8. Future imperfect: the response of the insurance industry to the emergence of predictive genetic testing*

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1. INTRODUCTION

This exploratory study of knowledge investment in the life insurance industry aims at examining the impact of increasing medical knowledge on the actuarial practice of life insurance companies. A huge literature exists on the innovative dynamics of a number of service industries. In the service industries, knowledge is often taken to be highly embedded in day-to-day operations or to be received through the purchase of equipment from other sectors. Indeed, most of the available studies of innovation in the service industries focus on the introduction of information and communication technologies (ICTs) in banking and insurance. Most of these studies focus on the impact of ICTs on the way recipient organizations do traditional things, and how this leads them to introduce new products (see Hecht 2001 and the seminal work of Barras 1990).

In contrast to these studies, this chapter does not consider the diffusion of new or improved equipment. Its emphasis is squarely on the diffusion of new information and knowledge and their impact on the accumulation of intangible capital by firms, for example, the process by which a firm acquires specific new knowledge. Specifically, our analysis is directed to firms’ responses to the emergence of a particular body of knowledge: genetics and the related development of genetic screening techniques. The innovative character of this study lies in the examination of how externally generated knowledge is acquired by a service industry. Genetics was chosen because of its potential impact on one of the key activities of the insurance industry – risk assessment. ICTs may enable firms to assess the risk attached to an increasingly greater number of policies, but they do not necessarily bring about any major change in firms’ risk assessment capabilities.

This study is necessarily exploratory in nature given the lack of indicators for understanding the extent to which (and in what ways) the service
industry approaches knowledge generated by other parts of the economy. An industry study approach is adopted in order to analyse how insurance companies are adapting and developing their knowledge base to keep pace with the breathtaking changes that are occurring, particularly in the scientific understanding of the genetic causes of an increasing number of diseases. In other words, we look at what kind of competence-building strategies (e.g. in-house R&D versus joint research activities) insurance companies are deploying to react to the emergence of genetic screening techniques.

This chapter focuses on a sample of UK-based European firms. The UK focus was adopted for a number of reasons. First, the regulatory framework related to access to and use of genetic information varies widely from country to country. It is likely that such differences impact dramatically on firms’ decisions. Therefore, given the limited scale of this study, it became necessary to control for this variable. Second, the UK (life) insurance market is the largest in Europe and all major players are active in it. Thus, our sample of UK-based firms includes all the major European Union (EU) and Swiss firms. Third, the UK industry association (Association of British Insurers, ABI) has developed a specific code of conduct that goes well beyond the traditional moratoria and bans introduced in other countries. Although a moratorium is now in place in the UK, insurance firms appear to be taking steps to develop competences related to the use of genetic tests, as opposed to the ‘wait-and-see’ strategy being adopted by their EU-based competitors. In short, the UK is a reasonable setting for an exploratory study of a set of activities that have just started attracting the attention and efforts of the industry.

This chapter is organized as follows. Section 2 reports on the rationale for this study, the key research questions and the methodology applied. Section 3 describes the current state of the technology and the regulatory response of the UK government and the ABI. Section 4 summarizes the main issues raised by the use of genetic information for insurance purposes. Section 5 concludes.

2. INSURANCE AND GENETIC TESTING: THE TECHNOLOGICAL AND INSTITUTIONAL FRAMEWORK IN THE UK

2.1 Genetic Testing

The possibility of using genetic information to assess individual risks for insurance purposes has gained enormous attention in the past few years,
particularly in the UK and the USA. Insurance is an indispensable part of life for the vast majority of people in the UK. For instance, mortgages are generally only granted if life insurance is in place. Increasingly, people rely on personal insurance schemes to gain access to various health services.

There are fears among the industry that allowing people to hide the results of genetic tests from insurers could result in the breakdown of the private insurance market. This is a phenomenon known as adverse selection. In this scenario, those who know they are at high risk will be more likely to purchase insurance than those who know their risk is low. Insurers, if unaware of this, assume their risk pool is unchanged and thus underwrite premiums which are too low to cover future claims. This would result in insurers being forced to raise premiums, making insurance cover a less attractive option for those with normal life expectancy. Eventually only those who are classed as high risk will want to buy insurance, leading to the collapse of the pooling system and the insurance market itself.

Genetic information in the form of family history has long played a part in insurance underwriting. The difference between family history and genetic testing is the apparent accuracy of a genetic test in predicting the probability of an individual succumbing to a disease. This would allow insurers to match individual insurance policies and premiums with the predicted diseases. Thus, those individuals with a ‘clean’ genetic record would be able to obtain insurance at lower rates, while those with ‘bad’ genes might be unable to obtain insurance at all, and would constitute a ‘genetic underclass’.

The clash between these two opposing positions (adverse selection versus a genetic underclass) has generated rather heated debate about the consequences of the commercial exploitation of genetic information. At this stage, this debate clearly does not anticipate any immediate large-scale application of genetic tests for insurance purposes. As an example of the current size of the problem, the Co-operative Insurance Society (CIS) saw 14 test results out of 460,000 applications for insurance between April 1997 and January 2001 of which only one test affected the terms of the policy (Department of Health 2001: 18).

As discussed later in this chapter, there are still limitations on what the technology can actually deliver. Indeed, the predictive capacity of current genetic tests is limited to identifying those who carry a certain gene, which may predispose them to a particular disease. The timing and likelihood of the disease developing and its severity cannot be specifically forecast. It is argued that because the timing of a genetic disease is not predictable from a test, it is possible that an applicant could be denied cover but might not develop the disease until the period of insurance cover has expired, that is, when they would no longer be a risk to the insurer (O’Neill 1997). It may
be unreasonable (and commercially unsound) to deny insurance to certain applicants who may pose no greater risk than others during the period of insurance. Besides, the UK industry, also in response to the pressure of consumers’ associations, has established a rather strict ‘code of conduct’ that further limits the use of those few genetic tests that are currently available.

There has also been discussion about the reliability of genetic tests and their results (Human Genetics Commission 2001; Meek 2001). Positive test results raise uncertainties about the course of disease development. In addition, it may be the case that several different genetic mutations are responsible for a single disorder, and a negative test result for one mutation does not guarantee freedom from the disease. While this scenario does not violate the insurance principle of equal knowledge, as neither the insurer nor the applicant is aware of the error, it highlights the uncertainties surrounding genetic testing.

