In a recent conversation with an economics alumnus I was asked how the economics curriculum today differed from what was taught 20-30 years ago. My first reaction was that the economics classroom, at least at the introductory and intermediate undergraduate level, would not be so different. The talk-and-chalk lectures of the past have, in some cases, given way to the point-and-click of computer generated slides, but at least in our introductory and intermediate courses one would still see some of the same graphs of price and quantity or indifference curves and budget constraints—though the axes may be labeled “i-phone” and “laptop” rather than “pen” and “pencil”. Of course, at the advanced undergraduate level the courses have changed more. The best of these courses are linked closely to the primary research interests of the faculty in question and as such are more influenced by the most active areas of scholarship within economics today. But perhaps the most striking difference in many of these courses would be the extent to which the lectures and problem sets incorporate empirical methods. Our students are not just learning statistical theory but are gaining hands on experience with the process of confronting theoretical ideas with quantitative data.

Fortunately the students seem to recognize the importance of having solid econometric training. Last year we enrolled a record 360 students in our intermediate econometrics courses, which translates on an annualized basis to almost 1 in 4 Brown undergrads. In the Spring we even had to cap the course in terms of the enrollments at 250. The course includes a lab session in which students work individually on computers in a classroom and we were up against a capacity constraint in terms of scheduling classroom space with the requisite number of computers. For a course that has a reputation as being relatively dry and formula-based—(Brown’s Critical Review warns “the material could be a little dull and more interesting material might be found elsewhere”)—this is a terrific testament both to the quality of the teaching and to the students’ appreciation of the importance of quantitative methods. But it helps that econometrics is now a prerequisite for a number of our popular substantively focused upper level courses. Among the top-rated courses that require a background in econometrics or statistics are Health Economics, Labor Economics, the Economic Analysis of Institutions, Corporate Finance, and Game Theory and its Applications. There are also a couple of new courses with strong empirical content. A new financial data center

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that, for the first time, gives Brown students access to key financial databases was used this fall as a basis for a new course taught by Ivo Welch using empirical methods to examine theories of stock market performance. A new course focused on econometric methods relevant to the analysis of macroeconomic processes will be introduced this year by Sophocles Mavroeidis. This importance of empirical methods at the undergraduate level is mirrored by developments in the graduate curriculum. For the last two years we have included in the first-year curriculum a course in Applied Economic Analysis that I am co-teaching with Nancy Qian. The premise of this course is that a basic understanding of the relationship between theory and empirical analysis is a critical component of a graduate education in economics, even for those who will primarily work in economic or econometric theory. An unanticipated by-product of this course is that first-year students are better prepared to work as research assistants on faculty projects in the summer after their first year. Last Fall Ken Chay, who we recruited last year from Berkeley, taught a new course focused on econometric methods used in the field of labor economics that attracted the vast majority of the second years and a substantial number of third and fourth year students as well. Empirical work is well-represented in terms of our graduate theses as well—all 13 of the students on the market this year incorporated some level of empirical analysis into their theses, though most of these had strong theoretical content also. Indeed, this careful integration of theory and empirical work is thought by many of the faculty to be an important distinguishing feature of Brown PhDs. As my colleague Glenn Loury wrote in a recent email, “Taking smart models to data on questions that matter’ is a phrase that might well capture [the] spirit” of the economics department at Brown. In any case, in my view, successfully implementing this vision requires that econometrics and theory be viewed not just as inputs into good empirical work but as intellectual communities in their own right. Although we hired two terrific young theorists in 2006-07, our graduate econometrics group was feeling somewhat depleted last year due to the retirement of Professor Lancaster (who remains active in the econometrics workshop) and the fact that our searches in the last couple of years in this area had come up empty. Fortunately, this year we were successful in hiring two junior econometricians, one at the untenured Associate level and one at the Assistant Professor level. I hope you will take the time to read about these two (Stefan Hoderlein and Blaise Melly) elsewhere in the newsletter.

It has been a very good year for the department more generally. We did exceptionally well on the PhD market with our students ultimately being placed at a number of very good schools including the University of Chicago and the University of Virginia. We hosted four conferences that brought leading economists to campus: a conference in international economics financed by the newly endowed Rhodes Center on International Economics and hosted by Ross Levine; the semiannual BREAD (Bureau for Research and Economic Analysis of Development) conference that I organized along with Kaivan Munshi, Kfir Eliaz and Mark Pitt; Kfir Eliaz organized a symposium on the fascinating subject of neuroeconomics (in which brain scanning technology such as MRIs are used to help interpret economic decision making) that attracted colleagues from Brown’s program in Brain Science; and a mini-conference organized by Geoffrey DeClippel focused on microeconomic theory. Several high-profile visitors to these conferences were so impressed with what they found at Brown that they suggested that they might be interested in being considered for a position. Two of our faculty, Rachel Friedberg and Anna Aizer, won university-wide awards for their contributions to undergraduate education. The work of several faculty including Oded Galor, Glenn Loury, Ross Levine, and Brian Knight, was noted in the national media. For details do have a look at our “What’s new” site at http://www.brown.edu/Departments/Economics/new.html.

