research review

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Executive Summaries in This Issue

Public Policy Discussion Papers

Consumer Behavior and Payment Choice:
A Conference Summary
by Marianne Crowe, Scott Schuh, and Joanna Stavins

Motivation for the Research

A pervasive transformation in payment practices is currently in progress. A workhorse traditional payment method—the writing of paper checks—is headed out to pasture and is being replaced by a host of new electronic payment methods emerging from the technological revolution in information processing. Public policymakers have a responsibility to make sense of this transformation. Payments industry participants, both suppliers and users of payment methods, are seeking legal and institutional arrangements that cultivate the best possible payments system. To achieve this lofty goal, policymakers must understand the behaviors and needs of consumers in order to create an environment that fosters payment methods that are appealing to consumers as well as being efficient and technologically advanced.

This paper provides a summary and overview of a conference, "Consumer Behavior and Payment Choice: How and Why Do Consumers Choose Their Payment Methods?" sponsored by the Emerging Payments Research Group (EPRG) at the Federal Reserve Bank of Boston in October of 2005. The aim of the conference was to bring together a diverse set of participants from the academic, private, and public sectors to explore what is known and not known about how consumers choose among payment methods and about the implications of their decisions for saving, consumption, and portfolio allocation.

Research Approach

To develop a better understanding of consumer behavior, the conference organizers brought together representatives from various communities and disciplines that have a common interest in understanding consumer payment behavior but distinct goals, motivations, and methodologies for studying this behavior.

The conference format was designed to balance the academic and business viewpoints to the greatest extent possible, in three types of sessions. The first was a lecture-style overview of consumer payment behavior, with one view presented by an industry practitioner and another by an academic observer. The second involved the presentation of relatively technical papers by academic researchers and discussions by both academic experts and private-sector experts, followed by open-floor discussion. The third type involved a panel discussion of a selected aspect of consumer payment behavior by business experts, anchored by an academic paper on the same topic.

Key Points

• The individual consumer's decision-making process concerning payment choice is quite complex.

• Standard economic models have difficulty incorporating this complexity.

• Additional research is needed—especially interdisciplinary research—into consumer decisions regarding payment methods, and this conference was an important step in that direction.

Implications
Taking consumers' preferences into account is important not only for research: understanding how people make payment or financial decisions is also important for policy.

Pension Accounting and Corporate Earnings: The World According to GAAP
by Peter Fortune

Motivation for the Research
Pension plans play an important role in the measurement—or mismeasurement—of many important indicators of economic health. For example, these plans affect corporate earnings, which, as a sign of general economic health, are crucial to our understanding of the U.S. economy. Pension plans also affect the measured personal saving rate, a focus of great concern in recent years.

This paper, the first of a two-part study on defined benefit pension plans, addresses the role of pension plan accounting in the measurement and interpretation of corporate earnings.

Research Approach
The author outlines the history of pension fund regulation and the alleged consequences of the accounting rules for pension plans under Generally Accepted Accounting Principles (GAAP) and compares financial statements for a specific company under GAAP accounting and current-value accounting. The paper also reports on some characteristics of defined benefit (DB) plans at firms in the Standard and Poor's 500 index and discusses some recent proposals for pension accounting reform, including marking to market, more accurate measurement of the pension obligation, and adoption of risk-based Pension Benefit Guaranty Corporation premiums. In an aside, the paper considers the effect of current pension fund accounting on the measured personal saving rate, compensation, and unit labor costs. Finally, the study discusses two lessons for pension asset managers: reassessing the risk of equities and focusing less on asset returns and more on balancing the risks of pension assets and liabilities.

Key Findings
- If analysts and investors thoroughly scrutinize the notes to a corporation's financial statements, they should be able to adjust both income statements and balance sheets to reflect the actual state of the firm's defined benefit pension plan. If they do so, the problems posed by GAAP accounting have no implications for economic fundamentals.

- However, if, as seems likely, these adjustments are not fully embedded into the market prices of the firm's equity and debt, adverse consequences of several kinds may ensue. Creditors may misjudge the creditworthiness of the firm, shareholders may incorrectly assess the state of the firm's finances and incorrectly project the firm's future financial prospects, and holders of the firm's employee stock options, as well as those who buy or sell exchange-traded options, may incorrectly assess the volatility of returns on the firm's assets. These incorrect assessments affect the prices of corporate debt and equity and lead investors to make the wrong portfolio allocations. Corporate managers may also mismeasure the marginal cost of labor, leading to incorrect employment decisions.

- Using current (mark-to-market) accounting reveals that pension funds are more underfunded, and that the underfunding is more volatile, than GAAP accounting suggests.

- Measuring actual pension costs with a mark-to-market approach that recognizes market values rather than book values, the volatility over a five-year period of actual pension costs is more than ten times the volatility of GAAP measures of pension costs.

- During the period 1991–2003, GAAP reporting of net pension assets and current-value reporting of funded status often gave conflicting signals about pension plan health. Indeed, in five of the thirteen years the two reporting methods gave opposite signs for net assets.

Implications

Current pension-plan accounting has two important effects: (1) it distorts the measurement of earnings and net worth in the short run, as well as the pattern of earnings over future periods, and (2) this distortion can send incorrect signals to investors about a firm's health, resulting in the mispricing of a firm's outstanding debt and equity instruments.

Net Periodic Pension Costs: Current-Year S&P 500 Firms with Defined Benefit Pension Plans

Millions of Dollars per Firm

Source: David Zion, CSFB; Company Reports; author's calculations.
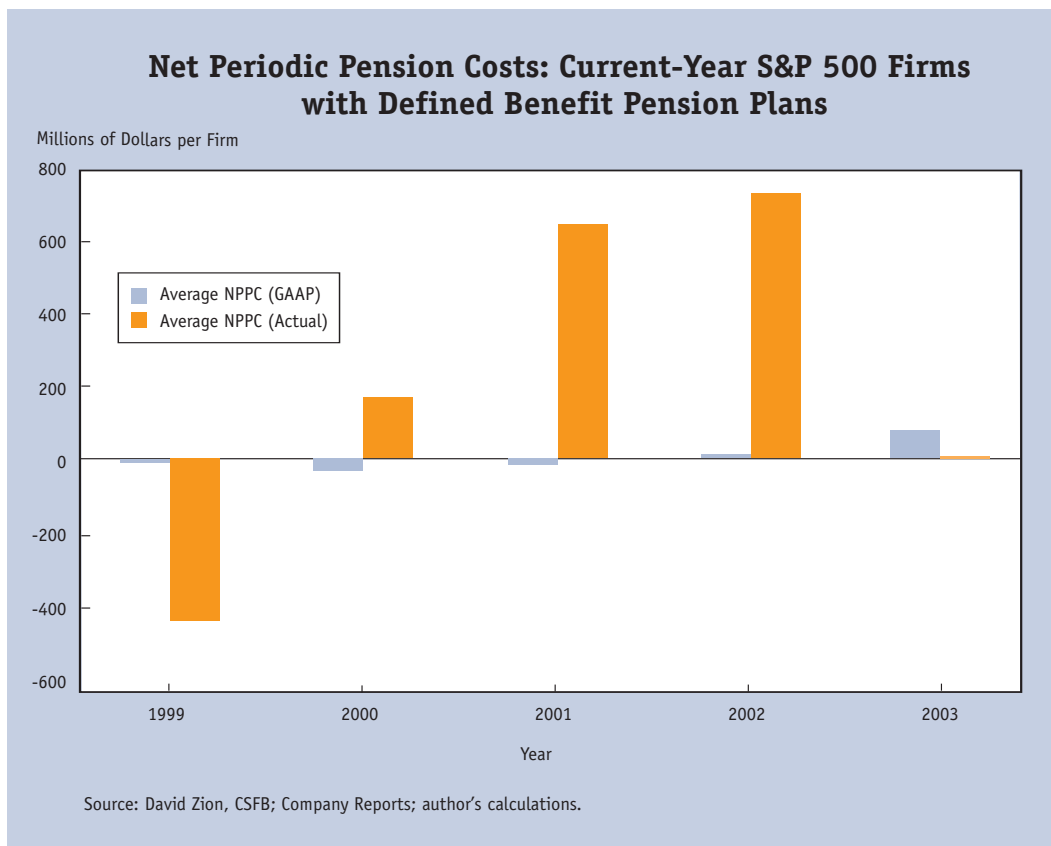
While this paper focuses on corporate earnings, it also mentions the effect of pension fund measurement on other indicators. For example, because of the way the National Income and Product Accounts (NIPA) treat pension plans, when benefit payments are high relative to pension contributions plus income on pension assets, as occurs during periods of stock market gains when companies either reduce their contributions or amend plans to increase benefits, even though consumers and retirees are better off, NIPA records a decline in the saving rate. Pension measurement conventions also distort the measurement of compensation and unit labor costs.

