# "No Solution to This Dilemma Exists": Discrimination, Insurance, and the Human Genome Project

**Department of Economics**
**University of Guelph**
**Discussion Paper Number 2008-8**

August, 2008

Michael Hoy
Department of Economics
University of Guelph
Guelph, ON, N1G 2W1
Canada

Michael Ruse
Department of Philosophy
Florida State University
Tallahassee, Fl., 32306
USA

## Abstract

The debate about whether insurance companies should be allowed to use results of genetic tests for underwriting purposes is both lively and increasingly relevant as both technology and lawmaking efforts are progressing rapidly. Much concern has been raised about whether allowing firms to use such information to create risk-rated insurance premiums (genetic ratemaking) is unfairly discriminatory. We show that, especially in the context of the manner in which insurance markets operate, arguments about the appropriateness of allowing such information use by insurers which are based on discrimination are very fragile from a conceptual or philosophical perspective. Moreover, a focus on discrimination is not very helpful from a pragmatic or policy oriented perspective. We argue that adopting a Utilitarian welfare framework, as inspired by Harsanyi's (1953,1955) veil of ignorance interpretation, in order to determine whether risk-rating by use of genetic test results is morally defensible provides a much more promising line of reasoning for settling this controversial issue.

## I. Introduction

The now-completed Human Genome Project has been hailed as a major step forward, not just in scientific understanding, but also in human health care. It has been recognized for some time, for example see Alper and Natowicz, (1993) and Kitcher (1996)[i], that there is potential for discrimination against the genetically disadvantaged or otherwise affected most notably in the area of insurance. Now that work has moved on quite far to finding genetic variants – the International HapMap Project – and to identifying those with bad effects, it is realized increasingly that all such work creates new social problems and exacerbates already-existing difficulties. There is concern that people who are found to have the "wrong" sorts of genes will be unable to get adequate medical coverage, or be refused certain kinds of jobs, or find life insurance premiums set at such a high level that such insurance will be effectively refused. This raises the concern about whether insurers should have access to genetic information (test results) of consumers in the same way as other medical information is currently used. Would allowing individuals to keep such information private create havoc in insurance markets? The philosophical and practical concerns are so worrisome and problematic that, in the opinion of some well-qualified commentators, "no solution to this dilemma exists" (Alper and Natowicz 1993, p. 1506).

The citizens of most Western countries, with the notable exception of the United States of America, receive universal health care and so, except for supplementary private health insurance typically available just for non-necessary elements of health care, the issue is not a major concern outside America.[ii] However, for life insurance it is a different matter. Life insurance is qualitatively different from health insurance. The need for health care tends to be objective at least in the context of a given society. If someone has appendicitis, the person requires and deserves an appendectomy. The cost of the procedure can be objectively measured. However, the desired amount of coverage for life insurance is a very subjective and idiosyncratic matter. It is therefore not easy to imagine what an appropriate universal life insurance system should look like. This is not, of course, to say that life insurance is not socially important. On the contrary, one can certainly argue that it is morally irresponsible for the main bread winner(s) of a family not to hold "adequate coverage". In fact, Bernheim, et al. (p. 361, 2003) find that "35.7 percent of poverty among surviving women … resulted from a failure to ensure an undiminished living

standard through insurance." This demonstrates the social importance of the private life insurance market. However, it is just that an "adequate" amount is not an easy or objective concept to measure which makes universal provision or even regulation a more complex issue when addressing life insurance.[iii]

The matter is so important socially that it would be wrong not to delve deeper into the controversial issue of who should have access to the personal information resulting from genetic tests. Simple intuition about what constitutes fair or unfair pricing practices based solely on a controversial argument about what is or is not morally unfair discrimination is not sufficient. Designing regulations to protect the (genetically) disadvantaged in society requires more thought. In fact, the level of controversy and complexity regarding how information obtained from genetic tests should be used in the life insurance market is so high that the result has been in fact the implementation of a broad range of regulations (see Knoppers, et al., 2004a). This is especially evident in Europe and other so-called Western countries. Response to this problem ranges from no regulations whatsoever, to voluntary moratoria that ban the use of genetic test results by the insurance industry (e.g., recently adopted in Germany and previously in France and the UK), to regulations that ban insurers from requesting any genetic information in their clients medical records (e.g., Austria, Belgium, Estonia, Luxembourg, Norway, and Denmark). The legislation in Belgium goes even further in that it doesn't allow insurers to accept (good) genetic test results that are voluntarily provided by consumers. Some countries, like the UK and Netherlands, allow insurers to request existing genetic test results only on policies that exceed some maximum amount or cap. In the UK this cap is currently set at £500,000 while in the Netherlands the cap was set at D.Fl. 300,000 (approximately $150,000 US) in 1998 and is adjusted every three years according to the cost-of-living index. In the UK the types of genetic tests that insurers may be privy to for policies exceeding the cap is also restricted to those genetic tests (diseases) that are judged to be "relevant" by a committee which is independent of the insurance industry. Clearly, there is a very wide range of responses in reaction to concern about how genetic information should be used by life insurers. We believe this reflects the fundamental problems of coming to grips with the basic issues of what constitutes discrimination and how one believes regulations about this type of information will affect the operation of the insurance market.

In the USA the legislative focus has been on health insurance rather than on life

insurance. This is natural given that European countries, and Canada, have strong public healthcare systems that don't risk rate premiums on any basis, let along genetic test results. In the USA at the state level there have been myriad regulations with varying types of restrictions on the use of genetic tests by insurers and employers. At the federal level the U.S. House of Representatives recently (March 5, 2008) passed the Genetic Nondiscrimination Act (GINA) as part of the Paul Wellstone Mental Health and Addiction Equity Act of 2007.[iv] The goal of this act, which has yet to be voted on in the Senate, is to protect individuals against discrimination based on their genetic information when it comes to health insurance and employment. In Canada there is essentially no legislation regarding the use of personal genetic information for the purpose of pricing life insurance, while any concern with health insurance is essentially moot given the presence of the Canadian national health insurance scheme (see Knoppers, et al., 2004b).

Although conceptually there may be no perfect solution, in the sense that everyone can have what they want or even agree as to what are fair principles for deciding the issues, we believe that a deeper analysis than has been done thus far can provide positive and helpful advances concerning the design of regulations aimed at dealing with the concern of genetic discrimination. In particular, first we carefully map out the philosophic underpinnings related to notions of unfair discrimination and highlight the existing controversies. In light of the various arguments put forward, we consider the impact of regulations on insurers' use of genetic information. We do this in the context of a well-developed economics literature that demonstrates how an imbalance in the information held by insureds versus insurers will play out in the design of insurance contracts. We add to this analysis by performing a range of standard normative principles, from Utilitarianism to Rawlsianism as well as considerations of discrimination and freedom, to assess the morality and the impact on human well-being of the well-meaning regulations. We demonstrate that, although it is not easy to obtain a coherent picture that allows one to determine the best regulatory response to increasing amounts of genetic information, we can avoid many of the pitfalls of earlier analyses that have fallen short of providing clear and non-controversial recommendations. In particular, we argue that concern regarding what information about an individual should be judged as morally fair or unfair to use in insurance pricing should not be based on the type of information per se, but rather should depend on the implications of using or not using the information in a given context. If there is

only "a little" genetic information available to a pool of insureds, then a regulation that bans its use by insurers is probably the best response. However, as the amount of such information grows, as we expect it may well do over the next 10 to 20 years, a strong case can be made to allow insurers to use such information, at least beyond some limited coverage requested by insureds.[v]

## II. Outlining the Case of Genetic Testing and Discrimination in Life Insurance

For simplicity, we shall focus on genes that have fairly unambiguous and inevitable effects. By this we mean genes that cause illnesses like Tay Sachs or Huntington's disease whatever the individual or others do. Such illnesses might be apparent from birth, might become apparent over time, or might be carried silently by parents and express themselves only in some or all offspring. We shall avoid the complication of genes that might (or more likely might) have bad effects only if the individual pursues some course of action, or fails to pursue some course of action (i.e., multifactorial genetic diseases). An example of such a more complicating gene is one that dramatically increases one's predisposition to breast cancer (such as the BRCA1/2 genes) but where the likelihood may be significantly reduced through an early double mastectomy or a drug treatment like tamoxifen. We believe that tackling such more complex cases first demands building our simpler analysis. For those cases where the likelihood of disease depends on some interaction between one's genetic endowment *and* one's personal choices creates additional challenges to any considerations of how alternative policies measure up in terms of discriminatory effects. This is especially so in cases where behaviors themselves are affected by genes, whether this is known or unknown.[vi]

### *Two kinds of prejudice*

Let us start with the case of medical insurance. We accept the general opinion that, if society deems it important – whether for expedient or moral reasons – that some basic general level of health care be available to all of its citizens, then the government must be involved. This could be either through offering some kind of universal, government-run system or through regulating for-profit insurance firms in the financial care they offer. This reduces the question of

appropriate pricing behavior to the issue of (non-necessary) supplemental health insurance. However, we begin with this case in order to lay out the issues involved in discrimination or prejudice since this is where the most heightened moral issues come into play.

