cdot W_{-1}$	D643	D651	D661
ΔUS1		.5027 (0.9)	-.03128 (-1.5)		.0009344 (2.1)					-192.3 (-2.6)
ΔUS2							.00001127 (3.7)			
ΔUS3	-1050 (-7.2)							191.0 (5.2)	193.2 (5.3)	
ΔUS4				-.07870 (-1.8)		.00141 (2.1)			117.2 (4.6)	
ΔCB	4273 (8.9)	-.6115 (-3.0)								
ΔEQ					.0003645 (3.2)	-.00350 (-1.4)				

	(Continued)			(Summary Statistics)		
	D692	D693	D694	$\bar{R}^2$	SE	DW
ΔUS1				.44	71	1.92
ΔUS2		-178.7 (-2.9)		.53	57	1.90
ΔUS3		-249.4 (-6.8)		.81	35	2.28
ΔUS4	89.56 (3.6)	-102.0 (-4.1)		.64	24	2.29
ΔCB				.77	108	1.13
ΔEQ			410.0 (3.4)	.78	110	1.58

TABLE 9

PRIVATE PENSION FUNDS

Equation	Lagged Stocks							
	$US1_{-1}$	$US2_{-1}$	$US3_{-1}$	$US4_{-1}$	CB_{-1}	EQ_{-1}	TD_{-1}	W_{-1}
ΔUS1	-.1600 (-2.7)			.1829 (1.8)	.1719 (3.5)	.1262 (3.7)	.3477 (4.8)	-.1199 (-3.6)
ΔUS2		-.1225 (-1.5)		.1905 (2.7)	-.04678 (-2.8)	-.02424 (-2.1)		.02516 (2.1)
ΔUS3	.08857 (3.7)		-.08552 (-1.9)				.07238 (5.6)	
ΔUS4	.05321 (2.4)	.1375 (2.5)	.1648 (3.9)	-.3129 (-4.5)			.06826 (5.3)	
ΔCB					-.3513 (-2.7)	-.1899 (-2.3)	.2957 (1.9)	.1960 (2.3)
ΔEQ	-.4734 (-4.3)				-.1817 (-1.8)	-.1201 (-1.7)		.1583 (2.1)

	Yields										
	R1·ΔW	R2·ΔW	R3·ΔW	R4·ΔW	RC·ΔW	RE·ΔW	RE_{-1}·ΔW	R1·W_{-1}	RC·W_{-1}	RE·W_{-1}	RE_{-1}·W_{-1}
ΔUS1	.02246 (2.4)						-.05206 (-2.8)				
ΔUS2		.02561 (2.7)					-.06153 (-3.3)		-.0009380 (-3.8)		.00280 (4.2)
ΔUS3			.02344 (1.9)				-.05958 (-2.7)	-.0002692 (-3.2)	-.0003701 (-2.0)		.00123 (2.5)
ΔUS4				.01532 (2.9)			-.02664 (-3.7)	-.0001776 (-3.6)			
ΔCB					.09195 (7.5)						
ΔEQ			-.1603 (-3.5)			.1582 (1.4)	.1826 (2.5)			-.00810 (-3.9)	

TABLE 9

(Continued)

	Other Non-Yield Variables									
	Const.	$ECG' \cdot \Delta W$	$V4' \cdot \Delta W$	$VC' \cdot \Delta W$	$VE \cdot \Delta W$	$ECG \cdot W_{-1}$	$\% \Delta P_{-1} \cdot W_{-1}$	$\% \Delta P' \cdot W_{-1}$	$V2 \cdot W_{-1}$	$V4' \cdot W_{-1}$
ΔUS1						-.0001105 (-1.6)	-.00195 (-3.4)			
ΔUS2			.00015 4 (2.8)		.00002157 (2.6)					
ΔUS3					.0001263 (4.7)					
ΔUS4										
ΔCB	1339 (3.8)			-.0003231 (-3.6)				-.00736 (-3.3)		
ΔEQ		.06585 (3.8)				-.00150 (-3.8)			.01078 (5.5)	.00001839 (3.6)

