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Program Report

The NBER Monetary Economics Program

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The activities and research of the NBER's Program in Monetary Economics over the last several years have been dominated by the financial and macroeconomic crisis that began in 2007 and erupted in full force in the fall of 2008. The recession that lasted from December 2007 until June 2009 was the longest since World War II, and the collapse of GDP and employment at the end of 2008 and the start of 2009 dwarfed any declines since the demobilization at the end of that war. Moreover, the character of the downturn was very different from that of other postwar recessions. Tight monetary policy intended to slow economic activity in order to reduce inflation played no role. Instead, the recession was intimately bound up with asset price fluctuations, financial market disruptions, and the effects of private debt accumulation. And more than six years after the recession began, unemployment remains elevated in the United States, as well as in most other advanced economies.

The Monetary Economics Program is one of three programs at the NBER that focus on macroeconomics, and whose work in recent years has therefore been largely devoted to issues related to the crisis; the other two are International Finance and Macroeconomics, and Economic Fluctuations and Growth. The International Finance and Macroeconomics Program, as its name implies, focuses on international macroeconomics. The boundaries between the Economic Fluctuations and Growth and the Monetary Economics programs are less clear-cut. Research on issues concerning long-run growth is the purview of Economic Fluctuations and Growth, and most work that is specifically devoted to monetary policy is done in Monetary Economics. But the Monetary Economics Program also studies a wide range of issues that are central to macroeconomic fluctuations. Important topics include interactions between financial markets and the macroeconomy, the behavior of inflation and unemployment, fluctuations in consumption and

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investment, and the sources of macroeconomic fluctuations. The NBER Monetary Economics Program follows the informal definition of monetary economics as anything that monetary policymakers should be interested in.

Researchers in the NBER's Program in Monetary Economics contribute to our understanding of issues in monetary policy and macroeconomics by conducting empirical and theoretical studies of a wide range of subjects. These studies are issued as NBER Working Papers, and are presented and discussed at regular meetings of the program and at special NBER conferences devoted to particular subjects related to monetary policy. The studies are subsequently published in academic journals and in NBER volumes.

Although the greatest long-run influence of the members of the Monetary Economics Program is surely through their research, they also have a tangible, immediate influence through an entirely different channel: former members of the program often hold policymaking positions throughout the world. Former NBER Research Associate (and former Director of the Program in Monetary Economics) Ben Bernanke served as Chair of the Federal Reserve from February 2006 until January 2014, when he was succeeded by former NBER Research Associate Janet Yellen. Former program member Stanley Fischer served as Governor of the Bank of Israel from 2005 to 2013, and has recently been nominated as Vice-Chair of the Federal Reserve. Program member Mervyn King was Governor of the Bank of England from 2003 to 2013. Former program member James Stock is currently serving as a member of the Council of Economic Advisers (CEA). Program member Lawrence Summers served as Chair of the National Economic Council in 2009 and 2010. N. Gregory Mankiw resigned from his position as Director of the Monetary Economics Program in 2003 to serve as Chair of the CEA, as did Christina Romer in 2009. When she returned to the University of California, Berkeley after her public service, Romer was reappointed as an NBER Research Associate and as Co-Director of the program.

Program members also interact frequently with macroeconomic policymakers. These interactions serve to keep program members abreast of developments in policymaking, and allow policymakers to inform NBER researchers about issues that are currently important to them. Traditionally, one session of the meeting of the Monetary Economics Program at the NBER's

Summer Institute is devoted to a discussion with a policymaker. However, for the past two years the program has taken this a step further by devoting an entire day to a symposium where current and former policymakers and NBER researchers discuss important policy issues. In 2012, the event, which was conducted jointly with the International Finance and Macroeconomics Program, focused on the European crises. In 2013, it focused on the 100th anniversary of the Federal Reserve. The four background papers that were prepared for the 2013 meeting (including [1, 2,] and [3]) were recently published in the *Journal of Economic Perspectives*, together with the remarks at that meeting by Federal Reserve Chair Ben Bernanke and the interview that former NBER President Martin Feldstein conducted with former Federal Reserve Chair Paul Volcker.

The work of the Monetary Economics group is so extensive and varied that discussing all of it would be almost impossible. In the remainder of this report, we therefore highlight a few areas of work that are closely related to the recent financial crisis and the subsequent weak recovery and research areas where program members have been particularly active.

Finance and Macroeconomics

Probably the biggest shift in the focus of researchers in the Monetary Economics Program in response to the crisis has been toward work on the interactions between financial markets and the macroeconomy. Before the crisis, those interactions were merely one subject out of the many that were addressed by researchers in the program. But since the crisis began, they have absorbed a large fraction of the program's attention. One indication of this greater emphasis on interactions between finance and macroeconomics is that the Monetary Economics Program now devotes a full day of its summer meeting to a joint session with researchers in finance to discuss research spanning the two fields. These events attract large audiences and great interest.

The evolution in the subject matter of the program is related to an important ongoing methodological development in monetary economics — one whose beginnings considerably predate the crisis, but that has gathered strength in recent years. Researchers are increasingly using microeconomic data to study macroeconomic questions. One obvious advantage of microeconomic data is that they allow for much larger samples: there is only so much that can be learned from a few hundred observations of quarterly macroeconomic time series data from the United States, or from several dozen macroeconomic observations from different countries. But a more important advantage of microeconomic data is that they often provide more compelling ways of untangling the difficult issues of causation that make much of economic research so challenging. In microeconomic settings, it is often possible to identify "natural experiments" where it is clear that differences among economic actors are not the result of confounding factors. And financial economics, where there are detailed data on prices and quantities of different assets, on prices at very high frequencies, and on the financial positions of numerous firms, households, sectors, and regions, provides a particularly fertile setting for the use of microeconomic data.

Researchers in the Monetary Economics Program and papers presented at program meetings have examined a wide range of issues at the intersection of finance and macroeconomics. One extremely important issue is the effects of financial market disruptions. If we observe financial market turmoil and disruptions in credit availability being followed by an economic downturn, we do not know whether the financial market problems caused the economy to weaken, or whether other forces caused both the financial and economic troubles. Microeconomic data provide ways of resolving this issue. For example, Bo Becker and Victoria Ivashina[4] focus on the *type* of financing obtained by firms in an attempt to separate shifts in bank loan supply from shifts in bank loan demand. They find that in times when credit markets are disrupted, firms that are normally able to issue debt and that need to borrow shift sharply away from borrowing from banks, and toward issuing debt directly. Since other considerations suggest that bank borrowing should be particularly attractive in times of economic turmoil, this strongly suggests a reduction in bank loan supply. Becker and Ivashina go on to show that these reductions in bank loan supply are associated with lower probabilities of borrowing among firms that have previously relied entirely on bank borrowing.

Papers by Gabriel Chodorow-Reich and Jesse Edgerton presented at the program's 2012 joint meeting with researchers in finance take this line of research a step further by looking for evidence of how financial market disruptions affect real economic outcomes.[5] Both papers exploit variation across firms in the extent to which the financial institutions they had been relying on were weakened by the housing-market and financial developments associated with the recession. Both find large effects of the disruptions in credit availability on firms' employment and investment. In a similar spirit, Mary Amiti and David Weinstein[6] use evidence from Japan, where some individual banks are quite large relative to the economy, to show that disruptions to the financial health of banks can have large effects on the economy as a whole.

A closely related issue is whether the large accumulation of household debt in the years before the recession contributed to the downturn and the slow recovery, as highly indebted households cut back on other spending to try to pay off their debt. In a series of papers, Atif Mian and Amir Sufi[7, 8, 9] use a range of different evidence to address this issue. For example, in one paper[10] they show that in counties where the increase in household leverage in the years before the crisis was larger, decreases in spending occurred sooner and were much larger. They go on to show that these effects may account for a substantial part of the overall decline in economic activity in the recession. Theoretical work by Veronica Guerrieri and Guido Lorenzoni,[11] Thomas Philippon and Virgiliu Midrigan,[12] and Paul Krugman and Gauti Eggertsson[13] demonstrates that effects through these channels can be very large.

Another example of an important set of issues at the intersection of finance and macroeconomics concerns the macroeconomic consequences of financial regulation and "macroprudential" policies. NBER researchers have tackled these issues in a wide range of ways. For example, Sumit Agarwal, David Lucca, Amit Seru, and Francesco Trebbi[14] identify a compelling natural experiment in bank supervision arising from the legally mandated rotation of supervision of some banks between state and federal regulators. They find powerful evidence of differences in the strength of supervision, and show that these differences have important effects on loan quality, the frequency of bank failures, and other outcomes. To give another example, Ing-Haw Cheng, Sahil Raina, and Wei Xiong[15] use an ingenious approach to investigate whether risky financial actions in the run-up to the crisis resulted from overoptimistic beliefs or from distorted incentives facing participants in the markets for sophisticated financial products. Understanding the relative importance of these two factors is potentially important to the design of future financial regulation. Using extensive detective work, they examine the personal housing-market transactions of participants in the mortgage securitization business. They find little evidence that these individuals acted as if they believed that housing was overvalued; this points to overoptimism affecting both their personal and professional decisions, rather than distorted incentives specific to their activities in mortgage securitization, as a driver of the housing bubble. Another example is provided by Shekhar Aiyar, Charles Calomiris, and Tomasz Wieladek,[16] who find that in the United Kingdom, the impact of changes in capital requirements on regulated banks on overall lending has been substantially blunted by offsetting movements in lending by financial institutions that are not subject to the requirements.

The Zero Lower Bound on Nominal Interest Rates

One prominent feature of the crisis is that central banks in many advanced economies brought their target interest rates close to zero. Because individuals always have the option of holding cash, which provides a zero rate of return, nominal interest rates cannot be negative. Thus central banks had largely exhausted their main traditional tool for stimulating a weak economy. Such a situation is known as a "liquidity trap."

As described in our previous program report, Japan's experience with zero nominal rates starting in the late 1990s and the Federal Reserve's decision to bring its target rate down to 1 percent in the early 2000s prompted considerable research on the zero lower bound and the possibility of a liquidity trap even before the crisis. However, the widespread and long-lasting experience with zero interest rates in the crisis has led to a great deal of additional work. Indeed, the NBER convened a conference in October 2013 under the leadership of Research Associate (and new Co-Director of the Economic Fluctuations and Growth Program) Mark Gertler on "Lessons from the Financial Crisis for Monetary Policy." Not surprisingly, many of the papers at the conference focused on issues related to the zero lower bound.

One body of work on the zero lower bound focuses on the ability of monetary policymakers to continue to influence the economy by changing expectations of future interest rates and money supplies — so-called "forward guidance." Earlier work by Lars Svensson[17] and Eggertsson and Michael Woodford[18] had shown that such policies can affect expectations of inflation, and so affect real interest rates. More recent work by Iván Werning[19] identifies another important channel: that policies can affect expectations of future economic activity and real income, which in turn affect decisions today.

Central banks' other main policy tool in a liquidity trap is "quantitative easing" — purchases of long-term government debt and other assets whose interest rates are not yet at zero. NBER researchers have explored numerous aspects of quantitative easing. Dimitri Vayanos and Jean-Luc Vila[20] show how investors' preferences for holding different types of assets can cause quantitative easing to bring down the interest rates on the assets targeted by central banks' purchases and on assets that are viewed as close substitutes. Empirical studies of the effects of quantitative easing often combine high-frequency observations with data on prices of wide ranges of assets. For example, Simon Gilchrist and Egon Zakrajsek[21] use data not just on interest rates but on the prices of credit default swaps, and find evidence that quantitative easing has had substantial effects on corporate credit risk but little impact on the risk of financial institutions. Arvind Krishnamurthy and Annette Vissing-Jorgensen[22] decompose the various channels through which quantitative easing affects different interest rates. They find the strongest effects on the assets directly targeted by the policies; for example, purchases of mortgage-backed securities are more effective in reducing mortgage interest rates than are purchases of Treasury bonds of comparable maturity. They also find that quantitative easing affects interest rates in part because investors interpret it as conveying information about the Federal Reserve's intentions about future monetary policy, which suggests an intriguing link between quantitative easing and forward guidance.

Fiscal Policy

At first glance, it might seem surprising that a recession linked to a financial crisis has caused researchers in the Monetary Economics Program to devote considerable effort to studying the short-run macroeconomic effects of fiscal policy. But the connection is logical. Prior to the crisis, there was broad support for the view that short-run stabilization should be mainly the province of monetary policy. As a result, the Monetary Economics Program was a center for research on macroeconomic stabilization policy. But the limitations on monetary policy arising from the zero lower bound have led to renewed interest in possibilities for using fiscal policy to stabilize the economy. It was natural for researchers in monetary economics, with their expertise in stabilization policy, to become actively involved in those efforts.

Microeconomic data play a major role in the fiscal policy work of researchers in the Monetary Economics Program. Emi Nakamura and Jón Steinsson[23] use the fact that defense spending is distributed very unevenly across U.S. states to estimate the effect of changes in government purchases on GDP at the state level. They then build a theoretical model to investigate the implications of their estimated state-level effects for the economy-wide effects of fiscal expansion. Jonathan Parker, Nicholas Souleles, David Johnson, and Robert McClelland[24, 25] use the fact that the exact timing of households' receipt of tax rebates designed to stimulate the economy has a component that is effectively random to estimate the short-run spending impact of the rebates. Claudia Sahm, Matthew Shapiro, and Joel Slemrod[26, 27, 28, 29] use surveys of consumers to address the same issue. And Christopher Nekarda and Valerie Ramey[30] use the uneven distribution of government spending across industries to investigate the impact of that spending on output, hours, productivity, and real wages.

