

September 2016

## INSIDE THIS ISSUE

- Do Credit Card Companies Screen for Behavioral Biases?
- The Effect of Pollution on Worker Productivity
- Did a Legal Ivory Sale Increase Smuggling and Poaching?
- Credit Controls and Monetary Policy: What U.K. History Teaches
- Means Testing Social Security: Income Versus Wealth

## Do Tax Incentives for Research Increase Firm Innovation?

Beginning in the early 1980s, business R&D spending as a share of GDP began to decline in the United Kingdom, while it was rising in most other OECD countries. Concerned about falling behind in innovation and growth, the U.K. government in 2000 launched a tax incentive program to encourage R&D. It was largely targeted at small and medium-sized enterprises (SMEs). In 2008, the government expanded this program.

### In Do Tax Incentives for Research Increase Firm Innovation?

#### An RD Design for R&D

(NBER Working Paper No. 22405), Antoine Dechezle-prêtre, Elias Einiö, Ralf Martin, Kieu-Trang Nguyen, and John Van Reenen report that the tax relief program not only spurred innovation by the firms that were its direct beneficiaries, but that it also had positive spillover effects on technologically related firms.

The researchers focused on a provision of the 2008 policy reform that changed the eligibility standards for receiving special tax treatment. The asset threshold for qualification was doubled,

so that after 2008, firms with assets as high as £86 million were redefined as SMEs for the purpose of the program.

Eligible SMEs could deduct an

---

Small and medium-sized firms in the U.K. doubled R&D spending and increased patenting by 60 percent in response to tax incentives.

---

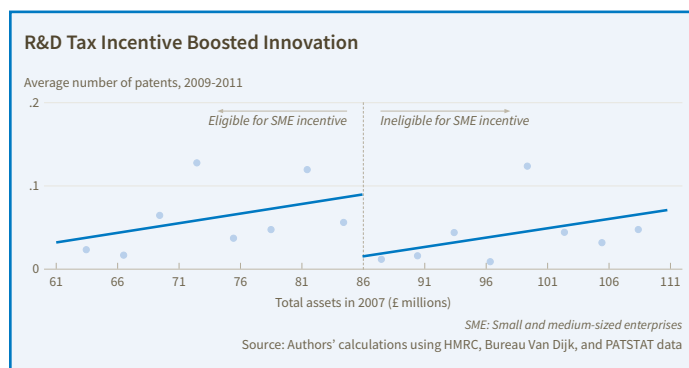
amount equal to 175 percent of their R&D expenses from their taxable income and, even if their taxable income was negative, they could still receive tax credits. By comparison, the deduction rate

of R&D spending by firms with assets just below and just above the new £86 million threshold. After 2008, companies that qualified for the special SME

tax treatment sharply increased R&D spending compared with those whose assets were too large, just above the £86 million threshold, for them to qualify. The firms that qualified doubled R&D

spending and increased patenting by 60 percent relative to those that were not eligible. The researchers found no evidence that the additional patents were of lower quality. They also estimated that R&D tax-price elasticity was 2.6, meaning that a 10 percent drop in the effective cost generated a 26

percent increase in spending. They cautioned against generalizing this figure over the entire range of companies, noting that tax subsidies tend to have greater impact on smaller firms in part because they have less access to credit.



was 130 percent for large firms, without the option of tax credits if their taxable income was negative.

The researchers examined data from 2006 through 2011, before and after the tax change, and compared the patterns

The researchers did not find evidence that firms reclassified existing activities as R&D or expanded relatively inconsequential projects. Extrapolating

from their findings, they estimated that in the absence of tax relief, aggregate business R&D spending would have been 10 percent lower in the U.K. dur-

ing the period under study. Further, they calculated that each £1 of taxpayer subsidy led to £1.7 in spending on R&D.

— Steve Maas

## Do Credit Card Companies Screen for Behavioral Biases?

There are substantial differences in the credit card offers that banks extend to different potential customers. Less-sophisticated borrowers receive offers with more back-loaded and hidden features, as well as more upfront rewards, visual distractions, and fine print at the end of the offer letter, according to [Hong Ru](#) and [Antoinette Schoar](#) in their new study, **Do Credit Card Companies Screen for Behavioral Biases?** (NBER Working Paper No. 22360). Banks also ratchet up these hidden features when their cost of funding increases, and when the credit risk of consumers is lower, which reduces the risk for the banks that customers default once they are hit with the unexpected charges. Hidden fees go up when state unemployment insurance benefits become more generous.