As always, I hope you enjoy this edition of the newsletter and I look forward to your comments and responses by email at econchair@brown.edu.

Andrew Foster, Professor and Chair
NEW FACULTY MEMBERS

BLAISE MELLY

Blaise Melly, Assistant Professor, received his Ph.D. in Economics from the University of St. Gallen, in 2006. He comes to us after having visited the Department of Economics at MIT. His areas of research are micro-econometrics and applied labor economics. He is especially interested in distributional treatment effects and wage inequality. He will teach econometrics at the undergraduate and graduate levels.

THE CHARM OF VARIETY

The classical task of an applied economist is to evaluate the effects of a treatment variable on an outcome of interest. Examples include the effects of government programs and policies, such as those that subsidize training for disadvantaged workers, and the effects of individual choices like college attendance. Continuous outcomes of interest may be wages, prices, test scores, etc.

Most of the literature estimating treatment effects has focused on identification and estimation of average treatment effects. The hegemony of the average has several reasons: it summarizes the effects with a single number; the interpretation is intuitive and simple; the implementation of the estimators is straightforward and typically fast. On the other hand, this necessarily limits the richness of the results and does not allow analyzing the effects of the treatment on inequality, poverty or any other features of the distribution. Exactly for this reason, Sir Francis Galton wrote that the souls of econometricians concerned only with averages “seem as dull to the charm of variety as that of the native of one of our flat English counties, whose retrospect of Switzerland was that, if its mountains could be thrown into its lakes, two nuisances would be got rid of at once.”

In order to complement the existing arsenal of methods, Blaise Melly, among others, has developed procedures to analyze the effects of treatments on the distribution of outcomes. While the average effect is by definition a single number, there are virtually an infinite number of ways to present distributional effects. A natural and intuitive one consists in presenting all (or selected) quantile treatment effects, i.e. the differences between the same quantile (e.g. the median, the 2nd decile or the 39th percentile) of the treated and control outcome distribution for the same population.

The fundamental problem is that only one of the potential outcomes is observed. For instance, if a person attended a training program, we cannot observe the wage he would have received in the absence of the program. We therefore cannot avoid making assumptions to identify counterfactual distributions such as the wage distribution we would observe if the treated population had not been treated (and vice-versa). The first possible strategy to identify counterfactual distributions is to assume selection on observables. This implies that there is no selection bias once we compare individuals with the same characteristics or population with the same covariates distribution.

In Melly (2006) and Chernozhukov, Fernandez-Val and Melly (2008) methods using this kind of identification strategy are proposed. The distribution of the outcome conditional on the control variables is estimated. In a second step, this conditional distribution is integrated over the counterfactual covariates distribution to obtain the counterfactual outcome distribution. As an illustration, they estimate the wage distribution that would have been observed in 1988 if the real value of the minimum wage had been as high in 1988 as in 1979. As their results show, the decrease in the real value of the minimum wage during the 1980s can completely explain the increase in wage inequality below the median. Once they correct for this unique event, the picture changes from “the rich are getting richer and the poor are getting poorer” to “the middle class is getting poorer”.

The assumption that selection into the treatment is not related to unobservables is not credible in many applications where the treatment is self selected. For instance, it is difficult to assume that the decision to attend college may not be related to the potential wage gain from college attendance. In this case, we need to have another source of exogenous variation in order to identify the effects of the treatment. In the return to college

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example, we may assume that the proximity of a college increases the probability of attending college but is not related to potential wages.

The estimation problem is more complex in this endogenous case because we cannot use all the variation in the value of the treatment (college attendance) but only the part due to the variation in the value of the instrument (college proximity). Froelich and Melly (2007) propose instrumental variable estimators for quantile treatment effects. They show that their estimators have good statistical properties, in particular that they are asymptotically efficient. The proposed estimators – both under exogeneity and endogeneity - are simple to implement and, moreover, convenient computer codes are provided by the authors to simplify their applications.

Literature cited

SRINKETH NAGAVARAPU
Newly arrived Assistant Professor
Sriniketh Nagavarapu graduated from Stanford University with a B.A. in Economics in 2002. While in college, his research focused on policies assisting low-income families in the United States. He stayed on at Stanford to pursue his Ph.D. in Economics, which he will complete in the summer of 2008. Over the past years, he has focused on the fields of development and labor economics. In particular, he is interested in two areas of research, especially in the context of developing countries: first, the interplay between the labor economic decisions of households and their surrounding environment; second, the implementation and targeting of government labor regulations and anti-poverty programs. Given the first interest, Nagavarapu's joint appointment in Brown's Center for Environmental Studies provides a valuable opportunity to inform his economic work with an inter-disciplinary approach.

Nagavarapu's dissertation examines the impact of expanding ethanol production in Brazil on deforestation and regional inequality. Brazil uses sugarcane to produce ethanol more efficiently than other countries. In view of this, the Brazilian government has pushed the United States and Europe to open their countries to the importation of Brazil's ethanol. But the consequences within Brazil of expanding export opportunities are uncertain. For some, concern centers on the potential for expanding sugarcane production to cause greater deforestation, either directly or indirectly. Environmentally sensitive areas could be trammeled by sugarcane producers. More likely, soy farmers or cattle ranchers who cannot compete with sugarcane producers to secure existing agricultural land could move into current forest land. Another concern may involve regional development. The poor Northeast region of Brazil is historically a key sugarcane producer and relatively dependent on agriculture, as compared to the rest of the country. A natural question is how much of the gains from expanding sugarcane production can be expected to accrue to this region, as opposed to other, wealthier regions that are also important sugarcane producers.

