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Contents

Can the Stock Market Tell Bank Supervisors Anything They Don't Already Know?

Jeffery W. Gunther, Mark E. Levonian, and Robert R. Moore

Stock prices provide useful predictive information, even after taking into account past rating information and information from the quarterly financial statements banking organizations file between inspections.

Various initiatives have been pursued in recent years to enlarge market forces' role in promoting a safe and sound financial system. Faced with dramatic increases in the size, scope, and complexity of banking organizations, policymakers have increasingly considered the possibility that the forces determining prices and quantities in the financial markets might be harnessed to supplement supervisory efforts aimed at maintaining safety and soundness.

A primary example of the increased emphasis on market forces is the comprehensive approach to capital adequacy recently developed by the Basel Committee on Banking Supervision. The new framework rests on three pillars—minimum capital requirements, supervisory review, and market discipline. By including market discipline, the committee recognizes that market forces can reinforce capital regulation and other efforts to promote safety and soundness.

Another example of the new emphasis is the Gramm–Leach–Bliley Act of 1999, which directed the Federal Reserve Board and the Treasury secretary to assess the appropriateness and value of requiring large depository institutions to issue subordinated debt. While the resulting study did not recommend the immediate establishment of such a requirement, the Board and the Treasury nevertheless concluded that the evidence supports use of subordinated debt both in supervisory monitoring and to encourage market discipline.[1]

This article considers only one of several avenues through which market forces might be used to support safety and soundness—the idea that investors' views on the financial condition and prospects of banking organizations can be distilled from stock prices and that such views can provide a useful supplement to supervisory assessments. Despite its intuitive appeal, insufficient analysis has been undertaken to document the empirical content of this basic idea. As a result, controversy remains over whether the financial markets can say anything about the health and prospects of financial institutions that supervisors do not already know.

Our empirical work uses supervisory ratings as a benchmark for banking organizations' financial safety and soundness, under the assumption that the results of supervisory inspections accurately reflect the financial condition of individual organizations. If after an inspection bank supervisors know everything about an organization's financial condition that investors know, and perhaps more, the question becomes whether market data can provide incremental information in the periods between inspections,

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beyond that offered by past inspection results and regularly reported data. It is important to note that the issue here is not which of these sources of information is better or more accurate. To be valuable, market indicators need not be superior to standard supervisory indicators. They just have to add a new perspective or dimension that helps provide a more complete picture of an institution's financial health, as Flannery (forthcoming) suggests. The tests reported in this article address this issue.

We find that a measure of financial viability based on stock prices helps predict the financial condition of individual banking organizations, as reflected in their supervisory ratings. Moreover, this measure provides useful information beyond that of past inspection results and quarterly financial statements. To the extent that these data are a reasonable proxy for the full set of information supervisors use between inspections, these findings indicate the financial markets can provide useful information to supplement supervisory assessments. The equity-market data give the right signals—or at least they are in broad agreement with subsequently assigned supervisory ratings—and they appear to contain new, or more timely, information not reflected by financing accounting statements.

EQUITY-BASED MARKET SIGNALS

The consensus of investors regarding individual organizations is reflected in market prices and price movements. The prices depend on future payoffs to investors and so are inherently forward-looking. With money at stake, investors have a strong incentive to collect valid information, evaluate it, and accurately assess the potential risks and rewards. At least in principle, a sense of what that assessment is can be extracted from the pricing of any risky claim on a bank or bank holding company.

In practice, the equity claims of an organization's owners have a number of advantages as a source of this type of information. Compared with other types of bank-related claims, markets for common shares are fairly liquid, so the quality of the price signals is reasonably high. Moreover, equity values are sensitive to changes in the condition of the issuing firm, making those changes easier to observe in share prices.

Equity claims present some complications because shareholders benefit if the issuer does well but have limited downside risk should losses occur, given the legal limits on their liability. Shareholders' limited liability is a particularly prominent issue in banking, since deposit insurance severely restricts or altogether eliminates the downside risk for depositors, leaving a substantial degree of that risk with the deposit insurance fund. However, models have been developed to account for these factors.

One prominent model is the option-based framework developed by Merton (1974, 1977). This model relies on the fact that under limited liability, equity is equivalent to a call option on the issuer's assets. With the analogy to options, the technology of option pricing can be brought to bear, and information on investors' implicit views of risk can be extracted from stock prices. This model has often been used in the banking context.[2]

KMV LLC has commercially implemented a variant of this model and incorporated proprietary elements that extend the basic Merton approach. Crosbie (1999) describes the KMV framework, in which the EDF™ credit measure serves as a summary measure of default risk. (EDF is an acronym for *expected default frequency*.) In essence, the EDF measure for a firm represents an estimate of the percentage of firms in the same financial condition that historically defaulted on an obligation within the next twelve months. We use KMV's EDF credit measure to investigate market information's capacity to supplement supervisory assessments.

A number of studies address the issue of whether market data can usefully supplement supervisory monitoring efforts. Flannery (1998) provides an overview of these and related studies, many of which focus on subordinated debt. Relatively recent studies examining equity-market data include that of Berger, Davies, and Flannery (2000), who find that supervisory assessments are generally less accurate than equity-market indicators in anticipating changes in financial performance, such as earnings, except when the supervisory assessments are based on a very recent inspection. Elmer and Fissel (2001) offer evidence that stock returns can help forecast bank failures. And finally, in the study most similar to our own, Krainer and Lopez (2001) find that equity-market information can help forecast downgrades in the supervisory ratings assigned to bank holding companies. Our analysis is distinguished by the estimation of statistical models based directly on downgrades from various rating categories, whereas Krainer and Lopez infer downgrade forecasts from a single statistical model based on the level of ratings. The estimation of downgrade models may allow a sharper focus on the contribution of equity-market data to the identification of adverse financial changes and at a minimum

Table 1
Definitions of Explanatory Variables

Equity-market data	
EDF	EDF™ credit measure (EDF is an acronym for *expected default frequency.*)
Past supervisory assessments	
BOPEC-1	Composite BOPEC rating from the immediately prior inspection of the holding company
CAMELS	Asset-weighted average composite CAMELS rating from the most recent exams of individual banks
Financial accounting data	
SIZE	Log of total assets
CAPITAL	Total equity capital
RESERVES	Loan-loss reserves
PAST-DUE 30	Loans past due 30–89 days
PAST-DUE 90	Loans past due 90 or more days
NONACCRUAL	Nonaccrual loans
SECURITIES	Investment securities
LARGE CDs	CDs of $100,000 or more
PROVISIONS	Loan-loss provisions in quarter
ROA	Net income for quarter

NOTES: *EDF* is proprietary and from KMV LLC. *BOPEC-1* and *CAMELS* are confidential and from the Federal Reserve Board. *SIZE* and the financial ratios are based on data from a regulatory report, Consolidated Financial Statements for Bank Holding Companies (FR Y-9C), issued by the Federal Reserve Board. *EDF* is as of the end of the month falling two months prior to the month in which the corresponding holding company inspection was opened. *CAMELS* is based on the most recent bank exam (one-bank holding company) or exams (multibank holding company) closed prior to the month in which the corresponding holding company inspection was opened. Financial ratios are scaled by assets, except for *PROVISIONS* and *ROA*, which are relative to average assets. These variables, along with *SIZE*, are from the quarter-end two months prior to the three-month period in which the corresponding holding company inspection was opened.

provides a separate vehicle for confirming the positive results Krainer and Lopez document. The following section details the types of data our analysis uses.

DATA

At the holding company level, the primary supervisory indicator is the BOPEC rating, derived from financial performance along five dimensions: bank subsidiaries (*B*), other (nonbank) subsidiaries (*O*), the parent company (*P*), consolidated earnings (*E*), and consolidated capital (*C*). The composite rating forms the basis of the dependent variables in the regressions reported below. This rating is defined as follows: 1—basically sound in every respect; 2—fundamentally sound but with modest weaknesses; 3—financial, operational, or compliance weaknesses that cause supervisory concern; 4—serious financial weaknesses that could impair future viability; and 5—critical financial weaknesses that render the probability of near-term failure extremely high.

Current BOPEC ratings serve as our benchmark for banking organizations' financial safety and soundness. For many of the largest banking organizations, this clearly is an oversimplification. For these firms, continuous on-site supervision provides supervisors with far more information about current conditions than can be captured and conveyed by a single composite measure, such as the BOPEC rating. Nevertheless, for banking organizations in general, the BOPEC rating is a good summary indicator of condition, and for the purposes of our analysis we assume this rating accurately reflects the financial condition of individual organizations.

With BOPEC ratings as our primary benchmark, we examine how these ratings are related to other types of information. Specifically, we assess the extent to which various types of information can help explain, or predict, the BOPEC rating an organization will receive once it is inspected. The variables we use to explain the level of and changes in BOPEC ratings fall into three main categories: equity-market data in the form of EDFs, past supervisory assessments, and financial accounting data. In combining the various data, an effort is made to reflect the flow of information as it occurs in real time, after accounting for reporting lags and other factors. That is, to predict a BOPEC at any point, we only use information that realistically would have been available to bank supervisors.[3] This allows us to focus on whether market data can provide incremental information to bank supervisors between inspections, beyond past inspection information and regularly reported accounting data. The explanatory variables themselves are summarized in Table 1 and discussed below.

Equity-Market Data

To incorporate information from the equity market, the analysis includes the EDF credit measure for individual banking organizations, as constructed by KMV (*EDF*). As described above, *EDF* is an estimate of the probability a firm will default within the next year. As a measure of credit risk, *EDF* should be positively associated with problem BOPEC ratings; while BOPEC ratings are not explicit estimates of the probability of default or failure, we would expect institutions in relatively weak financial condition to have higher *EDF* values and higher (worse) BOPEC ratings. KMV generally releases data about two weeks after each month's end, so *EDF* is as of the end of the month falling two months prior to the month in which the corresponding inspection was opened.

Past Supervisory Assessments

To help predict BOPEC ratings for individual organizations, the analysis includes two variables reflecting supervisory assessments made prior to the opening of the current inspection. The first variable is the rating an organization

received on its most recent prior inspection (*BOPEC-1*), which may be positively related to the organization's current rating. In addition, information is included from a separate bank exam process, which complements supervision at the organization level. Bank-level exam results can trigger changes in an organization's BOPEC rating. Ratings at the bank level range from 1 (best) to 5 (worst), similar to composite BOPEC ratings, and are referred to as CAMELS ratings. Composite CAMELS ratings are derived from the evaluation of six bank-level factors: capital adequacy (*C*), asset quality (*A*), management (*M*), earnings (*E*), liquidity (*L*), and sensitivity to market risk (*S*). The asset-weighted average of the composite ratings for an organization's bank subsidiary or subsidiaries (*CAMELS*) is included to capture supervisory information at the bank level. The variable *CAMELS* is based on the most recent bank exam (one-bank holding company) or exams (multibank holding company) closed prior to the month in which the corresponding holding company inspection was opened.

Financial Accounting Data

The analysis also controls for the potential predictive capacity of a number of indicators based on the quarterly reports banking organizations file with the Federal Reserve. One basic indicator is an organization's size. The log of total assets (*SIZE*) may reduce the chances of a substandard BOPEC rating if largeness provides financial strength, through either a greater ability to diversify risk or a closer relationship with the broader financial market.

The remaining nine variables are financial ratios that reflect various aspects of financial strategy and performance. The balance-sheet variables are scaled using total assets, and the income statement variables are expressed relative to average assets. Total equity capital (*CAPITAL*) and loan-loss reserves (*RESERVES*) serve as measures of capital adequacy. Each of these variables is expected to reduce the chances of a substandard BOPEC rating. Asset quality is measured using loans past due thirty to eighty-nine days (*PAST-DUE 30*), loans past due ninety or more days (*PAST-DUE 90*), and nonaccrual loans (*NONACCRUAL*). These variables are expected to raise the chances of a substandard BOPEC rating. Liquidity is measured using two variables: investment securities (*SECURITIES*) and certificates of deposit of $100,000 or more (*LARGE CDs*). *SECURITIES* should reduce the chances of a substandard rating, while the reverse is true for *LARGE CDs*. A reliance on this latter type of funding is often associated with aggressive banking strategies and frequently subjects an organization to added expenses. Finally, two income-statement variables are included to capture the effect of asset quality problems and other factors on profitability: loan-loss provisions (*PROVISIONS*), which should hurt BOPEC ratings, and net income (*ROA*), which should help the ratings. The financial ratios and *SIZE* are as of the quarter-end two months prior to the three-month period in which the corresponding holding company inspection was opened. The two-month lag used in the regressions compensates for lags in the submission and processing of financial statements.

