

## GENETIC INFORMATION AND LIFE INSURANCE RISK CLASSIFICATION AND ANTISELECTION (FIRST OF TWO PARTS)

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Recent scientific advances in the field of genetics have raised numerous medical, ethical and social issues. Insurance has assumed a prominent place in these discussions. From the consumer perspective, there is concern that insurers might one day use genetic information to deny coverage or invade privacy. Physicians worry that patients will avoid genetic testing and the benefits of disease prevention and early diagnosis because of fears that insurance might become unavailable if the test results were unfavorable. For their part, insurers are concerned that applicants will use knowledge of their genetic predispositions to exploit the insurance system.

The pace of genetic discoveries suggests it is time to establish more direct contacts between the disciplines of clinical and insurance medicine in order to encourage an active dialogue among interested parties. Historically, practicing physicians and life insurers have enjoyed a warm working relationship based on a common interest in the well-being of their patients and policyholders, respectively. This point is succinctly stated in an article published July 8, 1893, entitled "The Mutual Interest of the Medical Profession and Insurance Companies in the Prolongation of Life."<sup>1</sup>

The author encourages insurance companies to play a more active role in "aiding and abetting the physician of the future in the prevention of disease and the prolongation of life." He also cautions insurance company medical directors to resist the "excessive interest the agent has to insure anybody regardless of risk, or the desire of many applicants to be rated higher [more favorably] than their physical condition fairly warrants."

It is in this historical spirit of cooperation that I would like to address a number of the most important issues as viewed from the perspective of an insurance medical director. The goal will be to clarify what is and what is not possible within a private life insurance system, and explain the reasons why.

The discussion will be divided into two sections. Part I will summarize the principles of private life insurance, with particular emphasis on risk classification and antiselection. These topics were chosen because they are often the focus of attention at

medical meetings and in journal reviews. Part II will address specific concerns of life insurers and present a futuristic vision of the extent to which genetic information will affect the practice of medicine and the life insurance business. My remarks will be confined to individual life insurance. Readers interested in insurance provided on a group basis (by employers or via membership in an association) or as a social entitlement are referred to the cited reference.<sup>2</sup>

### Early forms of life insurance

Over a century ago, some insurance plans were based on a principle known as the "assessment technique." Under this arrangement, equal assessments were levied on all participants to cover death claims. For example, the Ancient Order of United Workmen, organized in 1868 and the first assessment society to provide death benefits (\$2,000 each), levied an assessment of \$1 against each member after payment of a death claim so that funds would be available for the prompt settlement of the next claim. Later plans adopted the practice of levying assessments at regular intervals, usually once a year, rather than after each death.<sup>3</sup>

Assessment insurance was based on the theory that there would be a continual flow of new members at the younger ages, with little variation from year to year in the average age or health of those in the group. Hence the total death rate would not increase and the annual assessments would remain relatively constant over the years.

These plans were destined to fail. One reason related to age considerations. The average age of the society began to increase, a trend that could not be offset even with the recruitment of additional young members. More importantly, the number of deaths in the group began to increase since the mortality rate for older people is greater than that of younger individuals. This triggered an increase in the annual assessment. At this point, some younger members began to withdraw from the society, often to join a younger society where protection could be obtained at a lower cost. Others decided not to join any society because the insurance protection cost more than they were willing to pay. The exodus of younger members exacerbated the situation even further; the average age of the society increased, more deaths occurred, the assessment increased again, and more younger members dropped out.

A second reason for failure of the societies concerned health status. With assessment insurance, there was no underwriting to detect individuals at greater risk of early death; assessments were the same for all participants, healthy or infirm. Those in poorer health recognized that society membership was very worthwhile since early death was a real possibility. They stayed in the society even as assessments continued to increase. In contrast, healthy members, young and old, felt they were being overcharged for the amount of protection they were receiving and followed the example of younger members by exiting the society in search of a more equitable system. The number of deaths relative to total membership increased again, causing yet another increase in the assessment of remaining members, thereby further accelerating the withdrawal of the young and healthy.

The situation in most assessment societies eventually reached the point where life insurance protection could not be provided at a price that was acceptable to the membership. Thousands of these societies failed during the 1880s and 1890s,<sup>4</sup> and others were reorganized in accordance with modern principles of life insurance management.<sup>3</sup> The legacy of this experience remains today in the term "assessment spiral," which is used to describe situations where the integrity of an insurance plan is jeopardized because higher risks preferentially join or stay in a plan, lower risks choose to leave or not join a plan, and premiums continue to increase.