Examining trends in land allocations over the last two decades provides reason for worry on both counts. Nagavarapu finds that the land area devoted to harvesting sugarcane has shown steady growth in the Center-West region of the country, a region including portions of the Amazon Rainforest. Over the same period, sugarcane land area has remained stable in the poor Northeast, while increasing steadily in Sao Paulo, the country's wealthiest state and largest contributor to sugarcane production. Of course, these facts alone do not provide a mode of predicting the consequences of an ethanol boom for the various regions of Brazil. The patterns in land allocation are the result of economic
decisions on the part of farmers and workers, decisions that together help determine prices, wages, and production. Simply extrapolating trends in equilibrium land allocations, wages, etc. could overlook the effects of these simultaneous economic choices and thereby produce misleading predictions.

Therefore, in order to address the issues of deforestation and regional inequality, Nagavarapu develops an empirical model of regional agricultural markets, allowing for decisions about land use, labor demand, migration, and sector and hours of work. He estimates the model using a combination of government-collected household survey data and aggregate data on land use and production over time. This provides a simulation framework with which one can make predictions of how land use and workers’ livelihoods will be affected by greater ethanol exports. Preliminary results suggest that much of the sugarcane expansion to support increased ethanol production would take place in Sao Paulo and the Northeast. While expected wages change similarly in all regions, within-region inequality appears to increase somewhat, as the wage gains enjoyed by sugarcane workers have only limited spillovers to other agricultural workers.

An example of Nagavarapu’s other area of interest is work on schooling in Argentina. The sharp devaluation of the Argentine peso in early 2002, punctuating an ongoing slowing of the economy, threw many households into crisis. In research currently in progress, Nagavarapu examines how the crisis affected secondary schooling decisions by these households. In particular, he is interested in understanding how – and why – enrollment decisions varied by age. Examination of the raw data suggests that the crisis did not affect enrollment rates on average; however, younger students in low- and middle-income households did seem to increase their dropout rates. His motivation in pursuing this fact further is that governments may wish to direct resources to poorer households in times of crisis to keep children in school, and the efficiency of such programs could be enhanced by a better understanding of which children are most at-risk of leaving school.

In Hoderlein’s previous research, the specific setting was classical consumer demand theory. The question with which he was particularly concerned was the following: How do the assumptions typically invoked in applied work impact the result, and how far can those assumptions be relaxed? He shows that the assumptions can in fact severely bias the results, and that economic theory may be tested using standard cross section data without assuming that all of the population is of the same type. Indeed, almost arbitrarily many and arbitrarily complex types are admissible, and economic theory may still be testable, as he shows by considering core economic concepts. Hoderlein is also working on tools with which questions like these can be answered, in particular so-called non-separable models which do not restrict the way heterogeneity enters.

Much of Hoderlein’s work is motivated by the recognition that economic applications with real world data are an integral part of any econometric analysis, while making econometric models more compatible with economic theory is a strong theme running through his research. For instance, in another very general class of econometric models which are plagued by the so called “curse of dimensionality” (meaning that the precision of any estimator of a relationship between variables decreases dramatically with the number of dimensions involved), he has suggested a structure that overcomes the “curse” while being more compatible with economic theory. This makes these models more applicable, a major concern for Hoderlein.
The Sarbanes-Oxley Act (SOX) was passed in 2002 after several high-profile accounting scandals (Enron, WorldCom). The law’s main goal was to improve the quality of financial reporting and to increase investor confidence. The Securities and Exchange Commission (SEC) was put in charge of enforcing the law. In 2003, SEC implemented Section 404 of SOX, which requires companies to put in place and periodically test procedures that monitor internal controls for financial reporting. This section requires that an outside auditor attests to management’s assessment of the company controls. According to the SEC, Section 404 procedures are intended to help companies detect fraudulent reporting early and deter financial fraud. Recently, Section 404 and its practical application have been under intense attack from business groups and lawmakers. While the SEC chairman Christopher Cox has repeatedly voiced his determination to impose Section 404 compliance on all public firms, Congress has put pressure on the SEC to delay small firms compliance.

The central question is whether the costs of the new regulation are excessive. Did the Act really improve the quality of financial reporting? And ultimately, did it increase or decrease the market valuation of firms? However, because SOX was passed during a period of unusual scrutiny of corporate governance practices and around the demise of Arthur Anderson, existing studies could not compare SOX’s effects to the counterfactual: how firms, corporate governance, and auditors would have changed in the absence of SOX. To cite The Economist, “An army of academics has weighed in on the great SOX debate. But their analyses are hindered by two difficulties. First, SOX was one of a number of post-Enron initiatives, ranging from tougher listing requirements for firms to longer jail sentences for errant executives. Untangling the effects of SOX from these other changes is hard. Nor is it easy to work out how investors and businessmen—who were trying to come to terms with the bursting of the late 1990s stockmarket bubble—might have reacted to the corporate scandals without SOX.” (July 28, 2007)

Ideally, to study SOX’s effect, one would like to have an exogenous experiment in which firms were randomly assigned to comply with the new rules. This would have allowed us to compare the treated and non-treated firms’ outcomes and to attribute any differences uniquely to the effect of the regulation.

