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EFFECTS OF SHIFTING SAVING PATTERNS ON INTEREST RATES AND ECONOMIC ACTIVITY

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ABSTRACT

Individuals in the United States consistently do most of their saving through financial intermediaries, but over time there have been and continue to be major shifts in people's reliance on specific kinds of intermediary institutions. In recent years, for example, individual savers have relied progressively more on pensions and thrift institutions and progressively less on life insurance companies. Moreover, legislative and regulatory actions currently under discussion would further alter the pattern of individuals' saving flows.

This paper assesses the potential effects on interest rates, and via interest rates (and asset prices and yields more generally) on nonfinancial economic activity, of four specific shifts in saving behavior: additional pension contributions financed by individuals, additional pension contributions financed by businesses, additional purchases of life insurance by individuals, and additional deposits in thrift institutions by individuals.

The paper's results indicate that such shifts, in plausible magnitudes, would have significant effects not only on interest rates and asset-liability flows but also on both the level and the composition of nonfinancial economic activity. In particular, although the specific effects differ from one shift to another, each would disproportionately stimulate capital formation in comparison to other forms of spending.

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Approximately two-thirds of the gross personal saving that individuals do in the United States takes the form of acquiring financial claims, and among those claims typically over 90% represent the liabilities of financial intermediaries. Pension funds, insurance companies, thrift institutions and commercial banks in fact provide the conduits through which the great majority of U.S. personal saving finds its way to the financing of physical investment. Because of the great variety of restrictions that federal and state-level legislation and regulatory rulings (as well as other institutional factors) place on these intermediaries' portfolio behavior, the pattern of individuals' saving allocations among these different intermediaries can importantly affect the allocation, and perhaps also the total amount, of the economy's investment spending. A larger flow of saving into thrift institutions, for example, typically encourages residential construction.

The same kinds of legislative, regulatory and other institutional constraints that influence intermediaries' portfolio behavior also in part determine individuals' allocations among these different institutionalized forms of saving. An obvious example is the accumulation of pension reserves, a type of saving over which most individuals have no choice at all short of changing jobs. Another familiar example is the effect of interest ceilings on the relative attractiveness of regulated deposits versus unregulated open market instruments. Still another is the dependence of the relative attractiveness of buying life insurance policies (in other words, accumulating life insurance reserves) on the characteristics of the policies that individual state regulatory commissions permit insurance companies to offer.

Although most macroeconomic analyses of saving and investment behavior typically take the pattern of saving flows as fixed, in reality it can sometimes change rapidly in response to just these kinds of influences. The 1974 Employment Retirement Income Security Act, for example, mandated minimum standards for funding (in other words, accumulating reserves) by private pensions, and since then many state and local governments have followed suit by upgrading funding practices for their employees' pensions as well.[1] Similarly, the 1978 authorization for issuance of money market certificates by thrift institutions presumably enabled these institutions to forestall much of the disintermediation that otherwise would have occurred during the subsequent period of record high short-term market interest rates. As of yearend 1979, only nineteen months after their initial authorization, money market certificates accounted for 30% of all deposits at savings and loan associations and 29% at mutual savings banks. Indeed, Jaffee and Rosen [24], using a partial-equilibrium model of the markets for savings deposits and residential construction, have estimated that the introduction of money market certificates resulted in 300,000 additional housing starts during the twelve months ended midyear 1979. The 1980 Depository Institutions Deregulation and Monetary Control Act, which will in time eliminate interest ceilings as well as other long-standing strictures on depositary intermediaries, will also probably bring major changes in the pattern of personal saving flows.

The object of this paper is to assess the potential effects on interest rates, and via interest rates (and asset prices and yields generally) on important aspects of economic activity like capital formation and production, due to several major kinds of shifts in the pattern of personal saving flows that are either in progress or in prospect in the United States. Gaining a better understanding of such effects can be important not only for interpreting economic outcomes as they develop but also for assessing in advance the implications of proposed actions that, if taken, will alter the pattern of saving flows in the future.

The principal research tool employed here for this purpose is a hybrid model combining the familiar MIT-Penn-SSRC (henceforth MPS) econometric model of the United States and a disaggregated structural model of the determination of long-term interest rates based on the market-clearing condition that the sum of the bonds demanded by various categories of investors must equal the sum of the bonds supplied by borrowers. Because most of the investor groups whose distinct bond demand behavior is explicitly represented in this model are familiar classes of financial intermediaries, the bond market model's disaggregated structure readily facilitates investigating the interest rate effects of shifts in saving patterns; such effects would be impossible to analyze using more conventional aggregate-level reduced-form models of interest rate determination. The remaining components of the MPS model (minus its term-structure equation, which is unnecessary in the presence of the structural bond market model) in turn develop the implications of these interest rate effects for other aspects of financial as well as nonfinancial economic activity. Because the combined MPS and long-term interest rate model is fully simultaneous, the general equilibrium solution that it determines allows for a rich set of feedbacks in both directions between financial and nonfinancial aspects of economic behavior.

Section I motivates the remainder of the analysis by first reviewing the relevant basic theory relating the structure of asset yields to the underlying pattern of wealth holding and then summarizing recent patterns of gross personal saving in the United States. Section II describes the combined MPS and structural interest rate model, emphasizing in particular the treatment of different investor groups' heterogeneous bond demand behavior. Section III uses simulation experiments based on this combined model to examine the financial and nonfinancial effects of potential shifts in saving patterns toward increased intermediation via pension funds, life insurance companies and thrift institutions. To anticipate, the results of these experiments indicate that such shifts, in plausible magnitudes, would have significant effects not only on interest rates and asset-liability flows but also on both the level and the composition of nonfinancial economic activity. Section IV briefly summarizes the paper's principal conclusions and emphasizes some important caveats.

I. Saving Flows and the Structure of Interest Rates in Partial and General Equilibrium

It is well known that, in a financial market consisting of investors with diverse preferences with respect to the risk, maturity or other characteristics of their portfolios, the partial equilibrium of the asset markets will in general imply a market-clearing structure of asset yields that reflects the heterogeneous investors' diverse preferences weighted by their respective wealth endowments.[2]

For the case of preferences with respect to risk, for example, an investor exhibiting constant relative risk aversion and holding joint normal (or lognormal) assessments of the returns on the various available assets will, in the absence of transactions costs, optimally demand the single-period portfolio allocation

$$\underline{A}^D_{it} = W_{it} \cdot (B_{it}\underline{r}^e_{it} + \underline{\pi}_{it}) \tag{1}$$

where $\underline{A}^D$ is a vector of asset demands satisfying $\underline{A}^{D\prime}\underline{1} = W$, W is total portfolio wealth, $\underline{r}^e$ is a vector of means of the joint asset return distribution corresponding to $\underline{A}^D$, B and $\underline{\pi}$ are respectively a matrix and vector of coefficients determined by the coefficient of relative risk aversion in the investor's utility function and the variance-covariance matrix of the joint asset return distribution corresponding to $\underline{A}^D$,[3] and subscripts i and t respectively indicate the i-th investor at the t-th time period. Partial equilibrium of the asset markets is equivalent to the market-clearing condition

$$\sum_i \underline{A}^D_{it} = \underline{A}^S_t \tag{2}$$

where $\underline{A}^S$ is a vector of given net asset supplies including zero values for all inside assets and nonzero values for all existing outside assets. If all investors share identical first-moment expectations, so that $\underline{r}_{it}^{e} = \underline{r}_{t}^{e}$ for all i, substitution from (1) then yields the determination of expected asset returns (and, consequently, beginning-of-period asset prices) according to

$$\underline{r}_{t}^{e} = (\sum_{i} W_{it} B_{it})^{-1} (\underline{A}_{t}^{S} - \sum_{i} W_{it} \underline{\pi}_{it}). \tag{3}$$

Hence the market-clearing vector of expected returns varies, for given aggregate portfolio wealth $\sum_{i} W_{it}$ and given outside asset supplies $\underline{A}^{S}$ (where $\underline{A}^{S}{}'\underline{1} = \sum_{i} W_{it}$), according to the division of that total wealth among investors with their diverse risk preferences and/or diverse variance-covariance assessments. In particular, transferring wealth to investors who are less risk averse, or who are more confident about uncertain outcomes, lowers the relative yield on the riskier assets. For the case of shared assessments this result is, of course, simply a generalization of Lintner's [27] demonstration that the market price of risk equals the harmonic mean of diverse investors' respective risk aversion coefficients.

