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Program Report

Corporate Finance

Robert W. Vishny

In the three years since my last report on the NBER's Program on Corporate Finance, the focus of its research has shifted somewhat from debates about the effects of takeovers and high leverage to some of the deeper puzzles which have intrigued finance researchers for many years. For example, what corporate governance systems work best and make for well-developed capital markets? How informationally efficient are markets, and how much more do insiders know than other market participants? How does the willingness of financial institutions to provide credit or insurance change cyclically? And, why are conglomerates valued less by the market than undiversified firms? This report summarizes some of the recent work done by NBER researchers in several of these broad areas.

The Informativeness of Insider Actions

A key issue in corporate finance is the degree to which corporate insiders can exploit their superior information in the marketplace. Even if insiders have superior information, various securities laws may limit their ability to take actions based on that information without first informing the market. For example, companies need to disclose large issues or repurchases of equity before they occur. If the market fully appreciates the superiority of insiders' information, then insiders will not be able to profit systematically from such information, because prices will adjust once insiders' upcoming actions are announced. Yet various researchers have found that the market is not fully efficient with respect to insider signals and, in particular, underreacts to the information content of insider signals. The implication of these findings is that well-timed decisions to go public, repurchase shares, and so on, can benefit insiders and their firms at the expense of the less-informed market.

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Erratum

In the Program Report by Claudia Goldin in the Spring 1998 NBER Reporter, a subhead was inadvertently omitted. On p. 4, the subhead after the first full paragraph should read "Early 20th Century Expansion in Education."

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NBER researchers have studied a wide variety of phenomena that appear to fit this general pattern. David Ikenberry, Josef Lakonishok, and Theo Vermaelen have found that, while share prices rise on the announcement of a share repurchase, they also continue to rise over the subsequent three years.¹ This suggests that corporate insiders are able to successfully time their repurchases to occur when stock prices are low. A similar phenomenon exists for security issuance decisions, particularly for initial public offerings (IPOs). Long-run returns of companies going public are on average significantly lower than those of the market as a whole, suggesting that insiders go public at relatively high share prices. Recent research by Alon Brav and Paul Gompers indicates that the only serious return anomalies are found in the smallest IPOs and those without venture capital backing.² Gompers and Josh Lerner also have found that, when venture capitalists distribute company shares from their venture funds to the limited partners (effectively a form of sale), subsequent returns on those shares are below market for at least 12 months after the distribution.³ Here the venture capitalist plays the role of well-informed corporate insider, successfully timing its sell decision. Roni Michaely, Richard Thaler, and Kent Womack document another example of underreaction to insider signals.⁴ They find that stock returns are abnormally low for a period of up to three years after firms cut dividends; this supports the idea that the market underestimates the informativeness of the signal. Nicholas Barberis, Andrei Shleifer, and I, as well as Harrison Hong and Jeremy C. Stein, have tried to formulate simple models to explain these results and those of other stock market anomalies, such as the well-known value and momentum anomalies.⁵ The principal contribution of these models is that

they try to predict when underreaction or overreaction to information will occur.

Internal Capital Markets and the Conglomerate Discount

Ever since the conglomerate merger wave of the 1960s, economists have tried to understand the efficiency properties of conglomerates. In the late 1960s, this meant marshalling arguments for the superiority of all the conglomerates being created. For the last 15 to 20 years, this has meant trying to understand why the conglomerates have been largely dismantled and why highly diversified firms seem to sell at a market value discount. Recent work by NBER researchers suggests that one of the main problems with conglomerates is the very same factor cited as a strength in the 1960s: they create internal capital markets and bypass the discipline of the external capital market.

Owen Lamont was the first to use COMPUSTAT business segment data to refocus empirical work on the interdependence among the investment of one division and the cash flow of other divisions.⁶ He shows that investment in non-oil divisions of petroleum companies fell when the cash flow of the oil divisions decreased dramatically with the large drop in oil prices in the mid-1980s. Using the COMPUSTAT universe of firms that report business segment information from 1980 to 1992, Hyun-Han Shin and Rene Stulz find that the investment by a segment of a diversified firm depends on the cash flow of the other firm's segments, but significantly less than on its own cash flow.⁷ The investment by segments of highly diversified firms is larger and less sensitive to the cash flow of those firms than is the investment of comparable single-segment firms.

The sensitivity of a segment's investment to the cash flow of other segments does not depend on whether its investment opportunities are better than those of the firm's other segments, however. This suggests that the internal capital market does not operate efficiently.

Two other recent working papers describe the inefficient operation of the internal capital market and its relationship to the conglomerate discount. Raghuram Rajan, Henri Servaes, and Luigi Zingales find that diversified firms systematically allocate more investment to low-Q divisions and less investment to high-Q divisions than do comparable stand-alone firms in those same industries.⁸ They then relate this measure of the misallocation of investment resources (judged against the stand-alone industry benchmarks) to the conglomerate discount in the cross-section of firms. They calculate a conglomerate discount for each firm by taking the deviation of firm value from a weighted average of book value multiples for each of the industries in which the firm operates. The authors find that their measure of investment misallocation by firm helps to explain the variation of the conglomerate discount across firms. They also show that the conglomerate discount is strongly related to the variance of the firm's investment opportunities, as measured by the variance of Tobin's Q across divisions. David S. Scharfstein also finds strong evidence of "corporate socialism."⁹ He finds that high-Q divisions invest less than their stand-alone industry peers while low-Q divisions invest more. Scharfstein also uses data on management ownership to relate the degree of socialism to the magnitude of agency problems within the firm. He finds that the degree of cross-subsidization is significantly greater when top management owns a smaller equity stake in the firm.

Volatility of Credit Supplied by Financial Institutions

How does monetary policy affect the credit supplied to firms? Anil K Kashyap and Jeremy C. Stein have a long-term research program in this area focusing on the role of banks. In a recent working paper, they analyze data for every insured commercial bank in the United States during 1976–93.¹⁰ Their key finding is that the impact of monetary policy on lending behavior is significantly more pronounced for banks with less liquid balance sheets—that is, banks with lower ratios of cash and securities to assets. Moreover, this result is entirely attributable to the smaller banks in their sample, those in the bottom 95 percent of the size distribution. These findings provide strong support for the existence of a "bank lending channel" of monetary policy transmission. Stein explores the theoretical basis for these "balance sheet" effects on lending in another paper.¹¹ He and Ken A. Froot also analyze a general model of the investment decisions of financial institutions which are fully integrated with their capital structure decisions.¹² Jun-Koo Kang and Rene Stulz show that these same balance sheet effects also have been important in Japan.¹³ Analyzing the period from 1990 to 1993, during which most Japanese banks experienced adverse shocks, they find that firms that were more bank-dependent invested less than other firms during this period.

The insurance industry also may be subject to important balance sheet effects. A recent paper by Froot and Paul O'Connell focuses on the market for catastrophe insurance in the United States during 1970–94.¹⁴ They find that the price of catastrophe insurance has fluctuated significantly in recent years. These fluctuations are commonly associated with the pat-

tern of catastrophe occurrences. For example, catastrophe losses in 1992–4 totaled \$38.6 billion in 1994 dollars, exceeding the cumulative total of losses during 1949–91 of \$34.6 billion. During this recent three-year period, prices on catastrophe reinsurance coverage more than doubled; then they began to decline. Froot and O’Connell find that supply rather than demand shocks are more important for understanding the effect of losses on reinsurance prices and quantities. Moreover, the evidence suggests that the effect of probability updating is small.¹⁶ The authors conclude that balance sheet effects and capital market imperfections are the dominant explanation for shifts in insurance supply. Finally, the estimated supply effects are very large: A \$10 billion catastrophe loss raises average contract prices by between 19 percent and 40 percent, and reduces the quantity of reinsurance purchased by between 5 percent and 16 percent. The basis for these large effects ultimately lies in imperfect access to external capital markets by insurance companies. In an early paper in this area, Anne Gron and Deborah Lucas find that when the net worth of insurers declines, the total amount of capital raised through security issues is small.¹⁵

Cross-Country Analysis of Corporate Governance and Financing Practices

As European integration continues and capital markets become more global, many governments have been exploring how they can increase the breadth of their capital markets. This inevitably leads to a discussion of corporate governance and to the questions of what represents good corporate governance practice and how it leads to broader capital markets. Further, how does capital market

development encourage economic growth? NBER researchers recently have focused on this set of questions.

In a pair of papers, Rafael La Porta, Florencio Lopes de Silanes, Andrei Shleifer, and I examine legal rules covering protection of corporate shareholders and creditors, the origin of these rules, and the quality of law enforcement in 49 countries.¹⁶ We show that common law countries generally have the best, and French civil law countries the worst, legal protections of investors, with German and Scandinavian civil law countries located in the middle. We also show that the dispersion of share ownership in the largest public companies is positively related to the degree of investor protection, consistent with the hypotheses that small, diversified shareholders are discouraged when countries fail to protect their rights. In a second paper, we show that countries with poorer investor protections, measured by both the character of legal rules and the quality of law enforcement, have smaller capital markets. These findings apply to both equity and debt markets (including private debt). French civil law countries have both the weakest investor protections and the least developed capital markets, especially as compared to common law countries.

One particularly important mechanism for corporate governance is universal banking. In Germany, where the stock market historically has been small, banks hold equity stakes in firms and have proxy voting rights over other agents’ shares. In addition, banks lend to firms and have representatives on corporate boards. Gary B. Gorton and Frank Schmid investigate the influence of banks on the performance of German firms in the 1970s and 1980s, taking account of banks’ equity holdings, the extent of banks’ proxy voting rights, and the ownership structure of the firms’ equity.¹⁷ Their evidence suggests that, during the 1970s, German banks

improved the performance of German firms to the extent that each held the firm’s equity. They also find no evidence of conflict-of-interest concerning bank use of proxy votes. However, by the mid-1980s, the world of German corporate finance had changed. Security markets became more developed and banks had reduced the extent of their blockholding. While the authors still find a positive effect from blockholding in the 1980s, the influence of German banks has clearly declined over time. According to the authors, German corporate finance may still be in the process of change, making it difficult to extrapolate their results into the future.

Raghuram Rajan and Luigi Zingales examine the link between financial development and economic growth.¹⁸ Because of the difficulties inferring causality from growth regressions, the authors take a somewhat different approach. Specifically, they ask whether industrial sectors that are more in need of external finance (as determined by the investment behavior of that sector in other countries) develop disproportionately faster in countries with more developed financial markets. They find this to be true in a large sample of countries over the 1980s. Their results suggest that financial development has a substantial supportive influence on the rate of economic growth, and this works, at least partly, by reducing the cost of external finance to financially dependent firms.

¹ D. Ikenberry, J. Lakonishok, and T. Vermaelen, “Market Underreaction to Open Market Repurchases,” *Journal of Financial Economics*, 39(2–3), (October 1995), pp. 181–208.

² A. Brav and P. Gompers, “Myth or Reality? Long-Run Underperformance of Initial Public Offerings: Evidence from Venture Capital and Non-Venture Capital-Backed IPOs,” *Journal of Finance*, 52(5), (December 1997), pp. 1791–821.

³ P. Gompers and J. Lerner, “Venture Capital Distributions: Short-Run and

Long-Run Reactions," *Journal of Finance*, forthcoming.

⁴ R. Michaely, R. Thaler, and K. Womack, "Price Reactions to Dividend Initiations and Omissions: Overreaction or Drift," *Journal of Finance*, 52(2), (June 1995), pp. 573-608. Formerly NBER Working Paper No. 4778, June 1994.

⁵ N. Barberis, A. Shleifer, and R.W. Vishny, "A Model of Investor Sentiment," *Journal of Financial Economics*, forthcoming, and H. Hong and J.C. Stein, "A Unified Theory of Underreaction, Momentum Trading and Overreaction in Asset Markets," NBER Working Paper No. 6324, December 1997.

⁶ O. Lamont, "Cash Flow and Investment: Evidence From Internal Capital Markets," *Journal of Finance*, 1, (March 1997), pp. 83-109. Formerly NBER Working Paper No. 5499, March 1996.

⁷ H. Shin and R. Stulz, "Are Internal Capital Markets Efficient?" formerly NBER Working Paper No. 5639, revised 1997.

⁸ R. Rajan, H. Servaes, and L. Zingales, "The Cost of Diversity: The Diversification Discount and Inefficient Investment,"

NBER Working Paper No. 6368, January 1998.

⁹ D.S. Scharfstein, "The Dark Side of Internal Capital Markets II: Evidence from Diversified Conglomerates," NBER Working Paper No. 6352, January 1998.

¹⁰ A.K. Kashyap and J.C. Stein, "What Do a Million Banks Have to Say About the Transmission of Monetary Policy?" NBER Working Paper No. 6056, June 1997.

¹¹ J.C. Stein, "An Adverse Selection Model of Bank Asset and Liability Management with Implications for the Transmission of Monetary Policy," NBER Working Paper No. 5217, August 1995.

¹² K.A. Froot and J.C. Stein, "Risk Management, Capital Budgeting and Capital Structure Policy for Financial Institutions," *Journal of Financial Economics*, 47(1), (January 1998), pp. 55-82. Formerly NBER Working Paper No. 5403, January 1996.

¹³ J. Kang and R. Stulz, "Is Bank-Centered Corporate Governance Worth it? A Cross-Sectional Analysis of the Performance of Japanese Firms During the Asset Price Deflation," NBER Working Paper No.

6238, October 1997.

¹⁴ K.A. Froot and P. O'Connell, "The Pricing of U.S. Catastrophe Reinsurance," NBER Working Paper No. 6043, May 1997.

¹⁵ A. Gron and D.J. Lucas, "External Financing and Insurance Cycles," NBER Working Paper No. 5229, August 1995.

¹⁶ R. La Porta, F. Lopez-de-Silanes, A. Shleifer, and R.W. Vishny, "Law and Finance," NBER Working Paper No. 5661, July 1996, and R. La Porta, F. Lopez-de-Silanes, A. Shleifer, and R. Vishny, "Legal Determinants of External Finance," NBER Working Paper No. 5879, January 1997, and *Journal of Finance*, 52(3), (July 1997), pp. 1131-50.

¹⁷ G.B. Gorton and F. Schmid, "Universal Banking and the Performance of German Firms," NBER Working Paper No. 5453, February 1996.

¹⁸ R.G. Rajan and L. Zingales, "Financial Dependence and Growth," NBER Working Paper No. 5758, September 1996, and *American Economic Review*, 88(3), (June 1998).

Research Summaries

The Future of Investment in Emerging Markets

Campbell R. Harvey*

Emerging market investments are certainly not for the faint of heart. In the early 1990s, several papers promoted the high average returns in these markets. Indeed, on the surface, these returns appeared to be much higher than those generated by investing in developed countries. At the same time, several developing countries liberalized their equity markets, allowing foreigners relatively

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unfettered access to them. As a result of these liberalizations and of domestic U.S. conditions, there was a sharp increase in U.S. capital flows to these equity markets.

Despite the considerable history of research on emerging markets, much of the current work was initiated as a result of the World Bank Conference on Portfolio Investment in Developing Countries, held in Washington in late 1993. Stijn Claessens and Sudarshan Gooptu brought together there a diverse group of academics and practitioners to try to gain a better understanding of emerging equity markets, and a number of myths about emerging markets were put to rest. Some of the ideas presented at

the conference motivated much of the research, including my own, on emerging markets over the next five years. That research is discussed here.

Special Challenges

I discuss these data challenges first, because we can ask many interesting questions about emerging markets, but we must take into account the special features of the data before trying to answer these questions. Most empirical research on emerging markets relies on the International Finance Corporation (IFC) indexes. These indexes represent portfolios of securities that comprise at least 60 percent of the market capitalization

in each emerging market. For some countries, there are only a few stocks in the IFC index portfolio. For example in December 1997, there were only 15 securities in the IFC global index for Hungary, 17 in the Moroccan portfolio, and 19 in the Venezuelan portfolio. Korea had the largest number (195) of securities. India had 133 securities in its IFC index, but more than 5,000 equity securities are listed in India. The small number of securities in these indexes means that the country portfolio may contain some variance that is usually diversified away with larger portfolios.

The IFC launched its data product in 1981. However, it reports data on eight countries back to December 1975, and on one country back to 1977. These data were "backfilled,"¹ which led to an obvious bias. The stocks selected in 1981 for the indexes would not necessarily be those selected in December 1975. This "look-back bias" should raise the portfolios' observed mean performance.

There may be other biases in emerging market equity data as well. Goetzmann and Jorion² showed that historically, markets have emerged, submerged, and re-emerged. For example in the 1920s, Argentina had a larger market capitalization than did the United Kingdom. However, its equity market all but disappeared by the 1930s. When we sample the data from 1981 and calculate statistics based only on this sample, we overlook what has happened in the longer term. While this is true for any market, it is particularly acute in emerging markets.

Further, there is extraordinary volatility in emerging markets. For example, from January 1981 to March 1998 the returns on the U.S. dollar index created by Morgan Stanley Capital International had a standard deviation of 14.4 percent on an annual basis. Among the 28 emerging

markets with more than three years of available data, dollar returns in 26 markets had standard deviations that were double the U.S. volatility; 9 markets had triple the U.S. volatility; and 7 had more than quadruple the U.S. volatility.