The fact that there are issues concerning pension plans and pension plan accounting has not gone unnoticed. Potentially mitigating developments include the following: defined benefit pension plans appear to be disappearing from the corporate menu of benefits, the Financial Accounting Standards Board is embarking on a major overhaul of pension accounting, and recent legislation

proposed by the Administration and by Congressional committees is designed to address problems with the funding requirements of the Employee Retirement Security Act and with the federal government's insurance of pension plans. However, this study illustrates both the magnitude and the importance of the challenge.

p-06-3

Risk Bearing, Implicit Financial Services, and Specialization in the Financial Industry
by J. Christina Wang and Susanto Basu

Motivation for the Research
The definition and measurement of financial institutions' output and prices is a difficult issue that has seen much debate and little consensus. It is made even more challenging by rapid and massive changes in the form of financial organizations and by the range and features of financial instruments they offer. This paper discusses how to measure correctly the output of financial institutions in both nominal and real terms, given that many financial services are provided without explicit charges.

Research Approach
The authors apply two principles in analyzing the operations of financial institutions: (1) one must understand the market context in which these institutions operate, particularly the way in which financial markets set the rates of return on (and thus the prices of) risky financial products, and (2) one must be precise about the definition of financial services.

In applying the first of these principles, the authors draw upon a large modern literature on asset pricing under uncertainty to choose the variables—the "reference interest rates"— that are key to the measurement of nominal financial output. Using the appropriate reference rates, they then impute the returns to financial institutions' ownership of financial assets—the income to their financial claims. With total income observed, they compute the nominal value of the output of financial institutions—financial services—as the residual income. The value of financial services associated with these institutions' liabilities is similarly imputed.

To measure real output, the authors apply the second principle. In their framework, a financial service is analogous to any other professional service, such as accounting or consulting. It is a flow of output that is valued by customers and is created through a production process using real resources. The only difference is that financial services are routinely priced implicitly by financial institutions and are collected in the form of interest margins, the spread between interest received and interest paid.

Key Findings
• To impute implicitly priced financial output, it is necessary to adjust each reference rate of interest (equal to the "user cost of funds") for the risk inherent in that corresponding financial transaction. If this is not done, nominal financial output will be overstated, and the bias can be large.

• The required risk correction can be implemented in practice, based on asset pricing theory, both at the level of individual banking organizations and for the banking industry as a whole.

• The reference rates or the related rate spreads used to impute the nominal output of financial institutions are not the right implicit price deflators for deriving the real output of financial institutions.

Implications

The authors' conception of bank value added helps to settle the long-standing debate about whether deposits are an input or an output. The answer is that they are both: they provide the bank with loanable funds for financing loans and are thus a purchased intermediate input to the lending process, while the set of services they provide to the suppliers of deposit funds are an output.

p-06-4

Collateralized Borrowing and Life-Cycle Portfolio Choice
by Paul Willen and Felix Kubler

Motivation for the Research

The goal of this paper is to explore how the ability to leverage equity holdings through collateral affects the demand for equity and the gains to trading equity. The analysis provides insights into life-cycle portfolio choice relevant for researchers in macroeconomics and finance and sheds light on the "participation puzzle"—why most investors do not own stock.

Research Approach

The authors develop a partial-equilibrium, theoretical model of investor consumption and portfolio choice. In the model, investors face a complex problem: they can buy equity, and they can engage in secured borrowing at one interest rate, unsecured borrowing at another, and riskless lending at yet a third. They face limits on the ratio of unsecured borrowing to labor income and limits on the ratio of secured borrowing to holdings of the risky asset.

The theoretical model of portfolio choice with collateralized borrowing is considered in two steps. First, the authors consider a two-period model and provide simple intuition for how various parameters like the interest rate on secured debt and margin requirements affect equity demand and consumption. They then extend the analysis to a multi-period model and construct realistic examples. To parameterize these examples, the authors use data from the literature and from their own informal surveys of financial institutions.

Finally, the authors consider the model in the context of actual household portfolio choice behavior. They show that according to the Survey of Consumer Finances, almost no one uses equity as collateral for loans, and they draw upon their findings to address the participation puzzle.

Key Findings

- Standard models with unlimited borrowing at the riskless rate dramatically overstate the gains to holding equity when compared with collateral-constrained models with even an unrealistically generous collateralized borrowing regime.

- With a realistic collateralized borrowing regime, the gains to holding equity over the life cycle exceed by only a narrow margin the gains to holding equity in a model with no uncollateralized borrowing at all.

- The gap between the results of a collateral-constrained model even with generous constraints and the results of a model with unlimited borrowing and lending at the riskless rate is large, and realistic limits to collateralized borrowing account for only a small part of it. To fully exploit collateralized borrowing, one must also be able to take out unsecured loans, both to consume future excess returns on equity and to smooth adverse stock return outcomes.

- Previous applied research generally assumed either unlimited collateralized or uncollaterilized borrowing, or none at all. These findings suggest that models with collateralized borrowing are closer to models with no borrowing at all than to models with unlimited uncollateralized borrowing.

- The authors document that it is difficult for people to use stock as collateral for loans. Margin requirements are high, margin interest rates are high, and alternatives like futures and options provide only limited opportunities for small investors.

Implications
The small gains to trade in equity revealed in this paper illustrate that the traditional focus on stocks and bonds in household portfolio choice problems is misguided.

The paper's results strengthen the role of borrowing constraints in explaining the portfolio participation puzzle; however, the authors do not view their results as resolving the puzzle but rather as reducing its magnitude.

Assets differ enormously in their potential to be used as collateral. One can use at least 90 percent of the value of real estate as collateral for loans. Thus, the fully leveraged return on such assets could potentially exceed the return on the fully leveraged portfolio of equity, possibly explaining why some investors invest in real estate when equity appears to offer a higher return. This is an area that appears to merit further research.

Another area for future research involves extending the model to revisit the remaining part of the participation puzzle. The paper shows that an asset usable as collateral has a shadow return because it relaxes a constraint. The transactions value of bonds could generate a similar shadow return for bonds, and this could explain why households hold bonds when the apparent risk-adjusted return on stocks is higher.