Other researchers focus on the aggregate evidence, and use a variety of approaches to address issues of causation. In our own work,[31] we use information from historical documents to identify a subset of legislated tax changes that were not taken in response to other factors likely to have important short-run effects on the economy, and that can therefore be used to estimate the macroeconomic effects of tax changes. Ramey[32] uses an analysis of news sources and other contemporary documents to find the timing of when news about changes in government purchases became available; she then uses this information to address the difficulties created by the fact that economic actors often know a great deal about changes in purchases well before they occur. Alan Auerbach and Yuriy Gorodnichenko[33, 34, 35] use information from real-time forecasts and other sources to tackle the important issue of whether the effects of fiscal policy are different when economic activity is depressed compared to times of normal economic activity.

Policymakers' and researchers' interest is often in the effects of fiscal policy in a particular set of circumstances, such as when the economy is in a liquidity trap. In addition, there are many different possible tools of fiscal policy, which may have substantially different effects; and there are different exchange rate regimes, which may have large effects on the impact of fiscal policy. Because these concerns raise issues that are often complex and subtle, there is often room for insightful theoretical analyses. For example, Woodford[36] analyzes how the response of monetary policy and the persistence of changes in government purchases affect the short-run effects of fiscal policy in baseline versions of widely used "new Keynesian" models. Lawrence Christiano, Martin Eichenbaum, and Sergio Rebelo[37] focus specifically on the zero lower bound on interest rates, and show that the effects of changes in fiscal policy can be very large when monetary policy is constrained by the bound. Emmanuel Farhi, Gita Gopinath, and Oleg Itskhoki[38] show how a country that has a fixed exchange rate or is in a currency union can use a combination of fiscal tools to achieve the same effects as it could if it were able to devalue. Similarly, Isabel Correia, Farhi, Juan Pablo Nicolini, and Pedro Teles[39] show how a combination of fiscal tools can be used to address the difficulties created by the zero lower bound on nominal interest rates. Farhi and Werning[40] address more broadly the issue of how membership in a currency union alters the effects of fiscal policy.

The Behavior of Inflation

Stabilization policy traditionally focuses on two outcomes: real economic activity and inflation. The behavior of inflation in the crisis has been deeply puzzling. Laurence Ball and Sandeep Mazumder[41] show that traditional models of inflation imply that the extended period of substantial economic slack over the past several years should have led to inflation falling sharply below zero, and that other standard models of inflation also do a poor job of explaining the recent behavior of inflation. Researchers in the Monetary Economics Program have therefore been devoting considerable effort to understanding the behavior of inflation.

A very large number of studies examine price-setting behavior at the level of individual products and firms. The studies use a wide range of data sources. For example, Peter Klenow and Oleksiy Kryvtsov[42] examine the individual observations underlying the Consumer Price Index; Eichenbaum, Nir Jaimovich, and Rebelo[43] employ scanner data from grocery stores; and Gopinath and Roberto Rigobon[44] study the individual prices used to construct indexes of import and export prices. Likewise, this work investigates a broad range of issues related to price setting. For example, Eric Anderson, Nakamura, Duncan Simester, and Steinsson[45] and Judith Chevalier and Anil Kashyap[46] study the nature of temporary sales and how they affect price adjustment at the macroeconomic level; Gopinath and Itskhoki[47] and Gopinath and Rigobon[48] examine the price adjustment of imported goods; and Michael Elsby, Donggyun Shin, and Gary Solon,[49] Alessandro Barattieri, Susanto Basu, and Peter Gottschalk,[50] and Pedro Martins, Solon, and Jonathan Thomas[51] consider the behavior of wages rather than prices. This work, ably summarized by Nakamura and Steinsson[52] and by Klenow and Benjamin Malin,[53] has established that the microeconomics of price adjustment are extremely complex, and has identified a range of intriguing stylized facts and potentially important determinants of price setting.

Some recent work proposes explanations of the puzzling resilience of inflation in recent years. Olivier Coibion and Gorodnichenko[54] document the failures of a wide range of existing theories. They then demonstrate that inflation behavior is much easier to understand if one uses survey-based measures of expected inflation in place of the assumption that economic agents have rational expectations, and they show that expectations of inflation appear highly correlated with the level of oil prices. Of course, this explanation raises the question of why agents would form their expectations in this way. James Stock and Mark Watson[55] propose instead that long-term expected inflation is cen-

tral to the behavior of inflation, and that the recent steadiness of inflation reflects an "anchoring" of inflation expectations. But this explanation too raises another puzzle: how can the Federal Reserve have succeeded in anchoring agents' expectations when actual inflation has been persistently below its target? And in work presented at the most recent meeting of the Monetary Economics Program, Gilchrist, Raphael Schoenle, Jae Sim, and Zakrajsek present evidence that recent financial disruptions themselves may be the source of the failure of inflation to decline sharply. The mechanism they explore is that in many settings lower prices are an investment in future market share, and that financial market disruptions can cause firms to forgo what would otherwise be profitable investment opportunities.[56] But given this wide range of hypotheses, the additional issues they raise, and the absence of decisive evidence for any of them, it is clear that we remain far from having a full understanding of the recent behavior of inflation.

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Research Summaries

Pricing Energy Efficiently

Lucas Davis*

Energy plays a central role in determining our overall economic well-being, from fueling our transportation systems, to heating and cooling our homes and businesses, to determining the cost and composition of goods and services produced in the economy. Energy prices determine choices both within and across energy sources, choices that are particularly important given increased concerns about carbon dioxide emissions and other external costs associated with the production and consumption of energy.

In recent work with several coauthors, I examine the efficiency of energy prices in a variety of U.S. and international settings. I explore a variety of possible rationales for government intervention in energy markets and find that observed prices often differ from those that would be dictated by efficiency considerations alone. This usually reflects governments' pursuit of distributional and other objectives which must be weighed against the distortions that are imposed by deviations from efficient pricing.

Global Fuel Subsidies

The prices drivers pay at the pump for gasoline and diesel fuel vary widely across countries. In Venezuela, for example, gasoline costs only 6 cents per gallon and diesel fuel is even cheaper. It is no coincidence that gasoline consumption per capita in Venezuela is 40 percent higher than in any other country in Latin America. Fuel subsidies increase consumption above the efficient level, allowing transactions for which buyers' willingness to pay is very low.

In a recent study, I find that gasoline and diesel subsidies totaled $110 billion worldwide in 2012.[1] The total dollar value of subsidies is largest in Saudi Arabia, Iran, Indonesia, and Venezuela, each with more than $10 billion annually in fuel subsidies. Under baseline assumptions about demand and supply elasticities, the annual efficiency cost of these subsidies — the amount of foregone output associated with these deviations from efficient pricing — is $44 billion, and this is *ignoring* externalities. Incorporating conservative estimates for the marginal external damages of driving doubles the estimated efficiency cost of these subsidies.

Of course, there is also an efficiency cost when fuel prices are too high. In 2012, there were about two dozen countries that subsidized gasoline, but also two dozen countries where gasoline prices were above $7 per gallon. While it is true that traffic congestion and other external damages vary substantially across locations, these countries have prices that are difficult to justify on the basis of economic externalities associated with gasoline consumption.

The Allocative Cost of Price Ceilings

Prices coordinate actions between buyers and sellers, but they also *allocate* goods to the buyers who value them the most. Normally in a market all the buyers who are willing to pay more than the price buy the good. This maximizes consumer surplus which is the total value that consumers place on the amount of the good they consume, less the cost of purchasing it. However, when a price ceiling is imposed in a market, there is no longer an immediate mechanism that ensures this allocation. This "allocative cost" of price ceilings has been noted, for example, in rental housing markets, but has tended to receive much less attention than the efficiency cost of too much or too little consumption.[2]

A particularly lucid example of an allocative distortion is the U.S. natural gas market, which was subject to price ceilings between 1954 and 1989. In work with Lutz Kilian, I find that price ceilings led to severe misallocation of natural gas in the residential market.[3] While some households enjoyed access to cheap price-controlled natural gas, other households were locked out of the market altogether because new residential connections were unavailable in many parts of the country. Many of the households without access would have been willing to pay more to obtain it, but there was no mechanism that allowed these welfare-improving reallocations.

We find that the allocative cost from price ceilings averaged $3.6 billion annually. We construct these estimates using a household-level model of natural gas demand. To estimate the model, we exploit the fact that by the 1990s the natural gas market had been completely deregulated and, in contrast to the period of regulation, all households purchasing new homes were free

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to choose natural gas. Our empirical strategy is to ask how much natural gas would have been consumed during the period of price regulation based on the household preferences revealed in the 1990s data.

Our estimates imply that the allocative cost is both large and long-lasting. In homes where natural gas was not available when the home was first constructed, households will often continue using less-preferred energy sources for many years. This lock-in effect means that the adverse effects of price ceilings can last much longer than the regulatory policies themselves. Even today, more than two decades after natural gas prices were completely deregulated, the pattern of energy use by U.S. households continues to reflect the legacy of price ceilings.

Market Structure and Two-Part Tariffs

Much like electricity, natural gas is delivered to final customers by local distribution companies. These are classic natural monopolies characterized by high fixed costs and low marginal costs. The standard prescription for achieving an efficient outcome in this context is to use a multi-part tariff. For example, with a basic two-part tariff, the regulator requires the company to set per-unit charges equal to marginal cost, yielding the efficient level of consumption and eliminating the deadweight loss associated with the monopoly. The company can then recoup its fixed costs by charging fixed monthly fees.

In practice, prices tend to differ substantially from this theoretical ideal. In work with Erich Muehlegger, I find that U.S. industrial customers face natural gas prices that are close to marginal cost, but that residential and commercial customers face prices close to *average* cost, with the vast majority of revenues coming from per-unit charges rather than through fixed monthly fees.[4] On average, we estimate that residential and commercial customers face markups of more than 40 percent above marginal cost. Based on conservative estimates of the price elasticity of demand, our estimates imply that the current rate structure imposes $2.7 billion in deadweight loss annually.

Some have argued that externalities such as the potential environmental consequences of fossil fuel consumption provide a potential rationale for current rate structures. Current markups are equivalent to those that would be implied by a $55 tax per ton of carbon dioxide emitted, a tax rate above the efficient level that emerges from most models linking climate and economic activity.[5] Moreover, burning natural gas emits only small amounts of criteria pollutants. Thus, residential and commercial customers in the United States may already be facing prices that are above social marginal cost. This illustrates the importance of accounting for pre-existing distortions when designing carbon taxes and other policies.

In future work it would be interesting to perform a similar study for electricity, another market characterized by high fixed costs and low marginal costs. In the United States in 2012, the average retail price of electricity was 10 cents per kilowatt hour, while the average wholesale price was only about 3 cents. Most of the 7-cent differential goes toward the transmission and distribution infrastructure. These costs are mostly fixed, not marginal, yet again only a small proportion of revenue is collected through fixed monthly fees. Electricity cannot be cost-effectively stored, making it considerably different from natural gas, but nonetheless it would be valuable to do a careful analysis of the efficiency consequences of current rate schedules.

Distributional Considerations

Policymakers often use taxes and subsidies on energy purchases to pursue distributional objectives even when such policies conflict with economic efficiency. Some argue, for example, that current rate structures in U.S. electricity and natural gas markets help low-income households by shifting costs to high-volume consumers. Although this view is widely held by regulators and rate-payer protection groups, there is surprisingly little direct empirical evidence.

In recent work with Severin Borenstein, I use nationally representative data to calculate the distributional impact of a transition to marginal cost pricing in U.S. natural gas markets.[6] We find that the correlation between natural gas consumption and household income is positive, but surprisingly weak. Our analysis highlights several confounding factors that help explain the weak correlation. For example, we document a *positive* correlation between household income and energy efficiency. Low-income households tend to live in homes with older furnaces, less insulation, and single-pane windows.

The weak correlation between natural gas consumption and household income means that current price schedules deliver only a modest amount of redistribution. Under baseline assumptions, we find that current price schedules impose more than $1 in deadweight loss for every $1 that is transferred to the bottom two income quintiles. We also show that even a modest increase in needs-based energy assistance would more than offset the distributional impact of price reform for most low-income households.

The idea of combining price reform with cash transfers arises frequently in discussions of energy markets. Several countries have recently reduced subsidies available for gasoline and diesel fuel, for example, while simultaneously increasing funding for cash transfers. This pairing makes the reforms more politically palatable and potentially makes it possible to improve both efficiency and equity at the same time.

Conclusion

Studies like the ones described above move us closer to understanding the sometimes complex efficiency and distributional implications of energy prices. One of the over-arching themes in these studies is the high economic cost of

departures from marginal cost pricing. These costs tend to be underappreciated by policymakers in part because the inefficiencies are largely borne by a diffuse set of energy consumers. However, because energy markets are very large, the total economic cost of these distortions can also be very large.

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School Assignment and School Effectiveness

Parag Pathak*

A growing number of U.S. households have the opportunity to send their children to public schools outside of traditional neighborhood boundaries. Over the last decade there has been a proliferation of research on the design of centralized choice systems intended to make it easier for children to exercise choice. Millions of students have been assigned to schools using mechanisms either directly or indirectly inspired by academic work.

In recent research with several coauthors, I explore the equity, efficiency, and incentive properties of these choice systems. Aside from these properties, centralized assignment generates valuable data and quasi-experimental variation that can be used for evaluation of various educational practices and policies. I have worked with several researchers to exploit this variation to study productivity differences between schools and school models.

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Immediate Acceptance

One of the most common school assignment systems is based on the concept of *immediate acceptance*: when applicants apply to a school, they are offered a seat immediately if they qualify. A mechanism based on this principle was in place in Boston until 2005, and hence it is commonly known as the Boston mechanism.[1] A large number of Local Education Authorities in England also employed this mechanism, called First Preference First.

