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Endogenous information, adverse selection, and prevention: Implications for genetic testing policy

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ABSTRACT

We examine public policy toward the use of genetic information by insurers. Individuals engage in unobservable primary prevention and have access to different prevention technologies. Thus, insurance markets are affected by moral hazard and adverse selection. Individuals can choose to take a genetic test to acquire information about their prevention technology. Information has positive decision-making value, that is, individuals may adjust their behavior based on the result of the test. However, testing also exposes individuals to uncertainty over the available insurance contract, so-called classification risk, which lowers the value of information. In our analysis we distinguish between four different policy regimes, determine the value of information under each regime and associated equilibrium outcomes on the insurance market. We show that the policy regimes can be Pareto ranked, with a duty to disclose being the preferred regime and an information ban the least preferred one.

1. Introduction

In this paper, we examine public policy toward the use of information from genetic tests by insurers. Individuals engage in primary prevention, which is not observed by insurers, and we study a wide range of policy approaches toward genetic information. Our results show that a duty to disclose Pareto dominates all other regimes, whereas an information ban is Pareto dominated by all other regimes. Unobserved prevention does *not* lend itself to an economic efficiency rationale for the current regulatory practice in many legislations. What's more, an information ban, which is the policy viewed as most favorably in general discussions, results in the lowest level of social welfare.

Our results inform public policy decisions about the use of test information in insurance markets. Genetic information is most relevant in the markets for health insurance, life insurance, annuities, and long-term care insurance. There is evidence of adverse selection in U.S. employer provided health insurance (Bundorf et al., 2010; Handel, 2013; Bajari et al., 2014), in the U.S. Medigap and non-group health insurance market (Finkelstein, 2004; Lo Sasso and Lurie, 2009), in the U.K. private health insurance market (Olivella and Vera-Hernández, 2013), and in annuity (Finkelstein and Poterba, 2002, 2004) and life insurance markets (He, 2009).[1] Genetic information can be a strong contributor to risk-based selection. For example, Zick et al. (2005) find that individuals who had a positive predictive test for Alzheimer's disease substantially increased their purchase of long-term care insurance. Oster et al.

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[1] The broader evidence on adverse selection is mixed. In addition to risk-based selection, there is evidence of selection on other dimensions. See Cohen and Siegelman (2010) and Chiappori and Salanié (2013) for surveys of empirical research on adverse selection in insurance markets.

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(2010) report "strong evidence of adverse selection" (p. 1048) in the sense that asymptomatic individuals who have tested positive for Huntington's disease are five times more likely to own long-term care insurance than comparable individuals without a positive test result. The increasing availability of mail-order genetic tests for a wide range of conditions is likely to increase the degree of private information in these insurance markets. Public policy can either exacerbate or mitigate the resulting adverse selection problems and has therefore a major impact on the efficiency of insurance markets and social welfare.

Regulation varies widely across jurisdictions and insurance markets, ranging from bans on the use of genetic test results, to voluntary restrictions, to no regulation.[2] To cover the broad array of legislation, we consider four policy regimes and determine the incentives for individuals to take genetic tests and implied insurance market outcomes. We analyze a duty to disclose or mandatory disclosure regime under which individuals must provide the results of any genetic tests to insurers. In the U.K., applicants must disclose positive test results for Huntington's disease when applying for a life insurance policy over £500,000. Canada has no specific legislation governing the use of genetic information. While Canadian insurance companies do not require genetic tests, they may request the results of any tests that have been performed. The situation is similar in Australia and New Zealand. In South Africa, insurers have agreed to a Code of Conduct under which they may not require genetic tests. Previous tests, but not their results, must be disclosed to the insurer. We also consider a consent law or voluntary disclosure regime under which individuals can choose whether or not to reveal test results. U.K. insurers have agreed to a moratorium on the use of genetic tests.[3] Individuals are still allowed to disclose favorable genetic test results to rebut family history information.

A ban on the use of genetic tests by insurers seems to be the most widely adopted policy. In the U.S., the Health Insurance Portability and Accountability Act (HIPAA) of 1996 and the Genetic Information and Nondiscrimination Act (GINA) of 2008 together effectively prohibit the use of genetic information (including family health history) in determining coverage or premiums in both group and individual health insurance for asymptomatic individuals. The Oviedo Convention, which is binding on the members of the European Community that have signed it, prohibits discrimination against a person on the basis of their genetic heritage. Austria, Belgium, France, Germany Portugal, Sweden and Switzerland have passed legislation that effectively prohibits the use of genetic tests by insurance companies.[4] Many jurisdictions have no explicit legislation on the use of genetic tests. In the U.S., HIPAA and GINA do not apply to life insurance, annuities or long-term care insurance. Most Asian and African countries have not enacted legislation regulating the use of genetic information by insurers.