The implications of diverse preferences with respect to asset maturity are analogous. As writers on the term structure of interest rates from Hicks [22] onward have recognized, nothing inherent to either long-duration or short-duration assets renders either one necessarily more risky than the other.[4] What matters in this context is the duration of the asset in relation to the duration of the investor's planned holding period. Stiglitz [41] has usefully formalized this relationship for the case of individuals with no bequest motive and no direct liquidity requirements, showing that such investors' demands for long- and short-term bonds — and hence, given the outside bond supplies, the term structure of interest rates — will depend on these individuals' respective planned consumption streams.[5] A direct implication of this analysis (though one not explicitly noted by Stiglitz) is that the market-clearing term structure of interest rates varies according to the division of the economy's total wealth among investors with different planned holding periods. In particular, transferring wealth to investors with longer planned holding periods lowers the relative yield on the longer duration assets.

Although most of the formal analysis along these lines has typically referred directly only to individual investors, the dependence of the asset market partial equilibrium on the distribution of holdings among final owners applies also to the distribution between direct holdings by final owners and intermediated holdings, as long as the intermediary in question provides some risk or liquidity pooling or other similar function.[6] By averaging across large numbers of individuals with uncertain but imperfectly related income and consumption streams, intermediaries achieve a greater stability and predictability of cash inflows and outflows, and hence typically have optimal portfolio allocations that differ from those of the underlying individuals.

Moreover, in the case of pension funds and life insurance companies intermediation effects on asset demands arise for yet a further reason. Virtually all large pension plans in the United States employ contractual annuity distribution systems that prohibit lump-sum withdrawals, and most life insurance policies have accumulation schedules designed to make early redemption disadvantageous. In addition to relying on the averaging of individual behavioral patterns, therefore, these intermediaries typically face long-term liability streams set by contractual arrangements and subject to short-run variations due largely to such factors as varying aggregate retirement decisions or random noise around actuarial means. Once again, the result is a different optimal asset allocation for intermediated than for directly held portfolios, and hence a market-clearing expected return structure that in general depends not only on the distribution of wealth among individuals but also on the distribution between direct holdings and intermediated holdings, and even on the distribution among different forms of intermediation.

This potential role of the distribution of asset holding in determining the asset market partial equilibrium would be of limited interest if that distribution remained largely unchanged over long periods of time. At least in the United States, however, the respective patterns of personal asset holding and saving flows have in recent years exhibited substantial shifts, as legislative and regulatory strictures as well as institutional practices have changed. Furthermore, as the examples noted in Section III below suggest, a large number of other such changes are currently either in prospect or under discussion.

As Table 1 shows, the U.S. pattern of personal financial asset holding has shifted a good deal since World War II.[7] The share of individuals' portfolios held through intermediaries first declined during the 1950s but then rose during the 1960s and especially the 1970s.[8] The composition within the intermediated share has also varied substantially, with pension fund reserves and thrift institution deposits both steadily rising in relative terms throughout the period — the former more than tripling, and the latter more than doubling as a share of all financial assets between 1950 and 1979 — and life insurance reserves steadily declining in relative terms. Table 2 shows how these changes in the form of personal asset holding have largely reflected the underlying

TABLE 1

U.S. PERSONAL HOLDINGS OF FINANCIAL ASSETS

	1950		1960		1970		1979	
	Amount	Percent	Amount	Percent	Amount	Percent	Amount	Percent
Direct Holdings	204.8	52.2	558.1	57.4	1,012.4	52.5	1,584.9	41.4
Intermediated Holdings	187.9	47.8	414.0	42.6	914.5	47.5	2,242.2	58.6
Commercial Bank Deposits	88.6	22.6	136.0	14.0	313.2	16.3	741.0	19.4
Thrift Institution Deposits	32.4	8.3	102.0	10.5	231.4	12.0	668.4	17.5
Life Insurance Reserves	49.4	12.6	85.2	8.8	130.3	6.8	210.7	5.5
Pension Reserves	17.5	4.5	90.8	9.3	239.6	12.4	622.1	16.3
Total Holdings	392.7	100.0	972.1	100.0	1,926.9	100.0	3,827.1	100.0

Notes: Amounts in billions of dollars.
"Direct holdings" includes mutual fund shares and money market fund shares.
"Commercial bank deposits" includes currency.
Detail may not add to total due to rounding.
Source: Board of Governors of the Federal Reserve System.

TABLE 2

AVERAGE U.S. PERSONAL SAVING FLOWS INTO FINANCIAL ASSETS

	1950-59		1960-69		1970-79	
	Amount	Percent	Amount	Percent	Amount	Percent
Direct Holdings	5.7	22.9	9.0	17.3	34.1	19.6
Intermediated Holdings	19.2	77.1	43.1	82.7	139.5	80.4
Commercial Bank Deposits	4.6	18.5	14.6	28.0	46.8	30.0
Thrift Institution Deposits	6.0	24.1	12.2	23.4	45.4	26.2
Life Insurance Reserves	3.0	12.0	4.3	8.3	8.6	5.0
Pension Reserves	5.6	22.5	12.0	23.0	38.7	22.3
Total Holdings	24.9	100.0	52.1	100.0	173.6	100.0

Notes: Amounts in billions of dollars.
"Direct holdings" includes mutual fund shares and money market fund shares.
"Commercial bank deposits" includes currency.
Detail may not add to total due to rounding.
Source: Board of Governors of the Federal Reserve System.

pattern of saving flows. In the case of both pension reserves and thrift deposits, the steady rise in share of total holdings has been a consequence of the allocation to these intermediaries of a large and relatively unchanging fraction of all new personal saving. If individuals continue to maintain this behavior, the shares of total holdings accounted for by pension fund reserves and thrift deposits will continue to rise until they converge to just over one-fifth and one-fourth, respectively. By contrast, the declining share of life insurance reserves in total holdings has reflected an equally sharp decline in the percentage allocation of new saving flows to life insurance (in part offset by capital gains on the equity component of these reserves).

Following the discussion above, these changes in the distribution of asset holding and saving flows between direct and intermediated holdings and among kinds of intermediaries matters for aggregate asset demands — and hence for the market-clearing structure of yields — only if the different respective forms of accumulation systematically correspond to different patterns of portfolio behavior. As Tables 3 and 4 show, such differences are indeed typical of individuals' and intermediaries' portfolio behavior in the United States.

The yearend 1979 portfolio allocations shown in Table 3 reveal a sharp difference between individuals' discretionary asset holdings, which were divided approximately evenly between short- and long-term instruments (among the latter, primarily equities), and the assets held by any of three kinds of financial intermediaries, more than four-fifths of which were invested at long term.[9] These intermediaries also differed among themselves in the specific assets comprising the major portion of their respective long-term portfolios — mortgages at thrift institutions, bonds

TABLE 3

PORTFOLIO ALLOCATIONS, YEAREND 1979

	Individuals' Discretionary Assets		Thrift Institutions		Life Insurance Companies		Pension Funds	
	Amount	Percent	Amount	Percent	Amount	Percent	Amount	Percent
Deposits and Currency	1,409.4	47.1	17.0	2.1	2.0	0.5	14.3	3.4
Short-Term Credit Market Instruments	150.4	5.0	24.9	3.1	8.1	1.9	7.8	1.9
U.S. Government Securities	64.6	2.2	4.6	0.6	0.8	0.2	7.8	1.9
Other Securities	85.8	2.9	20.3	2.5	7.3	1.7	0.0	0.0
Long-Term Credit Market Instruments	1,354.2	45.2	665.4	82.5	351.6	83.6	388.0	93.3
Equities	906.9	30.3	5.5	0.7	40.1	9.5	180.0	43.3
Corporate Bonds	71.6	2.4	20.8	2.6	173.1	41.2	141.4	34.0
Municipal Bonds	74.3	2.5	4.3	0.5	6.4	1.5	4.0	1.0
Mortgages	123.0	4.1	578.2	71.7	119.2	28.3	12.9	3.1
U.S. Government Securities	178.4	6.0	56.6	7.0	12.8	3.0	49.7	12.0
Other	80.3	2.7	99.2	12.3	59.0	14.0	5.8	1.4
Total	2,994.3	100.0	806.5	100.0	420.5	100.0	415.7	100.0

Notes: Amounts in billions of dollars.
"Discretionary assets" excludes life insurance and pension reserves, and equity in unincorporated businesses.
Detail may not add to total due to rounding.
Source: Board of Governors of the Federal Reserve System.

and mortgages at life insurance companies, and equities and bonds at pension funds. Moreover, as Table 4 shows, the distinction between individuals' and intermediaries' allocations of new saving flows has been much greater than that between their respective asset holdings.[10] Although the composition of the yearend 1979 holdings roughly matched that of the corresponding average 1970-79 net accumulations for intermediaries, individuals' accumulations were far more concentrated in deposits and other short-term instruments than were their total holdings. The chief source of this contrast was the equity market, in which individuals have traditionally been major holders (accounting for five-sixths of the total yearend 1979 market value) but consistent net sellers nonetheless.[11]

Given differences in portfolio behavior of this magnitude, not only between individuals and financial intermediaries in general but also among specific kinds of intermediaries, actual and potential shifts in the pattern of saving flows and wealth holding may well affect the structure of relative asset yields and, thereby, also affect important aspects of nonfinancial economic activity like capital formation and production. Even so, the fact that the relevant general equilibrium theory suggests the presence of portfolio-based intermediation effects at a qualitative level is of little interest unless these effects are of sufficient magnitude to matter in either the interpretation of observed outcomes or the assessment of specific legislative or regulatory actions. Assessing the quantitative importance of such effects in the U.S. economy is the object of Sections II and III below.