Besides, not all genetic tests are relevant for insurance purposes, and some categories of insurance may be more affected by genetic tests than others. The disorders most pertinent for insurance purposes are the late-onset dominant mono-genic disorders, of which the classic example is Huntington’s disease (Macdonald 2001). The late-onset nature of a genetic disorder is particularly important in discussions about insurance, because it is the predictive nature of the genetic test that is of concern in assessing an individual’s risk. There are only a small number of genetic diseases that fall within this category, primarily due to the rarity of late-onset diseases. Currently, few of these diseases can be treated. These diseases are the ones that most concern insurers, because a positive test result will greatly increase an individual’s risk, and that risk cannot currently be reduced by treatment or other preventative measures (see Table 8.1).

Some of these diseases may already be included in underwriting considerations based on family history. It thus follows that a negative test result will be positively beneficial in terms of obtaining insurance cover to someone with a family history of a disease. As an example, an applicant who has a parent who suffers from, or has died from, Huntington’s disease and has not taken a test themselves is likely to be classed as ‘ uninsurable’ (strictly speaking, insurable, but at an unacceptably high premium rate). If the applicant were to take a test and it prove negative, they would then be able to get insurance cover at a reasonable rate. If the test were positive they would remain uninsurable, but, from an insurance point of view, would be no worse off than if they had not taken the test. The implication, at least for those with a history of Huntington’s Disease, is that 50 per cent of those refused insurance based on family history could be accepted for insurance following a genetic test.

Finally, it is worth noting that genetic testing may impact on different
insurance products in different ways. Life insurance is a very extensive, mature market and therefore may be able to absorb a certain amount of adverse selection. The newer markets, for long-term care, critical illness and income protection, are much smaller than the life insurance market, and thus may be more vulnerable to the impacts of genetic testing.

2.2 Regulation of the Use of Genetic Tests in Insurance

Genetic testing and its potential use in insurance entered the UK political arena fully in 1995 when the House of Commons Select Committee on Science and Technology published their report entitled ‘Human genetics: the science and its consequences’ (Department of Health 2001). This report recommended that the industry be given one year to develop a suitable solution to the potential problems of adverse selection or creation of a genetic underclass. A second recommendation was for the creation of a statutory body to oversee developments in human genetics. The government felt that the insurance industry should draw up its own code of practice but, in response to a follow-up report from the Committee, the government set up the Human Genetics Advisory Commission (HGAC), a non-statutory body, in 1996.

The HGAC was in operation from December 1996 to December 1999. In March 1997 it published its first report entitled ‘The implications of genetic testing for insurance’ (HGAC 1997). This report recommended, first, that a two-year moratorium on the use of genetic tests in insurance should be put in place and, second, that a mechanism should be established whereby the

<table>
<thead>
<tr>
<th>Condition</th>
<th>Type of insurance</th>
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<tbody>
<tr>
<td>Huntington’s disease</td>
<td>Critical illness</td>
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<td></td>
<td>Income protection</td>
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<td>Long-term care</td>
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<tr>
<td>Early onset familial Alzheimer’s</td>
<td>Life insurance</td>
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<tr>
<td>Amyloid precursor protein gene</td>
<td>Critical illness</td>
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<tr>
<td>Presenilin 1 gene</td>
<td>Income protection</td>
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<tr>
<td></td>
<td>Long-term care</td>
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<tr>
<td>Hereditary breast and ovarian</td>
<td>Life insurance</td>
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<tr>
<td>cancer</td>
<td>Critical illness</td>
</tr>
<tr>
<td>BRCA1 gene</td>
<td>Income protection</td>
</tr>
<tr>
<td>BRCA2 gene</td>
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Source: Adapted from ABI News Release, 3 April 2001.
actuarial relevance and reliability of genetic tests could be assessed. The notion of a legislated moratorium was rejected by the Government, but the Genetics and Insurance Committee (GAIC) was established in April 1999 to provide the assessment mechanism recommended by the HGAC. The GAIC also has responsibility for reporting on the level of compliance with its decisions within the industry. By June 2000 the GAIC had published the criteria by which genetic tests would be assessed and approved. These covered issues of technical, clinical and actuarial relevance. The first application was submitted to the GAIC by the ABI in October 2000.

In May 1999 the government established a new body to look at the wider social and ethical issues, as well as the scientific issues, relating to genetics. This Human Genetics Commission (HGC) took office in December 1999 taking on the role previously filled by the HGAC. Following a period of consultation in May 2001 the HGC published its interim recommendations on the use of genetic information in insurance (HGC 2001). This report called for a three-year moratorium on the use of genetic tests in insurance, with an exception being made for policies over £500000. Similarly, the report of the House of Commons Science and Technology Committee on ‘Genetics and insurance’ which was published in March 2001 called for a voluntary moratorium on the use of positive test results for at least two years (Department of Health 2001, p. xxvi). Both the HGC and the House of Commons Science and Technology Committee reports recommended that the moratorium be backed by legislation unless the insurers were able to prove they could regulate themselves.

2.3 The ABI and the Genetic Testing Code of Practice

The ABI represents over 400 insurance companies in the UK, covering about 96 per cent of the market (Department of Health 2001, p. 51). By 1995 the ABI was aware of the issue of genetic testing, and set up the ABI Genetics Committee in 1996. That same year the ABI appointed Professor Raeburn of Nottingham University as its Genetics Advisor. In December 1997, following consultation with its members and the public, the first version of the Genetic Testing Code of Practice was published (ABI 1999a). The Code prevents insurance companies from asking applicants to undergo a genetic test in order to obtain insurance, and companies may only consider the results of tests which have been approved or are being considered by the GAIC. The Code also covers provision for an independent appeals system to consider complaints under the Code and requires companies to certify their compliance annually. Companies that do not comply with the Code could face possible withdrawal of membership of the ABI, and its accompanying bad publicity.
Originally, tests did not have to be disclosed in applications for mortgage-related life assurance up to £100000 for a house to be occupied by the applicant. Following the publication of the House of Commons Science and Technology Committee report in March 2001 and the HGC interim report in May 2001 the ABI extended this moratorium to include all classes of insurance up to a total value of £300000 (ABI 2001a). The Code sets out additional responsibilities for the Chief Medical Officer (CMO) and the Nominated Genetics Underwriter (NGU) in an insurance company. The CMO must be consulted over every application containing a genetic test result, and must provide expert medical advice and judgement. The role of the NGU is also of interest, as it requires a senior underwriter to become the central reference point within the company for matters relating to genetic testing in insurance applications. The responsibilities of the NGU include keeping up to date on genetics and assisting with the training of appropriate staff, and the role provides a ‘hub’ for company activities relating to genetic testing. While members of the ABI are required to comply with the Code, it could be viewed as a ‘minimum standard’, with some insurance companies ignoring genetic test results for all applications, or considering only negative results from the tests received (Department of Health 2001).