One issue with this mechanism is that applicants do not have the incentive to rank their desired schools truthfully. That is, ranking a competitive school first may harm a student's chances at lower-ranked schools, creating strategic pressure on the applicant. Should an applicant take a risk at the school she really wants, or instead rank a safe choice first? In work with Tayfun Sönmez, I show that if families do not understand these incentives and rank their choices truthfully, then sophisticated families who understand the rules of the game benefit at the expense of the unsophisticated.[2]

The poor incentive properties of immediate acceptance systems led author-

ities in Chicago to abandon their allocation scheme for the city's elite selective high schools in 2009. Officials in the Chicago Public Schools (CPS) observed that students with higher test scores were denied admission to their second-choice school, even though they had higher scores than students who ranked the school first. After eliciting preferences from more than 14,000 participants, CPS announced a new mechanism and asked participants to re-rank their choices. The new mechanism is a serial dictatorship where the highest-scoring student is assigned to her top choice, the next highest scoring student is assigned to her top choice among remaining schools, and so on. What is particularly surprising about this switch is that the new mechanism also did not have straightforward incentives because it limited the number of choices students could rank. Students could only rank four out of nine possible choices, necessitating strategic calculations on which choices to list and which ones to drop. In the subsequent year, they switched to a system with the same underlying algorithm, but allowed students to rank six schools.

A few years earlier, by an Act of Parliament, authorities in England outlawed First Preference First arrangements citing concerns that the procedure is unfair to unsophisticated participants. Following this legal ruling, many districts adopted variants of the deferred acceptance algorithm, known in England as Equal Preferences.[3] Using this procedure, first formally studied by David Gale and Lloyd Shapley in 1962, applicants start by applying to their first choice. Schools tentatively accept their preferred applicants up to capacity and reject the rest. Any rejected student applies to his next most preferred choice, and schools update their set of provisional acceptances by comparing these new proposals to students tentatively held over from the previous round. The algorithm terminates when there are no new proposals from rejected students.

The key idea is that assignments are deferred until there are no new proposals, and only then are they finalized. Unlike the First Preference First system, a student ranking a school second can displace one who ranks it first, if the school prefers that student. The reason it is called Equal Preferences is that when schools receive proposals, they do not discriminate among applicants based on where they were ranked on the applicant's preference form. As in the Chicago case, the Local Education Authorities that adopted Equal Preferences often limited the number of choices students could rank. Table 1 describes some of these transitions.[4]

Sönmez and I develop a way to rank systems based on their propensity toward manipulation.[5] Our approach makes it possible to evaluate whether the new systems are less manipulable than their predecessors. While our criterion is nonconsequentialist, it allows for relative comparisons of two systems without ideal incentive properties. As shown in Table 1 it also has important positive content where, with the exception of Seattle in 2009, every example involves the adoption of a less manipulable system according to our measure.

Design of School Lotteries

An important issue in student assignment systems involves resolving situations where two applicants have identical claims for school seats, but there is only one seat left. This can happen, for instance, when two students obtain the same priority at a school because they reside in the school's walk zone, and there are more walk-zone applicants than seats. One might suspect that using separate

Table 1: School Admission Reforms

School District	Reform Year	Old Rule	New Rule	More or Less Manipulable?
Boston Public Schools	2009	Boston	GS	Less
Chicago Selective Public HS	2009	Boston (list 4 choices)	SD (list 4 choices)	Less
Chicago Selective Public HS	2010	SD (list 4 choices)	SD (list 6 choices)	Less
Denver Public Schools	2012	Boston (list 2 choices)	GS (list 5 choices)	Less
Seattle Public Schools	1999	Boston	GS	Less
Seattle Public Schools	2009	GS	Boston	More
England – Newcastle	2005	Boston (list 3 choices)	GS (list 3 choices)	Less
England – Manchester	2007	FPF (list 3 choices)	GS (list 3 choices)	Less
England - Surrey	2010	GS (list 3 choices)	GS (list 6 choices)	Less

Note: Boston refers to the Boston mechanism, FPF refers to First Preference First mechanisms, GS refers to the student-proposing deferred acceptance algorithm of Gale and Shapley, and SD refers to a serial dictatorship.

lotteries at each school would be more fair than a single lottery because under a single lottery, if an applicant has a better lottery number than another applicant, that remains true at each school. However, together with Atila Abdulkadiroğlu and Alvin Roth, I show that a single lottery draw across all schools has better properties than school-specific lottery draws when using deferred acceptance.[6] In the case of New York City where there are 90,000 applicants each year, more than 2,000 additional applicants obtain their first choice with a single lottery draw compared to school-specific draws.[7]

Another popular mechanism is based on Gale's top trading cycles (TTC) algorithm. Roughly speaking, this procedure endows students with schools and allows them to trade with one another in an ordered market where trades among top choices occur before trades among lower choices. Suppose Ann wants school 1 as her top choice but has the highest priority at school 2, while Bob wants school 2 as his top choice but has the highest priority at school 1. In the TTC algorithm, Ann and Bob would trade their assignments. In 2012, the OneApp assignment system used in the Recovery School District in New Orleans employed a mechanism based on TTC.[8] In general, there is no preferred way to conduct lotteries for TTC. Together with Jay Sethuraman, I show that in the special case where schools do not have priorities, the allocations produced with a single lottery draw and with school-specific draws are identical.[9]

Boston's Choice Plan

Much of the initial work on student assignment was motivated by Boston's iconic school choice system, and it continues to inspire new scientific developments. In Boston and elsewhere, students wish to attend schools close to their home, especially at elementary school entry points. Districts recognize this by prioritizing applicants in the school's walk zone, a geographic area surrounding the school. On the other hand, such policies can increase segregation across schools as students who live near highly desired schools fill up the seats and prevent those from outside the neighborhood from having an opportunity to attend.

To ensure that out-of-neighborhood applicants have an opportunity to attend a particular school, many choice systems follow Boston's in having a slot-specific priority structure. In Boston, for half of the school seats, applicants with walk-zone priority are ordered ahead of those who do not have walk-zone priority. For the other half, students from the walk zone are treated in the same way as students from outside the zone. This 50-50 split represents a compromise between those in favor of neighborhood schools and those favoring more choice.

When a student is eligible to attend a school both because of walk-zone priority and because of the district-wide assignment rule, the assignment mechanism must deal with another type of indifference. Since students care only about their school assignment, they are indifferent about whether they consume a walk-zone or a non-walk-zone slot. The mechanism's precedence order specifies the order in which slots are depleted. Together with Umut Dur, Scott Kominers, and Sönmez, I show that student precedence has dramatic consequences for achieving distributional objectives.[10] In Boston, for instance, the precedence rule entirely undermined the intended effect of the 50-50 policy and the outcome was nearly identical to that without walk-zone priority at all. The reason is that applicants first depleted walk-zone slots before non-walk-zone slots. A walk-zone applicant who did not obtain a walk-zone slot competes with the general pool of applicants for non-walk-zone slots, but only after this applicant has been rejected from the walk-zone pool. This rejection induces a form of adverse selection — the applicant is rejected so he must have an unusually bad lottery number — that renders rejected walk-zone applicants not competitive for non-walk-zone slots. As a result, almost no students from the walk zone are assigned to the non-walk-zone slots, undermining the 50-50 compromise.

We develop a framework to study these features of slot-specific priorities and identify counterfactual policies that more faithfully implement policy goals. As a result of our work, Boston substantially changed its walk-zone policy in 2014.

Boston has also completely redesigned how it determines the set of options students are allowed to rank on their choice menu. Until 2014, residents were restricted to applying to schools in one of three zones of the city and a handful of citywide schools. In 2014, the city adopted a zone-free plan where choice menus are customized based on an applicant's address. The choice menus are designed to ensure that each student is able to apply to enough of the closest highly rated schools. Peng Shi and I use historical choices expressed in Boston to estimate models of school demand. We use these models to extrapolate the choices applicants would make under these new choice menus. Our results were discussed by school officials and played a significant role in the adoption of the new plan. We plan to update these predictions in a two-part project that will evaluate the performance of structural models of demand forecasting. Because our predictions were made in advance of the policy change, there is no scope for post-analysis bias.[11] We intend to revisit our predictions after applicants have expressed new choices in the spring of 2014, and to use the new data to assess the strengths and weaknesses of counterfactual prediction using discrete choice models of school demand.

Measurement of School Effects

Much of the excitement about school assignment mechanisms comes from the potential to engineer practical solutions that might improve welfare. In my view, an equally important role of common enrollment systems is in producing valuable data that can be used to evaluate the impact of various educational initiatives.

A longstanding question in education has been about the effects of attending charter schools, which are publicly funded schools with enhanced autonomy. When a charter school is over-subscribed, in many jurisdictions students

are admitted via lottery. Records on schools' admissions in decentralized and uncoordinated systems tend to be poorly kept and infrequently audited. Together with several co-authors, I collect admissions records from Boston-area charter schools and study the effects of attending an over-subscribed charter school on short-run measures of student achievement. We find large and significant test score gains for charter lottery winners in middle and high school.[12] In subsequent work, I find that charter lottery winners at Boston high schools increase SAT and AP scores, along with evidence of a substantial shift from two- to four-year colleges.[13] In contrast, in work with Joshua Angrist and Christopher Walters, I find more mixed evidence on the performance of charter schools outside of urban areas of Massachusetts.[14]

Charters are not assigned centrally in Boston, though they are now beginning to be assigned together with traditional district schools in unified enrollment systems in cities like Denver, Newark, and New Orleans. Alternative schools known as exam schools, which group together the highest-achieving students in the district, are centrally assigned in many cities based on admissions test scores. Together with Abdulkadiroğlu and Angrist, I exploit admissions discontinuities to measure the value of attending schools with high-achieving peers. On a wide range of academic outcomes, we find that marginal applicants who are accepted at exam schools do not score higher on subsequent performance metrics, such as standardized tests, than their near-peers who did not matriculate at exam schools.[15]

Another school model I have investigated using lottery-based variation in a centralized match is the small high school. Together with Abdulkadiroğlu and Weiwei Hu, we exploit variation in New York City's high school match to study the effects of attending an over-subscribed small high school, which typically has fewer than 500 students across grades 9 to 12. Unlike charter schools, these schools are run with teachers who are part of the city's collective bargaining agreement. Students are much more disadvantaged than typical New York City high school students. Our results offer some of the first evidence that traditional district schools can produce achievement gains comparable to high-achieving charter schools.[16] Based on surveys, many small high schools have similar characteristics to high-achieving charter schools including high expectations and data-driven instruction. These results highlight the potential for within-district reform strategies to substantially improve student achievement.

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Bank Leverage and Credit Supply

Hyun Song Shin*

Banks and other types of financial intermediaries are of special interest given their role in the economy and as their balance sheet decisions have direct implications for credit supply. In spite of this, financial firms are routinely excluded from the data samples in empirical studies in corporate finance. This means that some of the features of financial firms that make them special are often not addressed. Peering into the corporate finance of banks reveals some important lessons.

Basics of the Corporate Finance of Banking

Consider something as basic as leverage. Define leverage as the ratio of total assets to the equity of a firm. Figure 1, at the upper right, shows three ways that a firm (financial or otherwise) can increase its leverage. In each case, the gray shaded area represents the balance sheet component that does not change.

Mode 1 on the left is the case typically dealt with in MBA textbooks in corporate finance. It depicts a financial operation where the firm issues debt and buys back equity with the proceeds of the debt issue. The assets of the firm are unchanged. This is the way, for instance, that a private equity fund would acquire a target firm. Mode 2 depicts the consequences of a dividend paid to shareholders financed by an asset sale. The leverage goes up because the debt remains in place, but the assets shrink in value. The shrinking of the asset value could reflect simply a decline in the price of the assets, so that the increase in leverage is the result of market value changes.

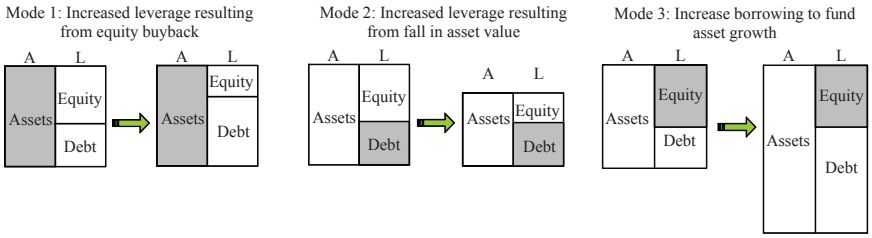

Figure 1: Three Modes of Leveraging Up

However, for banks neither Mode 1 nor Mode 2 turns out to be the right picture. Banks adjust their leverage as in Mode 3, where new assets are financed by issuing new debt, with equity varying very little.