TABLE 4

AVERAGE NET ACQUISITIONS OF FINANCIAL ASSETS, 1970-79

	Individuals' Discretionary Assets		Thrift Institutions		Life Insurance Companies		Pension Funds	
	Amount	Percent	Amount	Percent	Amount	Percent	Amount	Percent
Deposits and Currency	92.2	73.0	1.2	2.2	0.0	0.1	1.2	4.9
Short-Term Credit Market Instruments	9.8	7.8	2.1	3.8	0.7	3.1	0.6	2.5
U.S. Government Securities	3.0	2.4	0.2	0.4	0.1	0.4	0.6	2.5
Other Securities	6.8	5.4	1.9	3.4	0.6	2.7	0.0	0.0
Long-Term Credit Market Instruments	19.2	15.2	44.6	80.5	17.9	80.3	22.6	92.6
Equities	- 5.3	- 4.2	0.3	0.5	2.0	9.0	9.6	39.3
Corporate Bonds	4.3	3.4	1.4	2.5	10.1	45.3	8.5	34.8
Municipal Bonds	2.9	2.3	0.4	0.7	0.3	1.3	0.2	0.8
Mortgages	7.2	5.7	38.2	69.0	4.7	21.1	0.4	1.6
U.S. Government Securities	10.1	8.0	4.3	7.8	0.8	3.6	3.9	16.0
Other	5.1	4.0	7.6	13.7	3.7	16.6	0.1	0.4
Total	126.3	100.0	55.4	100.0	22.3	100.0	24.4	100.0

Notes: Amounts in billions of dollars.
"Discretionary assets" excludes life insurance and pension reserves, and equity in unincorporated businesses.
Detail may not add to total due to rounding.
Source: Board of Governors of the Federal Reserve System.

II. A Model of Interest Rates and Economic Activity

In order to investigate the economic effects of shifts in the pattern of saving and wealth holding, it is necessary to employ a model that does not arbitrarily rule out such effects at the outset. Unfortunately for this purpose, most of the familiar macroeconometric models of the United States do just that.[12] After first determining a key short-term interest rate through the interaction of monetary policy and the demand for money, most current models then proceed in the tradition of Modigliani and Sutch [35], Modigliani and Shiller [34] and Feldstein and Eckstein [12] to determine the model's key long-term interest rate as a direct consequence of the short-term rate, via a single reduced-form term-structure equation estimated directly with the long-term rate as the dependent variable.[13] Typically such term-structure equations also include other right-hand-side variables — for example, distributed lag proxies for expectations of future interest rates, price inflation, monetary growth, or interest rate volatility. Nevertheless, they typically exclude any representation of the pattern of wealth holding and saving flows among the investors (or, analogously, the pattern of financing by borrowers) whose portfolio choices together determine the structure of asset yields. Even in those models that do include substantial sectoral financial detail, such variables are usually only peripheral, without impact on interest rate determination. The few early attempts to include in the term-structure equation one or more variables representing portfolio effects on relative yields met with limited success at best.[14]

An alternative route — and the one implemented in the model employed in this paper — is to model the determination of relative interest rates directly along the lines of the asset market partial equilibrium framework represented in skeleton form by (1)-(3) above. Once incorporated into an overall model that also determines the non-yield arguments of the asset demands (as well as any endogenous asset supplies), this partial equilibrium framework becomes just a part of a full general equilibrium model.

By far the most important long-term asset yield in the MPS model, from the perspective of implications for nonfinancial economic behavior, is the corporate bond yield.[15] As is familiar from the work of Jorgenson [25] and Bischoff [3], the corporate bond yield exerts a major influence on business fixed investment in the MPS model through its role in determining the user cost of capital. The corporate bond yield also exerts an analogous influence on residential investment at only one step removed; in this case the relevant user cost depends on the mortgage yield, which in turn follows from the corporate bond yield via a simple term-structure-like relationship. In addition, the corporate bond yield influences both durable and nondurable consumption spending via two different channels. First, the motivation underlying the determination of expenditures on consumer durables is again analogous to that for business and residential investment, although in this case the model actually uses a simplified function relating these expenditures directly to the corporate bond yield. Second, following the "life cycle" model developed by Modigliani, Brumberg and Ando [2 , 29 , 32], the primary determinant of nondurable consumption is households' wealth, which consists in large part of equities;[16] the model determines the market value of equities as the quotient of dividend payments, determined by a function in which the corporate bond yield is one direct argument among several, and the dividend-price yield, which also follows from the corporate bond yield via another simple term-structure-like relationship. Finally, within the model's representation of the financial markets, the corporate bond yield is a direct argument of the functions determining numerous other yield and quantity variables that in turn also exercise diverse influences on nonfinancial behavior.[17]

Given the pervasive role of the corporate bond yield in the MPS model, portfolio-based intermediation effects that alter the structure of interest rates will in general also alter the model's implications for a broad range of financial and nonfinancial economic outcomes. As long as the model determines the corporate bond yield by a conventional term-structure equation that excludes such effects at the outset, however, it clearly cannot address questions raised about their likely importance.

The model employed here for this purpose therefore consists of an altered MPS model from which the usual single term-structure equation for the corporate bond yield has been removed and into which a disaggregated supply-demand model of the corporate bond market, constructed along the lines of (1)-(3) above, has been substituted in its place. This supply-demand model, initially developed in Friedman [14, 15], has several advantages in comparison with the more familiar single-equation term-structure model of long-term interest rate determination. The primary advantages of the supply-demand model in a more general context are the facility it provides for using the theory of portfolio behavior to restrict the model's implied equation for the long-term interest rate (in comparison to the unrestricted reduced-form nature of the directly estimated single term-structure equation) and the corollary discipline it imposes on the researcher of explicitly acknowledging that any factor hypothesized to influence the long-term interest rate can do so only by influencing some borrower's supply of bonds and/or some investor's demand for bonds.[18] In addition, the model's disaggregation, according to which different categories of investors exhibit different portfolio behavior in a way that matters for relative asset yields, is of particular importance in the context of this paper's focus on the macroeconomic effects of shifts in patterns of wealth holding and saving flows.

The demand side of the corporate bond market model consists of six equations separately representing the net purchases of corporate bonds by life insurance companies, other insurance companies, private pension funds, state and local government pension funds, mutual savings banks, and households. These investors together hold nearly 95% of all corporate bonds issued in the United States. Moreover, each of the five categories of institutional investors is subject to legislation and regulation that importantly affects its role in the U.S. financial intermediation process. The supply side of the model consists of two equations separately representing the net new issues of corporate bonds by domestic nonfinancial business corporations and finance companies, which together account for nearly 90% of all corporate bonds issued in the United States. Legislation and regulation of financial intermediation also affects nonfinancial businesses through their role as sponsors of most of the nation's private pension plans. A ninth equation determines the net of the bond purchasing and bond issuing activity of all other participants in the U.S. corporate bond market. The model's tenth, and final, equation is simply a market-clearing equilibrium condition analogous to (2), which permits the model to determine the corporate bond yield as in (3).[19]