Remarkably, for at least one set of firms, something very close to such an experiment exists. The majority of US companies had to comply with the new rule in 2004. However, companies in which small outside investors held less than $75 million in equity received a “stay of execution.”

In my work, I compare the companies that were just above the rule cutoff and had to comply with the rule to companies that were just below the cutoff and did not have to comply. This is a good quasi-natural experiment because the exact cutoff is not related to firm fundamentals. The big advantage of this approach is that it can isolate the effects of SOX Section 404 compliance from the effects of the changing business climate (and any contemporaneous events) that would have affected all firms. The cost of this approach is that it can look at small firms only. However, small firms are interesting in themselves. First, there are of course more small firms than large firms. Second, small firms pay disproportionately high costs because of the fixed cost nature of compliance. Third, small firms are likely to suffer more from asymmetric information and low reporting quality. Therefore, they could also benefit most from the new regulation.

The empirical results are strong and difficult to explain except in the context of SOX. There was a large increase in the audit fees paid by firms that complied with Section 404, compared to the firms that did not comply (from $370,700 to $882,300). For small firms with market size of around $130 million, a $0.5 to $1.0 million annual increase in the cost of audit compliance is not trivial. Moreover, firms that complied with the law became more conservative in their earnings reports. The average decrease in reported earnings was about $8.3 million. Finally, news of delays in the law application was considered as positive news from the market, implying that investors put a negative overall valuation on the new regulation.

Peter Iliev completed his doctoral thesis in April 2008 with principal advisor Professor Ivo Welch. In the Fall, he will be Assistant Professor of Finance, Smeal College of Business, Pennsylvania State University.
INEQUITIES IN INCOME AND IN HEALTH: EVIDENCE FROM THE UNITED STATES

by Alexey Levkov*, May 2008

The significant rise in disparities in the economic fortunes of American families over the last several decades is well documented. According to the Congressional Budget Office, households in the lowest quintile of the income distribution were making only 2 percent more in 2004 than they were making in 1979. At the same time gains at the top quintile were 63 percent. Similarly, estimates from the U.S. Census Bureau show that the difference between the 80th and the 20th percentiles of household income distribution increased by twenty percentage points between early 1970s and late 1990s. This is shown in Figure 1.

Several factors played an important role in explaining rising income inequality between households. First, there was a sharp increase in wage inequality, which was triggered, among other things, by (1) technological innovations that favored skilled workers, (2) openness of the U.S. economy to international trade, (3) influx of new immigrants, (4) declining rates of unionized labor, and (5) erosion of real minimum wages during the 1980s. Second, the bulk of the rise in female labor force participation came from married women with high-wage spouses, thus contributing to the rise of the upper tail of the household income distribution.

Much less is known, however, about the consequences of rising income inequality. The goal of this paper is to partially fill this gap. Building on a large literature that documents a causal effect of income on health, a natural question to ask is whether or not changes in the distribution of income had led to changes in the distribution of health outcomes among the U.S. population. Particularly, I study how life expectancy has changed over time for individuals at the bottom and the top of the household income distribution.

In order to study the potential impact of rising income inequality on life expectancy, I use the non-public-use version of the National Longitudinal Mortality Study (NLMS) to calculate life expectancy for a large representative sample of individuals with different levels of household income. The NLMS is unique in that it combines March Supplements of the Current Population Survey (CPS) for the years 1979-1998 with the National Death Index using respondents' social security numbers. Thus, the data provide information on demographic characteristics, labor force attachment, and income from various sources for almost two million individuals who were surveyed by the CPS, as well as subsequent date of death for individuals who died by 1998.

For each year between 1979 and 1998 I asked the U.S. Census Bureau to calculate life expectancy for individuals aged 15+ who are below the 20th or above the 80th percentiles of the year-specific distribution of household income (in $1998). The calculations of life expectancy were made separately by gender and at different ages using white, non-Hispanic population.

Estimates from the NLMS suggest that growing income inequality is accompanied by growing inequality in life expectancy among women. This is shown in Figure 2. Between 1979 and 1998, women at the top fifth of the income distribution gained 4 years of life expectancy at age 45 relative to women at the bottom fifth of the income distribution. Surprisingly, the divergence in life expectancy among women is characterized by increasing life

* This study is funded by the National Heart Lung and Blood Institute and is greatly appreciated. Special thanks to Sean Coady and the staff of the U.S. Census Bureau, especially to Norman Johnson and Eric Backlund for providing estimates from the National Longitudinal Mortality Study. I benefited from insightful conversations with Ross Levine, Anna Aizer, Ken Chay, Oded Galor, Yona Rubinstein, and David Weil.