Working Papers

w-06-1

The Monetary Transmission Mechanism
by Peter N. Ireland

complete text: http://www.bos.frb.org/economic/wp/wp2006/wp0601.pdf
email: irelandp@bc.edu

Motivation for the Research
This review essay on the monetary transmission mechanism was prepared for inclusion in *The New Palgrave Dictionary of Economics*, Second Edition, forthcoming 2008.

Research Approach
The monetary transmission mechanism describes how policy actions taken by the central bank induce changes in the short-term nominal interest rate or the nominal money stock in order to influence macroeconomic activity. Monetary policy actions directly impact interest rates, which in turn drive the household and firm decisions that influence employment, investment, output, and aggregate income. The central bank controls the monetary base, which consists of currency and bank reserves, and can increase or decrease the money supply through open market operations, such as buying or selling government bonds.

The traditional Keynesian model of the monetary transmission mechanism assumed nominal price rigidity would prevent immediate responses to changes in the monetary base, thus ensuring that the

central bank's policy actions would have some real effect. The interest rate channel, operating in a closed economy, is at the center of the standard Keynesian model, which dominated monetary policy analysis through the early 1990s. Monetary policy also acts through the asset price channel, the bank lending channel, and the balance sheet channel. In an open-economy model, additional policy effects operate through the exchange rate channel, as achieving equilibrium in the foreign exchange market mandates that changes in the domestic interest rate will be reflected in the exchange rate

Key Points
- Over the last few decades, the recognition that the optimizing behavior of households and firms plays a significant role in economic decision-making has led to refinements of the traditional Keynesian model. Dynamic stochastic general equilibrium (DSGE) models attempt to integrate agents' rational expectations within an environment that has some nominal price and/or wage rigidity. This macroeconomic model builds on powerful microeconomic foundational models.

- Three modifications involving aggregate output, the inflation rate, and the short-term nominal interest rate combined with a DSGE framework yield the New Keynesian model describing the monetary transmission mechanism.

- In the benchmark New Keynesian model, monetary policy still operates through the traditional interest rate channel. When short-term nominal interest rates rise or fall, the change translates into an increase or a decrease in the real interest rate since, as in the traditional Keynesian model, nominal prices move sluggishly or in a staggered fashion.

- Under the New Keynesian framework, however, policy actions differ in their quantitative effects, depending on how well these actions were anticipated. Extensions involving asset price channels, the balance sheet channel, and exchange rate channels have added to the large and still growing literature of how monetary policy is transmitted within a DSGE framework.

Implications
While the New Keynesian model is still being developed, in comparison with the standard Keynesian model it offers an important refinement that is much more descriptive of how households and firms react to monetary policy actions. Recent research has focused on how monetary policy can be implemented in a low-inflation environment when nominal interest rates approach the zero lower bound, as has occurred recently in a number of countries, most notably Japan and the United States. Other recent studies have focused on the importance of asset price channels, since over the last decade rising real estate and stock market prices have strongly affected many economies.

w-06-2

Measuring Trends in Leisure:
The Allocation of Time over Five Decades
by Mark Aguiar and Erik Hurst

Motivation for the Research
To understand how labor supply functions in a market economy, it is crucial to understand how individuals allocate time away from market-centered activities. Yet defining and measuring "leisure" merely as time not spent on market work fails to capture important non-market (home) productive activities, which change over time. Over the last 40 years there have been significant demographic shifts in the United States: since 1965, the average American has attained a higher level of educa-

tion, has become more likely to be single, has had fewer children, and has gotten older. All of these changes may affect how an individual allocates his or her time.

Most existing time allocation studies focus only on weekly hours spent in the market sector, resulting in imprecise and misleading conclusions about other activities. This paper addresses the gap in knowledge of how contemporary American households allocate time across market work, non-market work, and leisure.

Research Approach

By linking five detailed time-use surveys made over the last 40 years, this paper describes how work and leisure in the United States have evolved and changed between 1965 and 2003. Since the question of how time is spent in non-market-based activities has been relatively unexplored, the paper defines three categories for time spent on non-market production and three categories of leisure. The authors define their narrowest measure of leisure as activities that lack close market substitutes and are pursued solely for enjoyment, such as watching television or playing golf. A second measure of leisure adds activities that provide direct utility but may also be viewed as intermediate inputs, for example, eating and sleeping. The third measure further adds time spent in primary and educational child care. Given that leisure is commonly defined as a residual of total work, this broad benchmark is also included as a fourth leisure category.
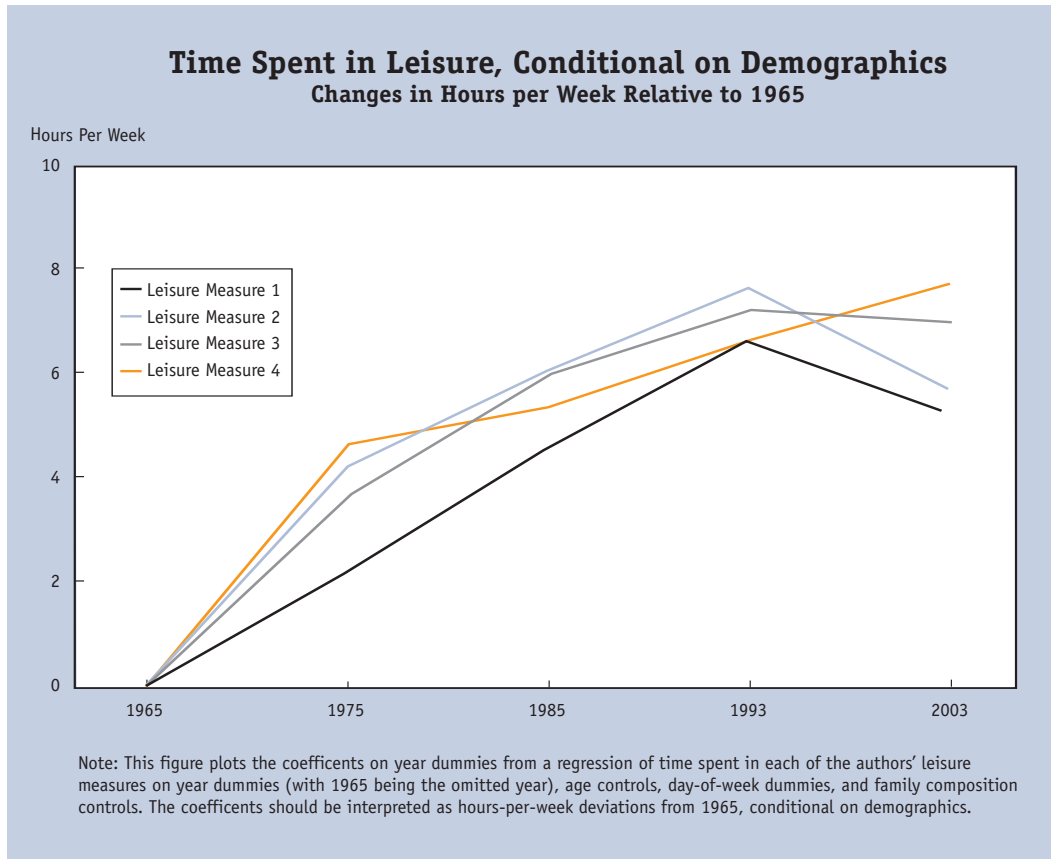
The authors take two approaches to documenting these trends. First, they report the weighted means from the time-use surveys for each category, restricting the sample throughout the analysis to non-retired individuals between the ages of 21 and 65. Second, they condition the change in time spent in various activities on demographics, by estimating equations for time spent in each activity for each individual in each survey, with demographic variables such as age, educational attainment, and family status as the independent variables.