High volatility need not be a problem for analysis, but the data need to be analyzed with care. For example, practitioners were promoting the high average returns of these emerging markets in the early 1990s, while I pointed out (see n. 1) that there is a large difference between arithmetic and geometric average returns. In the period prior to June 1992, for example, the arithmetic average return for Brazil was 21.7 percent per annum. However, the return to a buy-and-hold strategy averaged only 3.7 percent per annum.

Also, the distribution of emerging market equity returns data is highly non-normal.³ In portfolio theory, we usually think of optimizing a portfolio to minimize the variance for some target level of expected return. This paradigm is not sufficient when there is significant skewness and kurtosis in the data. Part of my research shows that the presence of higher moments significantly affects optimal portfolio weights.⁴

Expected Returns

How do we measure expected returns in these emerging markets? A naive extrapolation of history probably is not desirable. For example, the IFC began tracking Russia in January 1996. The average U.S. dollar geometric return was 68.6 percent through March 1998. Few would expect this type of return performance to persist.

The measurement of expected returns is important for portfolio analysis as well as for corporate finance. Indeed, one of the problems most discussed in international corporate finance is the measurement of

an appropriate discount rate to use in evaluating investment projects in emerging markets.

The standard theory in finance begins with a world version of a capital asset pricing model. An asset's covariance with a diversified world portfolio should determine its expected return. I test this model and find three problems. First, as already mentioned, the data are highly non-normal, which poses a problem in a model that only rewards covariance risk.⁵ Second, the risk parameters change through time and allowances must be made for this nonstationarity. Third, these markets, at least for part of the sample, are not integrated into world capital markets. As a consequence, I strongly reject this model.⁶

The assumption of financial market integration is critical to the theory. For many of the emerging markets, though, this assumption is violated. As a result, traditional asset pricing models cannot be applied.

Market Segmentation and Integration

Theory tells us how to price assets in an open economy with a world version of asset pricing theory, and in a closed or segmented economy. But what if the country has moved from a segmented economy to an integrated economy? And, suppose we are not sure of the transition date.

My research with Bekaert⁷ began with identifying the transition from an integrated to a segmented economy using an asset pricing model. Theory suggested a particular model for the integrated state and another for the segmented state. We framed the transition in terms of regime-switching: this particular problem seems ideally suited for a regime-switching framework, in that each of the regimes is well defined economically. We came up with a method for determining when the transition from

segmented to integrated markets (or vice versa) occurred for 12 emerging equity markets.

Next, we examined emerging market volatility.⁸ Given its persistence, we thought that we would be able to extract more information from the volatility. But estimating volatility in an emerging equity market proved to be very challenging. Our volatility model had to allow for both skewness and kurtosis in the returns distributions.

One common feature of these papers is the observation that various types of information will affect asset prices, depending upon whether the market is integrated or segmented. We postulate that local (country-specific) information is more likely to affect a country's equity returns and volatility when the country is segmented, and that world information is more likely to have an effect when the country is integrated into world capital markets. Our papers let the relative importance of local versus world information change through time. This contrasts with the usual approach, which forces fixed weights on conditioning information in time-series models.

These papers represent attempts to use the data in determining when market integration occurred. We are also able to shed light on the behavior of emerging market returns (average returns, volatility, correlation with the world, and predictability) in segmented versus integrated states.

Liberalizations

My early research with Bekaert lets the data determine the transition from integrated to segmented states. However, some of my current work examines "event" dates. In a recent paper, Bekaert and I examine three types of events that are related to market liberalizations: the introduction of a country mutual fund; the introduction of American Depository

Receipts (ADRs); and changes in government regulations.⁹

The introduction of a country fund, or the listing of an ADR, gives foreigners ways to access the local market without physically trading in it. While the local market officially might be closed to foreign portfolio investment, these vehicles open a market. We contrast the introduction of ADRs and country funds to official liberalizations.

This research really focuses on the definition of "liberalization." A traditional approach would focus exclusively on government regulations, or what we call official liberalizations. However, a market could be technically closed to foreigners but effectively open to foreign investment if foreigners could access it in different ways, such as through ADRs and country funds.

Our research examines the behavior of expected returns, volatility, and correlations with the world before and after liberalizations defined in different ways. We are careful to control for macroeconomic events and the structure of each country's equity market. We also explain that the liberalization process is both gradual and endogenous.

Our analysis suggests that expected returns decrease slightly after liberalizations, and correlations with world market returns increase. This does not imply that the diversification benefits of investing in emerging markets have disappeared. The post-liberalization correlations are still much lower than comparable correlations for developed countries. Our results do not support the notion that liberalization leads to significant increases in volatility.

In addition to determining the impact of liberalizations on emerging equity markets, our method has the ability to discern the impact of particular types of liberalizations. We leave for future research, though, the

question of identifying the most effective types of liberalizations.

Dating Integration

My recent research with Bekaert and Robin L. Lumsdaine applies novel structural break tests to financial and economic series whose behavior is likely to be affected by a market integration.¹⁰ We examine univariate as well as multivariate break tests.¹¹ In contrast to other empirical implementations of these methods, we allow for all the parameters to change after the capital market liberalization. Consistent with our previous research, we find that the relation between local market returns and world information is altered as a result of market integration. We not only present statistical tests of whether the break is significant, but we also present the median break dates with a 90 percent confidence interval around the break. That is, we "date" market integration using economic and financial series.

One particularly interesting indicator is U.S. capital flows to emerging markets. Linda Tesar and Ingrid M. Werner initiated the research on capital flows.¹² Using the equity flows data, Bekaert and I establish the date when flows "break" in the upward direction.¹³ We then trace the impact of these flows on both the behavior of the equity market and on a wide variety of economic aggregates. We argue that the increase in capital flows probably reflects an effective liberalization. That is, U.S. flows to these markets could occur only if the liberalization were operational and credible.

Future Questions

As with most research, we usually uncover more questions than answers. This is certainly the case for emerging markets. While we understand much more about these impor-

tant markets today than we did just five years ago, there are a number of gaps in our knowledge.

Perhaps the most glaring gap is a dynamic economic model of the integration process. Currently, we do not have an asset pricing theory that allows for a gradual and anticipated process of liberalization. This model would help us understand the complex economic and financial changes that I document in some of my research. Further, many corporations are wrestling with proposals to make direct investments in emerging markets. In order to evaluate these proposals, they need an asset pricing model that suggests appropriate hurdle rates for each potential investment. As corporations expand their operations to emerging markets, this need becomes more acute. The next generation of emerging markets research will have to meet this challenge.

Editor's note: Professor Harvey submitted this article for publication three weeks before the Russian equity market crashed.

¹ C.R. Harvey, "Predictable Risk and Returns in Emerging Markets," *Review of Financial Studies*, 8, 3, (Fall 1995), pp. 773-816.

² W. Goetzmann and P. Jorion, "Re-Emerging Markets," *NBER Working Paper No. 5906*, January 1997.

³ G. Bekaert and C.R. Harvey, "Emerging Equity Market Volatility," *Journal of Financial Economics*, 43, 1, (January 1997) pp. 27-77.

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⁶ Harvey, "Predictable Risk and Returns in Emerging Markets."

⁷ G. Bekaert and C.R. Harvey, "Time-Varying World Market Integration," *Journal of Finance*, (June 1995), pp. 403-44.

⁸ Bekaert and Harvey, "Emerging Equity Market Volatility."

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¹¹ Following J. Bai, R.L. Lumsdaine, and J.H. Stock, "Testing for and Dating Breaks in Stationary and Nonstationary Multivariate Series," *Review of Economic Studies*, forthcoming, 1998.

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¹³ G. Bekaert and C.R. Harvey, "Capital Flows and Behavior of Equity Market Returns," unpublished working paper, Duke University and Stanford University, 1998.

Patents, Patent Citations, and the Dynamics of Technological Change

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Economists accept that technological change contributes powerfully to long-run improvements in living standards. Yet, we know surprisingly little about the determinants of technological change, including the relative contributions of different economic agents to the change process, the empirical sensitivity of the proc-

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ess to economic incentives, and the extent of market failure surrounding decisions affecting investments in new knowledge and technology. In part, this lack of knowledge is attributable to the fact that, until recently, some economists have tended to view technology as a "black box" that affected the economic system but that was itself driven largely by exogenous noneconomic forces, such as the advance of science. Pioneering work by Schmookler, Griliches, and others showed that this was not true; more recently the so-called New Growth Theory of Romer, Lucas, Grossman and Helpman, and others, has placed technology squarely within the economic system. However, grappling with these ideas empirically requires con-

fronting the reality that many of the relevant activities, although endogenous to the political-economic system, are carried out in institutions such as universities and government laboratories, and may not be amenable to analysis with the standard tools of the theory of the firm.

More fundamentally, microeconomic analysis of the process of technological change must confront severe measurement problems. Fundamentally, technological change is driven by an investment process that produces a form of capital that is hard to see or measure. Moreover, technological change is inherently an interrelated and cumulative process: an important part of the economic consequence of investments made by one agent is the effect that such

investments have on the marginal product of other (either subsequent or made by others) investments. Thus, empirical implementation of New Growth Theory, and the broader agenda of quantifying the determinants of technological change, requires the development of methods 1) to measure the output of investments in new knowledge and new technology, including investments made in the university and government sectors, and 2) to quantify the linkages across time and institutional boundaries by which the "spillovers" and cumulative impact of new knowledge are manifested. Along with various coauthors, I have explored the use of data on patents and patent citations for these purposes.

Patents are an interesting "economic institution." In return for a government-enforced monopoly franchise on the commercial exploitation of an invention, the patentee must disclose and explain the invention, in principal with sufficient detail that a knowledgeable practitioner of the relevant technology could reproduce the invention using the patent document. When a patent is issued, a large amount of information is publicly recorded, and most of this information is now available in computerized form. The information that is available includes the following: 1) the names and postal addresses of the inventor(s); 2) the organization, if any, to which the patent property right was assigned or transferred when the patent was issued, and its legal address; 3) a detailed technological classification of the invention; 4) the patentee's specific claims regarding what the invention can do that could not be done before; and 5) citations that indicate previously existing knowledge, embodied in prior patents or other publications, upon which the patent builds.

Constructing a Database of Patents

Michael Fogarty, Manuel Trajtenberg, Bronwyn H. Hall, and I are engaged in an NBER project, funded by the National Science Foundation, to assemble patent information into a dataset for economic research. The data file, which eventually will reside on an Internet site accessible to all qualified researchers, contains most of the foregoing information for about 3 million U.S. patents granted since 1963. The dataset tracks the citations in all patents since 1977 and permits convenient merging of data relating to citing and cited patents. For example, one can look specifically at patents granted to inventors residing in the United States and ask what fraction of the subsequent patents citing them are also from the United States. Because of the detail in the patent data, one can ask about specific time periods or specific technological fields separately, and can look at finer geographic breakdowns, such as states or metropolitan areas.

Using these data, my coauthors and I have begun to explore two broad categories of questions about the dynamics of technological change. First, we examine the number and composition of citations that a patent receives from subsequent patents as an indicator of an invention's technological and economic impact. We also explore the use of these citation-based measures of impact to quantify the effects of changes in incentives for research organizations. Second, we consider patent citations as proxies for the flow of "knowledge spillovers" from the inventors whose patents are cited to the inventors making the citations. In this context, we examine the effects of geographic proximity, technological relatedness, organizational boundaries, and passage of time on these spillover flows.

Citation-Based Measures of "Basicness" of Inventions

My research in this area began with a paper written in 1990 with Manuel Trajtenberg and Rebecca Henderson and published recently.¹ We tested whether patent citations could be used to identify "basic" inventions, using the hypothesis that inventions coming out of universities were, on average, more basic than those coming from private firms. We proposed several measures of the basicness of inventions, based on patent citations. These include both "backward" measures (derived from the citations *made* by a patent) and "forward" measures (derived from the citations that a patent subsequently *receives* from other patents). For both forward and backward citations, the measures fall into three categories: *importance measures* are based on the number of citations made or received; *distance measures* relate to the proximity or remoteness of the cited or citing patents, across both time and technology space; and *originality* or *generality* measures relate to the dispersion of citations made or received across different areas of technology space. We also examined the extent to which the citations made by patents were to scientific articles rather than to other patents as an indicator of the closeness of the invention to basic science.² We found that the forward measures of basicness based on citations generally were significantly higher for university patents, but the differences in the backward measures were typically not significant, except for the citations to scientific papers, which were significantly higher for university patents.

We also proposed that the fraction of "self-citations"—citations that come from patents assigned to the same organization—was an indicator

of the originating organization's successful appropriation of the subsequent fruits of that research. The data confirm that this fraction was much higher for firms than for universities, and it was higher for large firms than for small firms (as high as 25 percent for the largest firms).

That first paper was based on patents from the 1970s and early 1980s. In 1980, Congress changed U.S. law, making it much easier for universities to get patents and license them to commercial firms. Following this change, the number of patents taken out by universities has exploded, from about 500 per year in 1980 to about 2,000 per year today. The motivation for the policy change was to increase the rate of technology transfer from universities to the private sector. The increase in the number of patents suggests that the policy was enormously successful. However, because patenting is now so much easier for universities, one wonders whether inventions in the current flood of patents are comparable in technological significance to those patented when doing so was more difficult. In another paper, Henderson, Trajtenberg, and I show that, according to citation-based measures, the technological impact of university patents declined dramatically during the 1980s, suggesting that the effective increase in technology transfer has been significantly less than the raw patent numbers suggest.³

In recent work with Michael Fogarty and Bruce Banks, I applied a similar analysis to patents assigned to U.S. government research labs.⁴ We found that, unlike university patents, federal labs' patents historically were less frequently cited than corporate patents, except for National Aeronautics and Space Administration (NASA) patents approved during the 1970s. The federal patents, particularly NASA patents, were somewhat

more basic than corporate patents, as indicated by their "generality" or the dispersion of their citation effects across many areas of technology. This paper also includes qualitative analysis based on interviews with inventors in both the government labs and in firms. These discussions show that, although there is a lot of "noise" in citations data, there is a systematic relationship between citations and technological impact.

A related paper written with Ricardo J. Caballero integrates citations as evidence of research spillovers into the theoretical framework of New Growth Theory.⁵ In the context of a general equilibrium dynamic growth model, we use citations to measure the cumulative impact of research on research productivity in subsequent periods. Our estimation of the model based on aggregate annual data suggests that a decline in the aggregate "fertility" of invention in the United States in the second half of this century was a factor in the productivity slowdown experienced in the 1970s.

Work in progress with Hall and Trajtenberg examines the relationship between the stock market's valuation of firms and the number of citations the firms' patents receive.⁶ Preliminary results suggest that firms' possession of frequently cited patents is correlated with market participants' perceptions of the value of firms' knowledge stocks. Further analysis will explore the timing of these relationships, possible connections among citations, private returns to inventions, and obsolescence of technology as other firms develop competing technologies.

Patterns of Citations as Evidence of Paths of Knowledge Flows

Turning to the use of citations to trace the flows of knowledge spill-

overs, my 1993 paper with Henderson and Trajtenberg examines whether patent citations come from geographically proximate inventors. Because citations tend to come from inventors pursuing technologically related research, and inventors working in particular areas tend to be concentrated in certain locations, our analysis controls for the nonrandom geographic distribution of researchers working in particular fields. We also exclude self-citations, to limit the analysis to citations that might indicate spillovers. We find that at the levels of metropolitan areas, states, and the United States as a whole, citations are concentrated locally to a statistically significant extent, although the actual magnitude of the effects is rather modest.⁷

Trajtenberg and I have extended this analysis in two more recent papers.⁸ Adapting the "citation function" formulation developed by Caballero and Jaffe, we examine the flows of citations across countries and time. We find strong evidence that citation flows are geographically localized, not only within the United States but also within the United Kingdom, France, Germany, and Japan. For example, even though we examined patents taken out in the U.S. patent system, patents from Japanese inventors are more likely to cite Japanese patents than German, French, or British patents; we find similar localization for all countries. We also find important time effects: citation localization is strongest in the first few years after a patent issues, and fades significantly over time. The results suggest strongly that, although knowledge eventually diffuses fully around the globe, inventors that work near important sources of new ideas benefit significantly sooner from their spillovers than do inventors that are farther away. We also find that self-citations arrive much more quickly than non-self-citations.

Overall, geographic localization is partly a result of self-citation at the level of individual firms, but it is still significant even after self-citations are eliminated.

Ongoing work will extend this research in several directions. We are preparing a survey of inventors to explore in more detail the relationships among patent citations, communication among inventors, research spillovers, and cumulative technological impact. We are also continuing to explore the finer detail of the geographic, institutional, and technological dimensions of the citation patterns. Because of the richness of the data, the potential range of research questions is large, including the following: What role do factors other than geographic distance (for example, language, culture, and economic ties) play in flows of knowledge around the globe? Do particular firms or kinds of firms play central roles in the flows of knowledge? Do particular kinds of research or technological fields generate measurably large spillovers? We are also pursuing further work linking patent citations to other economic observables, such as market value and productivity at the levels of firms, industries, and countries.