The specification of each investor group's respective demand for bonds follows from a linearization of the asset demand system (1), together with generalizations to allow for non-yield influences on desired portfolio allocations (for example, expected price inflation) as well as partial short-run adjustments of actual to desired allocations due to transactions costs. The precise specification actually used combines the linearized form of (1),

$$\underline{A}_{it}^{D*} = W_{it} \cdot (B_i \underline{r}_t^e + \Gamma_i \underline{x}_t + \underline{\pi}_i) \tag{4}$$

with the optimal marginal adjustment model

$$\underline{A}_{it}^{D} = \left(\frac{W_{i,t-1}}{W_{it}} \theta_i + \frac{\Delta W_{it}}{W_{it}} I\right) \underline{A}_{it}^{D*} + (I - \theta_i) \underline{A}_{i,t-1}^{D} \tag{5}$$

where $\underline{x}$ is a vector including the variances and covariances associated with $\underline{r}^e$ as well as any other relevant influences on desired portfolio selection, coefficient matrix B and vector $\underline{\pi}$ (as well as matrix Γ) are now time invariant, θ is a matrix of adjustment coefficients, I is the identity matrix, and ΔW is total investable cash flow. The specification of each borrower group's respective supply of bonds is analogous to (4) and (5) for the selection of liabilities to finance a given cumulated external deficit. For both investors and borrowers the primary rationale motivating the return-linear and wealth-homogenous portfolio selection model is, as usual, simply its convenience and tractability. The principal advantage motivating the optimal marginal adjustment model is that it captures in a tractable way the effect of differential transactions costs which, since they render the allocation of the new investable cash flow more sensitive to expected yields (and variances, etc.) than the reallocation of existing asset holdings, make the pattern of such cash flows especially important to asset demands and hence relative asset yields in the short run. Given the sharp disparity between the composition of investors' asset holdings and their new portfolio allocations, as illustrated in Tables 3 and 4, this distinction is particularly relevant in the context of an analysis of saving shifts like those that are the focus of this paper.[20]

Apart from the replacement of the single reduced-form term-structure equation by the ten-equation supply-demand model of the corporate bond market, the model employed for the empirical analysis of saving shifts in Section III below is identical in all respects to the familiar MPS model. Because the model's determination of the corporate bond yield is different, and because the corporate bond yield itself is so fundamental to the model's determination of both financial and nonfinancial outcomes, this one modification does significantly alter some of the model's macroeconomic properties.[21] More importantly for the purposes of this paper, the determination of the corporate bond rate by the disaggregated supply-demand model facilitates the analysis of shifts of wealth holding and saving flows among different forms of intermediation exhibiting heterogeneous portfolio behavior.

III. Empirical Assessment of the Effects of U.S. Saving Shifts

A. Increased Pension Contributions by Individuals

As is clear from Table 1, pension funds have been the most rapidly growing major form of financial intermediation in the United States for some years. With $416 billion in total assets as of yearend 1979, pensions had almost overtaken life insurance as a vehicle for intermediating private savings, and they represented an asset pool fully half as large as all thrift institutions combined. Pension funds now constitute by far the largest group of institutional investors in corporate equities, and they are second only to the life insurance industry among all investors in corporate bonds.

This rapid growth of the pension system has in part reflected tax incentives, which have become more important as effective tax rates on real capital income have risen, together with a widespread increase in the society's general sensitivity toward problems associated with aging. Specific legislative and regulatory actions, most notably the Employee Retirement Income Security Act of 1974, have further accelerated this process. Moreover, a variety of currently pending proposals would reinforce it yet further.

Not surprisingly, the economic effects of the shift toward saving via pensions — including both actual effects to date, and also potential future effects — have attracted substantial interest in studies that have focused on such matters as impacts on aggregate saving, trends in corporate ownership, pricing of equity securities, financial soundness of pension sponsors, potential government liability via the Pension Benefit Guarantee Corporation in the event of bankruptcy of corporate pension sponsors, and growing concentration of securities markets.[22] From the standpoint of this paper's concern with asset-market effects due to shifts in saving flows between investors exhibiting diverse portfolio behavior, the analysis in Friedman [13, 16] found sizeable impacts on the term structure of interest rates in the direction suggested by the analysis in Section I. Specifically, partial equilibrium simulations of the bond market model described in Section II indicated that increases in pension accumulations of reasonable magnitude, matched by equal reductions in individuals' direct asset accumulations, led on average to a pronounced flattening of the yield curve — in other words, to a lessening of the average "spread" of long-term over short-term interest rates.

The partial equilibrium nature of the analysis in those earlier papers imposed severe limitations, however. Most obviously, neither paper had anything quantitative to say about the nonfinancial ramifications of the simulated interest rate effects, nor about potential feedbacks by which whatever nonfinancial changes occurred would in turn affect financial markets. Moreover, even within the bounds of the financial markets alone, in the earlier analysis it was impossible to specify fully the complete set of mutually consistent restrictions underlying the simulation experiments. For example, if monetary policy acts to hold short-term yields fixed while the pattern of saving flows shifts, then the flattening effect on the term structure will translate directly into a decline in long-term yields stimulating investment and income generally, and thereby increasing the demand for money; in this case the ultimate macroeconomic impact will therefore represent some combination of a saving shift effect and a monetary policy effect. Alternatively, if monetary policy holds money stock growth fixed while saving flows shift, then both short- and long-term yields will change, and the spread between the two will narrow with ambiguous effects on nonfinancial activity. As applied to the investigation of saving flow shifts like that from individuals to pensions, the function of the general equilibrium framework consisting of the combined MPS and bond market model described in Section II is to overcome exactly this kind of limitation and ambiguity.

Column (1) in Table 5 summarizes the results, for selected financial and nonfinancial variables, of a simulation of this model in which the cash flow of pension funds is uniformly greater than the corresponding historical flow by $10 billion per annum.[23] Apart from this single exception, the simulation relies on historical values of all exogenous variables — including in particular the historical level of real government purchases of goods and services, and the historical level of the nominal money stock (M1). Hence the simulation represents the effects of the saving flow shift in the absence of any "accommodating" changes in either fiscal or monetary policy. Moreover, each equation in the model is adjusted by adding back the historical single-equation residuals so that, given the historical values for all exogenous variables including the pension cash flow, the model would exactly reproduce the historical values shown in the left-most column of Table 5. Differences between these historical values and the simulated values shown in column (1) are therefore attributable entirely to the effect of the extra pension contributions rather than to any underlying inability of the model to reproduce the observed historical record. The simulation period is the ten-quarter interval spanning 1967:I - 1969:II — perhaps the last time that the U.S. economy was neither in recession, nor in the immediate recovery from recession, nor under price controls, nor adjusting to sharp energy price changes.[24]

Individuals' wage and salary income is a variable determined

TABLE 5

SIMULATED EFFECTS OF $10 BILLION PER ANNUM SAVING SHIFTS: MEAN VALUES

Shift From To Variable	Historical	(1) Households Pensions	(2) Corporations Pensions	(2') Corporations Pensions	(3) Households Life Insurance	(4) Households Savings Banks
		1967:I - 1969:II Simulated Values				
r_{CP}	5.82	6.50	7.57	7.15	7.21	6.36
r_{CB}	6.56	6.14	6.32	6.40	6.15	6.52
ΔB	14.0	16.3	18.2	18.2	16.6	14.6
r_{DP}	3.13	3.13	3.37	3.28	3.22	3.16
S	729.6	739.6	672.5	661.2	723.3	728.7
X	1039.3	1046.0	1050.4	1047.8	1050.8	1043.9
IP	41.9	42.4	42.7	42.5	42.7	42.2
IE	65.5	66.4	66.9	66.6	66.8	66.0
IH	41.0	42.9	42.0	41.8	46.6	43.2
C	624.9	627.8	632.4	630.5	628.4	626.4
P	81.73	82.04	82.66	82.47	82.40	82.01
GNP	850.1	859.1	869.2	865.0	867.0	857.0
ΔWH	66.6	58.8	74.6	74.0	62.2	59.0
CDF	31.8	32.7	36.9	40.0	33.2	32.3
CPR	83.0	85.8	77.3	76.2	87.7	84.9

(Table 5 continued on the following page)

(TABLE 5 continued)

Variable Symbols:

r_{CP} = commercial paper yield (%)

r_{CB} = corporate bond yield (%)

ΔB = total net new issues and purchase of corporate bonds ($ billion)

r_{DP} = dividend-price yield (%)

S = market value of common stock ($ billion)

X = real gross national product (1972 $ billion)

IP = real investment in plant (1972 $ billion)

IE = real investment in equipment (1972 $ billion)

IH = real residential investment (1972 $ billion)

C = real consumer expenditures (1972 $ billion)

P = implicit price deflator (index, 1972 = 100)

GNP = gross national product ($ billion)

ΔWH = households' net accumulation of financial assets ($ billion)

CDF = nonfinancial corporations' net external deficit ($ billion)

CPR = corporate profits ($ billion)

endogenously within the MPS model and hence also within the model underlying the simulations reported in Table 5. In the simulation summarized in column (1), the $10 billion annual increase in pension contributions is financed by individuals in the sense that the relevant income variable includes an exogenous component equal to minus $10 billion per annum. Because income otherwise remains an endogenous variable, however, the general equilibrium solution of the model does not necessarily indicate a $10 billion annual reduction in income after allowance for changes in nonfinancial activity. Moreover, the impact on individuals' saving of whatever decline in their income does thus occur is currently a subject of some debate.[25] The specific restriction underlying this simulation is that individuals are fully aware of the additional pension contributions and regard the change solely as one of the form in which they save, so that the $10 billion annual reduction in income (before feedback effects) translates directly into an equal reduction in financial saving without affecting consumption.[26] Once again, because saving otherwise remains an endogenous variable, the general equilibrium solution of the model does not necessarily indicate a $10 billion annual reduction in financial saving after allowance for changes in income and other variables determining saving behavior.