What about the possibility and right of buying supplemental medical insurance? A state-backed system cannot offer everything, in every way, to every person. There are going to have to be some rules and restrictions. Although some people may be willing to pay huge taxes to support a magnificent system, others surely have the right (and power) to prevent indefinite spending. Hence, in reality, resources in a public health care system will be limited and person A with a serious disease is going to have to get priority over person B with a less serious disease. Suppose, however, someone wants access to a non-covered treatment or to be able to jump the queue for treatment or to have total freedom of choice about the place and nature of treatment? Would allowing such choices create discrimination for those who are genetically disadvantaged? Should one be able to purchase insurance from a private firm so that they can use the doctor of their choice? Does the price for such an option need to be the same regardless of genetic risk?

Some modern societies have answered "yes" to this question. Some have answered "no." In Britain, for instance, along with the National Health Service, there is a private sector (often involving the same institutions and the same doctors). Everyone is guaranteed basic health care, but you can buy insurance to get preferential treatment. In Canada, to the contrary, there is effectively one health care system for all. Any doctor who takes one penny of private money is forced to drop right out of the public system, and very few do. It is felt that it would be wrong with something like health care to give special privileges to a select, probably rich few. At one level, one can say that this is all a matter of freedom versus equality. The British system values freedom over equality. The Canadian system values equality over freedom. At another level, one can say that this is all a matter of prejudice. The Canadian system feels that it is wrong to deny the less wealthy the right to the same care available to the rich. One would be prejudiced against the poor (or not rich). Note however that the British system can also appeal to a sense of prejudice, in this case against the rich. One is denying them certain freedoms because they are rich and others are not. Paradoxically, Britain has a well-established framework that attempts to protect the genetically unlucky in life insurance while no regulations whatsoever exist in Canada. This underlines the complexity of the issue.

Let us spell out in a little more detail these two notions of prejudice. The first, perhaps more common or morally compelling notion, involves discrimination against the unfortunate – sick, poor, or whatever. Let us call this *L(osers) Prejudice* since it is prejudice against the losers in the genetic lottery of life. This kind of prejudice occurs if you discriminate against someone, or more precisely if (as the language goes) you morally discriminate against someone. You merely discriminate if (say) you distinguish the better players from the worse on the grounds that you want to build a winning team; but you morally discriminate if you take one person rather than another person for reasons irrelevant to the end, if you take white players over black ones simply because they are white and not black. This kind of (moral) discrimination is involved if we refuse to allow blacks to use the same beaches as whites, or to allow women to have more than a small quota of places in medical school or veterinary college. It is the discrimination shown if we refuse to invite a child to a birthday party because and simply because they have Down's syndrome while all other children from the same school grade are invited. As far as birthday parties are concerned, having Down's syndrome is not a morally differentiating property as long as there aren't activities that would be somehow compromised. Perhaps with respect to entry to medical school it is, whereas gender would not be a relevant property.

We are prejudiced against and discriminate against the child with Down's syndrome excluded from the party and the woman excluded from medical school. Note that probably you need to bring in a reference to the group or society to get a full sense of prejudice or moral discrimination. The owner of a sports team may say: "I have nothing against blacks, but I cannot afford to have a team with mostly black players for my ticket buyers, who are mostly white, will not pay to see a mostly black team play." Such a case generates additional complexity.

There is analogously another sense of prejudice, which we can call *W(inners) prejudice*, where we discriminate against the fortunate, because in some sense they are fortunate. (In other words, it has to be a morally relevant property going the other way. The Forbes list of the 100 richest Americans is not discrimination in this sense.) If one turns against bright children just because they are bright – sneering at them because they always want to answer the question first, for instance – this is moral discrimination. It is also moral discrimination if one does not allow them to develop their talents – if a school board refuses to offer any special faculties for the gifted, so that if anything they become bored and underachieve. One has a kind of converse of the kind of discrimination given first above. Whereas picking out the genetically disadvantaged

for differential treatment is morally undesirable, so likewise ignoring the gifted has morally undesirable consequences, and so qualifies as a morally differentiating property.

One matter which needs to be made straight when thinking about discrimination is the separation of ideas that are based on discrimination that is descriptive and that which is morality-based. To say one baseball player is "better" than another and deserves a higher salary as a result because he is more skilled can be thought of as an application of descriptive discrimination and the higher salary would presumably not be considered morally unfair. To say that an equally skilled black player should be paid less than a white player would be accepted by most people as unfair discrimination. There is still a descriptive difference in the latter case, but one that most would argue is immaterial to a difference in pay. Let us refer to this latter case as one in which it is not moral to use the differentiating property for the purpose proposed (i.e., less pay to the black player) and the former case as one in which it is; that is, skill is a morally differentiating property in that in the context of player-pay a differential can be supported on moral grounds. Insurance companies would argue that genetic background is a morally differentiating property in the context of charging differential premiums based on genetic test results because the expected cost of provision of insurance, or actuarial fairness, is the driving force behind price-setting for all policies. They think it unfair to penalize nature's fortunates.

> An insurance rate structure will be considered to be unfairly discriminatory... if, allowing for practical limitations, there are premium differences that do not correspond to expected losses and average expenses of if there are expected average cost differences that are not reflected in premium differences. (Williams 1969, 211-212)

An alternative view of what is a morally differentiating property can be developed on the basis of whether the property per se represents a moral difference. For example, consider the following non-compromising ethical argument regarding discrimination (see also, for example, Flew (1990)).

> It is morally wrong to discriminate against a moral being (or class of moral beings) unless that being (or class of moral beings) possesses a morally relevant differentiating property. …. Pargetter and Prior (1987, p. 129)

We take for granted that according to the above view genetic differences between people (per se) do not imply they are morally differentiated beings and so to assign different prices for the same level of insurance coverage would imply unfair discrimination. Another angle on this question is provided by Kahlenberg (1996) who places the focus on whether the differentiating attribute is 'immutable'. However, Boxill (1992) argues that certain immutable characteristics are valid criteria for differentiation along the lines of our baseball players having different intrinsic or innate abilities 'deserving' different pay levels. It is a delicate question whether the fact that 'bad genetic types' generate higher costs for the insurance pool creates reasonable or moral cause for differential treatment within the insurance market.

So, an appeal simply to rival intuitions about discrimination seems unlikely to be a fruitful basis for developing a set of regulations on the use of genetic test results for pricing in the life insurance market.[vii] We believe that since genetic tests can identify groups of individuals who are more costly to insure (i.e., generate higher expected claims), from the perspective of insurance pricing it is not sound reasoning to argue that this is not a morally relevant differentiating property. Individuals of different genotypes are descriptively different and it is hard to argue that this difference isn't relevant to a firm selling insurance. Of course, this in itself doesn't mean insurers should be allowed to use such information. Rather, we argue that in coming to a decision on the matter one shouldn't rely simply on whether the action can or cannot be determined to be discriminatory.

In our language, insurance companies accuse us of discriminating against the genetically advantaged if we do not allow that, for various reasons, some people are luckier than are others and we do not let them take advantage of this. And using this kind of language, we can now say that the Canadian health care system takes more seriously the matter of not discriminating against the disadvantaged whereas the British system at least in respects tries to alleviate discrimination against the advantaged. (The British system, having a universal system available to all, is obviously also concerned in major respects with discrimination against the unlucky. It is just that in allowing a parallel private system, it speaks to a concern about discriminating against the advantaged even though this might mean giving up some concern with discrimination against the disadvantaged.)

