Raj Chetty: 2013 Clark Medal Recipient

Martin Feldstein

Raj Chetty wrote to me during his first week as a freshman at Harvard College in 1997 to ask for a job as a research assistant. Although my research assistants were usually much further along in their studies, the high school essay that he sent to me—a critical comment on Robert Fogel and Stanley Engerman's (1974) *Time on the Cross: The Economics of American Negro Slavery*—was so well done that I decided to interview him. A brief discussion convinced me that he was unusually bright and would be both productive as a research assistant and fun to work with. But after a few months working with Raj as a research assistant, I realized that he was quite exceptional and should be investing in his own intellectual development rather than helping me with my current statistical research. I suggested a variety of things that he might read and we could discuss together. These included not only some papers in public economics but also risk theory and statistical decision theory.

Raj completed his Harvard BA in three years, graduating summa cum laude with a thesis on interest rates and business investment that was eventually the basis for a 2007 article in the *Review of Economic Studies*. He went on to complete his PhD at Harvard in the next three years. He then went to Berkeley as an assistant professor in 2003. Harvard lured him back in 2009.

Raj Chetty is eminently deserving of being awarded the John Bates Clark Medal at the age of 33. His research has transformed the field of public economics. His work is motivated by important public policy issues in the fields of taxation, social insurance, and public spending for education. He approaches his subjects with a creative redefinition of the problems that he studies, and his empirical methods often draw

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Table 1
Selected Papers by Raj Chetty

1. "Interest Rates, Irreversibility, and Backward-Bending Investment." 2007. *Review of Economic Studies* 74(1): 67–91.

2. "Moral Hazard versus Liquidity and Optimal Unemployment Insurance." 2008. *Journal of Political Economy* 116(2): 173–234.

3. "Is the Taxable Income Elasticity Sufficient to Calculate Deadweight Loss? The Implications of Evasion and Avoidance." 2009. *American Economic Journal: Economic Policy* 1(2): 31–52.

4. "Salience and Taxation: Theory and Evidence," (with Adam Looney and Kory Kroft). 2009. *American Economic Review* 99(4): 1145–77.

5. "Dividend and Corporate Taxation in an Agency Model of the Firm," (with Emmanuel Saez). 2010. *American Economic Journal: Economic Policy* 2(3): 1–31.

6. "How Does Your Kindergarten Classroom Affect Your Earnings? Evidence from Project STAR," (with John Friedman, Nathaniel Hilger, Emmanuel Saez, Diane Whitmore Schanzenbach, and Danny Yagan). 2011. *Quarterly Journal of Economics* 126(4): 1593–1660.

7. "Bounds on Elasticities with Optimization Frictions: A Synthesis of Micro and Macro Evidence on Labor Supply." 2012. *Econometrica* 80(3): 969–1018.

8. "Using Differences in Knowledge across Neighborhoods to Uncover the Impact of the EITC on Earnings," (with John N. Friedman and Emmanuel Saez). 2013. *American Economic Review* 103(7): 2683–2721.

9. "Active vs. Passive Decisions and Crowd-Out in Retirement Savings Accounts: Evidence from Denmark," (with John Friedman, Søren Leth-Petersen, Torben Heien Nielsen, and Tore Olsen). *Quarterly Journal of Economics*, forthcoming.

10. "Measuring the Impacts of Teachers I: Evaluating Bias in Teacher Value-Added Estimates," (with John N. Friedman and Jonah E. Rockoff). NBER Working Papers 19423.

11. "Measuring the Impacts of Teachers II: Teacher Value-Added and Student Outcomes in Adulthood," (with John N. Friedman and Jonah E. Rockoff). NBER Working Paper 19424.

on experimental evidence or unprecedentedly large sets of integrated data. While his work is founded on basic microeconomics, he modifies this framework to take into account behavioral and institutional considerations. The American Economic Association (2013) in its announcement of the Clark Medal declared: "He has established himself in a few short years as arguably the best applied microeconomist of his generation."