Figure 2 shows the scatter plot of the change in total assets, debt, and equity of Barclays. Each point corresponds to a change in one of these measures over a two-year period during the 18-year period of 1992 to 2010. There are nine such intervals. The data show very small changes in equity, even when assets change substantially during a two-year period. However, for debt the fitted line through the scatter plot between the change in assets and the change in debt has a slope very close to one, meaning that the change in

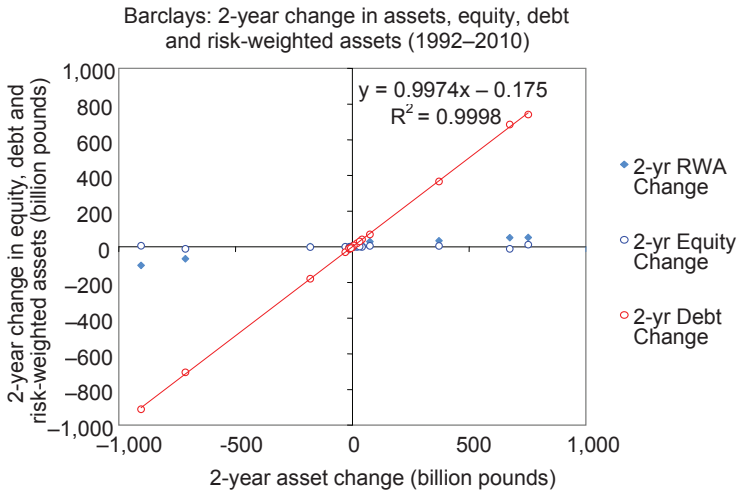

Figure 2: Two year changes in assets, equity, debt, and risk-weighted assets of Barclays
(Source: Bankscope)

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assets is almost all accounted for by the change in debt, just as in Mode 3 above. Since the total assets of the bank and the leverage of the bank move in lockstep in Mode 3, a theory of bank leverage gives a theory of bank credit supply.

Book Value of Assets and Bank Lending

The equity series in the scatter chart shows changes in the book value of equity, not the market capitalization of the bank. In empirical corporate finance studies for non-financial firms, it is customary to give more weight to the market capitalization than to the book equity. The rationale is that the accounting values do not reflect the true market value of the firm and for questions related to how much the firm is worth, it is better to examine the enterprise value of the firm, where enterprise value is defined as the sum of the equity market capitalization and the value of debt.

However, for banks the book value of assets conveys information on how much the bank lends. The book value of assets grows when the bank extends more loans. So, if our focus is on credit supply, then the book value of assets is a meaningful quantity. To be sure, researchers are also interested in how much the bank is worth to claim holders, a question for which the bank's enterprise value would be informative. But we are also interested in *how much the bank lends*, especially for macro applications. For this, we need to look at book values.

In joint research with Tobias Adrian and Paolo Colla,[1] I explore bank credit supply and how it differs from the credit that firms obtain through the bond market. Figure 3, at the upper right, shows total credit to U.S. non-financial businesses classified into whether the borrower is a corporate business or a non-corporate business. The left panel shows total credit to the corporate business sector and the right panel shows total credit to the non-corporate business sector.

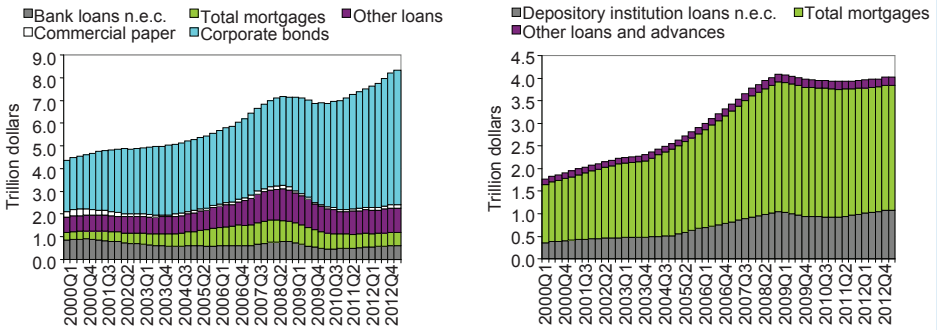

Figure 3: Credit to U.S. non-financial corporate business sector (left) and non-financial, non-corporate business sector (right)

(Source: Federal Reserve Flow of Funds, Tables L102, L103)

We note that lending to corporate businesses has surged since the financial crisis, mainly as a result of rising bond financing. Total credit to corporate businesses is much higher than before the crisis thanks to the increase in bond financing. In contrast, lending to non-corporate businesses has remained stagnant. Since small firms do not have the capacity to tap the bond market, they rely exclusively on bank lending. Bank lending rates have also remained high since the crisis. The left panel of Figure 4, below, shows the bank lending rate to U.S. businesses from a Fed survey, when the risk is "moderate" and the maturity is longer than one year. The lending rate has remained high, long after the Fed funds rate went to zero. The right panel of Figure 4 shows the spread between the bank lending rate and the Fed funds rate, which has stayed high at around 4 percent.

Procyclicality of Bank Lending

The availability of credit and how credit varies over the business cycle are clearly matters of great importance. Some cyclical variation in total lending is to be expected even in a frictionless world as there would be more positive net present value (NPV) projects that need funding when the economy is strong than when it is weak. The question is whether the fluctuations in lending are larger than would be justified by changes in the incidence of positive NPV projects. The fact that bank lending behaves so differently from bond financing suggests that credit supply by

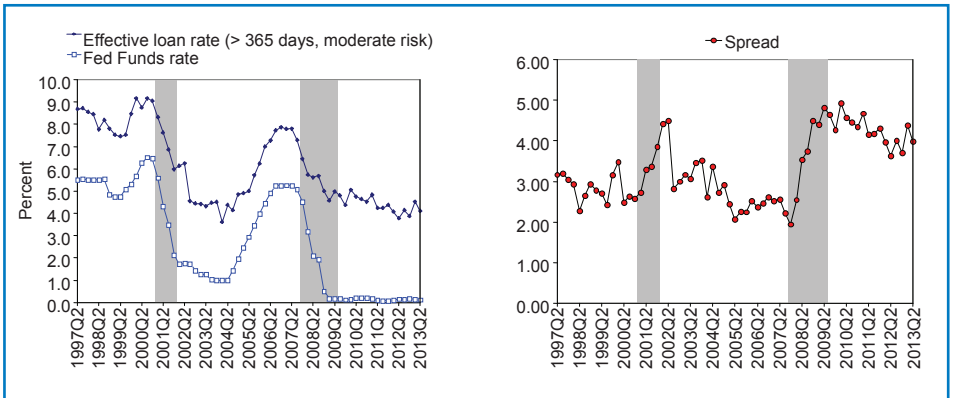

Figure 4: Weighted-Average Effective Loan Rate for More than 365 Days, Moderate Risk, All Commercial Banks (EELMNQ), the effective Fed Funds rate, and the spread between the two.

(Source: Federal Reserve survey of business lending conditions)

banks needs additional explanation.

Adrian and I[2] delve deeper into the reasons for the procyclicality of leverage and document the important explanatory role played by measured risks through the banks' value at risk (VaR). Formally, VaR is a quantile measure on the loss distribution, defined as the smallest threshold loss L on the bank's loan book, such that the probability that the realized loss turns out to be larger than L is below some fixed probability α. Roughly speaking, VaR is a measure of the "approximate worst case loss" for the bank in the sense that anything worse than this worst case loss happens only with some small probability α.

Adrian and I find that the VaR per dollar of assets fluctuates widely over the financial cycle in step with measures of risk such as the implied volatility embedded in the price of equity options. However, there are much more modest fluctuations in the banks' VaR per dollar of equity. In fact, the rule of thumb that banks keep the ratio of VaR to equity constant is a useful benchmark.

The reason why the VaR-to-assets ratio fluctuates widely, but the VaR-to-equity ratio does not, is accounted for by the active management of leverage by intermediaries, especially the active shedding of risks through deleveraging during times of market stress. In other words, banks cut back lending when measures of risk go up so that their total VaR is kept roughly constant. This suggests that financial intermediaries such as banks are shedding risks and withdrawing credit precisely when the financial system is under the most stress, thereby amplifying the downturn.

Some telltale signs of such behavior can be seen in our scatter chart for Barclays, Figure 2, which shows the relationship between changes in total assets and changes in risk-weighted assets. Risk-weighted assets are obtained by multiplying the bank's holdings of each type of asset by the measured risks associated with the asset. When balance sheets are expanding rapidly, risk-weighted assets show only modest increases, reflecting the lowering of risk weights during booms. In contrast, during downturns when the bank is contracting lending there is only a marginal reduction in risk-weighted assets because of the increase in the measured risks associated with lending.

Adrian and I explore a principal-agent model of the bank that could account for such procyclical behavior if the creditors to the bank impose tighter funding constraints on the bank, akin to the higher "haircuts" that are imposed on borrowers in repurchase ("repo") agreements during downturns. In a benchmark case that we consider, in which uncertainty is described by the extreme value distribution (EVT), the optimal contract between the creditors and the bank includes a leverage limit on the bank that implies a fixed probability of bank failure, irrespective of the risk environment. Since measured risk fluctuates over the cycle, imposing a constant probability of failure implies very substantial expansions and contractions of the balance sheet of the bank for any given level of bank equity. In other words, the contract implies substantial leveraging and deleveraging over the cycle.

International Dimension

The procyclicality of bank lending also has an international dimension. Valentina Bruno and I[3] address the global factor in cross-border bank capital flows and explore how global "push" factors that are associated with the bank leverage cycle act as global factors that drive cross-border capital flows across the world. Policy discussion has revolved around the notion of "global liquidity" whereby permissive credit conditions in financial centers are transmitted across borders to other parts of the world, leading to highly synchronized fluctuations in capital flows and financial conditions across jurisdictions.[4]

Bruno and I explore a model of global liquidity built around the operation of international banks in a "double-decker" model of banking where local banks borrow in U.S. dollars from global banks in order to lend to local corporate borrowers. In turn, the global banks finance cross-border lending to regional banks by tapping U.S. dollar money market funds in financial centers. One distinctive feature of our approach is that it generates a link between currency appreciation and the buildup of leverage in the banking sector. The link arises from shifts in the effective credit risk faced by banks who lend to local borrowers that may have a currency mismatch. When the local currency appreciates, local borrowers' balance sheets become stronger, resulting in lower credit risk and hence expanded bank lending capacity. In this way, currency appreciation leads to greater risk-taking by banks. This "risk-taking channel" of currency appreciation entails a link between exchange rates and financial stability. The rapid growth of the banking sector fueled by capital inflows and an appreciating currency has been a classic early warning indicator of emerging economy crises.[5] The framework in Bruno and Shin (2013) addresses the theoretical mechanism that links currency appreciation and the buildup of leverage, in contrast to conventional macro models of exchange rates where the focus is on the current account.

Summary

Empirical studies in corporate finance routinely exclude banks from the analysis because of their special nature. Given banks' importance as suppliers of credit to the economy, a focused study of the corporate finance of banking has value in its own right. Banks manage their balance sheets in a procyclical manner, expanding lending during boom times when measured risks are low and restricting lending during the downturn when measured risks increase. In a general equilibrium context, such procyclical behavior could be expected to have feedback effects that amplify shocks.

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[1] *T. Adrian, P. Colla, and H. S. Shin, "Which Financial Frictions? Parsing the Evidence from the Financial Crisis of 2007-9," NBER Working Paper No. 18335, August 2012, and* NBER

Macroeconomics Annual 2012, *Volume 27, D. Acemoglu, J. Parker, and M. Woodford, eds., Chicago, IL: University of Chicago Press, (2013), pp. 159–214.*

[2] *T. Adrian and H. S. Shin, "Procyclical Leverage and Value-at-Risk," NBER Working Paper No. 18943, April 2013, and* Review of Financial Studies *27 (2014), pp. 373–403.*

[3] *V. Bruno and H. S. Shin, "Capital Flows, Cross-Border Banking and Global Liquidity," NBER Working Paper No. 19038, May 2013.*

[4] *See Bank for International Settlements, "Global Liquidity - Concept, Measurement and Policy Implications," Basel, 2011, http://www.bis.org/publ/cgfs45.pdf , and H. Rey, "Dilemma not Trilemma: The Global Financial Cycle and Monetary Policy Independence," forthcoming in the Proceedings of the Federal Reserve Bank of Kansas City Economic Symposium at Jackson Hole, 2014.*

[5] *See P. Gourinchas and M. Obstfeld, "Stories of the Twentieth Century for the Twenty-First," NBER Working Paper No. 17252, July 2011, and* American Economic Journal: Macroeconomics, *4 (2012), pp. 226–65; and M. Schularick and A. Taylor, "Credit Booms Gone Bust: Monetary Policy, Leverage Cycles, and Financial Crises, 1870–2008," NBER Working Paper No. 15512, November 2009, and* American Economic Review *102 (2012), pp. 1029–61.*

Exploring Asset Pricing Anomalies

Lu Zhang*

One of the most important challenges in the field of asset pricing is understanding anomalies: empirical patterns that seem to defy explanation by standard asset pricing theories. The traditional approach to explaining these patterns focuses on the behavior of investors. Empirical evidence on anomalies has been cited widely in the academic literature on "behavioral finance" which challenges the efficient market hypothesis and admits the possibility of investor irrationality. I pursue a different approach in my work. Instead of focusing on the behavior of investors, I focus on the behavior of firms. In particular, I investigate whether recognizing the richness of firm investment decisions can help to explain some of the empirical patterns that are often labeled as anomalies.

My research explores the theoretical relation between firm attributes, investment decisions, and stock returns, and examines various empirical implications in this setting. Neoclassical investment theory implies that a firm invests until the net present value (NPV) of the last infinitesimally small project equals zero. For short-lived projects, this prediction means that the firm invests until its discount rate equals the benefits (for example, cash flows) of a marginal project divided by its costs. In turn, the discount rate is the weighted average cost of capital (WACC), which is the leverage-weighted average of the stock return and the bond return. Intuitively, a firm keeps investing until the costs of doing so, which rise with the level of investment, equal the benefits of investment discounted by the WACC.