Key Findings

- The main empirical result is that leisure time, measured in a variety of ways, has increased significantly in the United States between 1965 and 2003. This finding is true for both men and women, although how this gain is achieved differs for each group.

- American men have increased their leisure hours by devoting less time to the market sector. Women in the United States have increased their time spent in market labor yet simultaneously increased their weekly leisure time by reducing their time spent on non-market work. Over the last 40 years there has been a mean decline in total work for both men and women.

- Controlling for demographics, leisure has increased between 1965 and 2003, according to the authors' narrowest measure, by 5.1 hours per week for the average non-retired adult—6.4 hours for men and 3.8 hours for women. On the broadest of the three non-residual measures, again controlling for demographics, the average weekly increase in leisure over the roughly four decades has been 6.9 hours—7.9 hours for men and 6.0 hours for women.

- The various alternative definitions of leisure tell a fairly consistent story regarding the past 40 years, showing that much of the ambiguity of what constitutes leisure is empirically unimportant. Indeed, much of the trend in all the measures is driven by the behavior of the narrowest measure.

- In 1965, leisure time for less-educated and for highly educated (having more than a high school degree) American adults was roughly equal. Yet these measures started to diverge in 1985 and were dramatically different by 2003. A growing inequality of leisure in favor of less-educated adults is clearly discernible, particularly over the last 20 years.

Implications

In contrast to the usual inferences made from standard household surveys that measure time allocation according to market-based work, this paper's empirical results offer a dramatically different interpretation of how overall time allocation has evolved over the last 40 years. The steady decline in time spent in home production argues for a high elasticity of substitution between time and goods in home production, constant technological improvement in home production, or a combination of both.

Time Spent in Leisure, Conditional on Demographics
Changes in Hours per Week Relative to 1965

Hours Per Week

Legend:
- Leisure Measure 1
- Leisure Measure 2
- Leisure Measure 3
- Leisure Measure 4

Note: This figure plots the coefficents on year dummies from a regression of time spent in each of the authors' leisure measures on year dummies (with 1965 being the omitted year), age controls, day-of-week dummies, and family composition controls. The coefficents should be interpreted as hours-per-week deviations from 1965, conditional on demographics.

Ignoring how individuals allocate their time may give an incomplete view of the welfare consequences that result from inequalities in wages and expenditures. The paper shows that in the United States, the well-documented increase in earnings and spending among more-educated people is accompanied by relatively little change in home production, but a large decline in the relative time spent pursuing leisure activities.

Compared with the standard labor market model that relies on offsetting income and substitution effects, the finding that increased leisure varies with educational attainment poses an empirical puzzle. The time series data, which suggest that rising incomes induce greater leisure substitution, are at odds with the cross-sectional distributional data that show higher incomes associated with lower amounts of leisure. The patterns described in this paper should help guide the choice of parameters used for utility and home-production functions in calibrated models. The paper shows that the traditional income and substitution effects used to depict the post-war economy, which rest on relatively stable market work hours for adults and a constant level of leisure, are not correct.

Given earlier retirements and longer lifespans in the United States, it is possible that the increase in leisure documented in this paper may understate the true increase in lifetime leisure. The paper

measured trends only for working adults, but it is a fact that retired individuals have more leisure time. If we add to this consideration the claim that the nature of work has changed over the last decade—individuals may engage in more leisure-type activities while on the job, such as sending personal e-mail messages or surfing the web—leisure may have increased even more.

Taken together, the strong downward trend in total hours spent on market and on non-market labor suggests that the current U.S. economy may not be on a balanced growth path, although this observation does not negate the possibility that it may evolve to a balanced path in the future.

The time-series analysis in this paper focuses exclusively on the United States, and to the authors' best knowledge, no similar work has been done using European data. A parallel study concentrating on Europe is an important area for future research.

w-06-3

Dishonesty in Everyday Life and its Policy Implications
by Nina Mazar and Dan Ariely

Motivation for the Research
Dishonest acts are all too prevalent in everyday life. The everyday deceptions of companies, individuals within companies, and individual consumers, together generate significant economic loss for the American economy. As the damage to society's welfare has become more apparent, substantial resources have been invested to combat dishonest behavior, with little positive effect.

This paper examines the underlying decision mechanism for engaging in dishonest behavior, with the aim of drawing conclusions about how to approach curbing such behavior through public policy.

Research Approach
The authors summarize and describe selected evidence from the existing literature in a broad range of fields, including standard economics, behavioral economics, psychology, neuroeconomics, and neuroscience, that bears on how decisions about taking dishonest action are made.

They classify the approaches taken in the literature to curbing dishonest behavior into two groups. The first is based on the premise from classical economics that the individual is a rational, selfish human being who decides to act honestly or dishonestly in a given circumstance by performing an implicit cost-benefit calculation. The second is based on the premise that in addition to the external reward mechanisms, there exist internal reward mechanisms that also exert influence on individuals' decisions. Drawing on evidence from the literatures, the premise also posits that the internal reward mechanisms include such considerations as social utility and care about others' welfare.

The policy prescription implied by the first premise is to increase the likelihood or severity of the penalty for dishonest behavior, thus tilting the result of the cost-benefit calculation toward choosing honesty. The policy prescription implied by the second premise is to activate or strengthen the internal reward mechanism.

Analyzing the examples described in the paper, the authors draw conclusions about how to improve the results of public policies aimed at curbing dishonesty.

Key Findings

- Evidence from the existing literature described in this paper suggests that the relationship between the external and internal reward mechanisms is quite complex. In particular, the authors hypothesize that the internal reward mechanism is either active or inactive, rather than varying in a continuous way.

- Research exists that suggests that it is possible to move the activation threshold, that is, to cause internal reward mechanisms for honesty to be more active, or to kick in earlier.

- The authors' review of the literature suggests that there are four general drivers of dishonesty. These are: (1) lower external costs and relatively higher benefits of deception, (2) lack of social norms, resulting in a weak internal reward mechanism, (3) lack of self-awareness that primes the activation of the internal reward mechanism, or (4) self-deception.

Implications

If the reason for dishonest actions lies in a lack of internalized social norms, then the primary recommendation would be to invest in educational efforts and socialization to increase the strength of the internal reward mechanism. The questions then become how best to accomplish this and whether there is a critical age period for the internalization of such mechanisms.

If the reason for dishonest behavior is not a lack of social norms but simply a lack of self-awareness, then it is important to use contextual cues that increase awareness at the point when deception is about to happen.

The consideration of internal rewards also suggests that the theory of optimal punishment should be reconsidered with internal reward mechanisms in mind. A framework that combines the two approaches has the potential to help build a theory of repeated punishment with the same desired principles as optimal punishment but with more effectiveness.

w-06-4

Supply Matters for Asset Prices: Evidence from IPOs in Emerging Markets
by Matías Braun and Borja Larrain

Motivation for the Research

The dominant literature on asset pricing does not focus on supply and demand issues, as this body of work implicitly assumes that supply is perfectly elastic and that equilibrium prices completely adjust to changes in demand. Yet in practice, supply shocks are observed, and such rebalancing is not automatic, as recent theoretical and empirical work has started to recognize.

Research Approach

To further explore supply-side influences on market clearing and asset pricing, the authors test the impact of initial public offerings (IPOs) on the price performance of other stocks listed in a given market. This paper's focus on the effects of supply shocks is new to the literature, as most prior studies have explored how changes in investment demand influence prices.