We move now to a consideration of insurance markets, with a primary focus on life insurance. Suppose you have two people, one (A) with a genetic defect that is going to lead to a

horrendous illness and substantially increase mortality risk, like Huntingdon's Chorea, while the other person (B) has no such genetic 'defect'. Perhaps more commonly, A has a 90% chance of developing some ailment but B has only a 5% chance of getting the ailment. Both A and B want to provide for their families and to buy life insurance. A private firm, let us call them the Friendly Insurance Company, will want to refuse insurance to A but to sell it to B, or at least charge A a much higher premium. In other words, at least from a societal point of view, there will be L prejudice against A. (The Friendly Company will presumably admit that they are discriminating but deny that it is moral discrimination. This is why prejudice needs a reference to society.) If the government steps in and forces Friendly to sell to A at the same terms as to B, then there will be W prejudice against B. Friendly will have to charge more for premiums to B than without the government regulation in order to counter losses from contracts sold to A. Thus, B will pay more under this regulation even though (at least according to the insurance company) he or she does not have a morally differentiating property leading to higher expected insurance payments. The same situation holds if the government decides to take over the insurance business itself. B will pay higher taxes (relative to benefits received) even though he or she does not have the morally differentiating property. In fact, the situation is even worse than this. Knowing of his or her affliction, A will probably want to buy more insurance than B. To stop A from doing this is L prejudice. The trouble is that as A buys more and more insurance, the overall cost of claims for the pool, and hence the price – whether via direct pricing or taxation - keep going up and this results in increased W prejudice against B who, if allowed under the government plan, buys less insurance as a result. This is especially poignant if one focuses on those families (survivors) of people like B who die and so end up with more financial hardship as a result of the government's well-intentioned efforts to reduce L prejudice.

What is to be done? One hardly wants to deter or to stop people from buying any life insurance at all. People surely have a right – many would say an obligation – to buy such insurance to protect themselves and their families. Probably many would agree with the tenor of Philip Kitcher's approach, namely that when push comes to shove, it is better to reduce L prejudice than W prejudice.[viii] After all, those subject to L prejudice have problems already. It is bad enough to know you are going to have Huntingdon's Chorea without also being told that you cannot protect your family after you are gone. Those who suffer W prejudice can console themselves that already they are life's fortunates and that is reward in itself. But what makes the

case difficult for a straightforward argument on the basis of discrimination is that it isn't clear how to assess discrimination in the first place.[ix] Should one determine whether discrimination has occurred by only considering price differences? Suppose insurers offer menus of contracts to everyone (as described in the following section) and these contracts have different prices and quantities of coverage. Can one then ascertain whether this is discriminatory? At first blush it seems nobody suffers discrimination in this circumstance since everyone gets the same choice set – say a pair of possible contracts - from which to choose. But what if each different risk type ends up consistently purchasing a specific contract for which the price per unit is higher while in the other contract the coverage level is restricted? One type is disadvantaged in regards to the price dimension while the other in regards to the quantity dimension. Should we ask how the different contracts are ranked within each genetic type's own preferences? As we will argue, the essence of insurance markets is one of uncertainty and heterogeneous products. So making the case for or against a ban on genetic ratemaking is a very shaky business if one sticks to some the norm of discrimination.[x]

Before considering the implications of possible government actions regarding concerns about genetic discrimination by insurers, we need to consider how insurers might respond to the sort of regulations we see brought forward. In economics terminology, if insureds know more about their risk levels than do insurers then we say the environment is one of asymmetric information leading to adverse selection. This latter term follows from the presumption that if insurance companies must charge all risks – be they high (bad) or low (good) risks – the same price for insurance, then the higher (worse) risks will find the price favorable relative to their loss probability and hence will purchase more than will the lower (better) risks. Hence, the insurance companies' portfolios of contracts will be more heavily weighted[xi] towards the bad risks and so this is referred to as *adverse selection*. The specific context of a ban on insurers using information available to insureds through genetic tests is an example of (regulatory) adverse selection.

There is a large economics literature that studies the various strategies that firms may use in response to asymmetric information.[xii] Here we describe only the basic or canonical models. Although in some insurance contexts the actual set of strategies that firms use are likely to be richer than these canonical models suggest[xiii], the models described below are sufficiently robust for our purposes and expanding the strategy set available to insurance companies would not

change the qualitative nature of our analysis.

## III. Description (Models) of the Insurance Market

Our goal in this section is to convey the essential insights that the economics of insurance literature has provided in understanding how the insurance market would operate under conditions of asymmetric information; that is, if insurance buyers have relevant information about their risk level that insurance companies are either intrinsically unable to ascertain or are not allowed to use in setting prices (ratemaking). This is precisely the environment that would be created by a ban on insurance companies using genetic test results that their potential customers may have. We illustrate the possible outcomes of an insurance market under conditions of asymmetric information using simple hypothetical examples.

There are a number of assumptions usually made to simplify the analysis of insurance markets and adopting "more realistic" assumptions do not alter the qualitative nature of the results as used for our purposes. To begin, the usual assumption made is that insurance companies behave in a risk-neutral, expected profit maximizing manner; that is, they concern themselves only with the expected value of profit and not the potential variability of profits. Moreover, administrative costs are generally ignored and it is presumed that the market is competitive (many sellers). These assumptions lead to the result that, at least under symmetric information, insurance prices will be set at actuarially fair rates. The key is whether these actuarially fair rates are risk-type specific (i.e., based on particular genotype) or are actuarially fair when averaged over the pool of different types.

*Case of Symmetric Information (insurers allowed to use available genetic information)*

If insurers have the same information relevant to determining risk type as do consumers, we say the market is characterized by symmetric information. This will be the situation when firms are allowed access to any genetic test results held by insureds (i.e., the consumers have no "hidden information").

In this scenario, each risk type would be charged the risk-type specific price for insurance (i.e., underwriting occurs uninhibited). At least in these idealized models, higher risk types are presumed to purchase just as much insurance as the lower risk types, even though they face a higher price. This follows because they also face a higher risk (probability of financial loss), which makes buying insurance more attractive, and these two factors exactly cancel out.[xiv]

The following notation facilitates our presentation. Let $p_L$ be the probability of death

(financial loss) for the low-risk type (i.e., for anyone who does not have one of the "bad" genes) and $p_H$ be the probability of death for the high-risk type (i.e., for anyone who does have one of the "bad" genes). Let $p_A$ be the pooled or average probability of death for the group as a whole. If q is the fraction of the population with the "bad" gene, then $p_A = q \cdot p_H + (1-q) \cdot p_L$. Assuming just two risk types is a useful simplification. Naturally, this probability has to be defined over some specific period of time. For the sake of our illustration, we will assume this is over a ten year period.

Now consider the following hypothetical numerical example, which provides a clear and simple demonstration of our various scenarios of insurance pricing. Suppose we assume there is one main breadwinner in the family, although this is not important. Suppose the insurable interest for this person's family in her life is L = $200,000 and that in the absence of this coverage the family would have only $20,000 at its disposal. The 'insurable interest' could be the amount the family feels they need in order to cover the income loss should this person die. Note that the so-called 'insurable interest' is a subjective matter, although for sake of simplicity we take these amounts to be literally the wealth or income that is available to the family; so if the breadwinner lives the family has $220,000 while if the breadwinner dies the family has $20,000. Suppose relevant parameters are $p_L = 0.01$, $p_H = 0.1$, and $q = 0.1$, and so $p_A = 0.019$. First we assume that individuals aren't aware of being of "different genetic types", which is often the case in the real world even now. The key here is that the high-risk types are ten times as likely to die over some period, which we are taking as 10 years in this example, but for now we simply assume this heterogeneity isn't known so people base their expectations on the overall population average mortality rate. The usual assumptions about insurance purchasing lead to the result that, since the price is perceived to be actuarially fair, each family decides to purchase full coverage ($200,000) life insurance for the 10-year period. In the absence of any information from genetic tests, with each individual and the insurance company being presumed to think of each person as an average or typical risk, the insurance cost for $200,000 of coverage would be $3,8000 (i.e., 0.019x200,000).

However, if all individuals have had genetic tests and so know whether they have the bad or good gene, those who do have one of the bad genes would be charged $20,000 over the ten years for the coverage (0.1x200,000) while those who have the good gene would be charged only $2,000 (0.01x200,000). Some would say this is price discrimination while others would say not. We return to this question, which is at the core of our concern, later. But first we consider what would happen if insurers aren't able to distinguish between risk types but each individual knows her risk type.

