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Economics of Education

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Over the past few years, the number of Working Papers issued by NBER's Economics of Education Program has grown rapidly, with about five new papers added each month. To cope with the large number of excellent submissions, a spring program meeting has been added to each year's events, which already included a fall meeting, a Summer Institute program, and programs dedicated to special issues. This is all to say that education continues to be an extremely productive and exciting area of research in economics. I attribute this to three phenomena. First, policymakers are actively experimenting with education-related policies, and this creates a great deal of useful variation for researchers to analyze. Indeed, there is a virtuous circle between economic analysis and policy innovation because economics is the inspiration for, or intertwined with, many policies: school choice, accountability, savings and aid plans for college, incentive pay for teachers, reducing the barriers of entry into teaching, and so on. Second, the education program draws upon the talents of economists who come from a variety of fields, and this makes for an exciting dynamic owing to the opportunities for arbitrage of ideas and methods across fields. Third, and by no means least important, is the continued, rapid rise in the quantity and quality of data available to researchers. Researchers may differ on the substantive effects of state accountability laws and the federal No Child Left Behind Act, but no researcher would deny that these laws have created a deluge of data, much of which is longitudinal. Because of coincidence, imitation, and similar causes, researchers' access to rich data on colleges and foreign schools has also risen dramatically. A few states have even created "K–20" databases that allow us to track a student's

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progress from his pre-kindergarten or kindergarten entry to his final college course. The promise of such data is immense. Although program members continue to focus most of their research on the United States, they are increasingly taking advantage of foreign countries' data and willingness to conduct policy experiments. As a result, many of the methodological advances that are launched on U.S. data spread quickly to research around the world.

All program reviews are necessarily selective and this one is no exception. Three major themes in recent work deserve special mention: the effects of teachers, peer effects, and the complexity of college students' choices. Toward the end of this review, I describe other themes that are currently receiving less attention but are likely to emerge as absorbing topics soon.

Teachers

It is a commonplace that teachers *matter*, perhaps because nearly everyone can remember a teacher or teachers who strongly influenced his life. Thus, economists' inability to find consistent empirical evidence to support the idea that teachers matter has been a substantial puzzle. For years, most studies of teachers' effects depended on regressing students' achievement on the characteristics of their teachers: experience, highest degree, certification, and so on. Such studies often suffered from a selection problem — essentially, more qualified teachers had a tendency to gravitate to schools that served students from more privileged backgrounds. (Below, I shall have more to say on this tendency.) The selection problem caused researchers to *over*estimate the effect of teachers' credentials on achievement, yet still there was no consensus among studies that teachers' characteristics affected students.

This puzzle has been largely resolved in the past couple of years, owing to studies that directly estimate teachers' effects on achievement using longitudinal data. With a generous amount of data, the method is fairly straightforward: students' achievement is divided, statistically, into student fixed effects, grade fixed effects, year fixed effects, and teacher fixed effects. Jonah E. Rockoff has done seminal work on this topic.[1] While statistical decisions do arise, most authors uncover fairly large differences in the effects of teachers who teach the same grade in the same school, use the same materials, and draw students fairly randomly from the same population. For instance, estimates often suggest that the best teacher may

raise achievement by as much as half a standard deviation more per year than the worst teacher who operates in identical circumstances. In other words, we are not wrong to recall that "teacher X" raised our achievement.

Once researchers have calculated teachers' empirical effects, these become a powerful dependent variable that can be used to explore the effects of policy on the teaching workforce. One of the first things researchers did with the computed teachers' effects was investigate whether they were closely related to the teacher credentials upon which achievement was traditionally regressed. The answer was generally no: credentials do not explain teacher effects for the most part. (The exception is that very inexperienced teachers have worse effects, but even the effects of increased experience plateau after four to five years.) This brings us to the most recent work, which examines policy changes designed to affect teachers. Donald Boyd, Pamela Grossman, Hamilton Lankford, Susanna Loeb, and James Wyckoff (11844) and Thomas J. Kane, Rockoff, and Douglas O. Staiger (12155) investigate New York City's recent decision to allow people from a wider variety of backgrounds to teach: not just people who attain certification through regular channels, but also people with alternative forms of certification or temporary teaching licenses ("Teaching Fellows," Teach for America, international exchange programs, and so on). Both studies conclude that differences in certification explain only a small fraction (if any) of the variation in achievement: differences among teachers with the same certification dwarf the differences associated with certification. The rather striking implication of the evidence is that it may make sense for schools to focus their energy on ex post selection — that is, retaining teachers who empirically demonstrate good effects in their first few years, and not retaining others. Kane, Rockoff, and Staiger conclude that, even after one takes account of the effects that an ex post selection policy would have on teacher turnover (and, therefore, on inexperience), the evidence "suggests that selecting high quality teachers at the time of hire may be difficult ... The large observable differences in teacher effectiveness ex post suggest that districts should use performance on the job, rather than initial certification status to improve average teacher effectiveness."

The estimation of teacher effects and the subsequent finding that they are largely unrelated to credentials reconciles a good deal of other evidence and allows a relatively clear picture to emerge. For instance, I mentioned earlier that regressions of student achievement on teacher credentials produce inconsistent evidence. In retrospect, it is easier to see that the studies that suggested that credentials affected achievement substantially were those that did a poor job of controlling for teachers' tendency to gravitate toward more advantaged students. Recent working papers lay out increasingly rich evidence of this tendency. Eric A. Hanushek, John F. Kain, Daniel M. O'Brien, and Steven G. Rivkin (11154) and Charles T. Clotfelter, Helen F. Ladd, and Jacob L. Vigdor (11936) demonstrate that, perhaps because they experience only trivial wage changes when they switch schools, teachers who are able to make voluntary switches move to schools where students are more affluent, higher achieving, and less likely to be minorities. Boyd, Lankford, and Loeb (9953) show that teachers strongly prefer to teach where they live. This makes sense if the reduction in child care costs and the increase in neighborly amenities associated with proximity outweigh the (usually small) wage gains associated with teaching in a distant school, especially one located in a difficult neighborhood.

Suppose that a state were, rather, to implement a policy whereby a teacher would earn a bonus if she taught in a school that served disadvantaged students. Would anyone respond? Clotfelter, Elizabeth Glennie, Ladd, and Vigdor (12285) examine a North Carolina program that offered a modest bonus of $1,800 to certified math, science, and special education teachers who chose to work in high-poverty or academically failing secondary schools. Their findings suggest that teachers do respond, primarily because they leave at a slower than expected rate. Andrew Leigh ("Teacher Pay and Teacher Aptitude", Spring 2006 program meeting) offers further evidence that teachers respond to higher pay. Using data on the test scores of everyone admitted to Australian universities between 1989 and 2003, he shows that a single percent rise in starting-teacher salaries boosts the average aptitude of students entering teacher education courses by 0.6 percentile ranks. The North Carolina and Australia studies suggest that pay can be used to change the pool of prospective teachers available to a school, but this may be a far less direct way of improving teacher performance than simply paying teachers more when they raise achievements. Victor Lavy (10622) examines a pay-for-performance program in Israel, exploiting a natural experiment in teachers' assignment to the program. He demonstrates that teachers who experienced incentive-based pay raised their students' performance on high school exams. Because Florida is currently implementing a substantial pay-for-performance scheme, we are likely to learn more about this topic in future years.

Peer Effects

Investigation of peer effects, broadly construed, is perhaps the single most active area at present within the economics of education. This is sometimes difficult to explain to policymakers because there are no policies known as peer effect policies. Instead, understanding how peer effects function is crucial to analyzing numerous other policies, including selective college admissions, school tracking, desegregation, school choice, bilingual education, and even school finance. Put another way, peer effects are fundamental parameters that, properly estimated, are needed for numerous other analyses. In the context of education, economists define peer effects broadly: the effect that any student has on any other student, regardless of the channel by which the effect operates. That is, peer effects are not just one student's teaching another but may include phenomena such as one student's affecting the way a classroom operates, or a teacher teaches, and thereby influencing his classmates.

Two problems make estimation of peer effects challenging, and program members have made significant progress on both fronts. First, identifying peer effects is difficult because they can be confounded with numerous forms of selection. Most obvi-

ously, students X and Y might be similar and spend a lot of time together. Are they similar because Y influences X, or because similar students become friends, or because an administrator recognized their initial similarity and forced them to spend time together by making them roommates, putting them in the same class, and so on? (There are other identification problems that plague peer effects' estimation, but selection is the main one, in practice.) Second, most policies that turn on peer effects implicitly assume that they are non-linear, yet it is often difficult to find data or methods with the power to identify non-linear effects. Linear peer effects are not terribly interesting for policy because they imply that if one person gains from the reassignment of a peer, there is an equal, offsetting loss for another person. Thus, no amount of rearranging peers, as might occur if policy-makers were to alter desegregation programs or college admissions, could produce an outcome that was unambiguously better for society. In contrast, if peer effects are non-linear, it is possible that some arrangements of peers are better for everyone (or are, at least, much better for many people and only a bit worse for a few people).

Program members have made great progress on identifying peer effects by finding natural and policy experiments that rearrange students. I introduced a method (7867) that exploits natural variation in cohorts within a school; Andreas Ammermueller and Jorn-Steffen Pischke (12180) applied it to data on European primary schools, and Weili Ding and Steven F. Lehrer (12305) applied it to data on Chinese secondary schools. Both studies find evidence of significant peer effects in achievement, and the latter study suggests that they are non-linear (a point to which I will return). Eric D. Gould, Lavy, and M. Daniele Paserman (10844) apply the same method to a particularly interesting problem: the effect of an influx of immigrant students. They examine Israeli schools in which one grade experiences a substantial influx of immigrant students and an adjoining grade does not. Their results suggest that the immigrant students have no or only a slight effect overall but have an adverse effect on non-immigrant students who come from disadvantaged backgrounds. Two papers make powerful use of the method by applying it to military colleges, which arrange incoming students into very distinct units and strictly control cross-unit fraternization. Scott Carrell, Frederick Malmstrom, and James West (Fall 2005 program meeting) and Carrell, Richard Fullerton, West, and Robert Gilchrist (Summer Institute 2006) find evidence of significant peer effects in academic achievement, athletic performance, and even cheating. Finally, Zeynep Hansen, Hideo Owan, and Jie Pan (12251) use variation in the study groups to which students are assigned in business school courses. They find that male-dominated groups perform worse, both working in groups and in exams taken individually, than do female-dominated or gender-balanced groups.

Other papers exploit policy differences among schools that are otherwise very similar. Philip J. Cook, Robert MacCoun, Clara Muschkin, and Vigdor (12471) exploit differences in whether sixth grade is the top primary school grade or the bottom middle school grade. If the former is the case, then sixth graders are exposed mainly to younger peers. If the latter is true, then sixth graders are exposed mainly to older peers. The authors find that sixth graders exposed to older peers are more likely to have disciplinary incidents and that the differences persist in the seventh and eighth grades, when all of the students are in middle school. Hanushek and Ludger Woessmann (11124) compare students across educational systems that "track" earlier and later. In the latter systems, students' classrooms remain heterogeneous longer.

Additional papers make use of explicit randomized experiments. Lisa Sanbonmatsu, Jeffrey R. Kling, Greg J. Duncan, and Jeanne Brooks-Gunn (11909) use data from the Moving to Opportunity experiment, in which some families who apply for housing vouchers are induced to move out of high poverty areas. Compared to children in the control group, the children in the (randomized) treatment group are exposed to peers from higher-income families. The authors "had hypothesized that reading and math test scores would be higher among children in families [who move out of high poverty neighborhoods, but] ... the results show no significant effects on test scores for any age group among over 5000 children ages 6 to 20 in 2002 who were assessed four to seven years after randomization." This finding — an absence of peer effects — conflicts somewhat with the results of the aforementioned studies, but the Moving to Opportunity experiment alters families' lives on more dimensions than the typical school rearrangement does. Thomas S. Dee (11660) puts the randomization in the Tennessee Star Experiment (which was designed for analyzing class size) to unusual purpose: understanding the peer effects of teachers. Although the application strains the "peer effects" nomenclature and "role model effects" might be more natural, the study nevertheless belongs in this section. In it, Dee finds that students assigned to own-gender teachers have higher achievement, are more engaged, and are more positively perceived in school.

Many, though not all, of the above papers have difficulty identifying non-linear peer effects, primarily because the typical experiment (natural or otherwise) does not rearrange a sufficient number of students in a sufficiently diverse number of ways. In other words, the studies typically lack the power to discover non-linear effects. Ding and Lehrer's paper (12305) is something of an exception. Its authors suggest that students who are initially high achieving benefit more from having high achieving schoolmates than do students who are initially low achieving. However, Gretchen Weingarth Salyer and I (Spring 2006 program meeting) illustrate the most intense testing for non-linearities by examining more than 80,000 students exposed to reassignments in a large North Carolina school district. We test nine models of peer effects and find evidence of substantial non-linearities. For example, we find that students are disproportionately influenced by students who are initially like them. And, if a student who is initially very low achieving is "dropped" into a classroom, his presence most affects other students who were fairly low achieving themselves. Another result is that, while some classroom heterogeneity is fine, excessive heterogeneity reduces all students' achievement: the evidence against

bi-modal or "schizophrenic" classrooms is particularly strong.

College Students and their Choices

It is only a bit of an exaggeration to say that economic research on higher education used to focus on only two questions: what was the return to college education (where "college" was a generic thing) and whether "policy X" made students more likely to attend college? In *College Choices: The Economics of Where to Go, When to Go and How to Pay for It*, I predicted the proximate demise of these two questions owing to the fact that, at least for American students, they are not where the action is.[2] Most students who are at all interested in college now at least try attending some institution of higher education, but there is enormous variation in the sorts of institutions they attend, the curricula to which they are exposed, whether they persist and earn a degree, and how quickly they earn credits. It is increasingly naive to expect a college-related policy to have its main effects on the attendance margin as opposed to the "which college", "whether a degree", or "when a degree" margins. It is also naive to treat all postsecondary education as the same: a year is a year is a year, regardless of the curriculum delivered, the institution's resources, or the time the student devotes to the effort (full-time or part-time, for instance). Thus, I am not only unsurprised but also glad to see that, by what appears to be a wholly natural evolution, program members are increasingly investigating questions about how a student's college choices, in all their complexity, affect his outcomes.

Several papers consider persistence to the college degree and achievement in college classes. In practice, these are closely related topics because, once a student starts performing poorly in college, he is likely to stop persisting and may never (or only much later) earn a degree. Failure to persist is particularly common among students from disadvantaged backgrounds, students whose secondary school achievement was poor, and students who enroll in non-selective institutions. This is not to say that any of these factors is *causal* — for instance, being disadvantaged does not necessarily cause a student to drop out — but they suggest where the investigation should begin. Eric P. Bettinger and Bridget T. Long (10369, 11325) examine the effect of college remediation courses. These courses, which are many students' first postsecondary experience, are controversial. On the one hand, they may provide useful transitional experiences for students whose poor preparation would cause them to fail regular college courses. On the other hand, remediation increases the total number of courses a student must take before attaining his degree, thereby perhaps discouraging students who see a long plod ahead of them. Using rich administrative data from Ohio, where colleges differ in how they assign students to remediation, the authors find that both phenomena (encouragement and discouragement) exist. Being *placed* in remedial courses increases a student's probability of dropping out or transferring to a less selective college. However, actually completing a remedial course (the treatment on the treated effect) increases a student's persistence in college. The authors conclude that "remediation may serve…to re-sort students across schools" — in other words, to help them find the institution most likely to serve their needs. Josh Angrist, Kevin Lang, and Philip Oreopoulos (Summer Institute 2006) examine an explicit experiment in which a college randomized students to receive financial incentives for good grades, receive support services, or receive both. They find that, at the end of a year, the financial incentives have modestly improved the grades of female students, especially those who studied more in high school. John Bound and Sarah Turner (12424) investigate whether college students are more likely to persist when they attend a college with more resources. This is not an easy question because of self-selection: students who are more able and more motivated are admitted to colleges with more resources. However, the authors exploit the fact that states rarely increase the resources of their public institution in line with the size of the cohort ready to attend college. Therefore, students in "crowded cohorts" get fewer resources, all else equal, and the authors link this deprivation to decreased persistence.

Several papers examine how financial aid affects students. This is a classic topic, but the new twists are that authors examine persistence and the college selected. Authors have also greatly improved the methods used. Whereas numerous previous papers depended upon variation in financial aid that was fairly obviously endogenous (meritorious students got more, students admitted to selective colleges got more, states gave more when fiscal times were good, poorer students got more), recent papers often exploit a discontinuity in aid formulae or an experiment. For instance, Kane (9703) compares students on one and the other side of a (ex ante unknowable) discontinuity in California's aid formula. He also (10658) examines a policy change that made the District of Columbia's residents eligible for in-state tuition at Maryland and Virginia public colleges. The studies find that a $1000 reduction in cost causes a modest increase in the probability that a student will attend college at all (by 0.3 percentage points in the former study, by about 0.9 percentage points in the latter) but causes substantial shifts in *which* college students chose. In several years, when long-term outcomes can be investigated, researchers will be able to see whether the aid allowed students to attend colleges that were merely more expensive (though not to them) or to attend colleges that were truly better investments, thereby suggesting that students were previously liquidity constrained not to attend the optimal college. Christopher Avery, Kaitlin Burek, Clement Jackson, Glen Pope, Mridula Raman, and I (12029) examine a Harvard policy that eliminated or greatly reduced expenses for students from families with less than $60,000 in income. While the actual change in aid was modest and the number of students who matriculated as a result was modest as well, the policy greatly increased applications from students with low-income backgrounds. This suggests that disadvantaged students may fail to understand their opportunities to get aid and may need information as much as they need a generous aid formula. This theme is taken up by Susan M. Dynarski and Judith E. Scott-Clayton (12227) who show that much of the complexity in aid formulas, presumably the source of bafflement, serves

very little purpose in terms of identifying aid recipients and determining the dollars for which they qualify.