Chetty is a prolific scholar. It is difficult to summarize all of Chetty's research or even to capture the details of his most significant papers. I have therefore chosen a selection of Chetty's important papers dealing with taxation, social insurance, and education that contributed to his selection as the winner of the John Bates Clark Medal. These examples from different aspects of public economics indicate Chetty's combination of selecting important issues, creatively extending existing theory, and applying novel empirical methods. Table 1 presents a list of the papers by Chetty cited in this essay, and as is the style of this journal, I will refer to the papers by number.

Raj Chetty

Taxation

In studies of individual taxation, Chetty has taken on questions of how people perceive taxes and how they react to them. Chetty's most widely cited paper, "Salience and Taxation: Theory and Evidence" [4], written with Adam Looney and Kory Kroft, is a good example of Raj's innovative style in conceptualizing a question and bringing novel evidence to bear. He begins by posing the question of whether consumers react to the taxes that are imposed on retail products in the way assumed by standard theory. He shows that they do not. He then explores the implications of the more realistic description of their behavior for the incidence and welfare loss of taxes.

Their first clever strategy for assessing how consumers reacted to taxes on the products that they buy was to compare the reaction to state taxes on beer that are levied in some states as excise taxes, and therefore are built into the price that consumers see on the shelf, with the reactions to taxes on beer levied in other states as sales taxes, which are collected at the cash register after the individual has already made a purchase decision. They found that the more "salient" price effect of the excise tax had a bigger impact on the quantity of beer purchased than a comparable-size sales tax collected at the cash register.

Chetty and his coauthors confirmed this "salience" effect by conducting a major experiment in a large grocery store. They persuaded the store's management to post tax-inclusive prices for several hundred randomly selected products for several

weeks. Using scanner data, they found that the information about the higher prices reduced demand relative to control products and nearby stores where the tax was only levied at the cash register.

This novel question and the imaginative source of evidence implies that consumers are making suboptimal purchase decisions and therefore that the tax imposes a higher utility loss to the extent that the consumers ignore the taxes. The consumer also bears more of the burden of the tax because there is less of a decline in the quantity purchased. Chetty and his coauthors then show how to modify the traditional incidence and deadweight loss formula to take into account the consumers' suboptimal behavior.

Many economists have noted that small changes in prices or taxes do not induce changes in behavior comparable to the effects of larger changes in prices or taxes. More formally, the elasticity of response appears to be greater in response to larger tax and wage changes. Chetty [7] explains this apparent "threshold" effect by the cost that individuals face in adjusting to such changes. He develops a formal model that calibrates these adjustment costs and uses this model to reconcile differences between micro and macro models of labor supply. Chetty then goes beyond this application to positive economics to show how traditional calculations of deadweight loss can be modified to take these adjustment costs into account.

Another impressive application of an expanded model of taxation was Chetty's analysis [3] of the implications of taxpayer evasion of taxes. In a basic model of the deadweight loss of taxation in a model without tax evasion, higher marginal income tax rates create a deadweight loss in three ways: 1) reduced labor supply, broadly defined to include a number of effects like lower participation, reduced hours, less effort, the choice of lower productivity jobs; 2) a shift from taxable cash to untaxed fringe benefits, nice offices, and other favorable working conditions; and 3) a shift of consumer spending to categories that are tax deductible like mortgage interest, local government taxes, and others. The resulting deadweight loss can be calculated using the effect of the higher marginal tax rate on total taxable income because all three effects are responses to the same marginal tax rate, therefore implying that the taxable income is a type of Hicksian composite good (Feldstein 1999).

Chetty [3] extended this analysis to allow for the realistic possibility that taxpayers may modify their reporting of income in order to avoid paying their full tax liabilities and that taxpayers may incorrectly estimate the probability of getting caught for this tax evasion. In his paper titled, "Is the Taxable Income Elasticity Sufficient to Calculate the Deadweight Loss? The Implications of Evasion and Avoidance," Chetty showed that when evasion is taken into account, the taxable income elasticity is no longer a sufficient statistic with which to calculate the deadweight loss. He goes on to show how the deadweight loss formula based on the taxable income elasticity can be modified to derive a measure of deadweight loss as a weighted average of the elasticity of taxable income and the elasticity of total earnings with respect to the marginal tax rate. The relative weights placed on these two components depend on the extent to which changes in taxable incomes are driven by responses with real resource costs, such as changes in the form of compensation and of tax-deductible spending, versus

responses such as underreporting taxable income that have private costs to the individual (such as the risk of paying a fine) but no net social cost.