The Economics of Mass Migrations

Jeffrey G. Williamson*

The mass migrations that ended early in this century raise four fundamental questions: What explains them? How did they affect labor markets? Did their impact create a policy backlash? Does the experience offer lessons for today?

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While I doubt that we will ever be able to measure "invention" or "knowledge" as well as we measure labor or even capital, I do believe that this line of research is gradually increasing our ability to give empirical content to economic constructs that play crucial roles in economic theory and economic life.

¹ M. Trajtenberg, R. Henderson, and A.B. Jaffe, "University versus Corporate Patents: A Window on the Basicness of Invention," *Economics of Innovation and New Technology*, 5, (1997), pp. 19-50. Also presented as "Telling Trails Out of School: University versus Corporate Patents and the Basicness of Invention," at the 1991 AEA Annual Meeting.

² This last idea has been carried further by Francis Narin, who has looked in detail at the citations to scientific literature in biotechnology patents and has shown close links to research funded by the U.S. National Institutes of Health and other basic research agencies. See F. Narin, *Linkage Between U.S. Patents and Public Science*, CHI Research, Inc., 1997.

³ R. Henderson, A.B. Jaffe, and M. Trajtenberg, "Universities as a Source of Commercial Technology: A Detailed Analysis of University Patenting, 1965-1988," *Review of Economics and Statistics*, LXXX, 1, (February 1998), pp. 119-27.

⁴ A.B. Jaffe, M. Fogarty, and B. Banks, "Evidence from Patents and Patent Citations on the Impact of NASA and Other

Federal Labs on Commercial Innovation," NBER Working Paper No. 6044, May 1997. Forthcoming in the *Journal of Industrial Economics*.

⁵ R.J. Caballero and A.B. Jaffe, "How High are the Giants' Shoulders: An Empirical Assessment of Knowledge Spillovers and Creative Destruction in a Model of Economic Growth" in NBER *Macroeconomics Annual*, Vol. 8, O. Blanchard and S. Fischer, eds. Cambridge, MA: MIT Press, 1993.

⁶ B.H. Hall, A.B. Jaffe, and M. Trajtenberg, "Patent Citations and Market Value: A First Look," paper presented at the NBER Program Meeting on Productivity, March 6, 1998.

⁷ For example, we found that about 6 percent of citations come from the same metropolitan area, compared to an expectation of about 1 percent based solely on the geographic concentration of inventors. A.B. Jaffe, R. Henderson, and M. Trajtenberg, "Geographic Localization of Knowledge Spillovers as Evidenced by Patent Citations" *Quarterly Journal of Economics*, Vol. CViii, (August 1993), issue 3, p. 577.

⁸ A.B. Jaffe and M. Trajtenberg, "Flows of Knowledge from Universities and Federal Labs: Modeling the Flow of Patent Citations over Time and Across Institutional and Geographic Boundaries," *Proceedings of the National Academy of Sciences*, 93, (November 1996), pp. 12671-7; A.B. Jaffe and M. Trajtenberg, "International Knowledge Flows: Evidence from Patent Citations" NBER Working Paper No. 6507, April 1998.

Explanations for the Mass Migrations

Almost 60 million Europeans left for the New World during the half century or so prior to World War I. This impressive figure would be even higher if it included the Italians who went north, the Poles who went west, the Irish who went to England, and the other European migrants who sought better lives within Europe. Although wars, pogroms, religious discrimination, ethnic cleansing, and racist restrictions

played important supporting roles, the prime motivation for these migrations was economic fundamentals. One way those fundamentals were manifested was through self-selection. Overwhelmingly, the migrants were young male adults, the very people who are most sensitive to and who have the biggest impact on labor market events. Those economic fundamentals also were manifested by the timing of the mass migrations: when to move was driven by unemployment, business cycles, and industrial crises. But who moved and

where they moved were determined by long-run fundamentals that underlay labor markets around the globalizing Atlantic economy.

In a series of publications¹ culminating with a book recently published by the Oxford University Press,² Timothy Hatton and I have shown that the mass migrations obeyed a predictable law of motion but that the law was far more complex than an economist might guess. The poorest workers in the poorest regions of the poorest countries did not move even though the return to their move would have been highest. Furthermore, every country losing emigrants passed through a life cycle that took many decades to complete: poor agrarian countries registered very low exit rates; rapidly industrializing countries registered rising rates, not falling rates as traditional theory would have predicted; and more mature industrial countries registered declining rates as their labor market conditions improved.

What accounts for the upside of this inverted U-shaped trend? Poor migrants were income-constrained in a very imperfect capital market, but that income constraint was eased by the combination of improved conditions in their home countries and rising remittances from emigrant pioneers abroad. On the upside of the "inverted U," the demand for emigration also was driven by demographic factors at home: declining infant mortality and a delayed decline in fertility created a glut of young adults who were prime targets for emigration.

Thus, the rise and fall of emigration from Europe traced a law of motion as global labor markets became integrated. Then World War I and immigration quotas choked off European emigration abruptly; the decline would otherwise have happened, but more gradually.

Divergence and Convergence

In the first half of the 19th century, the Atlantic economy was characterized by high tariffs, modest commodity trade, very little mass migration, and an underdeveloped global capital market. Two profound shocks occurred in this environment that was still hostile to liberal globalization policy: early industrialization in Britain, which then spread to a few countries on the European continent; and resource "discovery" in the New World, set in motion by sharply declining transport costs linking overseas suppliers to European markets, so that real freight rates fell by 1.5 percent per annum between 1840 and 1910.³ These two shocks triggered a divergence in wages across countries that lasted until the middle of the century.⁴

This divergence was replaced by long-run convergence between 1846 and 1854. If we exclude Canada and the United States, two "exceptional" rich countries that bucked the convergence tide, then convergence up to 1914 is even more rapid. If we also exclude Portugal and Spain, two countries that failed to play the globalization game, convergence is faster still. The measure of wage divergence drops by more than a third from 1870 to 1900, and divergence drops by perhaps two thirds between 1854 and the end of the century. Gross domestic product (GDP) per capita converged as well,⁵ but real wage convergence was much faster. The globalization arguments that follow offer some explanations for why this is so.

What a Difference Factor Prices Make

The forces of convergence that seem to be so pronounced in the real wage data lead to different conclu-

sions from those often reached by prominent studies that have focused on GDP per capita or per worker-hour.

There are at least four good reasons that it is a mistake for the convergence debate to have ignored wages and other factor prices. First, the pre-World War II real wage data are probably of better quality than are the GDP data. Second, income distribution matters, and wage rates (when compared with other factor prices) offer a window through which to view distribution issues. Real people earn wages or profits or rents—they don't earn that statistical artifact known as GDP per capita. By averaging all incomes, macroeconomists exclude valuable information. Third, factor price movements help us understand the sources of convergence. For example, rapid technological catch-up in a poor country is more likely to increase all factor prices equally than is mass emigration or an export boom in labor-intensive manufactures. The open economy mechanisms that were important in driving late-19th-century convergence—trade, migration, and capital flows—operated directly on factor prices⁶ and thus only indirectly on GDP per capita. Focusing on GDP per capita alone misses a large part of this story. Fourth, economic change nearly always involves winners and losers, a fact that is crucial in accounting for the evolution of policy. Changes that increase GDP per capita and cause losses to the politically powerful often are successfully resisted, and examining the behavior of factor prices helps us understand such political resistance.

Impact of the Mass Migrations

Heckscher and Ohlin argued that integration of global commodity mar-

kets would lead to convergence of international factor prices, as countries everywhere expanded the production and export of commodities that used their abundant (and cheap) factor intensively. If so, mass migration should have helped along the process of factor convergence. The poorest European countries tended to have the highest emigration rates, while the richest new world countries tended to have the highest immigration rates. The correlation between the two wasn't perfect, but it was still very strong.⁷ Certainly the labor force impact was very big: mass migration after 1870 augmented the 1910 New World labor force by 49 percent and reduced the 1910 labor force in the emigrant countries around the European periphery by 22 percent. These big labor supply effects can be converted easily into a real wage impact in both sending and receiving countries. My colleagues and I estimate that effect in a series of papers and conclude that mass migration alone can explain about 70 percent of the real wage convergence observed in the late 19th century Atlantic economy.⁸

Mass Migration, Globalization, and Inequality

Because the migrants tended to be unskilled, and became increasingly so as the late 19th century unfolded, they tended to flood labor markets at the bottom in destination countries, thus lowering the unskilled wage relative to the skilled wage, to white-collar incomes, to entrepreneurial returns, and to land rents. Mass migration implied increasing inequality in rich, labor-scarce countries. Emigration implied declining inequality in poor, labor-abundant countries.

How did the typical unskilled worker near the bottom of the income distribution do relative to the

typical skilled blue collar worker, or the educated white collar employee near the middle of the distribution, or relative to the landowner and the capitalist near the top? Two kinds of evidence can be used to document late-19th-century inequality trends: changes in the ratio of the unskilled wage to farm land values per acre; and changes in the ratio of the unskilled wage to GDP per worker hour.

In the four decades prior to World War I, the wage/rental ratio plunged in the New World. One study reports that the Australian ratio fell to one quarter of its 1870 level by 1913, the Argentine ratio fell to one fifth of its mid-1880 level, and the U.S. ratio fell to less than half of its 1870 level. In Europe, the wage/rental ratio surged up to the beginning of World War I. The British ratio increased by a factor of 2.7 over its 1870 level, while the Irish ratio increased by even more. The Swedish and Danish ratios both increased by a factor of 2.3. Not surprisingly, the surge was less pronounced in protectionist countries: the ratio increased by a factor of 1.8 in France, 1.4 in Germany, and not at all in Spain.⁹ The evidence that the wage/rental ratio was dropping in the rich, labor-scarce New World is consistent with the hypothesis that inequality rose there, while the rising wage/rental ratio was consistent with the belief that inequality was falling in poor, labor-abundant Europe. There is also some evidence that globalization mattered: European countries staying open to trade absorbed the biggest distributional hit; European countries retreating behind tariff walls absorbed the smallest distributional hit.

What about the ratio of the unskilled worker's wage to the returns on all factors per laborer as measured by Maddison's estimates of GDP per worker-hour? Changes in this ratio measure changes in the economic

distance between the working poor near the bottom of the distribution and the average citizen in the middle of the distribution. It turns out that this ratio is highly correlated with more comprehensive measures of inequality in the few cases in which both are available. In any case, the ratio rose by more than 1.5 times between 1870 and 1913 in Denmark and Sweden—two countries setting the egalitarian upper bound—and it fell by half in Australia and the United States, two countries setting the inegalitarian lower bound. When this measure of inequality change is plotted against the 1870 real wage, it offers strong confirmation of the globalization hypothesis: inequality rose dramatically in rich, labor-scarce New World countries such as Australia, Canada, and the United States; inequality fell dramatically in poor, labor-abundant countries such as Norway, Sweden, Denmark, and Italy; inequality was more stable in European industrial economies, such as Belgium, France, Germany, the Netherlands, and the United Kingdom, and in poor European economies that failed to globalize, such as Portugal and Spain.

Globalization Backlash: Immigration Restrictions

American doors did not suddenly and without warning slam shut on European emigrants when the U.S. Congress overrode President Wilson's veto of the immigrant literacy test in February 1917 or when it passed the Emergency Quota Act of May 1921. Over the half century prior to the enactment of the Literacy Act, the United States had been imposing restrictions on what had been free immigration—including contract labor laws, Chinese exclusion acts, excludable classes, head taxes, and so on—and had long been debating

more severe restrictions. The Quota Act of 1921 was preceded by 25 years of active Congressional debate, and 86 percent of Congress favored more restriction according to the first vote on this issue in 1897. The United States was hardly alone. Argentina, Australia, Brazil, and Canada enacted similar measures, although in these countries policy change more often took the form of an enormous drop in or even disappearance of immigrant subsidies rather than their outright exclusion. Contrary to conventional wisdom, therefore, the United States did not make an abrupt regime switch around World War I, but rather it evolved toward a more restrictive immigration policy.

The empirical literature on the determinants of immigration policy is very new, but two recent papers by Timmer and me suggest some outlines.¹⁰ First, immigration policy has been slow to change, but it is worth noting that countries with the strongest historical persistence also exhibited the biggest policy switch at the end of the period of quiescence, from wide open to tightly closed, and these policy switches usually required long periods of debate. Second, labor market conditions also have influenced immigration policy consistently. Deteriorating living standards of unskilled workers mattered, but so did rising inequality. Both were associated with increasingly restrictive immigration policy.

The evidence just summarized speaks to the indirect impact of immigration on policy by looking at labor market performance. What about the direct impact of immigration on policy? Low and falling immigrant quality seems to have precipitated more restrictive immigrant policy, even after other forces are controlled for. To some extent, therefore, New World policy anticipated the impact of low quality immigrants on unskilled wages and moved to shut it down.

While the absolute size of the immigrant flow did not seem to have any consistent impact on New World policy up to 1930, its low and declining quality certainly did, which provoked restriction. Global competitors' policies mattered even more. Labor market conditions mattered most, with deteriorating conditions provoking a restrictive policy reaction. New World countries acted to defend the economic interests of unskilled labor.

The Lessons of History¹¹

There was a deglobalization implosion after 1914, driven by two world wars, two periods of fragile peace, the Great Depression and the Cold War. The last few decades of the 20th century have marked a successful struggle to reconstruct that pre-World War I global economy. Conventional wisdom has it that these spectacular changes in global policy were regime switches that were pretty much independent of economic events; thus they can be taken as exogenous.

This view ignores the fact that immigration policy in labor-scarce parts of the global economy became increasingly restrictive prior to 1914 and that much of this retreat from open immigration policies was driven by a defense of the deteriorating relative economic position of the working poor. It also ignores the fact that liberal attitudes toward trade were brief and that protection rose sharply almost everywhere on the European continent from the 1870s onwards. Most of this retreat from free trade was driven by a defense of the relative economic position of both the landed rich and the landless poor.¹²

Thus, a more accurate narrative of globalization experience in the decades prior to the World War I would read like this: A spreading technology revolution and a transportation breakthrough led first to a divergence

of real wages and living standards between countries; the evolution of well-functioning global markets in goods and labor eventually brought about a convergence between nations; this factor price convergence, however, planted seeds for its own destruction because it created rising inequality in labor-scarce economies and falling inequality in labor-abundant economies. The voices of powerful interest groups who were hit hard by these globalization events were heard, generating a political backlash against immigration and trade.

A late-19th-century globalization backlash made a powerful contribution to interwar deglobalization. Is this history likely to repeat? Maybe not. After all, the migration from poor to rich countries today is a pretty trivial affair compared with the mass migrations of a century ago. And governments today have far more sophisticated ways to compensate losers than they had a century ago. Yet, history does supply a warning: a backlash against globalization can be found in our past, so it might reappear in our future.

¹ T.J. Hatton and J.G. Williamson, "After the Famine: Emigration from Ireland 1850–1913," *Journal of Economic History* (September 1993), pp. 575–600; "What Drove the Mass Migrations from Europe in the Late Nineteenth Century?" *Population and Development Review* (September 1994), pp. 1–27; "Late-Comers to Mass Migration: The Latin Experience," in *Migration and the International Labor Market 1850–1939*, T.J. Hatton and J.G. Williamson, eds. New York: Routledge, 1994; and "International Migration and World Development: A Historical Perspective," in *Economic Aspects of International Migration*, H. Giersch, ed. New York: Springer-Verlag, 1994.

² T.J. Hatton and J.G. Williamson, *The Age of Mass Migration: An Economic Analysis*. New York: Oxford University Press, 1998.

³ K. O'Rourke and J.G. Williamson, *Globalization and History*, chapter 3, Cambridge, MA: MIT Press, forthcoming.

⁴ J.G. Williamson, "The Evolution of Global Labor Markets Since 1830," *Explorations in Economic History* (April 1995), pp. 141-96.

⁵ J.G. Williamson, "Globalization, Convergence and History," *Journal of Economic History* (June 1996), pp. 1-30; J.G. Williamson, "The Evolution of Global Labor Markets Since 1830"; K.O'Rourke and J.G. Williamson, *Globalization and History*, chapter 2.

⁶ K.O'Rourke and J.G. Williamson, "Open Economy Forces and Late 19th Century Swedish Catch-Up: A Quantitative Accounting," *Scandinavian Economic History Review*, 2 (1995), pp. 171-203; "Education, Globalization, and Catch-Up: Scandinavia in the Swedish Mirror," *Scandinavian Economic History Review*, 3 (1996), pp. 287-309; "Around the

European Periphery 1870-1913: Globalization, Schooling and Growth," *European Review of Economic History*, 1 (1997), pp. 153-90. See also A. Taylor, K. O'Rourke, and J.G. Williamson, "Factor Price Convergence in the Late Nineteenth Century," *International Economic Review* (August 1996), pp. 499-530.

