

# research review



Issue No. 7, January 2007 – June 2007

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### Graphic Designer

Heidi Furse

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# Public Policy Discussion Papers

p-07-1

## **The Boston Fed Study of Consumer Behavior and Payment Choice: A Survey of Federal Reserve System Employees**

*by Marques Benton, Krista Blair, Marianne Crowe, and Scott Schuh*

complete text: <http://www.bos.frb.org/economic/ppdp/2007/ppdp071.pdf>

email: [marques.benton@bos.frb.org](mailto:marques.benton@bos.frb.org), [krista.blair@bos.frb.org](mailto:krista.blair@bos.frb.org), [marianne.crowe@bos.frb.org](mailto:marianne.crowe@bos.frb.org), [scott.schuh@bos.frb.org](mailto:scott.schuh@bos.frb.org)

### **Motivation for the Research**

The way people pay for goods and services has been changing rapidly over the past decade, but publicly available data and research-based knowledge on consumer behavior and payment choice are scarce. Perhaps the most tangible change in payment behavior is occurring in the declining use of paper checks. This change directly impacts a central business concern of the Federal Reserve System, which handles roughly 40 percent of total U.S. check processing. The Fed, along with commercial banks, must consider how rapidly to downsize or consolidate these operations in order to contain costs, and in which products and services to continue to invest or divest. While the paper-to-electronics transformation has important implications for participants in the payments industry, it has broader economic and public policy implications as well. In evaluating the social welfare aspects of the payments revolution, the consumer welfare aspects have been a relatively neglected component of this evaluation.

While some data on consumer payment choices are readily available, what is not well understood is why the transformation of these choices is occurring the way it is. For example, why is it happening now and not earlier (or later)? Why are some consumers participating in new payment methods, but not others? This paper describes the results of a survey of payment behavior and attitudes of Federal Reserve employees undertaken in 2004 to make a modest contribution toward filling the data gap.

### **Research Approach**

The authors conducted a survey of consumer behavior and payment choice designed to shed some light on the determinants of consumer behavior with respect to payment choice, with an emphasis on check-writing behavior. In addition to asking about actual practices, the survey asks why consumers make the payment choices they do, about changes in consumer behavior over time, and about how consumers rate the relative values of some fundamental characteristics of payment methods, such as convenience, cost, and controlling the timing of payments.

The survey was conducted with a sample of more than 5,000 Federal Reserve System employees. Since the survey sample is not representative of all U.S. consumers, the aggregate statistics should not be used to draw conclusions about U.S. consumers in general. However, cross-sectional studies using the survey data can provide valid and useful information about individual consumer behavior. Moreover, the authors' findings are generally consistent with the results of other, more representative surveys on the same items addressed by other researchers.

Because the decision about whether to write a check is made jointly with the decision about whether to use any other payment method, the survey included questions about most common alternatives, including cash, credit cards, debit cards, Automated Clearing House (ACH), stored-value cards (SVC), and automatic bill payment.

### **Key Findings**

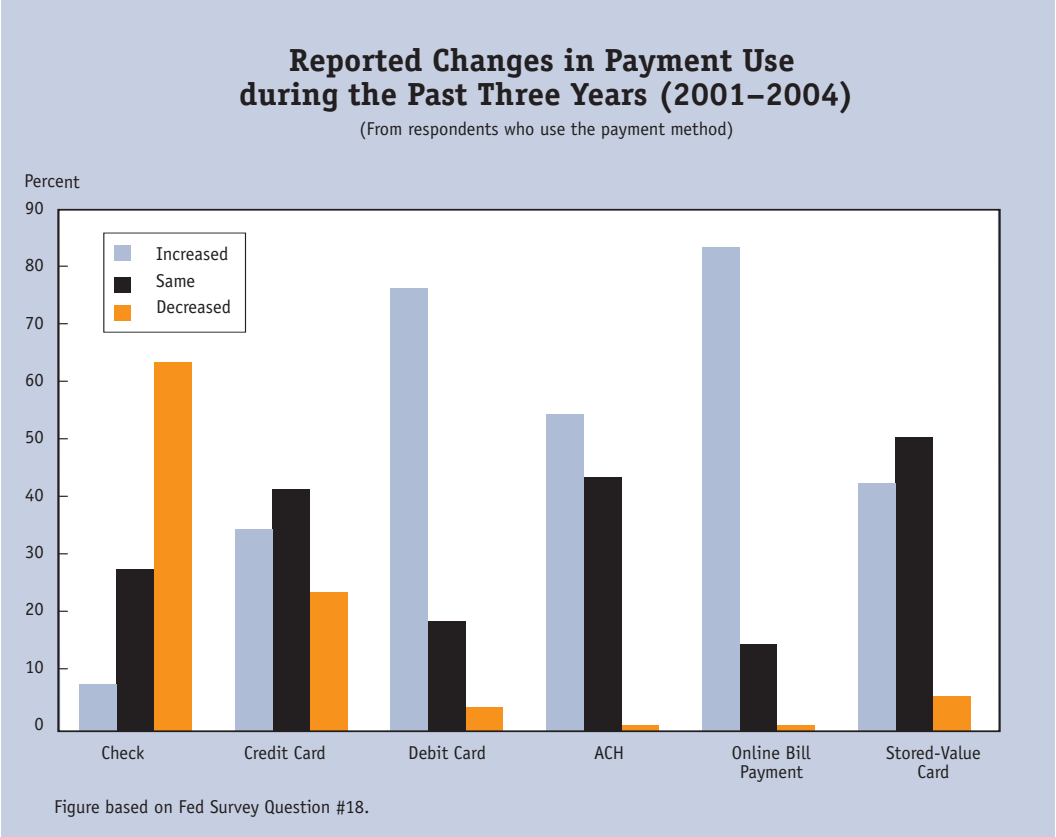
- The data show a trend away from check-writing and toward electronic and other emerging payment methods, but consumers' choice of payment method depends on the type of payment, the payment amount, and other complex factors.
- In 2004, for Fed respondents, paper checks still represented the single largest payment method in terms of transactions volume, but the volume of all electronic payments far exceeded the number of checks written.
- Cost, convenience, and control over payment timing are the most important characteristics determining respondents' adoption and use of payment methods. Safety and privacy are also important for methods susceptible to risks like identity theft.
- Payment choices vary widely across respondents in part because of heterogeneity in demographic characteristics, financial status, and other objective and observable factors. However, respondents' assessments of payment characteristics may also vary because of measurement errors, misperceptions, or inadequate information.
- Most respondents use a variety of payment methods each month. The single most important barrier to adopting a payment method differs according to the particular method. When respondents switch from checks to other payment methods, their choice depends on the location of the transaction and the amount of the payment, among other things.
- Cross-sectional evidence shows that respondents tend to use payment methods in a manner broadly consistent with their reported assessments of the payment characteristics associated with that method.
- When faced with changes in the payment system, some respondents report that they would or already did alter their payment behavior. The extent to which behavior changes, and the circumstances under which behavior change occurs, depends on the type and magnitude of the payments system change.

### **Implications**

Regarding the adoption of payment methods, the results suggest that the barriers to adoption are so different among the various electronic payment methods that it is unlikely that any single improvement to the payments system will encourage consumers to increase their use of electronic payments in general. For example, the most important barrier to the use of ACH payments cited by non-users of ACH was concern about overdrafts, while for online bill payments the major concerns were privacy and security. The top barriers to the use of credit cards and debit cards are even less subject to generalization: for credit card use, the most-cited barrier was the amount of debt in the household, and for debit card use, it was incentives offered by credit card issuers. However, respondents generally would be willing to use electronic payments more if the specific barriers that inhibited them from using each type of payment were removed.

As consumer behavior is understood more fully, it will be natural for policymakers like the Federal Reserve to start asking: what is best for consumers with regard to the payments system? A major hurdle to answering this question is the surprisingly widespread and persistent heterogeneity of consumers' payment preferences. Some U.S. households have no bank account, and thus cannot participate in some electronic payment innovations. Other developments—identity theft, credit and debit card interchange fees, technology barriers, financial market complexity, rapidly expanding choices, and the like—have potentially important impacts on the welfare of consumers as well.

Together, these real-world issues highlight the importance of gaining a better understanding of consumer preferences with respect to payment methods, both from the perspective of all participants in the payments system and from the perspective of policymakers interested in maximizing social welfare. The authors argue that it is critical to continue to expand the kind of data collection and research efforts described in this paper. The Boston Fed consumer payment survey is available from the Bank's web site, and suggested improvements to this particular consumer payment survey are included in the paper.



p-07-2

## Optimal Retirement Asset Decumulation Strategies: The Impact of Housing Wealth

by Wei Sun, Robert K. Triest, and Anthony Webb

complete text: <http://www.bos.frb.org/economic/ppdp/2007/ppdp072.pdf>  
email: [wei.sun@bc.edu](mailto:wei.sun@bc.edu), [robert.triest@bos.frb.org](mailto:robert.triest@bos.frb.org), and [webbaa@bc.edu](mailto:webbaa@bc.edu)

### Motivation for the Research

Housing constitutes much of the non-pension wealth of the majority of American households. As a result of inadequate saving rates, declines in Social Security replacement rates, increased life expectancy, and the demise of traditional defined benefit private-sector pensions, it seems likely that increasing numbers of households will need to tap their housing wealth in order to maintain their standard of living in retirement. Yet there has been virtually no research to date on how households can best accomplish this. To help fill this gap, this paper analyzes alternative strategies for using reverse mortgages to make housing equity available to fund consumption, while simultaneously allowing homeowners to continue enjoying the shelter services provided by their house.