Tax rules in the United States and other countries discriminate against saving by taxing the return to capital. However, the United States and other countries also offset this effect to some extent with special rules for reducing the tax on the return to saving relative to other forms of income. In the United States, such provisions include the 401(k) employer plans (in which employees have the opportunity to exclude part of their earnings from current taxation if employers deposit those funds in long-term investment accounts) and the Individual Retirement Accounts (in which individuals can choose to exclude part of their earnings by depositing those funds in similar investment accounts). Employees with 401(k) plans and Individual Retirement Accounts do increase their saving in that form; however, it remains controversial whether this represents a net increase in the employees' total saving, or a transfer from other forms of saving, or a rise in one form of saving that is offset by increased mortgage borrowing. This question cannot be fully resolved based on US experience because of limits on the data on total individual assets and liabilities.

For the data to tackle this issue, Chetty along with John Friedman, Søren Leth-Petersen, Torben Heien Nielsen, and Tore Olsen [9] reached out to Denmark, where there are complete records on the savings, asset, and liabilities of everyone in the country. The Danish tax system has both types of savings incentive accounts: the 401(k)-type and IRA-type. Moreover, Denmark changed the rules of these programs during the sample period of the study, thus offering a source of variation for the analysis to exploit. In this analysis, Chetty and his coauthors distinguished between "passive savers" who do not respond to any of the changes in the tax rules applicable to saving and "active savers" who do respond. Employer contributions to 401(k)-type plans do raise the total saving of passive savers in Denmark, but changes in the incentives in IRA-type plans do not alter the savings of this "passive saver" group. Active savers do respond to saving incentives in IRA-type plans but also offset their increased saving in these accounts by reducing their net saving in other accounts. This evidence suggests that IRA-type saving incentives in Denmark do not increase national saving.

The analysis of Chetty and his coauthors in this study [9] focused on the implications for overall national saving, not on the welfare effect of changes in the effective marginal tax rate on saving through IRA-type plans. Taxes on the return to saving create a deadweight loss by altering the relative price of current and future consumption. Since saving is only the current outlay to purchase future consumption, a tax on saving creates a deadweight loss even if does not alter the amount of saving (Feldstein 1978). The analysis in [9] shows that the active savers do not increase their total saving in response to more favorable IRA-type rules, but shift saving to a form that delivers a higher net-of-tax return and therefore higher future consumption. In doing so, the more favorable IRA rules do reduce the deadweight loss associated with the existing taxation of saving.

The four studies that I have summarized so far all deal with the effects of taxes on the behavior of individuals. Chetty shifts his focus to the behavior of firms in

"Dividend and Corporate Taxation in an Agency Model of the Firm" [5], written with Emmanuel Saez. This paper begins by using the experience with the 2003 reduction in the rate of personal income tax on dividends to confirm earlier evidence that such tax changes lead to higher dividend payouts by firms (Feldstein 1970). The authors then show that the increased dividend payout is greatest in firms where senior managers and the board of directors have substantial share ownership. Chetty and Saez then develop a model in which shareholders and managers have conflicting interests over the desirability of dividends versus retained earnings. This agency model is used to calculate the deadweight burden when higher taxes on dividends cause an increase in retained earnings.

Social Insurance and the Safety Net

The design and optimal level of social insurance typically involves balancing the benefits provided by insurance protection against the loss of output and other sources of deadweight loss caused by the moral hazard created by the social insurance.