Sample

The sample is based on bank holding company inspections opened in the period from June 1996 through March 2000. Of the 11,450 inspections and corresponding BOPEC ratings for this period, prior BOPEC ratings are available for 10,315. While many banking organizations have publicly traded stock, many more do not. Largely because of this, equity-market data can be obtained for only 948 of these 10,315 observations. Of the 948, supervisory financial reports are available for 914. Given the lagged structure of the regressions, the financial reports used are for the period from first quarter 1996 through fourth quarter 1999. CAMELS ratings are available for all of these remaining 914 observations.

RESULTS

Sample Means

Table 2 shows the sample means of the explanatory variables for the different BOPEC ratings.[4] Reading across the columns in the first row of the table, worse supervisory ratings are associated with a higher *EDF*. Organizations that are assigned worse BOPEC ratings tend to have had worse ratings at the prior inspection (*BOPEC-1*). Weak BOPEC ratings also tend to be associated with previous supervisory problems at the bank level (*CAMELS*), asset quality problems (*PAST-DUE 30*, *PAST-DUE 90*, and *NONACCRUAL*), a reliance on large CDs (*LARGE CDs*), and high loan-loss provisions (*PROVISIONS*). In addition, substandard supervisory ratings are negatively related to capital adequacy (*CAPITAL*), profitability (*ROA*), and organization size (*SIZE*).

Two minor surprises are that the relationship between investment securities (*SECURITIES*) and supervisory ratings is not statistically significant (p value $\leq .05$) and that loan-loss reserves

Table 2
Sample Means
(Quarterly Data for 1996–99)

	BOPEC rating				
	1	2	3	4	*p* value
Equity-market data					
EDF	.25	.39	1.33	2.89	.001
Past supervisory assessments					
BOPEC-1	1.16	1.91	2.66	2.71	.001
CAMELS	1.15	1.86	2.57	2.43	.001
Financial accounting data					
SIZE	15.22	14.90	13.89	12.81	.001
CAPITAL	9.16	8.28	6.86	6.15	.001
RESERVES	.97	.99	1.12	1.62	.001
PAST-DUE 30	.69	.78	.86	1.34	.001
PAST-DUE 90	.12	.17	.24	.54	.001
NONACCRUAL	.30	.46	.90	1.30	.001
SECURITIES	24.71	23.53	21.89	24.75	.115
LARGE CDs	8.68	9.93	10.61	13.71	.007
PROVISIONS	.06	.07	.16	.77	.001
ROA	.36	.30	.14	–.21	.001
Observations	449	428	29	7	—

NOTES: Dates are for the quarterly Y-9C data used to construct the financial ratios. Corresponding dates for *EDF*, *CAMELS*, and the current BOPEC rating are in the Table 1 notes. Composite BOPEC ratings are defined as follows: 1—basically sound in every respect; 2—fundamentally sound but with modest weaknesses; 3—financial, operational, or compliance weaknesses that cause supervisory concern; 4—serious financial weaknesses that could impair future viability; and 5—critical financial weaknesses that render the probability of near-term failure extremely high. To preserve the data's confidentiality, the sample's single 5-rated observation is not shown. *P* values less than or equal to .05 are associated with statistical significance. For *BOPEC-1*, the *p* value is determined by a likelihood ratio chi-square test, based on the ratios of observed and expected frequencies, for the null hypothesis of no association with current BOPEC ratings. The *p* values for the remaining variables are determined by the *k*-sample Van der Waerden test (chi-square approximation) for the null hypothesis of the same location parameter across BOPEC ratings. Financial ratios are multiplied by 100.

(*RESERVES*) do not appear to ameliorate supervisory problems. However, the positive association between *RESERVES* and supervisory problems can be explained, as asset quality problems are not held constant when comparing the average level of *RESERVES* across ratings. Problem institutions are likely to be so in part due to poor asset quality, which is commonly addressed through higher loan-loss provisions, leading to higher levels of reserves. The multivariate statistical techniques used in the next section facilitate an assessment of the relationship between *RESERVES* and BOPEC ratings that holds asset quality constant.

Predicting BOPEC Ratings

While Table 2 reveals interesting patterns involving potential relationships between an organization's current BOPEC rating and the explanatory variables, each variable's importance in explaining BOPEC ratings cannot be determined based on the differences in means alone. To identify each variable's incremental information content in predicting BOPEC ratings, we estimate a statistical model, or regression, of BOPEC ratings. If a variable is statistically significant in this regression, the variable conveys useful predictive information beyond whatever information may be contained in the other variables. As a first step, all the variables listed in Table 1 are included in the regression. The least significant variable is then dropped from consideration, and the regression is estimated again. This process is repeated until all the included variables are statistically significant.

The first column of Table 3 shows the results. The key finding is that the equity-market variable, *EDF*, is highly significant in explaining BOPEC ratings, indicating stock prices provide useful predictive information, even after taking into account past rating information and information from the quarterly financial statements banking organizations file between inspections. The positive sign of the estimated coefficient on *EDF* indicates supervisory problems are associated with higher values of *EDF*, as would be expected. The other significant variables are *BOPEC-1*, *CAMELS*, *CAPITAL*, *RESERVES*, *PAST-DUE 90*, *NONACCRUAL*, *PROVISIONS*, and *ROA*. The sign of the coefficient on each of these variables corresponds to expectations. For example, lower values of *ROA* are associated with more severe supervisory problems. *SIZE*, *PAST-DUE 30*, *SECURITIES*, and *LARGE CDs* are not significant in explaining BOPEC ratings.

To assess the extent of *EDF*'s contribution to the ability to predict BOPEC ratings, the second column of Table 3 displays the results of estimating the regression in column 1 with *EDF* excluded. The predictive capacity of the two regressions can be compared based on the measures of association shown in the last three rows of the table. For the purposes of these measures, pairs of observations are categorized as concordant (loosely speaking, the model gets it right), discordant (the model gets it wrong), or tied. A high incidence of concordant pairs, together with a low incidence of discordant pairs, indicates superior predictive capacity in the form of a close association between predicted and actual outcomes. The statistic gamma is a summary measure based on the number of concordant and discordant pairs; a high gamma value reflects superior predictive performance. The maximum value for gamma is 1. As the first and second columns of Table 3 show, the measures of association register only slightly better values for the regression including *EDF* than for the regression excluding it.

However, the regressions shown in the first and second columns apply to BOPEC ratings in general, most of which are unchanged from the prior inspection. Given the significant inertia in

Table 3

Probit Regressions of BOPEC Ratings

	Ordered regressions, all rating levels		Binary regressions			
			Downgrades from 1		Downgrades from 2	
α_1	3.02**	2.88**	2.95**	2.52**	.11	–.87
	(.37)	(.36)	(.47)	(.45)	(.83)	(.74)
α_2	6.89**	6.47**				
	(.44)	(.41)				
α_3	10.24**	8.74**				
	(.71)	(.61)				
α_4	18.02**	14.65**				
	(1.85)	(1.63)				
Equity-market data						
EDF	.55**		.72**		.97**	
	(.10)		(.19)		(.23)	
Past supervisory assessments						
BOPEC-1	1.14**	1.21**				
	(.13)	(.12)				
CAMELS	1.65**	1.60**	1.97**	1.94**		
	(.15)	(.14)	(.27)	(.26)		
Financial accounting data						
CAPITAL	–10.18**	–10.36**			–27.29*	–25.67*
	(3.37)	(3.29)			(11.02)	(10.09)
RESERVES	–52.71**	–46.52**				
	(17.70)	(17.03)				
PAST-DUE 90	117.7**	98.76**	148.7*	129.6*		
	(31.25)	(30.64)	(66.74)	(64.57)		
NONACCRUAL	43.02**	35.99*			117.8**	91.95**
	(16.19)	(15.98)			(31.92)	(28.60)
PROVISIONS	235.9**	190.6**				
	(59.22)	(56.08)				
ROA	–141.8**	–126.1**	–338.9**	–375.1**	–447.9**	–556.8**
	(39.65)	(35.08)	(100.2)	(99.64)	(151.7)	(130.6)
Measures of association						
Concordant	95.2	94.8	85.2	82.6	96.3	91.4
Discordant	4.4	4.9	14.4	16.8	3.6	7.8
Gamma	.91	.90	.71	.66	.93	.84

** Significant at the 1 percent level.

* Significant at the 5 percent level.

NOTES: Each type of regression is first estimated using all the variables in Table 1, except that *BOPEC-1* is excluded from the two types of downgrade regressions. The least significant variable in each type of regression is then dropped from consideration, and the regressions are estimated again. This process is repeated until all the included variables are significant at the 5 percent level. *EDF* is then dropped from the resulting regressions for comparison. Standard errors are in parentheses. The current BOPEC rating is the dependent variable in the ordered regressions. The likelihood contribution of an observation with a BOPEC rating of i is $N(\alpha_i - \beta'X) - N(\alpha_{i-1} - \beta'X)$, where $N(\cdot)$ is the standard normal cumulative distribution function, $\alpha_0 = -\infty$, and $\alpha_5 = \infty$. The dependent variable is 1 for downgrades and 0 otherwise in the binary regressions. The likelihood contribution of an observation that is not downgraded is $N(\alpha_1 - \beta'X)$, and the contribution of a downgraded observation is $1 - N(\alpha_1 - \beta'X)$, where $N(\cdot)$ is the standard normal cumulative distribution function. The regressions for downgrades from a rating of 1 are based on 429 observations (*BOPEC-1* = 1), including fifty-two downgrades. The regressions for downgrades from a 2 rating are based on 453 observations (*BOPEC-1* = 2), including seventeen downgrades. The predicted probability of the dependent variable falling into the best category—a rating of 1 for the ordered regressions and 0 for the downgrade regressions—is grouped into intervals of length .002 and defined as the "event probability." A pair of observations with different values of the dependent variable is defined as concordant if the observation with the best (lowest) value also has a higher event probability. The opposite case is defined as discordant. If a pair of observations with different values of the dependent variable is neither concordant not discordant, it is defined as a tie. Let n represent the number of pairs with different values of the dependent variable, c the number of concordant pairs, and d the number of discordant pairs. Concordant observations are reported as $100 \cdot c/n$ and discordant as $100 \cdot d/n$. The summary measure of association is the Goodman–Kruskal gamma, an indicator of rank correlation between the observed ratings and predicted probabilities, defined as $(c - d)/(c + d)$.

these ratings, the measures of association shown in the first two columns may not reflect the extent of *EDF*'s help in predicting whether an organization receives a different rating than it received during its last inspection. A change in rating is an event of considerable supervisory interest, particularly if the newly assigned rating is worse than the previous one. Reflecting these considerations, the next section focuses on *EDF*'s contribution to the ability to predict supervisory downgrades.

Predicting BOPEC Downgrades

The third and fourth columns of Table 3 show the results of predicting which 1-rated organizations are downgraded to a rating of 2 or worse; the fifth and sixth columns apply to the downgrade of 2-rated organizations to a 3 or worse. The number of observations involving downgrades from a rating of 3 or 4 is too small to support statistical estimation. In the downgrade regressions we estimate for 1- and 2-rated organizations, we follow the same procedure used in estimating the regressions for BOPEC ratings in general, through which statistically insignificant variables are sequentially eliminated from the list of variables in Table 1.

As Table 3 shows, a smaller number of variables help predict BOPEC downgrades than BOPEC ratings in general. Nevertheless, *EDF* is identified as a statistically significant variable in predicting BOPEC downgrades for both 1- and 2-rated organizations. In addition, the measures of association indicate considerably better performance for the regressions including *EDF* than for the regressions excluding *EDF*, suggesting *EDF*'s incremental contribution to the ability to predict BOPEC downgrades is notable.[5] The summary gamma statistic shows a 7 percent reduction in the association between predicted and observed outcomes when *EDF* is excluded from the regression predicting downgrades of 1-rated organizations. And the exclusion of *EDF* results in a 10 percent reduction in predictive association for downgrades of 2-rated organizations.[6] These results indicate equity-market information is valuable in identifying potential downgrades.

CONCLUSION

Our results show an indicator of financial viability based on stock prices provides incremental information to bank supervisors during the periods between inspections, beyond the information contained in past supervisory ratings and the quarterly financial statements routinely used in the supervisory process. We see this finding as evidence that investors' views regarding the financial condition of individual banking organizations, as distilled from equity prices, provide a useful supplement to supervisory assessments. In essence, the markets give the right signals, and the information they provide is not redundant.

This interpretation of our results hinges on whether past rating information and quarterly accounting data together form a reasonable proxy for the extent of supervisory information between inspections. It is important to note that the supervisory information produced between inspections in some—and perhaps many—cases almost surely extends beyond the types of information included in our statistical models. This is especially true for the largest organizations, where a continuous on-site presence provides supervisors with more information about current conditions than is reflected in the past rating information and quarterly financial data we use as standard supervisory indicators. Based on these considerations, further work is needed to incorporate additional supervisory information into the analysis. Related to this work is the important issue of the extent to which supervisors systematically quantify any assessments formed between inspections.