To isolate the effect of shocks upon asset supply in a quantitatively meaningful way, the authors focus on the month when IPOs were issued in 22 emerging markets. Using the Fama-French 17-industry portfolio classification, value-weighted industry portfolios are constructed for each country's stock market. Stock prices are taken from the Emerging Markets Database, are denominated

in U.S. dollars, and reflect the value recorded at the end of the month. The IPO data are chosen from Thomson Financial's SDC Platinum, and the sample is restricted to all common stock issues for new home market listings that exceed $20 million. To identify events clearly, the study uses only IPOs issued in a month when no other IPO greater than $20 million was listed in the same market. 254 IPOs dated between 1989 and 2002 are examined in 22 different emerging markets. For each IPO, excess returns are measured on the 17 industry portfolios present in the market of issuance during the month the IPO was listed.

These returns are then regressed on the covariance between each industry and the particular industry corresponding to the IPO under consideration. These returns are compared with the excess monthly returns for Fama-French's 17-industry portfolio compiled for the U.S. stock market from 1974 to 2003. The authors' identifying assumption is that because the American stock market is a well-diversified, internationally-integrated market with many arbitrageurs, the covariances in the U.S. stock market are close to fundamental measures of risk and thus capture the exogenous component of the covariance in each country's stock market.

Key Findings
• A significant negative relationship exists between stock market returns and the covariance associated with the IPO industry. This is a robust result for the entire data set.

• Asset prices fall as the covariance with the IPO increases. The price effect declines as the cross-section of assets covaries less with the IPO's industry. The coefficient on the IPO covariance increases in magnitude as markets become more segmented.

• The covariance effects are strong if the emerging market is poorly integrated with global capital markets; if the domestic market is well-integrated with international markets, the effects disappear. Thus, while a stock market such as the American one will not be significantly affected by a new issue, stock exchanges in emerging economies usually have many fewer investors and a smaller total market capitalization. In these smaller markets, an IPO that is large relative to the entire stock market amplifies the effect of the covariance. When the IPO is large relative to the local market capitalization, the cross-sectional gradient is steeper.

Implications
This paper offers empirical evidence that the composition of asset supply does matter for the cross-section of asset prices: introducing a new asset affects the prices of assets already present in a given market. Emerging markets are particularly sensitive to these influences, as demonstrated by tracking the effect IPOs have upon other stock prices in a given exchange. For investors in emerging markets, a strategy that sells the industry closest to an IPO during its month of issue and buys the most distant industry results in a spread of approximately 80 basis points.

w-06-5

Cyclical Wages in a Search-and-Bargaining Model with Large Firms
by Julio J. Rotemberg

Motivation for the Research
Post-war business cycle data for the United States show that real wages tend to increase with rises in employment, but that the wage rate increases actually observed are more moderate than predicted in a variety of theoretical models. These existing models tend to assume that firms are perfect-

ly competitive, that hiring costs exhibit constant returns to scale and therefore tend to rise significantly in a tight labor market, and that technological improvements tend to raise the marginal productivity of labor in economic expansions.

Research Approach

The author attempts to reconcile the difference between theoretical predictions and the actual behavior of real wages by constructing a general equilibrium model composed of large, imperfectly competitive firms in a flexible wage environment. The existence of imperfect competition among large firms allows changes in market power to be a source of cyclical fluctuations, and this helps explain why observed real wage behavior is less procyclical than predicted by most existing search-and-bargaining models. The model developed in this paper assumes that large firms have multiple vacancies and experience economies of scale in hiring costs, which is a step towards realism relative to models where each firm has only one worker.

Using quarterly BEA data from 1950:1 to 2002:1 that track business sector output, hours, and employment, the author ran regressions de-trending these three variables, following a method outlined in an earlier paper by the author. Using the de-trended data, the model was then tested against a stochastic steady-state and against a dynamic equilibrium relationship approximated around a steady state, in order to match the regression coefficients implied by the model to those found in the actual data.

Key Findings

• Incorporating economies of scale into search-and-bargaining models has profound implications: this adjustment makes it possible for the marginal recruitment costs of large firms to vary relatively little over the course of the business cycle. This in turn helps to explain why real wage increases are less procyclical than many general equilibrium models imply.

• The author's "large-firm assumptions" enable this model to capture differences in marginal labor productivity and expected hiring costs that help to explain why real wage behavior is more moderate than is predicted in most macroeconomic models.

• Real wages are more procyclical when productivity gains drive an increase in employment than when the employment gain is caused by changes in firm-level labor demand. Wage elasticity is always at least twice as large when responding to productivity increases .

• A reduction in the bargaining strength of workers tends to increase wage elasticity with respect to employment.

Implications

This study shows that modifications that enrich search-and-matching models in the direction of realism (the existence of imperfectly competitive large firms, the dependence of output fluctuations on nominal rigidities, the possibility that recruiting is subject to economies of scale) can also help explain the long-standing puzzle of why real wages do not vary significantly over the business cycle. By the same token, the paper suggests that search and matching features are useful additions to the relatively standard macroeconomic models that feature imperfectly competitive large firms, but whose predictions lack realism because these models neglect the role played by job vacancies and unemployment in the labor market.

A Survey of Economic Theories and Field Evidence on Pro-Social Behavior

by Stephan Meier

Motivation for the Research

Standard economic theory predicts that public goods are often underprovided because individuals will free-ride on the contributions of others, since they cannot be excluded from using the public good. In reality, people free-ride less often than is predicted by standard economic theory. In a number of situations, people behave not according to narrow self-interest, but rather pro-socially, that is, unselfishly. For instance, most people actually pay their taxes, a fact that cannot be explained by relying on strict self-interest axioms.

As a result of findings of this kind, economists have turned to psychologists, who have studied pro-social behavior for quite a long time. Consequently, a large number of economic theories have evolved to explain people's pro-social behavior and the variation in their respective behavior. This paper surveys and examines these theories, deriving predictions for behavior and confronting these predictions with existing empirical evidence.

Research Approach

The author surveys the most important economic theories that address unselfish behavior, examines these theories one at a time, derives predictions for behavior, and confronts the predictions with existing empirical evidence.

Key Points

• The evidence is overwhelming that human behavior is not motivated solely by narrow self-interest. Pro-social behavior is widespread and quantitatively important for economic and societal outcomes, and it needs to be taken into account in the design of institutions.

• In recent years, a number of theories have evolved that attempt to formalize pro-social behavior. The three most important approaches presented in this survey can be classified into three groups: (1) approaches that emphasize the distributional outcome, as do theories of outcome-based pro-social preferences, (2) approaches that highlight the importance of the process leading to a particular outcome, as stressed by theories of reciprocity and conditional outcomes, and (3) approaches that focus on the relevance of self-identity.

• The institutional environment affects the salience of particular social norms, as well as the intrinsic motivation to behave pro-socially; it also influences the social interaction between egoistic and/or altruistic individuals, as in the determination of how the violation of a social norm is punished.

Implications

The author believes that less emphasis should be given to the quest for the ultimate pro-social motivation and more to conditions that trigger one behavioral choice or the other. The theoretical evidence on theories on pro-social behavior is inconclusive because (1) not only do people differ substantially in their pro-social preferences, but (2) even the same person might show different patterns of pro-social behavior, depending on the situation. While in some situations people are motivated by altruism or inequality aversion, in other situations people care more about the socially efficient outcome. To gain a better understanding of the importance of these conditions will help to bring the various theories and their supporting evidence into line with one another.

