Genes as Tags: The Tax Implications of Widely Available Genetic Information

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Abstract - *Advances in genetic research promise to loosen the tradeoff between progressivity and efficiency by allowing tax liability (or transfer eligibility) to be based in part on immutable characteristics of individuals ("tags") that are correlated with their expected lot in life. Use of genetic tags would reduce reliance on tax bases (such as income) that are subject to individual choices and, therefore, subject to inefficient distortion to those choices. If genetic information can be used by private employers and insurers, the case for basing tax in part on it becomes more compelling, as genetic inequalities would be exacerbated by market forces.*

INTRODUCTION

The other essays in this volume make clear that the future of taxation depends importantly on innovations in the gathering and processing of information. As the so–called information economy continues to evolve, systems of taxation, which obviously require detailed and accurate information in order to function, will have to adapt as well.[1] In parallel with these innovations in the processing of traditional tax–related information, there have also been stunning technological developments in the identification of new information about individual human characteristics that may also have profound implications for taxation. We are speaking about the human genome and the vast amount of information that is now or soon will be available merely from a sample of a person's genetic material. Recent advances in genetic research have captured the public's imagination and promise to revolutionize our approach to treating human disease.[2] The question we wish to pursue, however, is how such advances in genetic research might bear on tax policy.

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1 See Slemrod (2006) for a discussion of the implications for tax policy of innovations in information technology.

2 Every few weeks a news story appears, reporting that scientists have discovered, or confirmed, the link between some illness and a particular gene, from Huntington's disease (which has long been known to be a hereditary disease) to cancer, heart disease, schizophrenia, and, most recently, diabetes and Alzheimer's. For example, see Langreth and Herper (2007) and Wade (2007a, 2007b). According to the GeneTests Web site (www.geneclinics.org), funded by the National Institutes of Health, as of June 4, 2008 there were 1,558 diseases for which tests are available, 1,272 of which are clinical and 286 for research only.

To explore that question, we consider how progress in genetics—specifically, the proliferation of knowledge about the human genome—may influence the feasibility and desirability of a tax that is based on individual human endowments, or, to use the economist's preferred term, a tax based on ability. The terms "endowment" or "ability" in this context refer to a measure of an individual taxpayer's innate lifetime earning capacity or the taxpayer's potential wage rate—an approximation of the income that an individual *could* generate during her lifetime if she chose to pursue her highest valued use, as that use is defined by the market. (Below we will explain why "endowment" may be a more descriptive term for what we have in mind than the term "ability"; however, consistent with the literature in this area, we will use the terms largely interchangeably.)

According to tax policy commentators, the benefit of basing tax liability on individual endowment rather than on, say, income or consumption would be a reduction in the efficiency cost of raising tax revenue for any given level of distributional consequences. The efficiency benefit of an endowment tax[3] would be the same as that of any lump–sum tax: because the endowment tax targets innate characteristics of individuals and, thus, would not depend on individual choices, the tax would avoid labor/leisure—and any other—distortions and, hence, would avoid the deadweight losses associated with alternative taxes such as those based on income or consumption. In addition, an endowment tax—unlike some other lump–sum taxes, such as a head tax—would allow the tax burden to be distributed in a manner that many would consider distributionally fair.[4] Under an endowment tax, the greater is a person's innate endowment to command and enjoy economic resources, the greater her tax burden would be. And the less her endowment is, the less her tax burden would be.[5]

Everyone agrees, however, that a primary difficulty with an endowment tax—and a difficulty that many commentators regard as insurmountable—is its impracticality. How could the taxing authority ever reliably determine an individual's *innate* ability to produce and enjoy income? What sort of test would the government use to determine a person's innate lifetime earning potential?[6] This is where genetic technology enters, or may someday enter, the picture.

The rapid technological progress in the understanding of the human genome may eventually provide a reliable way to estimate the value of something that approximates an individual's endowment—using the person's genetic information. That is, insofar as there are human genetic markers that are statistically correlated with lifetime income or other measures of well–being, such markers might be used in a tax–and–transfer regime. One form a genetic endowment tax might take would be as a separate,

[3] Although we generally refer to an endowment "tax," we mean this to include net transfers, so the reader should be thinking of a tax–and–transfer system that depends in part on an indicator of genetic endowment.

[4] This aspect of an endowment tax is shared by differential head taxes, such as those used in the Middle Ages when there was a fixed tax levy that varied only by one's station in life: peasant, noble, etc.

[5] Because we are applying a welfarist framework in this paper, when we use the term "distributionally fair" or "distributional equity," we mean a distribution of resources that is consistent with maximizing overall social welfare. As we explain more fully below, the welfarist case for redistributive transfers generally assumes the diminishing marginal utility of income for all individuals and, more generally, that individuals' utility functions are homogeneous.

[6] For example, one might consider how to implement an ability tax based on an aptitude test as a rough measure of a child's innate intelligence. One problem with such a test is the difficulty of selecting an appropriate testing age, when the child would be old enough to produce meaningful predictions of his/her income–earning ability but young enough to be immune to his/her parents' possible efforts at manipulation of the system (such as by urging the child, unlike with other tests, to pick the "wrong" answers.) Basing the tax on a test like the SAT would exacerbate the manipulability problem and raises the issue that one's potential score depends on human capital investment decisions previously made by parents and child, and for that reason is not immutable.

free–standing tax–and–transfer program, with the taxes or transfers calculated at birth (if not earlier) and actual remittances made throughout a person's life.[7] But other approaches are possible. Instead, the results of the genetic endowment test could simply be used as an input in the determination of an individual's tax liability, for example, as blindness, age and marital status are used in the current U.S. income tax system. Under such a system, genetic information would be used as a "tag," in the language of Akerlof (1978). Akerlof showed that any immutable characteristic of an individual that is correlated with ability can improve the equity–efficiency tradeoff of a tax system, because the use of such tags can produce some degree of redistribution without any efficiency cost (due to the immutability of the characteristic), thus reducing the need for distortionary redistributive tax instruments (which are not based on immutable characteristics), such as the graduated income tax.[8]

So why do we not already have a genetic endowment tax? For one thing, we do not presently have a test for overall genetic endowment. Despite all of the recent advances in genetic testing, scientists have yet to isolate the aspects of a genetic profile that measure an individual's innate capacity to produce income or well–being. There is, of course, a sense in which the existence of such a gene or combination of genes is problematic, even as a conceptual matter. The correlation of a particular genetic characteristic (which is innate) with lifetime income or lifetime well–being will depend on a number of contingent, external factors. Thus, whether a specific genetic profile will lead to higher lifetime well–being will depend on how the economy in which the person lives values the particular attribute associated with that profile. For example, whether a gene or combination of genes and epigenes for mathematical proficiency, if there is such a thing, would correlate with a relatively high lifetime income will depend upon the value placed on such a skill by the economy in which that individual happens to live.

Notwithstanding that qualification, we can still imagine science some day progressing to a point at which it is possible to identify significant and stable statistical correlations between a given genetic profile and lifetime earnings or even overall well–being. At least, such a development is not beyond our imagination. Indeed, according to some reports, researchers have in fact uncovered evidence of a gene that appears at least to influence some aspects of intelligence[9] and have certainly identified genes that affect one's propensity to acquire debilitating diseases, both of which would seem to be characteristics that would be importantly relevant to measuring lifetime well–being in any likely future economy. Thus, in the spirit of exploration and speculation that inspired this conference on the future of taxation and technology, our paper will explore how genetic information might be used in some future tax–and–transfer regime.

Not every conclusion or speculation in this paper, however, is pure science fiction. Some of the existing genetic research that identifies links between particular genes or collections of genes and numerous debilitating and sometimes deadly diseases could also be used as part of an endowment tax regime. Insofar as poor health suggests lower overall well–being, an endowment tax regime based on health–related genes could be social–welfare enhancing.[10] This conclusion is strengthened by the fact that

[7] Compare this to the proposal made in Ackerman and Alstott (1999) to grant a fixed sum of $80,000 to all people when they reach the age of 21 and who have also finished their high school studies.