Lenders can only charge late fees if borrowers miss payments. Prior research on credit card use suggests that the borrowers most likely to miss payments—less-educated or “unsophisticated” consumers who are less adept at predicting their future financial needs and behavior—are the least likely to read fine print and fully understand the terms of the credit agreements they take on. These consumers are also most readily

attracted by colorful pictures and typographical gymnastics.

Drawing upon a dataset gathered by Compremedia of almost one million credit card offers mailed to U.S. households between 1999 and 2011, the researchers

---

Banks offer less-sophisticated customers cards with more back-loaded and hidden features.

---

extracted “hard” information about the offers, such as annual percentage rates (APRs), fees, and reward programs, as well as “soft” information such as use of photos, color, font size, and whether information

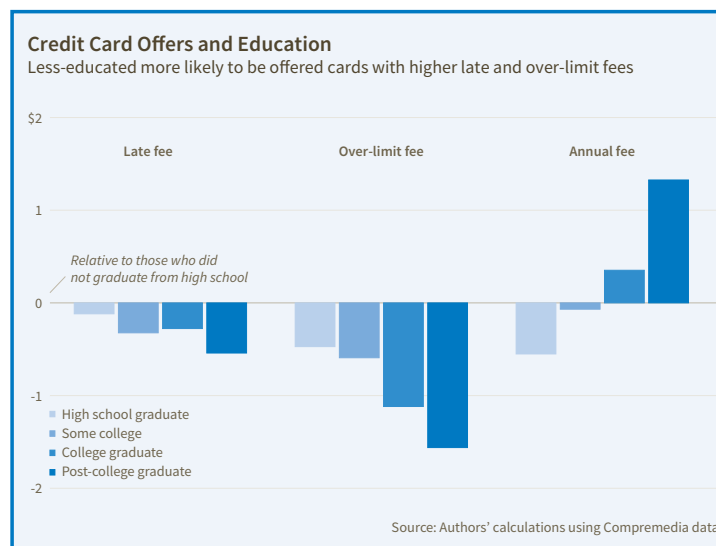
They find that less-educated households were offered higher late fees, over-limit fees, and default penalty rates, as well as more upfront inducements, such as low introductory APRs, cash back, and waivers of annual fees. In contrast,

more highly educated households were offered cards with front-loaded features such as stable regular purchasing APRs and low late fees and over-limit fees. Back-loaded characteristics tended

to be bundled together, and to be paired with rewards programs such as low introductory APRs, cash back, or points. Sophisticated customers were offered these rewards less often; instead, they tended to be offered participation in airline miles programs.

The researchers also found that when the federal funds rate (FFR)—the bank’s cost of funding—rose, the late and over-limit fees in unsophisticated

customers’ offers also rose, suggesting that banks were using these features to pass funding costs to these customers. In offers to sophisticated customers, FFR increases were associated with increases in regular



about an offer was provided at the beginning or the end of the letter. They investigate the correlations between these features of the offers and recipients’ educational attainment and income.

APRs and annual fees, and with decreases in late fees and over-limit fees.

Not surprisingly, banks appear to monitor the likelihood that unsophisticated customers will default on their debts, and to incorporate these probabilities into their card offers. The researchers found that when a state's unemployment insurance benefits increased, providing borrowers with smoother cash flow in the

event of job loss, banks issued potential borrowers within that state more offers with reward programs, late fees, and default penalties, and that they increased the number of colors in offer letters and moved the back-loaded features to the end of the letter. "Taken together, these results suggest that credit card companies realize that there is an inherent trade-off in the use of back-loaded features in credit

card offers: They might induce customers to take on more (expensive) credit, but at the same time, they expose the lender to greater risk if those consumers do not anticipate the true cost of credit." In other words, card companies seem to weigh the amount of fees they can extract from less-sophisticated borrowers without increasing their likelihood of default.

— Deborah Kreuze

## The Effect of Pollution on Worker Productivity

Even in a job where employees' only physical exertion involves answering the phone, air pollution takes its toll on productivity.

That is the finding of **The Effect of Pollution on Worker Productivity: Evidence from Call-Center Workers in China** (NBER Working Paper No. 22328) by Tom Chang, Joshua Graff Zivin, Tal Gross, and Matthew Neidell.

While previous studies have shown that pollution affects productivity in physically arduous jobs, the new research gauges its effects on workers whose tasks are primarily cognitive.