⁷ T.J. Hatton and J.G. Williamson, *The Age of Mass Migration*, chapter 3.

⁸ A. Taylor and J.G. Williamson, "Convergence in the Age of Mass Migration," *European Review of Economic History*, 2 (1997), pp. 27-63. See also "Globalization, Convergence and History" and "Around the European Periphery 1870-1913."

⁹ A. Taylor, K. O'Rourke, and J.G. Williamson, "Factor Price Convergence in

the Late Nineteenth Century."

¹⁰ A. Timmer and J.G. Williamson, "Racism, Xenophobia or Markets? The Political Economy of Immigration Policy Prior to the Thirties," NBER Working Paper No. 5867, January 1997; A. Timmer and J.G. Williamson, "Immigration Policy Prior to the Thirties: Labor Markets, Policy Interactions and Globalization Backlash," *Department of Economics, Harvard University* (March 1997).

¹¹ J.G. Williamson, "Globalization, Labor Markets and Policy Backlash in the Past," *Journal of Economic Perspectives* 1998, forthcoming.

¹² K. O'Rourke and J.G. Williamson, *Globalization and History*, chapters 6 and 12.



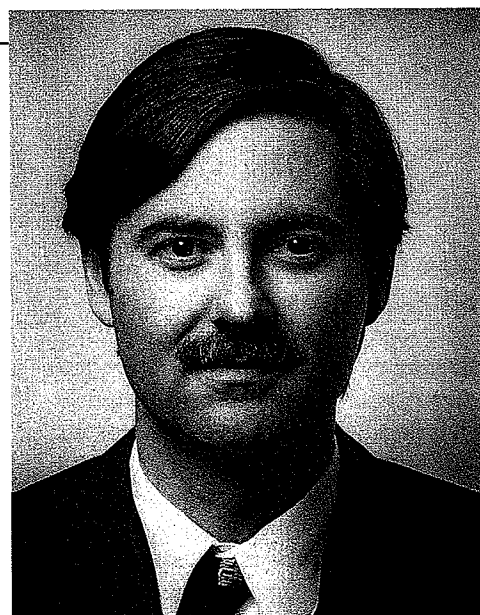
NBER Profile: Campbell R. Harvey

Campbell R. Harvey, the J. Paul Sticht Professor of International Business at Duke University, has been a Research Associate in the NBER's Program on Asset Pricing since 1993. He received his B.A. from the University of Toronto in 1981 and his Ph.D. from the University of Chicago in 1988.

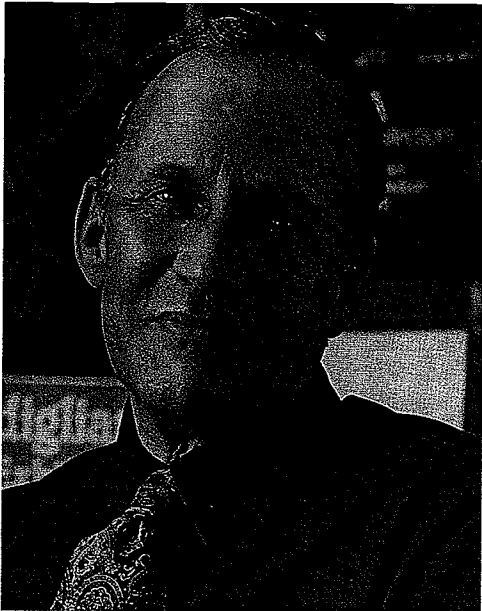
Harvey has served as a visiting faculty member at the University of Chicago and at the Stockholm School of Economics. He was the recipient of the 1993-4 Batterymarch Fellowship. His research focuses on empir-

ical asset pricing with models that allow for risk and risk premiums to change through time. Harvey is also the Associate Editor of 10 journals, including the *Journal of Finance* and the *Journal of Financial Economics*. He is currently the editor of *Emerging Markets Quarterly*.

Harvey lives in Chapel Hill, North Carolina with his wife Susana and their three children, Cassandra, Catriona, and Campbell II. In his leisure time, he enjoys playing the piano and spending time with his family.



NBER Profile: *Jeffrey G. Williamson*



Jeffrey G. Williamson is an NBER Research Associate, the Laird Bell Professor of Economics, and Chairman of the Economics Department at Harvard University. He holds an undergraduate degree in mathematics from Wesleyan University and a Ph.D. in economics from Stanford University.

Williamson taught at the University of Wisconsin for 20 years before joining the faculty at Harvard in 1983. He was appointed the Laird Bell Professor in 1984 and became Chair of the Economics Department in 1997. He teaches economic history, and was twice the recipient (1985, 1994) of the Galbraith Prize for the best teacher in the graduate economics program (awarded by Harvard's graduate students).

Williamson has been a Visiting Professor at Stanford and Cambridge Universities, the University of the Philippines, Australian National University, the Kiel Institute, and the University of Groningen. He has also been a consultant to the World Bank since 1973 and is currently Faculty

Fellow of the Harvard Institute for International Development.

The author of more than 150 scholarly articles and 20 books on economic history and development, Williamson served as President of the Economic History Association in 1994-5. Cambridge University Press is about to publish a book containing his 1997 Mattioli Lectures on globalization, inequality, and labor markets (with Philippe Aghion).

Both Connecticut Yankees, Williamson and his wife, Nancy Penfield, have been married for almost 40 years. Nancy is a computer specialist in Harvard's Department of Sociology. They have four adult children (one an academic economist) and three grandchildren (all babbling about supply and demand). When he is not traveling to Europe and to the developing world (or sitting in his seat behind third base at Fenway), Williamson swims, kayaks, chops wood, makes trails in the woods, and plays with his grandchildren at his cottage in Maine.



Conferences

New Directions in Productivity Analysis

On March 20 and 21, the NBER held a Conference of Research on Income and Wealth on the topic of new directions in productivity analysis. Conference organizers Edwin Dean and Michael Harper, both of the Bureau of Labor Statistics, and Charles R. Hulten, NBER and University of Maryland, selected the following papers for discussion:

Charles R. Hulten, "Total Factor Productivity: A Historical Review and Assessment"

Discussant: Jack Triplett, Bureau of Economic Analysis

Edwin Dean and **Michael Harper**, "The BLS Productivity Measurement Program"

Discussant: W. Erwin Diewert, NBER and University of British Columbia

M. Ishaq Nadiri, NBER and New York University, and **Ingmar R.**

Prucha, University of Maryland, "Dynamic Factor Demand Models and Productivity Analysis"

Discussant: Dale Jorgenson, Harvard University

Susanto Basu, NBER and Harvard University, and **John Fernald**,

Federal Reserve Board, "Why is Productivity Procyclical? Why Do

We Care?"

Discussant: Catherine Morrison, University of California, Davis

Jeremy Greenwood, University of Rochester, and **Boyan Jovanovic**, NBER and New York University, "Accounting for Growth"

Discussant: Barry Bosworth, Brookings Institution

Lucia Foster and **C.J. Krizan**, Bureau of the Census, and **John Haltiwanger**, NBER and University of Maryland, "Aggregate Productivity Growth: Lessons from Microeconomic Evidence"

Discussant: Mark J. Roberts, NBER and Pennsylvania State University

Nazrul Islam, Emory University, "Different Approaches to International Comparison of Total Factor Productivity"

Discussant: Charles Jones, NBER and Stanford University

Barbara M. Fraumeni, Northeastern University, "Expanding Economic Accounts for Productivity Analysis: A Nonmarket and Human Capital Perspective"

Discussant: Frank Wykoff, Pomona College

Martin Baily, McKinsey & Company, Inc., and **Eric Zitzewitz**, MIT, "Service Sector Productivity Comparisons: A Business Approach"

Discussant: Robert J. Gordon, NBER and Northwestern University

Ernst R. Berndt, NBER and MIT, and **A. Denny Ellerman** and **Thomas Stoker**, MIT, "Investment Productivity and Capacity in U.S. Coal Mining: Macro vs. Micro Perspectives"

Discussant: Larry Rosenblum, Bureau of Labor Statistics

Eldon Ball and **Shawna Grosskopf**, Economic Research Service, U.S. Department of Agriculture, and **Rolf Fare** and **Richard Nehring**, Southern Illinois University, "Productivity of the U.S. Agricultural Sector: The Case of Undesirable Outputs"

Discussant: Robin Sickles, Rice University

Frank Gollop and **Gregory Swinand**, Boston College, "Total Resource Productivity: Accounting for Changing Environmental Quality"

Discussant: William Pizer, Resources for the Future

Hulten's paper traces the development of the Solow residual from its origins in the national accounting movement through modern growth theory. He discusses its strengths and weaknesses, including the Solow paradox (where are the computers in the data?) and the "green" critique of growth accounting (where are the pollution externalities?) The former suggests that the Solow residual understates the true growth in pro-

ductivity; the latter suggests just the opposite. Hulten provides a critical review of these and other issues.

Dean and **Harper** review the status of the Bureau of Labor Statistics (BLS) program in the mid-1970s and discuss some important advances in the economics literature of that time. They then describe the development of multifactor productivity (MFP) measures for the private business and private nonfarm business sectors—

these were first published in 1983—as well as more recent work on expanding and improving these measures. They also describe recent extensions and improvements to measures for the manufacturing sector and for more detailed industries both within and outside of manufacturing. Finally, they comment on some of the conceptual and empirical obstacles to further improvements in the measures.

Nadiri and Prucha review dynamic factor demand literature and the use of dynamic factor demand models in estimating technical change. The approach and the class of models reviewed in this paper relax all of the assumptions of traditional productivity analysis, based on Divisia index number methodology. One advantage of this new approach is that it allows for careful testing of various features of a postulated model, rather than simply requiring those features to hold a priori. The approach can thus be used to test the validity of the assumptions underlying the Divisia index number methodology. Another advantage of the approach is that it generates a rich set of information about the structure of production, sources of productivity growth, the impact of technological change and the effects of policy instruments and expectation on output supply, input demand, and the direction of technical change.

Basu and Fernald find that variable utilization of inputs over the business cycle and resource reallocations are particularly important in explaining procyclical productivity. After controlling for those two factors and for imperfect competition and increasing returns, they find that aggregate technology improvements are contractionary, not expansionary, in the short run. The authors argue that models with sticky prices tend to predict this result. They also argue that the reallocation effects that they identify are not "biases"—they reflect changes in an economy's ability to produce goods and services for final consumption from given primary inputs of capital and labor. Thus, from a normative viewpoint, reallocations are significant for welfare; from a positive viewpoint, they constitute potentially important amplification and propagation mechanisms for macroeconomic modeling.

Greenwood and Jovanovic note that a satisfactory account of the

post-war growth experience of the United States should be able to come to terms with the following: 1) A slowdown in productivity began in the early 1970s. 2) The relative price of equipment falls steadily. 3) The skill premium rose, starting in the 1970s. The authors show that variants of Solon's (1960) vintage-capital model can go a long way toward explaining these facts. In brief, the explanations are: 1) Productivity slowed down because the new information technologies took longer to learn than earlier vintages of technology, and their implementation throughout the economy took some time. 2) The price of equipment fell because new technologies allow efficiency units of equipment to be produced more cheaply. 3) The skill premium rose because the newer more efficient capital complemented skill and because the use of skilled labor made adopting new technologies easier.

Foster, Krizan, and Haltiwanger seek to synthesize and extend the emerging literature on the connection between micro and aggregate productivity growth dynamics. They focus primarily on the empirical findings and find that the measured quantitative contribution of the role of reallocation for aggregate productivity growth varies significantly across studies. They try to understand the sources of these differences in results by first comparing the results across studies carefully, taking note of differences on a variety of dimensions including country, sectoral coverage, time period, frequency, and measurement methodology. Then they exploit establishment-level data for the U.S. manufacturing sector, as well as for a few selected service sector industries, to conduct their own independent investigation of the relevant issues. The inclusion of service sector results is of particular interest because the existing literature has almost exclusively focused on manufacturing industries.

Islam compares the methodologies and the results of the three approaches that can be used to compute total factor productivity (TFP) across countries: the time-series growth-accounting approach; the cross-section growth-accounting approach; and the panel regression approach. The time-series approach is long-standing and sophisticated, with limited application to a small sample of developed countries for which the required data are available. However, from the point of technological diffusion and convergence, the processes working in wider samples of countries may be of particular interest. The cross-section growth accounting and the panel regression approaches can help in this regard because both have produced indexes of relative TFP levels for large samples of countries. But neither of these two methodologies is flawless; however, each can contribute to our understanding of the cross-country processes related to TFP and technology. Furthermore, with time-series data accumulating with each year, extending the time-series approach (if not its very sophisticated version) to larger and larger samples of countries is more and more feasible.

Fraumeni models both firms and households as producers. The household is conceptualized as just another sector of production. Many prices of inputs and outputs in the household sector need to be inferred because they are not directly observable. A satellite account is a reasonable way to incorporate household accounts into the national accounts, because a wide range of values can result from alternative methodologies. This model is not like older models; it emphasizes human and nonhuman capital, and does not characterize households as producers.

Baily and Zitzewitz refer to a series of studies by the McKinsey Global Institute that compare productivity performance within indus-

tries across the major industrial countries and some developing countries. The authors, who look at five service industries, explore the implications of this work for output measurement. For example, the evolution of the hub-and-spoke system in airlines raised the frequency of service but adversely affected conventionally measured productivity. The major direction of innovation in retailing has been the development of new formats, notably high-service specialty retailers. Correct output measurement in services must capture the benefit to consumers of industry evolution.

Berndt, Ellerman, and Stoker exploit an unusual database to explore the differences between productivity trends at the aggregate level and at the firm level. The industry under scrutiny is the American coal industry, and the database is collected by the Mine Safety and Health Administration (MSHA) as part of its regulatory effort. Specifically, labor input and coal output are reported for every mine in the United States from 1972 on (through 1995 in the authors' analysis), along with the location of the mine and the mining technique. Thus, the authors can observe labor productivity for this

industry at the lowest practicable level, forming a national aggregate, as well as any number of subaggregates, from the bottom up. After some introductory comments on output, price, and productivity trends and the considerable heterogeneity of the industry, they divide the industry into 11 relatively homogeneous subaggregates based on technology and on location, which they use as a proxy for geology. They address the relation between labor productivity and total factor productivity, and discuss and develop several aggregate measures of productivity change based on the 11 subaggregates. Finally, they explain the dataset, present the model they use to estimate labor productivity at the level of the subaggregates and their summary regression results, as well as discussing what they identify as the four sources of productivity change in the American coal industry.

Ball, Fare, Grosskopf, and Nebring show how to model the joint production of goods and bads in a way that is useful for productivity analysis. They apply that model to data on the U.S. agricultural sector using activity analysis techniques. The authors apply their methods to a panel of

state-level data recently made available by Agriculture's Economic Research Service which includes variables that proxy the effects of pesticides and fertilizer on ground and surface water for 1972 to 1993. Although the authors consider these results to be preliminary, they find—as expected—that measured productivity differs when bads are accounted for. Their preferred model generally reports lower productivity growth for states with patterns of increasing trends in the pesticide and fertilizer variables.

Gollop and Swinand suggest a proper framework for total resource productivity (TRP) measurement. The welfare-based model they introduce derives formally from a model of welfare maximization. In this respect, it does depart from the “producer perspective” common to mainstream productivity work. However, it does not define TRP growth as the net growth in welfare, but rather as the net growth in “social” output within the welfare function. It effectively adopts a household-based production approach and thereby is wholly consistent with the evolution of productivity measurement over the past 40 years.



Thirteenth Annual Conference on Macroeconomics

Nearly 75 researchers convened in Cambridge on April 3-4 for the NBER's Thirteenth Annual Conference on Macroeconomics. As in recent years, this conference was organized by Ben S. Bernanke, NBER and Princeton University, and Julio J. Rotemberg, NBER and Harvard University. The following papers were presented and discussed:

John Shea, NBER and Princeton University, "What Do Technology Shocks Do?"

Discussants: Jordi Gali, NBER and New York University, and Adam B. Jaffe, NBER and Brandeis University

Pierre-Olivier Gourinchas, Stanford University, "Exchange

Rates, Job Creation and Destruction Discussants: David Backus, NBER and New York University, and Russell Cooper, NBER and Boston University

Casey Mulligan, NBER and University of Chicago, "Substitution over Time: Another Look at the Life Cycle Labor Supply"

Discussants: Robert E. Hall, NBER and Stanford University, and Jörn-Steffen Pischke, NBER and University of Chicago

Robert Shimer, Princeton University, "Why is the U.S. Unemployment Rate So Much Lower?"