	(Continued)				Summary Statistics		
	$VE \cdot W_{-1}$	D724	D752	D754	$\bar{R}^2$	SE	DW
ΔUS1		295.7 (2.9)		922.2 (4.8)	.55	90	2.38
ΔUS2					,77	45	2,09
ΔUS3	-.000002031 (-3.8)				.85	35	2.55
ΔUS4			371.7 (8.4)		.80	38	2.25
ΔCB					.64	262	2.38
ΔEQ					.85	217	2.36

TABLE 10

SAVINGS AND LOAN ASSOCIATIONS

Equation	Lagged Stocks						
	$US1_{-1}$	$US2_{-1}$	$US3_{-1}$	$US4_{-1}$	USA_{-1}	FF_{-1}	W_{-1}
ΔUS1	-.1977 (-3.4)			-.7848 (-2.8)	-.2440 (-4.4)		.06550 (4.7)
ΔUS2		-.5804 (-6.7)	-.3332 (-3.8)		-.4011 (-5.9)	-.2733 (-4.9)	.1352 (5.2)
ΔUS3			-.1662 (-3.0)		-.06359 (-2.0)	.1020 (2.6)	.07623 (4.0)
ΔUS4	.1062 (5.0)	-.1243 (-6.5)		-.5391 (-6.2)	-.1096 (-6.4)		

	Yields									
	R1·ΔWP	R2·ΔWP	R3·ΔWP	R4·ΔWP	RP·ΔWP	ΔWN/R2	ΔWN/R3	$R2 \cdot W_{-1}$	$R4 \cdot W_{-1}$	$RP \cdot W_{-1}$
ΔUS1	.1864 (2.5)				-.1392 (-2.1)					-.00470 (-4.2)
ΔUS2	-.05720 (-2.2)	.06001 (2.4)								
ΔUS3		-.1150 (-1.3)	.1394 (1.5)			-53.98 (-0.2)	100.3 (0.4)	-.01025 (-6.3)		
ΔUS4				.00219 (1.6)					.00278 (5.0)	

TABLE 10

(Continued)

	Other Non-Yield Variables									
	Const.	ΔWP	$\%\Delta P_{-1}\cdot\Delta WP$	V3·ΔWP	V4·ΔWP	VP·ΔWP	ΔWN	ΔWN/V3	$\%\Delta P_{-1}\cdot W_{-1}$	$V4\cdot W_{-1}$
ΔUS1	704.4 (1.9)	.1959 (2.1)	-.2177 (-3.9)						.01962 (4.3)	
ΔUS2	-253.7 (-2.3)		-.09063 (-2.0)		1.440 (3.0)				.01556 (5.4)	
ΔUS3	-168.9 (-1.6)		-.1346 (-3.9)	-.0001284 (3.1)	.0005333 (1.7)		-6.568 (-1.1)	-12.91 (-0.2)	.00938 (3.7)	-.00001428 (-0.9)
ΔUS4	727.4 (6.0)									

	(Continued)							Summary Statistics		
	$VP\cdot W_{-1}$	D604	D631	D633	D651	D673	D681	$\bar{R}^2$	SE	DW
ΔUS1						640.0 (3.6)		.52	172	2.63
ΔUS2	-.05847 (-3.2)							.59	158	1.76
ΔUS3						318.3 (2.8)		.61	103	1.95
ΔUS4		140.5 (2.6)	173.5 (3.2)	208.6 (3.9)	211.1 (3.9)			.66	53	2.33