Ctrip, China's largest travel agency, provided data on the daily productivity of 5,000 workers at its call centers in Shanghai and Nantong, which was measured against the government-reported daily air pollution index (API) for each city.

The primary pollutant in both cities is particulate matter, largely the result of fossil fuel combustion. The smallest of these particles are so fine that they can penetrate indoors and be absorbed into the blood-

stream, potentially affecting brain function. Particulate exposure also irritates the ears, nose, throat, and lungs, and causes mild headaches, which might similarly impede

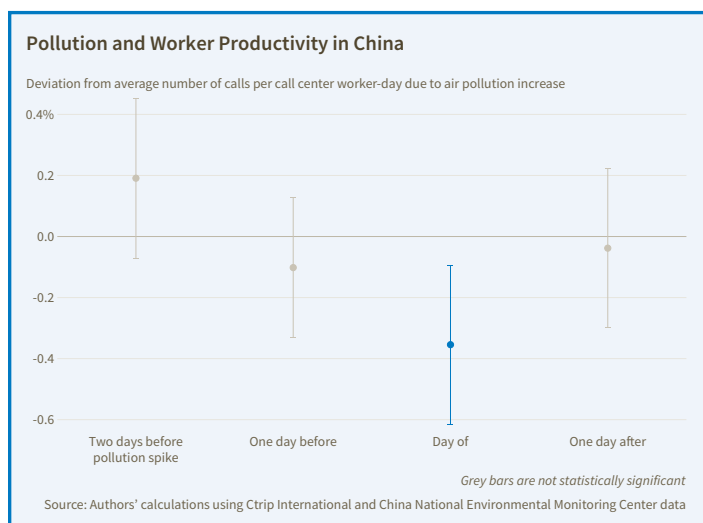
Among call center workers in two Chinese cities, each 10-unit increase in the pollution index reduced worker productivity — measured by number of calls handled — by 0.35 percent.

work performance. For particularly sensitive individuals, symptoms occur when the index rises above 100. Symptoms become more widespread when the index exceeds

The study of Chinese workers found that for each 10-unit increase in the pollution index, worker productivity, measured by number of calls handled, declined by

0.35 percent. The average duration of individual calls was not affected by pollution levels, but the time workers spent on break increased. Poor air quality impeded the performance of otherwise highly productive employees as much as it did that of less productive workers.

One concern the researchers had was that traffic — a major contributor to pollution — would distort the results of their study. A nightmare commute could reduce productivity by raising employee stress and causing late arrivals to work. However, the company was piloting a work-at-home program for 150 employees during part of the study period, and their performance was similarly affected by pollution.



150. To place this pollution level in perspective, in 2014, the API exceeded 150 on 13 days in Los Angeles and 33 days in Phoenix.

The researchers illustrate the magnitude of their findings by assuming that the same relationship that they estimate in China would apply to workers in Los Angeles County. They estimate that on the 90 days in 2014 when particulate pollution levels exceeded federal standards, productivity in the service sector was

reduced by \$374 million relative to what it would have been if the pollution levels had just met the federal standards.

“Given the size of the service and knowledge sectors in the developed world, even very small impacts from pollution could aggregate to rather substantial economic damages,” the researchers

conclude. “If our measured productivity impacts are the result of diminished cognitive function, the negative impacts of pollution may well be larger for high-skilled occupations that form the backbone of the service and information economy.”

— Steve Maas

## Did a Legal Ivory Sale Increase Smuggling and Poaching?

Advocates of legalizing the purchase of goods sold in black markets argue that allowing legal trade will displace illegal buying and selling, reduce criminal activity, and permit greater control of the previously illegal goods. New research indicates that this is not always the case.

In **Does Legalization Reduce Black Market Activity? Evidence from a Global Ivory Experiment and Elephant Poaching Data** (NBER Working Paper No. 22314), [Solomon Hsiang](#) and [Nitin Sekar](#) show that the production of black market elephant ivory expanded by an estimated 66 percent following a one-time legal sale in 2008. Seizures of contraband ivory leaving African countries also increased, from 4.8 to 8.4 seizures per country per year. The weight of ivory in the seizures increased by an average of 335 kilograms per year.

In 1989, the Convention on the International Trade of Endangered Species (CITES) banned international trade in ivory in order to protect the wild African elephant. Individual countries continued to regulate their domestic ivory trade. Poaching slowed, and elephant populations began to recover. African governments kept stockpiles of ivory harvested from animals

that died naturally.