*How would insurance companies (or the market) respond to privately held information (asymmetric information) held by consumers (case of a ban on insurers using genetic information held by consumers)?*

There are two principal market reactions used to describe how the insurance market would respond to the scenario in which insurance buyers have privately held information about their risk type. To highlight the impact of asymmetric information, we again assume all individuals have taken a (perfectly informative) genetic test. Now, consider the two possible market reactions:

*I. Separating pair of contracts (self-selection)*

Our description of a separating pair of contracts is due to the seminal articles of Rothschild and Stiglitz (1976) and Wilson (1997).[xv] The idea is that the firm offers a pair of contracts, one being the full coverage policy of $200,000 at the risk-type specific actuarially fair price for high-risk types (i.e., at a cost of $20,000). A second policy is offered with less than full coverage but at the unit price which is actuarially fair for low-risk types. The amount of coverage included for this contract is reduced from $200,000 by an amount that is just sufficient to make it less desirable to the high-risk types than the full-coverage / high-price contract that is "designed" for the high-risk types. Suppose this second contract involves $120,000 worth of coverage (i.e., 60% of the insurable loss) so that its cost will be $1,200 (0.6x0.01x200,000). The reason this self-selection strategy "can work" is that high-risk types value higher coverage more than do low-risk types due to their higher likelihood of making a claim and so the high-risk types are willing to purchase the higher-coverage policy despite its higher price. The low-risk types are not willing to pay this higher price for the higher coverage. This is the sense in which the menu of contracts acts as a self-selection mechanism; that is, the firms are able to separate the risk types without being able (or allowed) to observe any particular individual's risk type. Each type simply (self) selects the "appropriate" policy for the type he/she is.

*II. Pooling Contract*

In the case of separating contracts the good (low) risks end up with (possibly substantially) less than full coverage. This is the cost of excluding high risk types from the contract. However, if the fraction of high risks in the population is sufficiently small, it seems plausible that the low risks would prefer a contract that includes the high risks since the actuarially fair (population weighted) pooled price would not be 'too much higher' than the

actuarially fair price for low risks and obtaining a larger amount of coverage would be desirable. In our example, this pooled price is 0.019, which is higher than the actuarially fair low-risk type specific price of 0.01. Thus, low risk types would like to buy less than the $200,000 that they would like at price $p_L = 0.01$. We assume for our example that the low risk types would like to purchase $150,000 coverage at this price.[xvi]

The high risks, however, would want to buy more than $200,000 worth of coverage at price $p_A$ since this price is well below their actuarially fair price. If they did buy more, then the price $p_A$ would generate expected losses for the insurer since in this scenario the bad risks buy proportionately more insurance than do the good risks (i.e., relative to their population shares). If insurers can offer exclusive contracts with limited (fixed) coverage, then they would want to offer whatever contract at price $p_A$ is most desirable to low risk types with the result that high risks will end up also with the same coverage. Thus, for our example, the pooling contract would be a level of coverage of $150,000 for all consumers. Note that life insurer providers typically do not exercise a provision of exclusivity of contracts and so "over-insurance" by high risk types exacerbates the adverse selection problem relative to that generated in this model. The qualitative nature of the analysis here, however, does not change in that case except all analysis under asymmetric information follows the sort of pooling contract with no limitations on coverage (see Villeneuve (2000), Hoy and Polborn (2000), and Polborn, Hoy and Sadanand (2006)). Moreover, if the amount of genetic information became significant and insurers couldn't have access to it, then they may well begin to engage in exclusive contracting (i.e., stipulate that death payments are only payable if the insured does not have any life insurance with any other insurance companies). Given the current state of information, significant adverse selection due to privately held genetic test results has not been observed in the life insurance market simply because not many individuals yet hold such information.

The implications for all of the scenarios described above are given in Table 1. Net wealth, which is calculated for both the life and death states of the world, depends on both the amount of insurance purchased and the per unit price charged. The price differs for the two risk types in non-pooling scenarios.

If in the interests of avoiding L prejudice, legislation is introduced that restricts insurers from using the results of genetic tests that insureds have taken, then if the fraction of high risk types in the population is relatively large we expect to see a market outcome depicted by the separating contracts. The resulting outcomes are described in the third row of results in Table 1. The high risk types end up in the same situation as under no ban, while low risk types end up with less than full coverage. Low risk types 'prefer' to choose less coverage at the correspondingly lower price and so they are 'better off' than the high risk types from this perspective. In temporal terms, we call this an 'interim perspective' because some uncertainty

has been resolved (i.e., individuals know their risk-type), but at the time individuals purchase insurance they of course do not yet know the final state of the world (life or death of the breadwinner). We refer to considerations of well-being once the uncertainty about whether the bread winner has lived or died as the 'ex post perspective'. As a result of purchasing less than full coverage, the survivors of the low-risk breadwinner in the death state end up with the least wealth of all and so are the least well off from an ex post perspective. Thus, identifying who is better off in which contract situation depends on the temporal perspective chosen.

Suppose instead that the fraction of high risk types in the population is sufficiently low that we end up in the pooling equilibrium and both risk types end up with the same amount of insurance and pay the same price. This outcome is described in the last row of the results in Table 1. In this case there is equality from the interim perspective in the sense that everyone receives the same contract terms, but inequality from the ex post perspective as those surviving members of families whose main breadwinner has died have less wealth and so are financially worse off than those families with a living breadwinner'. Note that in this scenario the implication of banning insurance companies from accessing genetic test results means that the premium risk associated with no ban (symmetric information) is effectively replaced with the financial risk associated with life or death of the main bread-winner due to less than full coverage insurance being a characteristic of the insurance market equilibrium.

Table 1: Financial Implications of Alternative Insurance Market Outcomes
($p_L = 0.01$, $p_H = 0.1$, $p_A = 0.019$ ($q = 0.1$), $L = 200{,}000$, $W_0 = 220{,}000$)

| **Information Scenario and Type of Contracts** | Price per $ cover | Cost of Insurance (Coverage Purchased) | Net Wealth |
|---|---|---|---|
| **All Agents Uniformed** | 0.019 | $3,800 ($200,000) | $216,200 (either state) |
| **Informed: symmetric information** | | | |
| Contract A for L-types | 0.01 | $2,000 ($200,000) | 218,000 (either state) |
| **Contract B for H-types** | **0.1** | **$20,000 ($200,000)** | **200,000 (either state)** |
| **Informed: asymmetric information** | | | |
| Under **separating** contracts | | | |
| Contract C for L-types | 0.01 | $1,200 ($120,000) | 218,800 (no loss), 138,800 (loss) |
| **Contract B for H-types** | **0.1** | **$20,000 ($200,000)** | **200,000 (either state)** |
| **Informed: asymmetric information** | | | |
| Under **pooling** contract | | | |
| Contract D for **both** types | 0.019 | $2,850 ($150,000) | 217,150 (no loss), 167,150 (loss) |

It is also worth considering an 'ex ante perspective'; that is, how would individuals compare the well-being generated across the different scenarios described in Table 1 before they know the results of their genetic tests. If individuals already have information from genetic test results, the 'ex ante perspective' is still relevant from a social welfare perspective as it reflects the veil of ignorance hypothesis as characterized by Harsanyi (1953,1955) and so provides us with a utilitarian benchmark. It has been shown formally in Hoy (2006), and elsewhere, that having all agents uniformed actually leads to the highest expected utility from this ex ante perspective (or equivalently the highest level of utilitarian social welfare) – at least *with respect to financial impacts of the insurance market*. If individuals are informed of their risk type and behave accordingly, the symmetric information scenario produces an ex ante expected utility less than in the uninformed scenario. This follows because of the inequality of outcomes that arises in an insurance market characterized by informed insurance buyers and symmetric information (i.e., no ban). Another way of thinking about these unequal outcomes from an individual's (actual or self-interested) ex ante perspective is that if the future price for insurance can depend on some future determination of risk type (genetic test result), this generates an undesirable risk in incomes net of insurance payments. This risk has been referred to as premium risk.