[8] On this see Kaplow and Shavell (1994) and Sanchirico (2001).

[9] See Tang, Shimizu, Dube, Rampon, Kerchner, Zhuo, Liu, and Tsien (1999), Burdick, Lencz, Funke, Finn, Szeszko, Kane, Kucherlapati, and Melhotra (2006), and Nesser, Boodoo, Bouchard, Boykin, Brody, Ceci, Halpern, Loehlin, Perloff, Sternberg, and Urbina (1996).

[10] This requires that, other things equal, the social *marginal* utility of resources increases with declining health status.

there is a strong correlation between health and income. In this paper we sketch out how such a genetic endowment tax might be designed.

Even if a genetic endowment tax were to become a practical possibility, there would still be critics of such a policy. For some of those critics, the taxation of human potential—as opposed to taxing the realization of that potential as, say, income—is per se wrong, because such a tax would in some sense force individuals to work who prefer not to work, to work more than they desire, or to work in occupations that they otherwise would not choose. This is sometimes called the problem of "talent slavery" or "wage slavery."[11] For other commentators the case for adopting an endowment tax is problematic because, depending on one's assumptions about taxpayer utility functions, it is not clear that an endowment tax will increase overall social welfare.[12] Although we do believe (and argue below) that some (though not all) of these criticisms of endowment taxation have been overstated, we do not in this essay attempt to offer a systematic defense of an endowment tax. Indeed, we do not argue for or against any particular change in policy. Rather, the point of the essay is to describe what a particular type of endowment tax—what we call a genetic endowment tax—might look like in some not–too–distant future world, and to begin an examination of its advantages and disadvantages. Thus, this paper is meant not to advance any particular policy change, but to kindle the imagination.

In that spirit, we highlight one rationale for the adoption of an endowment tax that has not been discussed in the economic or philosophical literatures on the subject. Even if one agrees with the fundamental criticisms of the genetic endowment tax, once the relevant genetic tests become available, government policymakers will inevitably face the question of how to respond. This is because, even if the government does nothing, even if no genetic endowment tax regime is adopted, private employers (in deciding whom to hire and on what terms) and private insurance markets (in deciding whom to insure and on what terms) can be expected, in the absence of an effective legal prohibition, to incorporate such genetic tests into their hiring and underwriting practices. Such market responses would tend to exacerbate existing inequalities of well–being that flow from genetic differences.[13]

As we explain below, the government might anticipate or react to these various developments in a number of different ways. One possibility, to which much legal scholarship has attended,[14] would be a regulatory response; specifically, the government could adopt laws limiting the use of genetic information by insurers and employers. In fact, such genetic anti–discrimination rules have been adopted in many states in the U.S.[15] Also, federal law restricts the use of genetic information in certain situations by insurers seeking to exclude pre–existing conditions.[16] In addition, President Clinton in 2000

[11] See Rakowski (2000), Rawls (2001), Murphy and Nagel (2002), Zelenak (2006), and Hasen (2007).

[12] See Shaviro (2000).

[13] In addition, private genetic–testing companies will enter the market. Rugnetta, Russell, and Moreno (2008) note that, for example, DNADirect, Inc. offers 17 condition–specific tests (such as for blood clotting or diabetes risk) of varying cost directly to a private consumer.

[14] See Rothenberg (1995), Reilly (1997), and Diver and Cohen (2001).

[15] For example, 47 states currently have laws that restrict the use of genetic information by health insurance companies. Mississippi, Pennsylvania, and Washington appear to be the only exceptions. See the National Human Genome Research Institute Policy (NGRIP) and Legislation Database at http://www.genome.gov/PolicyEthics/LegDatabase/pubsearch.cfm. See also National Conference of State Legislatures tables on health insurance (at http://www.ncsl.org/programs/health/genetics/ndishlth.htm).

[16] The Health Insurance Portability and Accountability Act ("HIPAA"), enacted in 1996, prohibits health insurance companies, under certain circumstances, from excluding individuals from group health coverage on the basis of pre–existing conditions. The law specifically states that genetic information alone cannot constitute a pre–existing condition.

issued an executive order (Executive Order 13145) prohibiting federal agencies from obtaining genetic information about their employees or job applicants and from using genetic information in hiring and promotion decisions. In May 2008, Congress overwhelmingly passed (and President Bush promised to sign) the Genetic Information Nondiscrimination Act, which prohibits health insurance companies from using genetic information to deny benefits or raise premiums for individual policies, and sets large fines for employers who use genetic information in making decisions about hiring, firing, or compensation. The bill does not address discrimination by long–term care insurers or life insurers.

Such rules, we argue, can be understood as a form of indirect (somewhat hidden) genetic endowment tax–and–transfer regime. Alternatively, the government could allow insurers and employers to use genetic information to sort employees (that is, eliminate the existing genetic antidiscrimination laws) and could then implement a direct system of endowment taxation and transfer based on genetic information.

If, however, the government were to choose a third path—to allow genetic discrimination by repealing any existing genetic antidiscrimination laws without adopting an explicit genetic endowment tax–and–transfer regime as a replacement—we explain how the market itself might respond yet again, perhaps in the form of what we call "endowment insurance," which would be, in effect, a market–provided form of endowment taxation.

Whichever of these paths is taken, our general conclusion is that the increasing availability of genetic information to tax administrators, and the use of genetic information by private employers and insurers, will affect the optimal design of a tax–and–transfer regime.[17]

A SELECTIVE REVIEW OF THE ENDOWMENT TAX LITERATURE

From Optimal Income Taxes to Endowment Taxes to Tagging

Tax theorists have long struggled with the problem of designing a tax regime that balances the competing concerns of allocative efficiency and distributional equity. It is well known that, assuming the conditions of a competitive market, the only truly efficient tax–one that does not distort decisions—is a lump–sum tax, which means a tax that does not vary based on individual choices or behavior. The most straightforward lump–sum tax, the uniform lump–sum tax (or head tax) under which everyone pays the same amount, is universally considered distributively unacceptable. This conclusion can be based on any of several normative theories. For example, under a simple utilitarian approach that assumes that all individuals in society have identical cardinal utility functions that reflect a diminishing marginal utility of money, some degree of redistribution from the rich to the poor would be social–welfare maximizing. Indeed, if we ignore the incentive effects of such transfers, a simple utilitarian framework would suggest a policy of full equalization of wealth.[18] Of course, once we allow for the fact that taxes and transfers do affect incentives, including labor–market incentives, it becomes clear

[17] One important issue raised by the use of genetic information that we do not address in this paper is the concern about privacy. Some individuals may object to any use by the government or by private parties not authorized by them of their genetic information as a fundamental violation of privacy or because of the fear that it might be used in ways that are initially unintended or may end up being passed on to parties who are not supposed to have it. Such concerns would have to be addressed systematically before any tax or transfer system based on genetic information would be viable.

[18] This was first pointed out by Edgeworth (1897).

that redistributive transfers come at a cost that must be taken into account.

That is precisely what the optimal tax literature does. It develops models of optimal—i.e., social–welfare maximizing—tax regimes that take into account both the social welfare benefits (due to redistribution) and the social welfare costs (due to distorting behavior away from taxed activities) of those regimes. Critically, almost all of this literature assumes that an individual's endowment, or innate earning potential, cannot be directly observed by the taxing authority. Thus, Mirrlees' path–breaking 1971 article and nearly all that followed it focused on the design of an optimal *income* tax, on the theory that income, which is the product of unobservable endowment and unobservable effort, is in fact observable. Scholars working in the optimal tax field, including Mirrlees, however, have long acknowledged that *if* earning potential could somehow be observed, then any redistributive tax regime could in theory be made more efficient by switching to a system of taxes and transfers based directly on ability.[19] The intuition behind this conclusion is simple: for any tax regime that redistributes on the basis of income (or on the basis of any other observable characteristic, such as wealth or consumption, that is the product of endowment and individual choices such as labor effort), there would be an alternative endowment–tax regime that could achieve the same level of redistribution at lower cost in terms of distorted choices.