An additional question is whether market data can provide incremental information, even when inspections are current. We have shown market information is useful in tracking financial conditions, as reflected in BOPEC ratings. But are BOPEC ratings a comprehensive indicator of organizations' financial condition? BOPEC ratings themselves may be only imperfect indicators of risk levels. One possible avenue for exploring this question would be further work along the lines of Berger, Davies, and Flannery (2000) that compares the ability of equity-market information and BOPEC ratings to predict additional indicators of financial condition, such as default.

NOTES

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[1] See Board of Governors of the Federal Reserve System and U.S. Department of the Treasury (2000).

[2] For example, see Ronn and Verma (1986).

[3] The data we use to construct financial ratios are from

quarterly financial reports, Consolidated Financial Statements for Bank Holding Companies (FR Y-9C), issued by the Federal Reserve Board. Insofar as these data are subject to revision, the values of our financial ratios may not reflect their assigned values when the data were first reported, since we do not have access to the original data.

[4] The sole 5-rated observation is not shown to preserve the data's confidentiality.

[5] These results are based on the degree of association within the estimation sample. We have insufficient data to assess how well the various models forecast events outside the estimation sample.

[6] When all the variables shown in Table 3 are included in the downgrade regressions, whether they are significant or not, the reductions in association resulting from the exclusion of *EDF* are 8 percent and 4 percent, respectively.

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The Democratization of America's Capital Markets

John V. Duca

This article focuses on two implications of the democratization of U.S. capital markets: the possible impact of more households being exposed to stock market swings and the possible increased sensitivity of small and expanding businesses to fluctuations in securities markets.

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Since the early 1980s, financial innovations have benefited the United States by increasing the availability of financing for new firms and improving Americans' access to financial investments. Some innovations, such as the development of the venture capital market, arose from deregulation and efforts to find new ways of financing small firms, whose risk profiles made traditional financial sources less appropriate. By making capital more available, these financial-side innovations have enabled such firms to take advantage of new technologies by developing new products.

Other changes have stemmed from better information technology that has cut the costs of investing. In particular, lower mutual fund loads have made it feasible for many households to own diversified stock and bond portfolios. Partly as a result, the share of U.S. households owning stock has risen from less than 25 percent in the early 1960s to about 50 percent by the late 1990s. In these ways, borrowers' and investors' access to capital markets has increased, and this democratization of America's capital markets helped fuel the economic boom of the 1990s, the longest economic expansion on record.

THE DEMOCRATIZATION OF SMALL FIRMS' ACCESS TO CAPITAL

The ability of firms to finance start-ups and expansions has greatly improved. Traditionally, entrepreneurs financed a start-up from their savings or from capital provided by a few wealthy investors. After establishing a track record, a successful start-up could borrow from banks and, with further success, issue stocks and bonds to fund investments. The very best could even issue commercial paper to fund working capital (Prowse 1996). These traditional patterns have changed since the late 1970s owing to the rise of the high-yield, or "junk," bond market and of venture capital.

The High-Yield Bond Market

Before the 1980s, only large, well-established corporations issued bonds, typically bought by large institutional investors (for example, pension funds and life insurance companies) that were primarily interested in bonds from the most reputable and solid companies. Indeed, many institutional investors face legal or fiduciary constraints on whether and how much they can invest in below-investment-grade bonds. Mid-sized firms generally were seen as having below-investment-grade credentials. Many bond investors viewed them as lacking creditworthiness because information on such firms was limited

and difficult to collect and analyze. Also, below-investment-grade, or junk, bonds lacked a track record with which to assess their risk. Many low-grade bonds in that era were issued by firms whose credit ratings subsequently fell because of unexpected bad outcomes. As a result, to fund investments, a mid-sized firm usually borrowed from one bank, which, as the only longer-term creditor, could spread out the fixed costs of monitoring all the debt issued to the firm, thus keeping the financing costs down.[1]

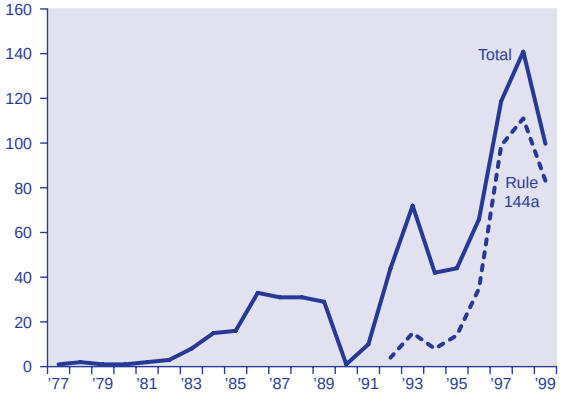
In the 1980s, three factors enabled mid-sized firms to issue bonds and shift away from bank loans. One was the development of the high-yield bond market fostered by a few pioneering investment banks that invested heavily in new junk issues from a select group of mid-sized firms (Loeys 1986). Prior to this, most junk bonds reflected the downgrading of bonds that had been investment-grade when issued. As the market gained experience with new junk issues, their risks became better known and the bonds became more acceptable to investors.

A second factor was a surge in mergers financed with bonds (leveraged buyouts or LBOs). This rise stemmed from fewer regulatory barriers to mergers, a greater need for consolidation among domestic firms because of more globalized markets, and improved economies of scale in back-office operations from lower computing costs. Corporate governance also shifted as investors increasingly demanded that firms cut costs and unlock value by divesting noncore lines of business. The growing demand for merger financing spilled over into the junk bond market because most merger-related issues had large debt payments relative to the acquiring firm's cash flow. In turn, the increase in the junk market's potential size spurred financial firms to expand their capacity to issue and market junk debt. As a result, the merger wave of the 1980s created a deepening of this market (Loeys 1986 and Becketti 1990, p. 49).

A third boost to junk bonds came from improved technology and analytical tools that help investors obtain information about mid-sized firms and buy bonds at a lower cost. As a result, information and transaction costs were lowered, fostering junk bond issuance during the economic expansion of the 1980s (Loeys 1986, p.11).

In the 1990s expansion, junk bond financing of mergers fell out of favor for two reasons. First, many LBO bonds ran into trouble during the 1990–91 recession. Second, the 1990s stock market boom enabled firms to use stock instead of debt to finance mergers. Nevertheless, the other factors behind the earlier growth of the junk bond market remained. In addition, starting in the early 1990s, Securities and Exchange Commission Rule 144a allowed firms to file a preregistration form that enabled them to quickly issue privately placed bonds (typically bought by large investors) without the usual registration and disclosure delays of traditional bond registration. As noted by Fenn (2000), although many firms subsequently register 144a bonds, they avoid the cost and uncertainty of delaying bond issuance. He also points out that many higher risk firms find Rule 144a issuance attractive not only to avoid delays but also because many of them could not meet the registration requirements of traditionally issued bonds. Issuance of 144a bonds surged in the late 1990s (*Figure 1*), especially for below-investment-grade firms for whom issuance delays can be costly.

Figure 1
Global Issuance of Below-Investment-Grade Bonds, 1977–99



SOURCE: Merrill Lynch.

The Rise of Venture Capital

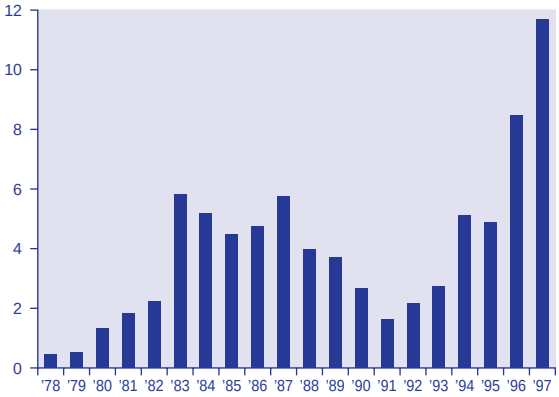
Firms' ability to raise start-up funding has improved greatly since the late 1970s (*Figure 2*). One reason is the impact of regulatory changes allowing pension funds and other institutions to make venture capital investments through limited liability partnerships, which overcome important hurdles to providing capital to new firms. The development of the Nasdaq stock market also aided venture capital by making it easier for firms to issue stock. In addition, new information technologies have opened up many opportunities for creating new products.

Limited Liability Partnerships, IPOs, and the Nasdaq. Before the 1980s it was extremely difficult for institutional investors to fund start-ups. Pension funds were limited by legal and fidu-

Figure 2

Venture Capital Disbursements, 1978–97

Billions of 1997 dollars



SOURCE: Statistical Abstract of the United States.

ciary constraints to investing in only investment-grade bonds and in stocks of well-established corporations. Other investors faced information-related hurdles such as imperfect information about how a new firm will fair. Will the firm use start-up funding poorly, or take desperate gambles if it encounters trouble, or even defraud investors? Gathering information on such questions is expensive. To recoup these fixed costs, an investor must either demand a high return that the firm may be unable to pay or take a big stake in that firm that limits the ability to diversify against firm-specific risk. For these reasons, outside seed capital came mainly from small groups of wealthy individuals who often shared information with one another.

Even if entrepreneurs surmounted this limited base for start-up capital, their options for financing working capital or new investments were largely limited to internal cash flow, trade credit, and bank loans. A bank, in contrast to many securities investors, can spread the fixed costs of monitoring and evaluating a firm over a larger amount of debt. This enables the bank to charge an affordable loan rate and monitor and limit the firm's risk-taking.

The ability of banks to perform this delegated monitor role was impaired during the 1970s, when high inflation pushed market interest rates above deposit rate ceilings. In response, households withdrew bank deposits to invest in market securities, and banks had to curtail lending. Particularly hard hit were smaller firms, which, unlike large companies, lacked the reputation needed to issue bonds or commercial paper. Between this rationing of bank credit and the limited base for seed capital, a lack of financing became a major impediment to small business formation. This spurred a series of deregulatory moves, including one allowing institutional investors to form partnerships that could invest in several start-up firms and receive the benefits of being delegated monitors.

These limited liability partnerships (LLPs) are joint ventures of several investors who pick a management team to select which start-ups to finance and monitor. The LLP reaps the cost advantage of a delegated monitor and the diversification gains to investing in a pool of start-ups. To encourage good performance, LLPs give managers a share in the profits. LLPs also discourage managers from taking excessive risk with others' capital by restricting their investment choices and by overseeing them through a board of directors. Other incentives for management include a limited lifetime of the LLP and the potential to manage future LLPs once a good reputation is established.[2]

When an LLP ends, it redeems the equity in its venture investments. This equity value is enhanced if the firms successfully conduct initial public offerings (IPOs) of stock. The reason is that traded equity can be held by more investors and has more liquidity than private equity. The development of the Nasdaq in the early 1970s improved the prospects for IPOs. The requirements for a firm's shares to be traded are generally easier on the Nasdaq than on the New York (NYSE) and American (AMEX) stock exchanges. In addition, unlike these exchanges, the Nasdaq is all-electronic, which lowers the transaction costs of buying and selling smaller batches of shares in newer or smaller companies. As the Nasdaq made it easier and less costly for firms to arrange IPOs through investment banks, venture capital investing saw boosted returns and volumes in the 1980s and 1990s.

The Role of New Nonfinancial Products. In addition to the above innovations, which have primarily expanded the supply of venture capital, nonfinancial innovations have increased the demand for venture capital and, indirectly, its supply. Advances in computer technology have generated an array of information-related products. Indeed, most of the venture capital surge in the late 1990s was concentrated in sectors that used information innovations to spawn new firms making new types of products (*Figure 3*).

Communications is an example of an industry in which technological progress and deregulation launched new firms. Likewise, the service sector is more open to new entrants, because the Internet facilitated the creation of new business service, retailing and consumer-related service firms (*Figure 3*). Computer advances

and the increased availability of venture capital have also spawned new biotechnology firms. In other industries, information advances created fewer opportunities for new firms. For instance, there is little venture capital financing of Old Economy product firms, as shown in Figure 3.

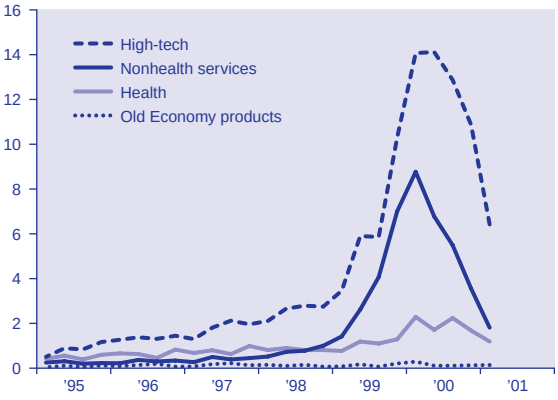
Within the high-tech sector, the volume of venture capital deals for software and networking firms has surged, while that for other types of computer firms has been relatively flat. This dichotomy fits with the general pattern of strong venture capital growth in new industries and less growth in industries dominated by established firms.