Housing differs fundamentally from other household assets in that it not only provides an important flow of services, but also has a significant residual value in excess of the service flow received during the owner's lifetime. The authors assume that the portion of housing wealth that is available for non-housing consumption is this residual value, the reversionary interest.

Reverse mortgages are a mechanism whereby a household can access the majority of the reversionary interest in its housing wealth. In contrast to a conventional mortgage, on a reverse mortgage the loan plus accumulated interest of a reverse mortgage is repayable only when neither borrower lives in the house from which the value is being extracted. The interest owed accrues more rapidly at high interest rates; thus, the amount that can be borrowed on a reverse mortgage is inversely related to prevailing interest rates. The Home Equity Conversion Mortgage (HECM), the product with over 90 percent of the U.S. market, allows borrowers, who must have reached the age of 62, to take their reverse mortgage in the form of a lump sum payment, a lifetime annuity income, or a line of credit.

This paper investigates three related issues: 1) What is the optimal age to take a reverse mortgage? 2) In what form should it be taken? and, 3) What effect does the availability of HECMs have on a household's optimal allocation of financial wealth?

### **Research Approach**

The authors model the relationship between the returns on housing, stocks, and bonds over the period 1975 to 2005, using a reduced-form vector autoregression, estimated with quarterly data on nominal yields on 1-year and 10-year U.S. Treasury bonds, the real gross capital gains rate on home ownership, real GDP growth, and consumer price inflation. In developing their simulation model, the authors assume that the prototypical household has the mean amounts of financial and housing wealth for the median 20 percent of married couples turning 65 in 2006. Then, incorporating reverse mortgages, the authors simulate a variety of decumulation strategies for this prototypical household. Unmarried individuals are not considered because the median individual in this category has extremely small amounts of both housing and financial wealth.

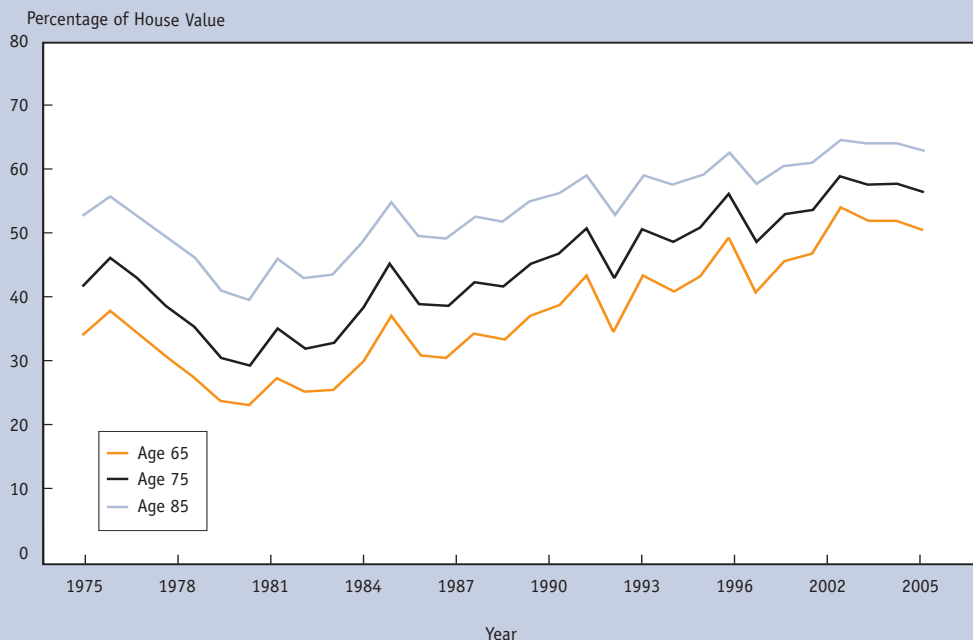
The optimal strategy depends on the expected returns to stocks, bonds, and the reversionary interest in the housing asset; the variances and covariances of those returns; and the household's attitude toward risk. The best strategy may also be affected by the household's liquidity constraints. The strategies tested include taking the proceeds from the reverse mortgage in the various available forms, and taking out a reverse mortgage immediately upon retirement (assumed to be aged 65) versus waiting until the household's financial resources are exhausted.

### **Key Findings**

- An investment in the reversionary interest has quite different characteristics from one in the house itself, with a much higher mean return and standard deviation. Thus, investing in the reversionary interest is much riskier than investing in the house.
- Over a wide variety of assumptions about asset returns, the optimal strategy for all but the most risk-tolerant households is to take a reverse mortgage in the form of a lifetime income annuity.
- The strategy of taking a reverse mortgage in the form of a line of credit once financial wealth is exhausted—the strategy chosen by most households in the real world—performs particularly badly.
- There are substantial differences in reverse-mortgage-equivalent wealth among the various strategies. A household with average housing and financial wealth and a relatively high degree of risk aversion would be 24 percent better off taking a lifetime annuity at age 65, rather than taking a line of credit when financial wealth is exhausted.

- Increases in interest rates reduce the income payable per dollar of housing wealth under an annuity strategy. This is true of both the strategy of taking a lifetime income annuity from an HECM, and the strategy of taking a lump sum from an HECM and purchasing an annuity in the financial markets. (The two options differ because of differences in the household's remaining stake in its house and possible differences in the pricing of the income streams.) Although annuity income rates are more favorable at higher interest rates, this advantage is insufficient to offset the reduction in the reverse-mortgage loan-to-valuation ratio.
- The strategy of postponing taking a reverse mortgage until wealth in the form of financial assets is exhausted, and then taking the reverse mortgage in the form of a lifetime income annuity from an HECM, provides the highest mean income at almost all ages, but with a standard deviation that increases sharply at very advanced ages. The strategy of taking a lifetime income annuity at age 65 provides a lower mean income at older ages, but at substantially reduced risk at all ages, since the household is no longer exposed to the risks of fluctuations in the value of its reversionary interest.
- Including the household's reversionary interest in the household's portfolio results in an increase in the optimal allocation of financial assets to stocks, regardless of the strategy adopted for decumulating the reversionary interest.
- The decumulation rate chosen has little effect on the optimal strategy.

### Percentage of House Value Available on HECM Loans 1975–2005



Notes: 1) This figure assumes a \$200,000 house, a 1.5-percentage point lender's margin, and the closing cost estimates used by the AARP in their online reverse mortgage loan calculator. These closing costs are an origination fee and a mortgage insurance premium each equal to 2 percent of the home's appraised value, miscellaneous closing costs of \$2,074, and a servicing fee of \$30 per month. 2) HECM loans have been available only since 1990, so amounts for 1975 to 1989 represent the percentages that could have been borrowed had they been available.



## Implications

Currently, retiree households that tap their housing wealth for consumption tend to choose a strategy that generally performs very badly—waiting until their financial wealth is exhausted, and then taking a line of credit against their housing equity. Households would be substantially better off taking their reverse mortgage as lifetime income, a result that is robust to alternative assumptions about rates of return and that is consistent with findings in the annuitization literature. But households appear overwhelmingly to choose the line of credit option. Their reluctance to take the lifetime income option mirrors the general reluctance of households to annuitize their financial wealth. It is an open question why this is the case. The failure of households to understand either annuities in general or the lifetime income option in reverse mortgages may be playing an important role.

The welfare consequences of this misunderstanding are huge. The authors' simulations show that for plausible parameter values, a household would require a 24-percent increase in total wealth in order to compensate for having to convert its reversionary interest into a line of credit when it had run through its financial wealth, rather than, at the start of retirement, converting its reversionary housing wealth into a lifetime income stream. Policies to educate households regarding the advantages of using a reverse mortgage to generate a lifetime income near the start of retirement have the potential to greatly increase retirees' welfare, especially as retirement savings continue to shrink and life expectancies continue to rise.

p-07-3

## The Theory of Optimal Life-Cycle Saving and Investing

by Zvi Bodie, Jonathan Treussard, and Paul Willen

complete text: <http://www.bos.frb.org/economic/ppdp/2007/ppdp073.pdf>  
email: [zbodie@zvbodie.com](mailto:zbodie@zvbodie.com), [jtreussa@bu.edu](mailto:jtreussa@bu.edu), and [paul.willen@bos.frb.org](mailto:paul.willen@bos.frb.org)

### Motivation for the Research

Decisions about saving and investing over the course of one's lifetime are a matter of intense concern these days to millions of people around the world. Some of the most basic questions people face are: 1) How much of their income should they save for the future? 2) What risks should they insure against? 3) How should they invest their savings?

Many of these and similar questions are answered for people—in whole or in part—by government, employers, trade unions, and other institutions. The authors argue that economic theory offers important insights and guidelines to government policymakers, to the financial services firms that produce financial products, to the advisors who make recommendations to their clients concerning which products to buy, to educators who are trying to help the public make informed choices, and, ultimately, to consumers who, in aiming to maximize their own welfare, are trying to answer these questions.