A comparison of the historical and simulated values of the yields on commercial paper and corporate bonds, on average over the simulation period, indicates that the increased pension contributions induce relative movements in these two interest rates consistent with the partial equilibrium results in Friedman [16]. In particular, the short-term yield is on average more than 1/2% higher than the corresponding historical value, while the long-term yield is on average nearly 1/2% lower — a result that could not be produced by familiar term-structure equations which, by imposing time invariance of the implied term premium, do not allow for shifts in the pattern of saving flows and wealth holding among investors with different portfolio behavior. Because the source of the relative interest rate movement here is a shift of saving flows among investors (in other words, a shift on the demand side of the financial asset markets), in the bond market the decline in yield represents a movement outward along borrowers' downward-sloping bond supply curve (in other words, their demand-for-funds schedule). In fact, the increase in the net volume of bond financing, in comparison with the corresponding historical volume, is more than $2 billion per annum. In the equity market the dividend-price yield remains unchanged, but greater dividends lead to an average increase from the historical of $10 billion, or more than 1%, in the value of outstanding equities.

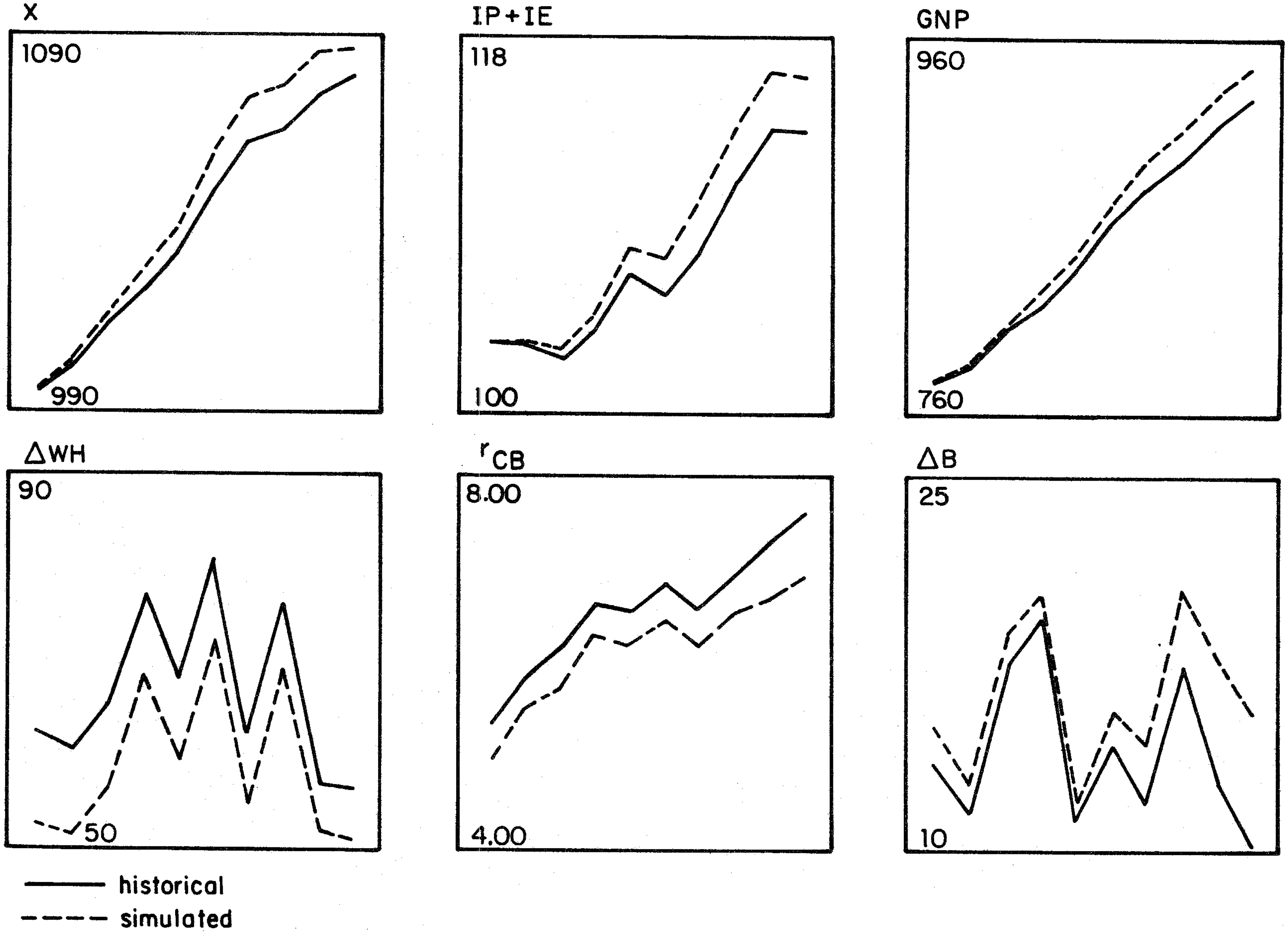
These financial effects of the shift in saving toward pension contributions in turn affect nearly all components of nonfinancial economic activity. Average real income is greater than the historical by nearly $7 billion, as the lower long-term interest rates stimulate all forms of investment while the greater value of stock market wealth stimulates consumption. The saving shift also influences the composition of economic activity, in that it does not stimulate the various components equally. In particular, the three categories of fixed investment, which together comprised only one-seventh of historical total spending, account for almost one-half of the simulated increase over the historical. Hence this simulation bears out the often suggested idea that pension contributions enhance capital formation. Finally, prices are modestly higher, because of the greater pace of real activity, so that the average nominal income is greater by $9 billion.

The bottom few lines of the table present values for additional variables that help in further understanding the simulation. First, despite the exogenous $10 billion annual reduction to finance the additional pension contributions, individuals' financial saving declines in comparison to the historical by not quite $8 billion per annum. The difference simply reflects the additional income generated by the higher level of economic activity. Second, nonfinancial corporations' net deficit financed externally rises somewhat in comparison to the historical despite a strong boost to corporate profits. The reason for this development is that corporations' share of the rise in investment spending takes up more than all of what is left of their additional profits after tax and dividend payments. Since the increase in the external deficit is considerably smaller than the increase in net bond financing, however, well over half of the bond issuing surge represents a restructuring of liabilities spurred by the change in the relative costs of long- and short-term borrowing.[27]

Figure 1 and Table 6 provide more complete information about the simulation. Figure 1 plots the quarter-by-quarter historical and simulated paths, for the ten quarters of the simulation period, for several key variables. As is familiar from most applications of the MPS model, any stimulus to real economic activity eventually "crowds itself out."[28] In this case the peak effect on real income occurs in the eighth quarter after the inception of the enlarged pension contributions, and nearly one-third of the effect on total income has subsided by the tenth quarter. The first column of Table 6 shows the difference from the historical in the eighth quarter for each of the variables for which the mean value is reported in Table 5. Of particular interest here are the large increase in the commercial paper yield, due to the increased demand for money associated with the larger nominal income, and the almost complete return of equity values to their

FIGURE 1

SIMULATED EFFECTS OF ADDITIONAL PENSION CONTRIBUTIONS



Notes: The simulation period plotted is 1967: I - 1969: II.
See Table 1 for definitions of variable symbols.

TABLE 6

SIMULATED EFFECTS OF $10 BILLION PER ANNUM SAVING SHIFTS: PEAK-QUARTER DIFFERENCES

Shift	(1)	(2)	(2')	(3)	(4)
From / To	Households / Pensions	Corporations / Pensions	Corporations / Pensions	Households / Life Insurance	Households / Savings Banks
Peak	1968:IV	1968:II	1968:II	1968:III	1968:III
Variable	Simulated Differences				
r_{CP}	1.12	2.15	1.67	1.82	0.74
r_{CB}	- 0.40	- 0.23	- 0.15	- 0.45	0.01
ΔB	3.3	2.9	3.1	2.4	0.4
r_{DP}	0.05	0.11	0.07	0.04	0.01
S	0.4	-36.9	-52.9	10.9	8.0
X	12.0	18.1	13.7	20.8	8.0
IP	1.0	1.3	1.0	1.4	0.6
IE	1.7	2.2	1.7	2.4	1.0
IH	3.9	2.0	1.5	9.3	3.4
C	4.8	9.5	7.1	7.0	3.0
P	0.55	0.95	0.77	0.87	0.39
GNP	16.0	24.9	19.4	26.7	10.9
ΔWH	- 6.3	8.8	7.6	- 1.6	- 6.6
CDF	2.0	6.6	9.3	2.3	1.0
CPR	4.9	- 3.4	- 5.2	8.6	3.2

historical level.