Finally, several studies examine the effect of a college's curriculum on student outcomes. Daniel S. Hamermesh and Steven G. Donald (10809) use a combination of survey and administrative data to produce estimates of the earnings effect of various college majors. The study is a convincing improvement over previous research because of its authors' unusual ability to control for pre-existing factors, such as incoming achievement and background, with very rich data and precise measures of course taking. Ofer Malamud (Fall 2005 program meeting) investigates the trade-off between forcing a student to choose his major early (thereby increasing his coursework in the area of his eventual degree) and allowing him to choose it later (thereby increasing his likelihood of being well matched to a major because he has had more opportunity to learn about fields before being forced to choose). The optimal timing of such choices has long been a puzzle. The study, which exploits institutional differences between Scottish and English universities, demonstrates that students who choose their major later are less likely to switch out of the field after college but that, conditional on staying in a field, students who choose their major early attain higher starting wages. Finally, Ronald G. Ehrenberg, George Jakubson, Jeffrey Groen, Eric So, and Joseph Price (12065) analyze an unusual policy experiment in which some graduate programs were given funding to alter their structure in ways intended to increase students' probability of and speed in getting their doctoral degrees. This study is especially noteworthy for demonstrating how mutually beneficial the relationship between institutions (in this case, the Mellon Foundation) and researchers can be. An institution wants to learn how to use funds well to produce particular outcomes; researchers need to find policy experiments that allow them to identify the effects of policy.

Emerging Themes

As more accountability programs are implemented, studies will increasingly trace their effect on students. Signs of this appear in Edward P. Lazear's work (10932), which provides insights into the incentives generated by accountability programs; Hanushek and Margaret E. Raymond's study (10591), which uses the staggered implementation of states' accountability programs to assess early effects on achievement; and Christiana Stoddard and Peter Kuhn's paper (11970), which investigates whether teachers work more hours when under pressure from accountability programs. Construing accountability more broadly, one can learn about the impacts of high school exit exams from Dee and Jacob (12199) or Francisco Martorell (Summer Institute 2005), or the effects of financial incentives for students to perform from Michael Kremer, Edward Miguel, and Rebecca Thornton (10971).

Working out empirical methods to deal with general equilibrium problems in education continues to be a challenge. General equilibrium is especially relevant to issues like school choice, school finance, the relationship between housing markets and schools, and desegregation. Progress is being made, however. Patrick Bayer and Robert McMillan (11802), Bayer, McMillan, and Kim Reuben (11095), and Bayer, Fernando Ferreira, and McMillan (10871) all display innovative methods of identification that exploit, but do not attempt to set aside, equilibrium properties of the market for education. On school finance, Katherine Baicker and Nora Gordon (10701), Ilyana Kuziemko and I (10722), Christian A. L. Hilber and Christopher J. Mayer (10804), and Kane, Staiger, and Stephanie K. Riegg (11347) explore links between house prices, intergovernmental aid for schools, and local school budgets. The linkages make it challenging to design effective redistributive aid among schools but do allow one generation to help finance another's education. Finally, Nora Gordon, Elizabeth Cascio, Sarah Reber, and Ethan Lewis (Fall 2005 program meeting) offer a striking new interpretation of school desegregation in the South, which they demonstrate was, to a large extent, a response to federal financial incentives (especially Title 1) rather than explicit court orders and the like.

Connections between health and education have often been neglected, but a number of interesting papers suggest that a new wind is blowing. David M. Cutler and Adriana Lleras-Muney (12352) provide an overall introduction; Justin McCrary and Heather Royer (12329) investigate whether more education makes women better mothers in terms of infant health; and Ding, Lehrer, J. Niels Rosenquist, and Janet Audrain-McGovern (12304) use data on genetic markers to evaluate the causal impact of health on education. Much of the relationship between health and education is associated with infancy and early childhood, where health, nutrition, and the environment may have disproportionate effects on cognitive development. This, in turn, may affect a person's later education, which may, in turn, affect the environment she provides for her infant. Janet Currie and Enrico Moretti (11567), Sandra E. Black, Paul J. Devereux, and Kjell Salvanes (11796), and Eric I. Knudsen, James J. Heckman, Judy L. Cameron, and Jack P. Shonkoff (12298) explore these linkages.

Summing Up

It is striking that many of the themes that I identified as emerging in my last program review have now been explored in a good number of studies. It is also striking how quickly new topics in the economics of education are emerging. While some of the appearance of novelty in this program review is deliberate (I have de-emphasized studies in areas that are well-trodden), much of the novelty simply reflects the evolution of the program, which continues to develop rigorous methods for investigating problems of fundamental importance and policy relevance.

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1 *J.E. Rockoff, "The Impact of Individual Teachers on Student Achievement: Evidence from Panel Data,"* American Economic Review, Papers and Proceedings, *May 2004.*

2 *C.M. Hoxby,* College Choices: The Economics of Where to Go, When to Go and How to Pay for It, *Chicago: University of Chicago Press, 2004.*

Realized Return Volatility, Asset Pricing, and Risk Management

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It is now widely accepted that expected returns, volatility, and broader financial risk measures all vary over time. In particular, there is a pronounced clustering in return volatility; occasional extreme return outliers — especially on the negative for equities; and an increase in return correlations during market downturns. This makes it more complicated for academics, regulators, and practitioners seeking to understand, monitor, act, and react to financial market dynamics to assess market conditions in real time. Textbook prescriptions for portfolio choice, asset pricing, and risk management typically are based on a static setting with known and invariant return distributions. These approaches are ill-suited for practical decision making: market agents know neither the parameters nor the parametric family of the return distribution, and the shape of the distribution is likely to change over time. Depending on the horizon, the challenges differ, with the notable exception that accurate assessment of the current volatility level remains pivotal. At daily or shorter intervals, it is critical also to understand the likely reaction of markets to impending news releases and to control for the intraday pattern in the market activity and return dynamics. For weekly and monthly frequencies, the persistence of volatility and the extent of asymmetry between return and volatility innovations both figure importantly in determining return distributions. For even longer quarterly and annual horizons, the main issues again relate to the temporal persistence of volatility, but good estimates of the non-negligible longer-run expected returns now also become critical.

The increased availability of tick-by-tick financial trade records and real-time news reports, coupled with our enhanced capacity to store and process vast amounts of data, have led to important new insights in regards to the issues discussed above. Specifically, over the last few years a very active research agenda into the direct (model-free) measurement of the realized return variation and covariation of financial assets at daily or even higher intraday frequencies has developed.

The intuition behind the realized volatility measure has been recognized for a while, albeit within a simplified setting. In a frictionless market with an unlimited set of price observations available over any interval, it is, quite generally, feasible to perfectly estimate instantaneous volatility if the process is not subject to jumps. However, given the discreteness of the price grid and other market microstructure effects, as well as the limited number of price observations available over short time intervals, even for liquid securities, instantaneous volatility cannot be measured with reasonable precision without (excessively) strong identifying assumptions. In the face of these practical limitations, we have focused a large part of our recent work on developing robust, yet accurate, volatility measures over non-trivial daily, or longer, time intervals that exploit the information available from intraday data.

In so doing, it is important to recognize the main qualitative features that affect the intraday return process but are absent at daily and lower frequency levels. Most importantly, the intraday volatility pattern and the presence of outliers (jumps) render standard ARCH-type volatility models inadequate unless they are explicitly extended to accommodate such features. We show that the original studies applying standard modeling and inference techniques to the newly available intraday data were seriously misspecified; they produced badly downward biased estimates of the degree of volatility persistence.[1] Meanwhile, by controlling for specific intraday features, we got much closer to the type of volatility dynamics obtained from daily data, although our model specification is still not entirely adequate. In short, direct estimation of the high-frequency volatility process is difficult and very sensitive to market microstructure effects and news.[2]

We instead advocate daily (or longer-horizon) volatility and covariability measures obtained by aggregating intraday squared returns and absolute return cross-products. Focusing on a non-negligible time interval enables us to exploit many return observations, ensuring that the estimated measure is reasonably precise. Moreover, by restricting the measurement to (a multiple of) a trading day and relying on equally-spaced returns sampled, say, every five or ten minutes, we can largely eliminate the intraday volatility pattern and other market microstructure effects. Formally, as the number of returns observed over the period grows toward infinity, the realized volatility provides a consistent measure of the ex-post return variation. Intuitively, the impact of the mean return is removed by the shrinking of the intraday time intervals, as the expected price movements become negligible relative to the return innovations.

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Importantly, these measures are conceptually distinct from model-based volatility estimates and/or forecasts from traditional models such as GARCH. They represent actual realized return variability assessed from ex-post data rather than ex-ante (conditional) return variances implied by a parametric model. Because volatility is genuinely stochastic, the realized variability inevitably differs from the ex-ante expectations, even if these are based on the true model. In other words, realized volatility represents the (true) expected volatility plus an unpredictable volatility innovation. In contrast, even if the daily squared return is almost unbiased for the underlying volatility, it is an extremely noisy estimator.

In this regard, when checking the adequacy of specific volatility models, we document the extraordinary improvement in the signal-to-noise ratio obtained by using the realized volatility estimators relative to the common practice of using the ex-post squared returns.[3] We find that, in certain realistic scenarios, the one-day-ahead volatility forecasts from the true model may explain up to half of the subsequent variation in the realized volatility; the same forecasts only "explain" about 5 percent of the variation in the future squared daily returns. We pursue the topic in detail — using simulation techniques and more elegant analytical means — in joint work with Steve Lange[4] and Nour Meddahi[5] respectively, emphasizing the impact of the forecast horizon and sampling frequency.

Given the direct construction of realized volatility from intraday returns, volatility in effect may be treated as observable, albeit with a limited measurement error. This sets the stage for standard time-series analysis of (logarithmic) volatility, a theme pursued jointly with Frank Diebold and Paul Labys in analyzing the volatility and covariability of foreign exchange returns,[6] and with Diebold and Heiko Ebens for individual stock returns.[7] This integrated approach to volatility measurement and modeling is pursued further with Diebold[8] and Nour Meddahi[9], respectively. In that work, we directly demonstrate the effectiveness of the approach for volatility forecasting. Moreover, with an accurate volatility proxy in-hand, we can study the properties of daily returns standardized by (realized) volatility. We find these to be much closer to Gaussian than is the case for standardized return residuals from stochastic volatility models, underscoring the potential gains from adapting the more precise volatility measures.[10]

A related contentious issue concerns the nature of the longer-run dependencies in return volatility. Recent work using daily returns has produced evidence of so-called long memory, implying a slow hyperbolic decay in the absolute and squared return auto-correlation patterns, rather than the faster geometric decay associated with traditional volatility models. This, of course, has important implications for longer-run conditional volatility and return distribution forecasts. Meanwhile, it has been suggested that this apparent long-memory is (spuriously) induced by infrequent structural changes in the volatility. Thus, it may be better captured by regime-shifting type models. The sharply enhanced inferential power obtained through the realized volatility measures allows for much stronger tests of the long-memory property over much shorter (calendar) samples than is possible with only daily or lower frequency data. Our original study along these lines strongly supported the long-memory hypothesis.[11] That finding has been confirmed by numerous later studies, even if this remains an active research topic.

The intraday return data also facilitate the study of market reactions to economic news. We find that a complete account of the foreign exchange return dynamics must include controls for the jumps that occur in response to scheduled U.S. macroeconomic news releases, such as the employment report and CPI inflation. Such news induce an immediate price revision along with an intensive and more refined price discovery process, associated with sharply enhanced volatility, lasting up to about two hours.[12] On the days of these releases, the induced jump and volatility contribute very significantly to the overall daily return variability. In work with Diebold and Clara Vega, we study more detailed issues, such as the impact of the expected announcement figure versus the surprise component and the sequence of releases relating to economic developments over a given month.[13]

In addition, expanding our perspective to include equity and bond markets, we document important linkages between the state of the business cycle and the financial market reaction to real and inflationary economic news. For example, we find that interest rates and equity market returns are negatively correlated in the expansion phase but positively correlated during recessions.[14] This approach has the potential to elicit direct evidence on the structural linkages across macro markets and thus enable us to study their time variation over both business cycles and distinct policy regimes.

Another avenue for exploring asset pricing issues using the intraday returns is to relate asset-specific realized volatility to the evolution of systematic macroeconomic factors in order to gauge the potential risk exposure of the security. Our joint work with Diebold and Ginger Wu provides one step in this direction. We find interesting systematic shifts over the business cycle in the size of the market betas of so-called value stocks relative to growth stocks, suggesting that the former are systematically perceived as more risky than the latter, which may help to explain the puzzling "value premium." Nonetheless, a more complete study, explicitly accounting for additional risk factors over longer time spans, is needed to validate the asset pricing implications of the documented features.[15]

The many useful applications of realized volatility have motivated a recent, somewhat technical, literature that seeks to minimize the aforementioned measurement errors induced by the presence of market microstructure frictions. The alternative realized volatility measures developed in this literature may also be used for robust inference concerning a variety of features in the underlying price process. In work with Diebold, we provide an overview of some of the developments in this rapidly progressing literature.[16] In further work with Diebold, we have focused on the application of the realized volatility measures along with some new related concepts termed power and bipower vari-

ation measures — obtained by summing properly scaled functions of the intraday absolute returns — to identify the timing and size of discontinuities, or jumps, in the prices for broad stock, bond, and foreign exchange markets. We find that the jumps are less persistent than the smooth, or diffusive, volatility component. We go on to show how this may be used in the construction of more accurate return variability forecasts by decomposing the realized volatility into its diffusive and jump components.[17]

Our recent work with Dobrislav Dobrev,[18] and Per Frederiksen and Morten Nielsen[19], provides a more systematic study of the applicability of the realized volatility tools in analysis of equity return distributions. On extracting the significant jumps and transforming the daily return process into a financial time-scale, with each "financial day" representing an equal amount of realized volatility, we find that the returns are indistinguishable from i.i.d. Gaussian. Importantly, these results directly confirm the theoretical underpinnings for the general continuous time jump-diffusive price representation commonly used in asset pricing and financial economics. More broadly, the findings confirm the practical reliability of the new realized volatility tools and the associated theory, and pave the way for further progress in characterizing and forecasting the full conditional return distributions. More research is needed, in particular in terms of the corresponding tools for the multivariate setting.

Numerous other useful applications of the realized volatility concept still await. For instance, specifying and directly estimating more realistic parametric, continuous-time asset pricing models may be made easier by matching the implications from the models with the directly observable realized volatility measures.[20] Also, finance theory often implies specific conditional volatility distributions, and/or conditional correlations, between the asset volatilities and the volatility of the systematic risk factors. One example is the volatility risk premium inherent in financial derivatives prices.[21] Another example is the affine term structure models, which imply that the yield volatility of zero-coupon bonds at any maturity is spanned by the level of contemporaneous yields across the risk-free term structure.[22]

In light of the rising prominence of the realized volatility concept for a variety of applications, it occupies a key position in our recent surveys, written jointly with Peter Christoffersen and Diebold, on risk management[23] and volatility forecasting.[24] We are currently working on a variety of additional aspects and applications of realized volatility. These include a more detailed investigation of the frequency and dynamic dependencies in the jump dynamics and direct studies of the presence and time-variation in volatility risk premiums. We expect to report on our findings from these projects in the near future.

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Firms in International Trade

Andrew B. Bernard*

For most of its lengthy history the field of international trade largely ignored the role of the firm in mediating the flow of goods and services. Traditional trade theory explained the flow of goods between countries in terms of comparative advantage, that is, a variation in the opportunity costs of production across countries and industries. Even the research focusing on differentiated varieties and increasing returns to scale that followed Helpman and Krugman continued to retain the characterization of the representative firm.[1] However, the assumption of a representative firm, while greatly enhancing the tractability of general equilibrium analysis, is emphatically rejected in the data. My research over the past decade has been an attempt to explore international trade from below: to understand the decisions of heterogeneous firms in shaping international trade and their effects on productivity growth and welfare.

Firm Heterogeneity and Trade

My early work with J. Bradford Jensen was motivated by a simple question: what do we know about firms that trade? The answer at the time was "very little" and our initial efforts focused on locating firm-level data and describing the world of exporting firms. Our first study compared exporters and non-exporters for the entire U.S. manufacturing sector and established a set of facts about exporting plants and firms.[2] Two major results stand out. First, only a small fraction of firms are exporters at any given time. Even in sectors where the United States is thought to have comparative advantage, such as Instruments, a majority of firms produce only for the domestic market. Similarly, some firms are exporting even in net import sectors such as Textiles and Apparel.

Second, exporters are substantially and significantly different than non-exporters, even in the same industry and region. Exporters are dramatically larger, more productive, pay higher wages, use more skilled workers, and are more technology- and capital-intensive than their non-exporting counterparts. In related work on German firms with Joachim Wagner, I again found these patterns of systematic differences between exporters and non-exporters and subsequent research by numerous authors has confirmed them to be robust across a wide range of industries, regions, time periods and countries at varied levels of economic development.[3]

Exporting and Productivity

The biggest question raised by this early research was the nature of the positive correlation between export status and productivity, that is, whether exporting leads to higher plant productivity. Research done with J. Bradford Jensen established that "potential" exporters have better characteristics years before they enter a foreign market, including higher productivity, higher wages, and larger size.[4] However, the most important finding was that exporters do not have higher productivity growth even though they have higher levels of productivity. Today's exporters have no advantage in terms of productivity growth relative to non-exporters over the next year, and over some horizons actual significantly underperform in terms of productivity growth.

As a complementary question, we asked if higher productivity increases the probability of a plant becoming an exporter. Studies on both the U.S. and Germany find evidence for the selection of high productivity firms into exporting as well as evidence of substantial sunk costs to entering the export market.[5] The strong conclusion from this empirical work is that high productivity firms are able to pay the sunk costs of entering foreign markets but that, once in, they do not receive an extra productivity kick.