So 'not knowing' sounds like a good situation and one might think that a ban on insurers using genetic test results may sound attractive because at least insurers are required to act *without knowing* the particular risk level of their customers. However, individuals actually knowing their risk type changes matters dramatically. Insurance companies will no longer offer the same policies as they would when consumers are ignorant of their risk type. Consider the results in the asymmetric information scenario under which separating contracts prevail as a market equilibrium. A ban that restricts insurers from using genetic test results once they are known by insureds unambiguously generates less expected utility from this ex ante perspective than does the symmetric information scenario that would persist in the absence of the ban. This follows because high-risk types end up in the same situation as under symmetric information but low-risk types end up with a restricted set of contracts from which to choose and end up not fully insured.[xvii] If, on the other hand, the insurance market outcome under asymmetric information is a pooling equilibrium, which is plausible if the fraction of high-risk types in the population is 'quite small', then it is ambiguous whether ex ante utility (or welfare) is improved by a ban. An advantage of the ban is that it eliminates premium risk or inequality due to price differences that would prevail otherwise. However, since insurance companies design their policies to attract low risk types, only partial coverage is offered to all and so this introduces financial risk for surviving members in those families for whom the main bread-winner dies.

The above noted welfare comparisons for all of the above scenarios – using both a utilitarian rule and Rawlsian rule – are summarized from each of the perspectives (ex ante,

interim, and ex post) in Table 2. In the next section we consider the arguments in a broader social context on both sides of the controversy regarding a ban on insurance companies using genetic test results to risk-rate premiums. We argue that whether one concludes that such a ban would reduce prejudice or not – as well as what type of prejudice L or W – depends on what temporal perspective one takes as well as how the 'market reacts' to such a ban.

Table 2: Summary of Normative Perspectives

| Normative Perspective | Temporal Perspective of Individuals (Insureds) | | |
|---|---|---|---|
| | Ex ante (before buying insc but know risk type | Interim (after buying insc but before know if good or bad state occurs) | Ex Post (after all uncertainty is resolved, including if good or bad sate) |
| Moral view of discrimination | B if pooling occurs (regardless of coverage level arising)<br><br>B is separating (??) – all get same choice set but could argue systemic disc | B if pooling<br><br>B(??) if separating as H- type discriminated on price, while L-type discriminate on coverage level | B if pooling<br><br>N (??) if separating as L-types not suffering loss treated best but L-types suffering a loss treated worst |
| Economic/actuarial view of discrimination | L – as this leads to separate, full coverage, contracts at "appropriate" risk-type specific prices | L | L |
| Utilitarian Rule | B if pooling **AND** amount of coverage is high (i.e., fraction of H-types "small enough")<br><br>L otherwise (certainly if separating occurs under a ban) | Same as in ex ante scenario<br><br>Same as in ex ante scenario | Same as in ex ante scenario<br><br>Same as in ex ante scenario |
| Rawlsian Rule | B if pooling (regardless of fraction of H-types, as long as pooling occurs)<br><br>L otherwise | Same as in ex ante scenario<br><br>Same as in ex ante scenario | B if pooling **AND** coverage level so high that those in bad state end up with more wealth than if they paid high price with full coverage<br><br>L otherwise |

Codes: B – supports ban, L – supports laissez faire, B = L – means either B or L gives equivalent results,
N – means no clear recommendation (conflicting aspects), (??) – means some doubt arises about how to apply the principle

We return now briefly to the rather more simplistic view of discrimination based on pricing only (also summarized in Table 2), rather than on the impact on individual well-being due to a more comprehensive assessment of the relevant characteristics of insurance contracts as described above. It seems obvious that from the moral view of discrimination, there is no discrimination if all individuals face the same price, which is the case under complete ignorance (all agents uniformed) about genetic risk type or, if consumers know their risk type but insurers don't, under a ban when a pooling contract is the result. This is a compelling conclusion to draw from any temporal perspective (i.e., ex ante, interim, or ex post). So in these cases this norm suggests a ban *if pooling is the expected market equilibrium outcome*. However, this approach to the argument ignores the important implication regarding the implicit restriction in the coverage of insurance that consumers of both risk types end up with and find undesirable; that is, the presumably unintended financial hardship for those families whose main breadwinner has died that may result from a ban.

If the ban leads to an insurance market equilibrium characterized by a separating pair of contracts, a clear conclusion based on the moral discrimination view doesn't present itself. From an ex ante perspective all individuals face the same choice set, so in that sense there is no unfair discrimination. However, each of the policies can be thought of as being 'designed' for members of a specific risk type. It may seem reasonable then to conclude that there is 'systemic discrimination' in that the system is discriminating between risk types in much the same way that economic and political systems can be criticized as being more advantageous for males as opposed to females or for certain races even if individual (moral) discrimination isn't obviously in evidence (e.g., see Crespi, 1945 and Bonilla-Silva, 1997). Matters are even more complicated when evaluation is made from an interim basis. Individuals know their risk types, high risk types are discriminated against in the price dimension, since the policy 'designed' for and chosen by them has a higher unit price. But low risk types end up with a lower coverage policy and so are discriminated against in the quantity dimension. From an ex post perspective, the survivors of families with a low risk type breadwinner who has died are clearly the worst off of all and so one could argue they are discriminated against (W-prejudice) the most. However, the best off from the ban are those families with the breadwinner not dying and so a clear recommendation about the ban cannot be made.

Overall, as a means of getting to a resolution on whether insurance companies should be banned from genetic ratemaking, we find the focus on unfair discrimination (especially based only on price differences) unsatisfying. Indeed, we view this as an important contribution of our paper and a reflection on the shortcomings of much of the existing literature addressing this debate. In the following section we collect the various arguments above, focusing on the welfaristic conclusions, in order to develop a more constructive methodology for addressing this important social issue.

## IV. Assessment of Existing Government Responses

*Blocking development of all information*

From our analysis in this paper, it seems clear that simply relying on rival intuitions without considering the implications of insurance market reactions and including a careful welfare analysis of the results is not going to take us far forward. We are going to have to dig a little more deeply into the problems armed with our descriptions of what are possible market outcomes under alternative insurance regulations regarding the information that insurance companies are allowed to access and use to set prices. Let us then consider the various options open to us in the light of the new genetic knowledge, or rather in the light of the potential of the new genetic knowledge. The first option is the most simple and it relies on a version of the argument often used in the 1970s by critics of human sociobiology, and even earlier by critics of nuclear weapons. Some knowledge is simply too dangerous or disruptive to have and so we should simply not go in those directions. We just don't need to know how to make bombs or whether there are biological differences between human races. Likewise we just don't need to know about biological differences between humans, where some differences lead to some being at higher risk of disease. Such knowledge is only going to lead to L prejudice and that is something that far outweighs any benefits. We should just drop all efforts to find the genetic underpinnings of diseases and leave matters at that and just focus on treating diseases in the absence of such knowledge. From the perspective of insurance market outcomes, this policy seems very effective. In our examples we see that when all agents are uninformed the insurance market works effectively and equitably.[xviii] Everyone thinks the price is actuarially fair and, with

no asymmetric information problems, contracts are designed and chosen in a way that leads to effective (100%) coverage levels at the same price for all. In fact, considering *ONLY* insurance market effects, this seems a *VERY* effective policy indeed.

Of course, the trouble is that things are never quite that simple. You want to ban all work on the atomic bomb, but while America stops research other unfriendly countries keep going flat out. It is surely unlikely that every country in the world is going to stop work on the genetic differences between people, and this work is after all a lot easier to perform than getting the materials for an atomic bomb, or building such a bomb when you have the materials. People can obtain genetic information from other countries. But even if all countries stop work on studying genes, it is by no means obvious that you are reducing L prejudice except in the context of insurance market operations. At least, you are not eliminating it in all contexts. Suppose you have a one in two chance of having Huntingdon's Chorea. You might not want the answer and prefer to wait and see if it happens. But you might indeed, at the age of 25, want the answer. If you do not have the gene, then you can keep going on your graduate degree in philosophy, even though it is going to take another five years to complete and then long years of finding a job and getting tenure and so forth. If you do have the gene, you might decide to cut your losses, become a schoolteacher now and enjoy the benefits of the salary and the satisfaction of doing a worthwhile job with children. By refusing to allow such information, you are discriminating against those at great risk although the source of discrimination is not from a higher price of insurance but rather from a restriction of their freedom to choose more effective life strategies. The rest of us, the lucky ones, just don't care. Moreover, in extending our consideration of more complex genetic diseases where action can be taken to lessen the risk of the disease (i.e., the multifactorial genetic diseases), obtaining this information can lead to better health outcomes to the genetically disadvantaged. And of course understanding the genetic component of diseases can lead to improved treatments and, should genetic therapy become more effective, even cure some very harmful diseases.