The theory of life-cycle saving and investing teaches us to view financial assets as vehicles for transferring resources across different times and outcomes over the course of the life cycle. This perspective allows households and planners to think about their decisions in a logical and rigorous way. This paper explains and illustrates the theory's basic analytical framework in nonmathematical terms.

### Research Approach

The authors lay out the basic analytical framework of the life-cycle model, explain the critical role of consumption in life-cycle planning, and highlight the use of financial assets as a means of transferring consumption from points in an individual's (or household's) life cycle when consumption is of relatively low value (usually, later in life) to points when consumption is relatively more valuable

(usually, earlier in life). A dollar is more valuable to an individual in situations where consumption is low than in situations where consumption is high. The law of diminishing returns is at work here—an additional spending dollar is generally more valuable to a recent college graduate than to a middle-aged executive. The authors focus on three principles and five concepts from the life-cycle model that are directly relevant to the practice of life-cycle planning, using an event tree (an analytical depiction of probabilistic branching) to illustrate the key concept that is at the heart of life-cycle planning.

Arguing that it is the role of providers of specialized financial services to develop products that draw upon the insights provided by life-cycle theory to meet consumers' needs in a manner that internalizes the theory's complexity, the authors cite and illustrate the methodology embodied in the contingent claims analysis framework developed by Merton, a framework that deals with the use of financial instruments to hedge against the possibility of bad outcomes. The authors then illustrate the paper's basic points with a real-world example of buying a house and obtaining a mortgage.

### Key Points

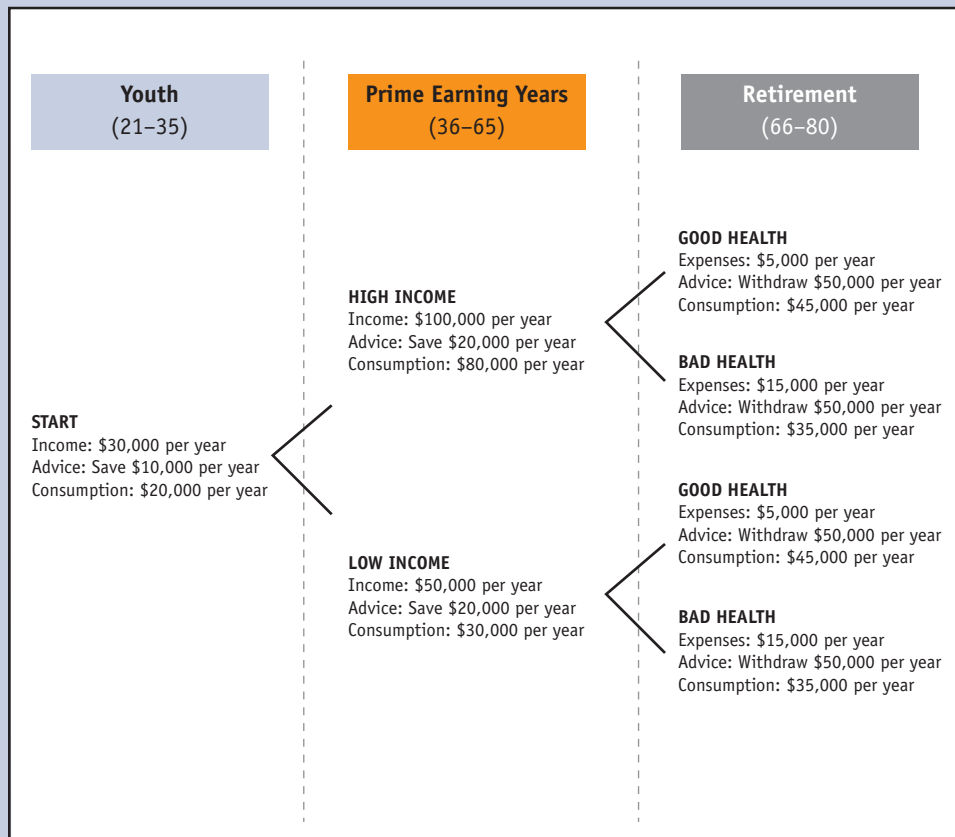
- Standard financial planning focuses on investment outcomes, whereas life-cycle planning shifts attention to the consumption outcomes. According to life-cycle theory, financial assets should be viewed as vehicles for moving consumption from one point in the life cycle to another. For example, by reducing saving while younger and leaving the amount saved unchanged in prime earning years, an investor can transfer consumption from retirement years to earlier time periods when needs are greater because resources available for consumption are generally lower.
- In deciding how much to spend, households should pay attention to their “lifetime budget constraint”—the present discounted value of their lifetime income—rather than their current income or current savings. For younger workers, future income means that their lifetime budget constraint dwarfs the comparatively small amount of savings already accumulated.
- Random unforeseen outcomes make calculating the lifetime budget constraint problematic. This obstacle can be dealt with by employing contingent claims. Such claims work well when both parties can verify the event in question and neither party can affect, or has better information about, the likelihood of the event's occurring. However, in practice, this is not always the case. Furthermore, the creation of contingent claims requires that there be a clear understanding of all the risks involved, and available techniques are not always up to the task.
- The life-cycle model views risky assets as a way to move money across different outcomes at a given point in time, not as a way to transfer resources across time. A decision to invest in a risky asset revolves around whether an investor is willing to give up a smaller amount in bad times in exchange for a larger amount in good times. If the two outcomes are equally probable, then investing in a risky asset seems to be a “good deal.” However, since a goal of financial planning is to smooth consumption over the life cycle, one needs to know whether the investor wants to transfer income from bad times to good times. In fact, an investor may wish to do just the opposite.
- Because of the contribution of labor income, the proportion of financial wealth appropriate to invest in risky assets can vary dramatically over the life cycle. The asset allocation pattern suggested by the life-cycle model will differ markedly across investors, depending on the degree of risk associated with the individual's human capital.
- In the real world, the job of creating financial instruments falls to financial intermediaries. The process followed in developing these instruments can be seen as comprising three phases: 1) creating and pricing contingent claims, 2) designing the products, and 3) constructing the products.

## Implications

In the past, when making financial planning decisions, households relied on institutions such as pension plans sponsored by employers and/or labor unions, social insurance programs run by governments, and support from family or community. Many experts agree that the mix of these institutional forms will change significantly in the coming years—particularly in the industrialized countries, where the overall population distribution is aging rapidly. As people find they can rely less on family and government support than in the past, they will turn to financial markets and related institutions to help them save and invest for retirement.

In response to global population aging and financial deregulation, governments and financial firms are seeking to create new institutions and services that will provide protection against the financial consequences of old age and insulate people against both inflation and asset-price fluctuations. As individuals gain more responsibility and choice over their own asset accumulation and drawdown processes, the challenge is to frame risk-reward trade-offs and cast financial decision-making in a manner that ordinary people can understand and implement over the entire course of their lives. The modern theory of household financial planning offers guidelines and techniques for financial services providers to develop and offer products that meet the needs of consumers, while internalizing the inherent complexity involved.

### An Event Tree Illustrating the Life-Cycle Model



# **GARCH-Based Identification of Triangular Systems with an Application to the CAPM: Still Living with the Roll Critique**

by *Todd Prono*

complete text: <http://www.bos.frb.org/economic/wp/wp2007/wp0701.pdf>

email: [todd.prono@bos.frb.org](mailto:todd.prono@bos.frb.org)

## **Motivation for the Research**

The author presents a new method for identifying the effect of an endogenous regressor in linear models of time-series data. The method is applicable in cases where proper instruments are not available. The identification derives from generalized autoregressive conditional heteroskedasticity (GARCH) in the model's error terms. Compared with the literature that bases identification on the GARCH structure, the methodology used here both generalizes and simplifies the existing framework. Given the reliance on GARCH errors, potential applications for this identification method are found in the asset pricing literature. This paper focuses on testing the capital asset pricing model (CAPM) of Sharpe and Lintner.

## **Research Approach**

The author first demonstrates how GARCH errors can aid in the identification of triangular systems. He implements this proposed identification method using either ordinary least squares and standard univariate GARCH and autoregressive moving average (ARMA) models, or generalized method of moments (GMM) estimation, and provides a Monte Carlo study of the GMM estimator. In order to recognize the potential of endogenous regressors to serve as observable proxies for the true market return, the author modifies an existing statistic for testing the CAPM.

## **Key Findings**

- Both an equal-weighted and a value-weighted portfolio of all NYSE/AMEX stocks are shown to be endogenous in a CAPM-style time-series regression.
- The CAPM is rejected if the correlation between innovations to an equal-weighted NYSE/AMEX proxy and the true market return exceeds 0.62. The general intuition behind this test is that if the statistical inefficiency of a given proxy to the true market return is gauged to be sufficiently strong, then the inefficiency of the true market return may be correctly inferred, and as a result, the CAPM rejected.
- The maximum correlation drops to 0.49 if a value-weighted proxy is used instead.

## **Implications**

Relative to the literature on GARCH-based identification, the method discussed in this paper distinguishes itself both by allowing for a time-varying conditional covariance, and by not requiring complete estimation of the GARCH parameters.