Currently only one test for one type of insurance has been approved by the GAIC and that is the test for Huntington’s Disease in relation to life insurance applications. However, until GAIC reaches a decision on applications submitted by the ABI in December 2000, companies may use test results relating to the following conditions and types of insurance which were the subject of those applications.

These tests and four others (for myotonic dystrophy, familial adenomatous polyposis, multiple endocrine neoplasia and hereditary motor and sensory neuropathy) were originally included in a list of tests issued by the ABI in 1998, which could be used by insurers. It has been agreed that, for the four tests which were not submitted to the GAIC and for any submitted which are subsequently rejected by the GAIC, insurers who made use of these tests in must refer back to November 1998, when the list was first published. Any applications which received less favourable treatment as a result of the tests being used from that point must be re-underwritten as if the tests had not existed (Department of Health 2001, p. 80).
3. RATIONALE AND METHODOLOGY

3.1 Rationale and research questions

Given the potential implications of genetic testing for the industry, it is no surprise that a substantial body of journalistic and academic literature has accumulated in the last few years focusing on the appropriateness of alternative policy responses to the emergence of predictive genetic testing. This chapter looks at yet another aspect: alongside the policy debate, and the efforts that both insurance firms (directly and through their associations) and customer associations are devoting to influencing the design of the policy framework, are insurance companies actually developing the ‘technical’ capabilities they need to be able to assess the actuarial and economic implications of genetic testing? And, if so, how?

There is a huge literature that focuses on the processes through which firms monitor, absorb, develop and commercially exploit new information and knowledge. Classic studies on the emergence of large, innovating firms stress the pivotal role played by the in-house R&D department (Chandler 1990). Mowery (1983) also pointed out that in-house and contract research actually complement each other, although contract research tends to focus on the easier, and more predictable, steps of the research process. More recently, both practitioners and academics have highlighted the emergence of new, highly specialized bodies of scientific and technological knowledge that are pushing firms to increase their reliance on external sources of knowledge. Building on the seminal work of Cohen and Levinthal (1989), which introduced the notion of absorptive capacity, a large body of empirical literature stresses the importance of networks of innovators as the locus of learning and innovation (Powell 1990; Freeman 1991).

This research aims to look at whether there is evidence of the development of competences related to genetic screening in the insurance industry. If so, we are interested in understanding whether these competencies are developed in-house, and by what kind of firms, or relying on external suppliers of relevant skills. In doing so, several assumptions have been made. First, that firms benefit from competence building because it improves their competitive advantage and firms that exhibit dynamic capabilities are able to improve or change their competences. Second, insurance companies dealing in long-term businesses, such as life, health and critical care insurance, will benefit from improving their competences in dealing with genetic testing in insurance applications. Third, some genetic tests are more relevant for insurance purposes than others. Examples would be predictive tests over diagnostic tests, and dominant over recessive genetic disorders. A rise in the use of relevant genetic tests will increase the pressure

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on insurance companies to obtain the competences needed to deal with the tests.

The research hypotheses are that companies will be adopting competence-building strategies in response to genetic testing, and that there will be a difference in the efforts being made by different types of firms to improve their competences in relation to genetics. Moreover, we explore the issue of whether and how firms in the insurance industry are building linkages with external sources of specialized knowledge and whether these networking activities involve all firms in the industry or only some of them.

3.2 Method, data and unit of analysis

There are two main categories of insurance, general insurance (including motor, property and liability policies), and long-term insurance, which includes life assurance, critical illness and income protection insurance, and pensions. This chapter is focused on the long-term insurance sector (excluding pensions) because it is the long-term products such as life and critical illness insurance that are most likely to be affected by genetic testing. For the purposes of this study the terms ‘critical illness’ and ‘income protection’ will be collectively referred to as ‘health insurance’. This should not be confused with private medical insurance, often provided by employers, but which is not included in this research as it is annually renewable and generally insures groups rather than individuals. Genetic tests are not, at the moment, relevant to this type of policy (Interview I). See Appendix 1, Table 8.A.1, for a full list of interviewees.

In 1999 (ABI 1999b) there were 829 insurance companies authorized to transact business in the UK, of which 233 were authorized to transact life assurance. This number includes both those companies which deal only in life insurance, and those which deal in both general and life insurance, the composites. In practice, the number actually writing insurance is lower than this (Howitt 1999). The ABI estimates that there are about 120 companies writing long-term policies for life insurance, critical illness insurance and income protection insurance (Interview I).

Table 8.2 shows that the volume of insurance business in the UK generally and in the life insurance market in particular has generally increased, while the number of companies active in that market has fallen. The decrease in the number of companies licensed to operate in the UK echoes the decline seen across Europe during the same period (Eurostat 1999). In 1999 the UK life insurance market was worth £91 775 million and made up 72.5 per cent of the insurance market in the UK. Table 8.2 shows that the life insurance market has almost doubled in value since 1993 when measured by premiums written. During the same period, life insurance has
increased its share in the total insurance market in the UK from 65.4 per cent to 72.5 per cent. The UK life insurance market is the largest in Europe, followed by France and Germany, and is the third largest in the world after North America and Japan, having 10.5 per cent of the world market in 1999 (Sigma 2000).

The largest 20 insurers in the UK account for most of the life insurance market. This figure has increased in recent years from 67 per cent in 1994 to the 1998 figure of 80 per cent (Sigma 1999), suggesting that the market in the UK is becoming increasingly concentrated. In 1998, 35 per cent of market share (by premiums) was held by the top five companies. The top 10 companies accounted for 54 per cent of the market. Compared to certain European countries, the UK market is not particularly concentrated. For example, in France the top five companies hold 53 per cent of the market, while in Germany the top three have a market share of 36 per cent.