Discussants: Richard Rogerson, University of Pennsylvania, and

Robert H. Topel, NBER and University of Chicago

Simon Gilchrist, NBER and Boston University, and **Charles Himmelberg**, Columbia University, "Investment Fundamentals and Finance"

Discussants: David Gross, University of Chicago, and Kenneth D. West, NBER and University of Wisconsin

John H. Cochrane, NBER and University of Chicago, "A Cashless View of U.S. Inflation"

Discussants: Henning Bohn, University of California, Santa Barbara, and Michael Woodford, NBER and Princeton University

Shea investigates the dynamic interactions of inputs, productivity, and technological indicators, such as R and D and patents, using annual panel data on 19 U.S. manufacturing industries from 1959-91. He finds that favorable technology shocks tend to increase inputs, especially labor, in the short run, but tend to decrease inputs in the long run. Favorable technology shocks do not increase measured total factor productivity at any horizon. Technology shocks contribute little to industry-level volatility at short- and medium-run horizons but are more important at longer-run horizons.

Gourinchas evaluates the importance of exchange rate movements on factor reallocation across and within sectors. He seeks to provide accurate estimates of the impact of exchange rate fluctuations and to further our understanding of how reallocation shocks propagate through the economy. He finds that exchange rates have a significant effect on gross and net job flows in the traded goods sector. Moreover, job creation and destruction move with each

other and in the same direction after a real exchange rate shock. His results indicate a strong tension between the positive co-movements of gross flows in response to reallocation disturbances and the negative co-movement in response to aggregate shocks.

Most studies of the intertemporal substitution of work use life-cycle data; from those studies, many have concluded that intertemporal labor substitution is not important for macroeconomics. **Mulligan** takes another look at life-cycle data and argues that a consideration of measurement errors, on-the-job training, and labor force participation over the life cycle suggests that substitution over time may be very important for macro fluctuations. The life-cycle data he uses includes fairly standard male cross-section and panel data samples, as well as a sample of women experiencing the termination of AFDC benefits as their youngest child turns 18 years old.

The unemployment rate in the United States is lower now than it has been since 1970. **Shimer** argues that the baby boom caused the increase

in unemployment during the 1960s and 1970s and the subsequent reduction in unemployment during the last two decades. He cites two reasons for this: First, total U.S. unemployment is a weighted average of the unemployment rates of workers in different age groups. The entry of the baby boom into the labor force in the late 1960s and 1970s increased the proportion of the labor force in its teens, the group with the highest unemployment rate. This placed more weight on the high unemployment group, raising the U.S. unemployment rate. The aging of the baby boom in the 1980s and 1990s reversed this trend. Second, the demand for teenage labor is somewhat inelastic, so the increase in the number of teenage workers in the 1960s and 1970s did not lead to a corresponding increase in teenage jobs. This raised the teenage unemployment rate. The aging of the baby boom during the 1980s and 1990s again returned the teenage unemployment rate to its normal level. Other demographic changes, notably the increased education of the labor force, have not

had a large effect on unemployment, Shimer concludes.

Gilchrist and **Himmelberg** separately identify and quantify the influence of "fundamental" determinants of investment from the influence of "financial" determinants of investment. Using a combination of firm-level sales and average industry returns, they construct alternative measures of the marginal product of capital that are not closely correlated with cash flow but are closely correlated with investment. One part of their analysis implies that cash flow shocks cause fundamentals to fall and investment to rise. Cash flow shocks also trigger a strong reorganization of the balance sheet: cash positions are shored up, debt is paid down, and the overall financial position of the firm is improved. Invest-

ment responds significantly to both fundamentals and financial variables. Their estimates imply that, for the average firm in their sample, financial factors raise the overall response of investment to an expansionary shock by 30 percent, relative to a baseline case for which financial factors are shut down.

Financial innovation challenges the foundations of monetary theory, and standard monetary theory has not been very successful at describing the history of U.S. inflation. Motivated by these observations, **Cochrane** asks, "Can we understand the history of U.S. inflation using a framework that ignores monetary frictions?" The fiscal theory of the price level allows us to think about price level determination with no monetary frictions. The price level

adjusts to equilibrate the real value of nominal government debt with the present value of surpluses. He describes the theory and argues that money is valued via a commodity standard or because the government accepts it to pay taxes. Both sources of value are immune to financial innovation and the presence or absence of monetary frictions. He then shows how the fiscal theory can accommodate the stylized facts that deficits and inflation seem to be negatively correlated.

This conference will result in a volume published by MIT Press. It may be ordered directly from the MIT Press at 5 Cambridge Center, Cambridge, MA 02142; or, by phone to (617) 253-2889; or, by email to mitpress-orders@mit.edu.

Trade, the Environment, and Natural Resources

The NBER Universities Research Conference on "Trade, the Environment, and Natural Resources," organized by James A. Brander of NBER and University of British Columbia, took place on May 8-9 in Cambridge. The following papers were discussed:

William K. Jaeger, Williams College, "A Theoretical Basis for the Environmental Inverted-U Curve and Implications for International Trade" Discussant: Clive Chapple, Queen's University

Werner Antweiler, **Brian Copeland**, and **M. Scott Taylor**, University of British Columbia, "Is Free Trade Good for the Environment?"

Discussant: Michael Rauscher, University of Rostock

Josh Ederington, University of Wisconsin, "International

Coordination of Trade and Domestic Policies"

Discussant: Robert Driskill, Vanderbilt University

John Beghin, North Carolina State University; **Brad Bowland**, University of Minnesota; **Sebastian Dessus** and **Dominique van der Mensbrugghe**, OECD; and **David Roland-Holst**, Mills College, "The Interface between Growth, Trade, and the Environment in Chile: Evidence from an Economy-wide Model"

Discussant: Eckhard Janeba, Indiana University

Carlo Perroni, University of Warwick, and **Randall Wigle**, Wilfrid Laurier University, "International Process Standards and North-South Trade"

Discussant: K. C. Fung, University of California, Santa Barbara

Jinhua Zhao, Iowa State

University; **Larry Karp**, University of California, Berkeley; and **Sandeep Sacheti**, American Express, "Common Ground between Free-traders and Environmentalists"

Discussant: Eduardo Vergara, Princeton University

John M. Hartwick, Queen's University, and **Ngo Van Long**, McGill University, "Deforestation and Development in a Small Open Economy"

Discussant: Georges Tanguay, McGill University

Arik Levinson, NBER and University of Wisconsin, "NIMBY Taxes Matter: State Taxes and Interstate Hazardous Waste Shipments" (NBER Working Paper No. 6314)

Discussant: Kathleen Segerson, University of Connecticut

Jaeger describes an "inverted-U" pattern, by which environmental damage will first rise and then fall

with rising incomes. He then develops a simple model in which the efficient path of environmental degrada-

tion produces an inverted-U shape. In most natural environments, two distinct types of services, one rival

and one nonrival, create a fundamental asymmetry in the aggregation of values. Typically, a nonrival or public good, such as ambient air quality or other amenities, competes with and is traded off against a private or rival good, such as waste disposal (pollution) or resource extraction. This asymmetry generally produces an efficient path similar to the observed inverted-U or "environmental Kuznets curve." This finding may have important policy implications, especially where environmental degradation is irreversible. In such situations, the case for preventing irreversible damage to the environment may be strengthened if increased future benefits can be predicted. Jaeger suggests that, given the U-curve, free trade may hasten the onset of a pollution downturn sooner, and at a lower level of pollution, than a more closed economy would.

Antweiler, Copeland, and Taylor set out a theory of how openness to international markets affects pollution concentrations. With data on sulfur dioxide concentrations from the Global Environment Monitoring Project, they divide trade's impact on pollution into scale, technique, and composition effects, which they then isolate and measure. They find that trade liberalization creates relatively small changes in pollution concentrations when it alters the composition, and hence the pollution intensity, of national output. If trade raises the value of national output and incomes, then the estimates of the associated technique and scale effects imply a net reduction in pollution from these sources. Combining these estimates of scale, composition, and technique effects yields a surprising conclusion: Freer trade appears to be good for the environment.

Using a model of self-enforcing international agreements, like the GATT, **Ederington** considers how to allocate scarce international enforcement power over trade and domestic policies within a unified agreement. He shows that, even when limited enforcement power prevents countries

from implementing a fully efficient set of trade and domestic policies, those countries may cooperate over domestic policy (set the domestic policy to fully counter any domestic distortion) and then adjust their trade policies to maintain the viability of the agreement. He then applies this basic result—that limited enforcement power restricts the trade (but not the domestic) policies attainable—to the question of how such joint agreements ideally might be structured.

Beghin, Bowland, Dessus, Roland-Holst, and van der Mensbrugghe investigate the implications of trade liberalization and pollution taxes on aggregate income and the environment in Chile. The environment is characterized by pollution emissions linked to economic activity, natural-resource use, and public health implications of urban air pollution in Santiago. Unilateral trade liberalization induces substantial worsening of pollution emissions and expansion of resource-based sectors. NAFTA integration is environmentally benign in terms of pollution emissions. MERCOSUR membership and unilateral liberalization have a negative effect on the environment and urban morbidity and mortality. Unilateral trade liberalization induces health damages equal to 13 percent of the income gains from free trade.

Perroni and Wigle examine the choice between alternative trade-based approaches to reducing global environmental damage, such as trade-related process standards, and tariff-based approaches. They find that both trade-related process standards and tariff-based policies are rather ineffective at reducing global emissions when compared with direct environmental policy instruments, such as general process standards. The adoption of command and control policies, such as general process standards, however, might be exceedingly costly to developing countries, especially because cleaner technologies require use of inputs that are comparatively more abundant in richer countries. By contrast, the adoption of tighter environmental

policies is likely to be relatively effective at reducing emissions, and dramatically less costly.

Zhao, Karp, and Sacheti study the effects of trade on resource use and welfare. Trade may cause an environmentally poor country to "drag down" its richer trading partner; in this case, both countries degrade their stocks of resources. Alternatively, trade may enable the environmentally richer country to "pull up" its partner; in this case both countries preserve their stocks of resources. These results rationalize the positions of environmentalists and free-traders. The direction of trade may change over time, but in steady states it is either inefficient or indeterminate.

Hartwick and Long describe an economy facing world prices and starting with a large endowment of land in forest and a small endowment of land in agriculture. Clearing forested land yields marketable timber and a unit of land for agriculture. Early on, the high price of agricultural land drives the clearing process. Later, the profit from marketing timber from the cleared land drives the process. Dates of "phase transitions" are endogenous. They also show that perpetual cyclic clearing and reforestation may be optimal for overshooting the steady state.

Levinson examines the extent to which state taxes have inhibited interstate transport of hazardous waste for disposal in the United States. He uses panel data from the Toxics Release Inventory and the Resource Conservation and Recovery Act on interstate shipments of waste and analyzes the data in conjunction with a set of state characteristics, including hazardous waste disposal taxes and disposal capacity. He concludes that hazardous waste taxes are a statistically and economically significant deterrent to interstate waste transport; that taxes are being imposed by large-capacity and large-import states; and, therefore, that these taxes have had a decentralizing effect on the national pattern of hazardous waste transport and disposal.

Bureau News

New Directors Elected

Three new directors have been elected to the NBER's Board over the past few months. **Gavin Wright**, the William Robertson Coe Professor of American Economic History at Stanford University and president of the Economic History Association,

replaces EHA past-president Richard Easterlin on the Board.

John Lipsky, chief economist of The Chase Manhattan Bank, and formerly chief economist of Salomon Brothers, Inc., is a newly-elected director at large. **Stephen Fried-**

man, a limited partner at Goldman, Sachs & Co., who was previously that company's co-chief operating officer and chairman, is also an NBER director at large. (Profiles of Lipsky and Friedman will appear in the next issue of the *NBER Reporter*.)

Productivity and Technological Change

On March 6, researchers in the NBER's Program on Productivity met at the Bureau's Cambridge office. **Jean O. Lanjouw**, NBER and Yale University, and **Mark Schankerman**, the London School of Economics, chose these topics for discussion:

Bronwyn H. Hall, NBER and University of California, Berkeley.

Adam B. Jaffe, NBER and Brandeis University, and **Manuel Trajtenberg**, NBER and Tel Aviv University. "Market Value and Patent Citations: A First Look"

Mary Ellen Mogee, Mogee Research & Analysis Associates.

"Patent Citations and Licensing Revenues"

Arvids Ziedonis, University of California, Berkeley. "Analyzing Academic Patent Licensing and Citation"

Discussant: **Suzanne Scotchmer**, NBER and University of California, Berkeley.

Dieter Harhoff

Wissenschaftszentrum Berlin, **Frederic M. Scherer**, Harvard University, and **Katrin Vopel**, Zentrum für Europäische Wirtschaftsforschung. "Citations, Family Size, Opposition, and the

Value of Patent Rights—Evidence from Germany"

Jean O. Lanjouw and **Mark Schankerman**. "Measuring Innovation: What Do We Gain from Multiple Indicators?"

Jonathan Putnam, Charles River Associates. "How Many Pennies for Your Quote? Estimates of the Value of Patent Citations"

Jean O. Lanjouw, **Ariel Pakes**, NBER and Yale University, and **Jonathan Putnam**. "A Report on a European Patents Project"

As patent data increasingly become available in machine-readable form, more researchers are using measures based on patents and their citations as indicators of technological output and information flow. **Hall, Jaffe, and Trajtenberg** explore the economic meaning of citation-based patent measures using the financial market valuation of the firms that own the patents. With a new comprehensive dataset containing more than 4,000 U. S. manufacturing firms and their patenting activity for the past 20 years, they analyze the contributions of R and D spending, patents, and citation-weighted patents to measures of Tobin's Q for the firms, attempting to learn what patent citations really

measure and whether they can be used as proxies for economically significant innovative activity

Mogee investigates the relationship between patent licensing revenues and patent citations. She focuses on a sample of 49 patents that generated licensing revenues and 147 that did not. For each patent, there is data available on the annual number of citations from 1971–85. She finds that the number of citations is strongly associated with the probability that a patent will generate licensing revenue, although not necessarily much revenue. There is only weak evidence of a relationship between revenues and citations; and little or no evidence of a difference among chemical, mechanical, and

electrical industries in the average number of citations per patent. However, there is an apparent relationship between the number of citations and revenues for two industries: biomedical and pharmaceutical.

Ziedonis, using observed licensing income as a measure of patent value, and drawing on new licensing data on 530 patents issued to the University of California from 1975 to 1988, examines the correlation between citations to university patents and net licensing income from those patents. His results indicate that the mean number of citations is significantly higher for licensed than for unlicensed patents. But there appears to be no significant difference in the mean number of

citations to exclusively- versus non-exclusively-licensed patents.

Harhoff, Scherer, and Vopel use survey estimates of the monetary value of individual patent rights and a broad set of indicators to search for reliable approximations of patent value. Their results suggest that both the number of backward citations (either to the patent or to the literature) and the citations that a patent receives are positively related to value. The number of different four-digit International Product Code classifications does not imply value in their data. However, patents that are upheld against opposition, or that represent large international patent families, are particularly valuable.

Lanjouw and Schankerman analyze a new, large scale database that brings together detailed information on patents in the United States from 1975-91. These data provide multiple indicators of a patent's underlying, unobservable value. Rather than

treat any of these indicators as "correct," the authors analyze them together in a latent variable framework that allows for each observable indicator to contain "measurement" error. One of their main objectives is to quantify how much "noise" each indicator contains; then they attempt to determine how the multiple indicators can be used together to construct a more informative measure of the patent's underlying, unobservable value.

Putnam asks how well counts of patent citations indicate the private value of returns to patenting; how subsequent inventions affect the private and social returns to R and D; and how a patent holder might respond to new information. He concludes that citations do explain some of the variation in the private value of patent returns. He notes that the firm's citing behavior is different from that of its rivals. Finally, citations provide evidence of disclosure, invest-

ment opportunities, endogenous depreciation, and creative destruction, he concludes.

Lanjouw, Pakes, and Putnam report on a joint project that analyzes a new comprehensive database of European patents. The primary goal of the project, sponsored by the OECD, is to combine family and renewal data for each patent to devise better measures of innovation. Future work with the data will include an investigation of R and D and innovation in the pharmaceutical industry.

In addition to the presentations described here, the meeting included a discussion of current and future projects in developing indicators of science and technology, led by **Dominique Guellec** of the OECD. The day concluded with a roundtable discussion led by **Zvi Griliches**, NBER and Harvard University, **Ariel Pakes**, and **Mark Schankerman**.

International Finance and Macroeconomics

On March 20, more than 30 members and guests of the NBER's Program on International Finance and Macroeconomics met to discuss their recent research. Charles M. Engel, of NBER and the University of Washington, and Andrew K. Rose, of NBER and the University of California, Berkeley, organized the meeting and chose the following papers for presentation:

V.V. Chari and **Patrick J. Kehoe**, Federal Reserve Bank of Minneapolis, "On the Need for Fiscal Constraints in a Monetary Union"

Discussants: Rudiger Dornbusch, NBER and MIT, and Nouriel

Roubini, NBER and New York University

Jose M. Campa and **Holger C. Wolf**, NBER and New York University, "Is Real Exchange Rate Mean Reversion Caused by Arbitrage?"

Discussants: Menzie D. Chinn, NBER and University of California, Santa Cruz, and Charles M. Engel

Roberto Rigobon, MIT, "Informational Speculative Attacks: Good News Is No News"

Discussants: Maurice Obstfeld, NBER and University of California, Berkeley, and Andres Velasco, NBER and New York University

Shang-jin Wei, NBER and Harvard

University, and **Junshik Kim**, Harvard University, "The Big Players in the Foreign Exchange Market: Do They Trade on Information or Noise?"