The appeal of an endowment tax, therefore, is that in theory such a tax can be calculated on the basis of an individual's earning potential irrespective of her choices or effort, thus eliminating any distortion in the choices between work and leisure or any other choice whose terms are distorted by, say, an income or consumption tax. Similarly, the endowment tax appeals to some liberal egalitarian philosophers who argue that inequality attributable to "brute luck"—of which differences in innate earning power would be an example—is morally arbitrary and (putting aside the wage slavery problem for the moment) ought to be eliminated through redistributive policy, whereas inequality attributable to informed choices are "deserved" and, hence, not appropriate targets for redistributive transfers.[20]

In this essay, we consider a relatively modest application of the endowment tax idea based on Akerlof's (1978) observation that, even in a system of distortionary taxes, if the tax policymaker can identify "tags"—observable characteristics of individuals that correlate with ability and that are not a matter of choice—those tags can be used to lower the welfare cost of any distortionary tax regime. The particular context in which Akerlof wrote was the debate over how to deal with the problem of poverty; specifically, whether to use a negative income tax by itself or whether instead to supplement a negative income tax with adjustments or transfers based on various tags such as age, blindness, or disabled status. What Akerlof showed was that the use of such tags can indeed lower the cost of redistribution. Thus, any extent of redistribution accomplished through tagging rather than differentials in income tax rates produces less overall distortion of choices, such as labor supply decisions.

A tax system that includes tags, however, is only as good as the tags that are chosen. A useful tag has three qualities: it must be observable by the taxing authority, it must be immutable, and it must be correlated with attainable well–being. The absence of any one of these factors under-

19 An early treatment in the economics literature is Allingham (1975).

20 See Dworkin (1981a, 1981b).

mines its usefulness as a tag. Indeed, a highly imperfect tag will almost certainly introduce more capriciousness into the distribution of tax liability than is justified by its efficiency benefits, and should not be used. This is not to say, of course, that all three of these factors must be perfect. The tag, if not directly observable, must at least be something that can be estimated with minimal error. There will always be the problem of individuals attempting to falsify their tag status—people pretending to be disabled, for example—and such fraud obviously inhibits the social gains available from the use of tags. (Of course, such fraud is a problem with any tax base, including income or wealth, and there is little reason a priori to expect the problem to be more pronounced with tags.) In addition, a tag need not be totally immutable (even blindness can be self–induced), but it must be relatively so—relative, again, to the other options, such as income. And finally, the correlation between the tag and attainable well–being also need not be perfect. Just good enough. Overall, the observability, immutability, and attainable well–being correlation need only be good enough that the social welfare gains from basing taxes and transfers on the tag exceed the welfare losses.[21] Besides the tags mentioned by Akerlof—age, blindness, and disability status—commentators have considered height (Mankiw and Weinzierl, 2007) or even race (Logue, 2004).

Note that a useful tag need only be *correlated* with the unobservable ability to produce and enjoy well–being, and it need not explicitly *measure* overall ability or even a component of it. If ice cream consumption were correlated with income–earning ability, allowing tax liability to depend on ice cream consumption would reduce the inefficiency for any given amount of redistribution, even though no one would argue that it *measures* ability or a component of it. Thus, although we will argue below that genetic information may at some point in the future measure expected ability to earn (and enjoy) income, the tagging argument does not require that genetic information actually measure ability, but only that the genetic index be correlated with ability.[22]

Criticisms of Endowment Taxation (and Responses)

Some commentators in the legal and philosophical literatures object on principle to an endowment tax. The idea seems to be that, under an endowment tax, high–ability people whose tastes tend to leisure rather than goods would be "forced" to work to pay their tax bills; whereas, under an income tax, in contrast, a high–ability person can choose not to work and, thus, avoid paying any tax if she so decides. Since every tax produces some form of this income effect, however, it is not clear why the particular income effect associated with an endowment tax would be especially problematic. That is, whenever an income or consumption tax is adopted (or the rates of an existing income or consumption tax are raised), it can be argued that people are "forced" to work more than before the change to the extent they want to maintain a given level of consumption.[23] Yet we do not generally hear "wage–slavery" or "talent–slavery"

[21] Stern (1982) formalizes the choice between a distortionary tax based on an easily observable indicator of ability such as income and a tax based on an immutable tag that is, however, observed with error.

[22] A gene–based tag seems less susceptible to the criticism made by Mankiw and Weinzierl (2007) that such a tax is intuitively unappealing because it is not targeting the "true" source of inequality, as would be true of height as a tag in a modern economy in which the non–tall are the object of discrimination but not in an economy based on "tall fruit–bearing trees."

[23] Others have made this basic point. See Kaplow (1994), Shaviro (2000), and Stark (2005).

complaints in connection with those changes.[24]

A more subtle, and potentially more serious, critique of the endowment tax comes from within the utilitarian framework itself. This critique raises the following question: can we be sure that an endowment tax will increase overall social welfare if we relax the traditional assumption (sometimes implicit and sometimes explicit in economic models of the endowment tax) that taxpayers have identical utility functions with respect to work and leisure? Thus, when tax policy commentators applying a utilitarian framework argue in favor of some degree of redistributive transfer from the better off to the less well off, they often adopt the assumption that all individuals have identical utility functions, at least with respect to goods (income) versus leisure, and they assume (as is standard) that those utility functions are concave. The result is that overall utility is maximized when income (or, under an endowment tax, potential income) is redistributed from rich to poor, until the marginal utility of income is equalized across the population. But the analysis becomes much more complicated and the result less certain when we relax those assumptions. If, for example, some otherwise identical individuals experience unusually high disutility (or unusually high utility) from working, it is less clear that overall welfare could be improved by a regime of endowment taxation.[25] That is, if we do not know that high–income people value the next dollar earned at least somewhat less than low–income people, the case for redistribution—at least under a utilitarian framework—is thrown into doubt. Of course, a similar objection can be raised against the redistributive effects of a progressive income or consumption tax. This objection, therefore, seems more appropriately directed at the idea of redistribution more generally.

Although many of the recent discussions of an endowment tax have focused on extreme versions of the tax (such as replacing the income tax with an endowment tax), which presumably helps to explain the preoccupation with wage slavery, we focus in this paper instead on a more modest use of the endowment tax. Specifically, we consider the use of tags to increase the efficiency of an existing redistributive tax regime, such as a progressive income tax. Of course, even the use of this type of tag can be criticized. One objection that is sometimes raised is that, even if the tag satisfies the three

[24] In addition, the argument that an individual can avoid paying income tax simply by deciding not to work at all, or can avoid paying consumption tax by not consuming, is misguided. Everyone has to produce *some* income and engage in *some* consumption to survive; and when they do, the income or consumption tax will be there to get them, just as the endowment tax would be. And it is not a response to this observation to argue that an individual with a very small amount of income or with very low levels of consumption might be exempted from an income tax or consumption tax (either through personal exemptions or exemptions for expenditures on necessities, respectively). Such an exemption could just as easily be adopted as part of an endowment tax regime. Likewise, it seems nonresponsive to argue that under an income or consumption tax, but not under an endowment tax, an individual can avoid taxation by not engaging in market transactions and by instead limiting her consumption to self–provided goods and services. This distinction too, however, depends on what amounts to an exemption in the existing models of real world income and consumption taxes for imputed income. A similar exemption could be made a part of an endowment tax, with all of the associated benefits and costs of such a policy. Alternatively, as Kaplow (1994) has suggested, an endowment tax that is capped at some percentage of an individual's actual income would achieve some of the efficiency benefits of the endowment tax while eliminating entirely the concerns of forced labor. Of course, how much of the efficiency benefits of the endowment tax would be achieved would depend on the percentage used for the cap and on the difference between individuals' potential income and their actual income. See Zelenak (2006).