### Principles of modern life insurance

The purpose of life insurance is to provide financial protection against untimely death. Policyholders pay a relatively small, affordable amount into a common fund and the proceeds are distributed to the beneficiaries of those who die. In this way, the financial losses associated with unexpected death can be mitigated even though the event itself cannot be prevented.

But not all people are alike. The likelihood and magnitude of loss faced by the insurance company will vary. Some people will apply for large amounts of insurance and others for small amounts. Some will be young and others old. Occupations and avocations will modify the likelihood of unexpected death, as will health enhancing activities such as exercise, proper diet, and avoidance of tobacco products.

These different factors are evaluated by the insurance company through a process known as "risk selection and classification." The more common term for this is "underwriting." By means of this process, the insurance company determines the appropriate contribution to the fund by an individual policyholder.

A fundamental principle of private life insurance is equity: policyholders with the same or similar risk of death are charged the same amount. The higher the risk, the higher the premium; the lower the risk, the lower the premium. In contrast, public life insurance programs such as social security death benefits operate on the principle of equality, where everyone at a given level of

income pays the same amount (subject to laws governing maximum age for contributions, etc.). Premiums are identical for young and old, healthy and unhealthy, and low or high risk of death.

During underwriting, risk classifications are created that recognize meaningful differences among individuals in order to place applicants into groups with comparable expected mortality rates. The risk presented by any single individual cannot be determined with absolute precision. But if people are assigned to groups with reasonable accuracy and the total number of people in these groups is large, then the estimate of the risk of the entire group is likely to be accurate.

For example, consider a scenario where 1000 people with symptomatic coronary heart disease (or some other significant health impairment) purchase life insurance. It is virtually certain that the overall death rate for the group will be greater than the death rate for a group of people of the same ages who have no discernible health problems. To allow for the higher death rate, the company must collect an extra premium from everyone with coronary heart disease since it is not known who will die prematurely. It is not expected that every member of the group will survive for a shorter period than the normal life expectancy. In fact, it is almost a certainty that this will not be the case. Rather, what is known is that a larger proportion of people with coronary heart disease will die at an earlier age than a similar group of healthy individuals.<sup>3</sup>

### Risk classification

The primary basis of risk classification is age. Yet within each age group, the probability of death is greater for some than for others. Because of the broad variation in life expectancy, all individuals within an age group cannot be offered insurance on the same terms. To accommodate for this variation, insurers generally use three mortality classifications: standard, substandard, and declined. (Some companies also use a preferred classification for applicants whose mortality risk is lower than average.)

Standard: This classification is used for applicants with an average or better than average life expectancy. Standard mortality, for purposes of comparison with other groups, is said to be 100 percent.

The mortality ranges for the standard classification are chosen so as to include the great majority of applicants. This practice is important because an excessive number of substandard or declined risks would undermine the morale of the agency force, increase the cost of doing business, and cause a loss of goodwill among the public. Apart from these practical considerations, the broader the base of standard risks, the more stable the mortality experience of the entire group. Approximately 91 percent of applicants for life insurance are accepted on a standard basis.<sup>3</sup>

There are upper limits to the risks that can be included within the standard group. If the spread of mortality became too broad,

★ better risks would either seek insurance from competing companies whose classification systems were perceived to be more equitable, or they would choose not to purchase insurance because the premiums were higher than they were willing to pay. This phenomenon reflects the fact that consumers in a private, voluntary insurance market are unwilling to subsidize the insurance purchases of others at higher risk.

**Substandard:** There is a natural reluctance to call this classification "substandard" since the term suggests that the insurance is lacking in some of the essential qualities of standard insurance. This is not the case. Insurance products offered within the standard and substandard classifications differ only in the premium charged. The substandard classification is used for risks that are greater than those accepted on a standard basis. Substandard mortality is generally considered to be an anticipated mortality significantly greater than the 100 percent mortality expected in the standard risk group. Five percent of applications for life insurance are accepted on a substandard basis.<sup>2</sup>

It is worth emphasizing that the purpose of the substandard classification is identical to that of the standard classification, namely, individuals share the risks of financial loss associated with unexpected death. The only difference is that the risks are greater for individuals in the substandard groups.