Building on an early contribution by John Cochrane,[1] I recognize that expressing the expected stock return, which equals the levered WACC, as a function of firm characteristics provides a framework for interpreting anomalies in the data. I label this relation "the WACC equation." This framework does not depend on investor attributes. A key insight that emerges in this setting is that evidence that firm characteristics forecast stock returns does not necessarily imply that stocks are mispriced.[2]

The WACC equation predicts that, all else equal, stocks of firms that are investing heavily should earn lower average returns than stocks with low investment, and that stocks with high return-on-equity (ROE) should earn higher average returns than stocks with low ROE. When expected returns are time-varying (and, more importantly, vary in the cross section), then stock prices vary and they will be related to investment and ROE according to the WACC equation. In particular, stock prices will not adjust in a way that gives rise to a cross-sectionally constant discount rate, which is only true if all firms are equally risky and stock prices follow a random walk.

The WACC equation's prediction is intuitive. All else equal, high expected returns, which translate into high costs of capital, imply low NPVs of new capital and therefore low investment; low expected returns imply high NPVs of new capital and therefore high invest-

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ment. In addition, high ROE relative to low investment must imply high costs of capital, which are necessary to offset the high ROE to induce low NPVs for new capital and therefore low investment. Conversely, low ROE relative to high investment must imply low costs of capital, which are necessary to offset the low ROE to induce high NPVs for new capital and therefore high investment.

My co-authors and I evaluate the empirical power of the WACC equation using factor regressions, a standard technique in empirical finance that relates the return on a security to the contemporaneous returns on a number of "factors." In one of the most widely cited applications of such factor models, Eugene Fama and Kenneth French specify three factors: the excess return on the overall stock market (the market factor), the return spread between small and large stocks, and the return spread (the value factor, denoted HML) between value stocks (with high book value of equity relative to the market value of equity) and growth stocks (with low book value of equity relative to the market value of equity).[3] Mark Carhart subsequently forms a four-factor model by adding to the Fama-French model the return spread (the momentum factor, denoted UMD) between winners (stocks with high prior six- to twelve-month returns) and losers (stocks with low prior six- to twelve-month returns).[4] The Carhart four-factor model is the current empirical benchmark for estimating expected returns in academic research and in investment management practice.

Motivated by the WACC equation, my co-authors and I propose a new four-factor model which we label the "*q*-model" that includes the market factor, a size factor, an investment factor, and an ROE factor. With a few exceptions, the *q*-model's performance is at least comparable to, and often better than, that of the Carhart model in explaining a comprehensive list of anomalies in factor regressions. A comparative advantage of the *q*-model is its economic motivation.

We construct the size, the investment, and the ROE factors from two-by-three-by-three sorts of stocks based on size (market equity), investment-to-assets, and ROE. The investment factor is the difference (low-minus-high) between the simple average of the returns on the six low investment portfolios and the simple average of the returns of the six high investment portfolios. The ROE factor is the difference (high-minus-low) between the simple average of the returns on the six high ROE portfolios and the simple average of the returns of the six low ROE portfolios.

From January 1972 to December 2012, the investment factor earned an average return of 0.45 percent per month, and the ROE factor earned on average 0.58 percent. Both average returns are statistically distinguishable from zero. The investment factor has a high correlation of 0.69 with the value factor, HML, and the ROE factor has a high correlation of 0.50 with the momentum factor, UMD. The Carhart four-factor model has difficulty explaining our factor returns, but the *q*-model can explain the Carhart factor returns. The evidence suggests that HML and UMD might be noisy versions of our new factors.

More importantly, using a set of 33 anomalies that are significant in the broad cross section, we show that the *q*-model performs well relative to the Carhart model. Across the 33 high-minus-low decile portfolios, the average magnitude of the unexplained average returns is 0.21 percent per month in the *q*-model, which is lower than 0.34 percent in the Carhart model and 0.55 percent in the Fama-French model. The number of anomalies still associated with unexplained average returns is also much lower: 4 for the *q*-model, 18 for the Carhart model, and 25 for the Fama-French model. The *q*-model's performance, combined with its economic motivation, suggests that it might be able to serve as a new empirical workhorse for estimating expected returns.[5] Fama and French (2013) have recently incorporated variables that resemble our new factors into their three-factor model to form a five-factor asset pricing model.[6]

My co-authors and I also explore a dynamic model with corporate income taxes and debt, and design a novel asset pricing test by matching average levered WACCs to average stock returns across different sets of testing portfolios. The results provide some support for our investment approach, and suggest that the WACC equation can explain a substantial portion of the spreads in average stock returns of portfolios sorted on unexpected earnings, book-to-market equity, and capital investment. The average magnitude of the model errors across ten unexpected earnings deciles is 0.7 percent per annum, which is lower than 4 percent from the Fama-French model. The high-minus-low decile has an error of –0.4 percent in our model, in contrast to 14.1 percent from the Fama-French model. Across ten book-to-market deciles, the average absolute error is 2.3 percent, which is comparable with 2.8 percent in the Fama-French model. However, the high-minus-low error is only 1.2 percent in our model relative to 7.3 percent in the Fama-French model. As such, portfolios of firms seem to do a good job of aligning investment with costs of capital. One weakness is that our estimates of capital's share and the adjustment cost parameter vary across different sets of the testing portfolios.[7]

We also apply our dynamic WACC model to price momentum and earnings momentum, two important anomalies in the cross section. To this end, we refine our empirical procedure by measuring monthly levered WACCs using annual accounting data. Because the stock composition of momentum portfolios changes monthly, portfolio fundamentals such as investment also vary monthly even though firm-level fundamentals are constant within a fiscal year. Since winners (stocks with high unexpected earnings or high short-term prior returns) have higher expected investment growth than losers (stocks with low unexpected earnings or low short-term prior returns) the dynamic WACC model succeeds in accounting for average momentum profits. In addition, as the expected investment growth spread between winners and losers converges within 12 months after the portfolio formation in the data, momentum profits predicted in the model also converge within 12 months as in the data.[8]

To understand the value premium, I also develop a dynamic, quantitative investment model in which asymmetric adjustment costs of capital and the countercyclical price of risk combine to cause assets in place to be harder to adjust downward (and therefore riskier) than growth options, especially in bad times when the price of risk is high.[9] This model's key prediction that value stocks are riskier than growth stocks in bad times seems to contradict conventional wisdom. My co-author and I address this seeming contradiction by defining the state of the economy based on the expected equity risk premium.[10] Peaks are identified as periods with the 10 percent lowest market risk premiums, and troughs as periods with the 10 percent highest risk premiums. As the model predicts, the market beta of HML is positive (0.40) in troughs but negative (–0.33) in peaks, suggesting that at least part of the value premium is attributable to risk.

Why do firm characteristics often seem to have more explanatory power than risk measures in explaining returns? My co-author and I offer suggestive evidence by showing that measurement errors in estimated betas can explain this pattern. For example, beta estimates from 36-month rolling-window regressions are average betas in the past three-year period, whereas the true beta is time-varying.[11]

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1 *J. H. Cochrane, "Using Production Based Asset Pricing to Explain the Behavior of Stock Returns over the Business Cycle," NBER Working Paper No. 3212, January 1992, published as "Production-Based Asset Pricing and the Link Between Stock Returns and Economic Fluctuations,"* The Journal of Finance *46 (1991), pp. 209–37.*

2 *X. Lin and L. Zhang, "Covariances versus Characteristics in General Equilibrium," NBER Working Paper No. 17285, August 2011, published as "The Investment Manifesto,"* Journal of Monetary Economics, *60 (2013), pp. 351–66. Some of the ideas discussed in this work first appear in L. Zhang, "Anomalies," NBER Working Paper No. 11322, May 2005.*

3 *E. F. Fama and K. R. French, "Common Risk Factors in the Returns on Stocks and Bonds,"* Journal of Financial Economics *33 (1993), pp. 3–56.*

4 *M. M. Carhart, "On Persistence in Mutual Fund Performance,"* The Journal of Finance *52 (1997), pp. 57–82.*

5 *K. Hou, C. Xue, and L. Zhang, "Digesting Anomalies: An Investment Approach," NBER Working Paper No. 18435, October 2012. The estimates reported in this summary are from the updated sample through December 2012 and will appear in the next draft of this paper. An early incarnation of this work appears as "Neoclassical Factors," NBER Working Paper No. 13282, July 2007. The insight that investment and ROE play a central role in the cross-section of returns within the neoclassical theory of investment is presented in Zhang, 2005, op. cit.*

6 *E. F. Fama and K. R. French, "A Five-Factor Asset Pricing Model," Fama-Miller Working Paper, University of Chicago, November 2013.*

7 *L. X. Liu, T. M. Whited, and L. Zhang, "Investment-based Expected Stock Returns,"* Journal of Political Economy *117 (2009), pp. 1105–39. This paper draws heavily on "Regularities," NBER Working Paper No. 13024, April 2007.*

8 *L. X. Liu and L. Zhang, "A Model of Momentum," NBER Working Paper No. 16747, January 2011.*

9 *L. Zhang, "The Value Premium,"* The Journal of Finance *60 (2005), pp. 67–103.*

10 *See R. Petkova and L. Zhang, "Is Value Riskier Than Growth?"* Journal of Financial Economics *78 (2005), pp. 187–202.*

11 *Lin and Zhang, 2013, op. cit.*

NBER Profile: *Lucas Davis*

Lucas Davis is a Research Associate in the NBER's Programs in Environmental and Energy Economics and Public Economics. He is the Harold Furst Associate Professor in Management Philosophy and Values at the Haas School of Business at the University of California, Berkeley. He received a B.A. from Amherst College in 1996 and a Ph.D. in Economics from the University of Wisconsin in 2005. Before arriving at Berkeley in 2009, Davis was an Assistant Professor at the University of Michigan.

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Davis lives in Oakland with his wife and daughter and they enjoy walking around the neighborhood and being involved in Oakland Public Schools.

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Parag Pathak is the founding co-director of the NBER's Working Group on Market Design and a Research Associate in the NBER's Programs on Education, Public Economics, and Industrial Organization. He is an Associate Professor of Economics at MIT, where he studies market design, the economics of education, and housing markets. He has helped to design algorithms that are currently used for allocating students to schools in several large metropolitan areas, including Boston, Chicago, Denver, New Orleans, and New York City.

Pathak attended Harvard University, receiving his bachelor's degree in Applied Mathematics in 2002 and a Ph.D. in Business Economics in 2007. Before joining the MIT faculty, he was a Junior Fellow at Harvard's Society of Fellows.

Pathak is an Associate Editor of the *American Economic Review* and *Econometrica*. His research has been supported by a National Science Foundation CAREER Grant and an Alfred P. Sloan Research Fellowship. He is a recipient of the Presidential Early Career Award for Scientists and Engineers.

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Hyun Song Shin is a Research Associate in the NBER's Program on Corporate Finance and the Hughes-Rogers Professor of Economics at Princeton University. His research interests cover financial institutions, risk, and financial stability issues, topics on which he has published widely both in academic and policy outlets.

He is the author of *Risk and Liquidity,* which was the 2008 Clarendon Lecture in Finance, and co-authored the 2009 Geneva Report on *The Fundamental Principles of Financial Regulation.*

Before moving to Princeton in 2006 he was based in the United Kingdom and held academic positions at the University of Oxford and at the London School of Economics. In 2010, he took leave from Princeton and served as the Senior Adviser on the International Economy to South Korea's President Lee Myung-bak. He will rejoin the policy world in 2014 as Economic Adviser and Head of Research at the Bank for International Settlements.

NBER Profile: *Lu Zhang*

Lu Zhang is a Research Associate in the NBER's Program on Asset Pricing and the Dean's Distinguished Chair in Finance and Professor of Finance at The Ohio State University. He is also an Associate Editor for the *Journal of Financial Economics,* and a co-founder (and President in 2013) of the Macro Finance Society, a newly established academic society devoted to advancing and disseminating high-quality research at the intersection of financial economics and macroeconomics. He received a Ph.D. in Finance from the University of Pennsylvania in 2002. Prior to joining Ohio State in 2010, he taught at the University of Rochester (2002–6) and the University of Michigan (2006–10).

Zhang's research focuses on asset pricing and its connections to macroeconomics, corporate finance, labor economics, and accounting. His recent work explores the implications of the neoclassical *q*-theory of investment for cross-sectional asset pricing and the linkage between labor market frictions and economic crises. His scientific articles have appeared in leading academic journals, and in 2005 he received the Smith-Breeden Award for best paper from the American Finance Association and *The Journal of Finance* for his work on "The Value Premium."

Zhang lives in Columbus, Ohio, with his wife, Yiqing, as well as one cat, Kiddy, and three parrots, Mango, Greenie, and Tilly. At work, he enjoys embarrassing (and being embarrassed by) his co-authors via Skype. At home, he enjoys playing the role of peacemaker between the cat and the birds.