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expectancy at the top, and declining life expectancy at the bottom of the household income distribution. These findings hold for life expectancy at all ages between 15 and 65, but are omitted due to space limitations. Life expectancy among men, on the other hand, has been increasing in a similar rate for men coming from the top and the bottom fifths of the household income distribution.

One has to be careful, however, with drawing causal interpretations from the preliminary analysis above. First, it is not clear whether changes in life expectancy among women are driven by changes in absolute or relative incomes. Second, it is possible that the causation runs in the opposite direction. If life expectancy proxies for health, and if productivity in the labor market depends on one's health, it is plausible that changes in life expectancy explain changes in the distribution of income. Another remaining question is why divergence in life expectancy occurs only among women. These questions are subject to further research.

Whatever the underlying mechanism is, the evidence from NLMS strongly suggests that inequality in life expectancy among women is growing in the modern America. This may have dynamical implications. At the lower end of the income distribution, expectations of declining life expectancy may lower the incentives to invest in human capital and thus lower the earnings potential. Moreover, if declining life expectancy indicates worsening health, the next generation of children born to “poor” women may be endowed with less human capital in the form of health. At the top end of the income distribution, on the other hand, incentives to invest in human capital are rising and the next generation is endowed with increasingly improving health. The dynamical implications, therefore, suggest that divergence of incomes in the United States is not about to stop anytime soon.

Alex Levkov is beginning his 4th year in the Economics Ph.D. program

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**FIGURE 2 - TRENDS IN LIFE EXPECTANCY BY QUINTILES OF HOUSEHOLD INCOME**


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**SMARTER, HEALTHIER, MORE PRODUCTIVE**

by Dimitra Politi
May 29, 2008

It is a well-documented fact that average IQ scores have trended upwards over time; this is the so-called “Flynn effect”. One of the possible explanations for this trend is better nutrition, leading to better health and cognition. Eradicating iodine deficiency in parts of the developed world in the early 20th century appears to have played some role in this phenomenon. My research is concentrated on measuring the effects of correcting iodine deficiency on a population’s human capital accumulation and productivity.

Iodine deficiency is the leading cause of preventable mental retardation in the world today. The World Health Organization (WHO) estimates that nearly 50 million people suffer some degree of mental impairment due to iodine deficiency. According to WHO’s Global Database on Iodine Deficiency, more than 285 million children receive inadequate amounts of iodine in their diet.

The human body needs minimal amounts of iodine to compose thyroid hormones which help regulate metabolism. If iodine is insufficient, the thyroid gland enlarges in order to keep producing the hormones; this enlargement is called a goiter. In addition to goiters, however, iodine deficiency in utero affects brain development in the foetus. At the extreme, iodine deficiency results in cretinism, which is a form of severe mental...
Doctors believe, however, that in regions of endemic iodine deficiency the whole population’s IQ distribution shifts to the left. A meta-analysis has shown that correcting iodine deficiency can increase average IQ by 10 to 15 points.

Iodine deficiency is endemic in mountainous regions far away from the ocean, where the soil has been eroded and stripped of its iodine content as a result of past glaciation or heavy rainfall. Developed countries such as the USA and Switzerland used to have regions of endemic iodine deficiency. The Swiss Alps were the worst-affected region in the world. The area around the Great Lakes also had very high rates of goiter because of soil erosion. This became known in the USA after statistics on recruits were collected during the WWII draft. Army physicians noted the high percentage of enlisted men who had trouble wearing a uniform, because their goiters were so big that they couldn’t button it around the neck. In fact, in some areas goiters were the most common reason for rejection from military service.

In the 1920’s, Switzerland and the USA engaged in countrywide campaigns to eradicate endemic goiters in the population; iodized salt first became available in Switzerland in 1922 and in the USA in 1924. Adding iodine to salt and making it widely available at the same price as common salt was the cheapest and easiest way to reach everybody in need of iodine. Little did the public authorities at the time know that they were fighting not only goiters, but also mental deficiencies and other consequences of iodine deficiency, which were harder to observe. The link between iodine deficiency in utero and cognitive ability was only established much later.

Adding iodine to salt was the first major nutrition intervention organized by public health authorities, yet its effects on productivity have never previously been studied in the past. We know that goiters disappeared from children and young adults, but the campaign also must have had significant effects on the cognitive ability of the cohorts exposed to it.

Looking for reliable data so far back in time can be challenging as much as it can be exciting. In joint work with Brown Prof. David Weil and working jointly with Dartmouth College Prof. James Feyrer (who earned his Ph.D. at Brown in 2001), we look at U.S. military data for evidence of the campaign’s effects on cognition. We use data from the medical examination of recruits during the draft for WWII, in order to get information on the comparative prevalence of goiter across US localities prior to the intervention. Then we examine individual data on soldiers from the WWII draft. Conveniently, some of the soldiers serving in WWII were born before 1924, when iodized salt first became available, and some were born after.