*Total information for all (symmetric information)*

So now you try the second option. We let freedom reign. Everyone can have and can demand the genetic information that they want. An individual can find out about his or her

genes. An insurance company can demand information about a person's genes (or at least existing genetic test results) before issuing a policy, and can decide whether or not to issue a policy and at what price. Note that this is not at once, and probably not ever, going to result in a company demanding every test that could possibly be conceived, now or in the future. Total knowledge would probably entail inordinate costs and time. The Friendly Company is probably going to demand some tests, just as it does in other ways at the moment – heart checks and HIV tests for instance – and leave others to chance – insurance companies don't ask us for a brain scan. Probably there will be a range of insurance policies, demanding more or less information and costing less or more comparably, and with possibilities for the future built in. It would cost more for a no-tests-ever-again policy than for a "we-can-demand-tests-once-a-year policy".[xix]

So where do we end up here? Clearly those with high-risk genes, the losers, are going to have to pay more for insurance, if indeed they can get it at all. There seems therefore to be significant L-prejudice against them, although whether this is moral prejudice is another matter. Remember, not inviting the Down's syndrome kid to the party is moral prejudice. Not allowing the kid with low aptitude to enter medical school is unfortunate in a way but it is not moral prejudice. Intelligence is morally relevant to success in medical school. A blind man should not get a driver's license. The possibility of life's genetic losers is unfortunate but it is not obviously prejudice if you let a private firm avoid losing money on them given that they must charge the good risks more than is their actuarially fair amount.

Where one might argue that there is moral prejudice is if this option (of total information), as opposed to other options, entails more problems for the losers than benefits for the winners. At a utilitarian level, at least, one could then argue that the greatest happiness for the greatest number is being downplayed. A Kantian perhaps might feel a bit differently but the case can probably be made here also. Certainly if one were behind Rawls's veil of ignorance, one might think that the comfort one could bring to the genetically afflicted would outweigh the benefits of the genetically lucky. However, as we have seen in the previous section, the welfare implications of such a regulation depend very much on a variety of factors that affect how the insurance market operates.[xx]

But are the genetic losers worse off under this scenario than they would be under other scenarios and from all perspectives? As we will see in the discussion of the third option, that of denying insurers the use of information held by their potential customers, there are market

environments (i.e., those with separating contracts) in which the genetically disadvantaged will not find themselves any worse off if insurers are allowed to use the information. In fact, the only effect from the ban is that the genetically advantaged end up purchasing lower levels of insurance in that scenario and so, in those families where the main breadwinner dies, it is these genetically advantaged (or rather their survivors) who end up in the worst off situation of all. So, although it seems at first glance that information for the individual but not the company will reduce such L prejudice, it may not.

*Keeping the insurers ignorant (asymmetric information)*

We come now to the third option, which is the legislative response in many European countries. We take it that it will never be the option of letting the Friendly Company know about the genes while keeping individuals ignorant. L prejudice would bloom and individuals would be bewildered – or, more likely, they would be making inferences. Probably they could work out their genetic composition from the policies that insurance companies would be prepared to offer them as long as the market is competitive. The more obvious third option, especially to people concerned to minimize L prejudice, is that of allowing individuals to find out about their genes but of preventing the insurance companies, the Friendly Company, from knowing about people's genes. The Company would not be able to demand genetic knowledge before deciding whether to issue a policy and how to price it.

What happens now under this option?[xxi] Obviously the people with bad genes would like to go out and buy lots of insurance and the people with good genes buy less – all other things being equal. Equally obviously, the Friendly Company is going to have to respond, or it will go under. As the preceding analysis argues, the insurer will deal with this problem in one of two ways. If exclusivity of provision is feasible, a practice used in the health insurance market, then the insurers may use the strategy of designing separating contracts to avoid excess losses. In this case "free choices by individuals lead to" the bad-gene people ending up paying the same high price for insurance and being no better off than if insurers are allowed to use the information about their genetic test results. The low risk types end up with less coverage than is desirable either from their own perspectives or from society's perspective. Alternatively, if the fraction of bad risks is not too large, the insurer may simply raise the price to whatever level required to

balance the costs of bad and good risks who are insured. Under exclusivity of provision, the coverage level of the contract is chosen to favor as much as possible the more desirable clients (i.e., the good risks), although this level may be so low that the effectiveness of the insurance market is severely compromised for all. If the insurer does not enforce exclusivity of provision, then since the bad risks can't be effectively restricted in the amount of insurance they buy, a pooling contract occurs in which the bad risks purchase higher coverage than the low risks and the price will reflect this imbalance.[xxii] Again, the good-gene people in this scenario end up with less coverage than is desirable, albeit at their risk-type specific "lower" price.

So the effect of well meaning regulations to eliminate L prejudice may in fact be ineffective in its goal and certainly can be viewed as creating W prejudice. Now it is fair to say that under said regulations the lucky are nonetheless better off from an interim perspective than are the unlucky. After all, if the good risks wanted to buy the same policy or level of coverage that the bad risks buy, they are free to do so in all of the scenarios about how the insurance market operates under asymmetric information. However, their ability to manage their risks through the insurance market is compromised by the regulation. Moreover, from the (ex post) perspective of the outcomes once the state of the world (death or life) is determined the lucky or good-gene people (survivors) in some of these market scenarios find themselves the worst off of all. Therefore, at the very least one can argue that such a regulation harms the good-gene people relative to the laissez faire approach in the sense of restricting their freedom to purchase insurance contracts that are suitable for them. Given the implications of compromised insurance coverage that results in some scenarios under such a regulation, one can go further and argue that the end result of the restriction on information is that good-gene people may suffer W prejudice as determined by an ex post welfare determination.

If under a ban on 'genetic ratemaking' it turns out that the insurance market equilibrium is one with pooling contracts, then a similar set of concerns as above applies in that such an outcome means all individuals – regardless of risk type – end up with less than full coverage insurance. From an ex post perspective, all survivors in families whose main breadwinner has died are worse off than they would be in the absence of the ban. So effectively we have both L and W prejudice arising from the government regulation! From an interim perspective, the bad-gene people prefer the outcome of the ban while the good-gene people prefer no such regulation, so in this sense one can argue that there is either less L-prejudice, more W-prejudice, or both.

From an ex ante perspective (or utilitarian welfare norm), the result of the government ban on genetic rate-making is ambiguous as there is a tradeoff between greater equality due to all facing the same price – hence less premium risk – but also reduced insurance coverage – hence more financial risk for all from the possibility of death of the breadwinner.

## V. Conclusion

There is no perfect solution in the sense that everyone is going to benefit to the full according to their wishes as the result of increasing genetic information. Private life insurance is simply not going to give genetic losers everything they might want at a price they can afford even if government regulations attempt to ensure this through well-meaning regulations. Perhaps like medical insurance there is a point where the state must step in and offer some protection to all or at least provide some limited coverage at a subsidized price to the genetically unlucky.[xxiii] However there are various options that could be taken with a view to reducing discrimination. We believe that the choice of option is not simply a matter of blind intuition, but that serious arguments can be offered for and against the possible choices. We point out that discrimination, and the related notion of prejudice, is not simply a black or white matter, but that there are various meanings in play, and that maximizing one end might well mean taking from another end. This is not necessarily a bad thing, but it is a thing that must be assessed.

There are several sources of difficulty in trying to resolve this debate through a simple intuition based on a view of discrimination. First, it is not so clear that allowing genetic ratemaking is unfair discrimination from a moral standpoint. The 'economic' or 'actuarial' view of unfair price discrimination offers an opposing view to the so-called moral concept that is not so easily dismissed. Although the proponents of these conflicting notions of discrimination see little to no merit in the other's view, we suggest that on the face of it neither is a terribly unreasonable stance. Moreover, in a market like insurance where there is more than one dimension on which to consider discriminatory effects (e.g., price vs. coverage level), serious complications arise in trying to settle this debate by relying on any particular concept of discrimination. For example, we see that a ban on insurance companies using genetic test results to risk-rate premiums can lead to problems for low risk types who, as a result, end up with less coverage.