TABLE 11

STATE AND LOCAL GOVERNMENT GENERAL FUNDS

Equation	Lagged Stocks									
	$US1_{-1}$	$US2_{-1}$	$US3_{-1}$	$US4_{-1}$	SL_{-1}	MT_{-1}	USA_{-1}	TD_{-1}	DDC_{-1}	W_{-1}
ΔUS1	-.3106 (-3.3)									.07037 (3.4)
ΔUS2		-.1822 (-3.9)			-.4953 (-4.0)					
ΔUS3	-.5104 (-2.8)	-.8237 (-3.2)	-.2228 (-2.6)	-1.109 (-3.4)	-1.097 (-3.7)	-.6395 (-2.1)	-.5805 (-2.9)	-.6665 (-3.1)	-.5968 (-3.0)	.6227 (3.1)
ΔUS4				-.05464 (-2.2)						

	$(\Delta WP/W_{-1})\cdot$ Lagged Stocks								
	$US1_{-1}$	$US2_{-1}$	$US3_{-1}$	$US4_{-1}$	SL_{-1}	MT_{-1}	USA_{-1}	TD_{-1}	DDC_{-1}
ΔUS1					-6.048 (-1.3)	24.86 (2.7)	-4.652 (-2.0)	-4.937 (-2.7)	
ΔUS2								-1.108 (-4.9)	
ΔUS3	18.08 (2.9)	23.93 (3.1)		33.74 (3.0)	28.15 (3.1)	23.14 (2.2)	20.08 (3.1)	22.93 (3.3)	21.41 (3.1)
ΔUS4			6.295 (3.6)	-2.667 (-2.2)			-1.101 (-2.7)	-.6339 (-3.3)	

TABLE 11

(Continued)

	(Continued)				Summary Statistics		
	D711	D731	D732	D742	$\bar{R}^2$	SE	DW.
ΔUS1	-1670 (-2.9)			-2656 (-4.3)	.62	515	2.26
ΔUS2		468.8 (2.3)			.43	186	1.97
ΔUS3			564.6 (4.1)		.35	122	2.32
ΔUS4					.52	108	2.17

TABLE 12

STATE AND LOCAL GOVERNMENT RETIREMENT FUNDS

Equation	Lagged Stocks $US1_{-1}$	$US2_{-1}$	$US3_{-1}$	$US4_{-1}$	CB_{-1}	EQ_{-1}	MT_{-1}	USA_{-1}	DDC_{-1}	W_{-1}
ΔUS1	-.5110 (-4.7)			-.09388 (-3.0)		-.1004 (-3.6)	-.1152 (-2.9)	-.1916 (-3.1)		.03688 (3.6)
ΔUS2		-.1205 (-2.9)	-.07291 (-2.3)	.02125 (4.2)						
ΔUS3	.1615 (5.7)		-.05696 (-2.6)			-.00409 (-1.7)	-.02557 (-4.9)		.1162 (4.5)	
ΔUS4		-1.032 (-4.5)		-.1021 (1.9)	-.07542 (-4.8)	-.1029 (-2.6)				.05756 (3.2)
ΔCB					-.02454 (-1.8)					.05000 (8.1)
ΔEQ				-.3184 (-9.0)		-.3782 (-7.3)	-.5325 (-4.6)			.1742 (6.6)

Equation	Yields $R1 \cdot \Delta W$	$R2 \cdot \Delta W$	$R3 \cdot \Delta W$	$R4 \cdot \Delta W$	$RC \cdot \Delta W$	$RE \cdot \Delta W$	$R1 \cdot W_{-1}$	$RC \cdot W_{-1}$	$RE_{-1} \cdot W_{-1}$
ΔUS1	.02554 (3.5)								
ΔUS2		.00627 (1.8)							
ΔUS3			.00710 (1.9)				-.0001671 (-2.5)		
ΔUS4		-.09640 (-2.7)		.1663 (3.4)					
ΔCB					.02753 (1.8)				-.00726 (-7.2)
ΔEQ						.1156 (3.2)		-.00222 (-3.7)	

TABLE 12

(Continued)