The Impact of Group Membership on Cooperation and Norm Enforcement: Evidence Using Random Assignment to Real Social Groups

by Lorenz Goette, David Huffman, and Stephan Meier

Motivation for the Research

The efficient functioning and ultimate success of an organization depend upon its members' individual willingness to engage in non-selfish actions and to censure those who act against its collective interests. An important feature of an organization is that it constitutes a socially-bounded group; however, many organizations are composed of self-selected members, and this characteristic can bias studies that seek to understand how cooperation and norm enforcement function within an organization. Related to the idea of group self-selection is the long-standing conjecture from the literature in social psychology and sociology that groups may be hostile to non-members and manifest this through vindictive punishment of outsiders. This paper provides evidence about organizational behavior that is free from the distorting influences of self-selection inherent to many groups.

Research Approach

This paper takes advantage of a "natural laboratory" environment to examine the behavior of real social groups whose members were randomly picked. In Switzerland, at least 300 days of military service are required of all male citizens, beginning with 21 weeks of basic training. During the seventh week, about a quarter of those in basic training are selected for 10 weeks of officer-candidate training that is specific to each branch of service and that takes place in separate locations. Twenty-five percent of those men who complete the 10-week training period are promoted to the rank of officer and enter a four-week Joint Officer Training Program. This brings new officers from all service branches together in one location, where they are randomly assigned to a platoon composed of members from different branches of the military. There is no institutionalized competition or cooperation between the various platoons, a fact that the experiment exploits to measure objectively how cooperation and norm enforcement function within and between groups. The real-world conditions of this study enable stronger group manipulation than is feasible in laboratory experiments that use group formations devoid of a specific social context, thereby lending greater weight to the study's conclusions.

Key Findings
• After three weeks, each platoon formed solid social ties despite the initial random group assignment. Significantly more cooperative behavior was displayed between members of the same platoon than between members of different platoons.

• Group membership increased the willingness to enforce social norms favoring cooperative behavior towards fellow members. When group norms were violated, there was a stronger tendency to punish infractions by in-group members than by out-group members.

• No evidence was found that group membership fosters vindictive punishment of outsiders, countering a long-standing conjecture in sociology and social psychology.

Implications

The results of this study suggest that an organization's social component fosters efficient group behavior that counteracts or limits purely selfish incentives. The willingness to enforce social norms that favor cooperation dovetails with a similar conclusion from an experiment that took place in a

very different cultural setting. Taken together, these findings suggest that upholding group norms, via rewards or punishments, is a behavioral pattern that is quite general across all groups, regardless of the particular context.

Further research extending this paper's analysis might examine how the size of a social group influences its tendency to cooperate and/or punish, and what this might imply about the optimal size of an organization, or for sub-groups within an organization. Another study might be conducted on the important question of whether demographic differences can fully explain why hostility might arise between groups as observed in previous studies, or whether demographic differences combined with intense social interaction between group members is a prerequisite to generating hostility between groups.

The Impact of Group Membership on Third-Party Punishment

Panel A: Norm Enforcement and the Identity of A1

Panel B: Norm Enforcement and the Identity of A2
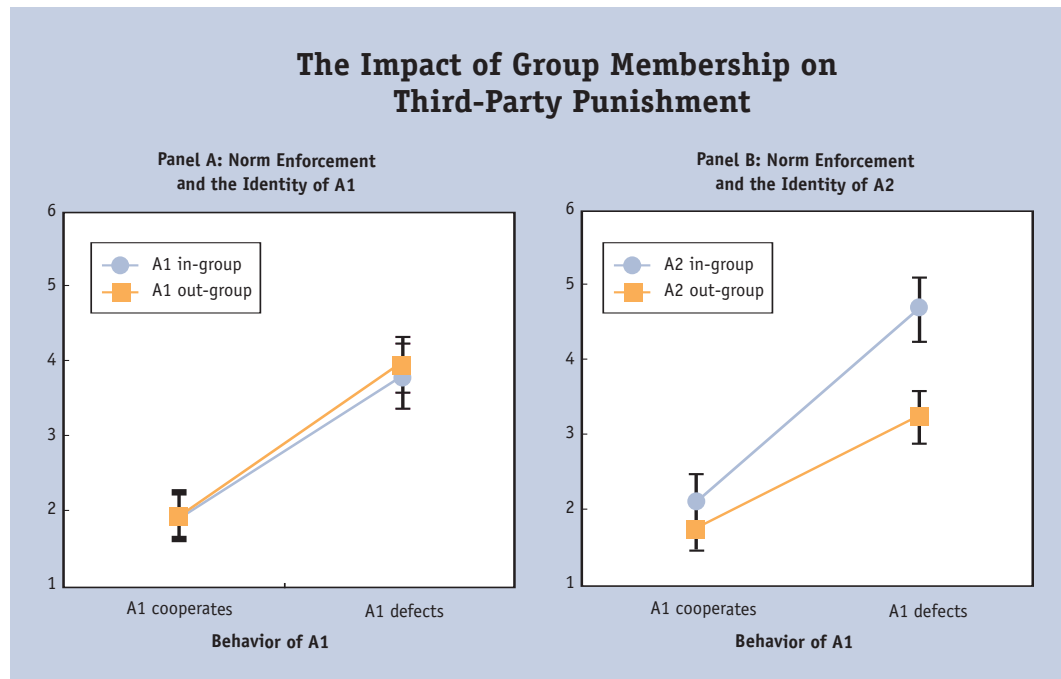
w-06-8

Do People Behave in Experiments as in the Field? Evidence from Donations
by Matthias Benz and Stephan Meier

Motivation for the Research
Over the last two decades, work in experimental economics has altered many assumptions that once governed standard economic theory. Behavioral economics, a growing new sub-field that integrates psychological insights and economic analysis, is heavily dependent upon evidence gathered from laboratory experiments. Yet it is an open question whether people's behavior in an experimental setting can truly predict how they might act outside of a laboratory setting. Critics contend that real-world behavior can be very different from behavior observed in an experimental laboratory environment. To help resolve the dispute, this paper is one of the first studies to directly compare the same subject's behavior in a laboratory setting with his or her behavior in a similar field (actual) situation.

Research Approach

Every semester at the University of Zurich, all students must decide whether or not to contribute to two discretionary social funds. Each student elects to make contributions to one or both funds by actively indicating this choice before mailing in the compulsory tuition fee; if no explicit selection is made, no donation is made. The university administration provided the authors with a panel data set composed of the voluntary decisions made by all students during their attendance.

The panel structure of the data set permits an analysis of real-life behavior both before and after conducting the experiment. To learn whether students behaved similarly in an experimental situation, a subset of students was tested in classroom experiments for two types of voluntary donations. The first experiment replicated the choice to contribute to the same social funds offered at the start of each semester. The second experiment involved making contributions to two accredited charities that remained anonymous. For each experimental study, four different incentive structures were implemented to see whether these altered donation behavior. The individual decisions students made for each experimental case were matched to the actual choices that they made each semester whether to contribute to the discretionary social funds

Key Findings

• Behavior in an artificial experiment corresponds to the same subject's behavior in the field. The level of donations made in the experimental setting was not significantly altered by different incentive structures. Individual performance in an experimental setting relates well both to past and future behavior in a real-life setting. Behavior in the classroom experiment correlates with the subject's actual behavior recorded up to two years before the experiment was conducted, and up to two years after the experiment.

• The results show that variances in individual behavior can be quite large from one similar instance to another; from this perspective, the correlation between the experimental and field outcomes may be challenged as rather weak. To address this dilemma, the authors appeal to the long-standing argument in psychology that the correlation in an individual's behavior between two related situations may be limited if behavior is influenced by particular situational factors and not by stable personality traits. Psychologists find that aggregating behavior over a greater number of similar instances lowers the variance and better captures the underlying preferences. In this study, rather than relying on few decisions, averaging actual behavior over four similar decisions made in the past or the future yields a higher correlation with behavior observed in the laboratory setting.