The most common method of dealing with substandard risks is to classify them into groups based on the expected percentage of standard mortality and charge premiums that reflect the increase in expected mortality. The number of substandard classifications may vary from three to 12, depending to some extent on the degree of extra mortality the company is willing to accept. Some companies are unwilling to insure substandard groups whose average mortality is expected to exceed 200 percent of standard, and they usually establish three substandard classifications with expected average mortalities of approximately 150 percent, 175 percent, and 200 percent. Other companies will offer coverage up to 500 or 1000 percent of standard mortality.

For instance, the mortality risk of an applicant with poorly controlled hypertension might be estimated at 300 percent, indicating a mortality rate of 3 times standard for a person of the same age. Or current cigarette smoking might be considered 200 percent of standard "nonsmoker" mortality because statistics indicate that smoking doubles the mortality rate. These examples are illustrative only. The percentages in a given case would depend on many variables.

Another method of pricing the substandard risk, widely used in the past and still favored by many companies for some products, is to "advance" the age of the applicant. Under this method, the applicant is assumed to be a number of years older than his or her real age and the policy is written accordingly. The number of years older is usually determined by adding the amount estimated as necessary to provide for the extra mortality to the pre-

mium for the applicant's actual age, and then finding the premium in the standard table that most closely matches that total.

As an example, if a 40-year-old with poorly controlled hypertension applies for insurance, the underwriter would estimate the monetary value of the extra mortality, add it to the standard premium, and use a standard table to find the age that is closest to this premium. If this age happened to be 46 years, the applicant would thereafter be treated in all respects (dividends, loan values, etc.) as if he or she were 46 years of age at the time of issue. This approach is conceptually appealing because policyholders are grouped by biological rather than chronological age.

The accuracy of risk classification has been confirmed by numerous industry studies. One study represented an analysis of the mortality experience resulting from 47 billion dollar-years of substandard individual life insurance in force among 12 companies. (One dollar-year of life insurance represents \$1 of insurance kept in force for one year.) The report concluded that there was "a strong correlation between the degree of substandard rating assigned by the issuing company and the level of mortality subsequently experienced on such business."<sup>6</sup> Another study analyzed the 25-year mortality results (1963-1987) of a European reinsurance company.<sup>7</sup> Over 40,000 policyholders were included. The report confirmed a high degree of correlation between actual mortality experience and what had been predicted during the underwriting process.

**Declined:** The declined classification is used for instances where the risk is so great that the company decides it cannot issue insurance coverage. This is because there is a point where yearly premiums become so high that they appear unaffordable to most people. Applicants who would accept insurance at such a high premium rate generally know more about their health than the company, i.e., they suspect that a relatively early death claim is likely. As a result, even very high premiums are inadequate to cover the risk. Most insurers decline an application if anticipated mortality exceeds 500 percent of standard. Conditions within this classification include recently diagnosed cancer (approximately 20,000 percent, or 200 times standard) and AIDS (over 50,000 percent, or 500 times standard). Approximately four percent of applications for life insurance are declined.<sup>5</sup>

**International Experience:** United States life insurance companies accept 96 percent of applicants who apply for coverage (91 percent standard plus five percent substandard), a percentage almost identical to the 97 percent figure reported in Canada.<sup>8</sup> The experience in these two countries reflects similar market conditions that exist in North America. From a more global perspective, it is difficult to compare acceptance rates in different countries due to factors such as market specific product design; historical savings patterns within the populace (e.g., in Japan the purchase of life insurance is viewed as an essential component of a savings plan); varying degrees of emphasis on socialistic programs (particularly within some European countries); and tax laws which make life insurance more or less attractive as an in-

vestment (e.g., in Taiwan,<sup>9</sup> as in many European countries, income tax law allows policyholders to deduct a portion of life insurance premiums from taxable income, thereby encouraging the purchase of life insurance coverage).

### How age and impairment affect the premium

The simplest form of insurance offered by most life insurance companies is yearly renewable term insurance. This product provides insurance for a period of one year only but permits the policyholder to renew the policy for successive periods of one year each without the necessity of providing evidence of good health.