	Other Non-Yield Variables									
	Const.	ΔW	ECG^•ΔW	%ΔP^•ΔW	V4•ΔW	VC•ΔW	VE^•ΔW	$ECG^•W_{-1}$	$VE^•W_{-1}$	D603
ΔUS1										
ΔUS2		-.04765 (-1.7)					.0001369 (3.7)		-.000003542 (-3.5)	
ΔUS3										126.2 (3.9)
ΔUS4					-.0002948 (-2.4)	.0001042 (3.7)				-292.3 (-2.3)
ΔCB			-.03987 (-6.6)							
ΔEQ	-1650 (-4.4)		.06573 (2.6)	-.2307 (-4.7)				-.00161 (-2.3)		

	(Continued)		Summary Statistics		
	D722	D753	$\bar{R}^2$	SE	DW
ΔUS1	455.3 (4.2)	612.0 (5.2)	.60	98	2.38
ΔUS2			.37	26	1.66
ΔUS3			.58	32	2.45
ΔUS4			.57	117	2.19
ΔCB			.80	197	2.23
ΔEQ			.91	104	2.43

Summary of Variable Symbols

BL = bank loans
$\Delta BLP = \Delta BL$ if $\Delta BL > 0$; 0 otherwise
$\Delta BLN = \Delta BL$ if $\Delta BL < 0$; 0 otherwise

CB = long-term corporate bonds

CC = consumer credit

CD = large negotiable certificates of deposit
$\Delta CDP = \Delta CD$ if $\Delta CD > 0$; 0 otherwise
$\Delta CDN = \Delta CD$ if $\Delta CD < 0$; 0 otherwise

CE = personal consumption expenditures

CM = commercial mortgages

CP = open-market paper

DD = demand deposits
$\Delta DDP = \Delta DD$ if $\Delta DD > 0$; 0 otherwise
$\Delta DDN = \Delta DD$ if $\Delta DD < 0$; 0 otherwise

DDC = demand deposits and currency

D601 = dummy variable with value of unity in 1960:I, zeros elsewhere
Dijk = dummy variable with value of unity in the k^{th} quarter of 19ij, zeros elsewhere ($i = 6,7$; $j = 0,1,\ldots,9$)

ECG = percentage change of the Standard and Poor's composite common stock price index lagged one quarter
ECG' = four-quarter moving average of ECG
ECG'' = eight-quarter third-degree polynomial lag of ECG with head, tail, and unit sum constraints

EQ = corporate equities

FF = Federal funds

GD = government deposits
$\Delta GDP = \Delta GD$ if $\Delta GD > 0$; 0 otherwise
$\Delta GDN = \Delta GD$ if $\Delta GD < 0$; 0 otherwise

MT = mortgages

P = consumer price index (1967=100)
$\%\Delta P$ = percentage change of P
$\%\Delta P'$ = eight-quarter moving average of $\%\Delta P$ lagged one quarter.

RC = yield on new issues of corporate bonds (Aa utilities)

RE = Standard and Poor's dividend/price ratio

RM = yield on new commercial mortgages (ALIA series)

RP = yield on commercial paper

RS = municipal bond yields (Moody's Aaa)

R1 = yield on 3-month Treasury bills

R2 = yield on 3-5 year Treasury securities

R3 = yield on 6-8 year Treasury securities

R4 = yield on 10-year and over Treasury securities

SC = security credit
$\Delta SCP = \Delta SC$ if $\Delta SC > 0$; 0 otherwise
$\Delta SCN = \Delta SC$ if $\Delta SC < 0$; 0 otherwise

SL = state and local government obligations

TD = time deposits
$\Delta TDP = \Delta TD$ if $\Delta TD > 0$; 0 otherwise
$\Delta TDN = \Delta TD$ if $\Delta TD < 0$; 0 otherwise

USA = U.S. Government agency issues

US1 = short-term Treasury securities (weighted maturity class data including all securities maturing within 1 year)