Chetty [2] made a major contribution to understanding this dynamic in a study of unemployment insurance. There is substantial evidence that higher unemployment insurance benefits lead to longer periods of unemployment. Chetty begins by decomposing the reasons for the increased duration into liquidity effects and moral hazard effects. He finds that increases in benefits have much bigger effects for households that are liquidity constrained. He also shows that lump-sum unemployment benefits have bigger effects on liquidity-constrained households.

The optimal level of unemployment insurance benefits depends on balancing the insurance protection that benefits provide with the loss of output caused by the moral hazard of the induced increase in unemployment. In turn, the gain from social insurance depends on the risk aversion of the unemployed individual. Earlier studies used the measures of risk aversion derived from investment portfolio decisions, which are inherently measures of long-term risk aversion. Chetty [2] notes that an unemployed individual at the time of unemployment typically has substantial fixed commitments—like rent or mortgage payments—that cannot be changed in the short run. In this situation, a loss of income associated with unemployment represents a larger fraction of the individual's uncommitted income, implying that the relevant risk aversion parameter is larger than it would be when considering long-term unconstrained decisions.

Chetty then derives a formula for the optimal level of unemployment benefits that depends on the reduced form elasticity with respect to liquidity and the moral hazard elasticity. Because the implied level of risk aversion is higher than in other previous studies, Chetty concludes that the optimal level of unemployment benefits is substantially higher than previous studies found and also higher than the benefit levels that are typical in the United States.

The Chetty calculation of the optimal level of unemployment benefits assumes a structure of the unemployment insurance system that provides government-financed

benefits proportional to previous wages. My own research on unemployment insurance led me to favor an alternative approach of mandatory unemployment insurance saving accounts that provide liquidity when an individual is unemployed based on previous mandatory saving by that individual (Feldstein and Altman 2007). Chetty's evidence on the importance of liquidity for the unemployed reinforces the desirability of such a structure that provides liquidity with relatively little risk of moral hazard—because an unemployed individual will be drawing upon that person's own previously accumulated funds.

While unemployment insurance is designed to provide cash benefits to individuals with a short-term loss of income, other programs like the Earned Income Tax Credit (EITC) are intended to provide cash to individuals whose income is low for a sustained period of time. The structure of the EITC makes benefits a function of the individual's earned income. If individuals understand the rules, they can adjust their income or the amount of income that they report to maximize their benefit.

In "Using Differences in Knowledge across Neighborhoods to Uncover the Impacts of EITC on Earnings," Chetty with John Friedman and Emmanuel Saez [8] explore the extent to which individuals adjust the income that they report by using a remarkable set of administrative tax return data on all individuals who filed for EITC in the 14 years from 1996 to 2009. The parameters of the EITC differ by family status, but the program provides a payment that is a percentage of earned income up to a certain level (for a single parent with two children in 2013, 40 percent of income up to $13,430 earned), then the amount of the credit paid does not change over a certain income range (for a single parent, two children, up to $17,530 earned), and then the credit phases out as additional income is earned (for a single parent, two children, the phase out rate is 21.06 percent) (Maag and Carasso 2013). With the enormous size of the dataset, Chetty and his coauthors can study the extent to which individuals in different geographic areas bunch their earnings at the income level that maximized their EITC payments.

More specifically, the study begins by focusing on self-employed individuals because that group has the greatest control over their reported earnings. They find that the degree of "sharp bunching" at the benefit-maximizing level of income differs substantially among geographic areas. Chetty and his coauthors infer that differences among areas are not random but reflect local knowledge. Self-employed individuals will become more informed about the EITC schedule if they move from an area with less "sharp bunching" to an area with more "sharp bunching." The study then uses this area measure of "sharp bunching" to assess the extent to which employed individuals (in addition to the self-employed) are able to report W-2 wage incomes that come close to maximizing their benefits. They find that recipients of the EITC do have an ability to learn from the knowledge in their neighborhood and to "optimize" in this way. This personal optimization may reflect actual earnings or fraudulent reporting, a difference that cannot be determined from the data.