Several sources of information were used in the attempt to study the competence-building strategies of insurance companies, and to look for differences between companies. The primary information on firm activities was gained through an in-depth review of the existing technical and policy literature, from interviews and questionnaires. It was important to interview both large and small insurance companies, and the organizations they may interact with. Interviews in the pilot stage were conducted with senior staff from three large insurance companies and one small insurance

### Table 8.2 The size of the UK insurance market

<table>
<thead>
<tr>
<th>Year</th>
<th>Total premiums (£ million)</th>
<th>Life premiums (£ million)</th>
<th>Life as % of total</th>
<th>Life companies</th>
<th>Composite companies</th>
<th>Total companies writing life</th>
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<tbody>
<tr>
<td>1989</td>
<td>206</td>
<td>64</td>
<td>65.4</td>
<td>194</td>
<td>59</td>
<td>253</td>
</tr>
<tr>
<td>1990</td>
<td>203</td>
<td>64</td>
<td>63.9</td>
<td>191</td>
<td>57</td>
<td>248</td>
</tr>
<tr>
<td>1991</td>
<td>202</td>
<td>64</td>
<td>61.5</td>
<td>177</td>
<td>59</td>
<td>236</td>
</tr>
<tr>
<td>1992</td>
<td>196</td>
<td>62</td>
<td>56.8</td>
<td>174</td>
<td>58</td>
<td>232</td>
</tr>
<tr>
<td>1993</td>
<td>81091</td>
<td>50207</td>
<td>56.8</td>
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<tr>
<td>1994</td>
<td>76405</td>
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<tr>
<td>1995</td>
<td>87867</td>
<td>53999</td>
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<tr>
<td>1996</td>
<td>96408</td>
<td>61929</td>
<td>56.8</td>
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<td>1997</td>
<td>109319</td>
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<td>1998</td>
<td>126648</td>
<td>91775</td>
<td>56.8</td>
<td>174</td>
<td>58</td>
<td>232</td>
</tr>
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company. Due to the limited availability of comparable financial information on insurance companies in terms of premiums written or turnover, large companies were defined as those included in the ABI Top 20 long-term insurers in 1999 (ABI 1999b). Three were publicly quoted companies and one was a mutual. Two of the companies were independent, and two were subsidiaries of larger groups. Following these interviews it became clear that both the ABI and the reinsurance companies had an important role to play in the way insurers learn about genetics. An interview was carried out with the Chief Underwriter of a reinsurance company to learn more about reinsurers’ interactions with insurance companies and the activities of the reinsurers themselves. The Assistant Manager of Life and the Head of Health at the ABI were also interviewed. Finally, the Genetics Advisor to the ABI and the Director of the Genetics and Insurance Research Centre at Heriot-Watt University were interviewed to gain a better understanding of the research work that is going on outside the industry, and the possible impacts of genetics on insurance and individuals.

The semi-structured interviews with companies asked about the different ways in which internal competences are changed, and the use of external and internal bodies to provide information. Specific questions dealt with staff training and employment, internal research efforts, external information sources and activities and the level of genetic testing penetration in the company. Interviews with insurers were anonymous both for the company and the person, as the purpose was to identify some general activities and efforts rather than individual corporate strategies. The non-company interviews were less structured, with simply a brief list of points to be covered beforehand. A number of the interviews were carried out face to face, but time constraints meant that several interviews were conducted over the telephone.

Semi-structured interviews provided a flexible way to identify key areas of activity within companies and external organizations which it was important to focus on in the questionnaires. Information gathered in this way has the advantage that it is up to date, which is often not the case with published information, and is important in an area where changes may occur rapidly. However, the relatively small sample of interviews possible in the time available may have resulted in the information being unrepresentative, but the choice of fairly diverse sample of companies it was hoped would minimize this problem. Furthermore, the interviews did not aim to be exhaustive; they were carried out to ensure that no highly important areas of activity were not excluded from the questionnaire. In addition to these methodological reasons, they were used to depict a background against which we could interpret the results of the survey.
The main areas of activity identified by the interviews were addressed in a short structured questionnaire directed to either the NGUs or CMOs in a sample of insurers. The initial choice for contact was the NGU or the deputy NGU. This is often the chief underwriter in a firm, who has the additional responsibility of ensuring that the firm keeps up to date with developments related to genetics. Thus, it was felt that their knowledge of activities in relation to genetic testing was likely to be the most complete of any individual in the company. The names and contact details (either fax or email) were obtained by telephoning the companies on the ABI list of life and composite insurers. Where the NGU (or deputy) could not be contacted the questionnaire was directed to the CMO, who sees all applications containing a genetic test. Prior to wider distribution the questionnaire was piloted on two senior members of staff from the ABI, and the chief underwriter of one insurance company. Following their comments some amendments were made and the final version achieved. The questionnaire contained stratification questions, to allow comparisons to be made between different types of companies. The main part of the questionnaire consisted of six questions covering the companies’ internal and external activities to see if firms were placing greater importance on external sources of information, and thus making use of a network outside the company.

The sample of companies to whom the questionnaire was sent was created from the lists of life and composite insurers (selling both long-term and general insurance) held by the ABI. A total of 32 composite and 144 life companies were listed some of which figured on both lists and so were removed from one. Research on the structure of the industry allowed us to identify a large number of entries that were for subsidiary companies, with a single underwriting department covering all the companies in that group. It also became apparent that several of the companies listed were not carrying out their own underwriting, but were outsourcing it to another insurance firm. Firms which sold only pensions were excluded from the survey. Questionnaires were finally sent to a total of 15 composite and 47 life companies. In our estimation, these firms included all the independent company members of ABI, which represent about 96 per cent of the UK industry. The questionnaire was sent out by fax or email in mid-July 2001, and a reminder was sent two weeks later to those who had not responded. Companies still not responding were contacted a third time and offered the option of completing the questionnaire over the telephone. The response rate to the questionnaire was 32 per cent, which included one response that could not be used in the quantitative analysis, but which provided additional background information. The completed questionnaire response rate was 30.6 per cent, and it is these that are included in the following analysis. We estimate that the number of respondents, although small, covers
over 50 per cent of the UK industry in terms of premiums, and includes the vast majority of firms with in-house underwriting capabilities.

4. RESPONSE OF FIRMS TO THE EMERGENCE OF GENETIC TESTING

4.1 Empirical analysis

This section analyses and interprets the results of the empirical research which was undertaken. In this exploratory study the aim is to ascertain whether companies are making efforts to build competences and, if so, whether they are using networks in order to do this. The research tries to identify some characteristics of these networks relating to the role of different participants, the flow of knowledge and the efforts of smaller and larger firms. The insurance industry is involved in a variety of activities in relation to genetics and genetic testing. These include the ABI’s Genetics and Insurance Forum (GIF), the UK Forum for Genetics and Insurance (a multi-disciplinary discussion group), and the Genetics and Insurance Research Centre (GIRC) at Heriot-Watt University. This last organization is funded by a group of 12 insurance companies through the ABI, though the centre itself is independent and all its work is available in the public domain. The aims of the centre are primarily to develop models of single and multi-gene disorders, and their effects on insurance, and to develop links with other groups such as geneticists, epidemiologists and health economists (GIF 2001, p. 1).