US2 = short-intermediate-term Treasury securities (weighted maturity class data including all securities maturing in 2 to 4 years)

US3 = long-intermediate-term Treasury securities (weighted maturity class data including all securities maturing in 6 to 8 years)

US4 = long-term Treasury securities (weighted maturity class data including all securities maturing in 12 years and over)

VC = four-quarter moving-average variance of the holding-period yield on corporate bonds
VC' = eight-quarter moving-average variance of the holding period yield on corporate bonds
VC'' = four-quarter moving-average variance of RC

VE = four-quarter moving-average variance of $RE_{-1} + 4 \cdot ECG$

VE' = four-quarter moving-average variance of $4 \cdot ECG$

VE'' = four-quarter moving-average variance of Standard and Poor's earnings/price ratio

VP = four-quarter moving-average variance of $\%\Delta P$

VP' = eight-quarter moving-average variance of $\%\Delta P$

VS = four-quarter moving-average variance of the holding-period yield on the state and local obligations

V2 = four-quarter moving-average variance of R2

V3 = four-quarter moving-average variance of the holding-period yield on 6-8 year Treasury securities

V4 = four-quarter moving-average variance of the holding-period yield on long-term Treasury securities

$V4'$ = eight-quarter moving-average variance of the holding-period yield on long-term Treasury securities

W = total financial assets (definition depends on the investor group)

$\Delta WP = \Delta W$ if $\Delta W > 0$; 0 otherwise

$\Delta WN = \Delta W$ if $\Delta W < 0$; 0 otherwise

TABLE 13

SIMULATION RESULTS

	Static				Dynamic			
	Separate		Combined		Separate		Combined	
Yield	ME	RMSE	ME	RMSE	ME	RMSE	ME	RMSE
Short-term Treasury (R1)	.02%	.66%	.02%	.66%	.05%	.67%	.06%	.69%
Short-intermediate-term Treasury (R2)	.03	.37	.03	.40	.04	.37	.06	.47
Long-intermediate-term Treasury (R3)	.00	.23	.01	.32	.00	.25	-.11	.43
Long-term Treasury (R4)	-.01	.19	.00	.19	.00	.20	.02	.21
Corporate bond (RC)	-.01	.26	-.01	.31	-.01	.26	.04	.37
Equity (RE)	.00	.33	.00	.34	.01	.33	.01	.37

Notes:

ME = mean error.
RMSE = root-mean-square error.
Yields in percent.
Simulation period: 1960:I - 1975:IV.

First, there is little evidence of significant bias in any of the simulations. The largest mean error is 11 basis points, which occurs for the long-intermediate-term Treasury yield (R3) in the full-model dynamic simulation. Second, the root-mean-square errors indicate that the model performs remarkably well in terms of within-sample fit. In the complete-model dynamic simulation, for example, the yields on long-term Treasury securities and corporate bonds have root-mean-square errors of 21 and 37 basis points, respectively. Third, in all simulations the root-mean-square error monotonically increases for Treasury securities as maturity increases. This result reflects the greater volatility of short-term yields. Finally, root-mean-square errors increase as expected when comparing dynamic to static simulations and separate sub-market to complete-model simulations. The greater number of endogenously determined values used in the simulations with the higher root-mean-square errors account for this result.

IV. Summary

Three basic areas associated with the development of a disaggregated structural model of U.S. security markets were presented in this paper. First, the model was specified using the familiar partial stock-adjustment methodology. Several sub-cases of a general stock-adjustment model were actually used because of the diversity among the categories of investors included in the model. Second, estimated equations representing the demands for corporate bonds, equities, and four distinct maturity classes of Treasury securities by 11 individual investor categories were presented. These estimation results provided broad support to the specification of the model based on summary statistics and expected coefficient signs. Finally, market-clearing identities equating exogenous supplies with market demands were used to solve for the six endogenous security yields. These simulation results indicated that the disaggregated structural model is very accurate in tracking historical security yields.