The premium is determined primarily by the death rate for the age of the individual involved. This is an important consideration, since each group of policyholders of a given age represents a separate class for premium purposes; each group must contribute according to its own expected death claims, and cross-subsidization between groups is not allowed.

The accompanying table lists annual male mortality rates and the corresponding life expectancies for a number of different ages.<sup>10</sup> The figures were taken from United States Decennial Life Tables (1979-81) because non-insurance readers are more likely to be familiar with these tables. Insurance companies base their premiums on mortality rates derived specifically for an insured lives population. Mortality rates in a standard class insured lives table are considerably lower than population mortality rates because of the effects of the underwriting process. For example, an insured lives table lists the expected mortality rate for a 40-year-old male in the first policy year as .00079,<sup>11</sup> as compared to the much higher value of .00303 in United States Decennial Life Tables.

To illustrate how life insurance premiums are determined, consider the example of a 20-year-old male. The death rate is 1.81

per 1,000 people (.00181). If a company insures 100,000 men aged 20 for \$1,000 for one year, it could expect 181 death claims totaling \$181,000. Since premiums are paid in advance, the cost of the anticipated death claims would be distributed pro rata over the 100,000 policyholders, and a premium of \$1.81 would be collected from each policyholder. (The actual premium would be higher since these figures include only the mortality cost and none of the expenses or profit objectives of the company). It should be noted that 1) the premium is precisely the same as the death rate applicable to those insured, and 2) those policyholders who die during the year contribute on the same basis as those who survive. The implication of this latter point is that each policyholder pays a share of his or her own death claim, a principle that underlies all life insurance contracts.

If the 99,819 survivors of the original group of 100,000 policyholders should be insured for another year, they would be exposed to the death rate for persons aged 21, or 1.94 per 1,000, which would theoretically produce 194 deaths (or slightly less since there are now fewer than 100,000 participants) and claims totaling \$194,000. That sum divided equally among the 99,819 participants would yield a share, or premium, of \$1.94 per person. If the 99,625 survivors should desire insurance for another year, provision would have to be made for \$203,000 in death claims, necessitating a premium of \$2.03.

Substandard risks are priced in a similar manner. In the case of a 20-year-old applicant who was in poorer health, the extra mortality risk would be estimated and used to determine the premium commensurate with the risk. If the anticipated mortality was similar to that of a 22-year-old, the premium for the first policy year would be \$2.03, i.e., the premium paid by the average 22-year-old.

It is apparent from the mortality table that, beginning somewhere in the 30s, mortality rates rise very sharply with advancing age, and the corresponding premiums would make yearly renewable term insurance prohibitively expensive at the older ages. For this reason, insurers offer level premium insurance, a type of insurance where premiums remain the same throughout the premium-paying period. The higher premium collected during early policy years offsets the less than adequate premium paid in later years. Even with this type of plan, life insurance is expensive if initially purchased at the older ages because mortality rates are high and the number of premium-paying years is relatively small.

### Antiselection

The observation has frequently been made that a life insurance company could safely insure the life of everyone who passes by any designated location in a typical city, so long as the practice does not become public knowledge.<sup>3</sup> Of course, the applications received by a life insurance company do not reflect such randomness. Instead, they are subject to a phenomenon known as antiselection (or adverse selection).

Table 1

#### Annual Male Mortality Rates and Life Expectancy by Age

Age	Annual Mortality Rate	Life Expectancy (years)
20	.00181	51.88
21	.00194	50.97
22	.00203	50.07
30	.00191	42.81
40	.00303	33.64
50	.00775	25.00
60	.01846	17.46
70	.04207	11.35
80	.09069	6.80
90	.18848	3.89

One definition of antiselection is provided by the Actuarial Standards Board: "The actions of individuals, acting for themselves or for others, who are motivated directly or indirectly to take financial advantage of the risk classification system."<sup>12</sup> The tremendous significance of antiselection is illustrated by the following description. The author is speaking in a health insurance context, but the principles apply to virtually all types of private, voluntary insurance products.