Research into the mortality and morbidity of people with long-term insurance is undertaken on a continuous basis by the Institute and Faculty of Actuaries, whose Continuous Mortality Investigation Bureau (CMIB) uses data from the insurance companies which are no longer commercially sensitive (Interview I). The CMIB does not at the moment include genetic testing in its research, perhaps due to the small number of policies currently affected by genetic testing (Interview K). As a minimum requirement, those firms that are members of the ABI have to keep up to date with developments and disseminate new information to relevant personnel within the firm. It was important, therefore, to interview a number of companies and other actors in the field to find out how this requirement was being manifested in specific firm activities and whether other activities, not identified by the literature review, were also taking place.

The insurance company interviewees agreed that at present, reliable genetic tests are so few that there is no problem with either adverse selection or a genetic underclass likely at this time. Internally, the NGU has a
central role to play in the transfer of information within the company, and the collation of information about genetic testing from both internal and external sources. The responsibility of the NGU to scrutinize all applications including genetic information was confirmed by all the companies interviewed. In the companies interviewed, only the reinsurer was involved in a programme of in-house research, where published medical data are collated by in-house doctors and used for the creation of mortality and morbidity statistics by in-house actuaries (Interview G). In order to access this data subscriptions to a variety of medical journals are taken out by the company. The statistics obtained are used to compile manuals, which are used by the client insurance companies to underwrite all but the most unusual or expensive policies. One insurer was carrying out internal literature reviews, though of an unspecified nature (Interview B).

The ABI is an important source of information for insurance companies, providing regular circulars to the industry. In addition, ABI committees and forums bring representatives of the industry together and ‘provide an opportunity to meet with and discuss with peers at other companies’ (Interview C). Reinsurers also have an important role to play for the insurance companies. As well as the production of underwriting manuals, reinsurers hold club meetings for underwriters on a regular basis for the discussion of a range of topics, including genetics (Interviews A and D). The participation of the Institute of Actuaries in the collection and analysis of data by the CMIB was mentioned (Interviews H, I and J), as was their role in pricing (Interview C), and in holding actuarial conferences which have recently been opened to underwriters (Interview A). The use of medical publications and other scientific literature in keeping up to date with changes involving genetic testing was mentioned specifically by three of the interviewees (Interviews B, C and G).

Joint activities revealed by the interviews appeared to be limited to involvement in the conferences and committees run by the ABI, reinsurers and Institute of Actuaries. The emphasis of the companies on the small number of applications affected by genetic tests and the lack of data available due to the rarity of both the diseases and the tests has not apparently encouraged them to pool their available data. As one interviewee said: ‘There is informal interaction between companies to integrate approaches, . . . but there is a lack of co-ordination between companies’ (Interview B). The Genetics and Insurance Research Centre (GIRC) is a joint venture funded by a group of insurance and reinsurance companies coordinated by the ABI. Company involvement is restricted to funding the centre and having a place on the steering committee. There is no formal mechanism for data sharing between the companies and the centre, with research being based on published epidemiological data (Interview K).
The information obtained by the literature review and interviews revealed that companies are adopting competence-building strategies in relation to genetic testing. These strategies include both internal activities such as staff training, and external activities such as conferences, seminars and committee membership. The differences in these strategies between large and small firms were not discernible from the interviews. To address this issue, and the role of networks in learning about genetics, the responses to the questionnaire were analysed.

As stated, the response rate to the questionnaire was 32 per cent (20 returned out of 62 sent). All of these firms have in-house underwriting capabilities. Their composition is described in Table 8.3. The breakdown by those companies which are funding the GIRC shows that half of the large companies and a third of the reinsurers which responded contribute to funding the centre: no small firms did. This allows us to claim that the sample of respondents is not biased towards those that tend to cooperate (funders of GIRC).

Further confirmation of the reliability of the sample comes from the differing characteristics of respondents. Thirty-seven per cent of respondents were mutual or cooperative firms, with the remaining 63 per cent being either public quoted, or public limited companies. Thirty-seven per cent were independent firms and 26 per cent were subsidiaries of UK companies, while 37 per cent were subsidiaries of international companies and had their head offices outside the UK. An interesting, and thought-provoking, result of the questionnaire is that only 84 per cent of the firms that responded were training their staff in connection with genetic testing, as required by the ABI Code of Practice. That 16 per cent of the firms were not training their staff should perhaps be of concern, as all the firms who received the questionnaire are members of the ABI, and should thus comply with the ABI Code of Practice.

On the basis of these results we proceed to analyse first the importance of sources of information, to ascertain the role of external sources of information in firms’ learning, and thus the potential for the use of networks. This is followed by a discussion of the importance of different sources of

Table 8.3 Composition of respondents

<table>
<thead>
<tr>
<th>Composition</th>
<th>Large companies</th>
<th>Small companies</th>
<th>Reinsurers</th>
</tr>
</thead>
<tbody>
<tr>
<td>GIRC Funders</td>
<td>50%</td>
<td>0%</td>
<td>33%</td>
</tr>
</tbody>
</table>

Source: GIRC: Generic and Insurance Research Centre.
internal and external information and methods of communication for all the firms. A comparison of these data for large firms, small firms and reinsurers is made, to identify whether differences in learning activities exist across the groups, as suggested by the research hypothesis.

From Table 8.4 it is clear that external sources of information are significantly more important than internal sources and there is a difference

<table>
<thead>
<tr>
<th>Sources</th>
<th>% of companies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Internal most important</td>
<td>5</td>
</tr>
<tr>
<td>External most important</td>
<td>58</td>
</tr>
<tr>
<td>Both the same</td>
<td>37</td>
</tr>
</tbody>
</table>

between the percentage of companies that rated external as most important and those that rated internal and external as being of equal importance. It is not possible to state whether this difference is significant.