Moreover, beyond feelings of price discrimination, the issue of who is harmed and who is benefited by such a regulation in a more general context depends not only on the normative principle being adopted but also on the temporal position from which any principle is implemented. We have argued that among the various norms we have considered, only the so-called economic/actuarial principle of price discrimination and the utilitarian welfare rule lead to consistent views of whether a ban or laissez faire is to be preferred. The economic/actuarial principle of price discrimination favors a laissez faire approach while the choice according to a utilitarian principle depends on the actual implications of the regulation (beyond price effects), which in turn depend on a number of characteristics of the insurance market environment. Although consistency across different temporal perspectives is not the only or even the most compelling characteristic of a means for evaluating the relative merits of the debate, an argument that changes across such perspectives is problematic. The utilitarian welfare rule is both normatively attractive in this application as well as being consistent.

Most importantly, we argue that there are scenarios in which well-meaning attempts to comfort or help life's afflicted might not work as well – certainly not work any better and have related drawbacks – than more disinterested approaches where free-market principles are allowed to rule. We do not say that anyone should be able to find out anything about anyone else. We do say that those who have a legitimate interest in information should not necessarily be barred from requesting it if the end result is problematic on practical grounds. In particular, we argue that, as things stand at the moment, there is good reason not to allow insurance companies to charge different prices for insurance based on the genetic test results of their customers. However, this conclusion is not based on a principle of discrimination but rather that, in the current information environment with relatively little genetic information being privately held, such a regulation creates little by way of practical problems in the insurance market and probably promotes utilitarian welfare. However, we should keep on open mind about this debate. If, in the future, substantial amounts of significant genetic information should become available to individuals (see Baker, 2008), as it may in say 10 to 20 years time, then such a regulation may prove to be counter-productive and ways of helping the genetically unlucky other than imposing a ban on insurers use of relevant genetic information should be explored.

## *References*


Ania, A. B., T. Troger, and A. Wambach (2002), "An Evolutionary Analysis of Insurance Markets with Adverse Selection," *Games and Economic Behavior*, vol. 40, pp. 153-184.

Alper,J. S., and M. R. Natowicz (1993), "Genetic Testing and Insurance," *British Medical Journal*, vol. 307, pp. 1506-1507.

Baker, M. (2008), "Genetics by Numbers," *Nature*, vol. 451/31, Nature Publishing Group, pp. 516-518.

Bernheim, B. D., L. Forni, J. Gokhale, L. J. Kotlifkoff (2003), "The Mismatch Between Life Insurance Holdings and Financial Vulnerabilities: Evidence from the Health and Retirement Study, " American Economic Review, vol. 93(1), pp. 354-65.

Billings, P. R., et al. (1992), "Discrimination as a Consequence of Genetic Testing," *American Journal of Human Genetics*, vol. 50, pp. 476-482.

Bonilla-Silva, E. (1997), "Rethinking Racism: Toward a Structural Interpretation," *American Sociological Review*, vol. 62, pp. 465-80.

Boxill, B. (1992), *Blacks and Social Justice*, revised ed., Lanham, MD: Rowman and Littlefield.

Bossert, W. and M. Fleurbaey (2002), "Equitable Insurance Premium Schemes," *Social Choice and Welfare*, vol. 19, pp. 113-125.

Browne, M. J. and K. Kim (1993), "An International Analysis of Life Insurance Demand," *Journal of Risk and Insurance*, vol. 60 (4), pp. 616-634.

Burkhauser, R. V. and T. M. Smeeding (1994), "Social Security Reform: A Budget Netral approach to Reducing Older Women's Disproportionate Risk of Poverty," Center for Policy Research, Syracuse University, Maxwell School of Citizenship and Public Affairs working paper no. 2/1994. pp. 18.

Crespi, L. (1945), "Is Gunnar Myrdal on the Right Track?," *Public Opinion Quarterly*, pp. 201-

212.

Crocker, K. J., and A. Snow (2000), "The Theory of Risk Classification," in *Handbook of Insurance* (ed., G. Dionne), Kluwer Academic, Boston, Dordrecht, and London, pp. 245-276.

Daniels, N. (2004), "The Functions of Insurance and the Fairness of Genetic Underwriting," in *Genetics and Life Insurance: Medical Underwriting and Social Policy*, ed. Rothstein, M., MIT Press.

Dionnes, G., Doherty, N. and N. Fombaron (2000), "Adverse Selection in Insurance Markets," in *Handbook of Insurance* (ed., G. Dionne), Kluwer Academic, Boston, Dordrecht, and London, pp. 185-243.

Dworkin, R. (2000), *Sovereign Virtue: The Theory and Practice of Equality*, Harvard University Press, Cambridge, Mass.

Finkelsteing, A. and J. Poterba (2002), "Selection Effects in the United Kingdom Individual Annuities Market," *Economic Journal*, vol. 112, pp. 28-50.

Fleurbaey, M. (2002), "Equality of Resources Revisited," *Ethics*, vol. 113, pp. 82-105.

Flew, A. (1990), "Three Concepts of Racism," *Encounter*, vol. 75, pp. 63-66.

Harsanyi, J. C. (1953), "Cardinal Utility in Welfare economics and in the Theory of Risk taking," *Journal of Political Economy*, vol. 61, pp. 434-435.

Harsanyi, J. C. (1955), "Cardinal Utility in Welfare Economics and in the Theory of Risk Taking," *Journal of Political Economy*, vol. 63, pp. 309-321.

Hendel, I. and A. Lizzeri (2003), "The Role of Commitment in Dynamic Contracts: Evidence from Life Insurance," *Quarterly Journal of Economics*, vol. 118, no. 1, pp. 299-327.

Hoy, M., Orsi, F., Eisinger, F., and J. P. Moatti, (2003), "The Impact of Genetic Testing on Health Care Insurance," *The Geneva Papers on Risk and Insurance: Issues and Practice*, vol. 28, no. 2, pp. 203-221.

Hoy, M. and M. Polborn, (2000), "The Value of Genetic Information in the Life Insurance Market," *Journal of Public Economics*, vol. 78, pp. 235-252.

Hoy, M., and P. J. Lambert (2000), "Genetic Screening and Price Discrimination in Insurance Markets," *The Geneva Papers on Risk and Insurance Theory*, vol. 25, pp. 103-130.

Hoy, M. and M. Ruse (2005), "Regulating Genetic Information in Insurance Markets," *Risk Management and Insurance Review*, vol. 8, no. 2, pp. 211-37.

Hoy, M., M. Polborn, and A. Sadanand (2006), "Advantageous Effects of Regulatory Adverse Selection in the Life Insurance Market," *Economic Journal*, vol. 116, pp. 327-354.

Hoy, M. (2006), "Risk Classification and Social Welfare", *The Geneva Papers on Risk and Insurance: Issues and Practice*, vol. 31, pp. 245-269.

Hoy, M., and J. Witt (2007), "Welfare Effects of Banning Genetic Information in the Life Insurance Market: The Case of BRCA1/2 Genes," *Journal of Risk and Insurance*, vol. 74(3), pp. 523-546.

Kahlenberg, R. (1996), *The Remedy*, New York: Basic Books.

Kitcher, P. (1996), *The Lives to Come: The Genetic Revolution and Human Possibilities*, New York: Simon and Schuster.

Knoppers, B., B. Godard, and Y. Joly (2004a), "Life Insurance and Genetics: A Comparative, International Overview," in *Genetics and Life Insurance: Medical Underwriting and Social Policy*, ed. Rothstein, M., MIT Press.

Knoppers, B.M., T. Lemmens, B. Godard, Y. Joly, D. Avard, T. Clark, P. Hamet, M. Hoy, S. Lanctôt, S. Lowden, H. Martin, C. Maugard, Y. Millette, J. Simard, M.-H. Vachon, F. Zinatelli, (2004b), "Genetics and Life Insurance in Canada: Points to Consider, (Task Force Statement)," *Canadian Medical Association Journal*, vol.170, no.9, (April, 2004), online version, pp. 1-3.

Lerman, C., N. E. Caporaso, J. Ain, D. Main, E. D. Bowman, B. Lockshin, N. R. Boyd, P. G. Shields (1999), "Evidence Suggesting the Role of Specific Genetic Factors in Cigarette Smoking," *Health Psychology*, vol. 18 (1), pp. 14-20.

Munafo, R. R., T. G. Clark, L. R. Moore, E. Payne, R. Walton, and J. Flint (2003), "Genetic Polymorphisms and Personality in healthy Adults: A Systematic Review and Meta-Analysis," *Molecular Psychiatry*, vol. 8, pp. 471-484.