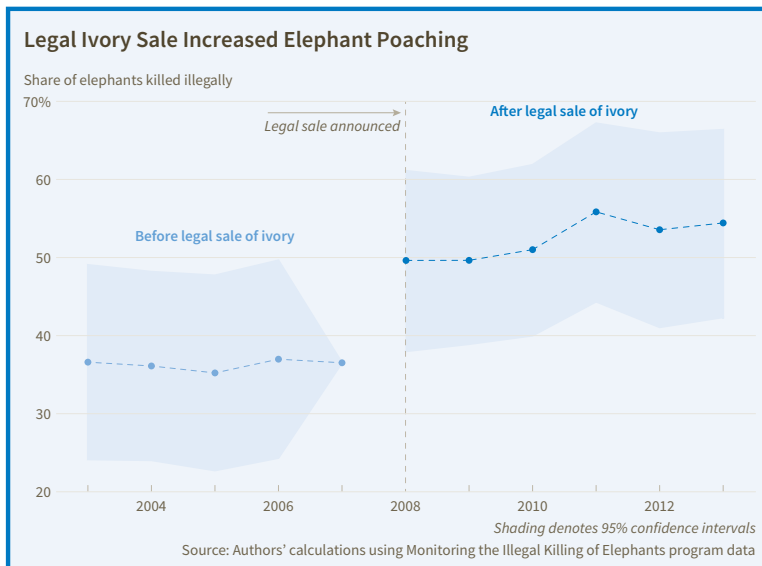
Poaching began increasing again in the mid-1990s. Following a single legal sale from stockpiles to Japan in 1999, China and Japan requested the right to make an additional

of Elephants (MIKE) program at 79 sites in 40 countries in Africa and Asia. Preliminary data collection began in mid-2002. The Proportion of Illegally Killed Elephants (PIKE) Index is the fraction of “detected

After the experimental 2008 sale, there was a discontinuous jump in the proportion of wild elephants poached and in seizures of contraband ivory leaving Africa.

purchase. After years of debate, the governments of those countries were able to purchase 62 and 45 tons of legal ivory, respec-

elephant carcasses that were illegally killed,” a measure designed to correct for fluctuating elephant populations and field worker effort.



The researchers examine how poachers responded to the 2008 sale by studying annual PIKE data from 2003 to 2013. They find a clear discontinuous increase in the index after the 2008 sale. They cannot explain this increase with changes in natural elephant mortality rates, or with economic variables such as China's or Japan's per capita GDP, Chinese or Japanese trade with elephant range countries, mea-

surements of China's physical presence in range countries, or per capita GDP in PIKE-reporting countries.

tures of China's physical presence in range countries, or per capita GDP in PIKE-reporting countries.

The researchers conclude that the legal sale of ivory “triggered an increase in black mar-

ket activity.”

ket ivory production by increasing consumer demand and/or reducing the cost of supplying black market ivory.” Supplier costs may be

reduced if legalization of a product makes it more difficult to detect and monitor illegal provision of that product. Consumer demand may

rise because legalization may reduce the stigma around a previously banned product.

—Linda Gorman

## Credit Controls and Monetary Policy: What U.K. History Teaches

If post-war British history is a guide, credit controls are less effective than traditional monetary policy in controlling inflation, but they are better suited to influencing bank lending and other variables emerging as financial stability objectives. That’s the conclusion of **Monetary Versus Macroprudential Policies: Causal Impacts of Interest Rates and Credit Controls in the Era of the U.K. Radcliffe Report** (NBER Working Paper No. 22380), a study which analyzes the Bank of England’s experiments with credit controls from the early 1950s to the early 1980s. This period, which the researchers dub the Radcliffe era after Lord Cyril Radcliffe, who chaired the committee whose 1959 recommendations the central bank followed, is relevant today because many central banks are using or weighing the use of such tools.

“If a similar set of macroprudential tools were to operate as it did in the Radcliffe era, it might fairly be said that ‘it does exactly what it says on the tin,’” write [David Aikman](#), [Oliver Bush](#), and [Alan](#)

[M. Taylor](#). Such tools “would more strongly modulate credit creation, and yet would have weaker output and inflation impacts than conventional monetary policy.”

There is very little scholarly analysis of credit controls during the Radcliffe era, in contrast to the volumes of research devoted to monetary policy. The researchers used archival data to create a new dataset on credit controls

during this period, and made every effort to avoid problems of reverse causality.