[25] This observation about endowment taxation has been made before, e.g., in Shaviro (2000). It is especially problematic if the high–ability people on average have relatively high preferences for goods versus leisure.

criteria discussed above—observability, immutability, and correlation with attainable utility—redistribution with respect to that tag can be stigmatizing. For example, Mankiw and Weinzierl (2007) suggest that, although height reliably correlates with lifetime earnings (and, of course, is observable and largely—although not completely—immutable), the use of height as a tag should be avoided because it suggests that the tall are in some sense more "able" than the short when, in fact, a more likely explanation for the correlation with lifetime earnings is employment discrimination against the non–tall. However, even if discrimination is the cause, it is not clear why that conclusion would cut against modest redistribution from tall to short. It does suggest, however, that the term "ability" may be misleading, in that the term suggests different levels of innate talent or skill rather than, more generically (and less normatively), different levels of potential expected lifetime earnings. What this discussion suggests is that, in policy and academic discussions of endowment taxation and tagging, care should be taken to use the term "ability" only where it is clearly appropriate.

Perhaps the most serious objection to introducing a system of tags into a tax-and-transfer regime is the worry that the three factors described above are not satisfied. And this is a serious objection indeed. The remainder of this paper addresses the possibility of a future world in which tax policymakers, as well as private actors, are able, through genetic technology, to identify genetic markers that meet these criteria.

THE GENETIC ENDOWMENT TA(X/G)

The Potential–Earnings and Potential–Health Indices

Imagine that a series of genetic tests are invented that enable scientists, with the help of statisticians and economists, to develop a reliable estimate of the statistical correlation between an individual's genome and her prospects for lifetime earnings.[26] Based on these genetic tests policymakers can produce an "endowment index" reflecting the overall potential expected value of an individual's innate endowment to produce income. To what extent that potential is translated into income will depend on many factors, including the individual's tastes for leisure versus market consumption and immediate versus postponed consumption.

To further refine the analysis, imagine that the overall genetic endowment index might be broken into two separate but related indices for every individual. The first index corresponds to an individual's lifetime earning potential, which we assume to be an approximation of the individual's ability to produce income over her lifetime. The second index relates to the individual's lifetime potential health status. A less favorable health status reduces attainable utility for a given income and, we assume, increases the social marginal utility of income. As we explain below, both indices could be further broken down into sub–indices. In addition, the potential–earnings and health–status indices can be combined to determine a single genetic index that

[26] We recognize that the relationship between any observable characteristic of an organism and its genome (i.e., all of the hereditary information usually encoded in the DNA, including both the genes and the non–coding sequences of the DNA) is characterized by great complexity involving interaction between many genes, gene products and environmental signaling. This interaction may involve many, even thousands, of genes for any common disease like cancer or heart disease, and will also be a function of both one's personal natural history and one's present environmental setting, so that even in simplified cases, where genetic connections may be traced, the genes will have different effects in different environments. There is no question that appropriately using genetic information as a tag for potential lifetime earnings is exceedingly complex, but given the enormously fast pace of scientific progress in this area, it may be a viable option some day.

is assumed to be (again, as a result of scientific progress) completely observable, utterly immutable (putting aside the possibility of genetic engineering), and closely correlated with potential utility.

Now consider how the potential–earnings index might further be broken down into sub–indices that would correspond to the components of innate earning potential. For example, imagine the day when there is a genetic marker, ascertainable at birth or earlier, for an individual's ability to do complex reasoning and mathematics, skills that may correspond with higher lifetime earning power. Likewise, there may some day be genetic markers for the ability to work well with other people, the ability to inspire loyalty among one's co–workers, the ability to persevere in the face of adversity, and even the ability to discern profitable opportunities from unprofitable ones or to distinguish trustworthy partners from scoundrels. And let us assume that all of these abilities turn out to be positively correlated with lifetime earnings. In addition, there may someday be genetic markers (such as, apparently, the genetic profile associated with height) that correlate strongly with potential earnings, but that are not representative of differences in ability. Rather, the differences may be attributable to discrimination or something else that remains undiscovered.

Each of these genetic sub–markers for potential earnings could then be used to produce a sub–index for each characteristic that, for the sake of argument, we presume is normalized around some societal average with respect to that characteristic. Thus, an individual might have a positive, zero, or negative sub–index for mathematical ability, perseverance, height, and so on, depending on which genetic markers she has. All of these sub–indices could then be combined to arrive at a single potential–earnings index.

The potential–health–status index would be similar in conception. Suppose that genetic research progresses to the point that scientists can identify the particular genes and other genetic material that are linked to substantially increased risk of certain serious diseases, conditions, or disabilities that tend to produce some combination of (a) loss of earning power, (b) unusually high medical bills (higher than some average level of medical expense), and (c) substantial reductions in the individual's quality of life (in terms of pain, general misery, and loss of ability to enjoy previously enjoyed activities). This index, too, could be defined with reference to some average level of lifetime health, which in turn would be based on some average level of risk of contracting various diseases.[27]

One function of such an index in a genetic endowment tax–and–transfer regime would be to enable further refinement of the estimate of an individual's lifetime potential earnings. After all, it is easier for a healthy person to find and keep a job than an unhealthy person. In addition, individuals with below–average health, even if their employment prospects are unaffected, may need additional resources in the form of medical care merely to restore them to some average baseline level of wellness or well–being. (This fact, of course, is the point of health insurance: to shift resources from the healthy to the unhealthy state of the world.) For these reasons, just as lawmakers might reasonably decide that social welfare would be increased by making transfers from individuals with high potential earnings to those with low

[27] As with the potential–earnings index, the potential–health index could be further broken down into sub–indices by disease or condition. Thus, an individual could have a positive, zero, or negative index for, say, cancer (or lung cancer or a particular type of lung cancer, etc.) based on whether her likelihood of contracting cancer during her lifetime was less than, equal to, or greater than some baseline level of risk. Separate sub–indices for every major disease could be developed, which could then be combined to produce a single health index.

potential earnings, they might reach a similar conclusion about transfers from those with better genetic potential for good health to those with a worse genetic health.

These two indices might then be summed to produce one endowment index, which might then be used in an endowment tax regime to achieve some level of non–distortionary redistribution. Transfers could be made from those with a positive endowment index to those with a negative endowment index. Furthermore, we might assign graduated rates to both the health–related and potential–earnings–related taxes and transfers, depending on how far above or below the baseline the particular index falls, such that those with, for example, a higher level of potential earnings would pay a higher percentage of those earnings in tax. Alternatively, going back to the tags analysis from above, one might use the endowment indices as adjustments to the already existing income tax system. This adjustment could be in the form of a deduction or a credit, possibly refundable as with the EITC. Again, the advantage of either approach—the free–standing endowment tax–and–transfer regime or the endowment adjustment to the existing tax regime—is that it would allow us to achieve a given distributional target while reducing the level of progressivity in the existing income tax system, thus reducing overall tax–induced distortions in the system.[28]

If for some reason policymakers preferred to have a redistributive regime that took into account only some of the various factors that affect lifetime potential earnings or lifetime health status, they could leave out some of the various sub–indices discussed above. The endowment index could be designed to include or exclude whatever combination of the various sub–indices the policymakers thought was appropriate. Thus, if policymakers decided that differences in lifetime earnings associated with differences in height or hair color or facial features should not be reduced by redistributive transfers, they could leave those factors out of the index. The point of collapsing, or building, all of the various genetic differences into a single index is not to suggest that all genetically affected differences in earnings or health potential are the same. Obviously they are not. Rather, the point is that insofar as a transfer of cash is to be used as a redistributive tool for any given set of genetic differences, it only makes sense to reduce those differences to a single metric for the purpose of calculating the redistributive transfer.