Natowicz, M. R., J. K. Alper, and J. S. Alper (1992), "Genetic Discrimination and the Law," *American Journal of Human Genetics*, vol. 50, pp. 465-475.

Otsuka, M. (2002), "Luck, Insurance, and Equality," *Ethics*, vol. 113, pp. 40-54.

Pargetter, R. and E. W. Prior (1987), "Discrimination and AIDS," *Social Theory and Practice*, vol. 13, pp. 129-53.

Pauly, M. V., Withers, K. H., Subramanian-Viswana, K., Lemaire, J., and J. C. Hershey (2003), "Price Elasticity of Demand for Term Life Insurance and Adverse Selection," NBER working paper #9925.

Polborn, M., Hoy, M., and A. Sadanand (2006), "Advantageous Effects of Regulatory Adverse Selection in the Life Insurance Market," *Economic Journal*, vol. 116, pp. 327-354.

Rothschild, M. and J. Stiglitz (1976), "Equilibrium in Competitive Insurance Markets: An Essay on the Economics of Imperfect Information," *Quarterly Journal of Economics*, vol. 90, no. 4, pp. 630-49.

Sandell, S. H. and H. M. Iams (1997), "Reducing Women's Poverty by Shifting Social Security Benefits from Retired Couples to Widows," *Journal of Policy Analysis and Management*, vol. 16 (2), pp. 279-297.

Villeneuve, B. (2000), "Life Insurance," in *Handbook of Insurance*, ed., Georges Dionne, Kluwer Academic Publishers.

Wagstaff, A., et al., (1999), "Equity in the Finance of Health Care: Some Further International Comparisons," *Journal of Health Economics*, vol. 18, 1999, pp. 263-290.

Williams, A. C. J. (1969), "Price Discrimination in Property and Liability Insurance," in

*Insurance, Government and Social Policy*, H.S. Denenberg and S.L. Kimball (eds.), Richard D. Irwin Inc, University of Pennsylvania.

Wilson, C. (1977), "A Model of Insurance with Incomplete Information," *Journal of Economic Theory*, vol. 16, pp. 167-207.

[i] See also Billings, et al. (1992) and Natowicz, Alper and Alper (1992).

[ii] One should be somewhat guarded regardless of country since, as noted by Wagstaff, et al. (1999, p. 269), "It is well known that during the last decade or so, there has been a shift in many OEC countries away from public sources of finance (… for health care …) to private sources." So concern about equity in health insurance provision resulting from increasing amounts of genetic information may spill into other countries. See Hoy, et al. (2003) for an example of the use of economic welfare analysis of the use of genetic testing in health care insurance.

[iii] As Alper and Natowicz (1993, p. 1506) note: "To an increasing extent, health insurance is considered to be a necessity that should be available to all. Even in the United States, the last Western country not to have universal health care, there is a consensus that a system guaranteeing a basic level of health care to all is essential."

[iv] For a chronology and updates on GINA, see www.genome.gov/24519851, the National Human Genome Research Institute, National Institutes of Health.

[v] Baker (2008, p. 516) notes that "Genomic association studies are starting to turn up increasingly reliable disease markers.

[vi] There is, for example, substantial evidence that various genetic factors influence the propensity to smoke and the ability to quit smoking as well as other behaviours (e.g., see Lerman, et al., 1999 and Munafo, et al., 2003).

[vii] Given that such information is often imperfect in assigning individuals to risk classes – especially when one considers multifactorial diseases where unobserved individual choices also affect risk – there are substantial complications in taking a simplistic view of discrimination as a basis for sound policy making. This follows regardless of which 'veiw' of discrimination to which one adheres (see Hoy and Lambert (2000) on this point and also Bossert and Fleurbaey (2002)).

[viii] See particularly the chapter "The New Pariahs?" in Kitcher (1996).

[ix] Daniels (2004) presents a cogent argument to the effect that actuarial fairness can only be a descriptive concept and so has no force as a normative or judgmental principle. We, in effect, tend to agree in practical terms with his conclusions regarding the desirability of community rating (eg., including no genetic ratemaking)- but only in 'certain situations'. Instead, we make the argument that it is best to dispense entirely with competing notions of fair or unfair discrimination and rely on other normative or justificatory criteria in developing a policy position.

[x] An influential notion of egalitarianism or fairness largely associated with Dworkin (2000), but others as well, roughly argues that inequalities created by "brute luck" should be eliminated by society but not inequalities created by "option luck" or choices. Although buying insurance eliminates effects of "brute luck" there remain inequities if the price of insurance varies across individuals or, at least from an ex post perspective if individuals end up with

different amounts of insurance. These phenomena are likely to be pervasive in the information environments pertaining to out problem in this paper. Although it would be interesting to pursue this philosophical perspective as a possible means of resolving the debate about genetic information use by insurers, we do not do so here as it would not lead to simple answer. See Fleurbaey (2002) and Otsuka (2002) for some interesting arguments and concerns about the "hypothetical insurance approach" as a basis for egalitarianism or fairness.

[xi] That is, relative to the population fractions of good and bad risks.

[xii] This literature began with the influential contributions of Rothschild and Stiglitz (1976) and Wilson (1977). Recent surveys include Dionne, Doherty, and Fombaron (2000) and Crocker and Snow (2000). For a discussion on how to relate this literature specifically to the use and regulation of genetic information in insurance markets, see Hoy and Ruse (2005).

[xiii] For example, in a study of the UK annuity market, Finkelstein and Poterba (2002) find that 'better risks' can be selected by offering a set payment in the event the holder of the annuity dies within a five or ten year guarantee period. Those with a higher mortality risk (i.e., a lower risk client from the insurers point of view when providing annuity payments) find this more advantageous. Contracts without this guarantee can then be assigned a somewhat higher price and will be selected by higher risks.

[xiv] See Pauly, et al. (2003) for an empirical exercise that includes measuring the effect on demand for life insurance due to different risk levels.

[xv] For some scenarios this is not a Nash equilibrium, although support for this separating pair of contracts persisting in the market place under conditions in which this would not be a Nash equilibrium is provided, for example, by Ania, Troger, and Wambach (2002).

[xvi] In an explicit economic model of this problem the prediction is unambiguously that less than full coverage would be desired by low risk types at such a price. The particular amount desired would depend on the risk tolerance of the low risk types.

[xvii] That is, if you turn out to be a high risk type you are no better off than under symmetric information while if you turn out to be a low risk type, you are worse off. From the perspective of not knowing what type you will be, the symmetric information scenario generates higher expected utility or well-being.

[xviii] There is an important caveat to this conclusion. Family history, which depends at least in part on genetic differences, can also imply significant differences in health and/or mortality risk and insurers use this information routinely to risk-rate policies. Adding results of genetic tests, however, increases the degree of risk differentiation and hence potential price differentials (see Hoy and Witt, 2007).

[xix] Hendel and Lizzeri (2003) demonstrate that term life insurance policies that allow buyers to automatically requalify without reclassification (i.e., guaranteed renewable contracts) are more expensive in the early periods of coverage than for policies which require a medical test every year in order to obtain renewal at preferred rates. The existence of guaranteed renewable contracts cannot reduce premium variations according to genetic test results for those whose test results occur before they make their decisions about how much insurance to purchase.

[xx] In fact, if the fraction of high risk types in the population is sufficiently small and the insurance market operates in a way that leads to a pooling equilibrium rather than a separating set of contracts, one can show that, from the

perspective of a person who does not yet know his genetic type (as implied by a real or hypothetical veil of ignorance), a ban on the information with the resulting pooling equilibrium leads to a higher expected utility than would a policy of laissez faire (see Hoy, 2006, proposition 1, page 255).

[xxi] The two possible outcomes for the insurance market are summarized by the last two rows of Table 1.

[xxii] See Polborn, Hoy, and Sadanand (2006) for explanations as to why lack of exclusivity of coverage occurs in the life insurance market. If sufficient asymmetric information problems were to arise due to substantially more genetic tests becoming available in the future, insurance companies may introduce some degree of exclusivity of provision.

[xxiii] To an extent death benefits within a social security system provide a form of publicly provided life insurance which is not risk-rated (see Burkhauser and Smeeding, 1994) and this feature could be enhanced (see Sandell and Iams, 1997). Results in Browne and Kim (1993) from a cross-country study demonstrate that government spending on social security is viewed as a substitute for private life insurance.