However, the role of productivity in shaping aggregate export responses should not be overstated. Work on the determinants of the U.S. export boom cautioned that improved U.S. productivity still played a minor role relative to exchange rates and foreign income growth in the dramatic expansion of exports in the late 1980s and early 1990s.[6]

While firm-level productivity is not improved by exporting, exporting does benefit the firm in other ways. First, plant failure is dramatically less likely for exporters.[7] In a study of the role of firm structure and multinational ownership on plant deaths, we find that exporting is strongly correlated with survival at U.S. plants, even after controlling for productivity and numerous other plant, firm, and industry characteristics. Ownership by a multinational, however, substantially increases the conditional probability that a plant will close. This relationship between multinationality and plant closure holds in other countries as well.[8]

The second major benefit of exporting for the firm is faster growth, both for output and employment. The faster output growth at exporters, combined with their higher initial productivity levels, leads to relatively large effects on aggregate productivity. A substantial fraction of overall manufacturing productivity growth is

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attributable to faster growth of high-productivity exporters.[9]

Firms and Trade — Theory

These empirical results suggested the need for a formal general equilibrium model of heterogeneous firms and international trade. Together with Jonathan Eaton, Jensen, and Samuel Kortum, I developed a model of international trade and heterogeneous firms that focuses on the relationship between plant productivity and exporting.[10] Starting from the stylized facts that there are relatively few exporters, that they are much larger and more productive, and that there is little or no evidence that exporting improves firm productivity, we construct a Ricardian model of heterogeneous firms, imperfect competition with incomplete markups, and international trade.

Simulating a 5 percent worldwide reduction in geographic barriers, we find that trade volumes increase by 39 percent and aggregate productivity increases because low-productivity plants fail and high-productivity survivors expand and start to export. The model provides a rich set of additional testable implications, as the interaction of lower trade costs and product differentiation leads to a range of responses by firms within the same industry: the least productive are the most likely to fail, and the relatively high productivity non-exporters are the most likely to start exporting.

In subsequent theoretical work with Stephen Redding and Peter K. Schott, I embed heterogeneous firms into a model of comparative advantage and analyze how firm, country, and industry characteristics interact as trade costs fall.[11] This paper combines the heterogeneous-firm trade firm model of Melitz[12] with traditional cross-country differences in endowments and cross-industry differences in production technology.

We report a number of new and often surprising results. In contrast to the neoclassical model, we find that simultaneous within- and across-industry reallocations of economic activity generate substantial job turnover in all sectors, even while there is net job creation in comparative-advantage industries and net job destruction in comparative-disadvantage industries. We show that steady-state creative destruction of firms also occurs in all sectors, but we find that it is more highly concentrated in comparative-advantage industries than in comparative-disadvantage industries. These results suggest that the effects of trade on labor market outcomes may not be confined to job losses in comparative-disadvantage sectors.

We also find that the behavior of heterogeneous firms magnifies countries' comparative advantage and thereby creates a new source of welfare gains from trade. The relative growth of high-productivity firms raises aggregate productivity in all industries, and productivity growth is strongest in comparative-advantage sectors. The price declines associated with these productivity increases inflate the real-wage gains of relatively abundant factors while dampening, or even potentially overturning, the real-wage losses of relatively scarce factors.

Firm Responses to Trade Liberalization

The empirical and theoretical work on firm heterogeneity and trade naturally leads to the question of how firms respond to trade liberalization and increased foreign competition. Jensen, Schott, and I test for the effects of competition from low-wage countries such as China on plant employment and plant survival.[13] High levels of import competition from low-wage countries are bad for plant growth and survival but are especially problematic for low-capital, low-skill plants in any industry. In addition, we find that plants facing high levels of competition from low-wage countries are more likely to change their output mix towards products made with more capital and more skilled labor. This discovery of product switching in response to foreign competition has led to a new series of papers documenting the extraordinary amount of ongoing product switching in the U.S. economy.[14]

In further work on the firm-level response to falling trade barriers, we test the additional implications of the new heterogeneous-firm models of Melitz and Bernard, Eaton, Jensen, and Kortum.[15] These models predict heterogeneous responses to reduced trade costs across firms, including entry into exporting by some and increased failure rates for others. The predictions of the theory are largely supported by the data on U.S. manufacturing plants. Using a new measure of trade costs, we find that reductions in trade costs are associated with faster industry productivity growth. The effect of falling trade barriers varies substantially across firms within an industry. Low-productivity plants fail more often and higher-productivity plants start to export. This heterogeneous response leads to a reallocation within the industry towards more productive establishments and helps to account for the aggregate productivity gains. Interestingly, a result not predicted by the theoretical models is that plant productivity actually rises in response to lower trade costs. This result points to the need for a richer set of firm-based theoretical models.

Trade and Wages

My work on the interaction of firms and international trade has naturally led to a series of related papers on the role of trade in contributing to wage inequality in the United States. Starting from the observation that exporters pay higher wages than non-exporters, Jensen and I asked whether increased exports contributed to the rise in wage inequality in the manufacturing sector in the 1980s.[16] The results showed that increased wage inequality was largely associated with changes in employment across plants in the same industry and that rising demand for exports played an important role in this employment shift. Related work on rising wage inequality in Mexico by Verhoogen and Robertson has also found a significant role for the interaction of firm heterogeneity and exporting.[17]

The empirical work on wage inequality suggested the need for a formal test of relative factor price equality across regions. Redding, Schott, and I develop a test of relative factor price equality that is robust to unobserved regional productivity differences, unobserved region-industry fac-

tor quality differences, and variation in production technology across industries.[18] In a series of papers applying the test to data on the United States, the United Kingdom, and Mexico, we find that there are significant and persistent differences in relative wages across regions, with skill-abundant regions such as New York and London having lower relative wages for skilled workers, even though absolute wage levels are higher in those areas.[19]

Firms and Products

An emerging line of research is examining the characteristics and decisions of importing firms as well as the interactions between firms, products, and trade. However, data on importing firms has been harder to locate as governments typically are more interested in documenting exports than imports. Recent research with Jensen and Schott using data on the entire set of U.S. private sector firms and all their trade transactions highlights the fact that we still have much to learn about the differences between trading and non-trading firms.[20] Of the 5.5 million firms operating in the United States, only 4.1 percent engage in importing or exporting. However, these trading firms are hugely important in the U.S. economy, accounting for more than 47 percent of total employment and typically importing and exporting multiple products. Even among the firms that trade, the most globally-engaged dominate: more than 95 percent of U.S. trade is conducted by just 10 percent of the trading firms (0.4 percent of all firms) and multinationals operating in the United States account for more than 90 percent of U.S. imports and exports.

Next Steps

In spite of a decade of research, we are just beginning to explore the role of firms in mediating the effects of trade on the economy. The new detailed data on firms, products, and trade will allow us to ask important questions about firms engaged in international trade and investment. Do multinationals behave differently when they trade inside the firm or with arm's length customers? How does the structure of the multinational firm respond to policy changes? How do domestic employment and wages respond when firms establish affiliates abroad? The dominant role of multinationals in U.S. trade means that the answers to these questions have implications for aggregate trade volumes, production and employment in the United States, wholesale and retail prices, corporate tax receipts, and a host of other issues.

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Economics of the Pharmaceutical Industry

Patricia M. Danzon*

The pharmaceutical industry is important because it is a major source of medical innovation. The U.S. research-based industry invests about 17 percent of sales in R and D, and R and D drives performance of individual firms and industry structure. It is also a heavily regulated industry. Drugs are evaluated for safety, efficacy, and manufacturing quality as a condition of market access, and promotional messages must adhere to approved product characteristics. Drug prices also are regulated in most countries with national health insurance systems. My research on the pharmaceutical industry has examined issues related to R and D performance and industry structure, and the effects of regulation on prices, availability, and utilization of drugs, and on productivity.

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R and D, Firm, and Industry Structure

Regulation of market access and promotion derives from uncertainty about drug safety and efficacy. These product characteristics can only be determined from accumulated experience over large numbers of patients in carefully designed trials or observational studies. The design, monitoring, and evaluation of these studies are public goods that in theory can be efficiently produced by an expert regulatory agency.[1] The 1962 Amendments to the FDA Act extended the powers of the FDA to review safety, efficacy, manufacturing quality, and promotion. Subsequent studies concluded that the safety and efficacy requirements added to the intrinsically high cost of R and D, led to launch delay of new drugs and favored large over small firms.

However, more recently the biotechnology revolution has transformed the nature of drug discovery and the structure of the industry. Increasingly, new drugs originate in small firms, which often outlicense their products to more experienced firms for later-stage drug development, regulatory review, and commercialization. In any year the biotechnology industry may comprise a couple of thousand firms, but the identity of these firms changes, as new start-ups are formed and established firms grow, merge, or are acquired by other established companies. Although larger firms have grown in market share, because of mergers, their performance has lagged that of smaller firms, on whom the large firms increasingly rely for new products.

In a series of papers, I and my coauthors have examined the effects on R and D productivity of firm experience and alliance relationships; the nature of the market for alliances between small and large firms; and the effects of mergers and acquisitions. In a study of the determinants of drug success in clinical trials,[2] we find that returns to a firm's overall experience (number of drugs developed across all therapeutic categories) are small for the relatively simply phase 1 trials, but

significantly positive (with diminishing returns) for the larger and more complex phase 2 and phase 3 trials that focus on efficacy and remote risks. We find some evidence that focused experience is more valuable than broad experience ("diseconomies of scope across therapeutic classes"). Products developed in an alliance have a higher probability of success in the more complex late stage trials, particularly if the licensee is a large firm. Thus although larger firms enjoy economies of scale in experience for the complex trials, smaller firms can tap into this expertise through licensing agreements.

Product development deals thus define the sharing of responsibilities and rewards between large and small firms. The small firm typically gets cash and/or equity up front, plus contingent milestone and royalties payments, and may choose to participate in late-stage development and co-marketing, in order to gain experience. In return, the large firm obtains rights to develop and market the new product, retaining the majority of product revenues, with specifics depending on the stage of the deal. The efficiency of the market for deals is important because it allocates rents between the smaller and originator firm, as opposed to the larger developer/marketer, and hence influences incentives. It also provides interesting evidence on how participants use contractual structure to control possible distortions attributable to symmetric information and agency.

Our analysis examines the determinants of deal prices, with the caveat that the reported financial values are the simple sum of up front cash, equity, and contingent milestone payments, ignoring the latter's uncertainty and lags; other contractual terms are not reported.[3] We find that inexperienced firms received substantially discounted payments on their first deal, although this discount was not consistent with the post-deal performance of these drugs. However, we find that these first deals are associated with substantially higher valuations from venture capital and public equity markets. This evidence suggests that a deal with an experienced pharmaceutical company validates a start-up company's products, sending a positive signal to prospective investors, and making the deal discount a worthwhile investment for the small firms.

In addition to product licensing, mergers and acquisitions (M&A) are common in the pharma-biotech industry. Large horizontal mergers were particularly frequent in the late 1980s and 1990s, while pharmaceutical acquisitions of biotech companies have become more common recently. Several of the largest firms are the result of successive large horizontal mergers, and this has contributed significantly to industry concentration. Such mergers are often rationalized on grounds of economies of scale and scope in R and D, marketing, and administration. In our analysis of M&A in the pharma-biotech industry, we tested various alternative hypotheses to explain both large and smaller mergers, and then examined the effects of mergers using propensity scores to control for merger endogeneity.[4] For larger firms, we find that mergers are a response to patent expirations and gaps in a company's product pipeline, which lead to excess capacity of the fixed marketing resources. For smaller firms, mergers are primarily an exit strategy in response to financial trouble, as indicated by a low Tobin's q, few marketed products, and low cash-sales ratios. Controlling for a firm's ex ante propensity to merge significantly affects the estimates of merger effects. Firms with relatively high propensity scores experienced slower growth in sales, employees, and R and D, regardless of whether they actually merged; this is consistent with mergers being a response to distress. For large firms, a merger did not significantly affect subsequent performance on average, whereas small firms that merged had slower R and D growth than similar firms that did not merge; this suggests that post-merger integration may divert cash from R and D. This conclusion, that merger is often a response to distress but is usually not an effective solution, is consistent with the subsequent slow-down in M&A in this industry, with the exception of selective, strategic acquisitions, as large firms acquire smaller firms with specifically well-matched capabilities or products. Thus, although the "survivor" evidence — with increased market share of the top ten firms over time — might suggest that large firms have advantages, recent stock market performance tells a very different story.

Price Regulation — Rationale and Effects

The high rate of entry to the pharmaceutical-biotechnology industry indicates that it is structurally competitive. To the extent that market power exists, it derives from patents that are legal grants of monopoly power to enable originator firms to recoup their R and D costs. Although patents bar generically equivalent products for the life of the patent, they do not prevent entry of similar products that may be therapeutic competitors. Thus, neither natural monopoly nor patents provide a rationale for regulating pharmaceutical prices.

The rationale for drug price regulation derives from pervasive insurance or third party payment, which makes patients insensitive to prices, hence creating incentives for suppliers to charge higher prices than would occur without insurance. Patient co-payments are a weak antidote, if insurance is to retain its value as financial protection. For example, assuming linear demand, if patients have insurance with a 50 percent co-insurance rate, then firms would charge drug prices twice as high as if patients were uninsured. To counteract this supplier moral hazard that applies to all insured health services, including drugs, both private and public insurers limit the prices that they will pay for all insured health services. Private sector pharmacy benefit managers (PBMs) in the United States negotiate price discounts as a condition of preferred formulary status. Public payers in other countries limit either the price the firm may charge or the amount the public payer will reimburse, or both. The fact that a firm may launch an approved drug without price approval if it is unreimbursed confirms that price regulation of drugs is best viewed as a response to insurance. Drug price regulation differs across countries and is multidimensional in its structure and effects, making generalization hazardous. For example, some countries include

a limit on aggregate annual drug spending, with a reduction in prices to offset any overshooting of target volume. Depending on the specifics of a drug price regulatory scheme, it may affect drug prices, availability, utilization, R and D level and location, and factor productivity.[5]

Reference Pricing

An increasingly popular approach to regulation is therapeutic reference pricing (RP). We studied the effects of RP as used in Germany, the Netherlands, and New Zealand.[6] Under RP, drugs are grouped based on indication, mechanism of action, and effects. The payer sets a maximum reimbursement (the RP) for all drugs in a group, based on the median, minimum, or other low supply price for the group. If a firm charges a price above the RP, the patient pays the excess. Therapeutic referencing is broader than generic referencing, which groups all off-patent products with the same active ingredient. Many countries, and most payers in the United States, use generic referencing. As implemented in the United States, generic RP is a powerful stimulus to generic price competition, because pharmacists are authorized and given incentives to substitute generically equivalent products and to select the cheapest.

Although a stated purpose of therapeutic RP is to stimulate price competition, the theory and evidence suggest that — at least as implemented in these countries — it is ineffective. Unless physicians or patients have incentives to choose cheaper drugs, the RP tends to become a floor as well as a ceiling price. Germany's RP system was largely ineffectual until 2004, because of both weak incentives and the exclusion of new on-patent products until 2004. In the Netherlands, firms discounted extensively to pharmacists on products that the pharmacists could substitute (generics and parallel imports), but there was little impact on list prices and hence little savings to payers. In New Zealand, low prices reflect the government's use of its monopsony power to negotiate price cuts as a condition of reimbursement, rather than market competition under RP. In sum, RP alone was ineffectual in the three countries we studied, and all three countries adopted other controls.

However, if the United States were to adopt therapeutic RP, with therapeutic groups defined to include both on-patent and off-patent products, negative effects on prices of on-patent drugs would likely be significant, because generic prices are lower in the United States than in other countries. Effects on global R and D would also be much larger, because of the large U.S. share of global sales. Thus it would be a serious mistake to extrapolate from the effects of RP in other countries to its likely effects in the United States.

External Spillovers

One country's system of price regulation can affect not only its domestic prices and availability, but also prices and availability of drugs in other countries. Such external spillovers can occur because of price regulation with external referencing (country A caps its price at the median or lowest price for the same products in a specified set of other countries) or because of parallel trade (also called drug importation). External referencing and parallel trade undermine a pharmaceutical firm's ability to price-discriminate across countries, based on elasticities that are country-specific. Rather, the optimal pricing strategy may be to charge a single price or a narrow pricing band, and to delay or not launch in countries that do not accept the single price. Non-launch is most likely in small countries with low prices, because the foregone revenue of non-launch is small, compared to the revenue loss if a low price contaminates a potentially higher price in a larger market. Findings from our analysis of launch delay for new drugs in 25 markets in the 1990s are consistent with this theory. We find that only 55 percent of the potential launches occurred. Countries with the most launches and shortest delays were the United States, Germany, and the United Kingdom — the three countries with unregulated prices (at that time). New Zealand and Portugal — small countries with low prices — had the fewest launches, except for Japan, which was an outlier with very few launches because of onerous approval requirements, not low prices. In general, launch hazards are positively related to expected price and expected volume, after controlling for income per capita. Controlling for expected price and volume, launch hazards have been significantly lower for EU countries that are significant parallel exporters.[7]

This evidence on adverse spillovers is highly relevant for proposals in the United States to legalize drug importation and/or limit prices to some average or minimum of foreign prices. Since the United States is the largest pharmaceutical market and has relatively high prices, such policies would make it costly for firms to launch drugs in other countries at prices below U.S. prices. If other countries were unwilling to pay U.S. price levels, they would likely experience delays or non-launch of new drugs; alternatively, they might pay the U.S. prices but restrict utilization in order to control health spending to target levels. Such an outcome would almost certainly reduce overall social welfare, assuming that the socially optimal global pricing strategy for drugs is Ramsey pricing to pay for the joint costs of R and D, with prices inversely related to per capita income as a proxy for elasticity.[8] There is some evidence suggesting that price spillovers from the United States to Mexico already exist. We find that prices for both drugs and biologics in Mexico were far out of line with per capita income, and utilization was correspondingly low.[9,10]

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Exchange-Rate Models

Charles Engel*

Recent research that my co-authors and I have undertaken, as well as related research by other NBER researchers, suggests that theoretical models of foreign exchange rates are "not as bad as you think." Since the 1970s, models have emphasized the role of exchange rates as asset prices. The new work, looking at present-value models of exchange rates, highlights the role of expectations in determining exchange rate movements. In this article, I briefly summarize some of the work that I have been involved with, along with a few related papers by other researchers. I also report on some research that has drawn the implications of this new work on exchange rates for open-economy macroeconomic policy.

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Should Exchange Rate Models Out-predict the Random Walk Model?