The finding that the model developed by Sharpe and Lintner does not seem to describe adequately the cross-sectional variation of expected returns provides a harsher critique of the CAPM than do earlier studies. The question then arises whether additional factors can be incorporated into the standard CAPM framework to modify this result. Merton's intertemporal CAPM provides a potential answer, as does the three-moment CAPM of Kraus and Litzenberger, which includes skewness in the market return as a second factor. An interesting investigation would be whether a

test statistic in the spirit of this paper's methodology can be developed for testing Kraus and Litzenberger's version of the CAPM. The identification method discussed in this paper could be used to estimate such a statistic.

w-07-2

## **Using Unexpected Recalls to Examine the Long-Term Earnings Effects of Job Displacement**

*by Yolanda K. Kodrzycki*

complete text: <http://www.bos.frb.org/economic/wp/wp2007/wp0702.pdf>  
email: [yolanda.kodrzycki@bos.frb.org](mailto:yolanda.kodrzycki@bos.frb.org)

### **Motivation for the Research**

A substantial literature in economics has analyzed the sources of earnings loss when an employment relationship is severed. When workers are displaced from their jobs, they lose the value of the human capital that is specific to their former employer or industry. Long-tenured workers lose the value of a high-quality job match, whether or not they were employed in positions that required skill, and some displaced workers lose the added earnings associated with unionization, other forms of rents, and industry wage premia. Finally, layoffs cause workers to lose deferred compensation, either contractual or implicit.

This paper seeks to add to the understanding of the longer-term earnings effects of job loss by tracking a group of Massachusetts workers for roughly a decade after they were permanently displaced. To a greater extent than previous studies, this study concentrates on workers who were highly unlikely to find jobs similar to the ones they had left. On average, these workers would likely incur a larger drop in earnings at their new employment than is typical of job losers.

### **Research Approach**

Applying econometric techniques to person-year panel data, this study examines a sample of Massachusetts workers who lost their jobs in the early 1990s and then took advantage of federally funded assistance programs. Departing from the procedure used in previous studies, the study uses unexpectedly recalled workers as the reference group, a practice that serves to mitigate possible selection bias. The study compares the subsequent earnings of workers who were permanently displaced from their previous jobs but found new jobs, with the earnings of colleagues who were also displaced, but then were unexpectedly recalled by the same employer.

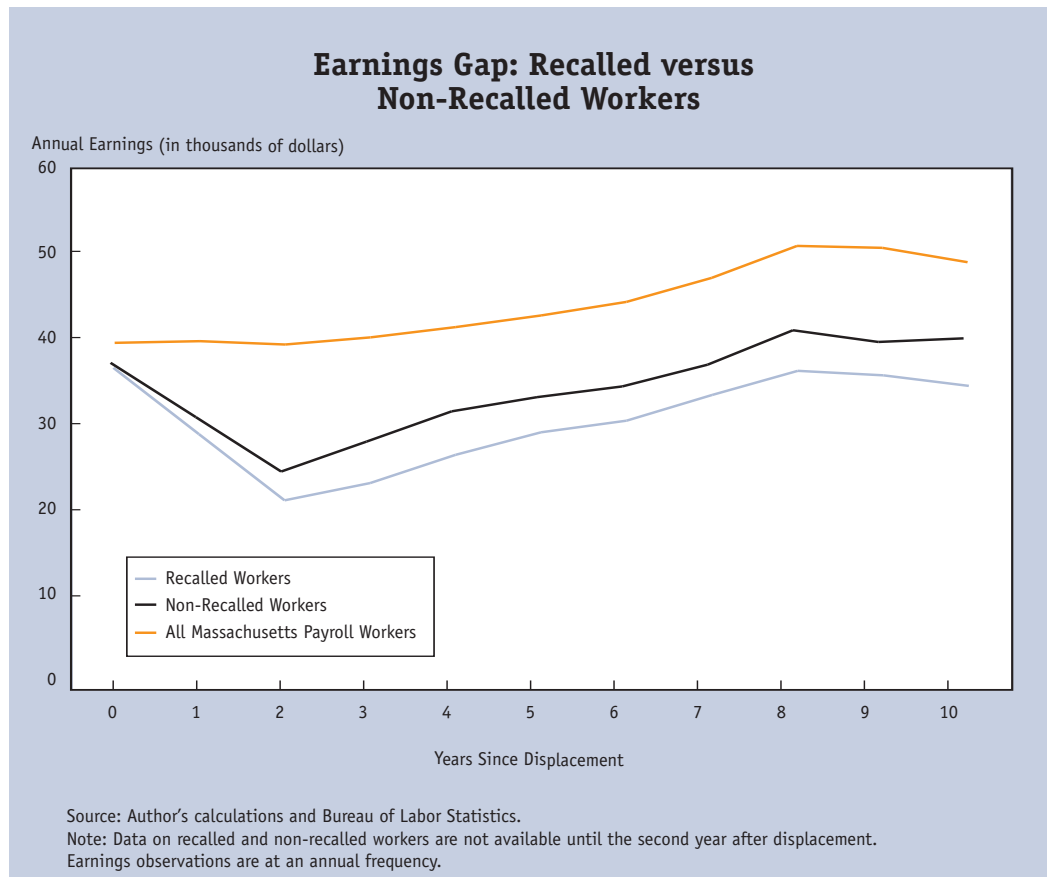
The data set was constructed using Social Security numbers to match earnings histories and employee characteristics drawn from Massachusetts wage and unemployment insurance claims records with data on recall status derived mainly from administrative data maintained under Title III of the Job Training Partnership Act (JTPA). The paper posits that subsequent earnings depend on the elapsed time since the initial displacement, as well as on additional factors that vary across individuals and/or calendar time. The Massachusetts sample appears to be fairly representative of the national population served by JTPA dislocated worker programs in the mid-1990s. However, compared with displaced workers as defined by the Current Population Survey jointly produced by the U.S. Department of Labor and the U.S. Census Bureau, Massachusetts JTPA Title III participants were much more concentrated in manufacturing, a sector with structurally declining employment and skill requirements that differed from those in the rest of the state's economy.

### **Key Findings**

- The consequences of a permanent job loss were substantial and long-lasting, and these costs increased somewhat in the recession of the early 2000s. Workers who were displaced in the 1990s

were disproportionately affected by the economic slump of the early 2000s.

- For workers who were permanently laid off, the annual costs in terms of lower earnings relative to the earnings of the unexpectedly recalled workers were largest in the three years following displacement. Nevertheless, a full decade after layoff, the permanently displaced workers were still earning between 11 and 17 percent less than the recalled workers, even after adjusting for sex, age, education, tenure at the previous employer, and reading ability at the time of layoff.
- Workers with no formal education beyond high school experienced particularly large earnings reductions from permanent job loss.
- The study is limited to workers who continued to have labor earnings in Massachusetts in each year from 1995 through 2003. Partly as a consequence of this sample design, the findings suggest that, on the whole, the disparities in earnings between the recalled and non-recalled workers were the result of differences in wage rates and hours worked, rather than of a different incidence of unemployment spells or temporary withdrawals from the Massachusetts labor force.
- More generally, this paper highlights the sensitivity of the estimates of job loss to the choice of reference group. Because the recalled workers also incurred involuntary earnings reductions after returning to their former employers, the measured costs of permanent layoff were substantially smaller when recalled workers were used as the comparison group than when all employed workers were used.
- Workers who were permanently displaced from their employer in the early 1990s had lower earnings in the recession of the early 2000s than did recalled workers with similar characteristics. For manufacturing workers in particular, this result holds up even in a dynamic specification that controls for workers' earnings history in the period following layoff.



## Implications

The evidence lends credence to the view that, as a group, displaced workers suffer definite earnings losses following layoff, even if they manage to remain fairly steadily employed.

The finding that the measured costs of permanent layoff were substantially smaller when recalled workers were used as the reference group than when all employed workers were used suggests that studies comparing displaced workers with never-displaced workers may not account fully for selection into unemployment.

The findings demonstrate that the available assistance programs for displaced workers were insufficient to offset the losses of specific human capital and wage premia that accrued from working in particular jobs or industrial sectors. The study also found that experiencing a permanent layoff was particularly costly for less-educated workers, defined as those who did not go beyond high school. A policy prescription might therefore be to explore the efficacy of providing stronger incentives for workers to pursue more education and training while employed, as opposed to concentrating only on post-displacement interventions.