They find that monetary and credit policies had distinct effects. In the 1950s, British officials distrusted the efficacy of monetary

---

In the United Kingdom between the 1950s and 1980s, macroprudential tools modulated credit creation but were less reliable than conventional monetary policy for controlling inflation.

---

policy. This view was reflected in the Radcliffe Report, which argued that because other financial assets could easily substitute for money, interest rate changes associated with traditional

had a more reliable impact than credit controls on consumer prices. Credit controls, in contrast, had the more significant effect on bank lending.

Both monetary policy and credit controls had important effects on macroeconomic activ-

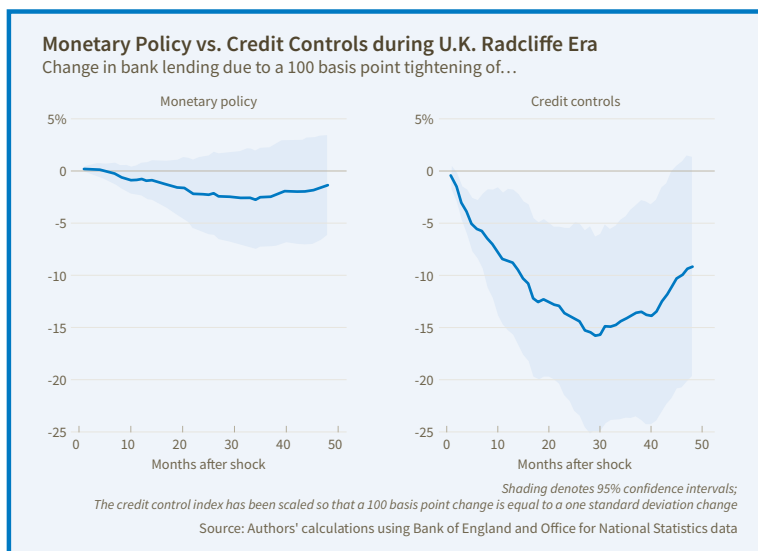
ity during the 1960s and 1970s. The authors estimate that a one percentage point rise in the policy rate resulted in a decline in manufacturing output of 2 percent after two years.

Consumer prices were slower to react, staying level for 20 months, then falling by about 3 percent after four years. The trade balance improved by about 0.75 percent after two years. Bank lending, however, did not respond significantly to monetary policy changes.

By contrast, a one standard deviation tightening of credit controls reduced bank lending by around 10 percent after two years and reduced the overall credit-to-GDP ratio. Contractionary monetary

policy had the reverse effect, leading the credit-to-GDP ratio to rise as GDP fell more than credit did. This tightening of credit controls was associated with a decline in manufacturing output of around 2 percent after two years. The researchers conclude that credit controls had “strong, predictable, and intuitive effects on lending.”

—Laurent Belsie



monetary policy would have limited impact. Officials preferred to complement changes in the policy rate with credit controls, such as credit ceilings, limits on installment loans, and reserve requirements, policies that are not unlike today’s macroprudential policy tools.

The researchers’ retrospective analysis of the impact of both monetary policy and credit controls yields mixed findings. Monetary policy



## Means Testing Social Security: Income Versus Wealth

In 2015, the annual cost of Social Security retirement benefits equaled 14.1 percent of workers' taxable income. By 2038, it is projected that the cost will amount to 16.6 percent. Future Social Security tax revenues are projected to fall short of future benefit commitments.

The prospect of large, unpopular, tax increases or large, unpopular, benefit cuts has focused attention on using "means testing" to reduce Social Security payments for beneficiaries who are relatively well-off. Means testing can, however, be implemented in various ways, and as Alan Gustman, Thomas Steinmeier, and Nahid Tabatabai demonstrate in **Distributional Effects of Means Testing Social Security: Income Versus Wealth** (NBER Working Paper No. 22424), different approaches affect benefits for different households in different ways. The distributional consequences of means testing are sensitive to the way the means test is designed.

Means tests reduce payments for those with wealth or income above certain levels. To show how different means tests affect different people, the researchers construct a test designed to reduce the average Social Security benefits of those in the upper quarter of the wealth distribution by \$5,000 a year. They also construct a test that reduces the benefits of those in the upper quarter of the income dis-

tribution by the same average amount.