Implications

The practical relevance of experiments depends at least partly on their external validity, and this paper shows a systematic positive correlation between pro-social behavior as displayed in the laboratory and as observed in real-life settings. Experimental measures of pro-social behavior can provide information about past and future behavior. This is significant, as there are differences between an experimental situation and a field setting that can lead to differences in individual behavior.

Individual behavior is hard to generalize, since it can be very dependent upon a particular situation. The work in psychology on whether behavior is governed more by a particular situation or by stable personality traits should be given more serious consideration in experimental economics and in the entire field of economics. Because there is a weak correlation between various situational outcomes, more detailed investigation is needed regarding the different conditions under which pro-social behavior prevails or disappears.

Efficient Expropriation: Sustainable Fiscal Policy in a Small Open Economy

by Mark Aguiar, Manuel Amador, and Gita Gopinath

Motivation for the Research

The authors explore the question of optimal fiscal policy in an open economy when the government lacks the ability to commit to policy and financial markets are incomplete. Despite the empirical importance of these two frictions, especially in emerging markets, their combined impact on fiscal policy has not been analyzed in the existing literature.

Research Approach

The authors develop an analytical model and derive their findings through formal mathematical proofs. In the model, the government implements fiscal policy on behalf of risk-averse domestic agents (or a preferred subset of agents) who lack access to financial markets and do not own capital. Uncertainty is driven by a stochastic endowment process, generating a risk against which the domestic agents cannot insure. Risk-neutral foreigners invest in capital that is immobile for one period and has an opportunity cost equivalent to the world interest rate. The government provides insurance by transferring income between foreign investors and domestic agents and is assumed to run a balanced budget. A useful expositional feature of the additive endowment shock is that the marginal product of capital is independent of the shock's realization. These assumptions allow the authors to isolate the role of fiscal policy in generating fluctuations in output.

Key Findings

- In an open economy where the government lacks fiscal policy commitment and financial markets are incomplete, the best policy choice of a benevolent government may amplify and prolong shocks to output. If the government could commit, the optimal fiscal policy would not distort capital in this economy.

- Incomplete markets provide an incentive to use fiscal policy to proxy for missing insurance markets, and the lack of commitment tempts the government to confiscate foreign capital. The government's credibility not to expropriate capital is shown to vary endogenously with the state of the economy and is "scarcest" during recessions.

- There is a range of discount factors for which the first-best investment is sustainable for high shocks, but not for low. When endowment shocks are persistent, a low endowment today implies reduced consumption tomorrow. Therefore, the lower the endowment today, the greater the government's incentive to deviate tomorrow. In other words, the government's credibility regarding the taxation of the next period's capital income is lowest during a bad endowment realization. This is the sense in which credibility is "scarce" during cyclical downturns.

- The increased threat of expropriation depresses investment during downturns, generating investment cycles even in an environment in which the first-best capital stock is constant.

Implications

The prediction that the threat of expropriation depresses investment following downturns is reminiscent of emerging-market crises. Governments often allow foreign capital to earn large returns in booms but confiscate capital income during crises. Moreover, as previously documented in the literature, investment remains persistently depressed during a crisis. The most recent financial cri-

sis in Argentina in January 2002 is a dramatic illustration of this phenomenon. A similar deterioration of property rights is observed in other emerging-market crises. The oscillation between pro-growth policies and populism observed in many developing economies seems to contribute to, rather than stabilize, the volatility of output. This paper rationalizes such behavior by focusing on two key characteristics that distinguish emerging-market economies: inadequate insurance markets and government inability to commit to future policy promises.

The key is that consumption is not perfectly smoothed intertemporally. This study explores in detail the case when no dynamic financial contracts exist. At the other extreme, if the government can replicate the complete markets allocation, the incentive to deviate is no longer history dependent. A reasonable conjecture is that if the government cannot smooth consumption perfectly over time, the amplification mechanism remains at work. A formal exploration of this "intermediate" case is left to future research.

Productivity and U.S. Macroeconomic Performance: Interpreting the Past and Predicting the Future with a Two-Sector Real Business Cycle Model
by Peter N. Ireland and Scott Schuh

Motivation for the Research
The American economy's post-war performance has been characterized by persistent fluctuations in the level and the growth rate of total factor productivity, a fact reflected in the landmark real business cycle model developed by Kydland and Prescott (1982). The productivity slowdown in the 1970s and revival in the 1990s were the most prominent episodes of the post-war period. Several multi-sector extensions of Kydland and Prescott's real business cycle model that distinguish between technological improvements to consumption-goods-producing sectors and to investment-goods-producing sectors capture the differential growth rates for consumption and investment observed in the American economy By incorporating new data, methods, and identifying assumptions, this paper complements and adds to the recent literature on productivity and post-war macroeconomic performance in the United States.

Research Approach
The authors construct an extended two-sector real business cycle model to conduct a structural econometric analysis, tracing how distinct technology shocks affect both the levels and the growth rates of total factor productivity in distinct consumption-goods-producing and investment-goods-producing sectors. While other researchers have already noted that different technology shocks set off very different dynamic responses, this study pushes this observation to link more fully the aggregate data with the historical realizations of each type of shock, in order to better gauge the volatility and persistence of each kind of shock.

The sample period runs from 1948:1 through 2005:1 and uses quarterly data measured in inflation-adjusted dollars to track three observable stationary variables: real personal consumption expenditures, real gross private investment, and hours worked in the non-farm business sector. All three series are seasonally adjusted and expressed in per-capita terms by dividing each one by the non-institutional civilian population aged 16 and over. By incorporating leisure as well as consumption into the representative household's utility function, the model offers an important extension that has

implications for the behavior of aggregate hours worked as well as for consumption and investment. The model links the three observable stationary variables to a vector of unobservable state variables, including the six shocks examined in this study. Given assumptions about the stochastic behavior of the six preference and technology shocks, the model treats the United States as a closed economy. The model's structural disturbances are identified based on the dynamic effects that the real business cycle model associates with each distinct type of shock, and the very different dynamic responses these shocks have upon aggregate consumption, aggregate investment, and hours worked.

Key Findings

- In the United States the divergence of productivity across the consumption-goods and investment-goods sectors is traced to highly persistent consumption-specific, as opposed to investment-specific, technology shocks.

- The results of this estimation indicate that the consumption-goods-producing sector was the most significant source of the U.S. aggregate productivity slowdown in the 1970s. The estimated level of total factor productivity in the consumption-goods-producing sector remained essentially unchanged from the beginning of 1973 through mid-1982. More generally, movements in the level of consumption-specific productivity appear to be enormously persistent, reflecting the importance of the growth-rate component of this sector-specific shock. The estimates of the consumption-specific technology shock remained above trend for an extended period between 1953 and 1979, and since then have remained almost continually below trend.

- This study's estimates suggest that capital adjustment costs are much more important in the consumption-goods producing sector, while capital utilization is more elastic in the investment-goods-producing sector. Though the standard errors are quite large, these estimates suggest that production processes are generally more flexible for investment goods than for consumption goods.

- The extended real business cycle model, which includes shocks to both levels and growth rates of productivity in distinct consumption- and investment-goods-producing sectors, clearly shows that different types of technology shocks have different short-run effects on hours worked: level shocks to the investment-goods sector increase hours worked, level and growth-rate shocks to the consumption-goods sector leave hours worked unchanged, and growth-rate shocks to the investment sector decrease hours worked on impact.