The paper adds support to the view that the consequences of job loss vary with business cycle conditions, even in the longer term. To test whether this observed relationship is idiosyncratic to a particular business cycle or location, one would need access to information about laid-off workers in various economic environments, a task that eventually will be possible through the U.S. Census LEHD project, which combines matched employee-employer data from an increasing number of participating states. If further research bears out this paper's tentative findings on cyclical influences, the policy prescriptions lie in fostering steady growth in the macro economy, and perhaps in assisting job losers to relocate to areas where the local economy is relatively strong.

w-07-3

## Impatience and Credit Behavior: Evidence from a Field Experiment

*by Stephan Meier and Charles Sprenger*

complete text: <http://www.bos.frb.org/economic/wp/wp2007/wp0703.pdf>  
email: [stephan.meier@bos.frb.org](mailto:stephan.meier@bos.frb.org), [charles.sprenger@bos.frb.org](mailto:charles.sprenger@bos.frb.org)

### Motivation for the Research

Many people carry large amounts of debt. In the United States, the average household has a non-mortgage debt burden of \$12,900, almost 20 percent of which is unsecured borrowing on credit cards. One explanation for such high levels of unsecured debt is that individuals incur unanticipated expenses, such as those resulting from medical problems or job losses. Another explanation is that time preferences vary among individuals, and that decisions to borrow and to service debt are influenced by how a person values the future as compared to the present. An individual's particular degree of present bias and long-term discount factor affect borrowing and repayment decisions differently—the discrepancy between how a decision maker's choices change, depending on the period under consideration, is alternately called dynamic inconsistency or time inconsistency. This inconsistency is often modeled as the interplay between two separate cognitive decision-making systems: the affective system, which privileges immediate gratification and severely discounts future time periods, and the deliberative system, which forms long-run goals and puts more value on the future. Someone with present-biased time preferences can be thought of as “impatient” because this person emphasizes “now” as opposed to later. This individual may make long-run plans, but then, as the future becomes the present, systematically violate these goals because of a self-control problem.

People who are impatient and lack self-control tend to favor consumption in the present over deferred gratification. According to behavioral economics, since taking a loan entails trading future income for current consumption, the self-control problems that result from time-inconsistent preferences help to explain different credit outcomes among a population. Yet there is very little direct empirical evidence to support the hypothesis that heterogeneity in impatience across individuals leads to differences in credit behavior. Previous behavioral research conducted on this issue has looked at either aggregate or self-reported debt measures. The former approach cannot isolate individual variations, while self-reported measures are inherently unreliable, as people tend to underreport their actual debt levels by a factor of three. This is the first study to use objective individual data to analyze the differences in time preferences that account for individual variations in credit behavior.

### **Research Approach**

A target group of 155 low-to-moderate income (LMI) individuals took part in an incentive-compatible choice experiment to measure each person's present bias and long-run discount factor, which were hypothesized to be important determinants of individual credit behavior. The experiment involved three time-frame sets in which the individual had a choice to receive a smaller monetary reward sooner, or a larger award later: 1) today or one month in the future; 2) today or six months in the future; and 3) six months or seven months from now. To ensure truthful responses, some monetary awards were paid through a random lottery drawing. Individual preferences and discount parameters were captured by the choices made in the three time frames.

To explore the relationship between impatience and actual credit behavior, these individual time preferences were then matched to objective data taken from each person's federal and state income tax returns, TransUnion credit report, and Fair Isaac Corporation (FICO) credit score, if available. Disposable income was calculated from individual tax returns by adding post-tax government transfers to adjusted gross income. The 155 participants had little disposable income, averaging around \$17,400 per year, no education beyond high school, and averaged fewer than one dependent. Credit reports record outstanding balances, how available credit is being used, loan balances that are past due or in collection, and adverse financial history such as bankruptcy or court orders to pay creditors. Among the individuals participating in the study, the average non-mortgage debt level on all active accounts was \$8,557 (standard deviation: \$20,697) and the average credit card debt was \$1,160 (standard deviation: \$2,328), resulting in an average credit card debt-to-income ratio around 7 percent, and a non-mortgage active debt-to-income ratio of about 54 percent for those with disposable income greater than zero. Compared with the general U.S. population, the individuals in the sample have notably high debt levels, as according to the Survey of Consumer Finances the average American self-reports a credit card debt-to-income ratio of 4.3 percent and a non-mortgage debt-to-income ratio of 23.5 percent. FICO scores, calculated on a scale of 300 to 850, with a higher score indicating a lower credit risk, are used as an aggregate measure of a person's credit usage and behavior. Twenty-three percent of the participants lacked a FICO score, either because of insufficiently long or non-existent credit history. Among the participants who did have a FICO score, the mean was 623 (standard deviation: 83), which is below the U.S. average of 678.

### **Key Findings**

- Impatience is associated with higher debt levels, but the structure of individual time preferences is of critical importance to determining credit behavior. Even after controlling for disposable income and other socio-demographic characteristics, persons with higher present-bias preferences have higher borrowing levels on active accounts, meaning installment accounts (a fixed monthly payment for the life of the loan) and, in particular, on revolving accounts (mainly credit cards). Lower long-run discount factors are unrelated to active debt balances.



- A higher degree of present bias (impatience), as indicated by a lower value of the present-bias parameter, is associated with higher active account balances, with an implied elasticity of -7.7. This means that a 1 percent increase in the present-bias parameter is associated with an almost 8 percent decline in active account balances. In terms of the relationship between impatience and revolving balances, with an implied elasticity of about -10.7, higher present-bias tendencies lead to significantly higher revolving balances.
- The results indicate that present bias affects only the decision to borrow, even though borrowing today and defaulting today both entail immediate benefits and future costs. The dynamic inconsistency inherent in present-biased time preferences indicates that some of this borrowing may be suboptimal, given a person's long-run plans.
- In distinct contrast to borrowing decisions, which are driven by present-bias preferences, repayment and default decisions seem to be driven by long-run discount factors. With an average implied elasticity of -19.6, persons with lower long-run discount factors have markedly higher delinquencies, meaning past-due payments on active accounts. Defaults, meaning accounts in collection and closed accounts with remaining balances, are a cumulative effect of delinquencies, so lower long-run discount factors are also associated with increased defaults. With an implied elasticity of -16, a 1 percent reduction in a person's long-term discount factor is associated with higher default amounts.
- FICO scores, which reflect an individual's creditworthiness and are widely used to determine loan interest rates, insurance rates, employment offers, and tenancy decisions, are associated with long-run discount factors. Lower credit scores are related to lower long-run discount factors. Present-bias preferences are not reflected in FICO scores. The results imply that individuals who display time inconsistent behavior do not have lower credit scores than those who are time consistent in their preferences.
- The results are not driven by credit constraints, and are robust to both precise income controls and credit availability controls. Additionally, all the results are robust to the inclusion of socio-demographic controls, consistent with the expectation that individual time preferences are largely independent of socio-demographic variables.

### Implications

By focusing on impatience and lack of self-control, the results contradict the view that current income conditions are the driving force behind individual credit behavior. Though the detailed results, which are based on the choices made by LMI individuals, may not be broadly applicable to the entire population, the credit behavior displayed by this cohort illuminates the general relationship between impatience and credit behavior. Since it has been shown that persons with higher present-bias behavior have higher levels of borrowing—even when disposable income and other factors are accounted for—this correlation suggests that, given long-run objectives, much current borrowing is suboptimal. In the United States, many persons and households across all income levels have high debt levels, particularly on unsecured debt like credit cards, and Americans' very low personal savings rate is a growing concern for policymakers. The results of this study could be used to design incentives that better align behavioral tendencies with desired welfare-enhancing outcomes.

The authors suggest that models of dynamic inconsistency may inadequately account for the various stimuli that trigger an individual's affective system. The results suggest that the affective system is stimulated differently when making choices about borrowing and repaying. Present bias, which responds to the affective system, is triggered by the decision to borrow, but not by the decision to default. Borrowing decisions may be highly responsive to present bias, as marketing appeals encourage consumers to focus on immediate gratification. Credit card spending and borrowing may be especially sensitive to the affective system, as the instant benefits obtained and the long-term

costs incurred are psychologically much more disconnected than with other payment methods such as cash, which link the benefit gained more immediately with the cost incurred.

w-07-4

## Debt and the Effects of Fiscal Policy

by Carlo Favero and Francesco Giavazzi

complete text: <http://www.bos.frb.org/economic/wp/wp2007/wp0704.pdf>

email: [carlo.favero@unibocconi.it](mailto:carlo.favero@unibocconi.it), [francesco.giavazzi@unibocconi.it](mailto:francesco.giavazzi@unibocconi.it)

### Motivation for the Research

It is a truth universally acknowledged that a fiscal shock due to a shift in taxes or in government spending will eventually affect the future path of government revenues and expenditures. Yet vector autoregressive (VAR) forecasting models that estimate the effect of fiscal shocks on macroeconomic variables like consumption, output, inflation, and interest rates fail to incorporate responses to the public debt level. Specifically, VAR models fail to keep track of the debt dynamics that come about following the fiscal shock, by omitting the level of the debt-to-GDP ratio. The result is that as the debt-to-GDP ratio rises over time, these models neglect the fact that eventually future taxes and public spending must be constrained in response to the accumulated deficits. Omitting feedback effects from the debt level means that the error terms in any estimated equations used to compute impulse responses are usually biased. This situation often results in flawed estimates of how fiscal policy shocks affect macroeconomic variables, particularly long-term interest rates. A central variable in transmitting fiscal shocks, interest rates depend on both future expected monetary policy and the risk premium, both of which are affected by the inherent stability of the debt dynamics. The omission of how spending and taxes respond to the level of public debt is a significant shortcoming in models run for countries, such as the United States, where the data show a positive correlation between the government debt (surplus)-to-GDP ratio. By incorporating the effects of fiscal policy shocks into a VAR model, this paper corrects for the shortcomings in forecasts based on the mis-specified methodology used in current VAR models.