Figure 1 also shows that the effect on investment in plant and equipment continues to persist beyond the eighth quarter, however, so that the burden of the crowding out that occurs toward the end of the simulation period falls mostly on consumption and residential investment. Because of the gradual acceleration of price inflation, the additional increase of nominal income over real income in comparison with the historical comes mostly at the end of the simulation period and does not abate. Individuals' financial saving, initially depressed by the full $10 billion per annum rate, continues to recover throughout the simulation period so that the shortfall in comparison with the historical is less than $6 billion by the end. In the bond market both the decline in the bond yield and the induced increase in financing volume continue to grow throughout the simulation period.

B. Increased Pension Contributions by Firms

Contributions by workers represent only one source of pension funding. Contributions in their behalf by employers is in fact the more typical funding mechanism in most industries in the United States. From the standpoint of effects on economic activity, of course, the question of who formally makes the payment is of less consequence than that of who ultimately bears its incidence. Pension contributions nominally made by firms actually represent workers' contributions to the extent that they simply take the place of wages and salaries which workers would otherwise have received. Conversely, contributions nominally made by workers actually represent firms' contributions to the extent that wages and salaries are greater so as to cover them. Viewed from this perspective, the simulation reported in Figure 1 and in column (1) of Tables 5 and 6 simply represents the extreme case in which the entire incidence falls on workers.

Column (2) of Table 5 summarizes an analogous simulation of the economic effects of the same $10 billion annual increase in pension funding, but in this case under the assumption that the entire incidence of the additional contributions falls on nonfinancial corporations. Corporate profits, like individuals' wages and salaries in the simulation described above, is an endogenous variable within the combined MPS and corporate bond market model. Here the $10 billion annual increase in pension contributions is financed by corporations in the sense that it is now corporate profits that includes an exogenous component equal to minus $10 billion per annum. Once again, however, corporate profits otherwise remains an endogenous variable, so that the general equilibrium solution of the model does not necessarily indicate a $10 billion annual reduction in profits after allowance for changes in nonfinancial activity.

The effects shown in column (2) for additional business-financed pension contributions are in many respects similar to those in column (1) for additional individual-financed contributions, but larger in magnitude. The feedback of the greater nonfinancial effects, however, causes some significant changes in the financial markets. Because of the increased demand for money to finance the much greater volume of nominal transactions, the commercial paper yield rises by 1 3/4% in comparison with the historical, and the dividend-price yield is higher by 1/4% also. The combination of a rise in the dividend-price yield and a decline in dividends due to smaller corporate profits results in a decline of $57 billion, or almost 8%, in equity values. In the bond market the chief effect is the result of an outward shift in both demand and supply curves, so that the direction of the effect on the volume of new financing is clear a priori while the direction of the effect on the bond yield is not. More specifically, because the shift represented by additional business-financed pension contributions increases the funds requirements of bond insurers and also increases the funds available for investment by bond purchasers, the large $4 billion per annum increase in bond financing is hardly surprising. The net movement in the bond yeild, which in principle could be either up or down, is a 1/4% decline.

Once again, these financial effects influence both the magnitude and the composition of economic activity. The average increase in total real spending relative to the historical is $11 billion, but in this case only about one-fourth of this increase takes the form of additional capital formation. Investment in both plant and equipment is somewhat greater than in the simulation summarized in column (1), but the boost to residential investment is much less because of the effect of the high short-term interest rates on thrift deposits and mortgage lending. With prices higher by more than 1% on average, the average increase in nominal income is $19 billion.

The variables shown in the final lines of the table indicate the source of much of the contrast between individual and business financing of additional pension contributions. Here individuals' incomes rise sharply so that their financial saving is $8 billion per annum greater than the historical, while corporate profits are now almost $6 billion per annum less than the historical as the greater volume of business activity makes up for not quite half of the additional pension contributions. Both of these changes are of opposite sign to those in column (1). Finally, as a result of the combination of lower corporate profits and greater investment expenditures, nonfinancial corporations' external deficit is greater than the historical by $5 billion per annum. Since this increase in the external funds requirement exceeds the increase in the volume of bond financing, corporations are meeting their enlarged needs for funds by borrowing more at both long and short term.

The simulated effect of the increased pension contributions on overall real activity peaks in the sixth quarter, and the "crowding out" phenomenon is essentially complete by the tenth quarter, with residential construction well below the corresponding historical level. Column (2) of Table 6 shows the differences from the historical for the sixth quarter, for each of the variables considered in Table 5. Comparison of columns (1) and (2) in Table 6 reconfirms most of the similarities and constrasts between individual and business financing of pension contributions already noted above.

In seeking to understand why additional pension contributions financed by corporations appear to have such greater stimulative effects on non-financial activity than do additional pension contributions financed by individuals, it is important to recognize the role of the tax system. Pension contributions are deductible from taxable income for either corporations or individuals, but the effective marginal rates of taxation differ sharply between the two. In the case of individual contributions, individuals absorb approximately five-sixths of the additional contributions as foregone after-tax income, and the government gives up about one-sixth in tax revenues.[29] By contrast, in the case of business contributions the government gives up about one-half of the additional contributions in tax revenue, so that the net loss to corporations (before allowance for changes in nonfinancial activity) is only the remaining one-half.

To a much greater extent than in the case of additional pension contributions financed by individuals, therefore, the effects on economic activity shown in column (2) of Tables 5 and 6 represent the combination of portfolio effects due directly to the altered saving flows and fiscal effects attributable more correctly to the enlarged government deficit. Column (2') in these tables isolates the importance of these fiscal effects by summarizing an analogous simulation for a $10 billion annual increase in pension contributions financed by nonfinancial corporations on a non-deductible basis. Specifically, while the corporate profits variable again includes an exogenous component equal to minus $10 billion per annum, the corporate tax functions are altered so as to include that $10 billion in profits subject to tax.

The results show that approximately one-fourth of the total effect shown in column (2), both for overall economic activity and for several financial variables, is in fact attributable to the fiscal effect that follows from the high-rate deductibility of the additional corporate pension contributions. Corporate profits are again depressed in comparison with the corresponding historical level, but corporate tax payments (not shown in the tables) are now $2 billion per annum greater on average over the simulation period. The enlargement of nonfinancial corporations' external deficit is greater, therefore, and the swelling of bond financing is greater also at the peak (which again occurs in the sixth quarter).

In sum, additional pension contributions financed by corporations appear to have somewhat greater effects on the magnitude of economic activity than do additional pension contributions financed by individuals, although much of the difference represents the larger fiscal effect that follows from deductibility of such contributions against a much higher marginal tax rate for corporations. By contrast, although additional pension contributions stimulate capital formation disproportionately in comparison with other kinds of spending no matter how they are financed, contributions financed by individuals have the greater impact on the composition of economic activity.

C. Increased Insurance Purchases by Individuals

As Table 1 shows, another of the major developments in patterns of saving in the United States during the post World War II era has been the relative decline of the life insurance industry. Although the amount of life insurance in force has shown solid growth, there has been an increasing tendency to divorce the saving and insurance functions through the use of term insurance (often purchased in group form) which does not accumulate reserves from one year to the next.[30] As a result, life insurance has steadily shrunk as a share of total U.S. saving.

In recent years some insurers have sought to slow or even reverse this decline through the introduction of new insurance products, most notably the variable-rate annuity tied to the performance of the investment portfolio (usually equities) used to fund it. In the face of the poor returns to equity investments in general during the last decade, however, together with increased doubts that equities provide a significant hedge against price inflation, the variable-rate annuity has at best met limited success. Students of the insurance industry have subsequently suggested other ideas, including the use of yet a different asset mix (short-term debt instruments in combination with a small amount of commodity futures contracts) and a revised payout schedule to provide a genuine purchasing-power annuity.[31] As yet such plans remain only proposals, however — perhaps in part because of the industry's regulatory structure, which places its activities primarily under the jurisdiction of individual state insurance commissions. Even so, it is possible that life insurers will introduce (and their regulators will approve) some set of new products that will once again enhance the growth of life insurance reserves, and hence bolster the growth of insurers' portfolios.

In that event, the data shown in Tables 3 and 4 suggest that asset-market effects comparable to those analyzed above in connection with pensions would also ensue.