Implementation Issues

For such an endowment tax–and–transfer regime to work, policymakers would obviously need to overcome numerous, possibly insurmountable, conceptual and technological difficulties. Some genes may have both welfare–enhancing and

[28] The current deduction for extraordinary medical expenses and the deduction for large casualty losses can be understood as just this sort of adjustment of unusually large consumption needs. The difference with the genetic health index would, in theory, be that the adjustment would be based on an individual's innate (genetic) propensity to contract certain diseases, thus eliminating any distortionary (moral hazard) effects that might accompany the current approach. The gene–based argument should not be thought of as a replacement for the realization–based deduction, though, unless the genetic test can predict outcomes without error.

Louis Kaplow has suggested to us the comparison to Social Security Disability Insurance, a payroll–tax–funded program that provides income to people unable to work because of a disability until their condition improves, and which offers income payments if their condition does not improve. A person qualifies if, among other conditions, they have a physical or mental condition that prevents them from engaging in any "substantial gainful work," and the condition is expected to last at least 12 months or result in death. Although medical proof is needed to show their inability to work, eligibility is subject to manipulation by applicants. In this case, use of genetic information can improve the accuracy of the disability determination and thereby more effectively target the payments, with less manipulation.

welfare–reducing attributes. For example, a gene may reduce one's risk of cancer but increase one's risk of some other illness. Such effects would have to be netted out. Similarly, if an individual had a genetic marker for several expensive but nonfatal diseases, but also had a gene for longevity, that grim combination would also need to be taken into account.[29] It is also likely that many of the various genes that correlate with traits that we regard as distributively significant, and, hence, the endowment tax indices and sub–indices based on those genes, are also correlated with each other. Thus, for example, the genetic profile that correlates positively with "good judgment," if there were such a thing, might also be be associated statistically with "low risk of lung cancer." Or maybe not. But this sort of interactive effect would have to be worked out.

As it turns out, there is in fact a strong positive correlation between health status and earnings and, thus, probably also with earnings potential.[30] This fact implies that an endowment tax based on the potential health index alone would also automatically capture some of the differences in earning potential. Put differently, an individual's genetic health status by itself might well be a useful tag. The correlation between health and income, however, is neither perfect nor universal. Some people with good health genes will have low earning power, and some with bad health genes will be high earners.[31] Whether the benefits of fine–tuning the tags to adjust for these possibilities would exceed the costs of doing so is an open question.

Even if an index of the sort we are imagining were created, presumably science would continue to develop over time, and more information would emerge on the connections between various genes and potential earnings or potential health. Also, the "tractability" of the factors could change. There could also be changes in the relative market value of various abilities or the costs of various illnesses. Thus, as mentioned above, having the good–at–math gene might be extremely valuable during one historical period, and then much less valuable in another. As a result, periodic adjustments to individuals' endowment indices and sub–indices would have to be made by the taxing authority if the accuracy of the indices were to be kept up to date. In theory, this could be handled in year–to–year adjustments to an individual's tax liability, as the overall index is recalculated for each individual based on the most current science available. Of course, some level of inaccuracy in the indices would be acceptable, a fact that suggests that constant updating may not be required. The fact, however, that the genetic endowment index, and, thus, the endowment tax, could change from year to year could be seen as a grounds for criticizing the endowment tax idea, and for preferring an income or consumption tax, which do not require continual modifications based on scientific progress.[32]

[29] The possibility of a longevity gene creates special complications. For example, imagine that, if an individual has this gene, her life expectancy is five years longer than the average. Now, if we are implementing a genetic endowment tax that is based on ability to earn as well as healthcare expenditures, should this person pay an extra tax (because she will be around longer to make more money) or receive a transfer (since she will be around longer and have greater consumption needs)?

[30] See, for example, Smith (1999).

[31] If, counterfactually, the correlation were to go the other way (if high earners tended to be less healthy), the two indices would have to be netted against each other in some way, and the use of the health tag alone might be problematic. One could even imagine a situation in which the optimal transfer would be from the (on average rich) sick to the (on average poor) healthy, or in the opposite direction, depending on the relative magnitude of the two indices.

[32] Although the optimal income tax would change as new evidence became available, such as new information about the elasticity of taxable income at various income levels or on the distribution of earning ability.

It is important here to emphasize that these genetic indices would, at best, reflect *estimates* of potential future earnings and future health. That is just how genes work. Although there are some diseases that seem to be wholly caused by a person's genes (Huntington's disease being the most famous example), most of the information that genes provide about health (and presumably about future earnings as well) would be estimates of probabilities; and the actual future health or earnings of an individual will depend on a combination of genetic predisposition and factors that bear on how the genome is "expressed," which can include choices that the individual makes as well as pure brute luck. Thus, just as having the lung–cancer gene (if one exists) would probably only mean that a person has a higher–than–average chance of getting lung cancer, having the good–at–math gene would only mean that a person has a higher–than–average chance of turning out to be a math whiz.

The Market Response to the Spread of Genetic Information and the Potential Government Counter Responses

Whether or not tax–and–transfer policy reacts to the availability of genetic information, private markets almost certainly will, unless the government steps in to prevent it. In this section we discuss some of the possible market responses, the benefits and costs of regulation of private use of this information, and whether these market responses suggest a reassessment of a gene–based tax–and–transfer system.

Imagine that the scientific advances in identifying genes that determine or influence potential earnings and potential health status described above become a reality and that such information becomes available to private parties, not merely to the individuals themselves (who might or might not want to know what their genetic future holds), but also to potential employers and insurers. We can imagine both employers and insurers putting this information to use. For example, potential employers would have an incentive to use the various genetic predictors of ability (such as those correlated with aptitude in math and abstract reasoning, good judgment, perseverance, amiable personality, and so on) to help them select the right people for the right jobs. Likewise, if there are industrial jobs that are best performed by people with special resistance to certain toxins, or jobs best held by people with specialized aptitudes, genetic testing may facilitate such efficient, social–welfare–enhancing job sorting. Indeed, with personality and aptitude tests that some employers already use, this type of job–sorting already occurs, though perhaps with less accuracy than would be the case if the genetic markers could also be used.

Genetically informed job sorting, thus, could well increase overall social welfare. Not all private uses of genetic information, however, would necessarily be considered benign. Employers and insurers might also want to use some genetic markers in ways that society regards as illegitimate reasons for distinguishing among people in employment decisions, and the law could prohibit the use of those markers—just as the law already prohibits the use of such criteria as race, gender, and age in employment decisions.[33] In addition, employers, and especially health insurers, would be very interested in an individual's potential health status, although not every employer and insurer would necessarily be equally interested in the same combination of health–related genes. For example, insurers who offer standard

[33] For example, some may object to the use of a genetic test for potential aptitude in place of an actual aptitude test. However, presumably an employer would use the combination of genetic and actual aptitude tests that would produce the most accurate overall prediction of likely job performance.

health insurance coverage would want to know an individual's genetic predisposition to various diseases that produce significant lifetime medical expenses. Indeed, such information would allow them to charge extremely "accurate" (in terms of actuarial accuracy) premiums to very narrowly drawn risk pools. Of course, for those individuals with a very strong genetic predisposition to the most expensive diseases, health insurance may well become cost–prohibitive. In addition, insofar as employers provide health insurance to their employees, or they serve as the underwriters of self–insured health benefit plans for their employees, as is often currently the case, the two effects would exacerbate each other: employers would be inclined not to insure, or hire at all, those with genetically predicted poor health.[34]

The market process just described, at least when it occurs in the insurance context, is often referred to as risk segregation or risk classification. It is an almost inevitable result of competition among employers and insurers. And it is normally considered to be efficiency enhancing. Accurate risk segregation, for example, helps insurance markets to function by allowing insurers to combat the problem of adverse selection due to asymmetric information, the tendency of relatively high–risk individuals to select into insurance pools, driving up the average cost of the pool and pricing some people out of the market. Obviously, the problem of adverse selection could become much worse in a world in which individuals themselves have access to their own genetic health profiles, but insurers do not. Thus, if individuals who might have a genetic predisposition to certain debilitating and expensive diseases had access to that information and insurance companies did not, health and disability insurance markets might not be sustainable (depending on how many individuals had those genes.) Genetic risk segregation can prevent this sort of collapse of insurance pools due to genetically motivated adverse selection. More generally, fine–tuned risk segregation in insurance markets facilitates the pricing of insurance according to individual risk characteristics.