A majority of both large and small companies stated that external sources of information were most important. Far fewer felt that internal and external sources were of equal importance, and very few felt that internal sources were the most important. This suggests that insurers are relying more on external information than on information generated inside the firm. While both large and small insurance companies rely predominantly on external sources of information, reinsurers stated that internal and external sources were equally important. Thus, it would seem that in-house sources of information are much more important to reinsurers than to insurers. Reinsurers differ greatly from insurers in this respect.

The importance of both internal and external sources has increased in the last three years for more than half the companies and only 5 per cent believe that there has been any decrease in the importance of sources about genetics. While there has been an increase in the importance of both internal and external sources of information for nearly two-thirds of the large insurance companies, all the reinsurers reported that both internal and external sources had become more important. In marked contrast to this, the majority of small insurance companies stated that there had been no change in the importance of either source of information (see Tables 8.5–8.7).

As shown in Figure 8.1, the most important source of information within the insurance firm is the NGU, with 89 per cent of respondents rating this as ‘extremely important’. However, 5 per cent of firms said that the NGU was not used as a source of information. Staff other than the NGU, and seminars and courses were ranked equally as the second most important
sources of information within the firm with 42 per cent of the respondents rating them as ‘extremely important’. Some firms may have included the CMO in the ‘other staff’ category, rather than listing them in the ‘other’ category. A fairly small percentage (22 per cent) of all firms rated in-house research as a source of extremely (11 per cent) or moderately (11 per cent)

### Table 8.5 Large insurance companies

<table>
<thead>
<tr>
<th>Sources</th>
<th>Increased</th>
<th>Decreased</th>
<th>Stayed the same</th>
</tr>
</thead>
<tbody>
<tr>
<td>Internal</td>
<td>63%</td>
<td>0%</td>
<td>38%</td>
</tr>
<tr>
<td>External</td>
<td>63%</td>
<td>13%</td>
<td>25%</td>
</tr>
</tbody>
</table>

### Table 8.6 Small insurance companies

<table>
<thead>
<tr>
<th>Sources</th>
<th>Increased</th>
<th>Decreased</th>
<th>Stayed the same</th>
</tr>
</thead>
<tbody>
<tr>
<td>Internal</td>
<td>25%</td>
<td>0%</td>
<td>75%</td>
</tr>
<tr>
<td>External</td>
<td>37%</td>
<td>0%</td>
<td>63%</td>
</tr>
</tbody>
</table>

### Table 8.7 Reinsurance companies

<table>
<thead>
<tr>
<th>Sources</th>
<th>Increased</th>
<th>Decreased</th>
<th>Stayed the same</th>
</tr>
</thead>
<tbody>
<tr>
<td>Internal</td>
<td>100%</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>External</td>
<td>100%</td>
<td>0%</td>
<td>0%</td>
</tr>
</tbody>
</table>

### Figure 8.1 How important is each of the internal sources of information to all companies?
important information and this decreased to just 7 per cent when the rank-
nings given by reinsurers were excluded. This suggests that in-house research
is of greater importance to reinsurers than insurers. The importance of
other internal sources is not greatly affected by removing the influence of
the reinsurers.

Table 8.8 shows that, in fact, in-house research is important to all the
reinsurers who responded to the questionnaire, in marked contrast to the
insurance companies. Only 13 per cent of the large companies rated in-
house research important, while none of the small companies made use of
in-house research.

Table 8.8 Importance of in-house research by company type

<table>
<thead>
<tr>
<th>Company Type</th>
<th>Extremely important</th>
<th>Moderately important</th>
<th>Not important</th>
<th>Not used</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reinsurers</td>
<td>33%</td>
<td>67%</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>Large firms</td>
<td>13%</td>
<td>0%</td>
<td>13%</td>
<td>64%</td>
</tr>
<tr>
<td>Small firms</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>100%</td>
</tr>
</tbody>
</table>

Moving to external sources of information (see Figure 8.2), the ABI is
overwhelmingly the most important. Ninety-five per cent of firms ranked
the ABI as extremely important, the remaining 5 per cent ranking it as
moderately important. All companies claim to make use of the ABI as a
source of information. Insurers rely heavily on reinsurers for information
with half of the firms stating that they were an extremely important source
of information. The other sources, such as other firms, universities, patient
groups, consumer groups and so on, were ranked as less important, but
were still used by a number of firms. Excluding the reinsurers’ responses
resulted in no significant changes to the ranking of external sources.

The method of communicating which firms ranked as most important
was participation in conferences or seminars, with 68 per cent ranking this
activity as extremely important (see Figure 8.3). Personal contact with
colleagues, and committee membership were also viewed as extremely
important for more than a third of all firms. Paper-based methods of com-
municating, such as mailing lists and publications were given less impor-
tance than face-to-face communication for obtaining information. Sixteen
per cent of firms are involved in joint research programmes or data sharing,
suggesting a high level of external involvement.

When the influence of the reinsurers is removed, the share of companies
ranking ‘Joint research programmes’ as ‘extremely important’ falls to just
6 per cent. Table 8.9 shows that 67 per cent of reinsurers rank as extremely
important the role of joint research programmes. This suggests that both
Figure 8.2  How important is each of the external sources of information to companies?

Figure 8.3  How important are each of the methods of communicating with external bodies to companies?

Table 8.9  Importance of joint research programmes by company type

<table>
<thead>
<tr>
<th>Company Type</th>
<th>Extremely important</th>
<th>Moderately important</th>
<th>Not important</th>
<th>Not used</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reinsurers</td>
<td>67%</td>
<td>0%</td>
<td>0%</td>
<td>33%</td>
</tr>
<tr>
<td>Large firms</td>
<td>13%</td>
<td>25%</td>
<td>25%</td>
<td>38%</td>
</tr>
<tr>
<td>Small firms</td>
<td>0%</td>
<td>25%</td>
<td>13%</td>
<td>63%</td>
</tr>
</tbody>
</table>
in-house (see Table 8.6) and external research may be more important for reinsurers than insurers. It has already been shown that reinsurers felt that both internal and external sources of information had increased in importance in the last three years, and were of equal importance now.

4.2 Discussion

Insurance companies are involved in competence-building activities in response to genetic testing. Both the interviews and the survey data highlight that firms are engaged in a whole range of activities aimed at gathering, analysing and even generating information about the development of genetic screening techniques and their use for insurance purposes. The importance of all sources of information related to genetics had not, in general, decreased over the last three years. Overall, all firms draw on both external sources of information and on in-house learning activities. However, the respondents to the survey considered external sources to be more important. This was not the case for reinsurers, who make use of both internal and external sources of information and have a different role to play in the way in which the industry is learning about genetic testing.