Education

Spending on education is one of the most substantial and important activities of government. For example, state and local governments spent $574 billion on primary and secondary education during the 2009–2010 school year, and $243 billion on colleges and universities (National Center for Education Statistics, undated). Economists are interested in ways to make that educational spending more productive and in understanding the effects of educational quality on later life outcomes. To study these important issues, Chetty and various coauthors amassed and linked amazing sets of data so they could trace the success of students in primary school to their college attendance and to their earnings later in life.

In the first of these education studies, Chetty with John Friedman, Nathaniel Hilger, Emmanuel Saez, Diane Whitmore Schanzenbach, and Danny Yagan [6] evaluated the impact of children's early primary education on their important outcomes later in life, including college attendance and incomes at age 27, using data from Project STAR, a careful experiment in Tennessee that randomly assigned students in grades kindergarten through third grade to different classrooms with different teachers. (Age 27 was the most recent year of the tax data that they could link to the primary school records.) Their first dramatic finding was that kindergarten test scores are highly correlated with adult outcomes, including college attendance and earnings, at age 27. This analysis also showed that students who were randomly assigned to small classes, as well as students with more experienced teachers, had higher earnings later in life. There is also a contagion effect: some classes in kindergarten through third grade produced better lifetime performance for the class as a whole.

In a second major education study, Chetty with John Friedman and Jonah Rockoff [10] studied whether teachers in a major urban school system who increase their pupils' test scores actually help them with achievements later in life. This study is another tour de force of combining massive independent datasets. There is no fancy economic theory, but rather thoroughly convincing econometric evidence based on bringing large amounts of relevant data to bear in a sophisticated econometric analysis. They start with data on 2.5 million pupils in grades 3 through 8 linked to tax records of their parents and of themselves as adults. Also integrated into the linked data are the identities of the colleges that they later attend, their incomes, and even the places where they live as adults. The teachers of these 2.5 million pupils are evaluated based on their "value added"—that is, the increase in test scores of these pupils in primary school. Using school district data for each pupil and taking into account each student's prior test scores, Chetty and his coauthors first study the effect of changing teacher assignments to show that there is little or no statistical bias in assessing the value added of individual teachers.

In a follow-up study [11], Chetty and the same coauthors also find that pupils who had high-value-added teachers are more likely to attend college, attend higher-ranked colleges, live in neighborhoods that measure higher in socioeconomic status, and earn higher salaries as adults. Perhaps the most amazing

finding in this study is that replacing a teacher in the bottom 5 percent of the value-added distribution with an average teacher would "increase the present value of students' lifetime income by more than $250,000 for the average classroom in our sample." In short, test-score effects identify teachers that can consistently improve student performance, and those improved test scores have very substantial positive effects on the students' lifetime earnings.

Colleague, Mentor, Teacher

Although the Clark Medal is awarded primarily on the basis of the economist's research contribution, Chetty also contributes fully as a colleague, mentor, and teacher.

Chetty has been the editor of the *Journal of Public Economics* since 2009, and Co-Director (with Amy Finkelstein) of the Public Economics Program of the National Bureau of Economic Research since 2008. When Chetty came to Harvard as a professor, he organized the Lab for Economic Applications and Policy (http://leap.fas.harvard.edu/) to encourage active collaboration among graduate students and faculty of the economics department as well as researchers in other Harvard faculties and visitors from other universities.

Chetty has made and is continuing to make a major contribution to the teaching of public economics. Much of Chetty's work, including several of the papers summarized here, was produced by Chetty and small teams of researchers, many of whom are very bright graduate students. Their experience creates a group of researchers who will at least aspire to follow Chetty's methods and approach.

At Harvard, Chetty not only teaches public economics to both graduate students and undergraduates, but for the first term of the second-year graduate course in public economics at Harvard, he has also made his Fall 2012 course available online, including 24 lectures of 90 minutes each, together with lecture slides and a reading list, at http://www.rajchetty.com/index.php/lecture-videos. It is certainly the best modern "textbook" of public economics.

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National Center for Education Statistics. Undated. Table 31: Direct general expenditures of state and local governments for all functions and for education, by level of education and state: 2008–9 and 2009–10. http://nces.ed.gov /programs/digest/d12/tables/dt12_031.asp.

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