To the extent, however, that differences in health risks are genetically determined (and, thus, are outside of the control of the individual), there is an obvious tension between the notion that individuals should pay insurance premiums that are actuarially fair (that reflect their expected costs to the insurance company) and society's concern with distributive justice, discussed above. That is, we mentioned above the fact that lawmakers might decide to increase social welfare through transfers from those with better genetic health prospects to those with worse genetic health prospects, just as lawmakers might decide to make transfers from high potential earners to low potential earners. The point of both sorts of transfers is to equalize the social marginal utility of income across individuals, and thereby maximize overall utility or welfare. When insurance companies can charge premiums that reflect genetically determined risks, however, it cuts in exactly the opposite direction. Rather than transferring from the better off to the less well off, genetically "accurate" insurance premiums reproduce the status quo: those with better genes pay less, while those with worse genes pay more. Again, this is the result of competition among insurers.

[34] Life insurance markets would also be affected. Life insurance companies would use the health–status sub–indices relating to longevity to determine how much to charge for life insurance premiums, and individuals with genetic markers for high risk of cancer and heart disease would either be forced to pay very high life insurance premiums or go uninsured.

Given this world of insurers competing to price their policies to maximize profits and of employers seeking to place employees in the jobs that maximize the employers' profits, and assuming for now that society (again, on welfarist or utilitarian grounds) wishes to reduce some of the inequality between the genetically rich and genetically poor, there are at least two obvious policy responses to the spread of genetic information. First, we could allow genetic risk segregation and job sorting to take place and then redistribute through a direct tax–and–transfer policy, as outlined in the previous section, perhaps through a tagging system added to an existing income tax regime; this would achieve the efficiency gains in insurance and labor markets without any unwanted distributional consequences. Alternatively, we could forgo the tagging approach and instead adopt insurance and employment laws forbidding genetic discrimination—that is, forbidding the use of genetic information in employment and insurance contexts.

At first blush, forbidding the use of genetic information by insurers would seem to have much the same effect as allowing them to use the genetic information but then enacting a redistributive tax–and–transfer system to undo the effect of the insurance discrimination. What's more, the anti–discrimination approach has the benefit of automatically calculating the welfare equalizing amount of transfer that occurs within the insurance pool; that is, the transfer (or cross–subsidization) from low–risk to high–risk individuals will exactly offset the genetically determined difference in pre–insurance well–being.[35] This type of indirect transfer regime, however, has some problems. First, there may be some fairness concerns with redistributing only from the genetically lucky to the genetically unlucky within an insurance pool that does not include everyone in society. That is, if the tax–and–transfer system were used to equalize between the genetically healthy and genetically unhealthy, the redistribution could be from everyone in society with the good genes to everyone in society with the bad genes. In general, spreading the redistribution over a larger base reduces the overall welfare cost of the redistributive regime. By contrast, if the regulatory approach is used—causing indirect transfers *within* insurance pools due to the rule against genetic discrimination—redistribution is more haphazard; it will be more effective for people in large pools than for those in small pools. Second, if insurers are forbidden to use genetic information but insurance applicants can use it, the potential for adverse selection is obvious. Third, if insurers cannot use genetic information, moral hazard problems arise as well. For example, if there were a gene that revealed only a predisposition to a certain disease (say, heart disease or cancer), insurers might be able to use that information to encourage those who are insured to take special steps to reduce their risks, such as through diet or exercise.[36] Forbidding the use of that information could actually impede appropriate medical treatment in that case.

All of these factors suggest that, if the government is going to adopt a redistributive response to the spread of genetic information, the best approach might be to allow insurers and employers to use genetic information, but then adopt an explicit genetic endowment tax regime (via tagging) that reduces the inequality between the genetic haves

35 This conclusion assumes that the insurance fully covers the risk that is insured.

36 Note that the Genetic Information Nondiscrimination Act of 2008 does allow insurance companies to urge patients to take appropriate genetic tests so as to help find the best, cost–effective therapy.

and have–nots.[37] Interestingly, the law in the U.S. seems to have gone the other way. As we have already noted, there is no explicit genetic endowment tax–and–transfer regime currently in the U.S., while most state governments in the U.S. have adopted rules forbidding insurers from using genetic testing in their underwriting procedures, and some have done the same with employment practices.[38] What is interesting for present purposes is the following observation: insofar as we have laws forbidding the use of genetic information, *there is a sense in which we already have policy that in some ways mimics a form of genetic endowment tax, though an imperfect one (and perhaps not even the best one we could have).*

This fact should, in our view, lead to a reframing of the debate over the endowment tax idea. That is, given the reality of the marketplace, and given the state anti–discrimination laws that have been adopted in response to the spread of genetic information, we already have policy akin to a form of endowment tax regime, one that is administered indirectly through employment and insurance markets. Thus, those who object to the "forced labor" or "wage slavery" associated with a direct endowment tax should also be concerned with the forced–labor effect of an indirect endowment tax. Thus, when an insurer, due to a state law against genetic discrimination, is forced to charge a genetically healthy individual a higher premium than she would have been charged if the insurer had been allowed to charge lower, actuarially fair (and genetically discriminatory) premiums, there would be a sort of "income effect." The individual with the "healthy" genetic makeup would have to work harder or longer hours at her job, or might even have to switch to a higher–paying job, to achieve the same level of consumption that she would under an actuarially fair insurance regime. As with the direct endowment tax, there would be no distortion in her choices, no substitution effect, as the "tax" (that is, the difference between her actual insurance premium and the actuarially fair insurance premium) is lump–sum based on the individual's genetic profile. But there could certainly be an income effect, of the sort that has raised concerns among endowment tax critics.

Thus, at this point, the relevant question is not whether to adopt an endowment tax regime, but whether to alter the one we effectively already have (by making genetic discrimination fully legal in all contexts). What the next subsection points out is that, even if policymakers chose to alter the existing indirect genetic endowment regime (that is, to repeal all of the laws forbidding the use of genetic information in insurance and employment markets), the market may yet respond again—this time with its own form of an endowment tax–and–transfer system, which we call endowment insurance.

Genetic Endowment Insurance

Let us for now assume that policymakers do decide to repeal the existing implicit genetic endowment transfer regime (by repealing laws against genetic discrimination) and decide also not to pursue an explicit genetic endowment tagging regime of the sort described above. What this means is that employers and insurers are allowed to require genetic testing of their applicants, and are allowed to use

[37] Note, however that there is less of a case for using an anti–discrimination principle instead of a genetic endowment tax if (a) there is universal compulsory health insurance (eliminating the adverse selection problem and the concern about unfairly burdening a small pool of contributors) and (b) the anti–discrimination principle is applied only to diseases or conditions that are fully genetically determined (such as Huntington's disease) where there is no, or relatively little, moral hazard concern (see Logue and Avraham (2003)).