Conferences

International Social Security

An NBER Conference on "International Social Security" organized by NBER Aging Program Director David Wise of Harvard University's Kennedy School of Government took place in Madrid, Spain, on September 26–28, 2013. These papers were discussed:

- **Alain Jousten**, University of Liège, IZA, and Netspar, and **Mathieu Lefebvre** and **Sergio Perelman**, University of Liège, "Health Status, Disability and Retirement Incentives in Belgium"
- **Kevin Milligan**, University of British Columbia and NBER, and **Tammy Schirle**, Wilfrid Laurier University, "Option Value of Disability Insurance in Canada"
- **Paul Bingley** and **Michael Jørgensen**, Danish National Centre for Social Research, and **Nabanita Datta Gupta** and **Peder Pedersen**, Aarhus University, "Health, Disability Insurance and Retirement in Denmark"
- **Luc Behaghel**, Paris School of Economics-INRA; **Didier Blanchet**, INSEE-CREST; and **Muriel Roger**, Banque de France, Paris School of Economics-INRA, and INSEE D2E, "Retirement, Early Retirement and Disability: Explaining Labor Force Participation after 55 in France"
- **Axel Börsch-Supan**, Munich Center for the Economics of Aging and NBER; **Hendrik Jürges** and **Lars Thiel**, University of Wuppertal; and **Tabea Bucher-Koenen, Johannes Rausch**, and **Morten Schuth**, Munich Center for the Economics of Aging, "Health, Financial Incentives, and Early Retirement: Micro-Simulation Evidence for Germany" (NBER Working Paper No. 19889)
- **Agar Brugiavini**, Ca'Foscari University of Venice and Venice International University, and **Franco Peracchi**, University of Rome Tor Vergata and Einaudi Institute for Economics and Finance, "Health Status, Disability Insurance and Incentives to Exit the Labor Force in Italy: Evidence from SHARE"
- **Mayu Fujii** and **Takashi Oshio**, Hitotsubashi University, and **Satoshi Shimizutani**, Gender Equality Bureau, "Option Value of Work, Health Status, and Retirement Decisions in Japan: Evidence from the Japanese Study on Aging and Retirement (JSTAR)"
- **Adriaan Kalwij**, Universiteit Utrecht; **Klaas de Vos**, Universiteit van Tilburg; and **Arie Kapteyn**, University of Southern California and NBER, "Health, Disability Insurance and Labor Force Exit of Older Workers in the Netherlands"
- **Pilar García-Gómez**, Erasmus University Rotterdam; **Sergi Jiménez-Martín**, Universitat Pompeu Fabra, Barcelona GSE and FEDEA; and **Judit Vall Castelló**, Universitat de Girona and CRES at Universitat Pompeu Fabra, "Financial Incentives, Health and Retirement in Spain"
- **Per Johansson** and **Lisa Laun**, Institute for Evaluation of Labor Market and Education Policy, and **Mårten Palme**, Stockholm University, "Pathways to Retirement, Stringency in Disability Insurance Acceptance and the Role of Financial Incentives in Sweden"
- **James Banks**, University of Manchester and Institute for Fiscal Studies; **Carl Emmerson**, Institute for Fiscal Studies; and **Gemma Tetlow**, Institute for Fiscal Studies and University College London, "Effect of Pensions and Disability Benefits on Retirement in the UK"

Summaries to these papers may be found at: http://www.nber.org/confer/2013/ISS13/summary.html

India Conference

On December 13–15, 2013 the NBER, along with India's National Council for Applied Economic Research (NCAER) and the Indian Council for Research on International Economic Relations (ICRIER), sponsored a meeting in New Delhi and Neemrana, India that included NBER researchers as well as economists from Indian universities, research institutions, and government departments. NBER Research Associates **Abhijit Banerjee** of MIT and **Gita Gopinath** of Harvard University organized the conference jointly with Sanjana Joshi and Rajat Kathuria of ICRIER.

The NBER participants, in addition to the organizers, were: **Janet Currie**, Princeton University; **Oliver Hart** and **Nathan Nunn**, Harvard University; **Anne Krueger**, Johns Hopkins University; **Jens Ludwig**, University of Chicago; **Atif Mian**, Princeton University; **Karthik Muralidharan**, University of California, San Diego; **Romain Wacziarg**, University of California, Los Angeles; and **Shang-Jin Wei**, Columbia University. **Raghuram Rajan**, who is on leave from the University of Chicago and the NBER while serving as the Governor of the Reserve Bank of India, also participated.

The topics discussed included the efficient design of social policy and transfer programs, the measurement of gains from trade, the importance of liquidity shocks in triggering recessions, the role of economic institutions in affecting the growth of manufacturing and trade, the economics of urbanization, and the economics of innovation and competitiveness.

The Economics of Environmental Protection in China

An NBER Conference on "The Economics of Environmental Protection in China" took place in Cambridge on February 14 and 15, 2014. Joseph Fan of the Chinese University of Hong Kong, and NBER Research Associates Matthew Kahn of the University of California, Los Angeles and Randall Morck of the University of Alberta, organized the program. These papers were discussed:

- **Maoyong Fan**, Ball State University; **Guojun He**, Harvard School of Public Health; and **Maigeng Zhou**, Centers for Disease Control and Prevention, "The Effect of Air Pollution on Cardiovascular Mortality: Evidence from the 2008 Beijing Olympic Games"
- **Dalia Ghanem**, University of California, Davis, and **Junjie Zhang**, University of California, San Diego, "'Effortless Perfection': Do Chinese Cities Manipulate Air Pollution Data?"
- **Ruixue Jia**, University California, San Diego, "Pollution for Promotion"
- **Jing Wu**, Tsinghua University; **Yongheng Deng** and **Bernard Yeung**, National University of Singapore; **Jun Huang**, Shanghai University of Finance and Economics; and **Randall Morck**, "Incentives and Outcomes: China's Environmental Policy"(NBER Working Paper No. 18754)
- **Junhong Chu** and **Ivan Png**, National University of Singapore, and **Yehning Chen**, National Taiwan University, "Climate Change in China: Communism is Cooler"
- **Shanjun Li**, Cornell University, "Better Lucky Than Rich? Welfare Analysis of Automobile License Allocations in Beijing and Shanghai"
- **Inês Azevedo** and **Long Lam**, Carnegie Mellon University, and **Lee Branstetter**, Carnegie Mellon University and NBER, "The Unsustainable Rise of the Chinese Wind Turbine Manufacturing Industry"
- **Douglas Almond**, Columbia University and NBER; **Shuang Zhang**, University of Colorado, Boulder; and **Maigeng Zhou**, Centers for Disease Control and Prevention, "Air Pollution and Short-Term Mortality in Beijing"
- **Siqi Zheng** and **Cong Sun**, Tsinghua University, and **Ming Lu**, Shanghai Jiaotong University and Fudan University, "Congestion and Pollution as the Consequences of Cross-Zone Schooling in Beijing"

Summaries of these papers may be found at: http://www.nber.org/confer/2014/EPCs14/summary.html

Economics of Digitization

An NBER Conference on "Economics of Digitization" took place in Palo Alto on February 21, 2014. NBER Research Associates Shane Greenstein of Northwestern University, Josh Lerner of Harvard Business School, and Scott Stern of MIT organized the program. These papers were discussed:

- **Jin-Hyuk Kim**, University of Colorado, and **Tin Cheuk Leung**, Chinese University of Hong Kong, "Quantifying the Impacts of Digital Rights Management and E-Book Pricing on the E-Book Reader Market"
- **Yongdong Liu**, **Denis Nekipelov**, and **Minjung Park**, University of California, Berkeley, "Timely versus Quality Innovation: The Case of Mobile Applications on iTunes and Google Play"
- **Erik Brynjolfsson**, MIT and NBER; **Tomer Geva**, Tel Aviv University; and **Shachar Reichman**, MIT, "Crowd-Squared: Amplifying the Predictive Power of Large-Scale Crowd-Based Data"
- **Glenn Ellison,** MIT and NBER, and **Sara Fisher Ellison**, MIT, "Match Quality, Search, and the Internet Market for Used Books"
- **Aleksi Aaltonen**, London School of Economics, and **Stephan Seiler**, Stanford University, "Cumulative Knowledge and Open Source Content Growth: The Case of Wikipedia"
- **Timothy Bresnahan**, Stanford University and NBER, and **Joseph Orsini** and **Pai-Ling Yin**, Stanford University, "Platform Choice by Mobile App Developers"
- **Luis Aguiar**, Institute for Prospective Technological Studies, and **Joel Waldfogel**, University of Minnesota and NBER, "Digitization, Copyright, and the Welfare Effects of Music Trade"

Summaries of these papers may be found at: http://www.nber.org/confer/2014/EoDs14/summary.html

NBER News

2013 Awards and Honors

A number of NBER researchers received honors, awards, and other forms of professional recognition during 2013. A list of the honors reported by these researchers, excluding those that were bestowed by the researcher's home university, is presented below.

Katherine Baicker shared the 21st Arrow Award from the International Health Economics Association for "The Oregon Health Insurance Experiment: Evidence from the First Year," *Quarterly Journal of Economics* 127 (2012), pp. 1057–1106 (also NBER Working Paper No. 17190, July 2011). This paper, co-authored with **Amy Finkelstein**, Sarah Taubman, Bill Wright, Mira Bernstein, **Jonathan Gruber, Joseph Newhouse**, Heidi Allen, and the Oregon Health Study Group, also received an HSR Impact Award. Baicker was also named to the Group Insurance Commission of Massachusetts.

Martha J. Bailey received the IZA Young Labor Economist Award.

Daniel Benjamin received the 2013 Norwegian School of Economics Sandmo Junior Fellowship, a prize for a promising young economist.

Lori Beaman was awarded an NSF CAREER grant for her work on social networks, labor markets, and agriculture in developing countries.

Jeffrey R. Brown was awarded the Robert Mehr Award for a paper published a decade earlier that has "best stood the test of time" from the American Risk and

Insurance Association. The award recognized "Redistribution and Insurance: Mandatory Annuitization with Mortality Heterogeneity," *Journal of Risk and Insurance* 70 (2003), pp. 17–41 (also NBER Working Paper No. 9256, October 2002).

Alan Blinder's book on the financial crisis and its aftermath, *After the Music Stopped*, was selected by *The New York Times* as one of the ten best books of 2013.

John Cawley received a 2013 Investigator Award in Health Policy Research from the Robert Wood Johnson Foundation for his research on the economics of obesity.

Raj Chetty received the John Bates Clark medal of the American Economic Association and the Calvo-Armengol International Prize from the Barcelona Graduate School of Economics.

Janet Currie was elected a Fellow of the Econometric Society and a member of the Institute of Medicine of the National Academy of Sciences. She also served as the Vice-President of the Society of Labor Economists.

David Donaldson received an Alfred P. Sloan Research Fellowship.

Ronald G. Ehrenberg received the Howard Bowen Distinguished Career Award from the Association for the Study of Higher Education (ASHE), and was named an academic fellow of the Labor and Employment Relations Association (LERA) for exceptional contributions to research in labor and employment relations.

Emmanuel Farhi received the award for the best French economist under the age of 40 from the newspaper *Le Monde* and the Cercle des Économistes, as well as the Junior Prize in Monetary Economics and Finance, awarded by the Toulouse School of Economics and the Banque de France.

Roger Farmer was awarded a Senior Houblon Norman Fellowship at the Bank of England and he delivered the 2013 John Flemming Memorial Lecture. He also shared the inaugural Maurice Allais Prize in Economic Science with his co-authors Carine Nourry and Alain Venditti for their paper "The Inefficient Markets Hypothesis: Why Financial Markets Do Not Work Well in the Real World," (NBER Working Paper No. 18647, December 2012).

Amy Finkelstein shared the 2013 Arrow Award for the Best Paper in Health Economics from the International Health Economics Association.

Marvin Goodfriend was named an Honorary Advisor of the Institute for Monetary and Economic Studies of the Bank of Japan.

Robert J. Gordon was selected by Bloomberg as "One of America's Top 10 Most Influential Thinkers."

John Graham was named a Fellow of the Financial Management Association and elected president of the Western Finance Association. His paper on "Human Capital Loss in Corporate Bankruptcy" received the best corporate finance paper award at the FSA Laval and FMA Asia conferences.

Veronica Guerrieri was awarded the Carlo Alberto Medal, a biennial prize that honors an Italian economist under the age of 40 for outstanding research contributions.

John Haltiwanger shared the 2013 Julius Shiskin Memorial Award for Economic Statistics with Maurine Haver. He was also elected a Fellow of the Society of Labor Economists.

Daniel S. Hamermesh received the Mincer Award for Lifetime Contributions to Labor Economics of the Society of Labor Economists, the IZA Prize in Labor Economics of the Institute for the Study of Labor, and the John R. Commons Award of the international undergraduate economics honor society Omicron Delta Epsilon.

Caroline Hoxby received the Smithsonian's American Ingenuity Award.

Jennifer Hunt received the Best Paper Prize from the *American Economic Journal: Macroeconomics*, along with her co-author Marjolaine Gauthier-Loiselle, for their paper on "How Much Does Immigration Boost Innovation?" 2 (2010), pp. 31–56 (also NBER Working Paper No. 14312, September 2008).

Solomon Hsiang was the inaugural recipient of the Geophysical Union's Science for Solutions Award for significant contributions in the application and use of Earth and space sciences to solve societal problems. He was also listed in *Forbes*' "30 under 30 in Law and Policy".

Christine Jolls was elected to the American Academy of Arts and Sciences.

Edward J. Kane received the Lifetime Achievement Award from the Midwest Financial Association.

John Komlos was elected a fellow of the Cliometrics Society.

Michael Kremer received the Theodore W. Schultz Award from the Agricultural and Applied Economics Association.

Annamaria Lusardi received the William E. Odom Visionary Leadership Award from the Jump$tart Coalition for Personal Financial Literacy for her contributions to promoting financial literacy. She also received the inaugural Steen award from the National Numeracy Network for her paper "Numeracy, Financial Literacy, and Financial Decision-Making," published in *Numeracy* in 2012 (also NBER Working Paper No. 17821, February 2012).

Matteo Maggiori shared the 2013 AQR Award with **Martin Lettau** and Michael Weber for their paper on "Conditional Risk Premia in Currency Markets and Other Asset Classes," NBER Working Paper No. 18844, February 2013.

Ulrike Malmendier received the Fischer Black Prize, awarded every two years to the best researcher in financial economics under the age of 40.

Enrico Moretti's book *The New Geography of Jobs* received the William Bowen Prize from the Princeton University Industrial Relations Section.