THE DEMOCRATIZATION OF HOUSEHOLD INVESTORS' ACCESS TO CAPITAL MARKETS

Between the mid-1970s and late 1990s, household portfolios changed greatly as the share of household financial assets in bank deposits fell, while that in mutual funds and securities jumped from 22 percent in 1975 to 42 percent in 1999. To a large extent, this shift stemmed from several innovations that lowered the cost of investing and broadened the menu of investments. These include the rise of money market mutual funds, the advent of Individual Retirement Accounts (IRAs), and declines in transaction costs.

Figure 3
Venture Capital Surges in High-Tech and Nonhealth Services, 1995–2001

Billions of dollars



NOTES: High-tech includes communications, other information technology, semiconductors, and software. Nonhealth services include consumer/business services and retail. Health includes biopharmaceuticals, healthcare services, medical devices, and medical information systems. Old Economy products include consumer/business and industrial products.

SOURCES: PricewaterhouseCooper's MoneyTree Survey (in conjunction with VentureOne) and author's groupings of the survey's categories.

The Rise of Money Funds and Money Market Deposit Accounts

In the early post-World War II era, there were regulatory ceilings on bank deposit rates. In periods of high inflation and high market interest rates, these ceilings were binding and many households earned below market interest rates on deposits. As high market interest rates became more persistent in the 1970s, some households withdrew their funds from banks and bought Treasury securities. With loanable funds shrinking, banks restricted lending and encouraged their larger, more established commercial borrowers to issue commercial paper backed by bank lines of credit.[3]

In response, some mutual funds invested in short-term securities (mainly Treasury bills and commercial paper) and offered households mutual fund shares with constant prices but yielding market interest rates and featuring limited checking. In the high-interest period of the late 1970s and early 1980s, these money market mutual funds grew rapidly, while banks and thrifts saw large deposit outflows. This led regulators to allow depositories to offer a new instrument—money market deposit accounts—that, like money funds, offered market interest rates and limited checking. Also, deposit rate ceilings ended in the early 1980s (Mahoney et al. 1987). These changes made it easier for households to invest in short-term money market instruments.

The Advent of Individual Retirement Accounts

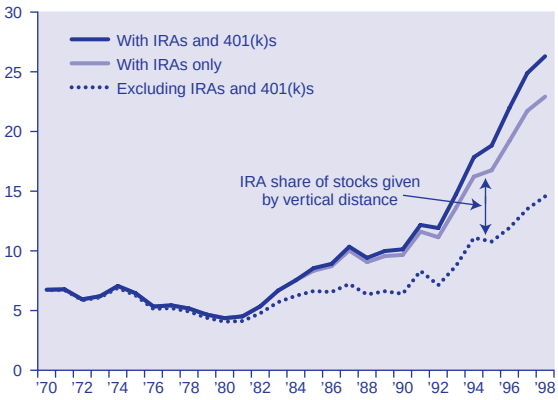
Starting in the early 1980s, Americans were able to deposit up to $2,000 annually in IRAs. The annual investments were tax deductible and the principal and earnings not taxed until withdrawn, presumably during retirement, when taxpayers would likely be in lower income-tax brackets. Since the mid-1980s, Congress has altered the eligibility and annual contribution provisions of traditional IRAs and has created new types of IRAs, such as the Roth IRA. The ability to compound investment returns tax-free until withdrawal for all types of IRAs and the deductibility of initial investments in traditional IRAs encouraged many wealthy Americans to shift existing assets into tax-preferred IRA accounts.

The advent of IRAs had four important effects. First, the eligibility requirements encouraged people to use third parties, such as mutual funds, to manage IRA assets and induced many families to shift from directly held stocks and bonds to indirect holdings through mutual funds (*Figure 4*). Second, the rise of defined-contri-

Figure 4

Households' Rising Reliance on Mutual Funds to Own Equity, 1970–98

(Equity fund assets as a share of household equity assets)



SOURCES: *Flow of Funds*, Federal Reserve Board; Investment Company Institute; Duca (2001b).

bution pension plans encouraged many people to incur the one-time costs of learning about investing, which prompted many to shift their nonretirement assets into mutual funds as well. A third stimulus to non-IRA mutual fund assets arose from the minimum balance requirements of mutual funds, toward which both IRA and non-IRA assets often count. Fourth, IRAs have enabled many who switch jobs to accumulate assets, whereas previously, job switchers lost pension assets held in defined-benefit plans that favored long-time employees.

Declines in Asset Transaction Costs

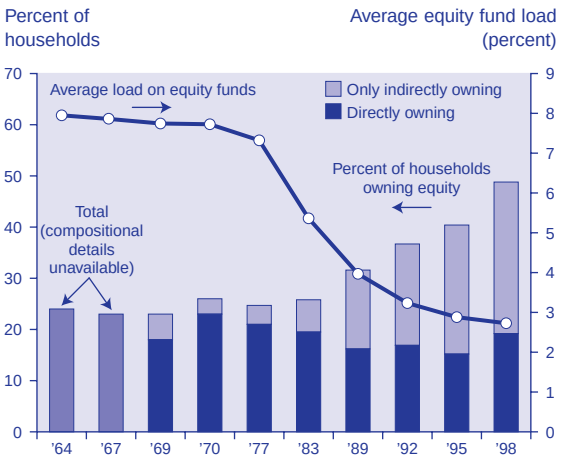
Declines in transaction costs have taken three forms: falling mutual fund loads, declining brokerage fees, and lower cost exchange-traded funds.

The Falling Costs of Investing in Mutual Funds. One of the more dramatic changes affecting household portfolios is the large decline in mutual fund costs, which may have spurred many middle-income families to begin investing in stocks. This possibility accords with the impact of lower transaction costs in portfolio choice models of Heaton and Lucas (2000) and Saito (1995). In these dynamic optimization models, utility functions characterized by habit formation imply that transaction costs can deter many families from investing in stocks. These papers tweak the conventional intertemporal framework by assuming that people's utility reflects not the sum of how they value consumption in separate periods but rather reflects that they get used to a certain standard of living from which they do not wish to deviate. Effectively, this assumption of "habit formation" makes near-term consumption more important relative to future consumption. As a result, transaction costs affect portfolio decisions. In calibration exercises, a decline in transaction costs can induce a large rise in equity participation. Theoretically, transaction fees have also been shown in other models to be barriers to entry, especially under uncertainty, as described by Dixit (1989).

Because of their limited wealth, many families are more apt to acquire a diversified stock portfolio by buying mutual fund shares rather than by directly buying stocks. For these families, the relevant transaction costs for investing in stocks are mutual fund fees, and if these fees fall, stock ownership rates should rise. This is consistent with Figure 5, which shows large increases in overall stock ownership rates accompanying large declines in equity mutual fund costs (see Duca 2000 and 2001a).[4] In addition, detailed data reveal that most of the rise in overall equity ownership occurred in indirect forms and that indirect ownership is also negatively correlated with equity fund loads. Furthermore, other data imply that the rise of indirect ownership primarily occurred through increased mutual fund ownership. The much higher fees of the 1970s and early 1980s may thus account for many households' relatively greater resistance to owning stocks before the late 1990s (Aiyagari and Gertler 1991, and Haliassos and Bertaut 1995).[5]

Figure 5

Equity Fund Loads Fall and Stock Ownership Rates Rise



SOURCES: Survey of Consumer Finances; Duca (2001a, 2001b).

In a related study using nearly three decades of time series data, Duca (2001b) finds that lower mutual fund loads and greater confidence in the future have boosted the relative use of mutual funds as a way of owning equity. He measures the relative reliance on mutual funds with equity fund assets as a share of all stocks owned by households. He argues that lower fund fees spur some shareholders to shift some assets from directly owned shares to mutual funds. Also, the lower fees induce initial stock ownership by households that are more apt to hold shares in mutual funds for reasons related to limited wealth and portfolio diversification. Recent calibration models of and empirical evidence on household portfolio behavior together suggest that falling mutual fund costs have boosted equity ownership rates in the United States.

The Decreasing Costs of Trading Stocks. Before 1974, the costs of trading stocks on the NYSE were fixed to prevent price competition among brokers. This placed small investors at a disadvantage because there were discounts for trades of large blocks of stock. Price competition was allowed for small trades on the NYSE beginning in April 1974 and on all trades after April 1975. These steps helped drive down brokerage costs. Although continuous data are unavailable, partial data from Schaefer (1997, p. 13) show that broker fees fell just after deregulation. Since the early 1980s, the rise of discount brokers has likely pushed costs down further, giving investors the option of buying or selling securities without professional advice. The Internet has aided such low-cost investing by partially substituting for broker services. Indeed, some old-line brokerage firms now offer the option of buying or selling stocks without a broker. While traditional broker services are still important, direct investors in stocks now can choose from a menu of services.

One interesting *non* development is that the proportion of American households that directly own stock has not increased despite declines in the fees of buying and selling stocks. One reason is that the limited wealth of many Americans does not permit them to easily buy and maintain a diversified portfolio of directly held stocks. As a result, declining fees have likely benefited wealthy households.

The Advent of Exchange-Traded Funds. Since December 1998, a new type of stock has traded on the American Exchange. Exchange-traded funds (ETFs) offer the diversification of index mutual funds at a lower cost. The first ETF duplicated the stocks in the S&P 500, thus the name Standard & Poor's Depository Receipts, or SPDRs. Mirroring the name abbreviation, shares in this ETF are called spiders. Nine other S&P-based ETFs (Select Sector SPDRs) have been created that replicate the subcomponents of the S&P 500.[6] Other ETFs now include World Equity Benchmark Series (WEBS), which duplicate indexes of foreign stocks, and Diamonds, which are based on the Dow Jones industrial average.

How do ETFs compare with index mutual funds? ETFs are continuously traded, unlike mutual fund shares, which can be bought or sold once a day. Like index mutual funds, ETFs buy and sell securities to match changes in the composition of the stock index they mirror. As a result, they have low costs like index mutual funds and are arguably a close substitute (for further discussion, see Malkiel 2000).

While ETFs compete with index mutual funds, a new investing service offers a substitute for actively managed mutual funds. In particular, some web-based companies offer investors customized stock portfolios at costs that, for investments of at least $30,000, are purportedly below the expenses of purchasing actively managed mutual funds (McGeehan 2000). These kinds of services, along with ETFs, broker innovations, and the potential for further declines in mutual fund costs, will likely continue to reduce household investors' transaction and asset management costs.

IMPLICATIONS

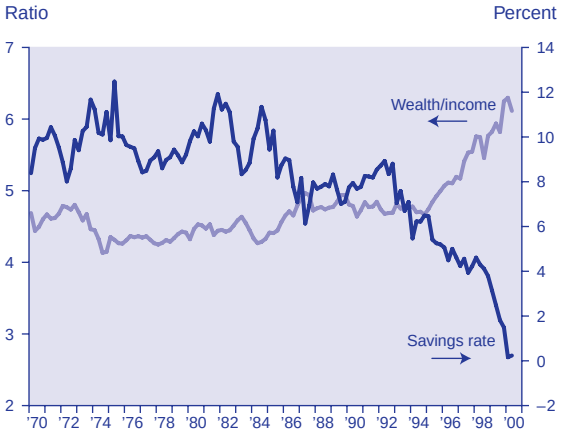
The increased openness, or democratization, of U.S. capital markets means that households have a wider array of investment choices and small businesses have more sources of capital. For example, more households can feasibly invest in stocks, and more small firms have access to venture capital. In addition, better diversification in their investment menus offers protection from disruptions in particular markets. This article focuses on two implications of the democratization of U.S. capital markets: the possible impact of more households being exposed to stock market swings and the possible increased sensitivity of small and expanding businesses to fluctuations in securities markets.

A Possible Rise in the Sensitivity of Consumption to Stock Wealth

According to many theoretical models, rising stock wealth boosts consumption by raising the permanent or life-cycle income of households (see Ando and Modigliani 1963, and Friedman 1957). Stock market wealth has a role in

Figure 6

Wealth Gains Associated with a Lower Personal Savings Rate



SOURCES: National Income and Product Accounts; *Flow of Funds*, Federal Reserve Board.

many econometric models of consumption based on the permanent income and life-cycle hypotheses (Board of Governors of the Federal Reserve System 1999, Bosworth 1975, Brayton and Tinsley 1996, and Mishkin 1977) and in models deviating from the life-cycle hypothesis. One example of the latter is Carroll's (1992) buffer stock model, in which utility-maximizing households alter their savings to hit a target wealth-to-income ratio. This implication is consistent with the recent fall in the personal savings rate and jump in the wealth-to-income ratio (see Board of Governors of the Federal Reserve System 2000 and Figure 6).