[38] See sources cited above in footnote 15, and also Rothstein (2001).

the information as they see fit. Assume also, of course, that individuals can have themselves tested and learn their own genetic makeup. One significant result of this set of assumptions that has significant consequences is that, at the moment an individual is born—indeed earlier, at the moment of conception (or the moment when sperm and egg combine to create a new set of chromosomes with its own complement of genetic material and that material can be analyzed without harm to the fetus) or upon genetic testing of the parents—much can be learned about that individual's future prospects. Indeed, assuming technological advances have given us the genetic endowment indices described above, we can know whether the individual is, overall, in terms of her inherited genetic endowment, rich, poor, or average.

In the absence of a genetic endowment tax regime, what might we expect to happen? One possibility is the rise of a private market in genetic endowment insurance.[39] One way to see this point is from the perspective of a risk–averse couple that is thinking about having a child. They know their own genetic endowments and, thus, have the ability to estimate the probability distribution of possible genetic endowments for their child. But they cannot be sure of exactly what genetic draw their child will receive. Putting aside for now the prospect of genetic engineering, there is some irreducible degree of uncertainty as to what their child's mix of genetic material will be. This concerns the prospective parents both because they care about the child and want him or her to have a good life, or at least not to have to bear the burden of a low genetic endowment, and because they know that their own prospects are tied to those of the child, since the child's consumption and medical needs will be their responsibility (at least for 18 years or so) and since they may be hoping the child will become rich and support them in their old age. So this genetic score means a lot to them.

Enter the genetic endowment insurer, which offers to sell the couple a policy that covers the family against the risk that the child will end up with a below–average genetic endowment. The policy is written and sold before conception, with a premium based presumably on the parent's own genetic endowment indices. After conception, when the fetus's genes can be tested, the test is given, and the policy either pays off or it does not. If the child is found to have a low genetic endowment, the family receives a lump–sum payment, which the parents can then invest in a deferred annuity on behalf of the child, the proceeds of which can be used to fund the extra medical expenses or to make up for loss of lifetime earnings due to the child's genetic endowment. Thus, a transfer is made to the families of the genetically unlucky children and, in a sense (because only the unlucky ones receive the insurance payout, though all pay into the pool), a tax is imposed on the families of the genetically lucky children. Of course, if policymakers are concerned that the parents of the genetically lucky children will squander the insurance

[39] Another possible repercussion is the rise of genetic engineering or eugenics, the incentive for which will depend on the genetic regulatory and tax–and–transfer policies in place, and any behavioral response to which belies our labeling such policies as having no effect on behavior other than an income effect. It is also possible, of course, that in some future world, technology may enable prospective parents to choose the DNA of their children or at least to have some level of control or choice in the matter. To the extent that were to happen, genetic markers, even if statistically correlated with well–being, would no longer be ideal tax tags, as they would no longer be immutable from an ex ante perspective. A discussion of the ramifications of this, and other related issues such as selective abortion, for our argument is best left for another time, beyond noting that using a genetic tag in the tax–and–transfer system will reduce the incentive to undertake these gene–improving activities and on average reduces the long–term average genetic endowment in the same way that an income tax affects income–producing activities.

money, they could adopt a rule requiring that the insurance proceeds be invested and spent a certain way, but this idea again takes us down the road of government intervention. The more government involvement there is, the more restriction there is on how the money is spent and perhaps on the amount of premiums that can be collected, the more a world of privately provided genetic endowment insurance begins to look like a regime of direct genetic endowment taxation of the sort described above, but administered through private insurers as tax collectors.[40]

The idea of genetic endowment insurance may seem farfetched, but it is less outlandish than one might think. Whenever a parent purchases life insurance on their young child, they are effectively purchasing genetic endowment insurance of sorts. That is, they are effectively purchasing insurance against the possibility that the child will someday reveal a genetic predisposition to an illness that will make him uninsurable. This is explicitly how the insurance is marketed.[41] It is only a few steps from this relatively common form of insurance to a broader market for insurance against bad health or ability genes. What is interesting about the idea for present purposes is that *such genetic endowment insurance would, if feasible, constitute a privately provided, wholly voluntary system of endowment taxation and transfer*.

To the extent the government gets involved in the problem of genetic inequality—and either adopts an explicit form of genetic endowment adjustment to the income tax or (through, for example, antidiscrimination rules) adopts regulatory policies that reproduce many of the effects of a form of genetic endowment tax—the demand for, and, thus, the market for, genetic endowment insurance would disappear. What this observation suggests is that privately provided genetic endowment or a system–of–government–provided genetic endowment taxes and transfers are substitutes for each other. This should come as no surprise. It has often been observed that the existing tax–and–transfer regimes are akin to insurance for the as–yet unborn against the possibility that they will be born with a low endowment.[42]

Note that both government–provided and privately provided genetic endowment insurance covers only the risk of an unfavorable genetic draw, and does not provide insurance against other types of risk. For example, even if there were a genetic endowment tax–and–transfer regime or alternatively if there were a private market in genetic endowment insurance, neither form of protection would address the risk that the economy might change over time to render an individual's initial endowment less valuable or the risk

[40] This discussion highlights one interesting aspect of the rise of genetic endowment indices that we have not yet discussed, and that is absent from the literatures on endowment taxation and genetic discrimination: each time there is a new discovery linking a particular gene to a particular disease, that discovery has the qualities of a one–time lump–sum wealth tax on all individuals who have that gene, whether born or unborn. That is, if you are alive at the time the discovery is made, then, in the absence of a system of redistribution or cross subsidization, you are essentially subject to a lump–sum tax equal to the present value of the lifetime expected costs of having that gene. (And if you have any plans to produce children, the tax must be multiplied by some inheritance factor.) This conclusion, however, assumes the absence of a market in genetic endowment insurance.

[41] For example, see www.afadvantage.com, where the pitch for such insurance is "No matter what health problems may develop in years to come, the policy cannot be cancelled."

[42] Sinn (2003) makes such an argument, stressing the possibility that cross–country mobility of individuals and capital will erode the ability of countries to provide such insurance. Compare the classic argument of Harsanyi (1955), who develops an approach to optimal progressivity based on risk–averse individuals choosing the tax–and–transfer system in an "orignal position" where no individual has any information about what ability they will draw from a known distribution.

that the individual might come down with some debilitating disease, whatever her genetic predisposition for such a disease might be. To put the point differently, how an individual's life turns out, in terms of overall well–being (including income, health, etc.), is a function both of her initial genetic endowment and post–birth brute luck, as well as many other factors; genetic endowment insurance—whether government– or privately provided—only addresses the first.[43] Of course, other types of government transfer programs, as well as other types of private insurance policies, might serve as insurance against these other sorts of risk. For example, the progressive income tax and privately purchased insurance contracts provide coverage against the possibility of extreme ex post outcomes. Such conventional forms of insurance, however, raise all of the familiar moral hazard problems associated with standard forms of insurance; further discussion of such insurance is beyond the scope of this particular essay.

CONCLUSION

Advances in genetic research raise the prospect of loosening the tradeoff between progressivity and efficiency by allowing tax liability (or transfer eligibility) to be based in part on immutable characteristics of individuals ("tags") that are correlated with their expected lot in life. Use of genetic tags would reduce reliance on tax bases (such as income) that are subject to individual choices and, therefore, subject to inefficient distortion to those choices. Taking advantage of this information will allow policy outcomes that dominate the outcome menu available without using genetic information as a tag—everyone can be made better off. The same distributional outcome can be attained with less cost to the economy.