Discussants: Linda S. Goldberg, Federal Reserve Bank of New York, and Richard K. Lyons, NBER and University of California, Berkeley

Giancarlo Corsetti, Yale University, and **Paolo A. Pesenti**, NBER and Princeton University, "Welfare and Macroeconomic Interdependence"

Discussants: Caroline Betts, University of Southern California, and Dale Henderson, Federal Reserve Board

Chari and Kehoe show that the desirability of debt constraints in monetary unions depends critically on the extent of commitment of the

monetary authority. If the monetary authority can commit to its policies, then debt constraints will only impose costs. If the monetary author-

ity cannot commit, however, then there is a free-rider problem in fiscal policy, and debt constraints may be desirable.

Campa and **Wolf** address a presumption in the theory of purchasing power parity: that the presence of arbitrage opportunities in goods markets causes mean reversion in the exchange rate. Looking at a monthly panel of the G-7 countries from 1960 to 1996, they find consistent mean reversion in bilateral real exchange rates. However, this behavior of exchange rates is not correlated with trade flows. Deviations of trade and of real exchange rates from trend are virtually uncorrelated. Large trade deviations do not seem either to cause or to accelerate mean reversion, nor do large deviations of real exchange rates seem to be associated systematically with trade volume or changes in trade levels. This lack of correlation persists even in the most pronounced cases of real exchange rate mean reversion.

Rigobon notes that several economists have pointed out that the apparent overreaction of financial

markets is a major factor contributing to the magnification of currency crises. He develops a simple model in which investors face uncertainty about the underlying fundamentals of the economy and in which the learning process is affected by the agents' actions. The model captures three characteristics of recent speculative attacks: excess volatility in capital flows; why these types of problems are more likely to occur in developing countries; and why the attacks tend to be concentrated in time and regions.

Wei and **Kim** ask whether private information exists in the foreign exchange market and whether speculation reduces or exacerbates volatility. Using a recent dataset describing foreign currency positions (including positions on options and other derivatives) of large market participants, they arrive at two main findings. First, the absolute value of the options position as well as large participants'

spot, forward, and futures positions Grainger-cause exchange rate volatility, which suggests that the large participants' currency speculation does not stabilize exchange rate volatility. Second, there is no positive association between large participants' positions in a foreign currency and its subsequent appreciation. This casts doubt on the view that large participants have better information about the future movement of exchange rates and further strengthens the case that the large players trade on noise rather than on information.

Corsetti and **Pesenti** analyze the international transmission of monetary and fiscal policies. In contrast to the traditional literature, their findings emphasize the positive externalities of foreign monetary expansions and foreign fiscal contractions on domestic welfare, while highlighting the ambiguous effects of domestic policy shocks on welfare.

International Trade and Investment

On March 27 and 28, members and guests of the NBER's Program on International Trade and Investment met to discuss their recent research. Program Director Robert C. Feenstra, also of the University of California, Davis, organized the program.

James R. Markusen, NBER and University of Colorado, and

David Carr and **Keith Maskus**, University of Colorado, "Testing the Knowledge-Capital Model of Multinational Enterprise"

Shang-Jin Wei, NBER and Harvard University, "Why is Corruption So Much More Taxing than Tax?"

"Arbitrariness Kills" (NBER Working Paper No. 6255)

Alessandra Casella, NBER and Columbia University, and **James E. Rauch**, NBER and University of California, San Diego, "Overcoming Informational Barriers to International Resource Allocation: Prices and Ties"

Gordon H. Hanson, NBER and University of Texas, "Market Potential, Increasing Returns, and Geographic Concentration" (NBER Working Paper No. 6429)

Dan Ben-David, NBER and Tel-Aviv University, and **Michael**

Loewy, University of Houston, "Free Trade, Growth, and Convergence" (NBER Working Paper No. 6095)

Kenneth F. Scheve, Harvard University, and **Matthew J. Slaughter**, NBER and Dartmouth University, "What Determines Individual Trade-Policy Preferences?"

Xavier Gabaix, Harvard University, "The Factor Content of Trade: A Rejection of the Heckscher-Ohlin-Beontief Hypothesis"

Carr, **Markusen**, and **Maskus** explain that the "knowledge-capital model" of the multinational firm includes three principal assumptions.

First, knowledge-based and knowledge-generating activities, such as R and D, can be separated geographically from production and supplied

to production facilities at low cost. Second, these knowledge-intensive activities are skilled-labor intensive relative to production; that gives rise

to vertical multinationals, which in turn fragment production and locate their activities according to factor prices and market size. Third, knowledge-based and knowledge-generating activities have a (partial) joint-input characteristic, in that they can be supplied to additional production facilities at low or zero cost; that gives rise to horizontal multinationals, which produce the same goods or services in multiple locations.

Wei analyzes the effect of corruption-induced uncertainty on foreign direct investment. His measure of uncertainty is based on unpublished responses by individuals to a survey on levels of corruption in "host countries." The result is striking—the effect of uncertainty on FDI is negative, statistically significant, and quantitatively large. An increase in the uncertainty level from that of Singapore to that of Mexico, which is at the average level of corruption in the sample, is equivalent to raising the tax rate on multinational firms by 32 percentage points.

Casella and **Rauch** show that imperfect international information creates difficulties in matching agents with productive opportunities and interferes with the ability of prices to allocate scarce resources across countries. Information-sharing networks among internationally dispersed ethnic minorities or business groups can

improve the allocation of resources, but they also might hurt those excluded from the preferential information channels. However, when ties are denser among countries with small wage differences than among countries with large wage differences, then such networks can worsen the allocation of resources and reduce the value of world output despite improving the welfare of the group itself.

Hanson examines the spatial correlation of wages, employment, and consumer purchasing power. Using data on U.S. counties, his estimates show support for small but significant scale economies and suggest that geographic concentration is a stable feature of the spatial distribution of economic activity. He also finds that demand linkages among regions are strong and growing over time, but limited in geographic scope. Shocks to income in one location also affect wages and employment in other locations.

Ben-David and **Loewy** emphasize the role of knowledge spillovers that are the result of increased trade on income convergence and long-run growth rates. Using evidence on 5 of the 6 original European Economic Community countries, they find that the removal of trade barriers during the postwar period coincided with new higher and steeper growth paths

for each country. Export-GDP ratios in each of the countries were substantially higher as well.

Scheve and **Slaughter** use a 1992 dataset of U.S. individuals' stated trade-policy preferences and find that factor-type dominates industry-of-employment in explaining support for trade barriers: home ownership in counties with a manufacturing mix concentrated in comparative-disadvantage industries is strongly correlated with support for trade barriers. This suggests that preferences depend in part on asset values. To the extent that trade policy is like other government policies affecting citizens, by changing relative product prices, these findings have implications for how individuals form opinions about a wide range of economic policies.

Gabaix submits Leontief's hypothesis on the factor content of trade to a genuine test. This hypothesis suggests that the traditional Heckscher-Ohlin-Vanek theory works if there are factor-augmenting differences in technology (for example, if an English worker is equivalent to 80 percent of an American worker). The data fail to confirm this theory, even if the test is restricted to the OECD countries. Gabaix explains links with the rest of the literature (for example, Daniel Treffer's work) which had supported this hypothesis.



The Well-being of Children

The NBER's Program on Children met in Cambridge on April 2 to discuss recent research. Program Director Janet Currie, also of the University of California, Los Angeles, selected the following papers for discussion:

Christopher Ruhm, NBER and University of North Carolina, Greensboro, "Parental Leave Entitlements and Children's Health

Joshua Angrist, NBER and MIT, and **Jonathan Johnson**, MIT, "Effects of Parental Absence on Families: Evidence from the Persian Gulf War."

Jasneem Chitty, Brandeis University, and **Ann Dryden Witte**, NBER and Wellesley College, "Effects of Information Provision in a Vertically Differentiated Market."

Phillip B. Levine, NBER and

Wellesley College, and **David Zimmerman**, Williams College, "The Effects of Welfare on Child Well-Being."

Karen Norberg, NBER and Boston University, "When Does Mother Go to Work? Infant Health, Development, and Temperament as Predictors of Mother's Labor Force Participation in the First Five Years."

Ruhm asks whether rights to paid parental leave improve pediatric health, as measured by birth weights and infant or child mortality rates. He uses data for nine European countries from 1969 to 1994, comparing changes in the pediatric outcomes to those of senior citizens, whose health is not expected to be affected by parental leave. He finds that more generous leave rights reduce the death rates of infants and young children. The magnitudes of the estimated effects are substantial. Further, a much stronger negative relationship exists between leave durations and postneonatal mortality or fatalities between the first and fifth birthday than between leave durations and perinatal mortality, neonatal deaths, or the incidence of low birth weight.

Angrist and **Johnson** estimate the effect of Gulf War deployment of men and women on their spouses' employment, their divorce rates, and their children's outcomes. Data from the 1992 Survey of Officers and Enlisted Personnel show that personnel deployed to the Gulf spent about 6 more months away from home than nondeployed military personnel. The estimates suggest that deployment of male soldiers reduced their wives' employment rates, probably as a result of added child care responsibilities. Deployment of fe-

male soldiers did not change their husbands' employment rates, but was associated with higher divorce rates. A year without a parent appears to increase the incidence of temporary handicaps in children by about 1.2 percentage points.

Chitty and **Witte** study the effects of consumer information on equilibrium market prices and observable product quality in the market for child care. They show conditions under which increased consumer information reduces price dispersion, maximum price, and average price; they then examine the effects of resource and referral agencies (R&Rs) on the distribution of child care prices and on the distribution of staff-child ratios. The authors find that R&Rs have economically large and statistically significant effects on the distribution of prices for the care of infants and toddlers. Geographic markets with R&Rs have significantly less price dispersion and lower maximum prices. Yet information provision via R&Rs does not affect staff-child ratios significantly. These findings support the contention that information provision can intensify price competition.

Levine and **Zimmerman** examine the effects of a mother's receipt of welfare on the well-being of children, including their health, and their

cognitive, social, and emotional development. Using data from the matched mother-child file from the National Longitudinal Survey of Youth, they find that once unobservable differences in mothers' characteristics are controlled for, the negative raw correlation between maternal welfare receipt and children's outcomes is eliminated completely.

Norberg reports that preexisting differences among children might explain certain daycare outcome effects. In a sample of 6697 children whose mothers participated in the National Longitudinal Survey of Youth, Norberg finds that infant health, development, and temperament are significant predictors of maternal employment. Mothers of infants with intrauterine growth retardation, extended hospitalization, or delayed development returned to work significantly later than other mothers, and mothers of infants with difficult temperaments returned to work significantly earlier than others. Infants' difficult temperaments affected mothers who worked before pregnancy differently from mothers who did not. Child gender affected mothers of lower and higher cognitive ability differently. The magnitude of these effects was large enough to have some practical importance.

Labor Studies

On April 3, the NBER's Program on Labor Studies met in Cambridge to discuss recent research. Program Director Richard B. Freeman and Research Associate Lawrence F. Katz, both of NBER and Harvard University, organized the meeting at which the following papers were presented:

Daren Acemoglu, MIT, and **Joshua Angrist**, NBER and MIT, "Consequences of Employment Protection: The Case of the Americans with Disabilities Act"; **Henry S. Farber**, NBER and

Princeton University, "Union Success in Representation Elections: Do Large and Small Units Differ?"; **Coen Teulings**, University of Amsterdam, "Aggregation Bias in Elasticities of Substitution"; **John J. Donohue**, NBER and Stanford University; **James J. Heckman**, NBER and University of Chicago; and **Petra E. Todd**, University of Pennsylvania, "Social Action, Private Choice, and Philanthropy: Understanding the Sources of Improvements in Black

Schooling in Georgia, 1911-1960"; **Harry Holzer**, Michigan State University; and **David Neumark**, NBER and Michigan State University, "What Does Affirmative Action Do?"; **David Card**, NBER and University of California, Berkeley; and **Alan B. Krueger**, NBER and Princeton University, "A Reanalysis of the Effect of the New Jersey Minimum Wage Increase on the Fast-Food Industry with Representative Payroll Data."

Acemoglu and **Angrist** note that the 1990 Americans With Disabilities Act (ADA) requires employers to accommodate disabled workers and outlaws discrimination against the disabled in hiring, firing, and pay. Although the ADA increases costs for employers, its impact turns in part on the provisions that are enforced and on the responsiveness of firm entry and exit to profits. The authors find that the ADA negatively affects employment of disabled workers under age 40 and disabled men over 40, but not disabled women over 40. There is little evidence of an impact on the nondisabled, suggesting that the adverse consequences of employment protection are limited to the protected group.

Farber notes that unions always have been less likely to win National Labor Relations Board (NLRB)-supervised representation elections in large establishments than in small ones, but that the gap in success rates has increased substantially over the last 40 years. He develops a pair of statistical models of election outcomes, which he then estimates using data on NLRB elections during 1952-95. He finds that the model which constrains the mean difference in pro-union vote probability between large

and small units to be fixed over time but allows for random heterogeneity across elections can explain the time-series patterns of "win rates" quite well.

While the employment effects of minimum wages are usually reported to be small (suggesting low substitutability among skill types), direct estimates suggest a much larger degree of substitutability. **Teulings** argues that this is related to a bias induced by the aggregation of skill types into broad categories. He develops a model in which skilled workers have a comparative advantage in complex jobs. His results for the United States show elasticities of complementarity to be underestimated by up to a factor of 5. These results suggest that the reduction of minimum wages during the 1980s contributed substantially to the rise in wage inequality.

According to **Donohue**, **Heckman**, and **Todd**, improvements in educational attainment and educational quality are universally acknowledged to be major contributors to black economic progress in the 20th century, but the sources of those improvements are less well understood. Many scholars assume that improvements in schooling reflect

private choice. In fact, schooling is publicly provided and increases in the quality and availability of black schools in the South occurred at a time when blacks were excluded from the political process. The authors demonstrate the important roles of social action, especially NAACP litigation, and private philanthropy in improving both access to and quality of public schooling in Georgia and in the rest of the South in the first half of the century.

Holzer and **Neumark** use data from a survey of employers to investigate the mechanisms by which affirmative action in recruiting and hiring influences hiring practices, personnel policies, and employment outcomes. Their results show that affirmative action increases the number of recruitment and screening practices used by employers, raises employers' willingness to hire stigmatized applicants, increases the number of minority or female applicants and employees, and increases employers' tendencies to train and formally evaluate employees. Affirmative action does not imply a decrease in the quality of applicants or the performance of employees. When it is used in hiring practices, it yields female and minority employees whose cre-

dentials are somewhat weaker, but whose performance generally is not. Overall, the more intensive search, evaluation, and training that accompany affirmative action appear to offset any tendencies of the policy to lead to hiring of less-qualified or less-productive women and minorities.

Card and **Krueger** re-examine the effect of the 1992 New Jersey minimum wage increase on employment in the fast-food industry. They use a comprehensive new dataset derived from the ES-202 data file of the Bureau of Labor Statistics (BLS). These data indicate similar or slightly faster employment growth in New Jersey

than in eastern Pennsylvania after New Jersey's minimum wage was increased; that is consistent with the main findings of their earlier survey. Using the ES-202 data to measure the effects of the 1996 increase in the federal minimum wage, which raised the minimum wage in Pennsylvania but not in New Jersey, they find no indication of relative employment losses in Pennsylvania. They then re-examine employment trends in a sample of fast-food restaurants assembled by the Employment Policies Institute (EPI) and David Neumark and William Wascher. The differences between this sample and both the

BLS data and the earlier sample are attributable to a small set of restaurants owned by a single franchisee who provided the original Pennsylvania data for a 1995 EPI study. The employment trends in the EPI/Neumark-Wascher sample are strikingly different for firms that reported their data on a weekly, biweekly, or monthly basis, possibly because of seasonal factors. Controlling for the systematic effects of the varying reporting intervals, the combined EPI/Neumark-Wascher sample shows no difference in hours growth between New Jersey and Pennsylvania.

Program on Public Economics

The NBER's Program on Public Economics met in Cambridge on April 16 and 17. Program Director James M. Poterba, of NBER and MIT, organized this program.