For the biggest part of the war the Air Force received higher-quality recruits than other Army branches, because the jobs related to military aviation required high-level technical skills. Air Force recruits were performing, on average, better than other recruits on Army standardized tests. Therefore, we treat the probability that someone joined the Air Force as a proxy for being smarter. We find that the probability of assignment to the Air Force for an enlistee coming from a high-goiter U.S. county jumped significantly right after iodization, and remained high for as long as the preferential treatment of the Air Force continued. This indicates higher cognition for those enlistees born after iodization in previously high-goiter areas. We don’t find similar jumps for other diseases or other birth cohorts, which is a nice check for the validity of our results.

In additional research on the Swiss experience, I look for the effect of iodization by studying 1970 Swiss Census outcomes. I combine individual data on schooling and occupational choice with a separate dataset on the penetration of iodized salt in the Swiss market from 1922 to 1967, as well as data on the prevalence of goiter across Swiss municipalities, taken from a monograph written back in 1880. I find that people born in high-goiter areas after iodization were much more likely to receive tertiary education and self-select into higher-paying occupations and professions that have higher cognitive demands compared to those born earlier in the same areas. I also find that females benefited much more from iodization than males.

Given that iodine deficiency is still a public health concern in many developing countries, studying the experience of Switzerland and the U.S.A. can be very informative, and teach us valuable lessons that we can apply to current-day public health campaigns. These results also underline the importance of in-utero and early-childhood health investments for future productivity outcomes.

Dimitra Politi has been in the Economics Ph.D. program since September 2003
HEALTH AND ECONOMIC GROWTH

by David N. Weil
Professor of Economics, Brown University

Health differences between rich and poor countries are staggering. Life expectancy at birth is 78 years among the 1.3 billion people living in countries classified by the United Nations as having a high level of human development but only 46 years among the 572 million people living in countries with low human development. In the typical country of sub-Saharan Africa, almost 20% of children do not live to their fifth birthday.

Some of the ill health in the developing world is due to causes like malnutrition, poor sanitation, and lack of access to medical care which have largely been eliminated in the developed world. But many developing countries are also plagued by illnesses such as malaria and helminth infections (including hookworm and schistosomiasis) that thrive in tropical conditions. Finally, HIV/AIDS, which has been contained in wealthy countries, takes a terrible toll in many poor countries.

My research over the last several years has been addressed to the question of how differences in health among countries affect economic outcomes. Is part of the reason why some countries are so poor because their people are unhealthy? Would improving the health of people in poor countries improve their economic status as well? (See Weil, 2007).

Much of the existing research on the relationship between health and economic outcomes has relied on a statistical approach, looking at data from cross-sections of countries. The best known finding in this literature, from Jeffrey Sachs of Columbia University’s Earth Institute (see for example Gallup and Sachs, 2001) shows that health has a powerful effect on economic outcomes. The implication of Sachs’s research is that if countries in sub-Saharan Africa could somehow achieve major health gains, they would reap a great bounty in terms of economic growth. The prospect of such economic benefits is often cited as an important secondary justification (beyond the obvious humanitarian grounds) for health initiatives. For example, the Abuja Declaration of 2005, signed by 53 African heads of state, notes that “malaria has slowed economic growth in African countries by 1.3% per year as a result of which GDP for African countries is now 37% lower than it would have been in the absence of malaria.”

Unfortunately, as we teach in econometrics, there are severe statistical problems in trying to estimate a causal relationship between two variables from a correlation. The fact that good health and high income are correlated might be due to health’s effect on income, but it might also be due to income’s effect on health (that is, the endogeneity of health), to the influence of some third factor (an omitted variable), or to a combination of all three mechanisms. Economists have statistical techniques for dealing with these problems, but their application is not always straightforward, and the answers that they give are often at variance with what is implied by the simple correlation. For example, a recent paper by Daron Acemoglu and Simon Johnson (2007) examined the “international epidemiological transition” that followed World War II, in which the rapid spread of antibiotics, vaccines, insecticides, and sanitation improvements produced massive gains in life expectancy in much of the developing world. Acemoglu and Johnson find that in countries that experienced large exogenous improvements in health (that is improvements unrelated to better income) there was actually a decline in income per capita. Acemoglu and Johnson argue that their finding is due to the negative effects that population growth, which took off after health improved, had on countries’ economies. Similarly, a paper by Werker et al. (2007), using variation in the toll of HIV/AIDS in sub Saharan Africa resulting from difference among countries in the rate of male circumcision (which reduces the spread of the virus), finds no evidence that HIV/AIDS is bad for economic growth.
own research in this area takes a different approach. Professor Ashley Lester, Quamrul Ashraf, a graduate student, and I have constructed a simulation model designed to predict the effects of health improvements on economic and demographic outcomes (Ashraf, Lester, and Weil, 2008). Since our model is not estimated based on cross-country data, it is not subject to the econometric problems discussed above. Two key features of the model are, first, that it takes into account many different channels by which health can affect the economy, and second, that it allows for the dynamic (that is, “over time”) impact of these different effects. Consider, for example, what happens in a country where life expectancy at birth suddenly rises from 40 to 60 years – this is approximately the size of the health improvement in the international epidemiological transition mentioned above. Since mortality in poor countries is concentrated at young ages, an immediate effect of higher life expectancy is an increase in the number of surviving children. There is thus a temporary rise in the ratio of dependent children to working-age adults, which poses an initial strain on family budgets but leads in the long run to lower fertility. Meanwhile starting 15 years after the improvement in health, there is a sharp rise in the rate at which new workers enter the labor force, leading to increased competition for land and capital. But there are other effects as well: people who are healthier can work more effectively, which leads directly to a rise in output. Similarly, healthy children stay in school longer and learn more per year, so that a few decades after the initial health improvement there is a further rise in worker quality.