Within each organization, the main gate-keeping role is that of the Nominated Genetics Underwriter, who has the responsibility of collating and disseminating relevant information received from external sources and internal work. Very few companies (that is, only reinsurers and large firms) are attempting to carry out in-house research as a way to learn about genetic screening. The distinction between large and small firms is also emphasized by the fact that ‘all sources of information’ are more important for large than for the small ones, with the exception of trade publications. This suggests that small firms may be interested in what is going on research-wise, but do not get actively involved in it. This passive role is also illustrated in Table 4.6, with none of the small firms carrying out in-house research. Similarly, Table 4.7 suggests that few small firms see external activities requiring active involvement as important to their learning about genetic testing.

The evidence from the interviews, backed up by the questionnaire analysis, showed that there were two main external sources of information for insurance companies, the ABI and the reinsurers. This applies to both large and small companies, though large companies appeared to make use of other external sources of information as well. The ABI and reinsurers provide different services to the firms. The ABI appears to act as a filter for information from government sources such as the HGC and the GAIC, and represents the interests of the companies to those bodies. The reinsurers have a role in translating published scientific and technical literature into
an actuarial form that can be used by companies in underwriting. Such a pivotal role is enabled by maintaining a position of centrality in the emerging network, but it also requires internal development of research that allows reinsurers to both absorb and to generate new information and knowledge that builds on published literature and external research activities.

Figure 8.4 visualizes the network of relations identified through the fieldwork. The arrows indicate the direction of the flow of information related to genetic testing. Reinsurers provide insurers with an informed assessment about the risks attached to claims or applications containing genetic information (large firms do the same for small firms, which often do not have an in-house NGU). Besides the information embodied into proposed premiums, interaction with reinsurers also helps large insurers to understand the developments in and relevance of genetic tests, as it allows them some access to the research undertaken by reinsurers. Reinsurers also learn from large insurers in the sense that through them they can aggregate dispersed information about an issue with which they do not have direct contact, as they do not, in the main, issue policies to private individuals (that is, the carriers of genetic information), but only other companies. With regard to the ABI, as the industry representative, it is both the receiver of and provider to government bodies of information, for example, in the form of submissions to the GAIC. Companies also receive information from the ABI and are providers of data on genetic tests (e.g. how many applications containing genetic information they process over a period of time). As members of the ABI, reinsurers also receive from and provide information to insurers. Figure 4.4 is a general structure that does not address the relative strengths of the various links in the network, but focuses only on the
kind of information that is exchanged among different types of organizations.

In a way, a gate-keeping role, similar to that discussed by Cohen and Levinthal (1989) with respect to firm-level activities, is performed for the industry by reinsurers. However, this role is somewhat different to that discussed by Cohen and Levinthal. The gatekeepers identified by the survey are a specific class of organizations (i.e. reinsurers and, to some extent, the ABI), which connect the industry with the scientific or policy-making community. It was not possible to identify a ‘technical’ role for the ABI, whose key function is to provide a forum for the industry, government and a number of public bodies interested in genetics and insurance issues. Networking activities are more important for large firms than for small firms and large firms rated all external sources of information higher than did small firms. Also it is only large firms and the reinsurers that fund the GIRC. This suggests that the large firms are more involved than small firms in learning through external networks are.

The network structure depicted in Figure 8.4 highlights a number of relationships that link this analysis to the wider literature on network organizations. In particular, there is a growing literature that focuses on the relationship between the evolution of organizational forms and the knowledge bases underpinning firms’ innovative activities. It is argued that the range of useful bodies of scientific and technological knowledge on which firms rely is also expanding, with the continuous development of new disciplinary specializations, or even completely new disciplines (see, e.g. Pavitt 1998). Wang and von Tunzelmann (2000) stressed that the range of disciplines relevant to firms’ innovative processes is expanding in both breadth, that is, the number of relevant disciplines is increasing, and depth, that is, their sophistication and specialization is increasing. Such increasing complexity at product and technological level in turn challenges firms’ in-house learning and innovative processes. Hence, the increasing attention being devoted to the analysis of networks, hybrid organizations and, generally speaking, distributed innovation processes (e.g. Coombs et al. 2001).

One line of research within this recent literature examines the changing relationship between what firms do and what they know. For example, Brusoni et al. (2001) argue that, under certain conditions, firms that rely on wide networks of specialized suppliers for the design and manufacture of specialized components need to maintain in-house competences about the components they outsource. Thus, their knowledge boundaries are wider than their production boundaries. Brusoni et al. (2003) have developed a simple indicator to capture the extent of ‘knowledge integration’ at firm level. The case of insurance, and the development of genetic screening capabilities, also touches on the relationship between who does what in this
industry and who is developing relevant capabilities. This specific service industry is structured around a tight hierarchy, which reflects the traditional division of labour between small and large firms: a small set of large, global reinsurance firms lie at the root of a network of increasingly specialized (in terms of the type of risk they underwrite) and local (in terms of geographic distribution) insurance companies. What is interesting is that this specific pattern of division of labour is reflected in the division of (genetic) knowledge. That is to say, reinsurers are doing in-house research to a greater extent than any other company type in the industry. Also, the vast majority of the insurance companies interviewed confirmed their reliance on reinsurers for assessment of genetic information.

This study also suggests that firms (whether insurers or reinsurers) that perform in-house R&D are more likely to engage in joint R&D programmes with external organizations. This result is similar to the results of a number of case studies in various manufacturing sectors, which show that large firms lie at the root of wide networks of suppliers that are specialized in individual pieces of equipment or bodies of knowledge, but need the coordinating efforts of larger organizations to assemble the final product (Granstrand et al. 1997; Prencipe 1997; Brusoni et al. 2001). Also, it is well known that firms that carry out in-house R&D also rely on contract R&D (Mowery 1983; Cohen and Levinthal 1989).

5. CONCLUSIONS

This chapter has focused on the competence-building activities of insurance companies in response to genetic testing. The results of the empirical research show that companies are making efforts to learn about genetic testing, and that external sources of information are more important to insurers than internal sources. It is therefore reasonable to suggest that companies are making use of networks in order to facilitate their learning. Reinsurers and, more particularly, the ABI, are both very important sources of information for companies and in a network structure reinsurers can be seen as the ‘gatekeepers’, playing the role of translators of medical and genetic data into actuarial data.