One concern about the importance of stock market wealth is that stock ownership is concentrated among the very rich, whose consumption is probably not affected much by swings in stock prices. Indeed, some studies find that the savings behavior of the rich differs greatly from that of the general populace (Carroll 2000a, 2000b and Dynan, Skinner, and Zeldes 2000). In particular, evidence reveals that the rich save partly to acquire and preserve (primarily through bequests) power and status (Carroll 2000b). These concerns imply that the stock market wealth effect will be very limited.

Nevertheless, rising stock ownership rates suggest that an increasing share of households, whose consumption is affected by wealth, is exposed to the stock market. Unfortunately, equity participation rate data are unavailable to directly test whether stock market wealth effects have become more important as stock ownership has become more widespread. However, equity fund loads appear to be a good instrument for equity participation. (This is suggested by Figure 5.) Taking this tack, Duca (2001a) adds the product of loads and the log of stock wealth as a separate variable to consumption regressions containing standard wealth variables to test whether loads affect the stock wealth elasticity of consumption.[7] If such interactive terms have negative signs, this is evidence that falling loads boost the impact of stock wealth on consumption by inducing more of the population to own equities. Using this approach, Duca (2001a) finds that the overall stock market wealth effect has grown in magnitude as equity mutual fund costs have fallen. His estimates indicate that a 100 percent rise in stock wealth is associated with a 3 percent increase in annual consumption in the late 1990s, up from about 1.5 percent in the mid-1960s. He also finds that estimates of stock market wealth coefficients vary less in rolling regressions that account for the time-varying effect of equity loads on wealth effects. As with all relatively new research, readers should view these results as providing some support for a hypothesis rather than conclusive proof.

Is Small Business Finance More Sensitive to Securities Market Fluctuations?

Evidence suggests that innovations have increased the availability of financing for small and expanding firms. This, however, makes financing for such firms more subject to swings in financial market conditions. For example, if the venture capital market should dry up, small or new business financing would contract. Even in such a case, small firms might still be able to borrow from banks, an option they had before the advent of the venture capital market. For this reason, while innovations could make the volume of financing more sensitive to financial market swings, they likely have boosted the absolute levels of such financing.

How sensitive to financial markets is the availability of financing for small or expanding firms? From the short history of venture capital, Gompers and Lerner (1999) find that when stock market prices fall substantially, the IPO market tends to shrink for a while, as it did in the late 1980s and early 1990s. In turn, the decline in the near-term prospects of making a successful IPO will likely reduce the expected returns to investing in LLPs, which generally have five- to ten-year lives. Consistent with this hypothesis, Gompers and Lerner find that a downturn in the IPO market is associated with a decline in the volume of new venture capital investments.

As with the IPO and venture capital markets, there is evidence that riskier firms' ability to issue high-yield bonds is more sensitive to financial market conditions than is that of better established firms. Indeed, the spreads of junk bond yields over Aaa-rated (the highest grade of corporate bond) yields jumped much more than did the spread between Baa- and Aaa-rated bonds during the 1990-91 recession.[8] (Baa-rated bonds are the lowest grade of investment-grade bonds in which banks and most institutional investors are able or willing to invest.) Mirroring this jump in junk bond default spreads was a relative rise in the default rates on junk versus investment-grade bonds.

A decline in securities market conditions can curtail the availability of high-yield bond or venture capital financing for small and expanding firms in two ways. Reduced expectations about the future economy will push stock prices and investment down even without any feedback between them. These effects are typically more pronounced for less established firms whose investment prospects are more sensitive to risk. Also, a drop in stock prices may increase investors' risk aversion, which may especially boost the premiums on riskier investments, such as high-yield bonds, IPOs, and venture capital. This feedback effect from a declining economic outlook further reduces the availability of small and start-up business credit. Banks, however, may partly offset such effects by lending more to the affected firms. In late 1998 and early 1999, financial market disruptions drove many large and mid-sized firms away from the bond and commercial paper markets to banks, where they had lines of credit. While smaller firms tend to have less access to such lines, some would be able to borrow from banks, which, during periods of high risk, can more closely monitor new credit extensions than can open markets.

However, banks would likely be less willing to compensate for a dearth of financing for start-up firms that lack credit and commercial histories. In addition, the end of Regulation Q has stabilized the availability of bank loans, while credit scoring and other less expensive ways of lending have helped banks lower their costs to make small business loans. On balance, the availability and stability of bank financing have likely increased, while the long-run availability of volatile short-run sources of start-up financing, such as venture capital, has also increased. In general, the availability of financing has risen for firms, but the nature of short-run fluctuations in availability has changed.

CONCLUSION

In the last quarter of the twentieth century, deregulation and technological advances spawned several financial changes that have increased the access of small investors and firms to U.S. capital markets. For households, these innovations have widened investment choices, particularly for stocks and nonbank interest-bearing assets. For less established firms, these changes first made junk bonds a viable source of capital; later innovations made venture capital increasingly available. The benefits of this democratization of America's capital markets have spurred other developed nations, particularly in Europe, to bolster venture capital and increase their citizens' access to mutual funds and other financial products.

NOTES

I thank Robert D. McTeer, Jr., for suggesting the article's topic; Jeff Gunther, Mark Wynne, and an anonymous referee for offering helpful suggestions; and Daniel Wolk for providing excellent research assistance. I also thank Stephen Prowse for extensive discussions about the private equity market. Any errors are my own.

1 See Rosengren (1990) for more discussion of how the rise of the junk bond market opened up the securities markets as a source of finance for less established corporations.

2 LLPs are one form of private, that is, nontraded, equity. For a more complete discussion of the role of private equity in funding new and existing firms, see Fenn, Liang, and Prowse (1997, 1998) and Prowse (1998).

3 See Post (1992) for more on the evolution of the commercial paper market.

4 Overall ownership includes directly owning individual stocks and indirectly owning stocks through mutual funds and other means. Ownership rates from the Survey of Consumer Finances (SCF) are not fully consistent over time for three reasons. First, pre-1989 SCFs treat all mutual fund assets as indirectly owning stock, but data since 1989 distinguish between bond and equity funds. Second, Federal Reserve statistics treat stock in IRA or 401(k) plans as indirect stock ownership since 1989. Third, some early SCFs treat privately held equity as owning stock, whereas later SCFs do not. 1986 data are omitted because they likely undercount broad stock ownership. This SCF only asked a family if it owned stock or mutual funds, whereas others also asked if households held stock in their employer or in investment clubs. There are also concerns about the quality of the 1986 SCF because it was done by phone, without edit checks of unusual answers. In addition, because the 1986 SCF recontacted 1983 respondents, the 1986 SCF could have

been distorted by selection effects from movers. Ownership rates are the most up-to-date data from Kennickell, Starr-McCluer, and Surette (2000); Katona, Lininger, and Mueller (1968); Katona et al. (1970); Katona, Mandell, and Schmiedeskamp (1971); and Durkin and Elliehausen (1978).

Equity fund load data are from Duca (2001b), who constructs estimates of asset-weighted loads from a sample of large equity mutual funds used by Duca (2000). These estimates are based on data from the funds, IBC/Donoghue, the Investment Company Institute, and Morningstar. Duca's cost estimates, which span 1960–2000, move together with more comprehensive industrywide cost estimates from Rea and Reid (1998) that are available only since 1980.

[5] Although Haliassos and Bertaut (1995) show that investment minimums at mutual funds are too low to explain why most households do not own equity, their findings do not rule out the possibility that mutual fund fees were an important barrier to more widespread stock ownership. This possibility is consistent with the findings of Heaton and Lucas (2000).

[6] "Standard & Poor's Depository Receipts," "SPDRs," and "Select Sector SPDRs" are trademarks of The McGraw-Hill Companies.

[7] This interactive load variable may also track a rise in the liquidity of stock wealth. In particular, by reducing the cost of going in and out of stocks, lower loads could conceivably boost the magnitude of stock wealth on consumption in the short run.

[8] Aside from an increase in downside macroeconomic risk, junk bond spreads were also probably boosted by new regulations that forced many thrift institutions to sell their substantial holdings of junk bonds. By causing an inward shift of the demand for holding junk bonds, these regulations conceivably pushed down junk bond prices and thereby put upward pressure on junk bond yields relative to other corporate yields.

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The Transition to Consumption Taxation, Part 2: The Impact on Existing Financial Assets

Alan D. Viard

Replacing the income tax with a consumption tax is likely to reduce the value of the capital stock. The division of this reduction between bondholders and stockholders and the effects on household lenders and borrowers depend on whether the tax is accommodated through higher consumer prices.

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In Part 1 of this article (Viard 2000), I discuss how replacing the income tax with a consumption tax generally reduces the value of the existing capital stock. In Part 2, I examine the allocation of this wealth decline between holders of different financial assets. How much of the total decline in the value of firms' capital is borne by bondholders and how much by stockholders? Are there wealth transfers between household lenders and household borrowers?

I consider three consumption tax designs—a retail sales tax, a traditional value-added tax (VAT), and a two-part VAT ("flat tax")—and show that they have similar potential effects. However, the impact of the consumption tax depends on how monetary policy responds to the tax reform and what transition policies, if any, are adopted.

If monetary policy keeps the consumer price level unchanged, the wealth decline generally falls on stockholders rather than bondholders. Also, there is little reallocation of wealth between household lenders and borrowers. It is possible to alter these outcomes with a transition policy that aids stockholders and household borrowers at the expense of bondholders and household lenders.

The effects are different if monetary policy accommodates the consumption tax by allowing the consumer price level to rise. Such accommodation is unlikely under a two-part VAT, but observers disagree on whether it might be adopted under a sales tax or traditional VAT to ease possible labor-market rigidities. If the tax is fully or largely accommodated, bondholders bear a heavier burden than stockholders. Also, wealth is transferred from household lenders to borrowers.

I first describe the three consumption tax designs and their effect on the total value of capital and after-tax rates of return. I then examine the allocation of the wealth decline under different monetary policy responses.

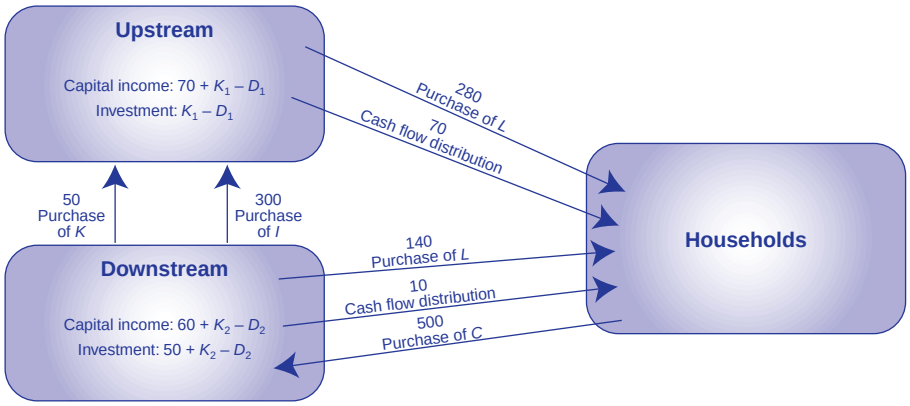
ALTERNATIVE TAX SYSTEMS

Economic Framework

I use a simple framework with no uncertainty and no international trade and investment. Firms produce consumer goods for sale to households, as well as capital and intermediate inputs for sale to other firms or for internal use. Capital depreciates at geometric rate δ, while intermediate inputs are (by definition) immediately used up in production.

Each firm issues bonds that promise fixed future payments and stocks that are residual

Figure 1
Application of Consumption Tax Designs



NOTE: Arrows denote direction of payment.

claims on all other cash flows generated by the firm's capital. By construction, the combined value of the bonds and stocks equals the value of the capital. The aggregate value of firms' capital equals national wealth. Households also make loans to each other. Since each loan is an asset of the lender and an offsetting liability of the borrower, these loans do not add to national wealth.

For each of the consumption tax designs and the income tax, I assume tax rates are the same across firms or households. To address regressivity, households may receive refundable exemptions. Revenues are distributed to households as transfer payments.

I compare the application of the tax systems in an example with two firms, Upstream and Downstream. Figure 1 shows the transactions between firms and households, with arrows denoting the direction of payment. I assume units are chosen such that consumer goods, capital, and intermediate inputs have the same per-unit marginal cost (at the observed output level).[1]

During the year, Upstream produces 50 + K_1 units of capital, selling 50 to Downstream and retaining K_1. However, D_1 units of capital depreciate. The firm also produces 300 + I_1 units of intermediate inputs, of which it sells 300 units to Downstream and uses I_1 units internally. Upstream purchases labor from households at a cost of 280 units. It distributes its remaining cash flow of 70 to its bondholders and stockholders.