Footnotes

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1. In [6], however, Friedman relaxes the assumption of exogenous security supplies and models both supply and demand endogenously.

2. For a more detailed comparison of structural and unrestricted reduced-form models of interest rate determination, see Friedman and Roley [9].

3. The last two terms may be replaced by

   $$\alpha^*_{it} \sum_{j'}^{J} \Delta A_t^{j'} \text{ and } \gamma^*_{it} \sum_{j''}^{J} \Delta A_t^{j''}$$, respectively, to enable several

   of the adjustment models discussed below to become nested within the most general model (2). For example, the "optimal marginal adjustment" model introduced by Friedman [5] may be obtained from this modified version of (2) by setting $\psi_{ik}^{j'}$, $\psi_{ik}^{j''} = 0$ for all i, k, j′, j″, and $\gamma^*_{it} = \alpha^*_{it}$, for all i. The other models considered below also include the "optimal marginal adjustment" model as a special case, but, in general, they are not special cases of (2) because of the presence of disaggregated exogenous financial flows.

4. The $\underline{\gamma}^*$ vector is analogous to (1) except that expected holding-period yields enter as reciprocals—e.g., $1/\mu_i$. For the own-yield on asset i (μ_i), for example, this implies that for negative financial flows the higher the own-yield, the less the amount of asset i sold. Alternatively, if the own-yield was not entered in reciprocal form, then the higher the own-yield, the greater the amount of asset i sold.

5. The modeling of foreign purchases of U.S. Treasury securities involves areas well outside the scope of the study. Therefore, foreign purchases are taken as exogenous. The total supply of U.S. Treasury securities is determined by fiscal policy and the government budget constraint; and monetary policy determines the Federal Reserve System's holdings. This results in the net amount of U.S. Treasury securities to be purchased by private investors.

6. This procedure is applied, by the Federal Reserve System, to monthly data. Quarterly observations are formed from the arithmetic means of seasonally adjusted monthly data.

7. Preliminary estimation results indicated that the portfolio selection behavior of mutual savings banks and savings and loan associations may be best represented by considering mortgage holdings separately from other

financial asset holdings. This dichotomy could be interpreted as implying that the decisions relating to the assets treated as endogenous are residual to the decisions concerning mortgages.

8. An exception to this procedure emerges in the demands for long-intermediate-term and long-term Treasury securities. Evidence of structural change within the sample period—which is discussed below—led to the estimation of two separate demand equations for each of these maturity classes. The equations for the earlier part of the sample period use an aggregative wealth flow variable.

9. For a possible interpretation of this procedure, see footnote 7.

10. In a test of rational, unitary, and autoregressive models of expectations in the context of a disaggregated structural model of the corporate bond market, the autoregressive model used here to represent expected capital gains on equities dominates the other expectations models. See Friedman and Roley [7]. Jones [11] also uses the autoregressive scheme to model expectations in a disaggregated structural model of the equity market.

11. Preliminary ordinary least squares estimates indicated the presence of a structural shift in the demands for long-intermediate-term and long-term Treasury securities by commercial banks. The midpoint corresponding to this apparent shift occurred during a change in the Federal Reserve's Regulation F and other related regulations. As a result, two separate equations are estimated for each of the relevant maturity classes. The first equation is estimated for 1960:I through 1965:I, and the second equation is estimated for 1965:II through 1975:IV.

12. In the simulations, the balance sheet constraints for individual categories of investors are not violated because a complete set of asset demands are not estimated. The set of equations for each investor category therefore implicitly includes a residual asset equation—consisting of money, state and local bonds, and commercial paper, for example—that defines the net purchases of the residual assets as the wealth flow minus total net purchases of endogenous assets. The simulation results are not altered by explicitly including these residual asset equations. In addition, Walras' Law implies that the market-clearing identity for these residual assets is redundant.

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