Timothy J. Besley, NBER and London School of Economics, and **Stephen Coate**, NBER and University of Pennsylvania,

"Analyzing the Case for Government Intervention in a Representative Democracy"

Discussant: Richard J. Zeckhauser, NBER and Harvard University

Steven Caldwell and **Melissa Favreault**, Cornell University, **Alla Gantman**, Boston University,

Jagadeesh Gokhale, Federal Reserve Bank of Cleveland,

Laurence J. Kotlikoff, NBER and Boston University, and **Thomas Johnson**, Cornell University,

"Social Security's Treatment of Postwar Americans"

Discussant: Eugene Steuerle, Urban Institute

Nada Eissa and **Hilary W.**

Hoynes, NBER and University of California, Berkeley, "The EITC and Labor Supply: Married Couples"

Bruce D. Meyer, NBER and Northwestern University, and **Dan T. Rosenbaum**, Northwestern University, "Welfare, the EITC, and the Labor Supply of Single Mothers"

Discussant: Jeffrey B. Liebman, NBER and Harvard University

James J. Heckman, NBER and University of Chicago, **Lance**

Lochner, University of Chicago, and **Christopher R. Taber**,

Northwestern University, "Evaluation of Education and Training Programs in a General Equilibrium Setting"

Discussant: Caroline M. Hoxby, NBER and Harvard University

John B. Shoven, NBER and Stanford University, "The Location and Allocation of Assets in Pension and Conventional Savings Accounts"

Discussant: James M. Poterba

Aaron Yelowitz and **Janet Currie**, NBER and University of California, Los Angeles, "Are Public Housing Projects Good for Kids?" (NBER Working Paper No. 6305)

Discussant: Robert V. Moffitt, NBER and Johns Hopkins University

David M. Cutler, NBER and Harvard University, **Douglas W.**

Elmendorf, Federal Reserve Board, and **Richard J.**

Zeckhauser, "Restraining the Leviathan: Property Tax Limitation in Massachusetts" (NBER Working Paper No. 6196)

Discussant: Robert P. Inman, NBER and University of Pennsylvania

Besley and **Coate** note that the "welfare economic method" of analyzing the case for government intervention is often criticized for ignoring the political determination of poli-

cies. To answer that criticism, some adopt the assumption that new interventions will not affect the level of existing policy instruments. The authors argue that this assumption is

particularly misleading in suggesting that political economy concerns must dampen the case for intervention.

Caldwell, **Favreault**, **Gantman**, **Gokhale**, **Kotlikoff**, and **Johnson**

note that Social Security faces a long-term funding crisis, the full dimension of which is not well known. The authors devise a simulation model for comparing the lifetime net benefits of successive cohorts of baby boomers and their children under alternative specifications of taxes and benefits to determine whether younger cohorts will get a worse deal than older ones. Equally important, they compare Social Security's treatment of the rich or middle-class versus poor members of each of these cohorts. They also conduct this analysis of the system's progressivity on a lifetime basis.

Eissa and Hoynes study the labor supply response of married couples to the 1987, 1990, and 1993 expansions in the earned income tax credit (EITC) using Current Population Survey data from 1984–96. They examine the impact of the EITC on labor force participation, total hours worked, and hours worked (conditional on working) separately for husbands and wives. Their main estimates are based on a sample of married couples with fewer than 12 years of schooling, because this is the group most likely to be affected by the EITC. Their results suggest that the EITC expansions over the past decade increased the likelihood of married men's labor participation by fewer than one percentage point and decreased the likelihood of married women's labor force participation by 2 to 3 percentage points. Further, they find that those already in the labor force have modest reductions in hours worked in response to the disincentive effects in the flat and phase-out regions of the credit. Overall, the evidence suggests that family labor supply fell after the expansion of the EITC.

In recent years, welfare and tax policy have changed dramatically. In particular, the EITC and the Medicaid programs have expanded, and the Aid to Families with Dependent

Children program and related training and child care programs have changed. Many of the program changes were intended to encourage low income women to work. **Meyer and Rosenbaum** examine the effects of these changes on the employment of single mothers. They find that a large share of the sharp increase in work by single mothers in recent years can be attributed to the EITC, with smaller shares resulting from reductions in welfare benefits and other changes in welfare programs.

Heckman, Lochner, and Taber develop a model of labor earnings, skill formation, and physical capital accumulation. The model analyzes both schooling choices and post-school on-the-job investment in skills in a framework in which different schooling levels index different skills. One key insight of this model is that accounting for the distinction between skill prices and measured wages is important for analyzing the changing wage structure, as they often move in different directions. Immigration of less-skilled workers contributes little to rising wage inequality. When the model is extended to account for the enlarged cohorts of the Baby Boom, the authors find that the same estimates of the supply functions for human capital that are used to explain the wage history of the last 15 years also explain the last 35 years of wage inequality, as documented by Katz and Murphy (1992).

Shoven addresses two important questions about saving for retirement. First, if assets are to be held in both conventional (and hence taxable) accounts and pension accounts, which assets should be held in each? Second, if the investor is substantially risk-averse, what is the optimal mix of stocks and bonds for retirement saving? He shows that the conventional wisdom of first placing heavily taxed corporate bonds in the pension account (and holding equity mutual

funds outside the account) is a poor asset location strategy for most people and for most circumstances. He also shows that even very risk-averse retirement savers should allocate more than half of their portfolio to stocks if asset returns have the same means, variances, and covariances that existed for the last 70 years.

Currie and Yelowitz combine data from several sources to look at the effect of public housing projects on housing quality and on the educational attainment of children. They use data from the Department of Housing and Urban Development to impute the probability that a household lives in a public housing project, and find that a higher probability of living in a project is associated with poorer outcomes. They then combine information on the probability of living in a project, obtained from the 1990–5 Current Population Surveys, with information from the 1990 census: both samples include an indicator equal to one if the household is entitled to a larger housing project unit because of the sex composition of the children in the household. Families entitled to a larger unit are 24 percent more likely to live in projects. Project households are less likely to suffer from overcrowding and are less likely to live in high-density complexes, the authors find. Boys raised in projects are also 12 to 17 percentage points less likely to have been held back in school one or more grades. Thus, most families do not face a trade-off between housing quality and child outcomes—the average project improves both.

Cutler, Elmendorf, and Zeckhauser report on Proposition 2½, a ballot initiative approved by Massachusetts voters in 1980 that sharply reduced local property taxes and restricted their future growth. They examine the reasons that voters felt the need for the proposition, using data on votes for Proposition 2½ and

support for overrides to the legislation a decade later. There were two reasons for voter discontent with the pre-Proposition 2½ financing system: agency losses from an inability to

monitor government were perceived to be high; and individuals gauged government as inefficient because their own tax burden was so high. By the early 1990s, people either regret-

ted their vote or felt their mission was accomplished: voters in communities with the largest cut in taxes voted significantly for more overrides later on.

Corporate Finance

The NBER's Program on Corporate Finance, directed by Robert W. Vishny of NBER and University of Chicago, met in Cambridge on April 17 to discuss the following papers:

Marianne Bertrand and **Sendhil Mullainathan**, Harvard University, "Executive Compensation and Incentives: The Impact of Takeover Legislation"

Discussant: **Kose John**, New York University

Timothy Opler and **Lee Pinkowitz**, Ohio State University; **René Stulz**, NBER and Ohio State University; **Rohan Williamson**, Georgetown University, "The Determinants and Implications of Corporate Cash Holdings"

Discussant: **David S. Scharfstein**, NBER and MIT

Owen Lamont, NBER and University of Chicago, "Investment Plans and Stock Returns"

Discussant: **Charles Himmelberg**, Columbia University

John Graham, Duke University, "How Big are the Tax Benefits of Debt?"

Discussant: **Roger H. Gordon**, NBER and University of Michigan

Bertrand and **Mullainathan** investigate the impact of changes in states' antitakeover legislation on executive compensation. They observe increases in both pay-for-performance sensitivities and average (or mean) pay for the firms affected by the legislation (relative to a control group). The increase in average pay may have been more than needed to maintain CEOs' individual rationality constraints, they find. However, the evidence shows that the increased pay-for-performance offsets some of the reduction in incentives caused by lower takeover threats.

Opler, **Pinkowitz**, **Stulz**, and **Williamson** examine the determinants and implications of holdings of cash and marketable securities by publicly traded U.S. firms in 1971-94. They find that firms have target levels of cash holdings. In particular, firms with strong growth opportunities and riskier cash flows hold relatively high ratios of cash to total assets. Firms

that have the greatest access to the capital markets (for example, large firms and those with high credit ratings) tend to hold lower ratios of cash to assets. However, firms that do well allow their cash level to increase above the predicted target. There is little evidence that excess levels of cash have a large short-run impact on capital expenditures, acquisition spending, and payouts to shareholders. The main reason that firms experience large changes in excess cash is the occurrence of operating losses.

Lamont notes that capital expenditure plans at the beginning of the year, as determined in a Commerce Department survey of firms, explain more than three quarters of the variation in real annual aggregate investment growth between 1947 and 1993. The negative correlation of contemporaneous investment and stock returns is explained by the negative correlation of planned investment and subsequent stock returns. Revisions to aggregate investment

(actual minus plan) within a year are essentially uncorrelated with current stock returns and positively correlated with current profits.

Graham uses firm-specific benefit curves to directly estimate the tax benefit of (debt) interest deductions. On average, the present value gross benefit of interest deductions is approximately 10 percent of firm value. Aggregating across firms, the economy-wide gross tax benefit arising from interest deductions varies annually, peaking at about \$118 billion in 1990. Net of the personal tax penalty associated with interest income, the benefit from interest deductions was about \$60 billion in 1990. Overall, the results suggest that the use of debt is least attractive to small, unprofitable firms with high expected costs of distress. Paradoxically, profitable firms with low apparent costs are very conservative in their pursuit of interest deductions.

Japan Project

The NBER's Japan Project, directed by Anil Kashyap of NBER and the University of Chicago, held its spring meeting on April 18. The following papers were presented:

Charles Y. Horioka, NBER and Osaka University; **Wako Watanabe**, Princeton University; **Hideki Fujisaki** and **Shohhei Ishibashi**, Government of Japan: "Are Americans More Altruistic than the Japanese? A U.S.-Japan Comparison of Saving and Bequest Motives"

Discussant: B. Douglas Bernheim, NBER and Stanford University

Jun-Koo Kang, Korea University and **Rene Stulz**, NBER and Ohio State University: "Is Bank-Centered Corporate Governance Worth It? A Cross-Sectional Analysis of the Performance of Japanese Firms During the Asset Price Deflation"

Discussant: Owen Lamont, NBER and University of Chicago; **Nathan Sussman** and **Yishay Yafeh**, Hebrew University: "Institutions, Economic Growth, and Country Risk: Evidence from Japanese Government Debt in the Meiji Period"

Discussant: Charles Calomiris, NBER and Columbia University

Takao Kato, Colegate University and **Motohiro Morishima**, Keio University: "The Productivity Effects of Participatory Employment Practices: Evidence from New Japanese Panel Data"

Discussant: Raghuram Rajan, NBER and University of Chicago

Masaharu Hanazaki, The Japan Development Bank, and **Akiyoshi Horiuchi**, University of Tokyo: "Why Has Japan Suffered from the Serious Bank Crisis?"

Horioka, Fujisaki, Watanabe, and Ishibashi compare U.S.-Japan saving and bequest motives using microdata from the "U.S.-Japan Comparison Survey of Saving," conducted in 1996. The evidence is not mutually consistent, but most of it suggests that the dominant explanation of household behavior in both countries is the selfish life-cycle model. The model is far more applicable in Japan than it is in the United States. Moreover, the dynasty model is more applicable in Japan than in the United States, but it applies in only a limited way, even in Japan.

Kang and Stulz examine the determinants of firm stock-price performance from 1990 to 1993 in Japan. During that period, the typical firm on the Tokyo Stock Exchange lost more than half of its value, and banks experienced severe adverse shocks. Firms whose debt had a higher fraction of bank loans in 1989 performed worse than other firms from 1990 to 1993. Also, firms that were more bank-dependent invested less during this period than other firms. This evidence points to an adverse effect of bank-centered corporate governance,

namely that firms suffer when their banks are experiencing difficulties.

Sussman and Yafeh examine a mechanism through which institutions might affect economic development—the cost of capital. In particular, they evaluate the effect of the establishment of modern state institutions (for example, a central bank or a constitution) on the risk premium associated with government debt abroad. Using hitherto unexplored monthly data on sovereign debt traded in London between 1870 and 1914, they investigate the impact of major reforms on the yields of Japanese government debt. They show that, although the risk premium on Japanese debt declined during the period, the establishment of modern Western institutions played only a limited role in this decline. The only reform that significantly reduced the perceived risk associated with Japanese bonds was the adoption of the gold standard in 1897. In addition, the war with Russia (1904–5) improved Japan's debt capacity and led to a substantial increase in the volume of Japanese debt. They conclude that well-understood monetary

rules, as well as military achievements, matter more for foreign investors' perception of a country than do modern state institutions.

Kato and Morishima use new Japanese panel data to estimate the impact on productive efficiency of human resource management practices (HRMPs) designed to promote information sharing at the top level and at the grass-roots level, and financial participation. By merging data from a new survey concerning HRMPs among publicly-held Japanese firms with corporate proxy statement data, they create the first enterprise-level panel dataset for up to 152 Japanese manufacturing firms that provides HRMP information annually from 1973–92. They find that moving from the traditional system of no participatory HRMPs to a highly participatory system of HRMPs leads to a significant 9 percent increase in productivity. The full productivity effect, however, is felt only after a long developmental phase (10 years). There is no evidence of significant productivity gains from changing the industrial relations system from the traditional one to an

intermediate system which lacks HRMPs in certain areas.

Hanazaki and **Horiuchi** provide a partial overview of the governance structure in the Japanese banking industry. They stress that bank management has been independent from outsiders' control. Even the Ministry of Finance has not effectively monitored and disciplined bank management, according to surveys of taxpayers. Thus, the issue of "who

monitors the monitor" in the Japanese financial system remains. It is this vacuum in terms of governance which is responsible for the delayed restructuring of the banking industry, which has been suffering from the problem of bad loans since the beginning of the 1990s. In April 1998, the Japanese government finally introduced the prompt corrective action rule, and ordered banks to submit explicit time schedules for

managerial restructuring in exchange for the government's injecting public funds into banks' capital. These policy measures seem at last to have induced hesitant banks to start restructuring their businesses. This fact in itself tells us that Japanese banks have no strong incentive to drastically reform their way of doing business on their own initiative.

Monetary Economics

The NBER's Program on Monetary Economics met in Cambridge on April 24. John Shea, NBER and the University of Maryland, and David N. Weil, NBER and Brown University, organized the meeting, at which these papers were discussed.

Bruce Hamilton, Johns Hopkins University, "The True Cost of Living, 1974-1991"

Discussant: Matthew D. Shapiro, NBER and University of Michigan

Joseph Peek, Boston College, and **Eric Rosengren**, Federal Reserve Bank of Boston, "Collateral Damage: Effects of the Japanese Real Estate Collapse on Credit

Availability and Real Activity in the United States"

Discussant: John Driscoll, Brown University

Karen Dynan, Federal Reserve Board; **Jonathan S. Skinner**, NBER and Dartmouth College; and **Stephen B. Zeldes**, NBER and Columbia University, "Do the Rich Save More?"

Discussant: Christopher D. Carroll, NBER and Johns Hopkins University

Susanto Basu, NBER and University of Michigan; **John Fernald**, Federal Reserve Board; and **Miles S. Kimball**, NBER and University of Michigan

"Are Technology Improvements Contractionary?"

Discussant: Michael Kiley, Federal Reserve Board

Argia Sbordone, Princeton University, "Prices and Unit Labor Costs: Testing Models of Pricing Behavior"

Discussant: Mark Bills, NBER and University of Rochester

Robert B. Barsky, NBER and University of Michigan, and **Lutz Kilian**, University of Michigan, "Money, Stagflation, and Oil Prices: A Re-Interpretation"

Discussant: Mark W. Watson, NBER and Princeton University

Using the Panel Study of Income Dynamics (PSID), **Hamilton** estimates a demand function for food consumed at home for 1974 to 1991, which he then uses to estimate the "true cost of living" over that period. He finds that, on average, the PSID sample of white households spent 16.64 percent of its income on at-home food in 1974. By 1991, this share had fallen to 12.04 percent. CPI-deflated per-household income grew 7 percent over this time span. Given the estimated income coefficient in the demand function, this

income growth is sufficient to explain just over half a percentage point of the decline in spending on food at home. Declining food prices explain perhaps as much as 1 percentage point of the decline; other factors explain less than 0.1 point of the decline; that leaves 3 points to be explained by bias in the CPI (Consumer Price Index). For blacks, food's share fell from 21.17 percent to 12.44 percent. Approximately 0.8 points of this decline can be explained by growth in measured income, another point by movement

in other factors, and as much as one more point by the decline in the relative CPI for food. Thus the food-share decline left to be explained by measurement error is 5.9 points. Hamilton estimates the CPI bias to be approximately 2.5 percent per year from 1975 through 1981; from 1981 to 1991 the bias falls to approximately 1 percent per year. For both subperiods the bias for blacks is at least a percentage point greater.

The dramatic 70 percent decline in Japanese commercial real estate prices from their peak in 1990 pro-

vides a natural experiment for testing the extent to which a loan supply shock can affect real economic activity. **Peek** and **Rosengren** use panel data that exploit the variation across geographically distinct commercial real estate markets in the United States, both in degree of Japanese bank penetration and in local demand conditions, to demonstrate that loan supply shocks emanating from loan problems in Japan had real effects on economic activity in the United States.