### Research Approach

The paper begins with a theoretical exercise showing how standard VAR models do not accurately trace the evolution of long-term debt dynamics. An empirical exercise then shows that the impulse response rates computed in an equation incorporating debt dynamics differ from the impulse responses calculated using the standard VAR methods currently employed. Using quarterly data for the U.S. economy starting in 1960:1 and extending to 2006:2, the debt dynamics of the deficit are computed from the National Income and Product Accounts (NIPA). Data for population and for the stock of U.S. public debt are taken from the FRED database. Real per capita expenditure is obtained by dividing the nominal variable by population multiplied by the GDP chain deflator. The average cost of servicing the debt is calculated by dividing net interest payments made on debt held by the federal government, excluding liabilities held in trust funds (primarily the Social Security Trust Fund), which are nonmarketable debt obligations.

The paper identifies fiscal shocks in two alternative ways: using the identification assumption first employed by Olivier Blanchard and Roberto Perotti in the *Quarterly Journal of Economics* (1982) and the “narrative approach” recently used by Christina and David Romer in NBER Working Paper 90289 (1989). This paper shows that the results are robust to the choice of the identification strategy.

### Key Findings

- Fiscal shocks are consistently shown to have no significant effect on inflation.

- An endogenous increase in public spending has an expansionary effect on output, while an exogenous increase in revenues is contractionary. After 1980, the impact of fiscal policy weakens, the effect of tax shocks becomes insignificant, and fiscal shocks become less persistent.
- During the 1960s and the 1970s, the effect of fiscal shocks on interest rates is insignificant. After 1980, when an increase in public spending lowered the cost of servicing the debt, the effect on interest rates is small but significant—a result that is counterintuitive.
- There is a sharp difference in the way U.S. fiscal authorities responded to the accumulation of debt during the 1960s and the 1970s, and during the 1980s and the 1990s. Prior to 1980, U.S. fiscal policy was not aimed at stabilizing the debt-to-GDP ratio. This probably reflects the government's desire to reduce the high initial debt ratio present after World War II.
- Before 1980, following a positive fiscal shock, allowing for a debt feedback results in a larger response of interest rates and inflation. Interest rates fall more in the model incorporating feedbacks, and the divergence widens over time, as debt accumulates, though it narrows again towards the end of the period. Following a positive shock to taxes, the output effects of shocks to taxes and government spending are larger in the model that includes a debt feedback effect.
- After 1980, U.S. fiscal policy becomes stabilizing. In the model that includes a debt feedback, a positive shock to taxes means that output rises, but in the model that does not include a debt feedback, a positive shock to taxes never has a statistically significant effect on output. This is partly explained by how spending responds to a tax shock: when taxes rise, spending initially falls but then rises, which is a feature of the stabilizing fiscal policy.
- In the model with a debt feedback effect, after 1980 spending shocks are less persistent, and taxes respond by offsetting government spending shocks. Following a shock to taxes, interest rates rise more in the presence of a feedback effect, mirroring the larger increase in GDP.
- The interest rate response to a positive government spending shock is negative at the start of the 1980:1–2006:2 period, but rises over time in the presence of a feedback effect.

### **Implications**

The results shed light on a common empirical finding—the effects of fiscal shocks seem to change across time. There seem to be two ways to explain the heterogeneity of impulse responses to fiscal shocks in the pre-1980 and post-1980 samples. First, the dynamic behavior of taxes and spending following a fiscal shock depends on the importance of the debt stabilization motive in the fiscal reaction function. Second, forward-looking agents respond differently to changes in taxes or government spending, according to whether they expect the government to solve its intertemporal budget constraint by adjusting taxes and/or spending in the future.

These results relate to the evidence of non-linearity in the response of private consumption to fiscal shocks, depending on whether the change in taxes is due to wanting to stabilize the debt, or unrelated to the government's stance on fiscal policy.

The methodology described in this paper accounting for the stock-flow relationship between debt and fiscal variables when analyzing the impact of fiscal shocks could also be applied to other dynamic models that include similar identities.

# Minimally Altruistic Wages and Unemployment in a Matching Model

by Julio J. Rotemberg

complete text: <http://www.bos.frb.org/economic/wp/wp2007/wp0705.pdf>  
email: [jrotemberg@hbs.edu](mailto:jrotemberg@hbs.edu)

## Motivation for the Research

Job vacancies drop considerably in recessions, suggesting that recruitment costs are quite procyclical. In the context of the Mortensen and Pissarides (M-P) model, the procyclicality of recruitment costs implies that real wages should be much more procyclical than they actually are. The M-P model makes this prediction because the ease with which firms can recruit workers in recessions strengthens firms' bargaining position, so that Nash bargaining between firms and workers leads to substantially lower wages than prevail during economic expansions.

This paper presents a model in which firms recruit both unemployed and employed workers by posting vacancies. In this model, unlike the M-P model, firms act monopsonistically and set wages unilaterally at a level aimed at retaining their existing workers and attracting new ones. Thus, employees' reservation wages no longer matter for wage determination. Instead, wages are greatly affected by the way workers weigh wage and nonwage aspects of a job when deciding among employment opportunities.

The paper also extends the M-P model by considering not only a specification in which firms act selfishly, but also one in which they act somewhat altruistically. The underlying idea, based on other work by the author, is that people expect those with whom they interact to display a minimal level of altruism, and that when they are disappointed in this expectation, they become angry and wish to retaliate.

The altruism-based model proposed here has several advantages: 1) it enables consideration of the limit at which workers do not impose any fairness requirements on their employers; 2) by emphasizing firms' concern for the welfare of workers, it is consistent with at least some companies' mission statements; 3) it allows consideration of a new source of fluctuations in wages and employment—showing that in this formulation, these variables respond to changes in the level of altruism required by workers.

## Research Approach

The author develops a simulation model, inspired by Burdett and Mortensen, but different in that it has an equilibrium in which all firms pay the same wage. The existence of such an equilibrium is due in part to two key assumptions: 1) that firms have multiple workers, and 2) that the marginal revenue product of labor decreases when firms hire more workers. Thus, a firm with systematically high wages keeps growing by attracting new workers, and thereby eventually finds itself with more workers than is optimal.

The paper then extends the model to incorporate altruism, and, after discussing the parameters that seem most valid empirically, simulates the results. Finally, training costs are added, since firms seek to control their training costs by setting wages at levels that retain existing workers.

## Key Findings

- Assuming that, as is common in macroeconomic models, people have a utility function that is logarithmic, the parameter  $\gamma$ , which measures the speed at which the marginal utility of consump-

tion rises when aggregate consumption declines, equals 1. With this parameter value, the model implies extremely large and counterfactual procyclical movements in both real wages and the marginal revenue product of labor. While it is standard to assume  $\gamma$  equals 1, the author gives several reasons to consider larger values, including that, as shown in Chetty and Szeidl's model, much of people's expenditure is committed in advance—so that small declines in income translate into large declines in discretionary consumption. This paper considers a variety of values, with an eye to finding those that fit best with the observed labor market dynamics.

- One of the model's conclusions is that the cost of attracting a worker by raising wages must be the same as the cost of recruiting by increasing vacancies. Thus, in booms, the cost of attracting a worker through creating new vacancies rises. The higher is the value of  $\gamma$ , the more the marginal utility of income falls for workers when the wage rate rises. This implies that increases in wages are less effective as a recruiting tool when wages are already high, so the cost of increasing employment by raising wages rises with the wage rate. Consequently, wages do not have to rise by very much for this increase to become as costly a recruiting tool as an increase in vacancies.
- The extent to which the marginal revenue product of labor must rise to induce increases in employment is comparable with the rise in wages that accompanies this employment increase. Otherwise, firms would be unwilling to allow the labor market to become tight, as labor market tightness increases the cost of recruiting via vacancies.
- The assumption that workers require firms to demonstrate altruism has a number of effects that tend to make real wages behave less procyclically: 1) wage increases lower workers' marginal utility of consumption, in turn lowering an altruistic firm's vicarious benefit from raising wages; 2) an increase in employment raises the share of workers who are new hires, again lowering an altruistic firm's vicarious benefit from raising wages; 3) increases in wages raise the utility of being employed relative to being unemployed, thereby raising the vicarious benefit that an altruistic firm experiences when it recruits new workers by creating more vacancies, as opposed to retaining them by raising the wage.

### Implications

In this paper, the effect of  $\gamma$ —the curvature parameter governing both the substitutability of wage and nonwage components of a job and the speed at which the marginal utility of income declines with income—on the extent to which wages are procyclical is the opposite from the effect found in the standard market-clearing model of the labor market. In the standard model, a higher  $\gamma$  means that the marginal utility of consumption falls more during booms, so the wage rate needs to rise more in booms to keep people indifferent between their old hours of work and slight increases in their hours of work. The reduction in the marginal utility of income that occurs in booms plays a role here as well, but here the effect is to discourage firms from using wage increases to retain and recruit employees.

The fact that the performance of the model presented here is enhanced by assuming that workers require firms to be at least minimally altruistic lends some credence to the idea that required firm altruism can capture some of the fairness considerations that employers and workers allude to when discussing wages. Nonetheless, it is important to note that the model requires nonstandard parameter values in order to explain the standard deviations of employment and wages and their correlation. Further work is needed to see whether these values are consistent with other observations.