For many years, the standard criterion for judging exchange rate models has been, do they beat the random-walk model for forecasting changes in exchange rates? This criterion was popularized by the seminal work of Meese and Rogoff.[1] They found that the empirical exchange rate models of the 1970s that seemed to fit very well in-sample tended to have a very poor out-of-sample fit. The mean-squared error of the model's prediction of the exchange rate (using realized values of the explanatory variables) tended to be lower than the mean-squared error of the naïve model that predicts no change in the exchange rate. While Meese and Rogoff's exercise was not strictly speaking "forecasting" (because it used realized explanatory variables to "predict" the exchange rate), subsequent work has evaluated exchange rate models by the criterion of whether they produce forecasts with a lower mean-squared error than the simple random walk forecast of no change. Mark's (1995) paper was important in reviving interest in empirical exchange rate models.[2] He found that the models were helpful in predicting exchange rates at long horizons. Subsequent work has cast doubt on whether exchange rates can be forecast at long horizons, so there is a weak consensus that the models are not very helpful in forecasting. (It is worth noting that there is a contingent that believes that non-linear models have forecasting power. When exchange rates are far out of line with the fundamentals, the models are useful in predicting that the exchange rate will return to its fundamental level.)

West and I[3] question the standard criterion for judging exchange rate models. Many exchange rate models can be writ-

ten so that they explain the exchange rate as a weighted sum of current "fundamentals" (such as money supplies, prices, output levels) and the expected future value of the exchange rate. The models actually put relatively little weight on the current fundamentals and much more weight on expectations. The realization of the current fundamental may affect the exchange rate indirectly by influencing the expected future exchange rate. But markets use many sources of information to form expectations of the future exchange rate, not just the realizations of the current fundamentals. So, the models imply that innovations in the current fundamental may not have a large effect on the exchange rate.

This type of model can be solved forward to express the exchange rate as the expected present discounted value of current and future fundamentals. West and I demonstrate the following result for this class of models: if the fundamentals are integrated of order 1 (that is, their first difference is stationary), and the discount factor is close to one, then the exchange rate will approximately follow a random walk. One important implication of this result is that the standard criterion used in evaluating exchange rate models -- can the models out-forecast a random walk? -- is not useful here. The Engel-West result shows that the models actually imply that the exchange rate will approximately follow a random walk. Evidence that they do not perform better than a random walk in forecasting exchange rates cannot be taken as evidence against the models. In practice for typical exchange rate models, West and I show that — given the value of discount factors measured in previous studies and the empirical properties of the fundamentals — the models indeed imply that exchange rates are nearly a random walk.

Other Means of Evaluating Exchange Rate Models

We argue that the Campbell-Shiller[4] technique for evaluating present-value models should not be applied to exchange rate models because all researchers acknowledge that some of the important fundamentals — errors in money demand, foreign-exchange risk premiums, the equilibrium real exchange rate — are not observed by the econometrician. The Campbell-Shiller technique implicitly requires that we know and observe all of the relevant fundamentals that determine the asset price.

But how closely linked are the "observed" fundamentals to exchange rates? West and I[5] note that, since the exchange rate is supposed to be the expected present value of current and future fundamentals, perhaps the exchange rate is useful in forecasting some of the observed fundamentals. In that paper we indeed find (weak) evidence to confirm the hypothesis. Note that since the exchange rate also moves with news about future "unobserved" fundamentals, we should not expect it to be an excellent forecaster of the observed fundamentals alone.

How Much of the Volatility of Exchange Rates is Accounted for by the "Observed Fundamentals"?

A separate criticism of the present value models of exchange rates is that the volatility of the present value is smaller in practice than the volatility of the exchange rate. That is actually the opposite of the way it should be. Calculating the present value requires making a forecast of future fundamentals. Researchers do not have all the information that the markets use in constructing forecasts, so their forecasts should have higher variance than the markets'.

An implication of the Campbell-Shiller technique is that if researchers used the asset price to forecast the fundamentals, they would have all the information that markets use, because that information is reflected in the asset price. But the exchange rate reflects information only about the true fundamental, not the component of the fundamental observed by the econometrician. Still, West and I[6] demonstrate that, again when the discount factor is near one, the variance in innovations of the discounted sum of current and expected future fundamentals calculated by the researcher with his inferior information set is approximately equal to the variance in innovations of the present value when forecasts are based on the market's information.

With that result in hand, we are able to ask how the conditional variance of the discounted present value of expected observed fundamentals compares with the conditional variance of the exchange rate. The answer is that the observed fundamentals for a few commonly used exchange rate models account for, on average, about 40 percent of exchange rate volatility. While this still means that either left-out fundamentals account for much of the volatility, or that there is excess volatility, it is encouraging relative to previous work. It no longer seems so hopeless that an improved exchange rate model can account for exchange rate volatility.

Indeed, perhaps such a model can be developed out of the new line of macroeconomic research that has emphasized that monetary policy is set as a Taylor rule: interest rates are set to respond to inflation, the output gap, and perhaps other economic variables. West and I[7] provide some favorable evidence for such models. We[8] show that the Taylor-rule model, when expressed as a present value relationship, has a modest positive correlation with the actual real dollar/DM rate over the 1979–98 period. An interesting implication of the model is that an increase in expected future inflation in a country actually causes the currency to appreciate. The reason for this is that under the Taylor rule, the policymaker raises interest rates more than the increase in expected inflation. This aspect of the model plays an important role in tracking the actual dollar/DM rate.

Mark's paper is closely related.[9] There are a few differences, two of which merit mention here. The first is a minor point conceptually, but seems to have important empirical implications. In modeling the Taylor rule, Mark allows for sluggish adjustment in the nominal interest rate, which is a feature of actual interest rate behavior that is well known in the literature. This modification appears to be partly responsible for the fact that Mark's empirical model produces an exchange rate that is much more volatile than

Engel and West's — indeed, the model's exchange rate is slightly more volatile than the actual exchange rate. The second point is important conceptually, but seems to have modest empirical implications. Mark allows for the possibility that agents do not know central bank policy and learn about it over time. While in Mark's formulation, this modification does not play a large role in explaining movements in exchange rates, I believe it is an important step in trying to get a handle on the formation of expectations.

Another important step in this direction is the contribution of Bacchetta and van Wincoop.[10] They examine exchange rate determination in a simple model in which agents have different information about future economic fundamentals. Perhaps it is most plausible to think of this as different forecasters using different techniques to analyze the future evolution of the economy. They emphasize how agents must try to infer the information that other agents have from the movements in exchange rates. Agents must forecast the forecasts of others – that is, they must form "higher-order beliefs". Kasa, Walker, and Whiteman[11] have drawn an interesting link between this line of research and my paper with West on volatility. They show that introducing higher-order beliefs into a standard exchange rate model works like an "unobserved fundamental".

Since expectations are the prime mover of exchange rates and expectations change only when there is news, we can ask whether exchange rates respond to news in the way the models predict. That is exactly the exercise undertaken by Clarida and Waldman.[12] As noted above, Taylor-rule models imply that a country's currency will appreciate when there is news of higher inflation. Clarida and Waldman examine announcements of inflation rates, compared to survey expectations of what the announced inflation rate will be. They find that when the announcement is that inflation is unexpectedly high, the currency tends to appreciate. That relationship is strong in countries that explicitly target inflation and is weaker or non-existent in countries that do not target inflation.

Conclusions and Implications

It is difficult to evaluate exchange rate models. Models of asset prices in general are difficult to test because asset price changes are driven by changes in expectations of future fundamentals. It is hard for the researcher to measure expectations. The problem is compounded in the case of exchange rates because we know that there are some components of the fundamentals that we cannot directly observe. Still, the recent research first refutes the notion that the failure of the models to predict exchange rate changes is strong evidence against the models. And, there is some favorable evidence: exchange rates contain news about future fundamentals; they are not so excessively volatile as the literature once accepted; Taylor-rule models show some promise; and, exchange rates respond to news in the way the models predict.

In closing I turn to my paper with Devereux,[13] which explores the implications of the fact that exchange rates respond primarily to news about future fundamentals. An overly brief synopsis of the main lesson from the new Keynesian economics is that monetary policy should aim — to the extent it can — to eliminate the distortions introduced by sticky nominal prices. Ideally, monetary policy should try to reproduce the outcome that would be achieved if nominal prices were flexible. We show that, in an open economy there is a problem when we mix the fact that the nominal exchange rate of any country pair responds to news about the future with the fact that there are nominal goods prices that are set in the currency of each country. Then, relative prices – the prices of goods set in one currency relative to those set in another currency — will change when the nominal exchange rate changes. The problem is that those relative prices are changing when there is news about future fundamentals (monetary and real) that drive the nominal exchange rate. If goods prices were flexible, then relative goods prices would not be influenced by news about the future that is driving the nominal exchange rate. This is a distortion in relative prices caused by nominal price stickiness. Our paper argues that, since most of the variation in exchange rates comes from news about these future fundamentals, most exchange rate variation generates inefficient relative price movements. We argue that there is a case for monetary policy to target unexpected changes in nominal exchange rates in addition to targeting inflation.

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In her spare time, she is an avid photographer and an active participant in the Chester County camera club (see patriciadanzonphoto.com).

TAPES Conference on Public Policy and Retirement

The NBER's TransAtlantic Public Economics Seminar (TAPES), focusing this year on Public Policy and Retirement, took place in Uppsala, Sweden on June 12-14. The following papers were discussed:

James M. Poterba, NBER and MIT; **Joshua Rauh**, NBER and University of Chicago; **Steven F. Venti**, NBER and Dartmouth College, and **David A. Wise**, NBER and Harvard University, "Defined Contribution Plans, Defined Benefit Plans, and the Accumulation of Retirement Wealth"
Discussants: Paul Bingley, Aarhus School of Business, and Anil Kumar, Federal Reserve Bank of Dallas

Jeffrey R. Brown and **Scott Weisbenner**, NBER and University of Illinois; and **Nellie Liang**, Federal Reserve Board of Governors, "Individual Account Investment Options and Portfolio Choice: Behavioral Lessons from 401(k) Plans"
Discussants: Brigitte Madrian, NBER and The Wharton School, and Matias Eklof, Uppsala University

Helmuth Cremer and **Philippe De Donder**, University of Toulouse**; Dario Maldonado,** University del Rosario, Bogota; and **Pierre Pestieau**, University of Liege, "Voting over Type and Size of a Pension System When Some Individuals Are Myopic"
Discussants: Dirk Krueger, J.W. Goether University, Frankfurt; and Amy Finkelstein, NBER and MIT

Gary V. Engelhardt, Syracuse University, and **Anil Kumar**, "Employer Matching and 401(k) Saving: Evidence from the Health and Retirement Study" (NBER Working Paper No. 12447)
Discussants: Courtney Coile, NBER and Wellesley College, and Clemens Sialm, University of Michigan

Paul Bingley, and **Gauthier Lanot**, Keele University (UK), "Public Pension Programs and the Retirement of Married Couples in Denmark"
Discussants: James M. Poterba, and Arthur van Soest, Tilburg University

Monika Butler, Universitat St. Gallen**,** and **Federica Teppa**, Universitat di Torino, "Should You Take a Lump-Sum or Annuitize: Results from Swiss Pension Funds"
Discussants: Vincenzo Galasso, NBER and Universita Bocconi; and Joshua Rauh

Gene Amromin, Federal Reserve Bank of Chicago**; Jennifer Huang**, University of Texas; and **Clemens Sialm**, "The Tradeoff between Mortgage Prepayments and Tax-Deferred Savings"
Discussants: Michelle J. White, NBER and University of California, San Diego; and Scott Weisbenner

Courtney C. Coile and **Phillip B. Levine**, NBER and Wellesley College, "Labor Market Shocks and Retirement: Do Government Programs Matter?"
Discussants: Olivia Mitchell, NBER and University of Pennsylvania; and Monika Butler

Anders Karlstrom, Royal Institute of Technology, Stockholm; **Marten Palme**, Stockholm University; and **Ingemar Svensson**, Social Insurance Agency, Stockholm, "The Employment Effect of Stricter Rules for Eligibility to DI: Evidence from a Natural Experiment in Sweden"
Discussants: Axel Borsch-Supan, NBER and University of Mannheim, and Marie-Louise Leroux, University of Toulouse

Matias Eklof and **Daniel Hallberg**, Uppsala University, "Estimating Early Retirement with Special Early Retirement Offers"
Discussants: Roger H. Gordon, NBER and University of California, San Diego, and Jeffrey R. Brown

Jeffrey R. Brown and **Amy Finkelstein**, "Supply or Demand: Why is the Market for Long-term Care Insurance so Small?"
Discussants: Leora Friedberg, NBER and University of Virginia, and Marten Palme

Antoine Bommier, **Marie-Louise Leroux**, and **Jean-Marie Lozachmeur**, University of Toulouse, "Varying Life Expectancy and Social Security"
Discussants: Panu Poutvaara, University of Helsinki, and Philippe De Donder

The private pension structure in the United States once was dominated by defined benefit (DB) plans, but currently is divided between DB and defined contribution (DC) plans. Wealth accumulation in DC plans depends on financial market returns, while accumulation in a DB pension is very sensitive to an individual's labor market experience. **Poterba** and his coauthors examine how the expansion of DC plans affects the average level of private retirement wealth and the variation in retirement wealth across households. They consider the stochastic contributions of asset returns, earnings histories, and retire-

ment plan characteristics using data from the Health and Retirement Study (HRS). The analysis simulates retirement wealth accumulation under DC and DB plans. For DC plans, the analysis matches individuals to randomly selected DC plans and draws asset returns from historical distributions. It allows for various asset allocation strategies and expense ratios. For DB plans, the analysis draws earnings histories from the HRS, and randomly assigns a pension plan to each job the individual holds. These procedures generate a distribution of potential DC and potential DB accruals that reflect the structure of DB and DC plans, the stochastic structure of earnings over the lifecycle, and the random contribution of asset returns to retirement wealth. The results provide a measure of the dispersion in prospective retirement wealth under both DB and DC regimes.

Brown and his coauthors examine how the menu of investment options made available to workers in defined contribution plans influences portfolio choice. Using unique panel data on 401(k) plans in the United States, they present three principal findings: 1) the share of investment options in a particular asset class (that is, company stock, equities, fixed income, and balanced funds) has a significant effect on aggregate participant portfolio allocations across these asset classes. Second, the vast majority of the new funds added to 401(k) plans are high-cost actively managed equity funds, as opposed to lower-cost equity index funds. Because the average share of assets invested in low-cost equity index funds declines with an increase in the number of options, average portfolio expenses increase, and average portfolio performance is thus depressed. Third, investment restrictions — such as requiring a match in company stock, or placing a ceiling on the fraction of assets that can be held in a particular asset — can change the overall risk/return profile of the portfolio much more than would be expected in a standard portfolio model. For example, restricting investment in company stock is associated with an overall reduction in all equities, not just company stock, perhaps suggesting that participants view such restrictions as a form of implicit investment advice.

Cremer and his coauthors study the determination through majority voting of a pension scheme in which society consists of far-sighted and myopic individuals. All individuals have the same basic preferences but those who are myopic tend to adopt a short-term view (instant gratification) when dealing with retirement saving. Consequently, they will find themselves with low consumption after retirement and regret their insufficient savings decisions. As a result, when voting they tend to commit themselves into forced saving. The authors consider a pension scheme that is characterized by two parameters: the payroll tax rate (that determines the size or generosity of the system) and the "Bismarckian factor" that determines how much it redistributes. Individuals vote sequentially. The authors examine how the introduction of myopic agents changes the size and the level of redistribution of the pension system. Their main result is that a flat pension system is always chosen when all individuals are of one kind (either all rational or all myopic), while a system that redistributes less may be chosen if society is composed of both myopic and rational agents. With logarithmic preferences, the size of the system increases with the proportion of those who are myopic. However, this property does not necessarily hold with more general preferences.

Employer matching of employee 401(k) contributions is a key component in pension-plan design in the United States. Using detailed administrative contribution, earnings, and pension-plan data from the Health and Retirement Study, **Engelhardt** and **Kumar** formulate a lifecycle-consistent discrete choice regression model of 401(k) participation and estimate the determinants of participation accounting for non-linearities in the household budget set induced by matching. The estimates indicate that an increase in the match rate by 25 cents per dollar of employee contribution raises 401(k) participation by 3.75 to 6 percentage points, and the estimated elasticity of participation with respect to matching ranges from 0.02–0.07. The estimated elasticity of intertemporal substitution is 0.74–0.83. Overall, the analysis reveals that matching is a rather poor policy instrument with which to increase retirement saving.

Bingley and **Lanot** study the economic determinants of the joint retirement process of couples. They propose a tractable, dynamic discrete choice model for the retirement decision of couples that allows for non-trivial saving behavior. They estimate the model on a sample of Danish couples of retirement age observed in the administrative database of the Danish population. The recent history of changes in a publicly financed early-retirement program provides them with the required variation in the data to insure the identification of the parameters of interest: the elasticity of retirement age with respect to incomes flows. In particular, their estimates imply a significant asymmetry in the sensitivity of retirement behavior of men and women with respect to variation in their own, or their spouse's income flows.

Butler and **Teppa** use a unique dataset on individual retirement decisions in Swiss pension funds to analyze the choice between an annuity and a lump sum at retirement. Their analysis suggests the existence of an "acquiescence bias," meaning that a majority of retirees chooses the standard option offered by the pensions fund or suggested by common practice. Small levels of accumulated pension capital are much more likely to be withdrawn as a lump sum, suggesting a potential moral hazard behavior or a magnitude effect. The authors hardly find evidence for adverse selection effects in the data. Single men, for example, whose money's worth of an annuity is considerably below the corresponding value of married men, are not more likely to choose the capital option.

Amromin, **Huang**, and **Sialm** show that a significant number of households can perform a tax arbitrage by cutting back on their additional mortgage payments and increasing their contributions to tax-deferred accounts (TDA). Using data from the three latest Surveys of Consumer Finances, they show that about 38 percent of U.S. households that are accelerating their mortgage payments instead of saving in tax-deferred accounts are making the wrong choice. For these households, reallocating their savings can yield

a mean tax benefit of 11 to 17 cents per dollar, depending on the choice of investment assets in the TDA. In the aggregate, these misallocated savings are costing U.S. households as much as 1.5 billion dollars per year. Finally, the authors show empirically that this inefficient behavior is unlikely to be driven by liquidity or other constraints, and that self-reported debt aversion and risk aversion variables explain to some extent the preference for paying off debt obligations early and hence the propensity to forgo possible tax arbitrage.