Figure 1 shows the capital income Upstream generates, 70 + K_1 – D_1, which is production (minus depreciation of capital and usage of intermediate inputs) minus wage payments. The figure also reports investment, K_1 – D_1, which is the net increase in the firm's capital. Note that cash flow equals capital income minus investment. I do not assign values to internal-use production and depreciation because these values cannot be observed from payment flows.

Downstream produces 500 units of consumer goods and sells them to households. It also produces K_2 units of capital and purchases another 50 units from Upstream. D_2 units of capital are used up through depreciation. Downstream produces I_2 units of intermediate inputs and purchases 300 units from Upstream, all of which are used in its production. Downstream buys labor from households at a cost of 140 units and distributes 10 units of cash flow to its bondholders and stockholders. This cash flow equals the firm's capital income, 60 + K_2 – D_2, minus investment, 50 + K_2 – D_2.

The key difference between the various consumption tax designs is whether the tax is imposed on firms or on households. Table 1 explains the calculation of the bases on which the firms are taxed under each system.[2]

Retail Sales Tax

Under the retail sales tax, each firm is taxed on the consumer goods it produces. The aggregate tax base is clearly national consumption. Firms are not taxed on production of capital or intermediate inputs (whether used internally or sold to other firms), and households are not taxed. So Downstream is taxed on 500 units of consumer goods, with no tax on Upstream or the households.

Sales tax rates can be expressed in either tax-inclusive or tax-exclusive terms. For example, consider a consumer good for which a household pays a firm $100 and the firm pays $25

Table 1
Computation of Base on Which Firm Is Taxed

	Sales of consumer goods	Sales of capital	Minus purchases of capital	Internal production of capital	Minus depreciation of capital	Sales of intermediate inputs	Minus purchases of intermediate inputs	Minus wage payments
Retail sales tax	✔							
Traditional VAT	✔	✔	✔			✔	✔	
Two-part VAT	✔	✔	✔			✔	✔	✔
Two-part income tax	✔	✔		✔	✔	✔	✔	✔

sales tax and retains the other $75. The tax-exclusive rate is 33.3 percent because the $25 tax payment is 33.3 percent of the $75 after-tax amount retained by the firm. However, the tax-inclusive rate is 25 percent because the $25 tax payment is 25 percent of the household's $100 pretax payment.

Although sales tax rates are usually expressed in tax-exclusive form, I use the tax-inclusive form for the sales tax and the other consumption tax designs. This is consistent with the common practice of reporting income tax rates in tax-inclusive form; if a household receives $100 pretax income, pays $25 income tax, and retains $75, the rate is said to be 25 percent, not 33.3 percent. In this article, I generally assume a 25 percent tax-inclusive rate for a new consumption tax because this rate is roughly sufficient to replace current U.S. individual and corporate income tax revenues.[3]

Traditional VAT

The traditional VAT taxes each firm on its value added, which is its sales (of consumer goods, capital, and intermediate inputs) minus its purchases (of capital and intermediate inputs), as the second row of Table 1 shows. Upstream's value added is 350 because it sells 50 units of capital and 300 units of intermediate inputs to Downstream and makes no purchases. Downstream's value added is 150 because it sells 500 units of consumer goods and purchases 50 units of capital and 300 units of intermediate inputs from Upstream. The combined tax base is still 500.

The VAT differs from the sales tax only when one firm sells capital or intermediate inputs to another firm. Neither firm owes anything under the sales tax; the VAT imposes tax on the seller but reduces the purchaser's tax by the same amount. Since their combined liability is zero, capital and intermediate inputs effectively remain tax-exempt. (As with the sales tax, no tax is imposed on internal-use production of capital or intermediate inputs.) The aggregate VAT base, like the aggregate sales tax base, is national consumption.

Two-Part VAT

Unlike the tax designs outlined above, the two-part VAT is partly imposed on households. As the third row of Table 1 shows, the base on which each firm is taxed is the same as under the traditional VAT, except that wage payments are deductible. Each household is taxed on its wage income. So Downstream is taxed on 70 (350 value added minus 280 wage payment), Upstream is taxed on 10 (150 value added minus 140 wage payment), households are taxed on 420 wages, and the aggregate base is still 500. Since the combined tax base on which each firm and its workers are taxed under the two-part VAT is the same as the base on which the firm is taxed under the traditional VAT, the two taxes have the same aggregate base.

It can be seen that the base on which each firm is taxed—value added minus wages—equals the cash flow distributed to bondholders and stockholders. In the aggregate, firms are taxed on national cash flow and households are taxed on national wages. Many economists have noted that national consumption equals national cash flow plus national wages.[4]

Following the usage of its most prominent supporters, Hall and Rabushka (1995), the two-part VAT is usually called the "flat tax," a misleading name that often causes it to be confused with a flat-rate income tax.[5]

Income Tax

The aggregate income tax base is net national product, defined as national consumption plus net investment (the production of new capital minus depreciation). The fourth row of Table 1 describes a two-part income tax system in which firms are taxed on the net capital income they generate and households are taxed on wages. To bring each firm's net investment into the tax base, the two-part VAT is modified in three ways. The deduction for capital pur-

chased from other firms is eliminated (but the tax on selling firms is retained), capital produced for internal use is taxed, and depreciation is deducted. The treatment of intermediate inputs does not change; inputs used internally remain tax-exempt, and purchased inputs remain deductible (offsetting the tax on the selling firm).[6] Upstream is taxed on $70 + K_1 - D_1$ and Downstream is taxed on $60 + K_2 - D_2$, the capital incomes shown in Figure 1. Households continue to pay tax on their wage income of 420. The aggregate tax base is $550 + K_1 + K_2 - D_1 - D_2$, which is net national product.

The income tax base is more complex than the consumption tax base because it requires the measurement of depreciation and internal-use capital. Distinguishing capital from intermediate inputs and measuring depreciation of the former are unavoidable complications of the income tax.[7]

This hypothetical two-part income tax omits many of the complicating features of the actual U.S. individual and corporate income tax. I now add a few of the omitted features to the analysis. I assume firms are taxed at rate τ_f on the tax base described above. (Since corporations can deduct interest paid to bondholders but not payments to stockholders, this approach implicitly assumes that firms issue a mix of bonds and stocks and reduces the value τ_f to reflect the tax savings from the interest deduction.) To represent the various investment incentives in the U.S. income tax, I assume firms receive an investment tax credit at rate Z for purchases and internal production of capital and pay a recapture tax of the same rate on sales of capital.

Households are taxed at rate τ_p on both wages and capital income from firms (although the capital income is also taxed at the firm level). This same tax rate applies to household loans; household lenders are taxed on their interest income and household borrowers deduct their interest expense. Capital income is measured in nominal terms; bondholders and household lenders are taxed on the portion of interest that compensates for inflation, and household borrowers deduct this interest. Stockholders similarly pay tax on the portion of capital gains that reflects inflation. Capital gains are taxed on accrual, and there are no front-loaded savings incentives.

TOTAL VALUE OF CAPITAL AND RATES OF RETURN

I define the value of capital as the consumption owners gain when they liquidate one unit of capital or, conversely, the consumption households must sacrifice to obtain one unit. I now examine the equilibrium relationship between the value of capital and its production cost under different taxes by considering a small change, or perturbation, to the circular flow between a firm and its bondholders and stockholders. This analysis also explains the relationship between the marginal product of capital and the after-tax rate of return savers receive.

In the initial year, a firm produces one additional unit of capital, reducing its output of consumer goods as required by its production function. The firm issues bonds and stocks that represent claims on the cash flow from the new capital and sells them to a household.[8] Since the firm is indifferent to small changes around the optimum, the equilibrium price at which it sells these securities must equal the after-tax receipts it would have obtained by selling the foregone consumer goods. The household purchasing the securities reduces its consumption by the purchase price. This reduction in consumption is the value of capital.

The capital stock remains one unit higher in each subsequent year. The output the additional capital produces, net of the portion required to replace depreciation, is sold as consumer goods. The firm distributes its after-tax proceeds from these sales to the household owning the securities. After paying any applicable taxes, the household consumes these proceeds. The after-tax rate of return equals the ratio of the increase in the household's consumption in each of these years to its consumption loss in the initial year.

Table 2 shows the results of this perturbation under the various tax systems.

Consumption Tax

The three consumption tax designs operate identically in this context. Let Q and MPK denote the equilibrium production cost of capital and its marginal product (both in terms of consumption). The firm receives a tax savings of $\tau_c Q$ by producing tax-exempt capital rather than taxable consumer goods. The equilibrium value of the securities and the reduction in the household's consumption must be $(1 - \tau_c)Q$, which is the value of capital.[9]

In each subsequent year, the capital yields MPK units of output, δQ units of which are invested to replace depreciation. The firm sells the remainder as consumer goods, paying tax of $\tau_c(MPK - \delta Q)$ on these sales. The household receives $(1 - \tau_c)(MPK - \delta Q)$ on its securities and consumes this amount. Dividing this annual consumption by the initial consumption reduc-

Table 2
Value of Capital and After-Tax Rates of Return

Effects in Initial Year

	(A) Price of foregone consumer goods	(B) Firm's tax savings	(C) Price of securities (A) – (B)	(D) Value of capital (C)
Sales tax and VATs	Q	$\tau_c Q$	$(1-\tau_c)Q$	$(1-\tau_c)Q$
Income tax	Q^*	ZQ^*	$(1-Z)Q^*$	$(1-Z)Q^*$

Effects in Each Subsequent Year

	(E) Additional consumer output	(F) Firm's tax	(G) Return on securities (E) – (F)	(H) Household's tax	(I) Additional consumption (G) – (H)	(J) Rate of return (I) / (D)
Sales tax and VATs	$MPK-\delta Q$	$\tau_c(MPK-\delta Q)$	$(1-\tau_c)(MPK-\delta Q)$	0	$(1-\tau_c)(MPK-\delta Q)$	$(MPK/Q)-\delta$
Income tax	$MPK^*-\delta Q^*$	$\tau_f[MPK^* - (1-Z)\delta Q^*] - Z\delta Q^*$	$(1-\tau_f)$ $[MPK^* - (1-Z)\delta Q^*]$	$\tau_p(1-\tau_f)$ $[MPK^* - (1-Z)\delta Q^*]$	$(1-\tau_p)(1-\tau_f)$ $[MPK^* - (1-Z)\delta Q^*]$	$(1-\tau_p)(1-\tau_f)$ $[MPK^*/Q^*(1-Z) - \delta]$

tion of $(1-\tau_c)Q$ reveals that the after-tax rate of return is $(MPK/Q)-\delta$, which is the same as the pretax rate of return. The consumption tax does not drive a wedge between the pretax and after-tax rates of return and therefore does not distort consumption–saving decisions.

Income Tax

The effect of the income tax is described in the last row of each panel. Let Q^* and MPK^* denote the equilibrium production cost of capital and marginal product under the income tax. When the firm produces a unit of capital instead of Q^* units of consumption, it receives tax savings of ZQ^* from the investment tax credit. The securities must have an equilibrium value of $(1-Z)Q^*$, which is the value of capital. In each subsequent year, both the firm and the household pay tax on the output, as the table shows. Since the after-tax rate of return is lower than the pretax rate of return, the income tax distorts consumption–saving decisions.

Tax Reform's Impact on Value of Capital

An immediate, unexpected replacement of the income tax with a consumption tax changes the value of capital from $(1-Z)Q^*$ to Q. The result can be simplified by imposing two restrictive assumptions. First, an unlimited quantity of capital can be produced at constant cost, so $Q = Q^*$. Second, the income tax system provides no investment tax credit (or other front-loaded investment incentives), so Z is zero. Under these assumptions, tax reform reduces the value of capital by fraction τ_c; the proportional decline equals the consumption tax rate.[10]

However, it is more realistic to assume the production cost of capital increases as more is produced. Since tax reform is likely to increase investment for most types of capital, $Q > Q^*$. Also, the current income tax includes many front-loaded investment incentives, so $Z > 0$. The proportional decline in value is then less than τ_c and may vary across different types of capital. Some types of capital may even rise in value.

In the analysis below, I consider three hypothetical firms, each of which holds capital with a value of 400 prior to tax reform. The first firm holds capital that is produced at constant cost and receives no front-loaded incentives, so replacing the income tax with a 25 percent consumption tax reduces its value by 25 percent, from 400 to 300. The second firm holds capital that is produced at increasing cost and receives some front-loaded investment incentives. Tax reform reduces its value by 10 percent, from 400 to 360. The third firm holds capital for which increasing costs and front-loaded incentives are even more pronounced. The value of this capital is unchanged by tax reform.

Tax Reform's Impact on After-Tax Rate of Return

Before tax reform, the after-tax rate of return is lower than the pretax rate of return. Since the rates are equal after reform, either the pretax rate must decline or the after-tax rate must rise, or both. If the real pretax rate of return was 6 percent per year and the real after-tax rate was 4 percent per year, what is likely to happen after reform eliminates the 2 percent wedge the income tax imposes?