The model is highly stylized, and numerous extensions could help to determine its applicability. A source of simplicity, but also an important shortcoming of the model, is that it considers homogeneous firms. Particularly because the business cycle is associated with differences in the rates at which different sectors expand and contract their employment, it would be useful to develop an

analogous theory where wages differ across firms. Similarly, the model covers only homogeneous workers; therefore, it does not make predictions about the wage dispersion within firms. Lastly, the model neglects variations in the extent to which firms lay off workers over the course of the business cycle; this topic also seems a promising area for further analysis.

w-07-6

## How Strong is the Macroeconomic Case for Downward Real Wage Rigidity?

by Steinar Holden and Fredrik Wulfsberg

complete text: <http://www.bos.frb.org/economic/wp/wp2007/wp0706.htm>  
email: [steinar.holden@econ.uio.no](mailto:steinar.holden@econ.uio.no), [fredrik.wulfsberg@norges-bank.no](mailto:fredrik.wulfsberg@norges-bank.no)

### Motivation for the Research

The concept of real wage rigidity plays an important role in how contemporary macroeconomic theory explains business cycle behavior and persistent inflation. Wage rigidity describes the tendency of wages to adjust slowly in business cycle upturns and downturns. During a recession, downward real wage rigidity (DRWR) accounts for why inflation-adjusted wage rates tend not to decrease, even when unemployment is high. There is strong empirical microeconomic evidence that individual workers are affected by wage rigidity, but whether it has a significant macroeconomic effect is a matter of some dispute, the resolution of which is hampered by a lack of empirical evidence concentrating on real wages. Most micro-based studies on inflation-adjusted wages do not capture firm-level compositional effects—such as giving smaller raises to some workers and larger raises to others, or changing the overall composition of the firm’s workforce. By using more aggregated industry-level data on real wages, this study seeks to complement the existing micro-based studies by providing cross-country macroeconomic evidence of DRWR.

### Research Approach

In contrast to most microeconomic studies of DRWR, which typically focus on wage changes for hourly workers using firm-level data, this study examined the annual change in the average gross hourly earnings for all manual workers in a given industry. The authors constructed a theoretical framework of firm-level wage behavior to use as a benchmark for the empirical exercise. The study used a panel data set of industry-level wage data compiled from 1973 through 1999 for 19 OECD countries. Real wages for a given year were measured by deflating the nominal wage with the average consumer price index for that year. The industries examined were construction; electric, gas, and water utilities; manufacturing; and mining and quarrying. Averaged over all workers, the data incorporate the firm- and industry-level compositional workforce changes that affect industry-level wage changes. By building notional country-year-specific distributions of wage changes—which estimate how wages would adjust if no rigidity were present—the probability of a notional real wage cut was calculated for each country year. Using the country-year-specific notional probabilities, simulations were run over all country-years, and the number of simulated notional real wage cuts was compared with the number of empirical wage cuts observed in the data. If the number of notional wage cuts was significantly larger than the cuts present in the empirical data, the conclusion was that actual real wages display downward rigidity. The relative difference between the number of notional and actual real wage cuts—the “fraction of wage cuts prevented” (FWCP)—measures the relative strength of DRWR.

To explore whether real wage rigidity is affected by a country’s economic and institutional variables, the 19 countries were separated into four geographical categories: 1) Anglo (Canada, Ireland, New Zealand, the United Kingdom, and the United States); 2) Core (Austria, Belgium, France, Germany, Luxembourg, and the Netherlands); 3) Nordic (Denmark, Finland, Norway, and

Sweden); and 4) South (Italy, Greece, Portugal, and Spain). Nations in the same geographic region tend to have similar labor market institutions—thus, high rates of unionization and fairly strict employment protection legislation (EPL) are found in the Nordic countries; moderate unionization and stricter EPL are present in the South; moderate unionization and moderate EPL exist in the Core, and lower unionization and weaker EPL are characteristics of the Anglo countries.

### **Key Findings**

- For the overall sample, wages are more rigid at more negative growth rates than at constant growth rates. Compared to the FWCP of 3.7 percent at zero growth in real wages, which implies that 3.7 percent of all notional real wage cuts are prevented by DRWR, the FWCP is 11.3 percent at -2 percent real wage growth, and is 18.4 percent at -5 percent real wage growth.
- With an FWCP of 6–7 percent, DRWR appears to have been stronger in the 1970s and the late 1990s than it was in the 1980s and the early 1990s. At -2 percent growth, DRWR is significant for all time periods.
- At -2 percent growth, the FWCP is significant for all regions except the South. Combining periods and regions, DRWR at -2 and -5 percent was prevalent in the Anglo, Core, and Nordic regions during the 1970s and the 1980s, but there was never significant DRWR in the South. DRWR is highest in the Core region at 18.8 percent, and is around 11 percent in the Anglo and Nordic countries. In terms of institutional factors, DRWR is affected by labor market rigidity and the degree of unionization. In terms of economic variables, DRWR is weakened by higher unemployment.
- The higher FWCP for negative rates of change of real wage growth, compared with times when real wages remain constant, is consistent with the authors' theoretical model. DRWR pushes real wages up—even when the real wage change is negative. The effect is that the number of large wage cuts is reduced, but the number of small wage cuts increases.
- The results in this study, based on industry-level wage changes, are smaller than those found in studies using data for individual employees' real wages. This is expected, as individual and firm level studies include compositional effects that drop out of the aggregated data.

### **Implications**

This study complements work on wage rigidity based on microeconomic data. Finding evidence for DRWR on the aggregate level implies that, at the individual level, DRWR is not entirely offset by wage flexibility for other workers in the same industry—making it more likely that DRWR affects aggregate variables.

In periods of low inflation it is difficult to distinguish between nominal and real wage rigidity. Since some DRWR is present in a high-inflation environment, it seems clear that this is an independent phenomenon.

The greater FWCP for negative real wage changes than for the zero growth level may also reflect compositional changes in the workforce. As older, higher-wage workers are replaced by younger, lower-wage workers, average wages may exhibit a small negative change, even if individual workers avoid real wage cuts. The finding of extensive downward rigidity at -2 percent or -5 percent growth in real wages is important, as it underscores that real wages need not be completely flexible downwards—even if a high incidence of real wage cuts is observed.

The finding across most OECD countries that DRWR reduces the extent of large real wage cuts (those below -2 and -5 percent) supports recent findings in the literature that DRWR has some

impact on cyclical and labor market fluctuations. But the ultimate impact on output and employment appears to be fairly small. Thus, there is a strong case that DRWR exists on the macroeconomic level, but its overall effect on aggregate economic performance is slight.

Given the univariate framework used in this study, it cannot directly explore how wages respond to changes in macroeconomic variables like unemployment and productivity. Doing this would be a good extension of the work presented in this study, as it is unclear whether DRWR truly affects macroeconomic performance. There is fairly strong evidence that the variation in unemployment rates across time and OECD countries is related to institutional labor market variables that influence wage-setting behavior, such as unemployment benefits, union density, and the degree of coordinated wage setting (union-type bargaining contracts). There is a need to test whether added wage pressures due to binding DRWR induce higher unemployment.

## Public Policy Briefs

b-07-1

### **Massachusetts Employment Growth 1996–2006: Effects of Industry Performance and Industry Composition**

*by Katharine Bradbury and Yolanda K. Kodrzycki*

complete text: <http://www.bos.frb.org/economic/ppb/2007/ppb071.pdf>  
email: [katharine.bradbury@bos.frb.org](mailto:katharine.bradbury@bos.frb.org), [yolanda.kodrzycki@bos.frb.org](mailto:yolanda.kodrzycki@bos.frb.org)

#### **Motivation for the Research**

The Massachusetts economy performed exceptionally well during the boom years in the latter half of the 1990s. The annualized employment growth rate during this period, 1.9 percent, was well in excess of the Commonwealth's long-term average, and comparable with the concurrent gain for the nation as a whole. But starting in 2001, when the dot-com bubble burst and the national economy slipped into recession, the Massachusetts economy experienced a greater setback than did most other parts of the nation. During the period when the national job count was falling, Massachusetts lost a greater fraction of its jobs than did any other state, and the eventual recovery started later and proceeded more slowly in Massachusetts than in the nation as a whole. Measured from 2001 to 2006, the annualized rate of job change in the state was -0.6 percent, more than a full percentage point below the 0.7 percent national gain.

This brief addresses two questions raised by the experience of the Massachusetts economy in recent years relative to the national experience: 1) Is the state's poor performance since 2001 the direct result of corrections in industries that grew unsustainably rapidly in the late 1990s? 2) To what degree is the Commonwealth's recent experience a reflection of job cuts in the industries that have been at the core of its knowledge-based economy?

If the answer to the first question is "yes," then one might view the 2001 peak in state employment as an artificially high benchmark, and the poor employment performance from 2001 to 2006 as mere "payback" for the high-flying late 1990s. With respect to the second question, if the state's key industries account for a significant portion of the deterioration in employment growth in Massachusetts, it becomes important to learn whether the poor performance of these key industries was specific to Massachusetts or a more general phenomenon, and whether their retrenchment represented a temporary setback or a structural decline.



This brief does not attempt to project how economic growth in Massachusetts is likely to compare with the national rate in coming years. Instead, the brief can be viewed as a justification for continuing investigations into the various cyclical, structural, and location-specific factors that affect the state's key industries.