Column 3 of Tables 5 and 6 summarizes the simulated results of an additional $10 billion per annum in net life insurance purchases by individuals. Specifically, in this simulation the accumulation of life insurance reserves net of policy loans (the difference between two endogenous variables in the model) includes an exogenous component equal to $10 billion per annum, while individuals' financial saving available for general disposition includes an exogenous component equal to minus $10 billion per annum. The model's exogenous variables are identical to their historical values in all other respects, and each equation is again adjusted by adding back the single-equation residuals.

In most respects the simulated results of the shift in saving toward life insurance resemble those reported in column (1) for additional individual-financed pension contributions. In the financial markets the shift in saving flows again generates effects on relative asset yields consistent with what the analysis in Section I implies on the basis of observed differences between individuals' and insurance companies' portfolio behavior. On average the commercial paper yield is higher by almost 1 1/2% and the corporate bond yield lower by almost 1/2% in comparison with the historical. Since the principal change in the bond market is an outward shift in the demand for bonds, the lower bond yield comes on an increase of nearly $3 billion per annum in financing by bond issuers. The dividend-price yield is slightly higher, so that equity prices on average are marginally lower than the historical despite greater dividends. In the quarter of the peak effect on nonfinancial activity, however, the level of stock market wealth is greater than the historical by $11 billion, or 1 1/2%. The associated effects on nonfinancial activity are the largest among all of the saving shifts considered thus far, just exceeding the impact of fully tax-deductible pension contributions by corporations. Moreover, here the effect on the composition of spending is by far the greatest, with additional capital formation (especially residential investment) accounting for two-thirds of the total increase. Individuals' remaining financial saving is again reduced in comparison with the historical, but by less than half of the $10 billion per annum in extra insurance purchases on average, and by less than $2 billion per annum at the quarter of the peak real effect.

Since the accumulation of life insurance reserves (not shown in the tables) is an endogenous variable in the model — in contrast to the accumulation of pension reserves — it is interesting to see how feedbacks from both induced interest rate effects and induced nonfinancial effects alter net insurance purchases. In the first quarter of the simulation, before any of the effects shown in the tables has had time to grow significantly, the net accumulation of life insurance reserves in comparison to the corresponding historical value is greater by almost the full $10 billion per annum imposed exogenously ($9.98 billion, to be precise). By the seventh quarter, when the peak impact on nonfinancial activity occurs, the combination of negative effects due to higher short-term interest rates and positive effects due to enlarged income flows reduces the net gain from the historical to just over $8 billion per annum. By the tenth quarter, when real "crowding out" has sharply reduced the enlargement of income flows but still left short-term interest rates high because of the additional demand for money due to the greater volume of nominal transactions, net life insurance purchases are little more than $3 billion per annum greater than the historical. The magnitude of these feedbacks serves as an illustration of the importance of relying on a general equilibrium framework for analysis of this kind.

D. Increased Thrift Deposits by Individuals

Perhaps no part of the entire financial intermediation structure in the United States has been the focus of more economic analysis, reform proposals, or political discussion than has centered on the group of "thrift" institutions consisting of savings and loan associations, mutual savings banks and credit unions.[32] The special role that savings and loans and mutual savings banks play in the financing of residential investment, the special problems that these lenders face as a consequence of the mean duration of their mortgage assets in contrast to that of their deposit liabilities, and the still further problems created for them by the interaction of Regulation Q ceilings and market interest rates in an era of rapid and volatile price inflation — all have combined to make the thrift institutions the target of a major legislative initiative in nearly every year during the past decade and a half.

In mid 1978 thrift institutions received authorization to offer a market-determined rate of interest on several kinds of savings certificates, and these have subsequently come to dominate their savings flows. Most recently, the Depository Institutions Deregulation and Monetary Control Act of 1980 has mandated several important changes in the way these institutions do business, among the most important of which are the extension of NOW account and automatic transfer systems nationwide in 1981 and the elimination of Regulation Q ceilings by 1986. In conjunction with changes in the mortgage instrument that are already becoming commonplace, the ability of thrift institutions to pass along higher portfolio returns to their depositors should further enhance the attractiveness of their liabilities. At the same time, they will have to compete with commercial banks without the small yield advantage that they have enjoyed for years under Regulation Q. In sum, substantial shifts in the pattern of individuals' saving flows, either toward or away from thrift institutions, are a distinct possibility for the foreseeable future.

Column 4 of Tables 5 and 6 summarizes the simulated results of an additional $10 billion per annum in deposits by individuals in mutual savings banks — because of legal restrictions the only one of the three kinds of thrift institutions to be a major factor in the bond market, and hence the only one whose demand for bonds is explicitly represented in the model described in Section II.[33] This simulation is identical to that summarized in column (3) in all respects except that here the variable including an exogenous component equal to $10 billion per annum is the accumulation of mutual savings bank deposits.

The simulated effects of the shift in saving toward mutual savings bank deposits contain few surprises, and overall they are the smallest among any of the saving shift effects examined here. The commercial paper yield rises on average by 1/2% relative to the historical, but the effect on both yield and new issue volume in the bond market is negligible, as is the effect on both yield and prices in the equity market. Total spending in real terms is greater than the historical by only $5 billion, of which two-thirds consists of additional capital formation. Given the role of mutual savings banks in the home mortgage market, it is not surprising that the greatest real impact is on residential investment. Individuals' remaining financial saving is reduced on average by three-fourths of the $10 billion per annum exogenously shifted into mutual savings bank deposits. Finally, because the induced increase in short-term interest rates is so small, the gain from the historical in the net flow into these deposits (not shown in the tables) never falls below $8 billion per annum.

IV. Concluding Comments

The analysis in this paper supports several theoretical and empirical conclusions.

First, at the theoretical level, partial equilibrium analysis of the asset markets indicates that shifts in the pattern of saving flows and wealth ownership, among investors exhibiting heterogeneous portfolio behavior, affects the relative structure of asset yields. In a general equilibrium model reflecting channels of influence in both directions between the financial markets and the product and factor markets, such shifts also affect nonfinancial activity.

Second, at the empirical level, analysis based on a large macro-econometric model of the United States that incorporates a supply-demand model of the determination of long-term interest rates indicates that sizeable impacts on relative asset yields follow from any of several kinds of shifts of plausible magnitude in U.S. private saving flows. In particular, changes in the intermediation of private saving in the direction of pension funds, life insurance companies and mutual savings banks all lower long-term relative to short-term interest rates, though by different magnitudes in each case.

Third, the changes in relative asset yields that follow from these saving shifts also have sizeable impacts on both the level and the composition of nonfinancial economic activity. In each case the increase in the inter-mediation of private saving not only raises total income and spending but also stimulates investment spending disproportionately, thereby increasing the share of total output devoted to capital formation, although again the specific magnitudes and proportions differ according to the particular saving shift involved.

These conclusions are of special interest in light of the substantial shifts that are already in progress, as well as in prospect for the foreseeable future, in the pattern of U.S. financial intermediation. Nevertheless, for several reasons it is important to regard the empirical results in particular as only tentative. In part this caution is warranted for the usual reasons appropriate in any such empirical analysis, including the limitations inherent in the use of any empirical model with its associated set of behavioral assumptions and other imposed restrictions. Even beyond this usual set of concerns, however, two further caveats arise from the structure of the simulation experiments described above, each of which simultaneously imposes a shift in saving flows among different investor groups while assuming that the portfolio selection behavior of each relevant group continues to follow the observed historical patterns as estimated in the model.

One potential problem in this methodology is that it does not make allowance for whatever changes in the intermediary's portfolio behavior may underly the shift of saving flows to it. This omission is probably of little harm in the case of pension funds, for which increased current flows largely reflect direct responses to legislative and other influences rather than the public's reaction to any change in pension investment behavior. In the case of life insurance companies, however, the industry's potential ability to attract enlarged saving flows will no doubt depend on, among other factors, its ability to offer new insurance products; and funding such new products may well require at least some change in insurers' investment behavior. Similarly, although increases (or decreases) in saving flows to thrift institutions will probably reflect legislative and regulatory changes for the most part, these changes are also likely to make at least some difference for these institutions' asset portfolios.

The other limitation of this methodology is that it does not make allowance for whatever changes individuals may make in the allocation of their remaining portfolios of directly held assets in recognition of the greater amount of assets held in their behalf by intermediaries.[34] For example, if corporations make additional contributions to defined-benefit pension funds that they sponsor, then the individual shareholders of these corporations may recognize that they now share the financial interest in a larger asset pool consisting usually of equities and bonds, and they may therefore cut back on their own direct investment in these securities. Similar arguments apply to life insurance and thrift deposits, albeit with less force because of the greater degree of asset transformation provided by the intermediary in these cases. Although it is not implausible that some amount of offsetting behavior of this kind occurs, it strains credulity that such behavior on the part of individuals would nullify even a large part, much less all, of the portfolio effects analyzed here.[35] Even so, for this reason it is probably best to consider the estimates found here as representing some form of upper bound on the effects that would actually follow in the presence of such offsetting behavior.