- Level shocks to investment-specific productivity and growth-rate shocks to preferences join together to explain most of the variability in both investment and hours worked.

- There is evidence of a productivity slowdown in the investment-goods-producing sector as well as the consumption-goods sector. Yet unlike other studies, the results from this model show that the investment-specific slowdown began after the consumption-specific slowdown ended. The investment-specific slowdown was less persistent; it peaked in mid-1984 and bottomed out in 1990. Viewed over the entire post-war period, the robust growth in investment-specific productivity in the 1990s appears to be a return to trend, following the earlier, transitory slowdown.

Implications

When the model is extended through 2011, it predicts that both consumption-specific productivity and investment-specific productivity will grow at average rates. This indicates that the productivity slowdown in the consumption-goods and investment-goods sectors appears to have ended in the United States. Yet the model interprets the most recent episode of robust growth in investment and in investment-specific productivity largely as a catch-up period after the previous productivity slowdown. The model indicates that the recent productivity revival was unusually strong and predicts that its intensity will not persist or repeat anytime soon. Thus the model points to healthy but unexceptional growth rates that do not exceed the long-run averages of the entire postwar period.

This present analysis assumes that private agents have perfect knowledge, and are always able to distinguish between shocks to the levels and growth rates of sector-specific productivities. Yet other studies contend that private agents were slow to recognize the persistent productivity shifts that occurred in the 1970s and the 1990s. It would be useful to extend this paper's analysis to study the different effects that growth-rate shocks may have on consumption-specific and investment-specific technologies when private agents lack full information.

The model used in this study treats the United States as a closed economy, an assumption that is more descriptive of the 1970s than of the more highly integrated global economy during which the productivity revival took place in the 1990s. A large and growing current account deficit in the United State formed some of the backdrop during the latest period of robust investment and investment-specific technological change. An open economy real business cycle model has shown that level and growth-rate shocks to consumption and investment-specific technologies pose different implications for the workings of the trade balance. These results suggest that developing an open economy version of the model presented in this paper would be useful.

Like most real business cycle models, this one assumes a homogeneous capital stock that can be reallocated across distinct sectors of the economy. Yet information technology (IT) played a particular role in the 1990s' investment and productivity boom. Developing an extended version of the model offered here might better capture the special role of capital goods. This would yield more insight into the investment component of capital goods, as well as how IT influenced the productivity revival in the 1990s and how IT-driven growth might extend into the future.

The analysis presented here captures the effects of one particular kind of structural change associated with productivity shifts due to technological change. This study does not consider the wider array shifting tastes, technologies, and government polices may have had on influencing the evolution of the post-war American economy.

w-06-11

Estimating the New Keynesian Phillips Curve:
A Vertical Production Chain Approach
by Adam Hale Shapiro

Motivation for the Research

The New Keynesian Phillips Curve (NKPC) has become the backbone of current macroeconomic inflation research. The model's prominence resides in its simple structure underpinned by microfounded principles whereby firms make their pricing decisions in a setting of nominal rigidities. There has been a large volume of econometric research related to the model. Examples include attempts to estimate the parameters, justify the structural significance, and deduce the implications for inflation persistence.

Unfortunately, econometrically the model has had limited success. Estimates of the parameters of the model are highly sensitive to the estimation procedure, the sub-sample over which the model is estimated, and the data used to estimate the model. Furthermore, there has been a large debate on the specification of the model, specifically concerning whether a lagged inflation term should be included in order to better fit the model to the data. Because of such controversy, ascertaining the correct parameters of the model is vital to determining the model's specification and validity.

Some researchers have argued that estimating the model using generalized method of moments (GMM) results in specification bias and therefore leads to unreliable estimates of the parameters. Others argue that GMM estimation still provides a robust and unbiased estimation of the parameters of the model. These researchers have conventionally proxied real marginal cost with real unit labor cost (RULC) and instrumented with a large instrument set that includes lags of variables that seem relevant to the model. It turns out, however, that many of these variables are only weakly correlated with the model's endogenous variables. Furthermore, a large number of variables must be included in the instrument set in order to induce a significant estimate of the coefficient on the marginal cost term. As this paper shows, a tradeoff emerges, and the addition of large blocks of lagged variables reduces the relevancy of the instruments, exacerbates the problem of weak instruments, and leads to estimates that are biased toward ordinary least squares estimation.

This paper provides an alternative to the RULC proxy and the instruments currently used in GMM estimation.

Research Approach
The author generalizes the original model into that of a vertical chain of production. In such a model, input prices play a vital role in firms' pricing decisions as goods travel down the chain of production from the crude-goods stage to the consumer goods or GDP stage. The novelty of the approach taken in this paper lies in the incorporation of input prices into both the real marginal cost proxy and the instrument set.

The new proxy proposed in this paper, the real unit input cost (RUIC), measures the cost of a unit of output in terms of the price of inputs used to produce the good. The real unit input costs of upstream firms are micro-founded within the model, in contrast with the instruments used by current researchers. In order to compare both proxies under vertical production-chain instruments, upstream RULC terms were constructed.

Key Findings
- The new instruments are exogenous and relevant to firms downstream on the production chain, two vital properties that good instruments should possess. Also, these instruments are sufficient by themselves to induce high relevancy and exogeneity. Importantly, they do not require inflation variables to be added to the instrument set, a requirement that has been a major drawback of previous approaches to estimating the forward-looking NKPC.

- Estimating the NKPC using either proxy with its own upstream instruments induces high relevancy and exogeneity. However, the RUIC and its upstream instruments still provide better estimates of the model in terms of the relevancy of the instrument set, stability of the parameters, and fit of the simulated inflation series with actual inflation.

- Overall, the RUIC and its upstream instruments generally outperform the RULC proxy under a variety of instrument sets. In comparison with the RULC proxy, the RUIC proxy, based on the vertical chain of production model, induces a better fit with the model in terms of relevancy with respect to the instruments, significance of the coefficient on the marginal cost term, and stability of this coefficient with respect to changes in the instrument set.

Implications
Finding an estimation method that gives unbiased and efficient estimates of the NKPC is quite important if the NKPC is to be utilized as either a monetary policy tool or a correct specification of macroeconomic behavior. This paper shows that the limited success of estimating the NKPC model using GMM is correlated with both the poor choice of marginal cost proxy and the poor choice of instruments.

Generalizing the NKPC model to a vertical chain of production allows for the creation of instruments that are micro-founded. These variables, the RUICs of firms in stages of production upstream to the GDP stage, keep both relevancy and exogeneity high, without relying on a large number of overidentifying restrictions. Furthermore, these duties are performed without requiring the inclusion of lags of inflation, a requirement that has been a major drawback of GMM estimation of the NKPC.

Another important result is that the coefficient on firms' marginal cost in estimates of the NKPC is smaller with the RUIC proxy than with the RULC proxy. Furthermore, the use of the RUIC and its upstream instruments seems to intensify the forward-looking behavior of the model. As shown previously in the literature, these coefficients have major implications for the origin of inflation persistence implied by the NKPC. The low measure of the coefficient on firms' marginal cost, even under the RUIC, implies that only a small amount of inflation persistence is inherited from the marginal cost term. Most of this persistence is still unaccounted for in the NKPC.

Finally, the lagged response of the RUIC to inflation has implications for frictions on the input side of the marginal cost term. Specifically, frictions dealing with stages lower in the production chain, such as capital adjustment costs, presumably play a large role in explaining why disinflations are associated with large falls in output. Incorporating investment and inventory frictions in the NKPC therefore seems to be an area deserving more attention.

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