Coile and **Levine** examine how unemployment affects retirement and whether the Unemployment Insurance (UI) system and Social Security (SS) system affect how older workers respond to labor market shocks. To do so, they use data from the longitudinal Health and Retirement Survey (HRS), pooled cross-sections from the March Current Population Survey (CPS), and March CPS files matched between one year and the next. They find that downturns in the labor market increase retirement transitions. The magnitude of this effect is comparable to that associated with moderate changes in financial incentives to retire and to the threat of a health shock to which older workers are exposed. Interestingly, retirements only increase in response to an economic downturn once workers become SS-eligible, suggesting that retirement benefits may help alleviate the income loss associated with a weak labor market. The authors also estimate the impact of UI generosity on retirement and find little consistent evidence of an effect. This suggests that in some ways SS may serve as a more effective form of unemployment insurance for older workers than UI.

Karlstrom, Palme, and **Svensson** study the effect of a reform of the Swedish disability insurance (DI) program whereby the special eligibility rules for workers aged 60–64 were abolished. They first use a differences-in-differences approach to study changes in the disability take-up compared to that of the 55-to-59-age group. Then they use a similar approach to study to what extent the employment effect of the reform is "crowded out" by an increase in the use of sick pay insurance, contributing to the well known increase in spending in that program, and/or unemployment insurance. In an extended analysis, they study the effect of firm closure on employment and use of different labor market insurance programs in different age groups before and after the reform.

Eklof and **Hallberg** analyze retirement behavior in Sweden during the 1990s with a focus on voluntary early retirement. They observe in the data that a non-negligible fraction of early retirees receive higher occupational pension benefits than regulated in the collectively agreed contracts. This is consistent with "buy-outs," also called early retirement pensions, where employers offer employees more generous pension programs if they agree on early retirement. Neglecting such offers produces biased estimates of the individuals' responses to financial incentives in the retirement decision. The available register data is limited such that access to early retirement pensions is only indirectly recorded for early retirees, and not recorded at all for non-retirees. This creates an error-in-variables problem in the retirement equation and a sample-selection problem in the access-to-early-retirement pension equation. The authors propose an estimation strategy whereby the retirement decision and the access to early pension are estimated in a simultaneous equation system, yielding unbiased estimates of the model parameters. They apply the model using detailed Swedish register data. They illustrate that the early retirement probabilities would decrease by 10–30 percent if early retirement pensions were absent.

Long-term care represents one of the largest uninsured financial risks facing the elderly in the United States. **Brown** and **Finkelstein** present evidence of supply-side market failures in the private long-term care insurance market. In particular, the typical policy purchased exhibits premiums marked up substantially above expected benefits. It also provides very limited coverage relative to the total expenditure risk. However, the authors present additional evidence suggesting that the existence of supply-side market failures is unlikely, by itself, to be sufficient to explain the very small size of the private long-term care insurance market. In particular, they find enormous gender differences in pricing that do not translate into differences in coverage, and they show that more comprehensive policies are widely available, if seldom purchased, at similar loads to purchased policies. This suggests that factors limiting demand for insurance are also likely to be important in this market. The evidence here also sheds light on the likely nature of these demand-side factors.

Bommier and his coauthors study the normative problem of redistribution between individuals who differ in their life span. They discuss important aspects related to the objective function in such a setting and argue that aversion to multi-period inequality and risk aversion with respect to the length of life should be taken into account. Then, they study the properties of the social optimum both with full information and asymmetric information.

These papers will be published in a special edition of the *Journal of Public Economics.* They will also be available at "Books in Progress" on the NBER's website.

International Seminar on Macroeconomics

The NBER's 29th Annual International Seminar on Macroeconomics, organized by Lucrezia Reichlin, Director General of the European Central Bank, and Kenneth D. West, NBER and University of Wisconsin, took place in Estonia on June 16–17. Jeffrey A. Frankel, NBER and Harvard University, and Francesco Giavazzi, NBER and Bocconi University, served as co-chairs. These papers were discussed:

Giancarlo Corsetti, European University Institute; **Luca Dedola**, European Central Bank; and **Sylvain Leduc**, Federal Reserve Board, "Productivity, External Balance, and Exchange Rates: Evidence on the Transmission Mechanism Among G7 Countries"
Discussants: Susanto Basu, Boston College and NBER, and Robert Kollman, University of Paris XII

Lans Bovenberg, Tilburg University, and **Harald Uhlig**, Humboldt University, "Pension Systems and the Allocation of Macroeconomic Risk"
Discussants: Henning Bohn, University of California, Santa Barbara, and Philippe Weil, Université Libre de Bruxelles and NBER

Troy Davig, Federal Reserve Bank of Kansas, and **Eric M. Leeper**, Indiana University and NBER, "Threshold Regime Switching: Spillovers, Asymmetries, and Preemptive Actions"
Discussants: Richard H. Clarida, Columbia University and NBER, and Jesper Linde, Sveriges Riksbank

Chryssi Giannitsarou, University of Cambridge, and **Andrew Scott**, London Business School, "The Inflation of Rising Government Debt — Should We Be Worried?"
Discussants: Domenico Giannone, Université Libre de Bruxelles, and Eric M. Leeper

Julio J. Rotemberg, Harvard University and NBER, "Cyclical Wages in a Search-and-Bargaining Model with Large Firms"
Discussants: Rodolfo Manuelli, University of Wisconsin, and Antonella Trigari, Universita Bocconi

Morten O. Ravn, European University Institute, " The Consumption-Tightness Puzzle"
Discussants: Kai Christoffel, European Central Bank, and Julio J. Rotemberg

Linda L. Tesar, University of Michigan and NBER, "Production Sharing and Business Cycle Synchronization in the Accession Countries"
Discussants: Paul Bergin, University of California, Davis and NBER, and Aurelijus Dabusinskas, Bank of Estonia

Francis X. Diebold, University of Pennsylvania and NBER, and **Kamil Yilmaz**, Koc University, "Volatility Contagion"
Discussants: Michael Binder, University of Frankfurt, and Kathryn M. E. Dominguez, University of Michigan and NBER

Corsetti and his coauthors investigate the international transmission of productivity shocks in a sample of five G-7 countries. Using long-run restrictions, they identify for each country shocks that permanently increase domestic labor productivity in manufacturing (their measure of tradable goods) relative to an aggregate of the other G-7 countries. According to standard theory, they find that these shocks raise relative consumption, deteriorate net exports, and raise the relative price of non-tradable goods, in full accord with the Harrod-Balassa-Samuelson hypothesis. Moreover, the deterioration of the external account is fairly persistent, especially for the United States. The response of the real exchange rate and (their proxy for) the terms of trade differ across countries: both prices appreciate in the largest and least open economies in the sample; they depreciate in the smaller and more open economies. These findings question the conventional view that supply shocks worsen the terms of trade of a country on impact, providing an empirical contribution to the current debate on the correction of global imbalances. Productivity growth in the U.S. manufacturing sector does not necessarily deteriorate the U.S. terms of trade, nor improve the U.S. trade deficit, at least in the short and medium run.

Bovenberg and **Uhlig** explore the optimal risk sharing arrangement between generations in an overlapping generations model with endogenous growth. They allow for non-separable preferences, paying particular attention to the risk aversion of the old as well as overall "life-cycle" risk aversion. They provide a fairly tractable model, which can serve as a starting point for exploring these issues in models with a larger number of periods of life, and show how it can be solved. They provide a general risk sharing condition, and discuss its implications. They explore the properties of the model quantitatively. Among the key findings are the following: first, the old bear a smaller burden of the risk in productivity surprises if old-age risk-aversion is smaller than life-cycle risk aversion, but a larger one if the old-age risk aversion is higher. Second, consumption of the young and the old always move in the same direction, even for population growth shocks. This result is in contrast to the result of a fully funded decentralized system without risk sharing between generations. Third, persistent increases in longevity will lead to lower total consumption of the old (and thus certainly lower per-period consumption of the old) as well as the young and higher work effort of the young. The additional resources are instead used to increase growth and future

output, resulting in higher consumption of future generations.

Davig and **Leeper** make changes in monetary policy rules (or regimes) endogenous. Changes are triggered when certain endogenous variables cross certain specified thresholds. The implications of threshold switching are examined in three models to illustrate that: 1) cross-regime spillovers can be quantitatively important; 2) symmetric shocks can have asymmetric effects; 3) endogenous switching is a natural way to formally model preemptive policy actions. In a conventional calibrated model, preemptive policy reaps benefits by shifting agents' expectations, enhancing the effectiveness of policy and yielding a quantitatively significant "preemption dividend."

The intertemporal budget constraint of the government implies a relationship between the ratio of current liabilities and: the primary deficit and future values for the deficit, narrow money, inflation, interest rates, and GDP growth. **Giannitsarou** and **Scott** evaluate the ability of this framework to explain the fiscal behavior of the G7 since 1970. They show how debt is normally financed through changes in the primary deficit (90 percent) with less substantial roles being played by inflation (2 percent) and GDP growth (5–10 percent). They then use this framework to consider the implications of demographic factors for government finances. Using projections for each country's future deficits and the impact on interest rates and growth rates, they provide upper bounds for the impact of demography on inflation, based on unchanged fiscal policies, and then calculate the required fiscal adjustment necessary to maintain stable inflation.

Rotemberg presents a complete general equilibrium model with flexible wages where the degree to which wages and productivity change when cyclical employment changes is roughly consistent with postwar U.S. data. Firms with market power are assumed to bargain simultaneously with many employees, each of whom finds himself matched with a firm only after a process of search. When employment increases as a result of reductions in market power, the marginal product of labor falls. This fall tempers the bargaining power of workers and thus dampens the increase in their real wages. The procyclical movement of wages is dampened further if the posting of vacancies is subject to increasing returns.

Ravn introduces a labor force participation choice into a standard, labor market matching model embedded in a dynamic stochastic general equilibrium set-up. He models the participation choice as a trade-off between forgoing the expected benefits of actively searching and the costs of engaging in a labor market search. In contrast to models with constant labor force participation, the model that he analyzes induces symmetry between firms' and workers' search decisions, since both sides of the labor market vary the search effort at the extensive margins. Ravn shows that this set-up is of considerable analytical convenience and that the introduction of participation choice leads to a strong tendency for procyclical unemployment, very low volatility of labor market tightness, and a positively sloped Beveridge curve.

Tesar provides a quantitative assessment of the role of trade in the transmission of business cycles within and between the regions of East and West Europe. The model allows for trade in intermediate inputs that are substitutes in production and for "nearshoring" in which intermediate inputs from East and West are complements. The model is calibrated to data on aggregate and bilateral trade flow, relative country sizes, and the extent of nearshoring. The model suggests that expanded East-West trade will produce positive output co-movements within Europe. However, the two types of trade also produce very different dynamics for consumption and labor supply. Thus, one's view of whether trade makes business cycles "more similar" across Europe or not depends both on the nature of trade and on the metric one uses to assess business cycle synchronization.

Although much has been made of the possibility of contagion in global asset markets following the late-1990s Asian crisis, the evidence remains mixed and controversial. **Diebold** and **Yilmaz** progress by formulating and examining precise and separate measures of *return spillovers* (multivariate linkages via the conditional means of returns) and *volatility spillovers* (multivariate linkages via the conditional variances of returns). Return contagion and volatility contagion then emerge as periods of return spillover bursts and volatility spillover bursts, respectively. Moreover, this framework facilitates study of both crisis *and* non-crisis episodes, including secular trends in spillovers. This turns out to be empirically important: in an extensive analysis of 16 global equity markets, there is striking evidence of divergent behavior in return spillovers versus volatility spillovers. Moving through the 1990s to the present, return spillovers display an upward trend but no contagion, whereas volatility spillovers display no trend but strong contagion.

The MIT Press will publish these papers in an annual conference volume later this year. They are also available at "Books in Progress" on the NBER's website.

Seventeenth Annual EASE Conference

The NBER, the University of Tokyo, the China Center for Economic Research, the Chung-Hua Institution for Economic Research, the Hong Kong University of Science and Technology, the Korea Development Institute, the Productivity Commission of Australia, the Singapore Management University, and the Tokyo Center for Economic Research jointly sponsored the NBER's 17th Annual East Asian Seminar on Economics on June 22–24. Takatoshi Ito, University of Tokyo and NBER, and Andrew K. Rose, University of California, Berkeley and NBER, organized the conference, which focused on "International Financial Issues Around the Pacific-Rim." These papers were discussed:

Peter B. Henry, Stanford University and NBER, and **Prakash Kannan**, Stanford University, "Growth and Returns in Emerging Markets"
Discussants: Takatoshi Ito, and Etsuro Shioji, Hitotsubashi University

Shin-ichi Fukuda and **Yoshifumi Kon**, University of Tokyo, "International Currency and the U.S. Current Account Deficits"
Discussants: Linda S. Goldberg, Federal Reserve Bank of New York and NBER, and Andrew K. Rose

Lee-Rong Wang, Chung-Hua Institution for Economic Research, "Financial Liberalization under the WTO and Its Relationship with the Macroeconomy"
Discussants: Shin-ichi Fukuda, and Roberto Mariano, Singapore Management University

Michael P. Dooley, University of California, Santa Cruz and NBER, **David Folkerts-Landau**, Deutsche Bank, and **Peter M. Garber**, Deutsche Bank and NBER, "Life on the Tri-Polar Sphere: How Should Interest and Exchange Rates Realign Next?"
Discussants: Barry Eichengreen, University of California, Berkeley and NBER, and John Simon, Reserve Bank of Australia

Eiji Ogawa, Hitotsubashi University, and **Kentaro Kawasaki**, Toyo University, "Adopting a Common Currency Basket Arrangement into the 'ASEAN Plus Three'"
Discussants: Michael P. Dooley, and Kiyotaka Sato, Yokohama National University

Takatoshi Ito, and **Yuko Hashimoto**, Toyo University, "Price Impacts of Deals and Predictability of the Exchange Rate Movements"
Discussants: Peter M.Garber, and Eli Remolona, Bank for International Settlements

Chulsoo Kim, Sookmyung Women's University, "Current Account, Government Budget, and World Output Shares"
Discussants: Ashvin Ahuja, Bank of Thailand, and Peter N. Kriz, Singapore Management University

Inseok Shin and **Changyun Park**, Korea Development Institute, "Stock Market Opening and the Cost of Capital: The Case of Korea"
Discussants: Yuko Hashimoto and Chulsoo Kim

Kyoji Fukao and **Miho Takizawa**, Hitotsubashi University; **Keiko Ito**, Senshu University; and **Hyeog Ug Kwon**, Nihon University, "Cross-Border Acquisitions and Target Firms' Performance: Evidence from Japanese Firm-Level Data"
Discussants: Chatib Basri, University of Indonesia, and Roberto Mariano

Barry Eichengreen, and **Pipat Luengnaruemitchai**, IMF, "Bond Markets as Conduits for Capital Flows: How Does Asia Compare?"
Discussants: Eiji Ogawa and Eli Remolona

Linda S. Goldberg, and **Jose Manuel Campa,** IESE, "Pass Through of Exchange Rates to Consumption Prices: What Has Changed and Why?"
Discussants: Chatib Basri and Kiyotaka Sato

Chung-Shu Wu and **Jin-Lung Lin**, Academia Sinica, "The Relationship between Openness and Inflation in Asian 4 and G 7"
Discussants: Peter B. Henry and John Simon

Jianhuai Shi, CCER, "Are Currency Revaluations Contractionary in China?"
Discussants: Ashvin Ahuja, Bank of Thailand, and Dante Canlas, University of the Philippines

According to **Henry** and **Kannan**, from 1976 to 2005 the emerging economies grew at an average rate of 5.1 percent per year, roughly twice the average growth rate of the United States. In contrast, average annual stock returns for emerging markets over the same time period were 7.78 percent, a number that is not significantly higher than the corresponding figure for the United States. On the other hand, average expected returns in emerging economies are greater than expected returns in the United States. Realized returns in emerging markets generally exceed expected returns, but the differential between the two (unexpected capital gains), has been larger in Latin America than in Asia.

Fukuda and **Kon** provide some theoretical and empirical support to the view that a remarkable change in international capital flows would help to explain recent

increases in the U.S. current account deficits. They first provide a simple open economy model, in which an increased motive for liquid foreign assets can cause large current account surpluses against the country that issues an international currency. Their dynamic analysis reveals that the current account surpluses are likely to remain large for years, accompanied by substantial depreciation of the real exchange rate against the international currency. Second, they provide empirical support for the theoretical implications. They show that there were not only large increases in foreign exchange reserves in East Asian economies but also substantial depreciation of East Asian real exchange rates against the U.S. dollar even after the economies recovered from the crisis. They then provide noteworthy regressions based on the Balassa-Samuelson model. They observe worldwide undervaluation of real exchange rates against the U.S. dollar after the Asian crisis. The degree of undervaluation was more conspicuous among the East Asian economies. Their results support the view that the U.S. current account deficit is not "made in the U.S.A." but is attributable to some events external to the United States.

Wang focuses on the relationship between the liberalization of the financial sector, competition within the sector, and the sector's overall contribution to economic growth. To identify such relationships, he follows the approach adopted in Eschenbach, Francois, and Schuknecht (2000), which involves cross-country growth regressions and includes a number of variables that seem to perform robustly in the literature. His contribution is mainly to adjust the way in which financial liberalization is measured based on the financial commitments under the General Agreement on Trade in Services, by following the method presented by Hoekman (1995) and other related studies. He finds that, based on the GATS commitments in overall financial sectors throughout four modes of supply offered by 93 WTO members, the degree of liberalization in terms of market access and national treatment are highly correlated. Under mode 1 (cross-border supply), 2 (consumption abroad), and 3 (commercial presence), the degree of liberalization in regard to market access is positively correlated with the income level; however, there is no such link under mode 4 (movement of natural persons). When compared with the performance in terms of liberalization across the four modes, higher income members have, on average, the highest level of market access liberalization under mode 2. However, in regard to the national treatment part, mode 3 appears to have the highest degree of liberalization regardless of the income level. Wang also finds that there is a positive pattern linking the financial sector competition indicators with his measure of financial sector liberalization, and economic growth with the financial sector competition. His findings, in a way that is similar to Eschenbach, Francois, and Schuknecht (2000), suggest that moving from a closed to a relatively open regime is correlated with significant pro-competitive pressures, and ultimately with large differences in growth rates.