Thus, our first contribution to the endowment tax literature is the observation that the spread of genetic information bears on optimal tax design, to the extent that genetic information is observable and provides nearly immutable tags for overall well–being. Our second contribution is to point out that, as genetic information spreads to private employers and insurers (and assuming that, in contrast to the current situation, the law did not effectively prevent them from using such information), the case for adopting some kind of a genetic endowment tax becomes more compelling, as genetic inequalities would be exacerbated by market forces. If society desires to reduce or eliminate such inequalities, to maximize overall utility by shifting resources from the genetic rich to the genetic poor, at least two potential policy instruments are available: a direct genetic endowment tax–and–transfer regime or a regulatory regime that forbids genetic discrimination and forces genetic cross–subsidization.

REFERENCES

Ackermann, Bruce A., and Anne Alstott. *The Stakeholder Society*. New Haven: Yale University Press, 1999.

Adler, Matthew D., and Chris William Sanchirico. "Inequality and Uncertainty: Theory and Legal Applications." *University of Pennsylvania Law Review* 155 No. 2 (December, 2006): 279–377.

Akerlof, George A. "The Economics of 'Tagging' as Applied to the Optimal Income Tax, Welfare Programs, and Manpower Planning." *American Economic Review* 68 No. 1 (March, 1978): 8–19.

Allingham, Maurice G. "Towards an Ability Tax." *Journal of Public Economics* 4 No. 4 (November, 1975): 361–76.

[43] Dan Shaviro helped us to see this point. For a more general discussion of the tension within welfarist policy analysis between ex ante and ex post perspectives in circumstances in which there is a societal preference for reducing inequality, see Adler and Sanchirico (2006).

Burdick, Katherine E., Todd Lencz, Birgit Funke, Christine T. Finn, Philip R. Szeszko, John M. Kane, Raju Kucherlapati, and Anil K. Malhotra.
"Genetic Variation in *DTNBP1* Influences General Cognitive Ability." *Human Molecular Genetics* 15 No. 10 (May, 2006): 1563–8.

Diver, Colin S., and Jane Maslow Cohen. "Genophobia: What Is Wrong with Genetic Discrimination?" *University of Pennsylvania Law Review* 149 No. 5 (May, 2001): 1439–82.

Dworkin, Ronald.
"What Is Equality? Part I: Equality of Welfare." *Philosophy & Public Affairs* 10 No. 3 (Summer, 1981a): 185–246.

Dworkin, Ronald.
"What Is Equality? Part II: Equality of Resources." *Philosophy & Public Affairs* 10 No. 4 (Autumn, 1981b): 283–345.

Edgeworth, Francis Y.
"The Pure Theory of Taxation." *Economic Journal* 7 No. 25 (March, 1897): 46–70.

Edgeworth, Francis Y.
"The Pure Theory of Taxation: II." *Economic Journal* 7 No. 26 (June, 1897): 226–38.

Edgeworth, Francis Y.
"The Pure Theory of Taxation: III." *Economic Journal* 7 No. 28 (December, 1897): 550–71.

Harsanyi, John C.
"Cardinal Welfare, Individualistic Ethics, and Interpersonal Comparisons of Utility." *Journal of Political Economy* 63 No. 4 (August, 1955): 309–21.

Hasen, David.
"Liberalism and Ability Taxation." *Texas Law Review* 85 No. 5 (April, 2007): 1057–113.

Kaplow, Louis.
"Human Capital under an Ideal Income Tax." *Virginia Law Review* 80 No. 7 (October, 1994): 1477–514.

Kaplow, Louis, and Steven Shavell.
"Why the Legal System Is Less Efficient than the Income Tax In Redistributing Income." *Journal of Legal Studies* 23 (1994): 667–81.

Langreth, Robert, and Mathew Herper.
"12 Gene Tests that Could Save Your Life." *Forbes.Com*. 31 May 2007.

Logue, Kyle D.
"Reparations as Redistribution." *Boston University Law Review* 84 No. 5 (December, 2004): 1319–79.

Logue, Kyle D., and Ronen Avraham.
"Redistributing Optimally: Of Tax Rules, Legal Rules, and Insurance." *Tax Law Review* 56 No. 2 (Winter, 2003): 157–257.

Mankiw, N. Gregory, and Matthew Weinzierl.
"The Optimal Taxation of Height: A Case Study of Utilitarian Income Distribution." Harvard University. Mimeo, April 13, 2007.

Mirrlees, James. "
An Exploration in the Theory of Optimum Taxation." *Review of Economic Studies* 38 No. 2 (April, 1971): 175–208.

Murphy, Liam, and Thomas Nagel.
The Myth of Ownership: Taxes and Justice. Oxford: Oxford University Press, 2002.

Nesser, Ulric, Gwyneth Boodoo, Thomas J. Bouchard, Jr., A. Wade Boykin, Nathan Brody, Stephen J. Ceci, Diane F. Halpern, John C. Loehlin, Robert Perloff, Robert J. Sternberg, and Susana Urbina.
"Intelligence: Knowns and Unknowns." *American Psychologist* 51 No. 2 (February, 1996): 77–101.

Rakowski, Eric.
"Can Wealth Taxes Be Justified?" *Tax Law Review* 53 No. 3 (Spring, 2000): 263–376.

Rawls, John.
Justice as Fairness: A Restatement. Cambridge: Belknap Press, 2001.

Reilly, Philip R.
"Laws to Regulate the Use of Genetic Information." In *Genetic Secrets: Protecting Privacy and Confidentiality in the Genetic Era*, edited by Mark A. Rothstein, 369–91. New Haven: Yale University Press, 1997.

Rothenberg, Karen H.
"Genetic Information and Health Insurance: State Legislative Approaches." *Journal of Law, Medicine, & Ethics* 23 No. 4 (1995): 312–9.

Rothstein, Mark A.
"Predictive Genetic Testing for Alzheimer's Disease in Long–Term Care Insurance." *Georgia Law Review* 35 No. 2 (Winter, 2001): 707–33.

Rugnetta, Michael, Jonathan Russell, and Jonathan Moreno.
"Genetic Non–Discrimination: Policy Considerations in the Age of Genetic Medicine." Washington, D.C.: Center for American Progress, April, 2008.

Sanchirico, Chris William.
"Deconstructing the New Efficiency Rationale." *Cornell Law Review* 86 No. 5 (July, 2001): 1003–89.

Shaviro, Daniel N.
"Inequality, Wealth, and Endowment." *Tax Law Review* 53 No. 3 (Spring, 2000): 397–422.

Sinn, Hans–Werner.
The New Systems Competition. Oxford: Blackwell Publishing, 2003.

Slemrod, Joel.
"Taxation and Big Brother: Information, Personalization, and Privacy in 21st Century Tax Policy." *Fiscal Studies* 27 No. 1 (March, 2006): 1–15.

Smith, James P.
"Healthy Bodies and Thick Wallets: The Dual Relation between Health and Economic Status." *Journal of Economic Perspectives* 13 No. 2 (Spring, 1999): 145–66.

Stark, Kirk.
"Enslaving the Beachcomber: Some Thoughts on the Liberty Objection to Endowment Taxation." *Canadian Journal of Law and Jurisprudence* 18 No. 1 (January, 2005): 47–68.

Stern, Nicholas.
"Optimum Taxation with Errors in Administration." *Journal of Public Economics* 17 No. 2 (March, 1982): 181–211.

Tang, Ya–Ping, Eiji Shimizu, Gilles R. Dube, Claire Rampon, Geoffrey A. Kerchner, Min Zhuo, Guosong Liu, and Joe Z. Tsien.
"Genetic Enhancement of Learning and Memory in Mice." *Nature* 401 No. 6748 (September, 1999): 63–9.

Wade, Nicholas.
"Scientists Identify 7 New Diabetes Genes." *New York Times* (April 27, 2007a).

Wade, Nicholas.
"Gene Identified as Risk Factor for Heart Ills." *New York Times* (May 4, 2007b).

Zelenak, Lawrence.
"Taxing Endowment." *Duke Law Journal* 55 No. 6 (April, 2006): 1145–81.