Aldo Musacchio was awarded the Manuel Espinosa Yglesias Prize for research on the Mexican banking system and the Prize for Academic Merit from the ITAM Alumni Association. He also shared the Gerry Feldman Prize from the European Association of Banking and Financial History with his co-author André Martínez Fritscher.

Kevin O'Rourke was elected a Fellow of the British Academy.

Philip Oreopoulos shared the best paper award from the *American Economic Journal: Applied Economics* with **Till von Wachter** and Andrew Heisz for "The Short- and Long-Term Career Effects of Graduating in a Recession," 4 (2012), pp. 1–29 (also NBER Working Paper No. 12159, April 2006).

Dimitris Papanikolaou and Andrea Eisfeldt shared the Smith Breeden Award for the best paper published in *The Journal of Finance* for "Organization Capital and the Cross-Section of Expected Returns," 68 (2013), pp. 1365–1406.

Mitchell Petersen and Michael Faulkender shared the BGI-Michael Brennan Award for the best paper in the *Review of Financial Studies* for "Investment and Capital Constraints: Repatriations Under the American Jobs Creation Act," 25 (2012), pp. 3351–88 (also NBER Working Paper No. 15248, August 2009).

Robert Porter served as the First Vice-President of the Econometric Society.

Richard Portes received an honorary doctorate from University of Paris-Dauphine.

James Poterba served as president of the Eastern Economic Association.

Jonathan Reuter and John Chalmers shared the TIAA-CREF Paul A. Samuelson Award for their paper "How Do Retirees Value Life Annuities? Evidence from Public Employees," *Review of Financial Studies* 25 (2012), pp. 2601–34 (also NBER Working Paper No. 15608, December 2009).

Alvin Roth was elected to the National Academy of Sciences. He also received an honorary doctorate from Technion-Israel Institute of Technology, and shared the Golden Goose Award (jointly with David Gale and Lloyd Shapley) for federally funded research with significant social impact.

John B. Taylor received the Adolph G. Abramson Award from the National Association for Business Economics for his paper "The Effectiveness of Central Bank Independence versus Policy Rules," which was published in the association's journal *Business Economics*.

Robert Townsend delivered the T. W. Schultz Memorial Prize Lecture on "Accounting for the Poor: Theory and Measurement" at the annual meetings of the Agricultural and Applied Economics Association.

John Van Reenen was elected a fellow of the Econometric Society and of the Society of Labor Economists.

Heidi Williams shared the Kauffman/International Health Economics Association Award for Health Care Entrepreneurship and Innovation Research with Eric Budish and Benjamin Roin for their paper, "Do Fixed Patent Terms Distort Innovation? Evidence from Cancer Clinical Trials," NBER Working Paper No. 19430, September 2013.

Program and Working Group Meetings

Development Economics

The NBER's Program on Development Economics, directed by Duncan Thomas of Duke University, met in Cambridge on October 11 and 12, 2013. NBER researchers Pascaline Dupas of Stanford University, Frederico Finan of the University of California, Berkeley, and Sebastian Galiani of the University of Maryland organized the meeting. The meeting was held jointly with the Bureau for Research and Economic Analysis of Development. These papers were discussed:

- **Mark Rosenzweig** and **Christopher Udry**, Yale University and NBER, "Forecasting Profitability" (NBER Working Paper No. 19334)

- **Anandi Mani**, University of Warwick; **Sendhil Mullainathan**, Harvard University and NBER; **Eldar Shafir**, Princeton University; and **Jiaying Zhao**, University of British Columbia, "Poverty Impedes Cognitive Function"

- **Karthik Muralidharan**, University of California, San Diego and NBER, and **Venkatesh Sundararaman**, The World Bank, "The Aggregate Effects of School Choice: Evidence from a Two-Stage Experiment in India" (NBER Working Paper No. 19441)

- **Pedro Carneiro** and **Hugo Reis**, University College London, and **Jishnu Das**, The World Bank, "Parental Valuation of School Attributes in Developing Countries: Evidence from Pakistan"

- **Arthur Blouin** and **Rocco Macchiavello**, University of Warwick, "Tropical Lending: International Prices, Strategic Default and Credit Constraints among Coffee Washing Stations"

- **Christopher Blattman**, Columbia University; **Nathan Fiala**, German Institute for Economic Research; and **Sebastian Martinez**, Stanford Institute for Economic Policy Research, "Generating Skilled Self-Employment in Developing Countries: Experimental Evidence from Uganda"

- **Imran Rasul** and **Daniel Rogger**, University College London, "Management of Bureaucrats and Public Services Delivery: Evidence from the Nigerian Civil Service"

- **Daron Acemoglu**, MIT and NBER; **Camilo García-Jimeno**, University of Pennsylvania; and **James Robinson**, Harvard University and NBER, "State Capacity and Economic Development: A Network Approach" (NBER Working Paper No. 19813)

Summaries of these papers may be found at: http://www.nber.org/confer/2013/BREAD13/summary.html

Environmental and Energy Economics

The NBER's Program on Environmental and Energy Economics, directed by Don Fullerton of the University of Illinois, met in Palo Alto on January 23 and 24, 2014. NBER Research Associates Chris Costello of the University of California, Santa Barbara, and Catherine Wolfram of the University of California, Berkeley, organized the meeting. Part of the meeting was held jointly with the Industrial Organization Program. In addition to the papers marked with a (*) in the foregoing summary of the Industrial Organization meeting, these papers were discussed:

- **Solomon Hsiang**, University of California, Berkeley and NBER, and **Amir Jina**, Columbia University, "The Causal Effect of Environmental Catastrophe on Long-Run Economic Growth"

- **Joseph Shapiro**, Yale University and NBER, "Trade, CO_2, and the Environment"

- **Severin Borenstein**, University of California, Berkeley and NBER; **James Bushnell**, University of California, Davis and NBER; **Frank Wolak**, Stanford University and NBER; and **Matthew Zaragoza-Watkins**, University of California, Berkeley, "Expecting the Unexpected: Emissions Uncertainty and Environmental Market Design"

- **Koichiro Ito**, Boston University and NBER, and **James Sallee**, University of Chicago and NBER, "The Economics of Attribute-Based Regulation: Theory and Evidence from Fuel-Economy Standards"

- **Christopher Costello** and **Corbett Grainger**, University of Wisconsin, Madison, "Property Rights, Regulatory Capture, and Exploitation of Natural Resources"

- **Samuel Bell**, Cornell University; **Kelsey Jack**, Tufts University and NBER; **Paulina Oliva**, University of California, Santa Barbara and NBER; **Christopher Severen**, University of California, Santa Barbara; and **Elizabeth Walker**, Harvard University, "Uncertainty, Self-Selection and the Design of Subsidies: Evidence from Zambia"

- **Michael Greenstone**, MIT and NBER; **Stephen Ryan**, University of Texas, Austin and NBER; and **Michael Yankovich**, U.S. Military Academy at West Point, "The Value of a Statistical Life: Evidence from Military Retention Incentives and Occupation-Specific Mortality"

Summaries of these papers may be found at: http://www.nber.org/confer/2014/EEEs14/summary.html

Industrial Organization

The NBER's Program on Industrial Organization, directed by Nancy Rose of MIT, met in Palo Alto on January 24 and 25, 2014. NBER researchers Severin Borenstein and Benjamin Handel, both of the University of California, Berkeley, organized the meeting. Part of the meeting was held jointly with the NBER's Environmental and Energy Economics Program, and papers marked with a (*) were presented to the joint session. These papers were discussed:

- **Randall Lewis**, Google, Inc., and **Justin Rao**, Microsoft Research, "On the Near Impossibility of Measuring the Returns to Advertising"

- **Nicola Lacetera**, University of Toronto and NBER; **Bradley Larsen**, Stanford University; **Devin Pope**, University of Chicago and NBER; and **Justin Sydnor**, University of Wisconsin, "Bid Takers or Market Makers? The Effect of Auctioneers on Auction Outcomes" (NBER Working Paper No. 19731)

- **Eric Anderson**, Northwestern University; **Emi Nakamura**, Columbia University and NBER; **Duncan Simester**, MIT; and **Jón Steinsson**, Columbia University and NBER, "Informational Rigidities and the Stickiness of Temporary Sales" (NBER Working Paper No. 19350)

- (*)**Soren Anderson**, Michigan State University and NBER; **Ryan Kellogg**, University of Michigan and NBER; and **Stephen Salant**, University of Michigan, "Hotelling Under Pressure"

- (*)**Louis Kaplow**, Harvard University and NBER, "Optimal Regulation with Exemptions and Corrective Taxes"

- **Aviv Nevo**, Northwestern University and NBER, and **John Turner** and **Jonathan Williams**, University of Georgia, "Usage-Based Pricing and Demand for Residential Broadband"

- **Brian Chen**, University of South Carolina; **Paul Gertler**, University of California, Berkeley and NBER; and **Chun-Yuh Yang,** Kaohsiung Medical University, "Moral Hazard and Economies of Scope in Physician Ownership of Complementary Medical Services" (NBER Working Paper No. 19622)

- **Ricardo Cossa**, Charles River Associates, and **Mariano Tappata**, University of British Columbia, "Price Discrimination 2.0: Opaque Bookings in the Hotel Industry"

- **Sumit Agarwal**, National University of Singapore; **Souphala Chomsisengphet**, Department of the Treasury; **Neale Mahoney**, University of Chicago and NBER; and **Johannes Stroebel**, New York University, "Regulating Consumer Financial Products: Evidence from Credit Cards" (NBER Working Paper No. 19484)

- **Ulrich Doraszelski**, University of Pennsylvania, and **Gregory Lewis** and **Ariel Pakes**, Harvard University and NBER, "Just Starting Out: Learning and Price Competition in a New Market"

- (*)**Hunt Allcott** and **Allan Collard-Wexler**, New York University and NBER, and **Stephen O'Connell**, City University of New York, "How Do Electricity Shortages Affect Productivity? Evidence from India"

Summaries of these papers may be found at: http://www.nber.org/confer/2014/IOs14/summary.html

Economic Fluctuations and Growth

The NBER's Program on Economic Fluctuations and Growth, directed by Mark Gertler of New York University and Peter Klenow of Stanford University, met in New York City on February 7, 2014. NBER Research Associates Robert Shimer of the University of Chicago, and Michael Woodford of Columbia University, organized the meeting. These papers were discussed:

- **Gabriel Chodorow-Reich**, Harvard University, and **Loukas Karabarbounis**, University of Chicago and NBER, "The Cyclicality of the Opportunity Cost of Employment" (NBER Working Paper No. 19678)
- **Roger Farmer**, University of California, Los Angeles and NBER, and **Carine Nourry** and **Alain Venditti**, University of the Mediterranean, "The Inefficient Markets Hypothesis: Why Financial Markets Do Not Work Well in the Real World" (NBER Working Paper No. 18647)
- **Fernando Alvarez**, University of Chicago and NBER; **Hervé Le Bihan**, Banque de France; and **Francesco Lippi**, EIEF, "Small and Large Price Changes and the Propagation of Monetary Shocks"
- **Charles Carlstrom**, Federal Reserve Bank of Cleveland; **Timothy Fuerst**, University of Notre Dame; and **Matthias Paustian**, Federal Reserve Board, "Targeting Long Rates in a Model with Segmented Markets"
- **Anna Orlik**, Federal Reserve Board, and **Laura Veldkamp**, New York University and NBER, "Understanding Uncertainty Shocks and the Role of Black Swans"
- **William Dupor**, Federal Reserve Bank of St. Louis, and **Rong Li**, The Ohio State University, "The 2009 Recovery Act and the Expected Inflation Channel of Government Spending"

Summaries of these papers may be found at: http://www.nber.org/confer/2014/EFGw14/summary.html

Law and Economics

The NBER's Law and Economics Program, directed by Christine Jolls of Yale Law School, met in Cambridge on February 7, 2014. These papers were discussed:

- **Alain Cohn** and **Michel Maréchal**, University of Zurich, and **Thomas Noll**, Swiss Prison Staff Training Center, "Bad Boys: How Criminal Identity Affects Rule Violation"
- **Jared Stanfield** and **Robert Tumarkin**, University of New South Wales, "The Effect of the Political Power of Unions on Firm Value"

- **Decio Coviello**, HEC Montréal, and **Nicola Persico**, Northwestern University and NBER, "An Economic Analysis of Black-White Disparities in NYPD's Stop and Frisk Program" (NBER Working Paper No. 18803)

- **Mariassunta Giannetti**, Stockholm School of Economics, and **Tracy Yue Wang**, University of Minnesota, "Corporate Scandals and Household Stock Market Participation"

- **Rohan Pitchford**, Australian National University, and **Christopher Snyder**, Dartmouth College and NBER, "Mortgage Origination and the Rise of Securitization: An Incomplete-Contracts Model"

- **Edward Morrison**, University of Chicago; **Arpit Gupta**, Columbia Business School; and **Lenora Olson**, **Lawrence Cook** and **Heather Keenan**, University of Utah, "Health and Financial Fragility: Evidence from Car Crashes and Consumer Bankruptcy"

- **Sumit Agarwal,** National University of Singapore; **Souphala Chomsisengphet,** Department of the Treasury; **Neale Mahoney,** University of Chicago and NBER; and **Johannes Stroebel,** New York University, "Regulating Consumer Financial Products: Evidence from Credit Cards" (NBER Working Paper No. 19484)

- **Vyacheslav Fos**, University of Illinois, Urbana-Champaign, and **Wei Jiang**, Columbia University, "Out-of-the-Money CEOs: Private Control Premium and Option Exercise by CEOs"