Dooley and his co-authors examine the behavior of interest rates and exchange rates following a variety of shocks to the international monetary system. Their analysis suggests that real interest rates in the United States and Europe will remain low relative to historical cyclical experience for an extended period but converge slowly toward normal levels. During this adjustment interval, the United States will continue to absorb a disproportionate share of world savings. After a substantial initial appreciation, the floating currencies will remain constant relative to the dollar in the undisturbed background system. In real terms, the dollar and the floating currencies will eventually have to depreciate relative to the managed currencies.

Ogawa and **Kawasaki** investigate whether the region composed of "ASEAN plus three countries" is an optimum currency area. They focus on whether the Japanese yen could be regarded as an "insider" currency along with other East Asian currencies, or whether it is still an "outsider" which is used as a target currency of foreign exchange rate policy for other East Asian countries. They use a Dynamic OLS methodology to estimate the long-term relationship among the East Asian currencies in a currency basket. Their empirical results indicate that the Japanese yen works as an exogenous variable in the cointegration system during a pre-crisis period while it works as an endogenous one during a post-crisis period. This implies that the Japanese yen could be regarded as an insider currency, along with other East Asian currencies, after the crisis although it is regarded as an outsider currency, along with the U.S. dollar and the euro, before the Asian crisis.

Ito and **Hashimoto** examine the price impact and the predictability of exchange rate movement using the transaction data recorded in the electronic brokering system of the spot foreign exchange market. With the institutional change in markets in recent years (such as the widespread use of computers in the FOREX markets), traders tend not to accumulate large positions during the day and to square positions at the end of business hours. In this analysis, the authors examine the impact of order flows on the price quotation and movements: whether deals at the ask (bid) side will cause the exchange rate to depreciate (appreciate) depends on the depth of market. Then, they examine whether deals done at period t predict the price movement for the next period, t+1, using information that is contained in the dataset. They find that coefficients are significantly different from zero for both 5-minute and 1-minute forecast horizons, but the significance disappears in the 30-minute interval. Also, t-statistics become larger as the prediction window becomes shorter. Price impacts of deals on one side of the market, that likely reflect order flows, are significant but short-lived. If one is in the market and observe these phenomena on the real-time basis, then price movements in the next few minutes may be predictable.

Engel and Rogers (2006) build a model in which a country will run a current account deficit if the discounted sum of its future shares of world GDP exceeds its current share of world GDP. They ask if current account balance can be explained with private savings, implicitly holding government budget balance and investment constant. **Kim** instead asks if current account balance can be explained with private savings and government budget balance, implicitly holding only investment constant. By introducing rule-of-thumb consumers into Engel and Rogers (2006) methodology, she can determine whether the recent tax cuts

have caused the recent increases in the U.S. current account deficit. Furthermore, with a government budget balance modeled explicitly, this paper asks whether we can explain the large current account surpluses of the emerging economies of East Asia.

Shin and **Park** study changes in the cost of capital after stock market opening based on the Korean experience. They use firm-level panel regression approaches, focusing on the relationship between foreign participation rates and the dividend yield. They find that the larger the foreign participation rate, the lower is the dividend yield. But, the relationship is only significant in the post-crisis period when the Korean stock market is fully opened and the foreign participation rate is relatively higher. The results are different from the existing studies based on cross-country data that find the effect of market opening is realized in the early stage of opening.

Fukao and his co-authors examine whether a firm is chosen as an acquisition target based on its productivity level, profitability, and other characteristics, and whether the performance of Japanese firms that were acquired by foreign firms improves after the acquisition. They use Japanese firm-level data for the period from 1994–2002. In their previous study of the Japanese manufacturing sector, they found that acquisitions by foreigners brought larger and quicker improvements in total factor productivity (TFP) and profit rates. However, one may argue that firms acquired by foreign firms showed better performance simply because foreign investors acquired more promising Japanese firms than Japanese investors did. In order to address this selection-bias problem, the authors combine a difference-in-differences approach with propensity-score matching techniques in this study. The basic idea of matching is that they look for firms who were not acquired by foreign firms but had similar characteristics to those acquired by foreigners. Using these firms as control subjects, and comparing the acquired firms and the control subjects, the authors ask whether firms acquired by foreigners show greater improvement in performance than firms not acquired by foreigners. Results from both unmatched samples and from matched samples show that foreign acquisitions improved target firms' productivity and profitability significantly more and quicker than acquisitions by domestic firms. Moreover, there is no positive impact on target firms' profitability in the case of both within-group in-in acquisitions and in-in acquisitions by domestic outsiders. In fact, in the manufacturing sector, the return on assets even deteriorates one year and two years after within-group in-in acquisition, while the TFP growth rate is higher after within-group in-in acquisition than after by-outsider in-in acquisition. These results imply that in the case of within-group in-in acquisitions, parent firms may be trying to quickly restructure acquired firms even at the cost of deteriorating profitability.

Eichengreen and **Luengnaruemitchai** use data on the extent to which residents of one country hold the bonds of issuers resident in another as a measure of financial integration or interrelatedness, asking how Asia compares with Europe and Latin America and with the base case in which the purchaser and issuer of the bonds reside in different regions. Not surprisingly, they find that Europe is head and shoulders above other regions in terms of financial integration. More interesting is that Asia already seems to have made some progress on this front compared to Latin America and other parts of the world. The contrast with Latin America is largely explained by stronger creditor and investor rights, more expeditious and less costly contract enforcement, and greater transparency that lead to larger and better developed financial systems in Asia, something that is conducive to foreign participation in local markets and to intra-regional cross holdings of Asian bonds generally. Further results based on a limited sample suggest that one factor holding back investment in foreign bonds in East Asia may be limited geographical diversification by mutual funds, in turn reflecting a dearth of appropriate assets. Asian Bond Fund 2, by creating a passively managed portfolio of local currency bonds potentially attractive to mutual fund managers and investors, may help to relax this constraint.

The sensitivity of border prices to exchange rates is much higher than the sensitivity of retail prices of similar goods to exchange rates. The distribution sector and imported input use play important roles in driving a wedge between these two levels of exchange rate pass through. **Campa** and **Goldberg** present cross-country evidence on sector-specific import-price sensitivity to exchange rates, and on changes over time in this sensitivity. They also document how changes over time in expenditures on local distribution and on the use of imported inputs in production should influence retail price sensitivity to exchange rates.

Investigating a sample of 114 countries, Romer (1993) found a significant negative relationship between openness and inflation. But for a cross-section dataset that covers so many countries, and may include some with a unique economic structure, these empirical results may be significantly distorted. In addition, to represent a country's characteristics by period-averaged indexes may not reflect the actual phenomenon. In their paper, **Wu** and **Lin** adopt a panel data set that includes some NICs and G7 countries in order to reinvestigate the relationship between openness and inflation. Since the number of countries they discuss is only thirteen, it is relatively easy for them to review the patterns of openness and inflation of each country. Moreover, using the panel data, they can verify the time-consistency theory by examining the corollary of the theory: that the effect of monetary expansion on output is smaller in a more open economy. Their empirical results show that openness and inflation do not have a regular relationship, as argued by Romer(1993), and that there exists no certain relationship between openness and the impact of money supply.

Shi empirically assesses the effects of the renminbi (RMB) real exchange rates on China's output. The econometrics of the paper show that even after sources of spurious correlation and reverse causation are controlled for, RMB revaluation has led to a decline in China's output — this suggests that RMB revaluations do tend to be contractionary. The paper provides some possible explanations of this finding, and point out that the it does not imply that China should continue to maintain an undervalued RMB.

NBER Conference in Beijing

The eighth annual NBER-CCER Conference on China and the World Economy, jointly sponsored by the National Bureau of Economic Research and the China Center for Economic Research at Beijing University, took place in Beijing on June 28–July 1.

At this conference, the discussion topics included: China's role in the world economy, the importance of international capital flows, monetary policy under fixed exchange rates, FDI and economic growth, the effect of social capital on poverty, regulation issues, human capital and its relation to growth and inequality, and the measurement of productivity.

U.S. participants at this year's conference were: NBER President Martin Feldstein and Professor Shang-Jin Wei, who is currently on leave from the NBER at the IMF, both serving as the U.S. conference organizers; NBER researchers Alberto F. Alesina of Harvard University; Ernst R. Berndt, James M. Poterba, and Nancy L. Rose of MIT; William J. Collins of Vanderbilt University; Mark Duggan, University of Maryland; Gordon H. Hanson, University of California, San Diego; Casey Mulligan, University of Chicago; and Michael Woodford, Columbia University.

The entire conference program with links to other related information is available on the NBER's web site at www.nber.org/china.

Tax Policy and the Economy

The NBER's Twenty-first Annual Conference on Tax Policy and the Economy, organized by James M. Poterba of NBER and MIT, took place in Washington, DC on September 14. These papers were discussed:

Jeffrey R. Brown, University of Illinois and NBER; **Norma Coe**, Tilburg University; and **Amy Finkelstein**, MIT and NBER, "Medicaid Crowd-Out of Private Long-Term Care Insurance Demand: Evidence from the Health and Retirement Survey"

Martin Feldstein, Harvard University and NBER, and **Daniel Altman**, NBER, "Unemployment Insurance Saving Accounts" (NBER Working Paper No. 6860)

John F. Cogan, Stanford University; **R. Glenn Hubbard**, Columbia University and NBER, and **Daniel P. Kessler**, Stanford University and NBER, "Evaluating Effects of Tax Preferences on Health Care Spending and the Budget"

Laurence J. Kotlikoff, Boston University and NBER, and **David Rapson**, Boston University, "Does It Pay, at the Margin, to Work and Save? — Measuring Effective Marginal Taxes on Americans' Labor Supply and Saving"

Gilbert E. Metcalf, Tufts University and NBER, "Federal Tax Policy Towards Energy"

Brown, **Coe,** and **Finkelstein** provide empirical evidence of Medicaid crowd out of the demand for private long-term care insurance. Using data from the Health and Retirement Survey, they estimate that a $10,000 decrease in the level of assets an individual can keep while qualifying for Medicaid would increase private long-term care insurance coverage by 1.1 percentage points. This implies that if every state in the country moved from their current Medicaid asset eligibility requirements to the most stringent Medicaid eligibility requirements allowed by federal law — a change that would decrease average household assets protected by Medicaid by about $25,000 — demand for private long-term care insurance would rise by 2.7 percentage points. While this represents a 30 percent increase in insurance coverage relative to the baseline ownership rate of 9.1 percent, it also indicates that the vast majority of households would still find it unattractive to purchase private insurance.

Feldstein and **Altman** ask whether unemployment insurance (UI) savings accounts based on a moderate saving rate can finance a significant share of unemployment payments or whether the concentration of unemployment among a relatively small number of individuals implies that the such account balances would typically be negative, forcing individuals to rely on government benefits with the same adverse effects that characterize the current UI system.They use data from the Panel Study on Income Dynamics. Their analysis indicates that almost all individuals would have positive UI Savings Account (UISA) balances and therefore remain sensitive to the cost of unemployment compensation. Even among individuals who experience unemployment, most would have positive account balances at the end of their unemployment spell. These findings suggest that the cost to taxpayers of forgiving the negative UISA balances is less than half of the

taxpayer cost of the current UI system.

Virtually all observers of health policy agree that the tax preference for employer-provided health insurance — under which employer contributions to employee health insurance are deductible to the employer and non-taxable to the employee — encourages overconsumption of health services in the United States. By making health spending in general, and insured health spending in particular, appear less costly, the tax preference gives employees the incentive to take compensation as health insurance rather than cash, even if they would otherwise prefer not to. Despite this, policymakers over the past 30 years have sought to level the tax playing field by expanding rather than eliminating the tax preference to include out-of-pocket spending. **Cogan, Hubbard,** and **Kessler** calculate the consequences for health spending and the federal budget of an above-the-line deduction for out-of-pocket health spending. They show how the response of spending to this expansion in the tax preference can be specified as a function of a small number of behavioral parameters that have been estimated in the existing literature. They compare their estimates to those from other researchers. And, they use their analysis to derive some implications for tax policy toward Health Savings Accounts.

Kotlikoff and **Rapson** perform a detailed analysis of taxes and saving over the life cycle. Their paper offers four main takeaways. First, thanks to the incredible complexity of the U.S. fiscal system, it's impossible for anyone to understand her incentive to work, save, or contribute to retirement accounts absent highly advanced computer technology and software. Second, the U.S. fiscal system provides most households with *very* strong reasons to limit their labor supply and saving. Third, the system offers very high-income young and middle aged households, as well as most older households, tremendous opportunities to arbitrage the tax system by contributing to retirement accounts. Fourth, the patterns by age and income of marginal net tax rates on earnings, marginal net tax rates on saving, and tax-arbitrage opportunities can be summarized in one word: bizarre.

Metcalf surveys federal tax policy on energy, focusing on programs that affect both energy supply and demand. He briefly discusses the distributional and incentive impacts of many of these incentives. In particular, he makes a rough calculation of the impact of tax incentives for domestic oil production on world oil supply and prices. He finds that the incentives for domestic production have negligible impact on world supply or prices, despite the United States being the third largest oil producing country in the world. Finally, Metcalf presents results from a model of electricity pricing to assess the impact of the federal tax incentives directed at electricity generation. He finds that nuclear power and renewable electricity sources benefit substantially from accelerated depreciation. Further, the production and investment tax credits make clean coal technologies cost-competitive with pulverized coal and wind and biomass cost-competitive with natural gas.

These papers will be published by the MIT Press as *Tax Policy and the Economy, Volume 21*. They are also available at "Books in Progress" on the NBER's website.

Mishkin Named to Fed Board

NBER Research Associate Frederic S. Mishkin was confirmed by the Senate to fill a vacant seat on the Federal Reserve Board of Governors. His term extends until January 2014.

At the Fed, Mishkin joins NBER colleagues Ben S. Bernanke, current Chairman of the Federal Reserve Board, and Randall S. Kroszner, who is a Fed governor.

Mishkin, a member of the NBER's Program of Research on Monetary Economics, is the Alfred Lerner Professor of Banking and Financial Institutions at the Graduate School of Business, Columbia University.

In addition to his teaching, research, and consulting experience, Mishkin was Executive Vice President and Director of Research at the Federal Reserve Bank of New York from 1994–7.

Twenty-seventh NBER Summer Institute Held in 2006

In the summer of 2006, the NBER held its twenty-seventh annual Summer Institute. More than 1300 economists from universities and organizations throughout the world attended. The papers presented at dozens of different sessions during the four-week Summer Institute covered a wide variety of topics. A complete agenda and many of the papers presented at the various sessions are available on the NBER's web site by clicking Summer Institute 2006 on our conference page, www.nber.org/confer.

Economic Fluctuations and Growth Research Meeting

The NBER's Economic Fluctuations and Growth Program held its annual Research Meeting on July 15 in Cambridge. Daron Acemoglu, NBER and MIT, and Anil K Kashyap, NBER and University of Chicago, organized this program:

Ricardo J. Caballero, MIT and NBER; **Emmanuel Farhi**, MIT; and **Pierre-Olivier Gourinchas**, University of California, Berkeley and NBER; "An Equilibrium Model of Global Imbalances and Low Interest Rates"
Discussant: Lars E. O. Svensson, Princeton University and NBER

Jonathan Heathcote, Georgetown University, and **Fabrizio Perri**, New York University and NBER, "The International Diversification Puzzle is Not as Bad as You Think"
Discussant: Nobuhiro Kiyotaki, London School of Economics and NBER

Raj Chetty, University of California, Berkeley and NBER; and **Adam Szeidl**, University of California, Berkeley, "Consumption Commitments and Risk Preferences"
Discussant: John C. Heaton, University of Chicago and NBER

Nick Bloom, Stanford University and NBER, " The Impact of Uncertainty Shocks: Firm Level Estimation and a 9/11 Simulation"
Discussant: Valerie A. Ramey, University of California, San Diego and NBER

Fatih Guvenen and **Burhanettin Kuruscu**, University of Texas at Austin, "Understanding Wage Inequality: Ben-Porath Meets Skill-Biased Technical Change"
Discussant: Steven J. Davis, University of Chicago and NBER

Francisco J. Buera, Northwestern University, and **Joseph P. Kaboski**, Ohio State University, "The Rise of the Service Economy"
Discussant: Robert E. Hall, Stanford University and NBER

Three of the most important recent facts in global macroeconomics — the sustained rise in the U.S. current account deficit, the stubborn decline in long-run real rates, and the rise in the share of U.S. assets in global portfolios — appear as anomalies from the perspective of conventional wisdom and models. **Caballero** and his co-authors provide a model that rationalizes these facts as an equilibrium outcome of two observed forces: 1) potential growth differentials among different regions of the world; and 2) heterogeneity in these regions' capacity to generate financial assets from real investments. In extensions of the basic model, they also generate exchange rate and FDI excess returns that are broadly consistent with the recent trends in these variables. More generally, the framework is flexible enough to shed light on a range of scenarios in a global equilibrium environment.

Heathcote and **Perri** show that a simple extension of one-good models can help to reconcile theory and data. In particular, they analytically solve for the equilibrium country portfolios in a two-country, two-goods model with non-diversifiable labor income and investment. In this set-up, consistent with the data, country portfolios contain a relatively small, but positive, share of foreign assets. International diversification is low because terms-of-trade movements provide considerable insurance against country-specific shocks and labor income risk (Cole and Obstfeld, 1991; Acemoglu and Ventura, 2002; Pavlova and Rigobon, 2003). International diversification is positive because foreign assets are crucial in sharing the financing of investment across countries. Finally, in the model a country's portfolio share of foreign assets should depend on its trade/GDP ratio and on its capital income/GDP ratio. The authors show how this relation is qualitatively and quantitatively consistent with country portfolios in the cross section of OECD countries in the 1990s.