Our model takes into account all these effects. Further, we have devoted a good deal of effort to quantifying the different magnitudes involved. For example, we have put together estimates of how much harder a healthy individual can work than an unhealthy one; how much an overall improvement in health will raise school attendance; how the increase in the number of workers interacts with the fixed quantity of land; how long it takes to accumulate capital commensurate with the increased size of the labor force; how long it takes families to adjust their fertility in the face of declining child mortality; and so on. Our model also keeps track of how many people of different ages are alive at each point in time, as well as how healthy and educated they are. We can then use the model to analyze particular scenarios, for example, how the time paths of a country’s population and income per capita following a health improvement would compare to the case where no such improvement took place. We can apply the model to both general health improvements such as the epidemiological transition mentioned above or to the eradication of particular diseases such as malaria.

Our analysis is not supportive of the Sachs view of health’s importance as an influence on economic growth. In our simulation, the period before any beneficial effects of an improvement in health are visible in GDP per capita can be quite long, on the order of a third of a century. It may take twice that long to achieve most of the long-run gains in income per capita resulting from increased health. Further, these gains are surprisingly small. An increase in life expectancy at birth from 40 to 60, which is a truly enormous improvement in health, raises GDP per capita by roughly 15 percent in the long run. When we examine the economic effects of eradicating specific diseases, we get similar results: eliminating either malaria or tuberculosis in the typical country in sub-Saharan Africa would raise GDP per capita by only two percent in the long run.

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In my current research, I am looking more deeply into the economic effects of malaria. This summer my research on this topic took me to Zambia, a country of 12 million people in southern Africa. As of 2006, malaria was endemic in every province of Zambia, and was the leading cause of illness and the second leading cause of death nationwide. There were roughly 4.9 million episodes of illness and 6,500 deaths due to the disease every year. In part because of malaria's toll, life expectancy at birth was 42 years.

In the year 2006, Zambia embarked on an aggressive campaign to control malaria, with the goal of reducing the incidence by 75% by 2011. In two years, 5.3 million insecticide treated bed nets were distributed to Zambian households, accompanied by extensive educational campaigns to encourage families to have their children sleep under them. A program of “indoor residual spraying,” in which long-lasting insecticide is sprayed on the walls of houses just before the start of the rainy season, is being expanded to cover half the country’s provinces. 60% of pregnant women are receiving prophylactic treatment with anti-malarial drugs, and all public health clinics in the country are now using state-of-the-art artemisinin-based combination therapy (ACT) as a frontline treatment for malaria.

So far, the program seems to be working. The number of children sleeping under bed nets is steadily rising and the number of cases of malaria reported fell by half a million between 2006 and 2007. If Zambia achieves its goal, it will represent the greatest public health victory against malaria in more than a generation, and the first time ever that so much success against the disease has been achieved in sub-Saharan Africa.

For an economist, the Zambian experiment provides a unique opportunity to study malaria’s economic effects. The fact that the anti-malaria program was rolled out very quickly and on a nationwide basis allows us to overcome the endogeneity and omitted variable problems discussed above, in which improvements in health might be causing economic outcomes, but might also be caused by them (or some third factor).

To analyze the effects of malaria control, I and my colleagues, Nava Ashraf of Harvard Business School and Guenther Fink of the Harvard School of Public Health, are putting together data from a number of sources. These include measures of the number of bed nets distributed, houses sprayed, and doses of ACT provided monthly for all of Zambia’s 72 districts, from the National Malaria Control Commission; the numbers of malaria cases presenting at health clinics and hospitals as well as the number of malaria deaths, by district, as reported by the Ministry of Health; measures of the number of sick children as well as the usage rate for bed nets from a series of household surveys; and school enrollment, completion, and dropout rates by district and year as reported by the Ministry of Education. We are also obtaining data on the effect of malaria on worker absenteeism and productivity from Zambia Sugar, a large private employer which conducted an extremely successful eradication campaign.

The first part of the project will look at both the overall malaria picture and the relationship between measures of malaria and measures of inputs into the anti-malaria campaign. The second part of the project will look at the economic and social effects of malaria control, using geographic and temporal variations in malaria reductions examined in the first part as a source of identification. Specifically, we will examine the effects of malaria control on overall health outcomes, educational attainment, worker productivity and absenteeism, and the rate of fertility.
In a final step, we will combine the estimates we get from the individual channels to generate an estimate of the total economic benefits of the current malaria program as well as future expansions of the program.