Summaries of these papers may be found at: http://www.nber.org/confer/2014/LEs14/summary.html

Labor Studies

The NBER's Program on Labor Studies, directed by David Card of the University of California, Berkeley, met in San Francisco on February 21, 2014. These papers were discussed:

- **Michael Elsby**, University of Edinburgh; **Donggyun Shin**, Kyung Hee University; and **Gary Solon**, Michigan State University and NBER, "Wage Adjustment in the Great Recession" (NBER Working Paper No. 19478)

- **Henry Farber**, Princeton University and NBER, "Union Organizing Decisions in a Deteriorating Environment: The Composition of Representation Elections and the Decline in Turnout"

- **Peter Arcidiacono**,**V. Joseph Hotz**, and **Arnaud Maurel**, Duke University and NBER; and **Teresa Romano**, Duke University, "Recovering Ex Ante Returns and Preferences for Occupations Using Subjective Expectations Data"

- **Ashwini Agrawal** and **Prasanna Tambe**, New York University, "Private Equity, Technological Investment, and Labor Outcomes"

- **Luigi Pistaferri** and **Giacomo De Giorgi**, Stanford University and NBER, and **Anders Frederiksen**, Aarhus University, "Consumption Network Effects"

- **Stephen Burks**, University of Minnesota; **Bo Cowgill**, University of California, Berkeley; **Mitchell Hoffman**, University of Toronto; and **Michael Housman**, Evolv, Inc., "The Facts about Referrals: Toward an Understanding of Employee Referral Networks"

- **Robert Valletta**, Federal Reserve Bank of San Francisco, "Recent Extensions of U.S. Unemployment Benefits: Search Responses under Varying Labor Market States"

Summaries of these papers may be found at: http://www.nber.org/confer/2014/LSs14/summary.html

Healthcare

The NBER's Healthcare Program, which is directed by Jonathan Gruber of MIT, met in Cambridge on February 28, 2014. Part of the meeting was held jointly with the NBER's Insurance Working Group, and papers marked with a (*) were presented to the joint session. These papers were discussed:

- **Jill Horwitz**, University of California, Los Angeles and NBER, and **Daniel Polsky**, University of Pennsylvania, "Challenges to Regulatory Decentralization: Lessons from State Health Technology Regulation" (NBER Working Paper No. 19801)

- **Jeffrey Clemens**, University of California, San Diego and NBER, and **Joshua Gottlieb**, University of British Columbia, "Bargaining in the Shadow of a Giant: Medicare's Influence on Private Payment Systems" (NBER Working Paper No. 19503)

- (*) **Marika Cabral**, University of Texas, Austin and NBER, and **Neale Mahoney**, University of Chicago and NBER, "Externalities and Taxation of Supplemental Insurance: A Study of Medicare and Medigap" (NBER Working Paper No. 19787)

- (*) **Liran Einav**, Stanford University and NBER; **Amy Finkelstein**, MIT and NBER; **Ray Kluender**, MIT; and **Paul Schrimpf**, University of British Columbia, "Beyond Statistics: The Economic Content of Risk Scores"

- (*) **Darius Lakdawalla**, University of Southern California and NBER; **Anup Malani**, University of Chicago and NBER; and **Julian Reif**, University of Illinois, Urbana-Champaign, "The Insurance Value of Medical Innovation"

Summaries of these papers may be found at: http://www.nber.org/confer/2014/INSs14/summaryHC.html

Insurance

The NBER's Insurance Working Group, directed by Liran Einav of Stanford University and Kenneth Froot of Harvard University, met in Cambridge on February 28 and March 1, 2014. Part of the meeting was held jointly with the Healthcare Program meeting. In addition to the papers marked with a (*) in the foregoing summary of the Healthcare meeting, these papers were discussed:

- (*) **Florian Scheuer,** Stanford University and NBER, and **Kent Smetters**, University of Pennsylvania and NBER, "Could a Website Really Have Doomed the Health Exchanges? Multiple Equilibria, Initial Conditions and the Construction of the Fine" (NBER Working Paper No. 19835)

- (*) **Gaston Palmucci**, University of Wisconsin, Madison, and **Laura Dague**, Texas A&M University, "The Welfare Effects of Banning Risk-Rated Pricing in Health Insurance Markets: Evidence from Chile"

- **Ralph Koijen**, London Business School, and **Motohiro Yogo**, Federal Reserve Bank of Minneapolis, "Shadow Insurance" (NBER Working Paper No. 19568)

- **John Kiff**, International Monetary Fund, and **Michael Kisser**, Norwegian School of Economics, "Longevity Risk Transfer Markets: Market Structure, Growth Drivers and Impediments, and Potential Risks"

- **Daniel Bauer**, Georgia State University; **Jochen Russ**, Institute for Financial and Actuarial Science and Ulm University; and **Nan Zhu**, Illinois State University, "Adverse Selection in Secondary Insurance Markets: Evidence from the Life Settlement Market"

- **Thomas Davidoff** and **Jake Wetzel**, University of British Columbia, "Do Reverse Mortgage Borrowers Use Credit Ruthlessly?"

- **Justin Gallagher**, Case Western University, and **Daniel Hartley**, Federal Reserve Bank of Cleveland, "Underwater? Household Finance and Migration Decisions after a Flood: The Case of Hurricane Katrina"

Summaries of these papers may be found at: http://www.nber.org/confer/2014/INSs14/summary.html

Development of the American Economy

The NBER's Program on the Development of the American Economy, directed by Claudia Goldin of Harvard University, met in Cambridge on March 1, 2014. The following papers were discussed:

- **Robert Margo**, Boston University and NBER, "Economies of Scale in Nineteenth Century American Manufacturing Revisited: A Solution to the Entrepreneurial Labor Input Problem" (NBER Working Paper No. 19147)

- **Peter Lindert**, University of California, Davis and NBER, and **Jeffrey Williamson**, University of Wisconsin, Madison and NBER, "American Incomes 1650–1870: New Evidence, Controlled Conjectures"

- **Joshua Rosenbloom**, University of Kansas and NBER, "Forging a Research Mission for the University of Kansas"

- **Carl Kitchens**, University of Mississippi and NBER, and **Price Fishback**, University of Arizona and NBER, "Flip the Switch: The Spatial Impact of the Rural Electrification Administration 1935–1940" (NBER Working Paper No. 19743)

- **Douglass North**, Washington University in St. Louis, and **John Wallis**, University of Maryland and NBER, "Leviathan Denied: Governments, Rules, and Social Dynamics"

- **Leander Heldring**, University of Oxford; **James Robinson**, Harvard University and NBER; and **Sebastian Vollmer**, University of Göttingen, "Monks, Gents, and Industrialists: The Long Run Impact of the Dissolution of the Monasteries"

- **Erik Loualiche**, MIT, and **Nicolas Ziebarth**, University of Iowa and NBER, "Internal Capital Markets in the Great Depression"

Summaries of these papers may be found at: http://www.nber.org/confer/2014/DAEs14/summary.html

Monetary Economics

The NBER's Monetary Economics Program, directed by Christina Romer and David Romer of the University of California, Berkeley, met in New York City on March 7, 2014. NBER researchers John Leahy and Virgiliu Midrigan of New York University organized the program. These papers were discussed:

- **Xavier Gabaix** and **Matteo Maggiori**, New York University and NBER, "International Liquidity and Exchange Rate Dynamics" (NBER Working Paper No. 19854)
- **Roc Armenter**, Federal Reserve Bank of Philadelphia, "The Perils of Nominal Targets"
- **Francesco Bianchi**, Duke University, and **Cosmin Ilut**, Duke University and NBER, "Monetary/Fiscal Policy Mix and Agents' Beliefs"
- **Christina Romer** and **David Romer**, "Transfer Payments and the Macroeconomy: The Effects of Social Security Benefit Changes, 1952–1991"
- **Saroj Bhattarai** and **Bulat Gafarov**, Pennsylvania State University, and **Gauti Eggertsson**, Brown University and NBER, "Time Consistency and the Duration of Government Debt: A Signalling Theory of Quantitative Easing"
- **Philippe Martin**, Sciences Po, and **Thomas Philippon**, New York University and NBER, "Inspecting the Mechanism: Leverage and the Great Recession in the Eurozone"

Summaries of these papers may be found at: http://www.nber.org/confer/2014/MEs14/summary.html

Productivity, Innovation, and Entrepreneurship

The NBER's Productivity, Innovation, and Entrepreneurship Program, co-directed by Nicholas Bloom of Stanford University and Josh Lerner of Harvard University, met in Cambridge on March 21, 2014. The following papers were discussed:

- **Pian Shu,** Harvard University, "Career Choice and Skill Development of MIT Graduates: Are the 'Best and Brightest' Going into Finance?"
- **W. Walker Hanlon**, University of California, Los Angeles and NBER, and **Antonio Miscio**, Columbia University, "Agglomeration: A Dynamic Approach"
- **Pierre Azoulay**, MIT and NBER; **Joshua Graff Zivin**, University of California, San Diego and NBER; **Danielle Li**, Northwestern University; and **Bhaven Sampat**, Columbia University and NBER, "Public R&D Investments and Private Sector Patenting: Evidence from NIH Funding Rules"
- **Ajay Agrawal**, University of Toronto and NBER; **Carlos Rosell**, Department of Finance, Canada; and **Timothy Simcoe**, Boston University and NBER, "How Do Tax Credits Affect R&D Expenditures by Small Firms? Evidence from Canada"
- **Manuel Adelino** and **Song Ma**, Duke University, and **David Robinson**, Duke University and NBER, "Firm Age, Investment Opportunities, and Job Creation" (NBER Working Paper No. 19845)

- **Shai Bernstein**, Stanford University, and **Albert Sheen**, Harvard University, "The Operational Consequences of Private Equity Buyouts: Evidence from the Restaurant Industry"

- **Achyuta Adhvaryu**, University of Michigan; **Namrata Kala**, Yale University; and **Anant Nyshadham**, University of Southern California, "The Light and the Heat: Productivity Co-Benefits of Energy-Saving Technology"

Summaries of these papers may be found at: http://www.nber.org/confer/2014/PRs14/summary.html

International Trade and Investment

The NBER's Program on International Trade and Investment, directed by Robert Feenstra of the University of California, Davis, met in Washington, D.C. on March 28 and 29, 2014. NBER researchers David Richardson of Syracuse University, and Matthew Slaughter of Dartmouth College organized the meeting. These papers were discussed:

- **Brian Cadena**, University of Colorado, Boulder, and **Brian Kovak**, Carnegie Mellon University and NBER, "Immigrants Equilibrate Local Labor Markets: Evidence from the Great Recession" (NBER Working Paper No. 19272)

- **José Fillat**, Federal Reserve Bank of Boston; **Stefania Garetto**, Boston University; and **Lindsay Oldenski**, Georgetown University, "Diversification, Cost Structure, and the Risk Premium of Multinational Corporations"

- **Anca Cristea**, University of Oregon; **David Hummels**, Purdue University and NBER; and **Brian Roberson**, Purdue University, "Estimating the Gains from Liberalizing Services Trade: The Case of Passenger Aviation"

- **Jennifer Poole**, University of California, Santa Cruz, "Business Travel as an Input to International Trade"

- **Alan Spearot**, University of California, Santa Cruz, "Tariffs, Competition, and the Long of Firm Heterogeneity Models"

- **Emily Blanchard**, Dartmouth College, and **Gerald Willmann**, University of Bielefeld, "Unequal Gains, Prolonged Pain: Dynamic Adjustment Costs and Protectionist Overshooting"

- **Katheryn Russ**, University of California, Davis and NBER, and **Balazs Murakozy**, Hungarian Academy of Sciences, "Competition with Multinational Firms: Theory and Evidence"

Summaries of these papers may be found at: http://www.nber.org/confer/2014/ITIs14/summary.html

International Finance and Macroeconomics

The NBER's Program on International Finance and Macroeconomics met in Cambridge on March 28, 2014. Research Associates Gita Gopinath of Harvard University and Hélène Rey of London Business School organized the meeting. These papers were discussed:

- **Xavier Gabaix** and **Matteo Maggiori**, New York University and NBER, "International Liquidity and Exchange Rate Dynamics" (NBER Working Paper No. 19854)
- **Ralph Koijen**, London Business School; **Tobias Moskowitz**, University of Chicago and NBER; **Lasse Pedersen**, Copenhagen Business School, New York University and NBER; and **Evert Vrugt**, VU University Amsterdam, PGO-IM, "Carry" (NBER Working Paper No. 19325)
- **A. Craig Burnside**, Duke University and NBER, and **Jeremy Graveline**, University of Minnesota, "Exchange Rate Determination, Risk Sharing and the Asset Market View" (NBER Working Paper No. 18646)
- **Philippe Martin**, Sciences Po, and **Thomas Philippon**, New York University and NBER, "Inspecting the Mechanism: Leverage and the Great Recession in the Eurozone"
- **Mark Aguiar**, Princeton University and NBER, and **Manuel Amador**, Federal Reserve Bank of Minneapolis and NBER, "Take the Short Route: How to Repay and Restructure Sovereign Debt with Multiple Maturities" (NBER Working Paper No. 19717)
- **Atish Ghosh**, **Mahvash Qureshi**, and **Charalambos Tsangarides**, International Monetary Fund, "Friedman Redux: External Adjustment and Exchange Rate Flexibility"
- **Michael Devereux**, University of British Columbia and NBER, and **David Cook**, HKUST, "Exchange Rate Flexibility under the Zero Lower Bound: The Need for Forward Guidance"

Summaries of these papers may be found at: http://www.nber.org/confer/2014/IFMs14/summary.html

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