Do households with higher lifetime incomes save a larger fraction of their income than other households? **Dynan, Skinner, and Zeldes** revisit this question, using new empirical methods and the PSID, the Survey of Consumer Finances, the Consumer Expenditure Survey, and other data sources. They first consider the various ways that life cycle models can be altered to allow for differences in saving rates: variations in Social Security benefits, time preference rates, subsistence parameters, substitution elasticities, and bequest motives. Using a variety of instruments for lifetime income, they find a strong positive relationship between personal saving rates and lifetime income. Their results support models with a precautionary motive for saving against contingencies while retired, and, among the very highest income groups, an operative bequest motive.

Basu, Fernald, and Kimball argue that technology improvements are contractionary. They construct a time series of aggregate technology change, controlling for imperfect competition, varying utilization of capital and labor, and aggregation. Contemporaneously, the correlation between technology improvements and input use is strongly negative, while the correlation between technology improvements and output is roughly zero. Technology improvements reduce employment within the year but increase employment after as much as three years. Output also falls slightly in the first year but increases strongly thereafter. These results contradict most frictionless dynamic general equilibrium models, which generally predict that technology improvements are expansionary and lead to a small increase in inputs and a larger increase in output. However, these results are consistent with plausible sticky-price models, which predict that: When technology improves, input use generally falls in the short run, and output itself may also fall.

Sbordone investigates the mechanism of price determination. She takes as given the paths of nominal labor compensation, labor productivity, and output, and determines the path of prices predicted by each of several models. She finds that the evolution of prices relative to unit labor costs is quite different from

what would be predicted by any of the competitive models he considers. Flexible price models of endogenous markup variation deliver a series of price/cost ratios that are positively correlated with the actual ones, but whose fluctuations are not nearly as wide as those observed in the data. Finally, she finds that a simple model with costs of changing nominal prices delivers an extremely close approximation both of the price/unit labor cost ratio and of the inflation process, even after allowing standard measurement of marginal costs.

Barsky and Kilian re-examine the stagflation of the 1970s. Stressing the causal role of money for output, inflation, and indeed the real oil price, they deemphasize the importance of exogenous supply shocks. Fully flexible non-oil commodity prices, sticky final goods prices, and oil prices with both administered and spot market components respond endogenously to money. Analysis of a simple dynamic sticky price model suggests that it is not necessary to appeal to foreign commodity price shocks as "aggregate supply" or "cost" shocks to explain historical stagflation. Barsky and Kilian confirm that much of the observed behavior in output, prices, and real oil prices during the 1970s and 1980s can be explained in terms of monetary or aggregate demand disturbances.



idiosyncratic. The model captures these different sources of risk, so that the authors can study their interaction in determining the risk premiums earned by the venture during development. The results show that the systematic risk and the required risk premium of the venture are highest early on and decrease as it approaches completion, despite the idiosyncratic nature of the technical risk.

Bertsimas, Kogan, and Lo quantify one aspect of the approximation

errors of continuous-time models by investigating the replication errors that arise from delta-hedging derivative securities in discrete time. They characterize the asymptotic distribution of these replication errors and their joint distribution with other assets as the number of discrete time periods increases. They introduce the notion of temporal granularity for continuous-time stochastic processes, which allows them to quantify the extent to which discrete-time

implementations of continuous-time models can track the payoff of a derivative security. They show that granularity is a function of the contract specifications of the derivative security and of the degree of market completeness. They derive closed form expressions for the granularity of geometric Brownian motion and of an Ornstein-Uhlenbeck process for call and put options, and perform Monte Carlo simulations that illustrate the practical relevance of granularity.

Higher Education

The NBER's Project on Higher Education, directed by NBER Research Associate Charles T. Clotfelter of Duke University, met in Cambridge on May 1. The program was:

Christopher Avery and **Andrew Fairbanks**, Harvard University, and **Richard J. Zeckhauser**, NBER and Harvard University, "An Assessment of Early Admissions Programs at Highly Selective Undergraduate Institutions."

Discussant: Sandra Baum, Skidmore College.

Charles T. Clotfelter, Alumni Giving to Private Colleges and Universities.

Discussant: Gordon Winston, Williams College.

Claudia Goldin and **Lawrence F. Katz**, NBER and Harvard University, "The Shaping of Higher Education in the United States, 1890 to 1940: Industrial Organization and Political Economy in the Formative Years" (NBER Working Paper No. 6537).

Discussant: Malcolm Getz, Vanderbilt University.

Scott E. Masten, University of Michigan, "Commitment and Political Governance: Why Universities, Like Legislatures, Are Not Organized as Markets." Discussant: Andrew Dick, University of Rochester.

Roger G. Noll, Stanford University, "The American Research University." Discussant: Caroline M. Hoxby, NBER and Harvard University.

Avery, Fairbanks, and Zeckhauser report that early admission procedures have evolved over decades to facilitate colleges' enrollment planning and to provide some students with early assurance of admission. At the most selective schools, early admissions procedures have become more formal and more binding over time. These procedures also have grown in importance; it is now common for a college to fill 25 percent to 50 percent of its incoming class with early applicants. Preliminary results from their analysis of applicant record data from 10 highly selective colleges over 6 years suggest that qualified applicants signifi-

cantly increase their chances of admission by applying early.

Using data from the College and Beyond survey, which focuses on students who entered one of a sample of institutions in the falls of 1951, 1976, and 1989, **Clotfelter** examines the size, distribution, and composition of alumni giving. Contributions by these former students tend to be concentrated, with half of all donations being given by the most generous 1 percent of the sample. Higher levels of contributions are associated with income and the degree of satisfaction with one's undergraduate experience, with satisfaction in turn being a function of particular aspects

of that experience.

Goldin and Katz report that 1890 to 1940—long before the rise of federal funding, the G.I. Bill, and mass higher education—was a formative period for the American university. The scale and scope of American institutions of higher education increased, the research university blossomed, states vastly increased their funding of higher education, and the public sector expanded relative to the private sector. Independent professional institutions declined, as did theological institutes and denominational colleges in general. Exogenous changes in the "structure of knowledge," and other changes

that affected the professions generally and the clergy in particular, generated increases in the scale and scope of institutions of higher education. These exogenous changes gave advantages to institutions, such as those in the public sector, that had research facilities, reputation, and financial resources, perhaps prompting the increase in the share of students in the public sector. The high school movement, which swept parts of the country from 1910 to 1940, brought students from less privileged backgrounds to college and thus buoyed enrollments in the public sector. States differed widely in their funding of higher education per capita, and the authors find that greater generosity in 1929 was positively associated with later statehood, lower private college enrollments in 1900, greater shares of employment in mining and manufacturing, higher income, and a proxy for greater and

more equally distributed wealth.

Masten analyzes the internal governance of academic institutions as a response to commitment problems arising in academic transactions. After describing the nature of academic exchange, he relates the merits of the three principle governance forms found in both political and academic settings—autocracy, unified democracy, and divided democracy—to attributes of colleges and universities. He tests his theory using data on the allocation of decisionmaking authority across 31 decision types for 967 colleges and universities.

Noll assesses how the composition of demand affects the behavior and performance of U.S. research universities. He concludes that in recent years research universities have become stronger in relation to both their own pasts and their competitors in other nations. Next, he summarizes changes in the composition of

demand for research universities. He concludes that direct payment from students is the only source of demand that is growing rapidly; the biggest reductions in demand are from state appropriations and medical care revenues, a result of the rise in managed care and cost containment. He also concludes that a structural change in government demand for higher education took place in the 1980s. After controlling for changes in the size of the age cohort, income, defense R and D spending, federal grants, and partisan control of state governments, more than 75 percent of the decline in state appropriations still remains unexplained. Recent trends in medical revenues and state appropriations appear to be permanent and present a greater challenge to university finances and governance than the reductions in federal R and D.

Market Microstructure

Members of the Market Microstructure Project gathered in Cambridge on May 15 to discuss their recent research. Bruce Lehmann, of the University of California, San Diego, organized the meeting. The following papers were presented:

Joel Hasbrouck, New York University: Security Bid/Ask Dynamics with Discreteness and Clustering: Simple Strategies for Modeling and Estimation. Discussant: Michael Brandt,

University of Pennsylvania.
Aditya Kaul, University of Alberta: Market Activity Before Volatile Periods: A Reassessment of the Non-Trading Risk Hypothesis. Discussant: Charles Cao, Pennsylvania State University.
Ananth Madhavan and **Venkatesh Panchapagesan**, University of Southern California: Price Discovery in Auction Markets: A Look Inside the Black Box. Discussant: Frank Hatheway,

Pennsylvania State University.
S. Viswanathan and **James Wang**, Duke University: Market Architecture: Limit Order Books versus Dealership Markets. Discussant: Ananth Madhavan.
George Sofianos, New York Stock Exchange, and **Ingrid M. Werner**, NBER and New York Stock Exchange: The Trades of NYSE Floor Brokers. Discussant: Duane Seppi, Carnegie Mellon University.

Hasbrouck shows that the short-term movements of a security price reflect the latent efficient price (or, the conditional expectation of terminal value) and various components arising from the trading mechanism itself. Observed bid and ask quotes

are only rough signals of these unobserved quantities. The bid and ask quotes in the dollar/DM market, for example, are discrete, with a tick size that is not trivial relative to the spread. Furthermore, the distribution of these quotes is clustered, with a greater-

than-expected incidence of five-tick multiples. He implements a Gibbs sampler approach that proves to be quick and effective; this strategy opens the door for the investigation of a broad class of structural microstructure models.

Kaul examines the extent to which non-trading risk explains high pre-close trading volume and bid-ask spreads. He relies on a model in which distant volatility has a smaller effect on trading activity than does near-term volatility. The model appears to perform well in explaining volume and spreads, with the parameters being of the predicted sign and generally significant. However, the incremental effects of non-trading volatility are not consistently positive or significant for market volume or for spreads and volume at the stock level. A second test finds that pre-close volume and spreads are not larger before overnight periods containing (predictable) macroeconomic news releases, as compared to normal overnight periods. The results of both tests are not consistent with the non-trading risk hypothesis. These results also point to the possible role of other factors, for example information acquisition, in the relation between trading activity and future volatility.

Madhavan and Panchapagesan examine the process of price discovery at the New York Stock Exchange (NYSE) single price opening auction. They show that specialists significantly facilitate price discovery. Specifically, the opening price that the

specialist sets is more efficient than the price that would prevail in a pure auction with only public orders. This is consistent with a model in which specialists learn from observing the evolution of the limit-order book. The specialist's opening trade reflects private information and noninformational factors, such as inventory control and price continuity.

Viswanathan and Wang analyze the customer's choice with respect to a limit-order book, a dealership market, and a hybrid market structure of the two. They conclude that: 1) a risk-neutral customer prefers to trade in a limit-order market; 2) a risk-averse customer prefers to trade in a dealership market when the number of market makers is large and when the variation in order size is significant; and 3) for risk-averse customers, the hybrid market, when properly structured, dominates the dealership market. Their theoretical findings are consistent with the empirical evidence on trading costs for stocks listed on both dealer and limit-order book markets. They also provide a rationale for the recent move in many large equity markets toward a structure by which small orders are executed against a limit-order book, and large orders are executed in a dealership setting.

At the end of March 1997, there were 926 active brokers on the trading floor of the New York Stock Exchange (NYSE). Those brokers complement the Exchange's electronic order flow transmission mechanism by executing orders on behalf of their customers and by providing information to off-floor market participants. **Sofianos** and **Werner** find that the dollar value of executed orders represented by floor brokers amounts to 44 percent of the value of all executed orders. Trades with active floor broker participation are on average 6 times larger than other NYSE trades. Off-floor traders, therefore, tend to use floor brokers for the execution of large orders, with floor brokers acting like a smart limit-order book, customizing execution strategies depending on the available liquidity so as to minimize market impact. The typical floor broker trade has floor brokers on both sides: these broker-to-broker trades account for 55 percent of all floor broker trades (by value). Floor brokers, therefore, create substantial additional liquidity in the NYSE marketplace. Finally, the authors find that upstairs-facilitated trades account for 22 percent of the value of all floor broker trades.

Additional Papers

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"Who Owns Guns? Criminals, Victims and the Culture of Violence," by **Edward L. Glaeser** and **Spencer Glendon**.

"The Structure of Factor Content Predictions," by **Daniel Trefler**.

"The Costs and Benefits of Achieving Price Stability," by **Martin Feldstein**.

Bureau Books

Tax Policy and the Economy

Tax Policy and the Economy, Volume 12, edited by James M. Poterba, is now available from The MIT Press. This volume includes the papers presented at the NBER's 12th Annual "Tax Policy and the Economy" Conference held in Washington last fall. They cover such topics as: how Medicare shifts costs among providers and insurers; using telecommunications regulations as tax policies; whether and how to provide tax incentives for higher education; the effects of the earned income tax credit on work incentives and income distribution; and how the Social Security earnings test affects the labor supply of older men.

Four additional papers in this volume address: the transition to a cash-flow type of tax; the choice of rates for a consumption tax; how tax reform affects corporate financial policy; and a look at tax reform from the perspective of financial accounting.

This volume should interest academic economists and students of economics, tax policymakers, and corporate tax specialists. Its price is \$30.00 (cloth), or \$15.00 (paperback). It may be ordered directly from the MIT Press at 5 Cambridge Center, Cambridge, MA 02142; or, by phone to (617) 253-2889; or, by email to mitpress-orders@mit.edu. (The MIT Press also has a web site: www.mitpress.mit.edu/journals/tcl).

Poterba is a professor of economics at MIT and Director of the NBER's Programs on Public Economics.

The following volumes may be ordered directly from the University of Chicago Press, Order Department, 11030 South Langley Avenue, Chicago, IL 60628-2215, 1-800-621-2736. Academic discounts of 10 percent for individual volumes and 20 percent for standing orders for all NBER books published by the University of Chicago Press are available to university faculty; orders must be sent on university stationery.

Geography and Ownership as Bases for Economic Accounting

Geography and Ownership as Bases for Economic Accounting, edited by Robert E. Baldwin, Robert E. Lipsey, and J. David Richardson, will be available in October from the University of Chicago Press for \$48.00.

This volume brings together a diverse group of experts in trade and international economics to explore the degree to which changes in the world economy may have increased the usefulness of international accounts drawn up on the basis of

ownership rather than on geography. It should interest both academic economists and policymakers whose focus is trade or international relations.

All three editors are Research Associates in the NBER's Program on International Trade and Investment. Baldwin is also a professor of economics at the University of Wisconsin, Madison; Lipsey teaches at Queens College and The Graduate Center at the City University of New York; and Richardson is a professor of economics at Syracuse University.

The Evolution of Retirement

The Evolution of Retirement, by Dora L. Costa, is available from the University of Chicago Press for \$39.95. This volume is an economic history of retirement in the United States from 1880-90. Not only does it examine the origins and evolution of retirement, but it also describes the factors underlying increased retirement rates and analyzes how and why they have changed over time. Costa explores the implications of these trends for families, households' consumption of goods and allocation of time, and government policy.

Costa is the Ford Career Development Associate Professor of Economics at MIT and a Faculty Research Fellow with the NBER's Programs on Development of the American Economy and Aging.

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Privatizing Social Security

Privatizing Social Security, an NBER Project Report edited by Bureau President Martin S. Feldstein, will be available from the University of Chicago Press in August for \$59.95. This volume explores issues involved in shifting from the current "unfunded" Social Security system to a "funded" system based on mandatory saving in individual accounts.

The first part of the volume examines the experience with privatizing social security in Argentina, Australia, Chile, Great Britain, and Mexico. The second part of the book looks at a variety of issues that would have to be resolved if the United States were to adopt a privatized system. Given the timeliness of this subject, the book should interest scholars and policymakers, as well as anyone who wishes to be more informed on the national debate over Social Security.

Feldstein is a professor of economics at Harvard University and a former chairman of the President's Council of Economic Advisers.

R&D and Productivity: The Econometric Evidence

R&D and Productivity: The Econometric Evidence, by Zvi Griliches, is now available from the University of Chicago Press for \$56.00. Griliches has been a leading scholar in the field of productivity research since its emergence in the 1950s. This collection of his essays looks at the relationship between productivity growth and R and D expenditures in industry—that is, whether resources spent on research pay off in increased or improved production.

After a comprehensive introduction, the essays establish the connection between R and D and productivity and its magnitude. Several papers incorporate productivity data from France and Japan to provide a comparative perspective, and one new paper outlines future directions for productivity research.

Griliches is the Paul M. Warburg Professor of Economics at Harvard University and Director of the NBER's Program on Productivity and Technological Change.

Inquiries in the Economics of Aging

Inquiries in the Economics of Aging, edited by David A. Wise, is now available from the University of Chicago Press for \$45.00. The papers in this book cover various aspects of health insurance and the increase in the cost of health care; retirement and long-term care options for the elderly; and the measurement, methodology, and data issues that will help to pave the way for future analysis.

This volume is geared toward academic specialists in gerontology and economics, and toward government policymakers. Wise is the John F. Stambaugh Professor of Political Economy at the John F. Kennedy School of Government, Harvard University, and Director of the NBER's Program on the Economics of Aging.