Chetty and **Szeidl** characterize risk preferences in an expected utility model with commitments. They show that commitments affect risk preferences in two ways: 1) they amplify risk aversion with respect to moderate-stake shocks; and 2) they create a motive to take large-payoff gambles. The model thus helps to resolve two basic puzzles in expected utility theory: the discrepancy between moderate-stake and large-stake risk aversion and lottery playing by insurance buyers. The authors discuss applications of the model, such as the optimal design of social insurance and tax policies, added worker effects in labor supply, and portfolio choice. Using event studies of unemployment shocks, they document evidence consistent with the consumption adjustment patterns implied by the model.

Uncertainty appears to vary strongly over time, temporarily rising by up to 200 percent around major shocks like the Cuban Missile crisis, the assassination of JFK, and 9/11. **Bloom** offers the first structural framework for analyzing uncertainty shocks. He builds a model with a time varying second moment, which he numerically solves and estimates using

firm-level data. The parameterized model is then used to simulate a macro uncertainty shock, which produces a rapid drop and rebound in employment, investment, and productivity growth, and a moderate loss in GDP. This temporary impact of a second moment shock is different from the typically persistent impact of a first moment shock, highlighting the importance for policymakers of identifying their relative magnitudes in major shocks. The simulation of an uncertainty shock is then compared to actual 9/11 data, displaying a surprisingly good match.

Guvenen and **Kuruscu** present a tractable general equilibrium overlapping-generations model of human capital accumulation which is consistent with several features of the evolution of the U.S. wage distribution from 1970 to 2000. The key feature of the model, and the only source of heterogeneity, is that individuals differ in their ability to accumulate human capital. To highlight the working of the model, the authors abstract from all kinds of idiosyncratic uncertainty, and thus, wage inequality results only from differences in human capital accumulation. They examine the response of this model to skill-biased technical change (SBTC) both theoretically and quantitatively. First, they theoretically show that in response to SBTC, the model generates behavior consistent with the U.S. data including: a rise in total wage inequality; an initial fall in the education (skill) premium followed by a strong recovery, leading to a higher premium in the long-run; the fact that most of this fall and rise takes place among younger workers; a rise in within-group inequality; an increase in educational attainment; stagnation in median wage growth (and a slowdown in aggregate labor productivity); and a rise in consumption inequality that is much smaller than the rise in wage inequality. They then calibrate the model to the U.S. data before 1970 and find that the evolutions of these variables are quantitatively consistent with their empirical counterparts during SBTC (from 1970 on). These results suggest that the heterogeneity in the ability to accumulate human capital is an important feature for understanding the effects of SBTC and interpreting the transformation that the U.S. economy has gone through since the 1970s.

Buera and **Kaboski** present four facts and a model explaining the rise of the service economy. First, the rising share of services in output is a recent phenomenon, starting around the mid-twentieth century. Second, it reflects increases in both the relative price and relative quantity of services to commodities. Third, this rising share is entirely explained by the surge of skill-intensive services, and is contemporaneous with the increases in the relative quantity of skilled labor and the skill premium. Finally, individual services follow a distinct product cycle as an economy grows. They start being provided as market services, but are later produced at home with the purchase of manufactured intermediate inputs and durable goods. In this model, agents make decisions between the market and home provision over a continuum of wants that are satiated sequentially. The disutility of public consumption and economies of scale (in the use of specialized capital and skills) are the key elements explaining the rich dynamics of the service economy. If skilled labor has a comparative advantage in the production of newer services, the theory explains the late rise in the service economy characterized by rising relative prices and quantities of services, and growth in the relative quantity of skilled labor and the skill premium.

Japan Project Meets

The NBER together with the Center on the Japanese Economy and Business, The Center for Advanced Research in Finance, the European Institute of Japanese Studies, and the Australia-Japan Research Centre held a project meeting on the Japanese economy in Tokyo on September 15–16. The co-chairs of the meeting were: Magnus Blomstrom, NBER and Stockholm School of Economics; Jennifer Corbett, Australia-Japan Research Centre; Fumio Hayashi, NBER and the University of Tokyo; Charles Horioka, NBER and Osaka University; Anil K. Kashyap, NBER and the Graduate School of Business, University of Chicago; and David Weinstein, NBER and Columbia University. The following papers were discussed:

Mitsuru Iwamura, Waseda University; **Shigenori Shiratsuka**, Bank of Japan; and **Tsutomu Watanabe**, Hitotsubashi University, "Massive Money Injection in an Economy with Broad Liquidity Services: The Japanese Experience 2001-6"
Discussant: John B. Taylor, Stanford University and NBER

Zekeriya Eser and **Joe Peek**, University of Kentucky, "Reciprocity and Network Coordination: Evidence from Japanese Banks"
Discussant: Timo Henckel, Australian National University

Shigeo Hirano, Columbia University, "Do Individual Representatives Influence Government Transfers? Evidence from Japan"
Discussant: Henry S. Farber, Princeton University and NBER

Koji Sakai, Hitotsubashi University; **Iichiro Uesugi**, RIETI; and **Guy Yamashiro**, California State University, "Effectiveness of Credit Guarantees in the Japanese Loan Market"
Discussant: Douglas W. Diamond, University of Chicago and NBER

Hiroshi Fujiki, Bank of Japan, and **Etsuro Shioji**, Hitotsubashi University, "Bank Health Concerns, Low Interest Rates, and Money Demand: Evidence from the Public Opinion Survey on Household Financial Assets and Liabilities"
Discussant: Kazuo Ogawa, Osaka University

Gauti Eggertsson, Federal Reserve Bank of New York, "A Tale of Two Countries: Fiscal Multipliers and Policy Coordination"
Discussant: Kenneth D. West, University of Wisconsin and NBER

Arata Ito and **Tsutomu Watanabe**, Hitotsubashi University, and **Tomoyoshi Yabu**, Bank of Japan, "Fiscal Policy Switching: Evidence from Japan, US, and UK"
Discussant: Matthew D. Shapiro, University of Michigan and NBER

Keiichiro Kobayashi, RIETI; and **Masaru Inaba**, University of Tokyo, "Business Cycle Accounting for the Japanese Economy"
Discussant: Julen Esteban-Pretel, University of Tokyo

Iwamura, **Shiratsuka**, and **Watanabe** present a model with broad liquidity services to discuss the consequences of massive money injection in an economy with a zero interest rate bound. They incorporate Goodfriend's (2000) idea of broad liquidity services into the model by allowing the amounts of bonds with various maturities held by a household to enter its utility function. They show that the satiation of money (or the zero marginal utility of money) is not a necessary condition for the one-period interest rate to reach the zero lower bound; instead, they present a weaker necessary condition — that the marginal liquidity service provided by money coincides with the marginal liquidity service provided by the one-period bonds, neither of which is necessarily equal to zero. This implies that massive money injection would have some influence on an equilibrium of the economy even if it does not alter the private sector's expectations about future monetary policy. The results indicate that forward interest rates began to decline relative to the corresponding futures rates just after March 2001, when the Bank of Japan started a quantitative monetary easing policy, and that the forward and futures spread never closed until the policy ended in March 2006. The authors argue that these findings are not easy to explain in a model without broad liquidity services.

Eser and **Peek** provide the first detailed empirical evidence on the cooperative behavior of individual members of a functioning, real world network. In contrast to experimental evidence from limited settings, this study uses detailed annual data on the volume of loans given to individual firms from each individual bank that lends to them for a period spanning nearly twenty years. Using this detailed data, the authors are able to exploit substantial cross-sectional variation in the degree of reliance of the banks on the network as a whole and on other individual banks within the network. In addition, they are able to investigate the impact of economic stress on the cooperative behavior of individual network members by comparing the 1980s with the more turbulent 1990s. They find strong evidence that the strength of system-wide reliance on, and thus commitment to, the network, as well as pairwise reliance on other network members, plays an important role in explaining the observed cooperative behavior by Japanese banks.

Although the conventional wisdom is that representatives to the Japanese Diet are "pipelines" between the national trea-

sury and local constituents, with great influence over the distribution of central government transfers to and within their districts, the systematic empirical evidence that this influence exists is relatively weak. **Hirano** uses two identification strategies to estimate how much individual Lower House Liberal Democratic Party (LDP) incumbents influence the distribution of government transfers during the period 1977 to 1992: the exogenous change in representation following the mid-term deaths of Japanese representatives; and the discontinuity surrounding elections where LDP candidates win or lose by very narrow margins. Overall, the influence of politicians on central-to-locality transfers is relatively small. However, the presence of a marginal LDP incumbent leads to about a 10 percent to 30 percent increase in per capita central government transfers to the municipalities where the incumbent has substantial electoral support.

From 1998–2001, the Japanese government implemented a massive credit guarantee program that was unprecedented in both scale and scope. Using a new panel data set of Japanese firms, coauthors **Sakai**, **Uesugi**, and **Yamashiro** empirically test whether government credit programs do more to stimulate small business investment or serve to worsen adverse selection problems in credit markets. They find evidence consistent with the former. Specifically, program participants 1) significantly increase their leverage, particularly their use of long-term loans, and 2) with the exception of high-risk firms, become more efficient. Overall, these findings suggest that government interventions in credit markets can be beneficial.

Fujiki and **Shioji** use household survey data that covers the period from 2001 through 2003 to study the cash and deposits demand of households. This data enable them to obtain empirical findings that could not previously be derived through analyses using conventional macroeconomic time-series data. First, for asset demand, they find that the fluctuations in the extensive margin (the decisions on whether or not to hold a financial product) are sometimes more important than the fluctuations in the intensive margin (the decisions on the amounts of the financial product held). Second, they conduct detailed analyses on the causes of fluctuations in the cash demand of individual households. Third, thanks to qualitative questions in the dataset, they manage to distinguish between the fluctuations in asset demand attributable to low interest rates and those in response to various measures that are aimed at enhancing the safety of household savings. Fourth, they quantify the economic effects of personal financial education.

Eggertsson offers an explanation of why recovery measures — such as fiscal spending, exchange interventions, and large increases in the money supply — had a smaller effect on nominal demand in Japan in the Great Recession (1992-2005) than in the United States during the Great Depression (1930s). In both episodes the short-term nominal interest rate was close to zero. He studies these episodes in a dynamic general equilibrium model with rational expectations and suggests that the difference is attributable to the Bank of Japan's independence. In contrast, the independence of the Federal Reserve in 1933 was eliminated, and monetary and fiscal policy was coordinated in conjunction with the recovery measures. This paper makes some preliminary suggestions for an institutional mechanism that takes advantage of policy coordination in the face of deflationary pressures, while preserving the well known advantages of central bank independence under normal circumstances.

Ito and **Watanabe** estimate fiscal policy feedback rules in Japan, the United States, and the United Kingdom, allowing for stochastic regime changes. Using Markov-switching regression methods, they find that the Japanese data clearly reject the view that the fiscal policy regime is fixed; that is, the Japanese government has been adopting either Ricardian or non-Ricardian policy at all times. Instead, these results indicate that fiscal policy regimes evolve over time in a stochastic manner. This is in sharp contrast with the U.S. and U.K. results in which the government's fiscal behavior is consistently characterized by Ricardian policy.

Kobayashi and **Inaba** conduct business cycle accounting (BCA) using the method developed by Chari, Kehoe, and McGrattan (2002a) on data from the 1980s-1990s in Japan and from the interwar period in Japan and the United States. They find that labor wedges may have been a major contributor to the decade-long recession in the 1990s in Japan. Assuming exogenous variations in the share of labor, they find that the deterioration in the labor wedge started around 1990, which coincides with the onset of the recession. Then they perform an alternative BCA exercise using the capital wedge instead of the investment wedge to check for the robustness of BCA implications for financial frictions. The accounting results with the capital wedge imply that financial frictions may have had a large depressive effect during the 1930s in the United States. This implication is the opposite of that of the original BCA findings.

Fall Research Meeting on Economic Fluctuations and Growth

The NBER's Program on Economic Fluctuations and Growth met at the Federal Reserve Bank of New York on September 29. NBER Research Associates Thomas J. Sargent of New York University and Christopher A. Sims of Princeton University organized the meeting. The following papers were discussed:

Robert Kollmann, University of Paris XII, "International Portfolio Equilibrium and the Current Account"
Discussant: Fabrizio Perri, Federal Reserve Bank of Minneapolis and NBER

John H. Cochrane, University of Chicago and NBER, "Identification and Price Determination with Taylor Rules: A Critical Review"
Discussant: Eric M. Leeper, Indiana University and NBER

Stephanie Schmitt-Grohe and **Martin Uribe**, Duke University and NBER, "Optimal Inflation Stabilization in a Medium-Scale Macroeconomic Model" (NBER Working Paper No. 11854)
Discussant: Christopher Erceg, Federal Reserve Board of Governors

Benjamin Eden, Vanderbilt University, "International Seigniorage Payments"
Discussant: Chris Edmond, New York University

Florin O. Bilbiie, University of Oxford; **Fabio Ghironi**, Boston College and NBER; and **Marc J. Melitz**, Harvard University and NBER, "Endogenous Entry, Product Variety, and Business Cycles"
Discussant: Michael Woodford, Columbia University and NBER

A. Craig Burnside, Duke University and NBER; **Martin S. Eichenbaum** and **Sergio Rebelo**, Northwestern University and NBER; and **Isaac Kleshchelski**, Northwestern University, "The Returns to Currency Speculation" (NBER Working Paper No. 12489)
Discussant: Pierpaolo Benigno, New York University and NBER

Kollmann analyzes the determinants of international asset portfolios, using a neoclassical dynamic general equilibrium model with home bias in consumption. For plausible parameter values, his model explains the fact that typical investors hold most of their wealth in domestic assets (portfolio home bias). In the model, the current account balance (change in net foreign assets) is driven mainly by fluctuations in equity prices. The model predicts that the current account will be highly volatile and exhibit low serial correlation and that changes in a country's foreign equity assets and liabilities will be highly positively correlated. Kollmann then constructs current account series that include external capital gains and losses for 17 OECD economies. The behavior of the empirical series confirms his theoretical predictions.

Cochrane notes that the parameters of the Taylor rule relating interest rates to inflation and other variables are not identified in new-Keynesian models. Thus, Taylor rule regressions cannot be used to argue that the Fed conquered inflation by moving from a "passive" to an "active" policy in the early 1980s. Since there is nothing in economics to rule out explosive hyperinflations, price level determinacy requires ingredients beyond the Taylor principle, such as a non-Ricardian fiscal regime.

Schmitt-Grohe and **Uribe** characterize Ramsey-optimal monetary policy in a medium-scale macroeconomic model estimated to fit well the postwar U.S. business cycles. The authors find that mild deflation is Ramsey-optimal in the long run. However, the optimal inflation rate appears to be highly sensitive to the assumed degree of price stickiness. Within the window of available estimates of price stickiness (between 2 and 5 quarters), the optimal rate of inflation ranges from -4.2 percent per year (close to the Friedman rule) to -0.4 percent per year (close to price stability). This sensitivity disappears when one assumes that lump sum taxes are unavailable and that fiscal instruments take the form of distortionary income taxes. In that case, mild deflation emerges as a robust Ramsey prediction. Given the finding that the Ramsey-optimal inflation rate is negative, it is puzzling that most inflation-targeting countries pursue positive inflation goals. The authors show that the zero bound on the nominal interest rate, which is often cited as a rationale for setting positive inflation targets, is of no quantitative relevance in the present model. Finally, they characterize operational interest-rate feedback rules that best implement Ramsey-optimal stabilization policy. They find that the optimal interest-rate rule is active in price and wage inflation, mute in output growth, and moderately inertial. This rule achieves virtually the same level of welfare as the Ramsey-optimal policy.

What "liquidity services" do "overpriced" assets provide? What determines the choice of the international currency? How do international seigniorage payments affect the choice of monetary policies? What are the optimal inflation rates in the global economy? And, does a country gain when others use its currency? **Eden** analyzes these questions in a model in which demand uncertainty (taste shocks) and sequential trade are key. He applies the analysis to the recent policy discussion concerning the accumulation of foreign debt by the United States. He argues that the recent experience of stable demand in the United States may explain why: 1) there are sizeable excess returns of gross U.S. assets over gross U.S. liabilities, 2) the United States is "cheap"

relative to the prediction of income-price regressions; 3) most U.S. liabilities are in dollar terms; and 4) a common currency increases trade. In the steady state, the stable demand country (the United States) gets seigniorage payments from foreigners with less stable demand. But this does not mean that the United States gains from having an international currency.

Bilbiie, **Ghironi**, and **Melitz** build a framework for analyzing macroeconomic business cycles that incorporates endogenous determination of the number of producers over the business cycle. Economic expansions induce higher entry rates by prospective entrants who are subject to irreversible investment costs. The sluggish response of the number of producers (because of the sunk entry costs) generates a new and potentially important endogenous propagation mechanism for real business cycle models (which typically rely on the accumulation of physical capital by a fixed number of producers). The model performs at least as well as the traditional setup with respect to the implied second-moment properties of key macroeconomic aggregates. In addition, consistent with the data, this framework predicts a procyclical number of producers, and procyclical profits, even for preference specifications that imply countercyclical markups.

Currencies that are at a forward premium tend to depreciate. This "forward-premium puzzle" represents an egregious deviation from uncovered interest parity. **Burnside**, **Eichenbaum, Kleshchelski** and **Rebelo** document the properties of returns to currency speculation strategies that exploit this anomaly. The first strategy, known as the carry trade, is widely used by practitioners. This strategy involves selling currencies forward that are at a forward premium and buying currencies forward that are at a forward discount. The second strategy relies on a particular regression to forecast the payoff to selling currencies forward. The authors show that these strategies yield high Sharpe ratios that are not a compensation for risk. However, these Sharpe ratios do not represent unexploited profit opportunities. In the presence of microstructure frictions, spot and forward exchange rates move against traders as they increase their positions. The resulting "price pressure" drives a wedge between average and marginal Sharpe ratios. The authors argue that marginal Sharpe ratios are zero even though average Sharpe ratios are positive.