The authors use the Health and Retirement Study sample of individuals aged 69 to 79 to assess the effects of the different tests. Of the sample, 35.4 percent was in either

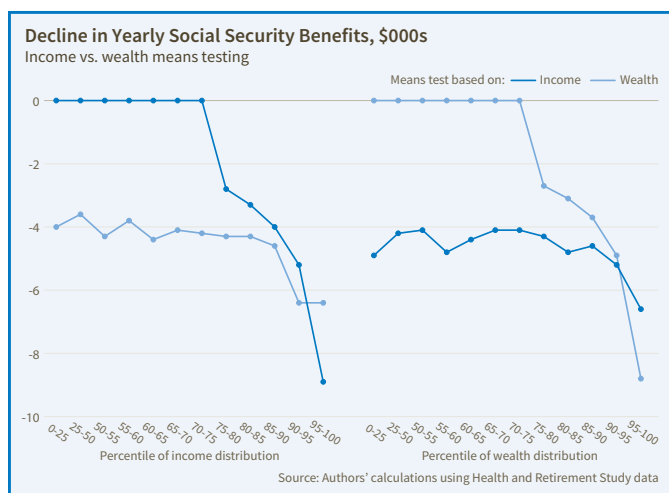
A host of factors, from the choice of income- or wealth-testing to how to treat single versus married households, makes the effect of "means testing" sensitive to details of implementation.

the top quarter of the income distribution or the top quarter of the wealth distribution, but only 14.5 percent of the sample was in the top quarter of both distributions. Thus if the means test was applied to those in the top

quarter of the income distribution the average benefit reduction for those in the top quartile of the wealth distribution would be similar if the means test applied to wealth. Among the 14.5 percent of the individuals who are in both the top income and the top wealth quartiles, the average benefit reduction would be \$8,600 if the test was applied to wealth.

The distributional consequences of means tests change if the unit of measurement changes from an individual to a household. They change if married households and single households are considered separately. They depend upon whether a means test's measures of income and wealth are calculated before or after taxes. Means testing at program entry would reduce benefits more for younger retirees than older ones simply because younger people have not lived on their retirement resources for as many years.

—Linda Gorman



wealth quartile, someone who believed that income in the top quartile was a better basis for means testing would find that only 41 percent of those whose benefits were reduced were part of their target group ( $14.5/35.4 = 0.41$ ).

The average Social Security benefit

### NBER

The National Bureau of Economic Research is a private nonprofit research organization founded in 1920 and devoted to objective quantitative analysis of the American economy. Its officers are:

James M. Poterba—President & Chief Executive Officer  
Martin B. Zimmerman—Chairman  
Karen N. Horn—Vice Chairman

The NBER Digest summarizes selected Working Papers recently produced as part of the Bureau's program of research. Working Papers are intended to make preliminary research results available to economists in the hope of encouraging discussion and suggestions for revision. The Digest is issued for similar informational purposes and to stimulate discussion of Working Papers before their final publication. Neither the Working Papers nor the Digest has been reviewed by the Board of Directors of the NBER.

The Digest is not copyrighted and may be reproduced freely with appropriate attribution of source. Please provide the NBER's Public Information Department with copies of anything reproduced.

Individual copies of the NBER Working Papers summarized here (and others) are available free of charge to Corporate Associates and to the affiliates of other organizations, such as universities and colleges, with subscriptions. For all others, there is a charge of \$5.00 per downloaded paper or \$10.00 per hard copy paper. Outside of the United States, add \$10.00 per order for postage and handling. Advance payment is required on all orders. To order, call the Publications Department at (617) 868-3900 or visit [www.nber.org/papers](http://www.nber.org/papers). Please have the Working Paper Number(s) ready.

Subscriptions to the full NBER Working Paper series include all 1000 or more papers issued each year. Subscriptions are free to Corporate

Associates. For others within the United States, the standard rate for a full subscription is \$9350; for academic libraries and faculty members, \$7480. Higher rates apply for foreign orders. The on-line standard rate for a full subscription is \$2250 and the on-line academic rate is \$1040.

Partial Working Paper subscriptions, delineated by program, are also available. For further information, see our Web site, or please write: National Bureau of Economic Research, 1050 Massachusetts Avenue, Cambridge, MA 02138-5398.

Requests for Digest subscriptions, changes of address, and cancellations should be sent to Digest, NBER, 1050 Massachusetts Avenue, Cambridge, MA 02138-5398 (please include the current mailing label), or by sending email to [subs@nber.org](mailto:subs@nber.org). Print copies of the Digest are only mailed to subscribers in the U.S. and Canada; those in other nations may request electronic subscriptions at [www.nber.org/digestsubscribe/](http://www.nber.org/digestsubscribe/).