My research in Zambia is part of a much larger project on African Economic Successes run by the National Bureau of Economic Research (NBER) and funded by the Bill and Melinda Gates Foundation. I am one of the two co-directors of this project, which is bringing together US, European, and African-based economists to study critical questions in the field of African development. Researchers funded by NBER’s program will visit African countries and interact with African officials and researchers. The project will include annual research conferences and will culminate in 2012 with a major policy conference in Africa.

References Literature Cited


Experimental research by Louis Putterman, Professor of Economics, Brown University

While “economic man” has traditionally been depicted as self-interested to the core, the inclination to reciprocate the trust of others, whether out of self-interested regard for one’s reputation or in adherence to a social norm, is often recognized by economists as playing a significant role in economic life. In an influential essay, Nobel Laureate Kenneth Arrow wrote: “Trust is an important lubricant of a social system. It is extremely efficient; it saves a lot of trouble to have a fair degree of reliance on other people’s word.” Arrow might also have spoken of trustworthiness, for only if a substantial proportion of a population is trustworthy can the practice of trusting survive.

The question of trusting and trustworthiness has attracted a fair amount of economic research over the past decade. In the investment or trust game developed by experimental economists in the mid-1990s, two subjects, A and B, are each given ten one-dollar bills and seated in separate rooms. A is asked to decide whether to send none, some, or all of the bills to B, who, both know, will receive three bills for every one that A sends (for example, if A sends $2, B receives $6). If A sends something, B is asked to decide whether to return some of the bills. The game mimics an economic opportunity in which both A and B can potentially benefit, since A is in a position to turn the $20 with which they are initially endowed into $40, and B can make this profitable for A by returning at least $11 (in that case pocketing $29 herself). If a rational and self-interested player A thinks that counterpart B is also strictly rational and self-interested, however, A will send nothing, since it would be irrational for B to return anything. In laboratory decision-making trials, however, most A’s do send some money, and more than half of the B’s sent money return some. Whether A’s on average profit from being trusting varies across trials.

During the past three years, Professor Louis Putterman and several collaborators have joined in this line of research in some novel ways. First, with economist Avner Ben-Ner at the University of Minnesota, Putterman conducted trust game experiments in which participants could enter into a binding but costly contract with their counterpart instead of relying on trust. Although using the contract is clearly the superior option in the absence of trusting and trustworthiness, and although the cost of the contract was modest, most participants carried out mutually profitable interactions without purchasing the contract. The A’s simply trusted, and most of the B’s were trustworthy. It appeared that the opportunity to communicate before engaging in their decisions was itself a powerful inducement to trustworthiness on the part of the B players, and most A’s sensed this and profited. This interpretation received support when another series of experiments was conducted in which contracts were not available but pre-play communication was. Again, most A’s were trusting and B’s were trustworthy. Also, in both sets of experiments, the outcome in which A sent the full endowment and B returned $20, giving both earnings of...
$20, was by far the most common. While A’s profited on average, there were of course some unscrupulous B’s. Note that A’s and B’s had no way to learn each others’ identities, as they were seated in different buildings and were recruited from a general student body numbering in the tens of thousands. An analysis of the first portion of this project is due to appear in the Journal of Economic Behavior and Organization.

Another set of trust game experiments was developed by Putterman and Brown Professor Emeritus Toby Page. These experiments were conducted in pilot versions by undergraduate Robert Frantz, who programmed them to be run on a computer network and wrote up the research in a senior thesis that was awarded a Samuel Lamport Prize at the 2008 Commencement. In this version of the game, words like “send” and “return” are not used, the idea being that their inclusion in the original game may trigger social cues regarding the normative appropriateness of reciprocity. Instead, the A player simply chooses a horizontal line within a trapezoid, the B player selects a point on the line, and the earnings of each are determined by the distance from his or her edge of the trapezoid (left for A, right for B) to the point selected by B. Play in this version was indeed closer to the prediction assuming selfish and rational decision-makers. Yet there was extensive cooperation when counterparts knew that they would play a finite number of times, supporting other experimental findings that subjects are not particularly good at the logical procedure called “backward induction.”

Finally, Putterman worked with former Brown undergraduate Stephen Atlas on research for Atlas’s Masters thesis at Tufts University. In this project, Atlas worked with programmers to create a decision-making lab on an island in the virtual world Second Life, to which players of the on-line game could send their avatars in the hope of earning some easy experimental currency (called Lindens). Visitors to the virtual lab were randomly assigned to the A or B role and played the standard trust game a single time with an unknown counterpart. Analysis of the first several hundred interactions showed similar but slightly lower levels of trusting and trustworthiness than in brick-and-mortar laboratory versions. In a next stage of the project, to be carried out in the summer of 2008, new subjects will be recruited to the virtual lab and will encounter three slightly different versions of the game, differing only with respect to subtle visual cues. The idea is to test whether subconscious processing of visual stimuli help determine whether people see a situation as one calling for “economic man”-type behavior versus “socialized” actions. The virtual lab approach is of interest to experimental economists because of its lower cost and its potential for recruiting subjects other than college students. And in the end, e-commerce interactions, including those on e-Bay and other web sites, are among the more important real-world applications to which a better understanding of what governs human trusting and trustworthiness will be applied.
Ending and Beginning

2008 PhD recipient Stelios Michalopoulos pictured at Commencement