### **Research Approach**

In order to measure the contribution of the fast-growth industries to the state's job growth in the boom of the late 1990s and in more recent years, the authors calculate the impact of simply removing the 10 industries that grew fastest in the state between 1996 and 2001 from the statewide job totals, thus calculating the growth rate of employment for the remaining industries. This calculation is performed first for the period between 1996 and 2001, then for the 2001–2006 interval. The same calculations are then repeated using the state's 20 fastest-growing industries from the late 1990s.

The authors employ an alternative approach to address the second question about the contributions of industries deemed critical in the development of the state's knowledge-based economy. By examining a related data series on 1996–2005 employment in the 10 key industry clusters identified in the Massachusetts Technology Collaborative (MTC) Index of the Innovation Economy, the authors compare the performance of these industry clusters with that of the Commonwealth's remaining industries.

### **Key Findings**

- In the early 2000s, Massachusetts industries generally experienced slower employment growth than did their national counterparts, and the “highest-flying” of the state's industries did “give back” some of their gains achieved in the late 1990s—but these facts do not explain the Commonwealth's overall employment trends relative to national trends. Other industries in Massachusetts that had not done exceptionally well in the late 1990s also underperformed relative to their national counterparts in the early 2000s, and this disparity accounts for almost all of the observed difference between the state and national growth rates of employment during the post-boom period.
- The industries in key clusters identified by the Massachusetts Technology Collaborative experienced employment losses both nationally and in the state in the early years of the 21st century, but the losses were steeper in Massachusetts. Thus, the identity of the state's key industry clusters and the comparatively poor performance of these clusters account for some of the weakness of employment trends in Massachusetts relative to the nation since the boom ended. The remainder of the shortfall is due to below-average growth in the rest of the Massachusetts economy (the non-cluster industries).

### **Implications**

Beyond the insights yielded on the post-boom period, these findings serve to define a framework for thinking about how industry performance and industry composition might affect the future development of the Massachusetts economy. Looking ahead, the state's leaders should consider how best to bridge the gap between Massachusetts and U.S. industry growth rates—in particular, the gap between the growth rates of the key clusters in Massachusetts and their growth rates in other locations. Gaining a better understanding of the comparatively poor performance of these industries in Massachusetts during the early 2000s would be an important step in such deliberations. Based on the finding that the key industry clusters had lower job growth in both Massachusetts and the nation than did other industries in the 1996–2005 period, the state's leaders may also want to consider whether other, as yet unidentified, industries can play a critical role in the further development of the Commonwealth's innovation economy.-----

## Contributing Authors

**Marques Benton** is an assistant vice president in the public and community affairs department at the Federal Reserve Bank of Boston.

**Krista Blair** is an assistant vice president in the human resources department at the Federal Reserve Bank of Boston.

**Zvi Bodie** is the Norman and Adele Barron Professor of Management at Boston University.

**Katharine Bradbury** is a senior economist and policy advisor in the research department at the Federal Reserve Bank of Boston.

**Margaret Carten** is a payments industry specialist in the emerging payments research group at the Federal Reserve Bank of Boston.

**Marianne Crowe** is a vice president in the emerging payments and Treasury services department at the Federal Reserve Bank of Boston.

**Carlo Favero** is Full Professor of Monetary Economics with Innocenzo Gaparini Institute for Economic Research at Bocconi University and a research fellow at the CEPR.

**Francesco Giavazzi** is Full Professor of Economics with Innocenzo Gaparini Institute for Economic Research at Bocconi University and a research fellow at the CEPR. He is also affiliated with the Massachusetts Institute of Technology and the National Bureau of Economic Research, and he was a visiting scholar in the research department at the Federal Reserve Bank of Boston while the paper summarized in this issue was completed.

**Steinar Holden** is full professor at the University of Oslo and a scientific advisor to the research department of Norges Bank.

**Yolanda K. Kodrzycki** is a senior economist and policy advisor in the research department at the Federal Reserve Bank of Boston.

**Stephan Meier** is a senior economist with the Research Center for Behavioral Economics and Decision-Making in the research department at the Federal Reserve Bank of Boston.

**Todd Prono** is a financial economist in the supervision, regulation, and credit department at the Federal Reserve Bank of Boston.

**Julio J. Rotemberg** is William Ziegler Professor of Business Administration at the Harvard Business School and a visiting scholar in the research department at the Federal Reserve Bank of Boston.

**Scott Schuh** is a senior economist and policy advisor in the research department at the Federal Reserve Bank of Boston.

**Charles Sprenger** is a graduate student at the University of California, San Diego. At the time the paper summarized in this issue was written, he was a research associate in the research department at the Federal Reserve Bank of Boston.

**Wei Sun** is a graduate research assistant at the Center for Retirement Research at Boston College.

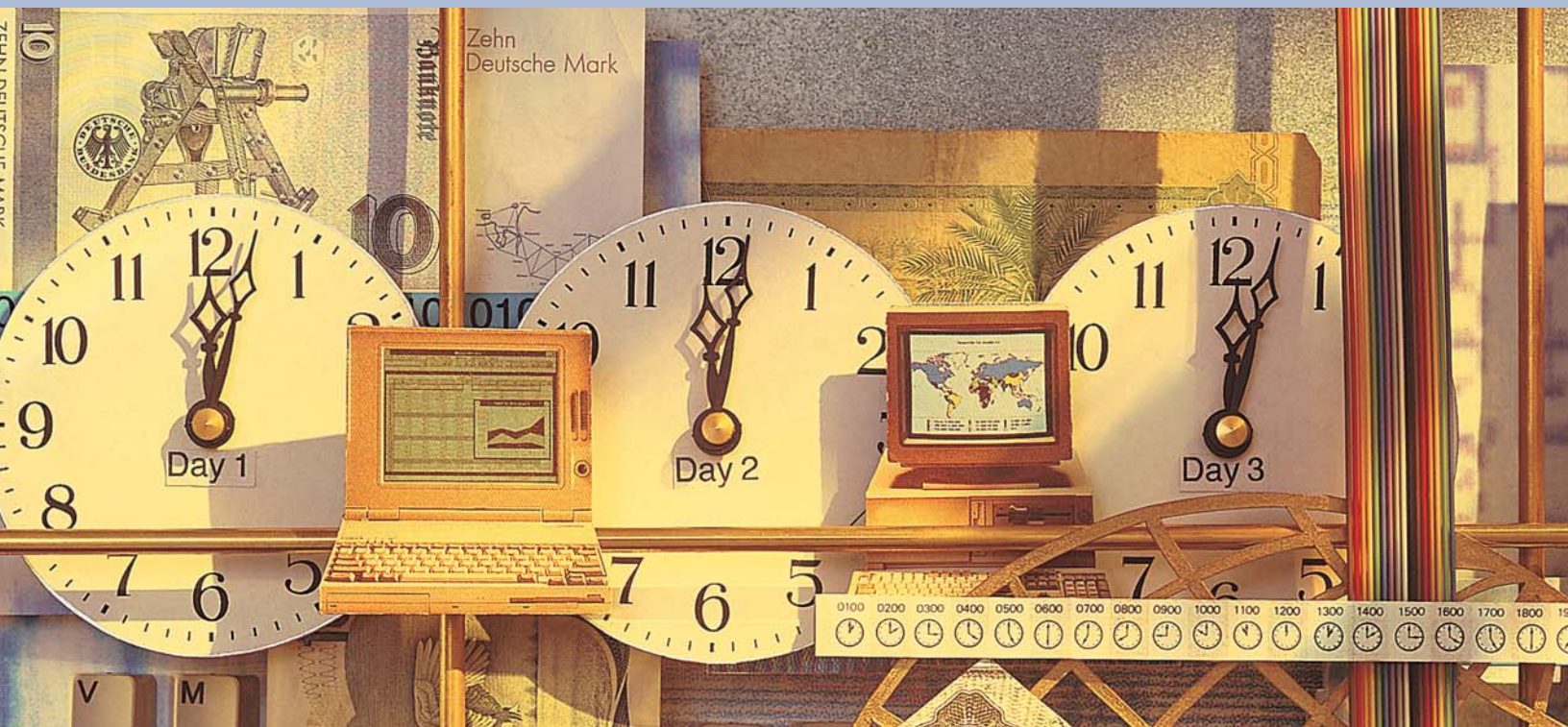
**Jonathan Treussard** is a Ph.D. candidate at Boston University and an instructor at Boston University School of Management's Finance and Economics Department.

**Robert K. Triest** is a senior economist and policy advisor in the research department at the Federal Reserve Bank of Boston and was recently a visiting scholar with the Center for Retirement Research at Boston College.

**Anthony Webb** is a research economist at the Center for Retirement Research at Boston College.

**Paul Willen** is a senior economist and policy advisor in the research department at the Federal Reserve Bank of Boston and a research fellow at the National Bureau of Economic Research.

**Fredrik Wulfsberg** is head of research for the monetary policy group in the research department of Norges Bank and was a visiting scholar at the Federal Reserve Bank of Boston at the time the paper summarized in this issue was written.



Research Department  
Federal Reserve Bank of Boston  
600 Atlantic Avenue  
Boston, MA 02210

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