"Antiselection has been described as 'that annoying tendency people have of doing what's best for themselves.' This represents the ability of eligibles with either high or low claim expectations to: 1) accurately predict their utilization, and 2) choose (or not) coverage in accordance with their best interest. Their best interest can be equated to economic incentive, which acts on both claim and premium expectations. On the claim side, people who expect a high level of claims are more likely to want coverage than people who expect a low level of claims. This incentive is enormously powerful, and its analysis and management is often a major part of a health actuary's job. On the premium side, the economic incentives can be equally as powerful. If an eligible person is faced with paying a premium of significant size, they are likely to look for other coverage alternatives."<sup>13</sup>

Antiselection is not a by-product of the information age nor a manifestation of the increased emphasis on privacy and confidentiality. It has always been a critical issue to sellers of private insurance. As noted earlier, assessment societies of the late 19th century recognized the detrimental effects of antiselection when elderly and less healthy members preferentially maintained their society memberships while young and healthy members exited in search of more equitable terms. Antiselection and the resultant assessment spirals eventually led to the demise of these societies, and played a major role in the failure of a Chicago-based insurer as recently as the 1970s.<sup>14</sup>

In 1902, medical directors of 15 life insurance companies recognized that their respective companies had lost substantial sums where fraud or misrepresentation was not detected. Since insurance applicants "were not always candid about their medical histories, such losses meant higher premiums for the vast majority of policyholders who were honest. What was needed was a system that would protect the honest consumers against higher premiums which would be necessary if the forgetful or dishonest applicants were too often successful."<sup>15</sup> These discussions led to the formation of the Medical Information Bureau (MIB), a non-profit association of life insurers that conducts a confidential interchange of coded underwriting information among its members as an alert against fraud and misrepresentation.

### Antiselection by those at higher risk

Antiselection may be a factor in the insurance purchases of applicants who are either higher or lower risks than the average person in a group. Antiselection by higher risk applicants occurs when the proposed insured is placed in a group with a premium

rate that is too low to pay the expected death claims. For example, someone with a diagnosis of coronary heart disease would know that death was more likely in the near future compared to healthy individuals of the same age. If the insurance company did not learn about this important information during the application process or if they were prevented from using it, the premium charged would be insufficient to cover the risk of death. The individual with coronary heart disease would be happy with this result but the same could not be said about the others in the group. They paid premiums commensurate with their risks of death and would not have freely chosen to subsidize the individual who took advantage of the system.

Antiselection is limited by the underwriting process. Information pertinent to the insurance contract is usually obtained from the applicant and agent, and sometimes from the applicant's personal physician, an independent examining physician, or the Medical Information Bureau. If significant discrepancies are discovered, the underwriter asks for a clarification. For example, the applicant may have neglected to mention a history of hypertension, a prior injury that is relevant to the type of insurance being considered, a hazardous occupation or avocation, or a recent bankruptcy. Misstatement of age also occurs.

Misrepresentation of tobacco use is a fairly common occurrence. Many companies issue life insurance policies with large discounts if the applicant has not smoked cigarettes or used other tobacco products within the last 12 months. The companies usually request a urine specimen to screen for nicotine (or its by-products) in order to confirm non-tobacco status. (The cut-offs are set high enough to eliminate the possibility of false positives due to second-hand smoke.)

One major United States laboratory reported that six percent of applicants who said they didn't use tobacco tested positive for nicotine.<sup>16</sup> The sample involved 32,000 specimens. A similar study involving twenty of the leading life insurance companies in the United Kingdom found that 6.4 percent of applicants misrepresented their tobacco use.<sup>17</sup> It is worth emphasizing that these instances were not the result of a misunderstanding. Applicants were generally given three chances to disclose the fact that they used tobacco: on the insurance application, during an interview with the paramedical examiner who collected the urine specimen, and during the inspection report (a telephone interview to confirm and clarify information on the application form).

Use of illegal drugs is another instance where misrepresentation is sometimes discovered during the underwriting process. Applicants are asked about the use of illegal drugs such as cocaine. In spite of answering "no" to this question, insurance laboratory data continue to report misrepresentation rates (as determined by urine cocaine testing) that average 2.7 (1993) to 5.8 (1989) per 1,000 applicants tested. The frequency of misrepresentation varies dramatically with age and geographic area, reaching a high of 13.1 per 1,000 applicants tested. Results are similar in Canada.<sup>18</sup>

A final example of antiselection by higher risk applicants occurs with the purchase of term rather than whole life insurance. Term insurance is regarded as temporary because it provides protection for a limited period only, such as five, 10, or 20 years. The premium is relatively low at the younger ages because expected mortality rates are low during the term of the policy. In contrast, whole life insurance is regarded as permanent insurance since it provides life-long protection; the premiums at the younger ages are higher than those for term insurance because they will remain level for life. Actuarial studies of claims data consistently show a higher mortality with term plans compared to whole life plans.<sup>19</sup> Antiselection accounts for much of the difference and the reason relates to basic economic principles: people at higher risk of death preferentially buy a less expensive product (term insurance) because this allows them to maximize their gain in proportion to the premium invested.