Political Economy

The NBER's Working Group on Political Economy, directed by Alberto Alesina of NBER and Harvard University, met in Cambridge on October 6. These papers were discussed:

Torsten Persson, Stockholm University and NBER, and **Guido Tabellini**, Bocconi University, "Democratic Capital: The Nexus of Political and Economic Change" (NBER Working Paper No. 12175)
Discussant: Rafael Di Tella, Harvard University

Filipe R. Campante, Harvard University, "Redistribution in a Model of Voting and Campaign Contributions"
Discussant: Alessandro S. Lizzeri, New York University

Ernesto Dal BO, University of California, Berkeley; **Pedro Dal BO**, Brown University; and **Jason Snyder**, Northwestern University, "Political Dynasties"
Discussant: Benjamin Olken, NBER

Erik Snowberg and **Eric Zitzewitz**, Stanford University, and **Justin Wolfers**, University of Pennsylvania and NBER, "Partisan Impacts on the Economy: Evidence from Prediction Markets and Close Elections" (NBER Working Paper No. 12073)
Discussant: Roberto Perotti, Bocconi University and NBER

Francesco Caselli, London School of Economics and NBER, and **Nicola Gennaioli**, Stockholm University, "Economics and Politics of Alternative Institutional Reform"
Discussant: Nicola Persico, University of Pennsylvania

Christina M. Fong, Carnegie Mellon University, and **Erzo F. P. Luttmer**, Harvard University and NBER, "Race and Giving to Hurricane Katrina Victims: Experimental Evidence"
Discussant: Eliana La Ferrara, Bocconi University

Persson and **Tabellini** study the joint dynamics of economic and political change. The predictions of the simple model that they formulate are strongly supported in a panel of data on political regimes and GDP per capita for about 150 countries over a period of 150 years. Democratic capital — measured by a nation's historical experience with democracy and by the incidence of democracy in its neighborhood — reduces the exit rate from democracy and raises the exit rate from autocracy. In democracies, a higher stock of democratic capital stimulates growth in an indirect way by decreasing the probability of a successful coup. The results suggest a virtuous circle, where the accumulation of physical and democratic capital reinforce each other, promoting economic development jointly with the consolidation of democracy.

Campante reassesses the relationship between inequality and redistribution in the context of a model in which individual political participation is endogenous and can take two distinct forms: voting and contributing to campaigns. This model, which embeds as a specific case the standard median-voter-based prediction that higher inequality leads to more redistribution, shows that the interaction between contributions and voting can explain why this prediction fails to hold: higher inequality leads to an increase in the contributions of wealthier individuals relative to those of poor individuals, and this shifts the political system in favor of the former. In equilibrium, there is a non-monotonic relationship in which redistribution is initially increasing and eventually decreasing in inequality. The model also predicts how inequality will affect political participation. Campante presents empirical evidence supporting those predictions, and hence the mechanism proposed, using data on campaign contributions and voting from U.S. presidential elections.

Dal BO, **Dal BO**, and **Snyder** study political dynasties in the U.S. Congress since its inception in 1789. They document patterns in the evolution and profile of political dynasties, study the self-perpetuation of political elites, and analyze the connection between political dynasties and political competition. They find that the percentage of dynastic legislators is decreasing over time and that dynastic legislators have been significantly more prevalent in the South, the Senate, and the Democratic party. While regional and party differences have largely disappeared over time, the difference across chambers has not. The authors document differences and similarities in the profile and political careers of dynastic politicians relative to the rest of legislators. They also find that legislators who enjoy longer tenures are significantly more likely to have relatives entering Congress later. Using instrumental variables methods, they establish that this relationship is causal: a longer period in power increases the chance that a person may start (or continue) a political dynasty. Therefore, dynastic political power is self-perpetuating in that a positive exogenous shock to a person's political power has persistent effects through posterior dynastic attainment. Finally, they find that increases in political competition are associated with fewer dynastic legislators, suggesting that dynastic politicians may be less valued by voters.

Political economists interested in discerning the effects of election outcomes on the economy have been hampered by the problem that economic outcomes also influence elections. **Snowberg**, **Wolfers,** and **Zitzewitz** sidestep these problems by analyzing movements in economic indicators caused by clearly exogenous changes in expectations about the likely winner during election day. Analyzing high frequency financial fluctuations on November 2 and 3 in 2004, they find that markets anticipated higher equity prices, interest rates, and oil prices, and a stronger dollar, under a Bush presidency than under Kerry. A similar Republican-Democrat differential was also observed for the 2000 Bush-Gore contest. Prediction market based analyses of all Presidential elections since 1880 also reveal a similar pattern of partisan impacts, suggesting that electing a Republican President raises equity valuations by 2-3 percent, and that since Reagan, Republican Presidents have tended to raise bond yields.

Caselli and **Gennaioli** compare the economic consequences and political feasibility of reforms aimed at reducing barriers to entry (deregulation) and improving contractual enforcement (legal reform). Deregulation fosters entry, thereby increasing the number of firms (entrepreneurship) and the average quality of management (meritocracy). Legal reform also reduces financial constraints on entry, but it facilitates transfers of control of incumbent firms, from untalented to talented managers. When incumbent firms are better run, entry by new firms is less profitable, so in general equilibrium a legal reform may improve meritocracy at the expense of entrepreneurship. As a result, legal reform encounters less political opposition than deregulation, as it preserves incumbents' rents, while at the same time allowing the less efficient among them to transfer control and capture (part of) the resulting efficiency gains. Using this insight, the authors show that there may be dynamic complementarities in the reform path, whereby reformers can skillfully use legal reform in the short run to create a constituency supporting future deregulations. Generally speaking, the model here suggests that "Coasian" reforms improving the scope of private contracting are likely to mobilize greater political support because — rather than undermining the rents of incumbents — they allow for an endogenous compensation of losers. Some preliminary empirical evidence supports the view that the market for control of incumbent firms plays an important role in an industry's response to legal reform.

Fong and **Luttmer** investigate individual motives for giving to the needy using a large randomized experiment. In the experiment, respondents from the general population had an opportunity to give to victims of a natural disaster — namely, Hurricane Katrina. Respondents first saw a small presentation about Katrina victims in a small city. By showing pictures with either predominantly black or predominantly white victims, the researchers manipulated respondents' perceptions of the race of the victims in that city. They then used accompanying audio information to manipulate perceptions of the income and worthiness of the victims. Respondents then decided how to split $100 between themselves and the Katrina victims. The income of the victims had a highly significant effect on giving; respondents gave more when they believed the victims to be poorer. Surprisingly, race had virtually no effect on giving, even though it had a highly significant effect on beliefs about the racial composition of the victims. Similarly, information about the worthiness of the victims affected beliefs but not giving.

Market Microstructure

The NBER's Working Group on Market Microstructure, directed by Research Associate Bruce Lehmann of University of California, San Diego, met on October 6 in Cambridge. The meeting was organized by Lehmann, Duane Seppi of Carnegie Mellon University, and Avanidhar Subrahmanyam, University of California, Los Angeles. The following papers were discussed:

Avraham Kamara, Xiaoxia Lou, and **Ronnie Sadka**, University of Washington, "The Polarization of Systematic Liquidity in the Cross-Section of Stocks"
Discussant: Jay Coughenour, University of Delaware

Darwin Choi and **Heather Tookes**, Yale University, and **Mila Getmansky**, University of Massachusetts, Amherst, "Convertible Bond Arbitrage, Liquidity Externalities and Stock Prices"
Discussant: Nicolas Bollen, Vanderbilt University

Ellyn Boukus, Yale University, and **Joshua V. Rosenberg**, Federal Reserve Bank of New York, "The Information Content of FOMC Minutes"
Discussant: Michael Fleming, Federal Reserve Bank of New York

Zhi Da, University of Notre Dame, and **Pengjie Gao,** Northwestern University, "Clientele Change, Liquidity Shock, and the Return on Financially Distressed Stocks"
Discussant: Gergana Jostova, George Washington University

Hendrik Bessembinder and **Ivalina Kalcheva**, University of Utah, "Liquidity Biases in Asset Pricing Tests"
Discussant: Gideon Saar, Cornell University

Paolo Pasquariello, University of Michigan, and **Clara Vega**, Federal Reserve Board of Governors, "Strategic Order Flow in the On-The-Run and Off-The-Run Bond Markets"
Discussant: Arvind Krishnamurthy, Northwestern University

Kamara, Lou, and **Sadka** demonstrate that the cross-sectional variation of liquidity commonality has increased over the period 1963–2005. In particular, the sensitivity of large-cap firms' liquidity to market liquidity has increased, while that of small-cap firms has declined. This increased polarization of systematic liquidity can be explained by patterns in institutional ownership over the sample period. The analysis also indicates that the ability to diversify aggregate liquidity shocks by holding large-cap stocks has declined. The evidence, therefore, suggests that the fragility of the U.S. equity market to unanticipated liquidity events has increased over the past few decades.

Choi, **Tookes**, and **Getmansky** use convertible bond issuance and equity short interest data to identify convertible bond arbitrage activity and examine its impact on stock market liquidity and prices for the period 1991 to 2005. They find considerable evidence that arbitrage-induced short selling is related to liquidity improvements in the stock. They then link total issuance and their proxy for arbitrage activity to convertible bond arbitrage, hedge fund flows, and returns data. They find that issuance is sensitive to both the supply of capital from arbitrageurs and to their measure of convertible bond arbitrage activity. The latter finding suggests an important role for arbitrageurs' use of the funds that they raise.

Boukus and **Rosenberg** analyze the information content of Federal Open Market Committee minutes from 1987–2005. They apply an objective, statistical methodology known as Latent Semantic Analysis to decompose each minutes release into its characteristic themes. They show that these themes are correlated with current and future economic conditions. Their evidence suggests that market participants can extract a complex, multifaceted signal from the minutes. In particular, Treasury yield changes around the time of the minutes release depend on the specific themes expressed, the level of monetary policy uncertainty, and the economic outlook.

Da and **Gao** provide empirical evidence supporting the view that a sharp rise in a firm's default likelihood causes a change in its shareholder clientele. As institutions decrease their holdings of the firm's share, trading volume and cost increase; the order imbalance measure indicates large selling pressure. The resulting liquidity shock leads to a further concession in the stock price, recovering in the subsequent month though. Such price recovery explains the first-month abnormally high return earned by stocks with high default likelihood that is documented in Vassalou and Xing (2004). The abnormally high return is therefore mostly a reward for providing liquidity when it is most needed, rather than compensation for bearing a systematic default risk.

Bessembinder and **Kalcheva** examine how microstructure biases arising from "bid-ask bounce" affect empirical asset pricing tests. They mainly focus on tests of whether liquidity is priced, but their analysis also provides new insights regarding tests of whether systematic risk is priced. They present theory and simulation-based evidence indicating that bid-ask spreads and endogenous trade or no-trade decisions lead to biases in observable risk and return measures that affect the reliability of asset pricing tests. Their most robust finding is that these frictions can lead to upward bias in estimates of the return premium for illiquidity. They exploit the fact that CRSP has reported closing quotes for Nasdaq National Market System stocks since 1983 to verify empirically that the estimated return premium related to the bid-ask spread is significantly larger when returns are computed from closing prices

rather than quote midpoints. They also document that, depending on research design, microstructure considerations potentially obscure the relation between average returns and betas. They discuss possible methodological corrections for these microstructure biases, and conditions under which they may be effective.

Pasquariello and **Vega** study the determinants of liquidity and price differentials between on-the-run and off-the-run U.S. Treasury bond markets. To guide their analysis, they develop a parsimonious model of multi-asset speculative trading in which endowment shocks separate the on-the-run security from an otherwise identical off-the-run security. They then explore the equilibrium implications of these shocks on both off/on-the-run price and liquidity differentials in the presence of two realistic market frictions — information heterogeneity and imperfect competition among informed traders — and a public signal. They test these implications by analyzing daily differences in market liquidity and yields for on-the-run and off-the-run three-month, six-month, and one-year U.S Treasury bills and two-year, five-year, and ten-year U.S. Treasury notes. The evidence suggests that 1) off/on-the-run bid-ask spread differentials are economically and statistically significant, even after controlling for differences in several of the bonds' intrinsic characteristics (such as duration, convexity, or repo rates); 2) their corresponding yield differentials are neither, inconsistent with the illiquidity premium hypothesis; and 3) off/on-the-run liquidity differentials are larger for bonds of shorter maturity, immediately following bond auction dates, when the uncertainty surrounding the ensuing auction allocations is high, when the dispersion of beliefs across informed traders is high, and when macroeconomic announcements are noisy, consistent with our stylized model.

Bureau Books

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

Health Care Issues in the United States and Japan

Health Care Issues in the United States and Japan, an NBER Conference Report edited by David A. Wise and Naohiro Yashiro, is available from the University of Chicago Press for $65.00. Wise directs the NBER's Program of Research on Aging and is the John F. Stambaugh Professor of Political Economy at Harvard's Kennedy School of Government. Yashiro is affiliated with the Japan Center for Economic Research and International Christian University.

Recent data show wide disparity in the effectiveness of the health care systems of Japan and the United States. Japan spends close to the lowest percentage among OECD countries of its gross domestic product on health care, the United States spends the highest percentage, and yet life expectancies in Japan are among the world's longest. Clearly, there is much to be learned from a comprehensive comparative analysis of health care issues in these two countries.

In *Health Care Issues in the United States and Japan,* contributors explore the structural characteristics of the health care systems in both nations, the economic incentives underlying the systems, and how they operate in practice. Japan's system, they show, is characterized by generous insurance schemes, a lack of gatekeepers, and fee-for-service mechanisms. The U. S. structure, on the other hand, is distinguished by for-profit hospitals, privatized health insurance, and managed care. But despite its relative success, an aging population and a general shift from infectious diseases to more chronic maladies are forcing the Japanese to consider a model more closely resembling that of the United States. In an age when rising health care costs and aging populations are motivating reforms throughout the world, this timely study will prove invaluable.

Monetary Policy with Very Low Inflation in the Pacific Rim

Monetary Policy with Very Low Inflation in the Pacific Rim, an NBER-East Asia Seminar on Economics volume edited by Takatoshi Ito and Andrew K. Rose, is available from the University of Chicago Press for $85.00.

Extremely low inflation rates have moved to the forefront of monetary policy discussions. In Asia, a number of countries — most prominently Japan, but also Taiwan and China — have actually experienced deflation over the last fifteen years. This conference volume explores the factors that have contributed to these circumstances and forecasts some of the potential challenges faced by these nations.

The editors of this volume attribute low inflation and deflation in the region to a number of recent phenomena. Some of these episodes, they argue, may be linked to rapid growth on the supply side of economies. Others are due to inadequate demand policy, sometimes resulting in a "liquidity trap." In such a trap, nominal interest rates hit a "zero-lower bound" so that conventional loosening of monetary policy is ineffective. The expectation of falling prices can encourage agents to defer costly purchases, thereby discouraging growth. The current practice of inflation-targeting may make this phenomenon possible if inflation targets are set quite low, so that a few bad shocks lead to deflation. Ito and Rose are NBER Research Associates in the Program on International Finance and Macroeconomics. Ito is also a professor of economics at the University of Tokyo. Rose is a professor of economics at The Haas School of Business, University of California, Berkeley.

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Innovation Policy and the Economy, Volume 6

Innovation Policy and the Economy, Volume 6, edited by Adam B. Jaffe, Josh Lerner, and Scott Stern, is available from the MIT Press for $25.00 for paperback and $58.00 for cloth-bound.

This annual series of conferences on innovation, sponsored by the National Bureau of Economic Research, brings the work of leading academic researchers to the broader policy community. This volume considers such topics as the diversity of patent protection and the implications of weak patents for innovation and competition; reforms in U.S. patent policy that will encourage innovation; the multifaceted benefits of the Internet for consumers, including price competition and novel forms of communication; the drug development and approval process; the "offshoring" of research and development; and the advantages of industry-specific studies of the relationship between innovation and competition. The papers highlight the role of economic theory and empirical analysis in evaluating current and prospective innovation policy alternatives.

All three editors are NBER Research Associates in the Program on Productivity. Jaffe is also the Fred C. Hecht Professor in Economics and Dean of Arts and Sciences at Brandeis University. Lerner is the Jacob H. Schiff Professor of Investment Banking at Harvard Business School, with a joint appointment in the Finance and Entrepreneurial Units. Stern is an Associate Professor of Management and Strategy at the Kellogg School of Management, Northwestern University.

NBER International Seminar on Macroeconomics 2004

The *NBER International Seminar on Macroeconomics 2004*, edited by Richard H. Clarida, Jeffrey A. Frankel, Francesco Giavazzi, and Kenneth D. West, is available from the MIT Press for $30.00 for paperback and $60.00 for cloth-bound. This annual conference volume is an international companion to the more American-focused *NBER Macroeconomics Annual.*

The individual papers in this volume examine such topics as whether rule-based monetary policy should target price levels or inflation rates; how much cyclical correlation across countries can be attributed to transmission between multinational companies and their international affiliates; the different effects of monetary policy in high-debt and low-debt countries; and the prospects for the ten 2004 entrants to the European Union, based on the experiences of EU entrants of the 1980s.

Clarida is a Research Associate in the NBER's Program on International Finance and Macroeconomics (IFM) and the C. Lowell Harriss Professor of Economics at Columbia University. Frankel directs the NBER's IFM Program and is the James W. Harpel Professor of Capital Formation and Economic Growth at the Kennedy School of Government, Harvard University. Giavazzi is an NBER Research Associate in IFM and a Professor of Economics at Bocconi University.

Tax Policy and the Economy, Volume 20

Tax Policy and the Economy, Volume 20, edited by James M. Poterba, is available from the MIT Press for $25.00 for paperback and $58.00 for cloth-bound. This NBER series on taxation and government spending includes papers that provide important background information for policy analysts in government and the private sector without making specific policy recommendations. This twentieth anniversary volume addresses issues relevant to current policy debates as well as questions that are of longer-term interest, including: the distribution of the corporate income tax burden; tax incentives for entrepreneurship; the effect of the Earned Income Tax Credit on labor supply; refund-splitting as a way to encourage saving by low-income households; the concentration of variable annuity ownership households in high tax brackets; and new evidence on the fiscal health of the federal government that takes the Medicare prescription drug benefit into account.

Poterba has been Director of the NBER's Public Economics Program since 1991 and has edited Volumes 6-20 of *Tax Policy and the Economy*. He is also the Mitsui Professor in the Department of Economics at MIT.

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