This study has focused on a specific point in the evolution of genetic screening technologies. The sheer novelty of the technology implies that its application for insurance purposes is still limited. The range of tests technically reliable (besides issues of national bans on their use) is so limited that this type of technique has not had an impact on the models insurance firms use to assess individual risk. However, some insurance firms have started to develop in-house and relational capabilities to assess the opportunities and
threats arising from genetic screening. The possibility of using genetic information fired public debate, such that government action was provoked to quickly establish forums for debate. Developing a working knowledge about these issues has suddenly become of fundamental importance to an industry that needs and wants to be involved in, and possible even lead, future debates in the policy-making process.

On a more speculative basis, this chapter raises a number of issues related to broader questions. First, what is the right notion of productivity to be applied to this industry? Traditional studies that focus on the impact of ICTs focus on the role played by scale economies in retailing, that is, productivity is about pooling the risks of as many customers as possible. Pooling in the insurance industry has been made possible by the availability of new, sophisticated database systems. However, pooling risk is not the same as ‘assessing’ risk. Genetics potentially allow firms to assess more and more precisely individual (as opposed to pooled) risks.

In terms of competition analysis, traditional indicators of ‘competitiveness’ at industry level rely on numbers of firms, rates of entry and exit, market shares and concentration. While all these indicators are useful in stable contexts, they are not necessarily so in fast-changing environments characterized by the emergence of new bodies of knowledge. This study has revealed that, while the UK-based industry is highly competitive in terms of the number of firms active in it, the division of knowledge (related to genetic testing) is concentrated in the hands of a few global firms (that is, the reinsurers). This might be interesting from a ‘dynamic’ competition analysis point of view. Related to this point is the finding that firms in the UK market are outsourcing their underwriting function (on the grounds of the operating costs associated with it). While this study did not focus on this specific issue, it opens up the question of at what level of analysis should competitiveness in the insurance industry be assessed. Does ‘competition’ involve the number of firms that offer end products to clients through independent retailing networks? Or should it be based on the number of firms that maintain independent underwriting (and thus risk assessment) capabilities? So far, information has been based on the number of firms that exist in the market as independent retailers.

In terms of the policy implications of this study, we have seen that EU member countries have so far adopted their own regulatory frameworks for use of and access to genetic information. Reinsurers have been shown by this research to be the key actors in the network and reinsurance is a tightly knit business managed by a few global firms. Thus, it is not clear to us whether ‘member country’ is the right unit of regulation: it is possible that the right counterpart to global reinsurers is the EU and not individual member countries.
NOTES

* Participants in the NewKInd Workshop (Maastricht, 11–12 March 2002), the International Schumpeter Society Meeting (Gainesville, Florida, 27–30 March 2002), and ‘The economics and business of bio-sciences & bio-technologies: what can be learnt from the Nordic Countries and the UK?’ Workshop (Gothenburg, 25–27 September 2002) provided very useful comments. Also, we are grateful to three anonymous reviewers for their very insightful comments. The usual disclaimers apply. Financial support from EURONSTAT, NewKInd Project – IST 1999-20728 is gratefully acknowledged.

1. Underwriting determines the risk that each individual will add to the pool of those insured, and charges a premium to enter the pool based on the risk that is added at the time of application. Insurers calculate premiums so that the pool is sufficiently large to cover the payouts which may have to be made. Because the risk is pooled, the payouts will be matched by the premiums paid into the pool by those who do not need to make a claim.

2. The impact of multifactorial disorders on the insurance industry may be small, because the increased risk associated with a positive test result is small, and may be counteracted (Macdonald 2001). In the case of these diseases a positive test result is an indication of increased susceptibility. Individuals may be able to reduce their susceptibility by making appropriate medical or lifestyle choices, such as opting for preventative surgery or stopping smoking.

3. Reinsurers are the insurance companies’ insurers. Insurance companies have an agreement with their reinsurer allowing them to underwrite standard policies up to a certain value without consulting the reinsurer. Unusual policies, such as those containing a genetic test result or those of high value, will be underwritten separately by the reinsurer. The reinsurer will collect a certain proportion of the premiums paid by policy holders in return for taking a portion of the risk associated with each policy.

4. Copies of the questionnaire, semi-structured interview and list of companies to whom the questionnaire was sent are available on request, or can be downloaded with the report that provides the background for this chapter at Website www.researchineurope.org/newkind/index.htm, viewed 2 October 2003.

5. Companies which appeared in the ABI ‘Current largest 20 based on UK premiums in 1999’ (ABI 1999b, p. 85) were considered for the purposes of this analysis as being ‘large’ companies. Those that did not appear in the list were classed as ‘small’ companies. This system was used as it was not possible from the data provided by companies or industry literature to determine the size of a company according to the ‘gross premiums written’, ‘turnover’ or ‘number of policies sold’.

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### APPENDIX

**Table 8.A.1 Interview codes**

<table>
<thead>
<tr>
<th>Interview Code</th>
<th>Interviewee</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>NGU, large insurance company</td>
<td>8 June 2001</td>
</tr>
<tr>
<td>B</td>
<td>Technical manager, small insurance company</td>
<td>15 June 2001</td>
</tr>
<tr>
<td>C</td>
<td>Communications manager, large insurance company</td>
<td>20 June 2001</td>
</tr>
<tr>
<td>D</td>
<td>NGU, large insurance company</td>
<td>6 July 2001</td>
</tr>
<tr>
<td>E</td>
<td>New business manager, large insurance company</td>
<td>6 July 2001</td>
</tr>
<tr>
<td>F</td>
<td>Service manager, large insurance company</td>
<td>6 July 2001</td>
</tr>
<tr>
<td>G</td>
<td>Chief underwriter*, reinsurance company</td>
<td>15 August 2001</td>
</tr>
<tr>
<td>H</td>
<td>Professor Sandy Raeburn, Genetics Advisor to the ABI</td>
<td>12 June 2001</td>
</tr>
<tr>
<td>I</td>
<td>Patrick Mahon, Assistant Manager Life, ABI</td>
<td>3 July 2001</td>
</tr>
<tr>
<td>J</td>
<td>Richard Walsh, Head of Health, ABI</td>
<td>3 July 2001</td>
</tr>
<tr>
<td>K</td>
<td>Professor Angus Macdonald, Director, Genetics and Insurance Research Centre, Heriot-Watt University</td>
<td>21 August 2001</td>
</tr>
</tbody>
</table>

*Chief underwriter also nominated genetic underwriter.*

**Notes:**
NGU: nominated genetic underwriter.