### **Antiselection by those at lower risk**

Lower risk individuals also practice antiselection when making insurance purchases. The following example concerns annuities.

Annuities are periodic payments that begin at a specified date and continue for a fixed period (e.g., 10 or 20 years) or for life. For instance, a 45-year-old may purchase an annuity that will pay \$1000 per month starting at age 65 and continuing for as long as the individual is alive. Insurers have found that the mortality rate among persons who purchase annuities is lower than that of those who purchase life insurance. One important reason is antiselection: individuals who know or suspect they have serious health problems rarely, if ever, purchase annuities. In fact, many people contemplating the purchase of annuities that will pay benefits in the near future undergo a thorough medical examination to be certain they have no serious health problems before committing their capital to annuities. On the other hand, people who know or suspect that their life expectancy may be less than average usually seek life insurance instead.<sup>3</sup> These mortality differences are so substantial that insurers must use special mortality tables to calculate annuity premiums.

### **The federal government**

Additional instances of antiselection involve property/casualty programs sponsored or contemplated by the federal government. The first case was chosen to demonstrate the extent to which people will use available information to guide their insurance purchases.

The federal government sells flood insurance to people who live in areas at high risk for flooding. Instead of requiring that participants purchase coverage long before a claim might be incurred (a situation analogous to requiring that life insurance be purchased well in advance of the time when death is likely to occur), the government allowed waiting periods of as little as five days. A federal advisory panel reviewing the catastrophic Midwestern

floods of 1993 reported numerous instances of antiselection, with people "avoiding insurance payment premiums until rivers were already swollen and beginning to spill over their banks." They cited one town that "bought flood insurance for its public school after it became alarmed by the rising river. Townspeople then shored up the levee with sandbags, holding back the flood just long enough for the new insurance policy to take effect before the school was flooded."<sup>20</sup>

The second example concerning the federal government is tantamount to an endorsement of the risk classification process and a recognition of the critical importance of antiselection (adverse selection). US Senate bill 1350 was an attempt to establish a federal natural disaster insurance program.<sup>21</sup> One item of particular concern to the government was the need to limit cross-subsidization between geographical areas at high and low risk for natural disasters (a situation analogous to subsidization between life insurance applicants at high and low risk of death): "... if premiums reflect average losses for a rating area with dissimilar risks, lower-risk homeowners may refuse to purchase insurance at premiums higher than their risk exposure. As the lower-risk homeowners opt out, actuarially sound rates would have to increase to reflect the higher average risk of the remaining pool of homeowners.

Consequently, premiums would also increase, and homeowners most likely to purchase the insurance would be those with the higher risk of loss—a clear case of adverse selection."<sup>21</sup> The report also emphasized that "For an insurance company doing business on its own account, it is crucial that the premium charged matches the homeowner's risk. This is called underwriting, and a failure to underwrite carefully could expose the company to losses greater than it has been paid to accept."

### **Genetic information and antiselection**

Genetic diseases have always been present: it is the advent of genetic tests that concerns insurers. Life insurance companies use both loss analysis and risk analysis when calculating premiums and determining the type of information needed to classify risks. Loss analysis looks at the past, and risk analysis looks at the present and into the future. Because the risk portfolios of all insurers already contain large numbers of policyholders with genetic diseases, insurers would not be concerned if future purchasing decisions were based on prior buying practices, since these claims would be anticipated by loss analysis.

This will obviously not be the case after genetic testing becomes common medical practice, any more than it was with past medical advances that provided patients and applicants with better information about their health and expected longevity. It is inevitable that economic incentives will encourage insurance applicants to use favorable and unfavorable genetic information to guide their purchases. Life insurance companies will need access to this same information in order to classify the risks they are asked to accept.

Acknowledgments: The author would like to thank Dan Case, Don Chambers, André Chuffart, Erik Grossman, and Alexander Lowden for their comments on this manuscript.

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