Footnotes

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1. See Treynor et al. [43] for a review of the effect of the ERISA legislation on funding of private pensions, and Tilove [42] for a review of developments in the funding of state and local government pensions.

2. See, for example, Lintner [27] on risk aversion preferences and Stiglitz [41] on maturity preferences. The structure of the argument that follows is condensed from Friedman [16].

3. The specific form of (1), if all assets are risky, is $B = -\frac{1}{\rho}[\Omega^{-1} - (\underline{1}'\Omega^{-1}\underline{1})^{-1}\Omega^{-1}\underline{1}\underline{1}'\Omega^{-1}]$ and $\underline{\pi} = (\underline{1}'\Omega^{-1}\underline{1})^{-1}\Omega^{-1}\underline{1}$, where ρ is the coefficient of relative risk aversion and Ω is the variance-covariance matrix. Here B is singular, so that the asset demand system will be capable of determining all relative yields and all but one absolute yield. Alternatively, in the presence of a risk-free (certain return) asset the full Ω matrix is singular, so that it is necessary to partition the set of demands; the resulting asset demand system, in which $\underline{A}^D$, $\underline{r}^e$ and Ω refer to the risky assets only, is then just $\underline{A}^D = W \cdot (B\underline{r}^e)$ where $B = \frac{1}{\rho}\Omega^{-1}$, and the optimal portfolio demand for the risk-free asset is simply $(W - \underline{A}^{D\prime}\underline{1})$. See Friedman and Roley [18] for a proof that constant relative risk aversion and joint normal asset return assessments imply asset demand functions that are homogeneous in wealth and linear in expected returns, and Roley [40] for a thorough treatment of the distinction between the cases with and without a risk-free asset.

4. The concept of "duration" here means the weighted-average discounted maturity; see, for example, Hopewell and Kaufman [23].

5. See also Leijonhufvud [26], especially pp. 205-230, 282-299.

6. If the intermediary is simply a shell, which provides no such service and through which investors see perfectly, then, of course, all that would matter for the market-clearing structure of yields would be the distribution among final holders.

7. Extending the analysis to include direct holdings of nonfinancial assets could also be useful, pending the adequacy of price data for such assets; behavior with respect to nonfinancial assets lies beyond the scope of this paper.

8. Because individuals' direct financial asset holdings consist disproportionately of equities, the percentages indicated in Table 1 have fluctuated from one year to the next with the fluctuation of equity prices, but the general evolution shown in the table is valid regardless of the choice of specific illustrative years.

9. Especially for individuals and pension funds, the fluctuation of equity values again causes these percentages to vary from one year to the next. Once again, the general distinctions drawn in the text are valid regardless of the specific year in question.

10. The asset accumulations shown in Table 4 represent the difference between purchases and sales; they are net of price changes.

11. Indeed, individuals' aggregate position as net sellers of equities far antedates 1970. Individuals have been net sellers of equities including mutual fund shares in every year since 1962, and net sellers of equities other than mutual fund shares in every year since 1958. Individuals were net purchasers of mutual fund shares until 1971, but since 1972 they have been net sellers of both mutual fund shares and other equities.

12. To the author's best knowledge, this generalization applies with equal force to models of other economies too.

13. As Feldstein and Chamberlain [11] have pointed out, the equation is not even a valid reduced form in the presence of feedback from the long-term rate to the variables determining the short-term rate (for example, income in the money demand function).

14. The most comprehensive attempt in this direction was that of Modigliani and Sutch [36]. See also Okun [39] and Malkiel [28].

15. See Friedman [17] for a more detailed explanation of the influences of the corporate bond yield enumerated in this paragraph. For more complete descriptions of the MPS model (and its antecedents), see de Leeuw and Gramlich [6, 7], Gramlich and Jaffee [21], Cooper [5], Modigliani [30], Ando [1] and Modigliani and Ando [31]. The version of the model used in this paper is the 1978 version as supplied by the staff of the Federal Reserve Board.

16. See again Table 3. What matters in this context, however, is the contribution of equities not to the level but rather to the variation of households' wealth. Given the great volatility of equity prices in contrast with the fixed-price nature of deposits, the 30% share of equities in households' total wealth greatly understates the role of equities in accounting for the variations of household wealth over time.

17. The most important element of financial quantity variables' effects on nonfinancial behavior in the MPS model is the credit availability effect in the mortgage market; see de Leeuw and Gramlich [7] and the papers by Gramlich and Hulett, Modigliani, and Jaffee in Gramlich and Jaffee [21].

18. In addition to the references cited above, see Friedman and Roley [19] for a discussion of structural modeling of interest rate determination and explicit comparisons to the single-equation reduced-form approach.

19. The particular corporate bond rate used in this model is the observed new-issue yield on long-term bonds rated Aa by Moody's Investors Service, Inc. An additional equation then determines the Aaa seasoned yield, the corporate bond rate used in the MPS model, as a simple direct function of the Aa new-issue yield. Eliminating the Aaa seasoned yield altogether and using the Aa new-issue yield in its place would have required re-estimating each MPS model equation in which the corporate bond rate appears.

20. See Friedman [14, 15] for the detailed development of the corporate bond market model.

21. See Friedman [17] for an analysis of changes in the model's implications for the effectiveness of monetary and fiscal policies.

22. A few recent examples include Feldstein [9, 10], Munnell and Connolly [37], Oldfield [38], Gersovitz [20], and Drucker [8].

23. Because the bond market model represents separately the portfolio behavior of private pension funds (1979 total asset holdings \$237 billion) and state-local government pension funds (1979 total asset holdings \$179 trillion), it is necessary to allocate this \$10 billion additional cash flow between the two. The experience since implementation of the ERISA legislation suggests that the portfolio behavior of private funds is becoming more similar to that of state-local funds. Hence in this simulation the entire amount is shifted to the latter. In fact, the difference is relatively minor. Values corresponding to those in Table 5, for an analogous simulation based on a \$10 billion per annum shift entirely to private pensions are, for example, 6.45 for r_{CP}, 6.21 for r_{CB}, 16.0 for ΔB, 1045.5 for X, and 858.4 for GNP.

24. Even so, analogous simulations for other sample periods produce roughly comparable results. For 1975:I - 1977:II, for example, the simulated (historical) values are, for example, 5.80 (5.67) for r_{CP}, 8.81 (8.92) for r_{CB}, 33.6 (32.2) for ΔB, 1258.0 (1254.9) for X, and 1666.7 (1662.2) for GNP. These results are very similar to those reported in Table 5 after allowance for the smaller real value of \$10 billion eight years later. Analogous comparisons for each of the further simulations reported below also reveal similarly comparable results.

25. See, for example, the discussion in Feldstein [9, 10].

26. Among the other important assumptions implied by this restriction is absence of any liquidity constraints on individuals.

27. The CDF variable refers to nonfinancial corporations only, while the ΔB variable refers to financial and nonfinancial corporations. In fact, however, nonfinancial corporations account for essentially all of the simulated increase in net bond financing.

28. See, for example, Modigliani and Ando [31].

29. It is difficult to be precise here because of the form of the MPS model's personal tax functions.

30. Purchase of ordinary whole life insurance on a minimum deposit basis has the same effect. The life insurance cash flow variable that matters for companies' bond demand in the model used for these simulations is the cash flow net of changes in policy loans outstanding.

31. See, for example, Bodie [4].

32. See, for example, the papers in Modigliani and Lessard [33], and the references cited therein. See also the report of the President's Commission on Financial Structure and Regulation (the Hunt Commission), and the House Banking Committee's report prepared in conjunction with the proposed (but not enacted) legislation on Financial Institutions and the National Economy.

33. The MPS model includes a detailed treatment of the deposit and mortgage lending activities of both mutual savings banks and savings and loan associations; see Gramlich and Jaffee [21]. As of yearend 1979 mutual savings banks' total liabilities accounted for $165 billion out of the $806 billion shown in Table 3 for all thrift institutions combined.

34. The simulations discussed in Section III uniformly rely on the assumption that individuals reduce the total of their direct saving dollar for dollar with the increase in intermediated saving, but that they do not alter the allocation of that total in comparison with their normal behavior.

35. See Friedman [16] for a discussion of this problem for the case of pensions, including numerous reasons why such "hyperrational" offsetting behavior is unlikely to be complete, or even very great.

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