Our paper contributes to the literature on risk classification and the private and social value of information in insurance markets.[5] Crocker and Snow (1986) show that the inclusion of costless categorical variables in the pricing of insurance increases welfare. This result also holds when categorization is costly by allowing the government to offer partial social insurance (Rothschild, 2011). Endogenous information and genetic testing is examined in Tabarrok (1994) who proposes genetic insurance to protect revealed high risks who might otherwise be unable to afford coverage. Crocker and Snow (1992) find that the private value of information is negative if insurers can observe whether individuals are informed or not and if consumers do not have prior information. Furthermore, the private value of information is non-negative only if insurers are unable to observe the consumers' informational status or if individuals are able to conceal it (Doherty and Thistle, 1996).

Whereas the aforementioned papers assume risk types to be exogenous, other authors have studied situations where individuals can take actions to mitigate risk. Doherty and Posey (1998) consider primary prevention for revealed high risks and find that testing is encouraged when informational status and test results can be concealed by the individual. In Bardey and De Donder (2013) test results have to be revealed and high risks can engage in prevention, which is either observed or not. Neither of these papers compares policies in terms of social welfare, so their conclusions are conditional on a specific regulation.

Barigozzi and Henriet (2011) and Crainich (2017) study observable self-insurance (secondary prevention). Whether individuals choose the level of self-insurance that maximizes social welfare, depends on whether genetic information can or cannot be disclosed and on the proportion of high risks in the latter case (Crainich, 2017). Barigozzi and Henriet (2011) rank the policy alternatives discussed above according to social welfare and find that a duty to disclose weakly dominates all other regimes, whereas an information ban is strictly dominated. Given the stark differences between self-protection and self-insurance, it is not clear to what extent the welfare results in Barigozzi and Henriet (2011) can be generalized. We fill this gap in the literature and analyze social welfare under all four relevant policy regimes towards genetic testing, when individuals can engage in unobservable primary prevention.

Primary prevention is a central determinant of genetic risks. These risks are mostly multifactorial in the sense that the interaction of risk-relevant behavior with endowed genetic factors determines the likelihood of onset of disease. A good example that is widely used in the literature, is a mutation of the genes BRCA1 and 2, which leads to an elevated risk of breast and ovarian cancer (Thompson et al., 2002). Besides genetic determinants there is a variety of behavioral factors that are associated with breast cancer risk.[6] We argue that individuals' engagement in prevention reflects their information about risk. Similarly, there are genetic tests that indicate an increased risk of heart attack, hypertension and type 1 and 2 diabetes, as well as other diseases, where lifestyle choices affect the overall risk of developing the disease. Against this background, we argue that prevention is at least as important as self-insurance when studying genetic testing policy.

The global incidence of monogenic diseases at birth is estimated at 1 in 100.[7] Hemoglobin disorders (e.g., alpha- and beta-thalassemia, sickle-cell trait, hemophilia) are the single most common, estimated to affect nearly 3 percent of conceptions. Cystic fibrosis is estimated to affect 1 in 2–3000 live births in the EU and about 1 in 3500 in the U.S. Fragile X syndrome is the most common mental impairment, affecting 1 in 3600 males and 1 in 4–6000 females worldwide. Huntington's disease is estimated to affect 5–7 people per 100,000 in western countries. The most

[2] See Joly et al. (2010) and Otlowski et al. (2012) for surveys of regulation on the use of genetic information.

[3] The U.K. moratorium has been in place since 2001 and has been extended until at least 2019.

[4] Belgium makes an exception for life insurance policies above approximately $150,000. In Germany, there is an exception for life insurance policies with a sum insured exceeding €300,000.

[5] See Crocker and Snow (2013) and Dionne and Rothschild (2014) for recent surveys. The papers mentioned are most applicable to health and long-term care insurance where contracts are exclusive. For the welfare effects of genetic testing in life insurance, see Hoy and Polborn (2000) and Polborn et al. (2006).

[6] Typical risk factors are nutrition habits, alcohol consumption, smoking before the age of 16 and exercising habits amongst others (Colditz and Frazier, 1995; Thune et al., 1997). In general, any habits that disturb the hormonal balance can lead to an increase in breast cancer risk.

[7] Population incidence rates are obtained from WHO (2017) and from Modell and Darlinson (2008) for hemoglobin disorders.

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