In the long run, the rate of return (pretax and after tax) may be close to 4 percent. Even a modest rise in the 4 percent after-tax return would probably prompt additional saving that eventually results in a large expansion of the capital stock. The expansion of the capital stock drives down its marginal product, lowering the pretax rate of return well below 6 percent. However, because this expansion of the capital stock is the cumulative effect of the increased flow of savings each year, it occurs only gradually. In the short run, therefore, the capital stock has not expanded significantly and the rate of return is likely to be close to 6 percent. The after-tax rate of return rises by nearly the full 2 percentage points.[11]

Asset owners' well-being depends on the equilibrium after-tax rate of return, as well as the value of their assets. An asset's value merely measures the current consumption the owner would receive from immediately liquidating it. However, an owner who intends to consume over an extended period benefits from the increase in after-tax rates of return, to an extent that depends on the length of his or her consumption horizon.[12]

Conversely, the well-being of a borrowing household depends (negatively) on the after-tax rate of return, as well as on the value of its liabilities. A liability's value merely measures the current consumption the borrower would have to sacrifice to immediately retire it. However, a borrower who intends to repay over an extended period is harmed by the increase in the after-tax rate of return that must be paid on the liability until it is repaid.

Debt Structure

I assume each of the three hypothetical firms issues bonds with a value of 100, one-quarter of its capital. The value of each firm's stock is 300, or three-quarters of capital. (These ratios are close to the averages for nonfinancial corporations.) I also consider a household that makes a loan of 100 (Lender) and one that receives the loan (Borrower).

Let r^* denote the nominal after-tax rate of return prior to reform. Each debt instrument (firm bond or household loan) provides a nominal pretax interest payment of $r^*/(1 - \tau_p)$ each year until it matures and a nominal principal repayment of unity at maturity. Since nominal interest payments are taxed at rate τ_p under the income tax, the holder of each instrument receives net payments of r^*. Consider a debt instrument that matures M years after the reform. Its price immediately before the unexpected reform, denoted P^*, is the present discounted value of its after-tax payments, which is unity.

$$(1) \qquad P^* = \sum_{t=1}^{M} r^* \left(1 + r^*\right)^{-t} + \left(1 + r^*\right)^{-M} = 1.$$

I now examine how an immediate, unexpected tax reform changes the value of bonds and household loans. Subtracting the change in the value of each firm's bonds from the change in the total value of its capital yields the change in the value of its stock. The change in the value of household loans controls the allocation of wealth between lending and borrowing households.

Since nominal debt payments are fixed, an important issue is whether the consumer price level changes when the reform occurs. Since the price level depends on money supply and demand, it remains unchanged if the money supply is adjusted to offset any changes in money demand resulting from tax reform.[13] I now consider the effects of tax reform on asset values, under the assumption this monetary policy is pursued and the consumer price level is unchanged.

ASSET VALUES WITH UNCHANGED CONSUMER PRICE LEVEL

What happens to the value of outstanding debt immediately after a 25 percent consumption tax unexpectedly replaces the income tax? The reform has two conflicting effects. First, the price rises to reflect the tax savings bondholders receive (the elimination of income tax on interest payments). Second, the price is reduced because future payments are discounted at a higher equilibrium after-tax interest rate. In general, the new price of the debt instrument is

$$(2) \qquad P = \sum_{t=1}^{M} \frac{r^*}{(1 - \tau_p)} \left(1 + r\right)^{-t} + \left(1 + r\right)^{-M},$$

where r is the nominal after-tax (and pretax) interest rate after reform.

For simplicity, I assume the pretax interest rate is constant during the M years after tax reform, so the after-tax interest rate rises by the amount of the former tax on interest income.[14] In other words, r equals $r^*/(1 - \tau_p)$, the nominal pretax interest rate before reform. Substituting into Equation 2 reveals that under this assumption, the debt instrument's price remains equal to unity because the tax savings offset the loss from the higher discount rate.[15]

As Table 3 shows, the value of each firm's bonds remains equal to 100. The decline in the value of each firm's capital falls entirely on stockholders as residual claimants. As the value

Table 3
Impact of Tax Reform with Unchanged Consumer Price Level

		Allocation of Decline in Value of Capital		
		Capital	Bonds	Stock
Before tax reform				
Each firm	Value	400	100	300
After tax reform				
First firm	Value (% change)	300 (–25%)	100 (0)	200 (–33%)
Second firm	Value (% change)	360 (–10%)	100 (0)	260 (–13%)
Third firm	Value (% change)	400 (0)	100 (0)	300 (0)

	Wealth Reallocation Between Household Lenders and Borrowers		
	Combined	Lender	Borrower
Before tax reform	0	100	–100
After tax reform	0	100	–100

Table 4
Impact of Tax Reform with Unchanged Consumer Price Level: Existing Debt Grandfathered

		Allocation of Decline in Value of Capital		
		Capital	Bonds	Stock
Before tax reform				
Each firm	Value	400	100	300
After tax reform				
First firm	Value (% change)	300 (–25%)	89 (–11%)	211 (–30%)
Second firm	Value (% change)	360 (–10%)	89 (–11%)	271 (–10%)
Third firm	Value (% change)	400 (0)	89 (–11%)	311 (+4%)

	Wealth Reallocation Between Household Lenders and Borrowers		
	Combined	Lender	Borrower
Before tax reform	0	100	–100
After tax reform	0	89	–89

of the first firm's capital declines by 25 percent, from 400 to 300, the value of its stock declines by 33 percent, from 300 to 200. As the value of the second firm's capital declines by 10 percent, from 400 to 360, the value of its stock declines by 13 percent, from 300 to 260. Because stockholders own only three-quarters of the firm but bear the full wealth decline, their proportional loss is four-thirds times the proportional decline in capital value. For the third firm, whose capital value remains unchanged, neither bondholders nor stockholders experience any wealth decline. The impact on stockholders varies, depending on the type of capital their firms hold. Also, although not shown in the table, the impact is more (less) severe if firms are more (less) leveraged.

Because the value of debt is unchanged when $r = r^*/(1 - \tau_p)$, there is no redistribution of wealth between lending and borrowing households. As the second panel of Table 3 shows, both the wealth of Lender and the liability of Borrower remain equal to 100.

Transition Relief: Grandfather Existing Debt

Depending on their consumption horizons, stockholders may be either better or worse off because of tax reform. Although their initial wealth declines, they benefit from earning the higher equilibrium after-tax rate of return. Bondholders and household lenders, however, clearly gain because they avoid any loss of initial wealth —under the assumption $r = r^*/(1 - \tau_p)$—and benefit from the higher equilibrium after-tax rate of return if they do not immediately liquidate their assets and consume. Household borrowers are harmed because their initial liability is unchanged but they face higher future after-tax borrowing rates.[16]

Some believe these results are too generous to bondholders and household lenders and too harsh on stockholders and household borrowers.[17] These observers often advocate grandfathering debt instruments that are outstanding on the reform date. Bondholders and household lenders would continue to pay tax on interest income from these instruments, although at rate τ_c rather than τ_p, and firms and household borrowers would deduct their interest expense from these instruments at the same rate. In principle, total revenues would be unchanged.[18]

Under this policy, the value of outstanding debt would be

$$(3) \qquad P = \sum_{t=1}^{M} \frac{r^*(1-\tau_c)}{(1-\tau_p)}\left(1+r\right)^{-t} + \left(1+r\right)^{-M}.$$

Substituting in $r = r^*/(1 - \tau_p)$ yields the price $1 - \tau_c[1 - (1 + r)^{-M}]$. For debt nearing maturity, the value would still be close to unity. (The treatment of interest is unimportant because most of the present value consists of the imminent principal repayment.) For debt far from maturity, the proportional decline in value would approach the tax rate. If the nominal pretax interest rate r were 6 percent, with a 25 percent consumption tax rate the decline in the price of debt with ten years to maturity would be 11 percent.

The top panel of Table 4 shows the impact of debt grandfathering on bondholders and stockholders, using this 11 percent estimate. Bondholders suffer an 11 percent loss at all firms. Stockholders at the first firm suffer a 30 percent rather than a 33 percent loss, and those at the second firm suffer a 10 percent rather than a 13 percent loss. The third firm's stockholders now gain wealth. Although the impact differs across firms holding different types of capital (or with different degrees of leverage), debt grandfathering tends to make the proportional losses of bondholders and stockholders more similar in the aggregate.

Table 5
Equilibrium Wage Rates

	(A) Payment received from households	(B) Firm's tax	(C) Wage payment to worker (A) – (B)	(D) Worker's tax	(E) Worker's net wage (C) – (D)
Sales tax, traditional VAT	MPL	$\tau_c MPL$	$(1-\tau_c)MPL$	0	$(1-\tau_c)MPL$
Two-part VAT	MPL	0	MPL	$\tau_c MPL$	$(1-\tau_c)MPL$
Income tax	MPL^*	0	MPL^*	$\tau_p MPL^*$	$(1-\tau_p)MPL^*$

As the bottom panel of Table 4 shows, the household lender now suffers an 11 percent wealth decline while the household borrower enjoys an 11 percent decline in its liability. Wealth is reallocated from lenders to borrowers.

If this policy is desired, it can be administered most easily under a two-part VAT because working households can report interest income and expense on the same tax returns they use to report wages. The policy is less convenient under a sales tax or traditional VAT because households must file new tax returns solely to report interest income and expense.[19]

COULD TAX REFORM INDUCE AN INCREASE IN CONSUMER PRICES?

The above analysis assumes the consumer price level is unchanged by tax reform. The asset pricing implications are different if the consumer price level rises in response to tax reform. Some argue that the labor-market effects of adopting a sales tax or traditional VAT may prompt a monetary policy response that raises the consumer price level.

Labor Markets under Alternative Tax Systems

To understand this argument, I consider a simple perturbation to the circular flow between firms and workers (*Table 5*). A firm purchases one additional unit of labor from a household and produces additional consumption. Let MPL and MPL^* denote the marginal product of labor under a consumption tax and the income tax, respectively. For the firm to be indifferent to this perturbation, its after-tax receipts from selling the additional consumption must equal its wage payment. After paying any applicable taxes, the household consumes its additional wages.

Under the sales tax and the traditional VAT, the firm pays an additional tax of $\tau_c MPL$ on its additional consumption output. For the firm to be indifferent to the perturbation, the equilibrium value of its wage payment to the household must be $(1 - \tau_c)MPL$. Since the household pays no tax, its consumption increases by this amount.

Under the two-part VAT (which taxes the firm on value added minus wage payments), the perturbation does not change the firm's tax liability because its value added and wage payments rise by the same amount. For the firm to be indifferent to this perturbation, the equilibrium value of its wage payment must be MPL. However, the household pays tax of $\tau_c MPL$ on its wage income, so its consumption increases by only $(1 - \tau_c)MPL$.

Under the income tax, this perturbation does not change the firm's tax liability because its receipts and wage expenses increase by the same amount. For the firm to be indifferent to the perturbation, the equilibrium value of its wage payment must be MPL^*. However, the household pays tax of $\tau_p MPL^*$ on its wage income, so its consumption increases by only $(1 - \tau_p)MPL^*$.

Each of the three consumption tax designs distorts the labor–leisure decision by driving a wedge at rate τ_c between the marginal product of labor and the after-tax wage rate. The income tax also distorts this decision by driving a similar wedge at rate τ_p.

To consider the transitional impact of tax reform on labor markets, I make a few simplifying assumptions. Although tax reform is likely to greatly increase the marginal product of labor in the long run by significantly expanding the capital stock, the short-run change in marginal product should be small because (as discussed above) the capital stock expands only gradually. So I assume the marginal product of labor is initially unchanged, $MPL = MPL^*$.[20] I consider a worker with a marginal product of twelve consumer goods per hour, who earns $12 per hour when these goods sell for $1 each, and I assume

the consumption and personal income tax rates are both 25 percent.

The replacement of the income tax with a two-part VAT has little impact on labor markets because these taxes are similar in form as well as substance. Table 5 implies that under either tax, the firm pays the worker $12 and the worker pays $3 tax. Under the current income tax, firms withhold the worker's wage tax, so the paycheck is actually $9, with a stub noting that the worker is being paid $12, $3 of which is withheld for taxes. Hall and Rabushka (1995, 145) propose similar withholding under a two-part VAT.

The treatment of wages under a sales tax or traditional VAT differs in form, but not in substance, from that under an income tax because the tax is imposed on the firm rather than the worker. In accordance with Table 5, the firm now pays a wage rate of only $9 because it retains only 75 cents after tax for each of the twelve goods the worker produces. The paycheck amount is still $9, but the stub is now different, showing $9 as the wage with no tax withheld. The worker owes no additional tax, and disposable income is still $9. This wage-rate adjustment illustrates the public-finance principle that imposing a tax on the seller rather than the buyer has no real economic effect because the equilibrium price adjusts by the amount of the tax.

Potential Nominal-Wage Rigidity and Monetary Accommodation

Some argue that this adjustment may not easily occur. They note the longstanding literature suggesting that workers resist nominal-wage reductions and argue that this resistance applies to reductions in the wage rate listed on the paycheck stub, not reductions in take-home pay.[21] Even if such resistance does not exist, they note that the Fair Labor Standards Act (FLSA) prohibits the necessary adjustment for lower-paid workers. This law prescribes a minimum value (currently $5.15 per hour) for the wage rate shown on the paycheck stub.

If the listed wage rate remains rigid, the adoption of a sales tax or traditional VAT has problematic labor-market consequences. After paying sales tax or VAT, firms retain only 75 cents for each unit produced and they can profitably hire workers at a $12 wage rate only if their marginal product is fifteen units, rather than the twelve units possible before reform. The implied hiring reduction and unemployment could be substantial.

The literature on nominal-wage rigidity generally assumes workers do not resist real-wage reductions achieved through inflation. Similarly, since the FLSA minimum wage is not indexed, its real value can be reduced through inflation. If nominal-wage rigidity otherwise impedes the necessary adjustment, a possible response is a monetary policy that rapidly increases the consumer price level by a factor of $1/(1 - \tau_c)$.[22] I refer to this policy as "full accommodation" of the consumption tax and to a smaller price increase as partial accommodation.

Full accommodation raises the price of consumer goods to $1.33. Since firms retain $1 after paying sales tax or VAT, they can profitably hire workers at a $12 wage rate if their marginal product is twelve units, the same as before reform. The necessary real-wage adjustment occurs without any reduction in nominal wages.

It is unclear whether nominal-wage rigidity poses a problem. Workers who resist isolated reductions in their nominal wage rate may accept an economywide reduction made in response to a highly visible change in tax policy, particularly when take-home pay is unaffected. Congress can also amend the FLSA when it adopts tax reform. Accommodation may be unnecessary.

I make no prediction about whether monetary policy would accommodate all, some, or none of a sales tax or traditional VAT. Instead, I compare the asset-price effects of tax reform under the different possibilities. I have already described the effects without accommodation and now describe them with full accommodation. Intermediate effects occur under partial accommodation.

ASSET PRICE EFFECTS WITH FULL ACCOMMODATION

With accommodation, the nominal interest rate (and the inflation rate) is extremely high during the brief period when the price level is rising. If $r = r^*/(1 - \tau_p)$ thereafter, full accommodation reduces the real value of debt by factor τ_c.

As the top panel of Table 6 shows, bond values fall from 100 to 75 at each firm. At the first firm, as total value falls from 400 to 300, stock values fall from 300 to 225, which is also a 25 percent decline. At the second firm, however, as total value declines from 400 to 360, stock values fall only from 300 to 285, a mere 5 percent. At the third firm, where total firm value is unchanged at 400, stock values actually rise, from 300 to 325. Overall, bondholders now bear heavier burdens than stockholders, reversing the pattern seen in Table 3.

Table 6
Impact of Tax Reform with Full Accommodation

Allocation of Decline in Value of Capital

		Capital	Bonds	Stock
Before tax reform				
Each firm	Value	400	100	300
After tax reform				
First firm	Value (% change)	300 (–25%)	75 (–25%)	225 (–25%)
Second firm	Value (% change)	360 (–10%)	75 (–25%)	285 (–5%)
Third firm	Value (% change)	400 (0)	75 (–25%)	325 (+8%)

Wealth Reallocation Between Household Lenders and Borrowers

	Combined	Lender	Borrower
Before tax reform	0	100	–100
After tax reform	0	75	–75

The value of the household loan also falls from 100 to 75. As the bottom panel of Table 6 shows, the household lender suffers a 25 percent wealth decline while the household borrower enjoys a 25 percent decline in the value of its liability.[23]

Although this analysis generally ignores consumer-owned capital, it should be noted that accommodation benefits homeowners with mortgages at the expense of mortgage lenders, in the same way it benefits stockholders of leveraged firms at bondholders' expense. Consider a homeowner with a $120,000 house and an $80,000 mortgage, and assume that tax reform reduces the home's real value to $110,000.[24] If the consumption tax is not accommodated, the real value of the mortgage is still $80,000 and the homeowner suffers a 25 percent decline in home equity, from $40,000 to $30,000. But if the tax is fully accommodated, the real value of the mortgage falls to $60,000 and the homeowner's equity rises from $40,000 to $50,000, as the mortgage lender bears more than the full burden of the decline in value. (Of course, accommodation is irrelevant if the homeowner does not have a mortgage.)

Some believe an accommodated consumption tax would be too harsh on bondholders and household lenders and too favorable to stockholders and household borrowers, the opposite of the concerns expressed with no accommodation. If accommodation is considered undesirable, it can be avoided by adopting a two-part VAT. Or if a sales tax or traditional VAT is adopted, steps can be taken to facilitate rapid nominal-wage adjustment. Or if nominal-wage rigidity is considered inevitable, the need for accommodation can be avoided by phasing in the sales tax or VAT and phasing out the income tax over an extended period. With a smooth ten-year phase-in, for example, nominal wages need fall only 2.5 percent per year from their prereform path; if they had been growing 4 percent per year, they can still grow 1.5 percent per year during the phase-in, avoiding outright reductions. However, since firms have an incentive to delay investment while a consumption tax is phased in, it may be better to immediately replace the income tax with a two-part VAT and then phase in a sales tax or traditional VAT and phase out the two-part VAT.

CONCLUSION

Replacing the income tax with a consumption tax—whether in the form of a sales tax, traditional VAT, or two-part VAT ("flat tax")—is likely to reduce the total value of the capital stock. The division of this reduction between bondholders and stockholders and the effects on household lenders and borrowers largely depend on whether the tax is accommodated in the form of a higher consumer price level. Accommodation is unlikely under a two-part VAT, but observers disagree about its likelihood under a sales tax or traditional VAT.

If the consumption tax is not accommodated, the real value of debt changes little. The decline in the value of capital is largely borne by stockholders, and there is little reallocation of wealth between household borrowers and lenders. With full accommodation, the real value of debt is sharply reduced. Bondholders bear heavier burdens than stockholders, and household borrowers gain at the expense of household lenders.

These transitional effects deserve careful attention in the evaluation and implementation of tax reform.

NOTES

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1 For pedagogical purposes, I compare the application of the various tax systems to a fixed level and composition of output. This does not imply that equilibrium output is the same under the different taxes. As discussed elsewhere in this article, the income tax equilibrium differs from the consumption tax equilibrium.

2 Koenig and Huffman (1998, 25–26), Congressional Budget Office (1997, 7–16), Gravelle (1996, 1422–28), Auerbach (1996, 43–46), and Joint Committee on Taxation (1995, 51–52, 57–58) also describe these tax designs. Another tax system is a personal consumption tax in which each household is taxed on its consumption and firms are not taxed. This design, which has received little attention in the past few years, is not considered here.

[3] See Viard (2000, 6, 19 note 5) and the references cited therein.

[4] Viard (2000, 7), Bradford (2000, 68), Koenig and Huffman (1998, 26), Congressional Budget Office (1997, 66), Gravelle (1996, 1425), Auerbach (1996, 30–31), and Joint Committee on Taxation (1995, 55) note this equality.

[5] The name is particularly misleading because this tax has the potential to be less flat than the sales tax or traditional VAT. Hall and Rabushka (1995, 55) propose that the household component include a nonrefundable exemption, and another prominent academic supporter, Bradford (2000, 67–70), suggests that it have a progressive rate structure. Bradford calls this tax the X-tax. Koenig and Huffman (1998) and Joint Committee on Taxation (1995, 57) call it the Hall–Rabushka tax, while Hall (1996) calls it the Hall–Rabushka VAT. Congressional Budget Office (1997) calls it the bifurcated VAT.

[6] Intermediate inputs remain outside the tax base because they do not add to net national product. Since they are immediately used up, depreciation always equals production.

[7] Sections 263 and 263A of the Internal Revenue Code prohibit firms from deducting purchases of capital or the costs of producing internal-use capital, while section 162 allows a deduction for intermediate inputs. Litigation has increased in the past decade as the IRS has become more vigilant, albeit selectively, in denying deductions for intangible capital. Section 168 sets fixed depreciation schedules for tangible capital, and section 197 sets a fifteen-year schedule for many purchases of intangible capital. However, section 167 requires that internally produced intangible capital be depreciated over its "useful life," which is another source of litigation.

[8] If the "new view" of corporate financial policy is valid, firms are at a corner solution in which they issue no new stocks. The perturbation in the text must be modified to have the firm reduce dividends rather than issue securities. Since the imposition of a higher personal tax rate on dividends than on capital gains then has effects similar to those of front-loaded investment incentives, Z can be viewed as including this tax rate differential. Viard (2000, 14–16), Congressional Budget Office (1997, 67), Gillis, Mieszkowski, and Zodrow (1996, 748), and Auerbach (1996, 37, 69) discuss the new view and its implications.

[9] The perturbation reduces production of consumer goods by one unit, but the securities-owning household reduces its purchases by only $(1 - \tau_c)Q$ units. A household that receives lower transfer payments (due to the revenue loss) reduces consumption purchases by $\tau_c Q$, closing the circle.

[10] Viard (2000, 8–11) presents this simplified analysis in greater detail.

[11] Huffman and Koenig (1998, 25), Auerbach (1996, 58–59), and Kotlikoff (1996, 174–76) provide more detail on how tax reform may affect rates of return.

[12] Viard (2000, 10), Congressional Budget Office (1997, 67), Gillis, Mieszkowski, and Zodrow (1996, 748), Auerbach (1996, 60), and Joint Committee on Taxation (1995, 87) make this point.

[13] Tax reform is likely to initially reduce the real quantity of money demanded by raising after-tax interest rates and temporarily lowering consumption. So keeping consumer prices unchanged may require slowing money growth.

[14] The assumption that the pretax interest rate is unchanged shortly after tax reform is inspired by the previous conclusion that the marginal product of capital is little changed at that time. However, this reasoning is simplistic. Before reform, the pretax interest rate may not equal the net-of-depreciation marginal product because bonds and stocks receive different firm-level tax treatment. Congressional Budget Office (1997, 33–34) and Auerbach (1996, 48–49) discuss this difficult issue.

[15] Municipal bonds, which this article does not consider, clearly decline in value because they receive no tax savings (they are already tax-exempt) but are subject to the higher discount rate.

[16] Recall the assumption that the current income tax allows borrowers to deduct interest expense. If interest is nondeductible (as it is for some loans), tax reform does not change borrowing costs.

[17] For example, Bradford (2000, 111), Koenig and Huffman (1998, 26), and Pearlman (1996, 421) describe this outcome as a "windfall" for bondholders and household lenders. Bradford (2000, 101) and Gravelle (1996, 1445) note that leverage magnifies the impact on stockholders.

[18] Variants of this policy are proposed or discussed by Bradford (2000, 110–11), Koenig and Huffman (1998, 26), Pearlman (1996, 420–23), and Hall and Rabushka (1995, 79–80). Pearlman argues that in practice, this policy could reduce total revenue.

[19] Pearlman (1996, 408, 413) notes that transition relief is less likely to be offered under a sales tax. Another form of transition relief allows firms to deduct depreciation on existing capital. This relief is most beneficial to short-lived types of capital, as Viard (2000, 11) and Bradford (2000, 110) note. The tax savings flow to stockholders as residual claimants, with no effects on bondholders or household lenders and borrowers. The resulting revenue loss raises the revenue-neutral tax rate.

[20] With endogenous labor supply, tax reform may initially reduce the marginal product of labor. See Huffman and Koenig (1998, 25), Auerbach (1996, 57–58), and Kotlikoff (1996, 175).

[21] Taylor (1999, 1013–21) surveys the literature on nominal-wage rigidity.

[22] Bradford (2000, 100–102), Congressional Budget Office (1997, 65–66), Gillis, Mieszkowski, and Zodrow

(1996, 752–53), Hall (1996, 77–78), Auerbach (1996, 44 fn. 29), Gravelle (1996, 1441–42), and Viard (1994) discuss these issues. Most, but not all, of these authors suggest that nominal-wage rigidity will require some accommodation of a sales tax or traditional VAT.

[23] Accommodation also lowers the real value of the $3 trillion of nominal debt the U.S. Treasury owes to the public, thereby lowering the tax rate required for long-run budget neutrality.

[24] Tax reform is likely to reduce the value of consumer-owned capital, such as owner-occupied homes, along with the value of business capital, but for different reasons, reflecting the distinctive tax treatment of consumer capital. See Viard (2000, 11–13), Bradford (2000, 107), and Congressional Budget Office (1997, 66–67).

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